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**Journalism Design: The NewsCube,
Interactive Technologies and Practice**

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Abstract

Journalism is in a period of transition. Disrupted by social and mobile technologies, practitioners need new ways to create stories and engage audiences if they hope to remain relevant and viable. Yet journalists' relationship with technology is fraught. Weighed down by legacy production processes and entrenched ideas about what journalism is, newsrooms have failed to fully exploit the potential of new platforms. But as technology becomes more interwoven in our lives, and interactions move out of the computer and into the everyday world, those practices will need to change. The question is how.

This thesis is concerned with the practice of journalism, the practice of design, and what one can learn from the other. In order to argue its central proposition — that design methods are central to the future of journalism practice — the thesis documents and evaluates a design-led approach to addressing a journalistic issue. It does this via the NewsCube: a digital artefact that uses space and shape to tell news stories. The NewsCube is a unique storytelling format.

Through a transparent process of concept development, design, prototyping and evaluation, the project detailed in the following pages reveals new possibilities for journalism practice: that stories could be tactile, fun and designed for distributed control. Physicality and playfulness are not values readily associated with journalism, but the work here suggests that such qualities could inform new forms of engagement.

The contribution of this thesis is, in the first instance, to journalism: that it is through design that journalism can innovate. That the practice-led, future-focused methods of design research can be used to generate new ideas for journalism that exploit technology and embody core journalistic values. But there is a contribution to design also. The design process revealed a distinctly journalistic way of thinking, which, when combined with design methods, led to a new concept of news interaction.

The application of design research methods to a journalistic dilemma is arguably original in journalism research and this thesis proposes Journalism Design as an emerging area of research and practice that not only addresses the technological possibilities for journalism, but the journalistic possibilities for technology.

Declaration by author

This thesis is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

I have clearly stated the contribution of others to my thesis as a whole, including statistical assistance, survey design, data analysis, significant technical procedures, professional editorial advice, and any other original research work used or reported in my thesis. The content of my thesis is the result of work I have carried out since the commencement of my research higher degree candidature and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution. I have clearly stated which parts of my thesis, if any, have been submitted to qualify for another award.

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Publications during candidature

Journal articles

Doherty, S. (2015). NewsCubed: journalism through design. *Journalism Practice*, 10(5), 569–588. http://dx.doi.org/10.1080/17512786.2015.1049645

Angus, D., & Doherty, S. (2015). Journalism meets interaction design: an interdisciplinary undergraduate teaching initiative. *Journalism and Mass Communication Educator,* 70(1), 44–57. http://dx.doi.org/10.1177/1077695814563981

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Doherty, S. (2012). Will the geeks inherit the newsroom? Reflections on why journalists should learn computer science. *International Journal of Technology, Knowledge and Society*, *8*(2), 111–121.

Creative Works

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Doherty, S. (2011). Playing with the facts. *The Walkley Magazine*, *68*, 40–40.

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	Wrote paper (100%)

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Contributions by others to the thesis

No contributions by others.

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journalism, design, innovation, interaction design, newscube, practice, practice-led research, research through design, technology

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Contents

Figures and tables

Abbreviations

ABC	Australian Broadcasting Corporation
AI	artificial intelligence
AR	augmented reality
CSCW	computer-supported co-operative work
FOI	freedom of information
HCI	human-computer interaction
IoT	internet of things
IxD	interaction design
J+IxD	Journalism + Interaction Design initiative
PRT	Process Reflection Tool
RtD	Research Through Design
Ubicomp	ubiquitous computing
VLAD	Vicious Lawless Association Disestablishment Act 2013
VR	virtual reality

Chapter one
Introduction

*"The iPad isn't about saving newspapers. It's about inventing new ways
of telling stories, using a whole new language — one that we can't
even imagine right now."*

Fake Steve Jobs, 2010

Journalism, as a practice, is in a period of transition. Disrupted by social and mobile technologies, both media orgaisations and individual practitioners are searching for new ways to create stories, engage audiences and monetise them, hopeful of sustaining journalism and its values. It is a challenging period. On the one hand, emerging technologies provide new and exciting ways for journalism to develop. On the other, new technologies challenge established culture and practice, and this creates a dilemma about how to make the transition.

Recent scholarship on journalism tells a story of both "innovation and radical change" (Franklin 2014, p. 469) as well as one of stasis. Picard, for instance, notes that "journalists and enterprises [are] adjusting to new conditions, undertaking regeneration and renewal, and pursuing new opportunities" (Picard, 2014, p. 3). Similarly, studies of emerging practice reveal how robots are being used to create journalistic content (Clerwall, 2014; van Dalen, 2012), the possibilities for augmented reality (Pavlik & Bridges, 2013), and the influence of ambient computing (Hermida, 2010b). These are all signs that journalism is evolving in response to new technologies.

But we also know that the relationship between journalism and technology is fraught. Ethnographic studies of newsrooms tell us that journalists struggle to integrate new technology into existing practice, weighed down by legacy products, poor technical skills and entrenched ideas about who is a journalist. Even those involved with journalism startups — nimble, tech-focused, investor-backed businesses — are constrained by journalistic conventions: unable to disrupt journalism's core tenets (Carlson & Usher, 2015).

However, as technologies evolve there may be a need to embrace new practices in light of what is possible with new platforms. The technology literature suggests that computers will become more interwoven in our lives: they will be part of the environment and everyday objects; they will be intelligent; and they will enable more creative engagement (Harper, Rodden, Rogers, & Sellen, 2008). New technologies could lead to new types of news products and services — stories and experiences designed for interaction as well as information, designed for values such as playfulness, tactility and engagement, as well as the the public interest. To create such stories journalists will need to develop new approaches to narrative using technology.

The problem for journalists is that although computation and digital disruption have impacted nearly every aspect of their work and destabilised business models, engrained culture has meant newsrooms are not sufficiently innovative. It is tech companies, not media companies, that are at the forefront of integrating new technologies with the delivery of news. As a result, there are calls for new journalistic practice (Picard, 2009) and for news organisations to innovate and find ways of offering new value to audiences (Christensen, Skok, & Allworth, 2012; Picard, 2010).

There are parallel issues in journalism research. Scholars of journalism tend to study existing practice using observational or analytic methods, but there is a view that research should play a role in shaping the future of journalism (Kopper, Kolthoff, & Czepek, 2000). This has led to calls for journalism researchers to widen their perspectives (Steensen & Ahva, 2015) and for theoretical renewal (Mitchelstein & Boczkowski, 2009). Another solution to these issues could be in practice itself. Practice-led research uses professional practice, and the artefacts created, as a method of inquiry. The approach is linked to Schön's (1983) notion of reflective practice: that knowledge can be produced through action.

Schön (1983) suggests that among professionals, "knowing is ordinarily tacit, implicit in our patterns of action and in our feel for the stuff with which we are dealing" (p. 49). This idea of knowledge generated through practice resonates with Arthur's (2007; 2011) idea of *deep craft*, a form of practice based on a "context of knowings" that provides an understanding of "how to manipulate newly discovered or poorly understood phenomena" (2007, p. 285). Arthur makes a link between innovation and the knowledge gained from practice. He points out that real advanced technology stems not from

knowledge but from knowing, and it comes from practical experimentation and research — both characteristics of practice-led methodologies.

In journalism, practice-led research is a relatively recent idea but in disciplines such as design the approach is more established. Designers have several models of practice-oriented research, all of which aim to "create something new" (Löwgren & Stolterman, 2004, p. 9). Within design, the discipline of interaction design is concerned with the intersection of people and technology and with creating user experiences that augment human interaction. It is a practice-led, people-centred approach to solving problems, or more specifically, dilemmas, and is good for inventing new things (Gaver, 2012).

The design process typically consists of phases of research, designing, evaluating and redesigning. Throughout this iterative process the designer draws on their own "reflective and critical mind" (Löwgren & Stolterman, 2004, p. 15) to develop an artefact "in close relationship with a changing and growing understanding of the situation" (p. 9). In this way design is a reflective practice that draws on the designer's own knowledge as well as their knowledge about the context in which they are working.

The ability for interaction design to generate new ideas for specific contexts means it is an approach that can accommodate, and design for, existing conditions. A focus on invention also means that design artefacts represent a new possibility and so can prompt reflection on how an existing situation might need to change in order to exploit that possibility.

This thesis argues that for journalists grappling with the promises of new technology alongside entrenched practices, interaction design offers a way to develop new ideas, and also allows them to draw on deep craft to drive innovation. It does this through the design, development and evaluation of the NewsCube, an artefact created to address the dilemma of using hypertext in news stories.

Hypertext is the underlying structure of the internet and a fundamental part of online journalism. Studying how journalists have used it highlights the challenges of working within established practice and provides insight into how they might better exploit technologies in the future.

Definitions

Both journalism and design are discussed in further depth throughout this thesis, however it is useful to define the terms here.

Journalism

As a practice, journalism is essentially the process of "finding things out and telling people about them via newspapers, radio, television or the Internet" (Franklin, Hamer, Hanna, Kinsey, & Richardson, 2005, p. 124). Journalists communicate what they have found out via news stories, often designed in an inverted pyramid style, which is a style of writing that organises information in order of importance with respect to news value. Journalistic storytelling was originally a one-way process between journalists and their audiences, however, new technologies are changing that "from a linear to a networked process, whereby there is constant communication and interaction with information" (Beckett & Mansell, 2008, p. 93).

Journalism practice also encompasses the notion of social responsibility: "that journalism helps people understand the world around them and make informed decisions" (Franklin et al., 2005, p. 124). This is based on the idea that citizens have a "moral right" to be served by the press and that an adequate news service is a "pubic responsibility" (Hocking, 1947, pp. 168–169). There is also a view that journalism acts as a check on executive power. The "fourth estate" model embodies this ideal — that whatever a country's formal constitution, "genuine political power resides in the informal role of the press, which in turn derives from the relationship between the press and its readers" (Hampton, 2009, p. 3). Journalists, in this context, are independent of the three estates of parliament — the Lords Spiritual, the Lords Temporal, and the Commons (Carlyle, 1840) — and so can encourage governments to consider the public response of their actions.

Journalistic ethics underpin socially responsible practice. Journalistic ethics guide "what individual journalists should do in particular situations, and ... what news media should do, given their role in society" (Ward, 2009, p. 296). While journalistic ethics are defined in various codes of practice[1], journalists exert a level of individual agency in their work. They make judgements about what is news and how to tell stories. These judgments are grounded in values, which include core tenets of practice and news value.

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[1] See, for example, the International Federation of Journalists' principles of conduct: http://www.ifj.org/about-ifj/ifj-code-of-principles/

Those tenets are ideas such as public service, objectivity, autonomy, immediacy and ethics — the "ideal-typical" values that give journalists legitimacy and credibility (Deuze, 2005). They sit alongside news values, which determine the worth of journalistic outputs (Galtung & Ruge, 1965; Harcup & O'Neill, 2001). The ability make judgements about news and action requires "active learning and critical and creative thinking" (Sheridan Burns, 2013, p. 35) on the part of the individual.

Journalism research is a multidisciplinary field that studies what journalism is and why it matters. It is negotiated across three main populations: journalists, educators, and scholars (Zelizer, 2008), and the field draws on approaches from sociology, history, language studies, political science, and cultural analysis. Journalism researchers tend to use analytic or critical methods to study journalistic products, processes, or their reception by audiences. These approaches result in scholarship that examines what is, rather than what might be.

Design and interaction design

As noted above, interaction design is concerned with the intersection of people and technology. As a design discipline, it draws on "concepts and theories from other design disciplines and from the transdisciplinary academic field of design studies" (Löwgren & Stolterman, 2004, p. 6).

Design, by its nature, is concerned with achieving a balance between possibility and use. It is a creative process that results in an ultimate particular — something specific to situation and use (Stolterman, 2008). Such artefacts represents a new possibility and so can allow designers to push the boundaries of established practices and transcend, or move beyond, the limitations of the present (Löwgren & Stolterman, 2004).

There is a body a of literature that links design with innovation (Brown, 2008; 2009; Meinel & Leifer, 2015; Mueller & Thoring, 2012). Scholars and entrepreneurs alike see value in the user-focused, creative approach that designers take to solving problems and see it as a path to innovation. Brown, for instance, encourages business leaders who are looking at innovation as source of competitive advantage to "incorporate design thinking into all phases of the process" (Brown, 2008, p. 85).

The term design thinking is used to describe the way designers deal with open, complex problems. In business it is seen as: "a discipline that uses the designer's sensibility and

methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity" (Brown, 2008, p. 85).

In academic research, design thinking is less about market opportunity and more about a means of inquiry (Cross, 1982; Downton, 2003; Koskinen, Zimmerman, Binder, Redstrom, & Wensveen, 2012; Stolterman, 2008; Zimmerman, Forlizzi, & Evenson, 2007). Design practices are seen as "tools for thought" (Löwgren & Stolterman, 2004, p. 168) that help produce new knowledge. The focus of design is on investigating issues and coming up with ideas about how to solve them. It is about imagining possible futures and addressing problems in parallel with solutions. It uses practice as a form of inquiry and creates artefacts that are mindful of the context of use, in particular, the way users interact with technology.

Research questions

This thesis proposes design as a way of drawing on journalistic values and tenets to develop innovative technologies for practice. It aims to understand how we can design technologies that exploit computational advances while addressing the embedded values, needs and expectations of the people and environments in which they will be used.

Three questions are addressed through this thesis:

1. Can interaction design enable journalists to create new, tangible, forms of storytelling that exploit digital platforms and embody their values?

2. What can practice-led design research contribute to journalism in its current state of disruption?

3. What can journalism contribute to interaction design practice and research?

Contribution

The application of design research methods to a journalistic dilemma is arguably original in journalism research. Similarly, the resulting artefact — the NewsCube — is a unique storytelling format and represents an original contribution to journalism practice. The

NewsCube is available as a free online tool[2] and the key functionality has been released under an open source licence via GitHub[3].

Thus, the contribution of this thesis is, in the first instance, to journalism. The research documented in the following pages shows how the practice-led, future-focused methods of interaction design research can be used to generate new ideas for journalism that aim to exploit technology and embody core values. My research found that tactile and playful news interactions, along with the ability for control over a story to be distributed between authors and readers, were ideas that could inform future journalistic practice. In this way, this thesis shows that design can enable journalists to engage constructively with technology.

However, the thesis also makes a contribution to design. The design process revealed a distinctly journalistic way of thinking, which, when combined with design methods, led to a new concept for news interaction. Through a journalistic approach to design, and the documenting of that process, the research demonstrates how knowledge can be produced about the future of interaction in a specific domain.

In light of these outcomes, this thesis proposes Journalism Design as an emerging area of research and practice that not only addresses the technological possibilities for journalism, but the journalistic possibilities for technology.

Thesis structure

The thesis addresses the research questions by first examining the intersection of journalism and technology through the scholarly literature on news production and emerging journalistic practice. **Chapter two** also introduces concepts such as augmented reality and the internet of things as examples of technologies that might impact journalism in the near future, and details the need for innovation.

Chapter three examines hypertext as an example of journalists' ability to exploit a new technology. It takes a broad view of hypertext research in an effort to show how theories and findings by computer scientists and literary scholars can inform journalistic practice.

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[2] The NewsCube beta is available at: http://newscube.io

[3] The NewsCube has been released under a Mozilla Public Licence v2.0 via GitHub: http://github.com/newscube

Chapter four forms part of the project's contextual research phase. This exploration of how theories of hypertext play out in practice revealed the potential for three-dimensional, hyperlinked news stories. This investigation, combined with the literature survey in chapter three, revealed opportunities for news designs that allow greater reader involvement and to use shape as a tool for storytelling.

Chapter five outlines the methodological arguments underpinning the thesis. The chapter looks at journalism and design in greater depth. It examines design as practice and a method for research, in particular the role of design artefacts, and considers the potential for design to be used as a way of creating new ideas for both journalism practice and journalism research. This chapter also outlines the thesis methodology and research activities. It defines Research Through Design and explains how this design-led approach was used to develop and evaluate the NewsCube.

Chapter six explains the design and development of the NewsCube prototype. It details the project's conceptual model and the design artefacts created. The chapter discusses the sketches, wireframes, low and high-fidelity prototypes that were produced as a result of the design process and how they were informed by journalistic thinking.

Chapter seven is the first of the evaluation chapters. It examines user feedback on the NewsCube prototype through the theory of affordance. This analysis led to one of the project's initial findings: that tactility, playfulness and fun, albeit not traditional news values, are important to users.

Chapter eight examines user feedback through the notion of tradition and transcendence. This is the idea that design artefacts provide insight into how established practice might change to accommodate the possibilities of the new design. The findings here suggest distributed control, physicality and emotion are new ideas for future journalistic practice.

Chapter nine outlines the next iteration of the NewsCube. It explains how the design evolved and what users thought of it. The feedback suggests an appetite in traditional news organisations for new ideas about how to engage audiences and a willingness to experiment with new technologies to achieve that goal.

Chapter ten returns to the thesis questions and discusses them in light of the process and outcomes. It argues that the thesis makes a contribution to both journalism and to design.

Ethical approval

This project received ethical clearance from the University of Queensland School of Information Technology and Electrical Engineering, ref: EC201503DOH.

An interest

I come to this research as a former journalist. I spent 12 years in reporting and production roles in newspapers and online publications in three countries before moving to academic work and PhD study.

The later years of my newsroom experience coincided with Web 2.0 and I was involved in working out how best to use hyperlinks, video, blogs and animations to tell news stories. The possibilities were exciting, yet we tended to take newspaper content and put it on the web along with some bells and whistles. The needs of the newspaper continued to be prioritised despite the rapidly changing technologies around it: social networks; the iPhone; tablet computers. Our practice was not evolving. It was not exploiting the opportunities these new platforms offered, nor the threat they posed to our practice and our business models.

I came to the view that journalists needed to rethink fundamentally how they could use the internet and emerging technologies to tell stories and engage readers. These experiences have motivated my interest in academic research, and in turn, this thesis.

Chapter 2
Journalism and technology

"... we are at an inflection point in global media. The pace of disruptive change in new technology — in particular, the explosive growth of mobile and social media — poses a direct challenge to how the FT produces and sells its journalism. It presents the FT with a great opportunity too — to reach more readers than ever before, in new and exciting ways."

John Fallon, 2015

In broad terms, this thesis is about how journalists might exploit technology to design new ways of telling stories and engaging with audiences. This suggests there is an underlying problem with the way journalism has approached technology in the past. Indeed, the scholarly literature on journalistic production reveals an industry struggling to define itself, and its value, as methods of production and audience behaviours change. This chapter reviews the literature on how journalists have adapted to technological change. It suggests that new approaches to practice will be needed for the profession to remain relevant and valuable to audiences as technologies become more ubiquitous and interwoven in our lives.

Old practices die hard

The scholarly journalism literature provides good insight into how news organisations have coped with integrating new technologies such as multimedia and interactive media into established processes (Anderson, 2013; Boczkowski, 2004; Brannon, 2008; Domingo, 2008a; Ryfe, 2012; Steensen, 2011). It tells us that they haven't. Journalists and editors have struggled to exploit new technologies and, as a result, online journalism is often legacy journalism delivered digitally. Instead of redesigning stories so they exploit the assets of the new media — hypertext, multimedia, interactivity — journalists have relied on established formats and designs. In summary, the reasons for this fall into three areas:

- the dominance of legacy media products, print in particular;

- an inability of practitioners to master digital storytelling tools;
- an unwillingness to give users some control over editorial processes.

There is a strong history of ethnographic studies of newsrooms, including Tuchman's (1978) often cited study, *Making News*, as well as Gans' *Deciding What's News* (Gans, 1980) and Sigal's *Reporters and Officials* (Sigal, 1973). These observational studies reveal an unreflective journalistic practice, in which "journalistic culture persisted through unconscious routine" (Ryfe, 2012, p. 16). Even later works focused on digital news production show that traditional processes still dominate. Boczkowski (2004), for instance, found that levels of innovation in online newsrooms were influenced by the relationship with the print operation. This had led to "the creation of a new medium increasingly dissimilar from the old one" (p. 188).

Steensen (2011) and Domingo (2008a) pick up this theme, and both have discussed the "myth" of online journalism, arguing that the promises and potential of new technologies have not come to fruition. Although Pavlik (2001) observed that the once-basic inverted pyramid news writing style was becoming obsolete in the online world, "being supplanted increasingly by immersive and interactive multimedia news reports" (p. 232), Brannon's comparative study of three online newsrooms several years later, revealed that online journalism needed to be more than "retrofitting the journalism produced for one medium to another" (Brannon, 2008, p. 100). Part of this seems to be due to editorial priorities. Boczkowski and Brannon both identify an asymmetric organisational structure and its impact on online journalism: in many newsrooms it is the legacy products that set the news agenda and control most of the reporting and production resources.

Ryfe's (2012) more recent ethnographic studies of three American newsrooms reinforce these observations. He spent five years observing the transition from legacy to new media and concluded that journalists have not adapted very well: "For the most part, they continue to gather the same sorts of information, from the same sorts of people, and package it in the same news forms they have used for decades" (p. 3).

However, Ryfe (2012) sees the challenge to journalism as ontological, not technological or economic: "it goes to the heart of what journalism is, what journalists do, and why they do it" (p. 11). He notes the tendency of journalists to "reproduce their shared culture in an unreflective way" (p. 15) but also observes that newsrooms are alive with disagreement about stories, treatment and priorities, among other things, and that disagreement is "as vital as agreement in reproducing journalism's culture" (p. 16). Indeed Fulton and McIntyre

(2013) see journalistic conventions as enabling, arguing that "rather than the structures of journalism constraining their activity, these structures actually enable a journalist to produce their work" (pp. 18-19).

However, Ryfe (2012) identifies three cultural dynamics that he says inhibit change in journalism:

- News production is structured by deeply ingrained habits, and efforts to change them triggers an identity crisis;
- Journalists are invested in prior successes and they are loathe to give up that investment without a tangible benefit;
- Journalism is defined by "constitutive rules" that structure interactions with sources, editors and readers.

Resistance to the internet was greater in the earlier years of Ryfe's research and he says most journalists recognise that their profession must adapt. Despite this, news production remains unchanged. He attributes this to the constitutive aspect of journalistic culture, that journalists see themselves as the filters of information and that this "anchors journalism to tradition simply by defining what counts as an instance of practice" (Ryfe, 2012, p. 116).

The reasons for this are cultural: journalism is grounded in ideas of detachment, independence and objectivity, but Ryfe says that online, "this simply will not do" (Ryfe, 2012, p. 10). Success online, he argues, "requires that journalists, far from being disinterested observers, should be interested and active participants — and this requirement challenges a core aspect of journalistic culture" (pp. 10-11).

Anderson (2013) and Spyridou, Matsiola, Veglis, Kalliris, and Dimoulas (2013) also identify self image as a factor in journalism's struggles. Anderson's ethnographic study of the Philadelphia news ecosystem encompassed both traditional and online organisations. Again, he tells a story of how journalism has remained the same despite huge changes in the information environment — "a story of stasis" (Anderson, 2013, p.159). According to Anderson, journalists often validate themselves and their profession through the act of "reporting the news". So, even though the news groups he studied were struggling, and it made sense for them to "network the news" through collaboration with other organisations, hypertext links or partnerships, "such collaboration and innovation not only did not occur; it seemed to be purposefully thwarted" (p. 7).

That journalists would hamper such innovation when it is what is needed to preserve their craft seems counter-intuitive. They may see reporting as fundamental to their practice, but it is the aggregators and social networks that are reaping the benefits of that effort. Companies such as Facebook and Twitter do not report original news, but they are fast becoming dominant players, either as sources for mainstream news coverage (Broersma & Graham, 2013; Paulussen & Harder, 2014; Vis, 2013) or as a vital distribution platform for news providers (Hille & Bakker, 2013; Ju, Jeong, & Chyi, 2013).

Ju, Jeong and Chyi (2013) suggest that a strategy by news organisations to use social networks as a way to generate "eyeballs" before generating a viable business model, means they risk making the same mistakes they made on the web: giving content away for free. The literature suggests there is greater value in exploiting the network to augment reporting efforts.

Working the network

Networked journalism (Jarvis, 2006), like computational journalism (Flew, Spurgeon, Daniel, & Swift, 2012) and citizen journalism (Gillmor, 2004), is a practice that has emerged alongside new technologies. Networked journalism uses social media, hypertext and digitally connected audiences throughout the newsgathering, reporting and distribution processes, and these processes are networked, not linear: "there is constant communication and interaction with information" (Beckett & Mansell, 2008, p. 93).

Journalists' use of hypertext is examined closely in the next chapter, but here it is worth noting that the news media has tended to use hypertext, or hyperlinks as they are manifest, as a way of connecting stories to related content, usually within the same publication. This use of hypertext does not tend to involve the collaboration between professionals and amateurs that is a key feature of networked journalism.

In networked journalism, collaboration means journalists can take advantage of a "digitally equipped public as a kind of news hyper-source" (Russell, 2011, p. 2). But it also means journalists exert less control over information, because the balance of power between news providers and news consumers has shifted (Russell, 2011). Online, the information flow is non-linear, distributed across a network of sender and receiver nodes. "Because message production can take place at any node in the network, information distribution is a diffuse, parallel process, unlike the compressed, serial process of mass

media" (Newhagen & Levy, 1998, p. 15). In such a system the established processes and standards of mass media production are "unnatural, unrealistic, and practically impossible to apply" (p. 16). Hence, the struggle for legacy media to adapt.

Russell (2011), Ryfe (2012), Anderson (2013) and Sheller (2015) all illustrate this struggle, and point out that journalism is increasingly becoming a participatory process involving non-professional reporters, and the audience: networked communication has "transformed the role of the audience from a mostly passive to an active voice" (Russell, 2011, p. 43). This public participation in professional journalism is confronting to news organisations. Beckett and Mansell (Beckett & Mansell, 2008) argue that networked journalism not only means decentralised decision making and nonhierarchical structures, but also facilitates greater diversity, which "confronts the traditional practices of journalism" (p. 94). In this context they see the role of journalists more as a "facilitator of on and offline news production" (p. 92). Similarly, Newhagen and Levy (1998) suggest a "pathfinder role" that involves journalists or editors guiding readers through a complex information environment rather than acting as gatekeepers.

Such a change in role has implications for journalistic identity. Social media is tightly coupled with conventional media (Dourish & Satchell, 2011), and Ryfe (2012) suggests that in such an environment ideas of detachment, independence and objectivity are no longer appropriate. These ideas are part of journalism's ideal-typical values (Deuze, 2005). Technology, it appears, has not changed those values but some suggest it must. Ryfe argues that for journalists to survive in the "densely clustered world of online interaction they will have to make personal, even intimate, connections with others" (Ryfe, 2012, p. 10), and Deuze (2005) suggests that multimedia, along with multiculturalism, "potentially challenge historically embedded views in journalism" (p. 455), and that "any definition of journalism as a profession working truthfully, operating as a watchdog for the good of society as a whole and enabling citizens to be self-governing is not only näive, but also one-dimensional" (p. 458). Indeed the notion of the "Fifth Estate" is based on the idea that networked individuals can themselves "enable a new source of accountability in government, politics and other sectors" (Dutton, 2009, p. 1).

There are signs that attitudes are changing. Journalists' use of Twitter in particular, reveals how making personal connections has become a key aspect of reporting and disseminating news, as well as engaging with audiences (Broersma & Graham, 2013; Hille & Bakker, 2014; Lasorsa, Lewis, & Holton, 2012; Vis, 2013). Lasorsa, Lewis, and Holton

(2012) observe that journalists who tweet have begun using features of microblogging, such as offering opinions, in their normal journalistic practice. Such journalists "operate on a neutral platform (via Twitter.com), and so do not face the same level of oversight nor the same necessity to stay on-topic journalistically" (p. 24).

Twitter has also been exploited during social uprisings and popular protests, revealing a type of storytelling that is co-constructed by journalists, bloggers and activists. Studying information flows during the 2011 Tunisian and Egyptian uprisings, Lotan et al. (2011) observed that Twitter served both as a common medium for professional journalism and citizen journalism, and as a site of global information flow. Their findings suggest that news of the unrest emerged from "a hybrid and dynamic information network whose structures and influences change depending upon how a variety of actors behave" (p. 1400). Working together, these actors, "can constitute a particular kind of online press" (p. 1400).

Papacharissi and de Fatima Oliveira (2012), studying the #Egypt hashtag during the unrest, identified a style of "affective" storytelling that was constructed collaboratively by citizens, bloggers, activists, journalists, and media outlets. This resulted in news feeds that blended opinion, fact, and emotion, and which, combined with the instantaneous nature of Tweets, was "compelling and engaging for readers, but not necessarily compatible with fact checking processes of western paradigms of journalism" (p. 279).

In this context, journalists still needed to make decisions about how to tell stories,

> ... but these decisions are collaboratively and organically made through practices of repetition and redaction that do not always produce a coherent narrative. Instead they result in parallel narratives, possessing variable levels of coherence and continuity, yet interconnected through the presence of affect." (Papacharissi & de Fatima Oliveira, 2012, p. 278)

Hermida (2010b) points out that social technologies blur the boundaries between newsmakers, reporters and consumers. He sees micro-blogging services, such as Twitter, as awareness systems, as they enable citizens to maintain a mental model of news around them. He describes this as ambient journalism: "an awareness system that offers diverse means to collect, communicate, share and display news and information, serving diverse purposes" (p. 301).

In unpacking this idea, Hermida draws on Weiser's (1991) notion of embedded and invisible technologies:

> In such systems, completeness of awareness is not the goal, as it would be if an individual were actively pursuing an interest in a specific news event in print, broadcast or online. Instead of overwhelming an individual with an endless stream of tweets, Twitter as an always-on, asynchronous awareness system informs but does not overburden." (Hermida, 2010b, p. 302)

In such a system the role of the journalists could change to that of sense-maker, rather than reporter, and Hermida suggests there could be a role in "designing the tools that can analyse, interpret and contextualise a system of collection intelligence, rather than in the established practice of selection and editing of content" (Hermida, 2010b, p. 304).

Proximate futures

In the technology literature the concept of the networked society is embodied in the idea of ubiquitous computing (ubicomp). This is the notion that computing is all around, not only in our mobile phones and computers, but in the built environment and everyday objects, and that individuals can access it effortlessly and on demand. Weiser's *Scientific American* article, cited above, describes a system of interconnected microprocessors that would "weave themselves into the fabric of everyday life until they are indistinguishable from it" (Weiser, 1991, p. 94).

Since then, the concept has evolved to encompass ideas such as the internet of things, wearable computing, augmented reality, calm computing, pervasive computing, locative media, near-field communication, among others. Indeed, the field has become so pervasive that Abowd (2012) has suggested it is time it disappeared. The idea that computation can be transferred from desktop computers into the environment is driven by two trends: a massive increase in computational power and an expanding context in which that power is used (Dourish, 2004).

Weiser's vision was one of streamlined integration between everyday life and computation, and much subsequent research has framed ubicomp as what Bell and Dourish (2006) describe as a proximate future: "That is, motivations and frames are often written not merely in the future tense, describing events and settings to come, but describe a

proximate future, one 'just around the corner' " (p. 134). Greenfleld (2006), for instance, describes a fully integrated system called "everyware" in which powerful informatics never reach the surface of awareness, so that people engage with the system unknowingly. This is a future vision, one that has not come to pass.

By contrast, Bell and Dourish (2006) argue that the ubiquitous era is already here — we are living it — it's just that we failed to notice because we were expecting seamless interoperation and homogeneity. Instead, inconsistent infrastructure, patchy networks, restricted power, and legal and social influences mean the ubicomp reality is as messy as everyday reality. "The desktop computer has not been displaced, but augmented" (p. 141) and computation has moved beyond the confines of the desk and into our phones, watches and other everyday objects.

This is the messy computational environment in which journalism now operates and although there is a disconnect between the vision and reality of ubicomp, connected everyday objects and augmented and virtual reality are real technologies with journalistic applications. Also, notions of technology-enabled civic engagement could lead to new ways for individuals to have a public voice, separate from media outlets.

Pavlik and Bridges (2013), for instance, have investigated the possibilities of augmented reality (AR) for journalism, finding that it has the potential to: "... create a form of storytelling that is more about citizen engagement in a participatory, first-person narrative form rather than the long-standing third-person approach common to most newspaper, magazine, television, and radio reporting" (Pavlik & Bridges, 2013, p. 51).

AR is a form of interaction in which computation moves into the real world: "the site of the interaction is the world of the user, not that of the system" (Dourish, 2004, p. 38). This contrasts with virtual reality (VR), in which the user moves into the world of the computer and "interaction takes place in a fictional, computer-generated world" (p. 38).

Pavlik and Bridges (2013) note that while the geo-locative nature of AR means it is suited to "place-based traditions of news reporting ... it has the capability to bring this model to an entirely new level of precision" (p. 51). Geo-tagging, they suggest, gives journalists new ways to approach data mining and story presentation.

Meanwhile the internet of things (IoT) "envisions a future in which digital and physical entities can be linked ... to enable a whole new class of applications and

services" (Miorandi, Sicari, De Pellegrini, & Chlamtac, 2012, p. 1497). This means content and services will be "all around us, always available, paving the way to new applications, enabling new ways of working; new ways of interacting; new ways of entertainment; new ways of living" (p. 1497). This suggests various levels of interaction between humans and computers. Atzori (2014) identifies three stages: first objects posting information to human networks; second, objects interacting on social networks with humans and other objects; and third, where objects interact socially with each other to build a communication network. The potential and challenges for journalism in such an environment are so far unexamined, but a practice such as journalism, that places responsibility for ethics and values in the hands of practitioners, does not have ways of dealing with the third level of this interaction at the ready.

Separately, the notion of future civic engagement is characterised by the idea that personal mobile devices, open data, cloud computing and urban interfaces will facilitate greater public participation in community life and governance. Foth, Tomitsch, Satchell, and Haeusler (2015) suggest that if cities of the future can provide "touch points" between the architecture and the citizens, then "the might of the Fifth Estate will greatly increase" (p. 630). They point out that the sophisticated filters and recommendation systems of social networks such as Facebook and Google do not necessarily serve the public interest:

> With the absence of a journalistic or editorial code of ethics, these algorithms determine the make-up of the Facebook news feed, Google's top search results, and the recommendations on who to follow on Twitter and what to buy on Amazon. They are optimised to prioritise content that will generate more traffic. (Foth, Tomitsch, Satchell, & Haeusler, 2015, p. 626)

The risk is that despite the advantages of social media, the tendency for commercial platforms to create "personalised spaces, walled gardens, which are tailored to individual preferences" (Foth, Tomitsch, Satchell, & Haeusler, 2015, p. 626) means these platforms "will not bring about a quantum change in the practice and impact of civic engagement" (p. 626). This suggests a role for journalists outside the newsroom and beyond the production of news. To make such a transition journalists would need to see themselves as part of a digitally connected community and understand how to use technologies, along with journalistic values, to work in the public interest. Certainly journalists are able to adapt to new technologies, indeed there is a "symbiotic" relationship between the media and

technology: "It owes its very existence to technological inventions" (Küng, 2011, p.43). However, the literature discussed earlier in this chapter suggests there is a reluctance among those most vested in current professional conventions to adapt (Lasorsa, Lewis & Holton, 2012), and Sheller (2015) has pointed out that the "traditional newsroom is not capable of adapting to the new situation simply by incorporating it" (p. 5).

Dealing with disruption

Sheller's quote suggests a disconnect between new technologies and how they are used in practice. Already technologies such as hypertext, social networks and mobile devices have impacted all aspects of news production. News is now delivered on hyperlinked websites (De Maeyer, 2012); journalists use social networks to find and report stories (Lotan et al., 2011; Papacharissi & de Fatima Oliveira, 2012; Penney & Dadas, 2014; Starbird & Palen, 2012); and mobile phones have become important production and consumption devices (Westlund, 2013). But if the future of technology is as immersive and interactive as the technology literature suggests, then journalists may find it increasingly difficult to adapt and may find themselves economically unviable.

Scholars of innovation define this issue as disruption:

> New entrants to a field establish a foothold at the low end and move up the value network—eating away at the customer base of incumbents—by using a scalable advantage and typically entering the market with a lower-margin profit formula. (Christensen, Skok & Allworth, 2012, p. 6).

This is a pattern that repeats across industries and the challenge for incumbents is whether to adapt or not: "A false choice between today's revenues and tomorrow's digital promise" (Christensen, Skok & Allworth, 2012, p. 6). In the media industry we are seeing disruption play out through the emergence of social networks and hardware manufacturers from outside the industry, combining technologies that, at least initially, don't appear related to existing offerings. Downes and Nunes (2013) see this as one of the causes of what they term big bang disruption: unplanned and unintentional disruption; the type of innovation that "changes the rules" (p. 44).

The move by social networking site Facebook to consolidate news distribution via the Instant Articles service is a case in point (Jewell, 2015) and Newman, Levy and Nielsen

(2015) suggest the role of search and social gateways, in particular Facebook, is strengthening. Indeed, journalism seems to be losing influence to tech companies. Pavlik and Bridges (2013) point out that much digital innovation occurs outside news organisations — at Google, Facebook and Apple — and that the news media is being left out of the equation in which tech giants control the hardware, software and networks on which audiences communicate. The risk for journalists in this context is that their work "will be deemed irrelevant by news consumers" (Christensen, Skok & Allworth, 2012, p. 6).

Already digitalisation has disrupted the mass-media, mass-advertising business models that had made news provision so lucrative in the late 20th century (Picard, 2014). In response, news providers have rolled out paywalls, digital subscription packages and turned to crowd sourcing to pay for journalism. Not-for-profit foundations and private investors have also entered the funding mix. In America the Knight Foundation, which has long supported journalism initiatives, has in recent years begun supporting journalism innovation. Through the Knight News Challenge it has awarded grants to experimental projects (Lewis, 2011). In Australia, the Walkley Foundation in 2014 began offering seed funding to projects that would help create a culture of innovation in the local media industry. More broadly, the emergence of investor-backed startup culture[4] has spurred new, digital-only organisations such as Vox, Matter, BuzzFeed, Storyful, among others, which are competing with established media brands for market share.

These tech-focused businesses are not bound to produce industrial-era products so operate with fewer overheads and staff. As a result they have emerged as serious challengers to institutional producers of news (Boyles, 2015). Within such businesses there is a culture of experimentation and creativity, fostered by flatter organisational structures and collaborative work: "As startups are unbound by traditional constraints of newsroom management, the timeline to bring a new product to market is highly accelerated" (Boyles, 2015, p. 7).

This new breed of media organisation draws on technological superiority as a way to differentiate their offerings from traditional news, yet they must also balance "institutional mimicry with being explicitly innovative and forward-looking" (Carlson & Usher, 2015, p. 7). And this creates tension "between the need to critique traditional news as inadequate with the need to rely on journalism's institutionalized legacy" (p. 7). Carlson and Usher argue

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[4] This thesis draws on Thiel and Masters' (2014) definition of a startup as a company that receives funding from an external source.

that while there is an emphasis on innovation in startups, this is accompanied by a "soft critique of journalism that ultimately reinforces traditional journalistic modes" (p. 7). While these businesses improve the presentation and delivery of news, they do not "advocate disrupting journalism's core tenets or rebuilding the epistemic grounds on which news rests" (p. 12).

Commitment to core values is not necessarily a problem, indeed Pavlik (2013) advocates that innovation in journalism should be guided by four principles: intelligence or research; freedom of speech; truth and accuracy in reporting; and ethics. All key journalistic values. However, there is a view that journalism needs to find new value and innovate if it is to remain a viable practice (Boyles, 2015; Christensen, Skok & Allworth, 2012; Pavlik, 2013; Picard, 2010; Raetzsch, 2015).

Picard (2010) argues that the fundamental problem facing news orgnisations is not technology but making content useful and valuable to audiences. While the notion that the underlying social and democratic value of journalism is "good", this does not necessarily translate to value for audiences, who seek functional, emotional, and self-expressive benefits from news. As a result news organisations are "experiencing a continuing crisis of value destruction" (p. 16) and they must find ways to innovate and create new value to replace that being destroyed.

Innovation is essentially "an idea, practice, or object that is perceived as new by an individual or other unity of adoption" (Rogers, 2003), although in the news media innovation has been defined as "the process of taking new approaches to media practices and forms while maintaining a commitment to quality and high ethical standards" (Tarde, Parsons & Giddings, 1962, cited in Pavlik, 2013, p. 183). In some ways the efforts by journalists to incorporate social tools to their workflow, or following their audiences on to networked platforms, could be viewed as innovations, but Sheller's (2015) point about incorporation suggests that simply reacting to new technologies will be insufficient. The technology literature reveals an alternate approach.

Proactive journalists

Scholarship on the relationship between people and technology is helpful in explaining conflicts between what new technologies make possible and how they are used. This is the field of interaction design (IxD) and it is concerned with studying the intersection of

people and computers. It is closely aligned with human-computer interaction (HCI) and HCI researchers highlight the importance of human values in computing (Harper, Rodden, Rogers, & Sellen, 2008). Dourish and Bell (2011), for instance, call for a "deeper understanding of how social and cultural practice is carried out in and around emerging information technologies" (p. 42), because, "It is lived and embodied practice ... that gives form and meaning to technology" (p. 73).

Dourish (2004) also argues that the increasingly pervasive nature of computing means we need new ways to interact with computers, and he advocates for embodied interaction: "interaction with computer systems that occupy our world, a world of physical and social reality, and that exploit this fact in how they interact with us" (p. 3). This suggests a need to understand the way in which people experience the world.

Arguments for a proactive approach to technology highlight this point. The disconnect between the promise and reality of ubicomp, for example, has prompted debate around the role of people as technology becomes more powerful and pervasive and Rogers (2006) advocates for a shift away from proactive computing in favour of proactive people. Ubicomp, in her view, should be enabling, and ubicomp experiences should "provoke us to learn, understand and reflect more upon our interactions with technologies and each other" (p. 412). She advocates re-conceptualising ubicomp "in terms of designing user experiences that creatively, excitedly, and constructively extend what people currently do" (p. 406).

This view would put journalists at the centre of the design process for news-focused technology. Rather than simply appropriating technologies — software, devices and interactions would be created to achieve journalistic goals and embody journalistic values. HCI scholars also suggest that advances in technology lead to the need for a greater emphasis on human values: "the ideas we all hold about what is desirable in different situations, societies and cultural contexts" (Harper, Rodden, Rogers, & Sellen, 2008, p. 35). For journalists, this augurs well, if they can find ways to embody their values and principles in the platforms of the future.

To do this they will need to draw on their own, deep knowledge of their profession and indeed, within journalism, there are calls for practitioners to be involved in creating technology for their use. Hermida (2010b), for instance, suggests journalists should be designing tools for interpreting and contextualising a system of collection intelligence, and

Christensen, Skok and Allworth (2012) suggest newsrooms need a new approach built on experimentation. They encourage news organisations to challenge their own assumptions and look beyond their existing business models to find value. This resonates with Picard's (2009, 2010) call for new journalistic practice, and Ryfe's (2012) idea that journalists need to reconsider their reason for being. This suggests there is potential for journalists to take a proactive approach to technology.

Making links

Before examining the intersection of interaction design and journalism more closely, this thesis first takes a closer look at hypertext as a specific example of how journalism practice has adapted to technology. Hypertext is the underlying structure of the web, and as such, underpins the networked and social media practices discussed in this chapter. Making links between stories, facts and people is one way that journalists "make personal, even intimate, connections with others" (Ryfe, 2012, p. 10). Given the access to information that the internet affords, and the increasing role audiences have in the production and distribution of news, then how journalists use that infrastructure is important.

Studying how journalists have exploited hypertext can also provide insight into how they should approach future technologies. The literature tells us that deeply engrained production habits are partly to blame for the trouble journalists have had in adapting to new technologies: it is vital that practitioners find ways to evolve.

The NewsCubed project is concerned with these things. It examines how hypertext is used as a journalistic tool with a view to designing a story format that exploits some of its untapped potential and facilitates collaboration with the audience. It aims to create something new, and to demonstrate how interaction design can be used to create an experience that enhances and augments the way journalists work, communicate, and interact with their audiences (Rogers, Sharp, & Preece, 2011).

Chapter 3
The hypertext dilemma

The bandit: "Sure, I killed the man. But I didn't kill the woman."
The woman: "... now that I have killed my husband, now that I have been
violated by the bandit — what am I to do?"
The dead man: "Lying there before me was the dagger that my wife had
dropped. I picked it up and shoved it into my chest."

Ryūnosuke Akutagawa, 1921

Hypertext is the underlying structure of the world wide web, yet it is under-researched in journalism practice, particularly as a narrative device. While computer scientists and literary scholars have explored the impact of hypertext on narratives, on comprehension and on the role of readers, little of this knowledge has filtered into journalism scholarship.

Yet any news story online will be peppered with hyperlinks — bits of computer code that allow the reader to find out more about a topic or issue. It is a ubiquitous technology that the news media has adopted but not exploited. Studying hypertext is therefore a useful way of exploring how journalism has struggled to make the most of new technologies.

As discussed in the previous chapter, the dominance of established news formats and strong cultural traditions have hampered the development of new journalistic practices. The literature on hypertext reinforces these points and also reveals that journalism research plays a limiting role. Rather than exploring the possibilities new technologies open to practice, scholars tend to focus on content created with existing technologies: they look backward, rather than forward.

Hypertext and narrative

Hypertext is one of the defining characteristics of the internet. It enables writers and publishers to create relationships between content and to give the reader a level of control of their interaction with it. Indeed, there is a view that hypertext can facilitate greater depth

in the reporting of stories and allow them to be told from multiple perspectives. Moreover, it can deepen the relationship with the audience, so has the potential to attract new readers or keep existing ones engaged for longer.

This is all good news for news publishers looking to exploit new technologies, combat eroding business models and retain transient audiences. But few of these affordances have been explored or exploited by journalists, who have tended to see hypertext as a "tool to insulate against outside organizations" (Weber, 2012, p. 196). Rather than explore the technology and design ways to exploit its potential, hyperlinks have been added to traditional story formats.

Studies of hypertext (Beyers, 2006; Coddington, 2012; Dimitrova & Neznanski, 2006; Dimitrova, Connolly-Ahern, Williams, Kaid, & Reid, 2003; Larrondo Ureta, 2011; Larsson, 2013; Leccese, 2009; Tremayne, 2004; 2005; Tsui, 2008) reveal limited use of hyperlinks in online journalism, with the majority of links leading to pages on the same website and few links to primary sources or related background information. This has the effect of diluting the potential for greater interactivity, credibility, transparency and diversity that hypertext affords (De Maeyer, 2012). Such a lack of engagement with a fundamental aspect of the internet is troubling, particularly when journalism faces challenges from digital disruption. But given the reluctance of news organisations to network journalism (Beckett & Mansell, 2008; Russell, 2011; Ryfe, 2012; Sheller, 2015) it is perhaps understandable.

Nevertheless, hypertext has untapped potential in a news network.

Hypertext theory posits that information, composed of collections of text, images and audio can be linked electronically and organised in a non-linear way. The key ideas emerged in the work of Bush (1945), Nelson (1965), and Englebart (1988) and have been developed by both computer scientists and literary scholars.

Nelson, who coined the term "hypertext", first defined it as "a body of written or pictorial material interconnected in such a complex way that it could not conveniently be presented or represented on paper" (Nelson, 1965, p. 96). He later referred to hypertext simply as "non-sequential writing", which he said could lead to "all sorts of new text forms: for scholarship, for teaching, for fiction, for hyper-poetry" (Nelson, 2003, p. 198).

Other definitions focus on the structure of hypertext: Nielsen (1990a) described it as consisting of "interlinked pieces of text (or other information)" (p. 2); Conklin (1987) described it as "a computer-based medium for thinking and communication" (p. 32); and Landow (2006) said hypertext "denotes text composed of blocks of text ... and the electronic links that join them" (p. 3). He argued the term hypermedia extended this notion by including other media.

In its basic form a hypertext consists of nodes of information connected by links. It is this link-and-node concept that provides the underlying structure of the world wide web: "a web of nodes in which the user can browse at will" (Berners-Lee & Cailliau, 1990, n.p) and relationships are created between pieces of digital content using hyperlinks. By contrast, in the field of spatial hypertext, which grew out of efforts to visualise link-and-node systems (Shipman & Rosenberg, 2009), meaning is implied by the visual arrangement of information (Matias & Williams, 2009). There is a view that spatial hypertext not only provides a way of visualising complex structures, but allows users to "take advantage of human perceptual abilities" (Marshall & Shipman, 1995, p. 89).

However, it is in the application of these concepts to narrative that the potential of hypertext can be more fully explored, and a number of researchers (Bernstein, 2009; Bolter, 2001; Bolter & Joyce, 1987; Landow, 2006; Moulthrop, 1995a; Pope, 2006) have examined hypertext in the area of fiction. This work has led to the development of hypertext authoring systems, including Storyspace (Bolter & Joyce, 1987); Aquanet (Marshall, Halasz, Rogers, & Janssen, 1991); Tinderbox (Bernstein, 2003); VIKI (C. C. Marshall, Shipman, & Coombs, 1994); and VKB (Shipman, Hsieh, Maloor, & Moore, 2001). Examples of hypertext fiction include *Afternoon, a Story* (Joyce, 1987); *Patchwork Girl* (Jackson, 1995); *Victory Garden* (Moulthrop, 1995b). In these stories, the reader decides the order of events based on the choices they make at various nodes.

Within the literature, debate about the benefits of hypertext as a narrative tool is polarised. On the one hand, there is a view that hypertext advances traditional forms of writing, particularly print (Bernstein, 2009; Bolter, 2001; Bolter & Joyce, 1987; Conklin, 1987; Landow, 2006; 2009; Murray, 1998; Pope, 2006), while on the other hand there is a view that non-linear narratives are more difficult to understand (Conklin, 1987; Moulthrop, 1995a; J. Nielsen, 1990b).

Bolter (2001) has argued that hypertext is the remediation of print: "where printed genres are linear or hierarchical, hypertext is multiple and associative. Where a printed text is static, a hypertext responds to the reader's touch" (p. 42). Landow (2006) posits that hypertext reconfigures text and narrative and that Aristotelian concepts of plot, which have a beginning, middle and end, do not apply to hypertext. Meanwhile, Conklin (1987) suggests the "ability to organize text in different ways depending on differing viewpoints" (p. 38) is the essential advantage of hypertext.

This idea of varying viewpoint resonates with work by Bernstein (2009) as well as Bolter and Joyce (1987), who suggest "the most obvious way to construct a hypertextual fiction is by presenting the reader with choices that affect the plot" (p. 48). Murray (1998) calls this a multiform story, and Bernstein (1998; 2009) refers to it as a Rashomon pattern, in reference to the 1950 Japanese film that tells a the story about the rape of a woman and the murder of her husband from the perspective of four characters[5].

Hypertext in journalism

Within the scholarly literature on journalism, hypertext is considered one of three characteristics of online journalism, along with multimedia and interactivity. Hypertext — or hyperlinks, as it is manifest — ostensibly provides online journalism with greater interactivity, credibility, transparency and diversity (De Maeyer, 2012). However there is a view that journalism has not exploited the potential of hypertext, or the other multimedia assets (Boczkowski, 2004; Brannon, 2008; Domingo, 2008a; Steensen, 2009), with Steensen observing that "linear text is preferred over hypertext" (Steensen, 2011, p. 320) and Domingo (2008) suggesting interactivity in online journalism is a myth.

In a discourse analysis, De Maeyer (2012) found that hyperlinks were considered by educators and practitioners alike to be a fundamental part of the web and that the use of hyperlinks added depth to reporting. But there was also a view that "ideal" practices were not common.

The view that journalists are not exploiting the potential of hypertext is supported by empirical studies (Beyers, 2006; Dimitrova, Connolly-Ahern, Williams, Kaid, & Reid, 2003; Larrondo Ureta, 2011; Leccese, 2009; Paulussen, 2004; Tremayne, 2004; 2005; Tsui,

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[5] The quote at the beginning of this chapter is from that story.

2008). This research reveals limited use of hyperlinks in online journalism, with the majority of links leading to pages on the same website and few links to primary sources or related background information. This has the effect of diluting the potential for the depth in reporting that hypertext affords.

Tsui (2008) found that citation — the "ability to connect a claim directly to its source" (p. 73) — was rarely used by newspapers, which preferred to link to themselves, rather than to external sources. This was in contrast with blogs, which linked heavily to external websites. The value of such external links has been studied also. However, Leccesse (2009) found that limited use of hyperlinks meant political blogs were "like a newspaper comprised of only op-ed pages featuring opinion columnists who gather most of their information from secondary sources" (p. 587). These studies build on earlier research that showed that the number of external links on US news sites was decreasing (Tremayne, 2005) and that few links on news sites were "characterized by in-depth news reporting and the integration of hyperlinks to sources, archival documents and/or related (background) information" (Paulussen, 2004, n.p). And though Gao and Vaughen (2005) revealed differences in the types of links attracted by newspapers in four countries, a common feature was that links tended to come from within a masthead's own national borders.

There are a handful of studies that consider journalistic hyperlinks beyond the internal and external perspective of some of this earlier work. Coddington (2012) has examined how links contribute to news frames, Larsson (2013) explored the motivations for journalistic hyperlinks, and Larrondo Ureta (2011) studied web special features — in her view "one of the maximum expressions of hypertextuality" (p. 199). She argued that although story packages sometimes masked "a lack of content", such packaging was a way of exploiting the "hypertextual, multimedia and interactive dimensions of the online medium" (p. 199) and that although it was not yet a characteristic format, it indicated the potential for online journalism.

These more recent studies reinforce the notion that hypertext is underexploited, but they also suggest that the practice among journalists is evolving. However, journalism scholarship on hypertext has a tendency to count links or explore where they go, and this approach does not appear to recognise the healthy literature that explores the qualities hypertext brings to narrative. Among this body of work are studies that address the role of the audience, issues of comprehension, hypertext design, and the case for visualisation as a design principle.

Although some of this literature is now more than a decade old, it is worth revisiting, because as technology has moved on the value of journalism is being challenged (Picard 2010; Christensen, Skok & Allworth, 2012). It is possible that among the theories and findings of earlier work on hypertext there are ideas and approaches that journalism might benefit from now.

Audience

There is a view that hypertext alters the relationship between author and reader. Landow (2006) refers to the "hypertextual dissolution of centrality, which makes the medium such a potentially democratic one" (p. 123), and Bolter (2001) suggests that hypertext "offers the reader a new literary experience in which she can share control of the text with the author" (p. 122).

Michael Joyce, author of *Afternoon, a Story* and co-developer of Storyspace, makes a distinction between exploratory and constructive hypertexts. An exploratory hypertext is a delivery or presentation technology that enables audiences to "view and test alternative organizational structures" (Joyce, 2003, p. 615). A constructive hypertext, by contrast, is an invention or analytic tool, which requires a capability to act: "to create, to change, and to recover particular encounters within the developing body of knowledge"; and they also require "visual representations of the knowledge they develop" (p. 616).

In Joyce's view a constructive hypertext is a tool for inventing and if the audience is to have a role in creation, then the role of author needs to be considered. Balestri (cited Joyce 2003) has observed that hypertext "changes the relationship between writer and reader. The reader becomes a collaborator, constructing and resconstructing the text, choosing his own path through it" (p. 618).

Fredin (1997), in examining what he termed news hyperstories — stories consisting of a network of interlinked files — suggested a new model of the audience member was necessary because "the user must be actively engaged, fundamentally because the user must make choices to keep the story moving" (p. 2). He described a user model based on the concepts of curiosity, flow, schema, metacognition, and self-efficacy. "Taken together they describe a more active and dynamic audience member than is generally presumed with other news media" (p. 8).

Fredin's study predates citizen journalism and data visualisation, both areas of journalism research that touch on audience participation. But as Meijer (2013) contends, "audience research plays a marginal role in journalism studies" (p. 754). While there is a substantial literature on media effects (Bryant & Oliver, 2008), this work tends to focus on the impact of mass media on individuals and society. Similarly, though there is a body of work that examines the role of citizen journalists (Gillmor, 2004; Ostertag & Tuchman, 2012; Robinson & DeShano, 2011), and visualisation scholars have highlighted the tension for journalists between allowing users to control the visual data experience and the need to drive the narrative (McGhee, 2010; Segel & Heer, 2010), there is little work that addresses how hyperlinks — the essence of the web — impacts this relationship and the construction of news hyperstories.

This is an important question. "Contemporary audiences aspire to participate in the journalistic process, not for the sake of participation as such, but to enable a more valuable, more truthful, multi-vocal journalism" (Meijer, 2013, p. 766). Hypertext can help facilitate this.

Comprehension

Another issue that is consistently raised in discussions of hypertext and narrative is that of comprehension — in Conklin's (1987) terms, "disorientation and cognitive overhead" (p. 38). He refers to the "disorientation problem" as the potential of a user to become lost in a hypertext and notes that cognitive overhead can occur when a reader needs to make additional effort to maintain several tasks and trails at once.

Nielsen (1990b) too, has observed that "one of the major usability problems with hypertext is the user's risk of disorientation with navigating the information space" (p. 298), and argues that to navigate hyperspace, users need to be able to recognise their current location. Pope (2006) observes that "every" participant in his study quickly lost orientation, and Moulthrop (1995a) has discussed the "threat of multiplicity in electronic writing" (paragraph 15). Meanwhile Bernstein (1998) has suggested a lack of vocabulary adds to the "unruliness" of hypertext.

Scholars studying hypertext and journalism have also noted the challenge of dealing with coherence: Engebretsen (1997), who suggests "hyper-news" as "presenting the raw material of a news incident in the form of independent nodes instead of writing it as a

coherent narrative" (p. 222), identifies the loss of coherence as the greatest cost of hypertext. Lowrey (2004), in an experiment aimed at testing assumptions about the benefits of non-linear news stories, found that while non-linearity was good for readers' perceived control over a story, it negatively impacted feedback and had little effect on credibility or knowledge acquisition. Yaros (2011) has suggested that "coherence between text and links is perhaps as important as the coherence in text alone" (p. 292). And while McAdams and Berger (2001) suggest hypertext is better for stories with multiple components, Hall (2001) points out that the way pieces of a story are connected "is fundamental in determining its meaning" and that "the loss of linear structure allows no clear authorial thesis or summation" (p. 69).

However, not all scholars view disorientation negatively. Landlow (2006) points out that what one reader might find disorientating, for another is pleasurable and notes that disorientation is not unique to hypertext, and that it "arises both in the normal act of reading difficult material and in poorly designed systems" (p. 150). He suggests a need to develop "a rhetoric and stylistics of hypertext writing" (p. 151). Bernstein (1998) offers several patterns for the "description, analysis, and perhaps for design of complex hypertexts" (p. 21) and Engebretsen (1997) questioned "where was the coherence in the news before it was created by the journalist?" (p. 223).

Making hypertexts

But how best to construct such a hypertext story? Existing hypertext authoring systems and many studies of hypertext narrative focus on fiction. Journalistic stories are different: they are based on facts; aim for balance; rely on sometimes messy evidence; and are at the mercy of newsroom production processes.

Bernstein (2009) has suggested scholars "contemplate the challenge of historical narrative" (p. 8) and Matias' (2005) historical documentary and Mulholland Collins & Zdrahal's Story Fountain (2004) are examples of multi-perspectival narratives in the this area. Meanwhile Kolb (2004) has experimented with argumentative hypertext. However, with the exception of experiments with students by Yaros (2011), Lowrey (2004), and Vargo et el. (2000), there is little research that examines the implications of such narrative structures on professional journalism practice.

This could be a result of a methodological approach. Many studies of journalistic hypertext tackle the issue from a content perspective, with content analysis a common technique (Beyers, 2006; Dimitrova & Neznanski, 2006; Dimitrova, Connolly-Ahern, Williams, Kaid, & Reid, 2003; Larrondo Ureta, 2011; Tremayne, 2004; 2005). This work has resulted in new ideas about news stories — Tremayne, for example, suggested hypertext could be used to give a story context, and Larrondo Ureta (2011) advocates packaging — but few practical examples. Similarly, De Maeyer (2013) discusses the challenges in social science of counting and coding links. By contrast, researchers in computer science and fiction have created hypertext narratives (Jackson, 1995; Joyce, 1987; Moulthrop, 1995) and built authoring systems and tools (Bernstein, 2003; Bolter & Joyce, 1987; Marshall, Halasz, Rogers, & Janssen, 1991; Marshall, Shipman, & Coombs, 1994; Petersen & Wiil, 2011; Pohl & Purgathofer, 2000; Shipman, Hsieh, Maloor, & Moore, 2001; Subašić, Berendt, & Trumper, 2011).

This presents an opportunity. Not all stories fit neatly into the journalistic inverted pyramid that organises information in order of perceived importance. And journalism, by its nature, covers news incrementally: stories are produced over time and around news angles — various perspectives of a story that together make up the coverage. There is scope for inquiry into how hypertext might reconfigure established journalistic practice, to better equip it for advances in technology. This raises questions about narrative design, process and control: how do audiences read and make sense of such stories; how should journalists create them; and how much control should the author and reader have?

Answering such questions will need a methodological approach that focuses not on content, but on design.

Designing hypertext narratives

Scholarship on the design of hypertext narrative goes some way towards addressing some of these issues. Within this literature there is a tendency to focus on graphical constructs (Bernstein, 1998; Germán & Cowan, 2000; Gloor, 1997; Petersen & Wiil, 2011; Rossi, Schwabe, & Garrido, 1997), or space and structure (Bernstein, 2011; Chen & Carr, 1999; Dillon, McKnight, & Richardson, 1993; Kaplan & Moulthrop, 1994; Marshall, Shipman, & Coombs, 1994; Nürnberg, Leggett, & Schneider, 1997; Pohl & Purgathofer, 2000; Subašić, Berendt, & Trumper, 2011; Westerman & Cribbin, 2000). A few researchers have

considered hypermedia design in the context of journalism (Fredin, 1997; Hall, 2001; McAdams & Berger, 2001; Vargo et al., 2000) but this work has not extended to concepts of space, which along with visualisation, is a theme within hypertext research.

In terms of narrative design, Rossi, Schwabe and Garrido (1997) and later Germán and Cowan (2000) have outlined various patterns used by hypertext designers to aid navigation. Bernstein (1998; 2011) also discusses patterns but he argues the need for a vocabulary of hypertext that would aid the design of complex structures. He identified nine hypertext patterns but noted that current tools for visualising hypertext were not effective in representing these patterns.

While these scholars have analysed existing findings, work by Petersen and Wiil (2011), Subašić, Berendt, and Trumper (2011), Pohl and Purgathofer (2000), and Kaplan and Moulthrop (1994) have developed and evaluated tools and interfaces. These are not design studies in the tradition of design research, but the process of creating a tool, or interface, and testing it, does resonate with research in that field[6]. The approach enables researchers to tackle questions around process, navigation and comprehension.

Petersen and Wiil (2011) identify several hypertext structures that support the structure and organisation of information, in particular to aid the work of investigative teams in fields such as policing, counterterrorism and investigative journalism. They divide investigative tasks into five processes: acquisition, synthesis, sense-making, dissemination, and co-operation and develop a tool to support those processes.

Subašić, Berendt, and Trumper (2011) developed the STORIES tool to enable readers to understand a story and search for underlying documents for facts. Pohl and Purgathofer (2000) examined whether visualisation supported hypertext authoring, and Kaplan and Moulthrop (1994) explored the relationship between navigation and space.

Few of these ideas resonate with work in the area of journalistic narrative and research into how best to design journalistic hypertexts includes McAdams and Berger's (2001) suggestion to draw on Murray's (1998) ideas of a procedure of authorship, and Hall's (2001) concept of hypertext as "a particular trajectory through a series of texts rather than merely the texts themselves" (p. 66).

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[6] See chapter five for further discussion of design research.

An exception is Fredin's (1997) decade-long study into how best to use hypertext in news stories. Observing that the "organizational rules that apply to newspaper articles cannot be transferred directly to hyperstories" (p. 22), he identifies eight hyperstory prototypes and describes a process in which stories are made up of many sections, each a separate file, and for which the journalist constructs a metastory that provides readers with choices. Although his monograph is now 20 years old, it is worth revisiting, because while ideas such as layering information are now fairly common, others are only beginning to be seen in practice. For instance, *ProPublica*'s 2011 story, "Why Can't Linda Carswell Get Her Husband's Heart Back" has characteristics of Fredin's (1997) complex glossary and complex digression formats, in that it allows access to detailed discussion and interpretation via a separate network of files. And more recently, the new, news offering from Vox Media, vox.com, aims to provide greater context to stories though a series of information 'cards' that provide background data. Again, an example of Fredin's glossary and digression formats. But such narratives are not the norm.[7]

Fredin's (1997) idea of a metastory resonates with a study by Pohl and Purgathofer (2000) who found that graphical overview maps that represented the overall structure of a document played "an important role in authoring (and also navigating) hypertext" (p. 810), however, his suggestion that an effective hyperstory would come from "the journalist's understanding of what the story is", suggests changes to journalism practice:

> It is the journalist's models of the world that will lead to excellent hyperstories because it is those models that will suggest the links that users may find interesting and insightful. The challenge of constructing outstanding hyperstories rests ultimately on how deeply the journalist comes to understand the situations he or she report upon. (Fredin, 1997, pp. 35-36)

This has implications for the feasibility of a redesign of news stories, as any requirement to create a meta-level narrative would lead to changes in the way journalists carry out their work. Given the efforts in Europe to claim copyright over hyperlinks and story snippets[8], the legality of laying narratives is becoming fraught, and there is the issue of how to present such a layered hyperstory, particularly when the space in which it exists could be difficult to define: when do you stop linking?

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[7] See chapter four for analysis of hypertext in news stories

[8] For instance, the Leistungsschutzrecht für Presseverleger (LSR) law in Germany that forces search engines and aggregators to pay royalties for publishing parts of articles.

Visualising space

The notion that hypertext exists in space is another dimension that has implications for journalism. This idea is recurrent in the literature and as news moves from traditional platforms to those that are digital, mobile and ubiquitous, constructing narratives becomes a matter of facilitating navigation in an information space.

Bolter (2001) suggests that readers "tend to conceive of hypertext spatially: the links constitute a path through a virtual space and the reader becomes a visitor or traveller in that space" (p. 29); Nürnberg, Leggett & Schneider (1997) define spatial hypertext as the "placement of data objects in a space" (p. 2); Kolb (2009) relates hypertext to notions of space from Newton, Aristotle and Leibniz. Meanwhile, Johnson-Sheehan and Baehr (2001) conceive of users as "hunters and gatherers in virtual space" (p. 23).

Kaplan and Moulthrop (1994) distinguish between "architectonic space" and "semantic space". They argue that computer screens represent architectonic space and that this is not the only sort of space involved in hypermedia design. Instead, hypermedia operates in semantic space, "where there is always a surplus of meaning" (p. 208). They posit that users should be able to "situate themselves within a dynamic information space" (p. 215). However, Dillon, McKnight, and Richardson (1993) argue that navigating such a space is "spurious":

> By definition, semantic space is n-dimensional and practically unbounded. In order to visualise the semantic space it needs to be given physical representation and in so doing, it becomes at most three-dimensional (though more often two-dimensional) and physically bounded. (Dillon, McKnight & Richardson, 1993, p. 186).

Visualisation helps address concerns about navigating space, and there is a body of work that views the visualisation of information — particularly in terms of space — as an important design principle for hypertext (Pohl & Purgathofer, 2000; Chen, 1999). Marshall, Shipman, and Coombs (1994), in developing the spatial hypertext system VIKI, "found that a visual/spatial metaphor for hypertext allows people to express the nuances of structure, especially ambiguous, partial, or emerging structure, more easily" (p. 13). Although, Kaplan and Moulthrop (1994) posit that systems such as Storyspace, VIKI and VKB "concentrate on the arrangement of nodes in a graphic representation" and so do not reflect the "complex phenomenology of virtual space" (p. 207).

Chen (1999) argues that "spatial metaphors are by far the most popular design principle for information visualization" (p. 402) and, writing with Czerwinski (Chen & Czerwinski, 2000), suggests "two- and three-dimensional visualizations have always been some of the most popular design options when it comes to the layout of semantic structure" (p. 633). Meanwhile Pohl and Purgathofer (2000) argue that "visualizations of knowledge structures is one of the most attractive and usable features of hypertext systems" (p. 810).

However, these ideas have not translated to journalism, where academics and practitioners have focused on creating narratives from data sets (Cox, 2011; Flew, Spurgeon, Daniel, & Swift, 2012; Hermida, 2010a; McGhee, 2010; Segel & Heer, 2010; Yau, 2011), the rhetorical aspects of information visualisation (Hullman & Diakopoulos, 2011), aggregating large volumes of news (Rennison, 1994), and the design of visual narratives (Chen, 2010; Moere & Purchase, 2011; Segel & Heer, 2010; Tufte, 2001).

Flew et al (2012), Hermida (2010a), Cox (2011) and Yau (2011) highlight the strengths of visualisation, such as aiding sense-making and creating new knowledge, while Rennison (1994) approaches visualisation as a way of understanding relationships between news stories. An exception is Subašić, Berendt and Trumper (2011) who refer to news and blogs as "rich information spaces" (p. 447) and outline a system in which stories can be visualised and explored in stages, enabling the user to track changes over time. While they refer to the "topic landscape" (p. 450), their project focuses on text mining, rather than space visualisation.

Segel and Heer (2010), meanwhile, used case studies to examine narrative control within data visualisation. They identify a spectrum of author-driven and reader-driven approaches, and suggest that visual narratives must balance the story intended by the author with that discovered by the reader. They identify three hybrid schemas:

- the martini glass, which prioritises author-driven narratives;
- the drill-down story, which prioritises the reader-driven approach;
- the interactive slideshow, which promotes a dialogue between the two.

It is worth observing that these schemas do not give a sense of the multi-dimensional space associated with hypertext. So while they provide some insight into ways of presenting visual stories, and address aspects such as narrative control and evolving stories, they don't address the notion of readers as "hunters and gatherers in virtual space" (Johnson-Sheehan & Baehr, 2001).

Shape

Another body of work considers shape as a way of understanding digital environments (Dillon, 2000; Dillon & Schaap, 1996; Dillon & Vaughan, 1997; Johnson-Sheehan & Baehr, 2001; Matias, 2005; van Dyke Parunak, 1989; Westerman & Cribbin, 2000). Dillon and Vaughan (1997) conceive of users as "travellers in semantic environments" (p. 102) and suggest that shape helps address issues of cognitive overhead (as outlined above), allowing users to better exploit the information in hypertext. Johnson-Sheehan and Baehr (2001) have suggested that the structure of hypertext "should also reflect a simple three-dimensional shape (for example, cube, sphere, pyramid) that "users can 'close' in their minds" (p. 26). Although Westerman and Cribbin (2000) warn that mapping information in three dimensions can increase the navigational demands on the user and suggest this be offset by additional semantic information.

As travellers, or hunters, users need direction. Van Dyke Parunak (1989) identifies direction as one of five common navigation strategies that humans have developed. This strategy depends on texture and comparability: "texture is the existence of some field or distinguished point relative to which directions can be established. Comparability is the existence of a relation ... between any two points of the space" (p. 44).

Van Dyke Parunak (1989) distinguishes between three classes of system: those with no directionality; those with texture but not comparability; and those with both. He suggests that hypercubes, like linear topologies, exhibit both texture and comparability, and support all five navigational strategies. His work addresses graph theory in relation to hypermedia topologies. While this is outside the scope of this project, the ideas that a cubic form can facilitate navigation raises interesting possibilities. Van Dyke Parunak suggests that in a story context, the sides of a cube would act a texture — a place from which to determine direction, or in the case of this project, narrative. And the relationship between the faces, or parts of the story, address comparability.

Matias (2005) explored these ideas in Philadelphia Fullerine. This project used a 60-faced hypermedia spherical sculpture to tell a story about the life of lower-class people in 19th century Philadelphia. Matias argued the shape made fewer demands on readers than linear narratives and freed viewers to begin in any place that interested them. However, he also noted that the shape caused some disorientation: "Had I wanted viewers to find information more easily, I could have followed my original intent to make a cube-shaped

sculpture" (p. 14). A hypercube, he argued, simplified navigation by grouping links on sides, ie, providing texture.

Matias' work, along with that of Dillion, Kaplan and Moulthrop, Van Dyke Parunak, and Johnson-Sheehan and Baehr show there is potential for cubic, hypertext narratives. A cube would also act to bound the semantic space within which the story exists and provide navigational paths through the content.

New paths for journalism

This review has taken a broad view of hypertext research in an effort to show how some of the theories and findings by computer scientists and literary scholars might inform the development of journalistic practice. Among these insights, the idea that hypertext can be used to alter plot and provide depth to narratives could be valuable to journalism. Similarly, the idea that hypertext stories could be designed as three-dimensional shapes opens interesting design possibilities.

As discussed in chapter two, the news industry is facing disruption from social networks and technology companies that are better equipped to reach and engage digital audiences. For journalists, the possibility of providing additional depth and perspectives to stories, or creating new story forms, should be welcome.

However, the literature discussed here also raises some important points about narrative control. By offering more links, a reader is given more choice, and more choice means a power shift. This control is at the heart of discussion around hypertext and narrative: control over the narrative and control over how the audience interacts with that narrative. How to balance these demands while making the most of the ability of hypertext to remediate print is a complex dilemma that established journalism research methods can not easily tackle. Rather than the observational, content-focused approaches that journalism scholars have taken to study hypertext, perhaps the more experimental, design-oriented methods of interaction designers may be more appropriate.

Design methodologies use practice as a form of inquiry and aim to create and evaluate prototypes to understand and discover new possibilities. In the hypertext context, a design approach would enable researchers to experiment with ideas such as space, shape and control, that emerge in the literature.

Before exploring design in greater depth, this thesis first aims to understand to what extent the hypertext theories outlined in this chapter are evident in contemporary journalistic practice. What follows is a small investigation of the use of hypertext in news stories.

Chapter four
Linked up: hypertext in news stories

"If you don't have a good story, technology is technology."

David Dufresne, 2010

The breadth of research among computer scientists and literary scholars suggests there is potential for hypertext to reconfigure established journalistic practice. Hypertext, in theory, can remediate print, alter ideas about plot, provide depth to narratives and, potentially, extend audiences. News stories are peppered with hyperlinks and journalists have integrated hypertext to their practice through social media and digital publishing, where links are used to package long-running coverage.

Yet the journalism literature indicates the full potential of hypertext remains untapped. Journalism scholars have tended to study how hyperlinks are used, and practitioners have been reluctant to embrace the non-linear, interactive qualities of hypertext. Similarly, ideas about using shape to navigate hyperspace have not been explored.

To understand whether, or how, these theoretical concepts play out in practice, 24 examples[9] of the use of hypertext in news stories, news packages and news curation applications were evaluated in terms of characteristics identified in the literature on hypertext discussed in the previous chapter. The designs were selected on the basis that they were either an example of story packaging (Larrondo Ureta, 2011; McAdams & Berger, 2001), or they allowed greater user control over the narrative (Bolter, 2001; Fredin, 1997; Joyce, 2003).

The stories, packages and apps were assessed for their use of hypertext and for the level of control afforded to the reader. Stories were analysed in terms of the nature and destination of hyperlinks, the use of multimedia, nature of interactivity, level of reader control, and how readers navigated the story or package. Story design was also

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[9] See appendix page 195.

considered, including the use of shape, (Dillon, 2000; Dillon & Schaap, 1996; Dillon & Vaughan, 1997; Johnson-Sheehan & Baehr, 2001; Matias, 2005; van Dyke Parunak, 1989; Westerman & Cribbin, 2000) structure (Bernstein, 1998; Fredin, 1997), visualisation (Chen, 1999; Kaplan & Moulthrop, 1994; Marshall, Shipman, & Coombs, 1994; Pohl & Purgathofer, 2000; Segel & Heer, 2010), and how these characteristics worked to facilitate navigation and understanding of the story space.

The data set included 12 examples from established news brands (*The Guardian*, *Financial Times*, *ABC*, *New York Times*, *The Telegraph*, *SBS*). This group included web-only publishers such as *ProPublica* and *The Global Mail* (now defunct). The were also 12 examples from news startups (*Quartz*, *Narratively*, *The Atavist*) and news curation applications (Circa, Flipboard, Paper.li, Storyify, News360, Pulse) as well as the standalone project *Prison Valley.* This meant there were some fundamental differences in the type of content being evaluated. Traditional publishers, for instance, overwhelmingly provided original journalism, whereas news startups and mobile apps generally provided tools that aggregated content from social platforms. This leads to a marked difference in the primary use of hypertext by legacy and new media companies: where established mastheads tend to link internally ie: to other related content on the same site; news apps and curation tools use hypertext as an aggregation tool, so most links are external, ie: to the original source.

Hyperlinked tales

Most of the hypertext structures observed could be considered link and node systems (Berners-Lee & Cailliau, 1990). Files, or stories, link to other, related, files or stories. Among the news packages and stories studied, these links tend to be internal — leading to related stories or to non-related content on the same site ie: part of the site's global navigation. In the case of the news apps, links were predominately external, reflecting the aggregation focus of these tools. Exceptions to these trends included stories from *ProPublica*, *SBS* and the *Prison Valley* website.

"Why can't Linda Carswell get her husband's heart back" (Marshall, 2011) is a long-form feature story that is part of the larger "Post Mortem" story package. The story uses hypertext to give readers access to a database containing source materials, such as medical records and communication as well as annotations by the journalist. Readers can

Why Can't Linda Carswell Get Her Husband's Heart Back?

Linda Carswell poses at the Langham High School track by a memorial plaque for her husband. Her lobbying and testimony played a crucial role in the Jerry Carswell Memorial Act, a new informed consent for autopsies bill passed in Texas this year. (Sharon Steinmann/ProPublica)

by Marshall Allen
ProPublica, Dec. 15, 2011, 12:44 p.m.

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"Your husband is dead," the doctor told Linda Carswell.

This was not supposed to happen. Jerry Carswell had been admitted to Christus St. Catherine Hospital in Katy, Texas, with kidney stones. The previous night, he'd been walking around his room, talking about basketball and the upcoming presidential election with his son, Jordan. The plan was for the 61-year-old to be discharged that morning.

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When Miranda Pakozdi entered the Cross Assault video game tournament this year, she knew she had a slim chance of winning the $25,000 prize. But she was ready to compete, and promised fans watching online that she would train just as hard as, if not harder than, anyone else.

Over six days of competition, though, her team's coach, Aris Bakhtanians, interrogated her on camera about her bra size, said "take off your shirt" and focused the team's webcam on her chest, feet and legs. He leaned in over her shoulder and smelled her.

Ms. Pakozdi, 25, an experienced gamer, has said she always expects a certain amount of trash talk. But as the only woman on the team, this was too much, especially from her coach, she said. It was after she overheard Mr. Bakhtanians defending sexual harassment as part of "the fighting game community" that she forfeited the game.

Sexism, racism, homophobia and general name-calling are longstanding facts of life in certain corners of online video games. But the Cross Assault episode was the first of a series this year that have exposed the severity of the harassment that many women experience in virtual gaming communities.

And a backlash — on Twitter, in videos, on blogs and even in an online comic strip — has moved the issue beyond endless debate among gaming insiders to more public calls for change.

Executives in the $25 billion-a-year industry are taking note. One game designer's online call for civility prompted a meeting with Microsoft executives about how to better police Xbox Live. In February, shortly after the Cross Assault tournament, LevelUp, an Internet broadcaster of gaming events, barred two commentators who made light of sexual harassment on camera and issued a formal apology, including statements from the commentators.

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A demonstration at Comic-Con. Trash talking is common in the world of online gaming, but women are often singled out.
Sandy Huffaker for The New York Times

Readers' Comments

"It would be more productive to ask what it is about these 'games' which produces such violent and degrading behavior."
phylum chordata, earth
Read Full Comment »

FACEBOOK
TWITTER
GOOGLE+
EMAIL
SHARE
PRINT
REPRINTS

Figure 1 (left)
ProPublica allowed readers to switch on special hyperlinks to explore story sources more deeply.

Figure 2 (above)
Highlighted links in The New York Times lead to additional evidence.

choose to turn on "source" links, which highlights sections of the story that have associated files and notes (figure 1). Similarly, "In Virtual Play, Sex Harassment Is All Too Real" (OLeary, 2012) from *The New York Times* (figure 2) featured highlighted links that enabled pop ups of video clips and audio that acted as evidence of the harassment female gamers are subjected to during competitions. These features have characteristics of Fredin's (1997) complex glossary and complex digression formats, in that it allows access to detailed discussion and interpretation via a separate network of files. However, it doesn't allow for "trailblazing" by the reader, as there are no paths from this file network to other stories.

There were a couple of examples that exhibited qualities of spatial hypertext, including *The Block* (Smith, 2012), and *Prison Valley* (Dufresne & Brault, 2010). *The Block* is an interactive video-style documentary focuses on a housing estate in Sydney. Viewers move through a virtual, street-view style map of the two-acre block and explore it via interviews and file footage (figure 3). These stories are arranged on the map in a way that implies meaning eg: we hear from boxer Anthony Mundine in the gym on Everleigh Street. In this
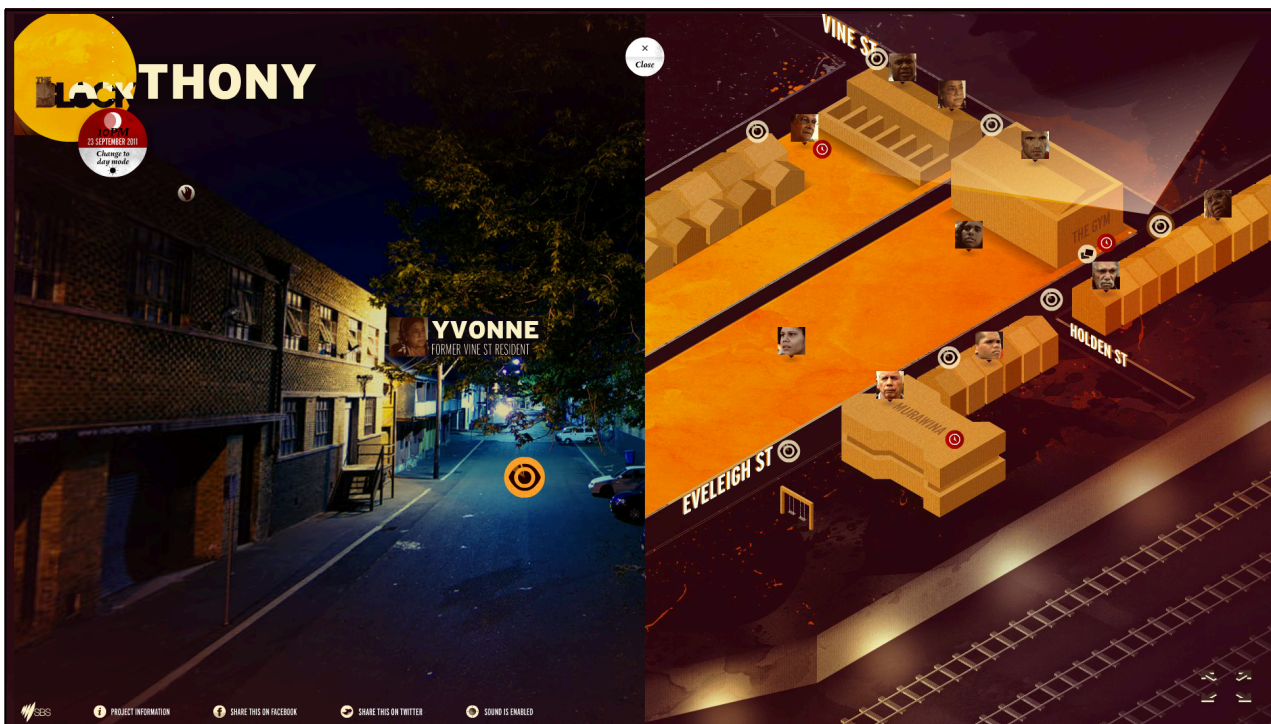
Figure 3
The Block allows readers to navigate the story via a virtual map. Stories are located at places associated with each source.

way, meaning is implied by the visual arrangement of information (Matias & Williams, 2009). That the hypertext nodes are related through their proximity also give a sense of neighbourhood (Bernstein, 1998).

Similarly, in *Prison Valley* (figure 4), is a multimedia web documentary with a geographical setting that the viewer explores via links, in this case Canyon City in the US. From a virtual hotel room, the viewer explores the town and its prison system via documents, video interviews and forums. Viewers can collect information and souvenirs along the way. These are kept in the hotel room and provide a way of tracking and retracing their path. Because *Prison Valley* does not use a map in the way *The Block* does, viewers cannot readily work out where they are. However, in terms of navigation, the hotel room provides a way to recognise their location and situate themselves within the information space (Kaplan & Moulthrop, 1994; Nielsen, 1990).

Apart from these examples, most of the news sites studied packaged related coverage of a news topic, long-running or complex story on a specific web page. Such pages often contained excerpts and links to previously published content and generally the most recent or most newsworthy stories had prominence. Decisions about what to place on the page
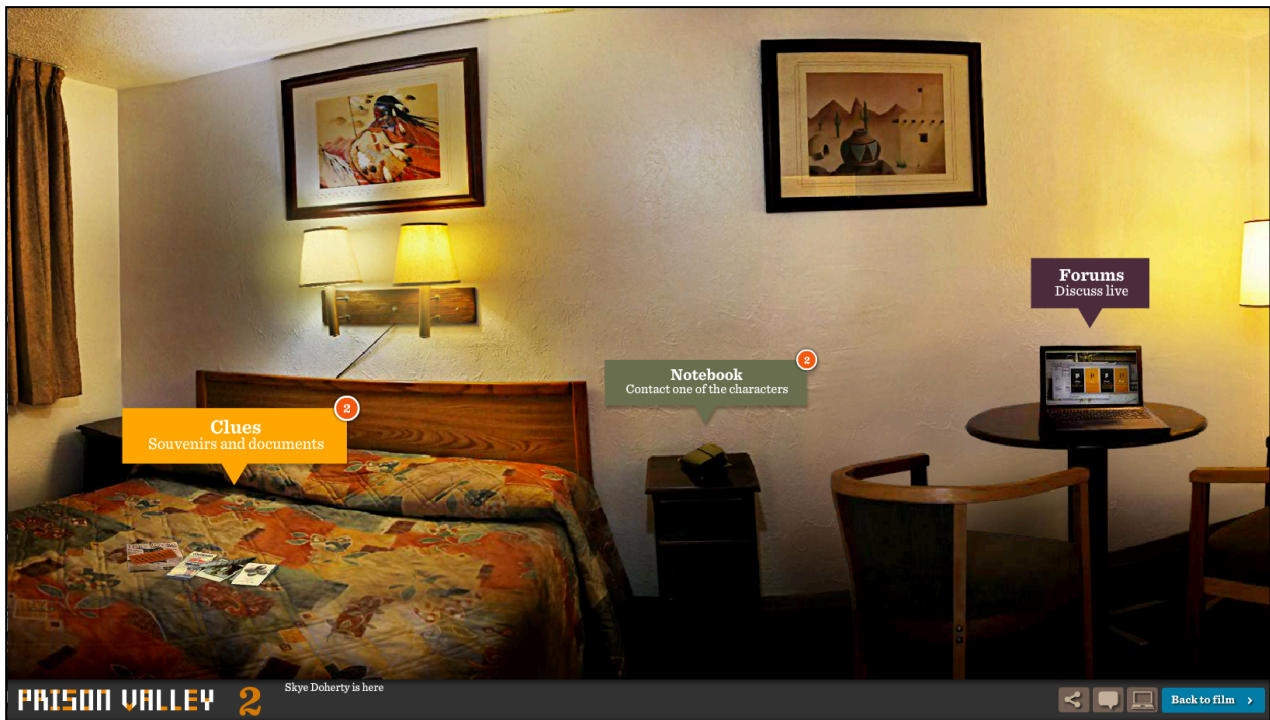
Figure 4
In Prison Valley readers navigate the story from their hotel room. The notebook, clues, room door and forum are links to other parts of the story.

and where are usually made by editors. This type of packaging is an example of the dominance of relative hyperlinks — links to other content on the same site.

These types of packages differ from other collections of news on a website in that they are story-specific. The architecture of many news websites allows for grouping content in categories based on criteria such as geographical region, newspaper section (eg: finance, sport, comment), or medium type. A news package, by contrast, might contain stories that would otherwise be spread across these sections. What ties them together is the narrative.

However, what this type of packaging doesn't accommodate well are alternative ways of ordering stories or combining them with related content that is not generated by the publisher. There is also limited user control over the way the content is delivered. In most cases the most recent story is at the top, followed by older content. In some cases comment and analysis or rich media content is highlighted. Also, these packages are not generally offered on the publishers' mobile editions.

Control

Among the examples studied, control of the narrative still largely rested with the author and users were able to explore the hypertext via embedded links. While some of the news curation tools allow users to construct packages, this functionality did not extend to the readers. For example, Paper.li and Storify allow users to create, edit and publish narratives, however, readers of these stories do not have the same control. Another restriction among apps was access to content. Most of those studied here allowed users to aggregate content only from selected sources. Scoop.it was an exception in that it allowed users to create original content within the tool.

The ability to curate content from multiple sources was common among news curation applications. The mobile apps Pulse, News360, Paper.li, and Flipboard, for example, allows users to personalise the services by feeding in content from multiple sources and allows viewing in a choice of templates. But these are all predominantly aggregation tools, using selected sources, and there is no ability to create original content or generate relationships between them.

Storify (figure 5) differs here, as it does allow readers to create stories using aggregated links and original text. It, along with Scoop.it and Paper.li, also encourages constructive
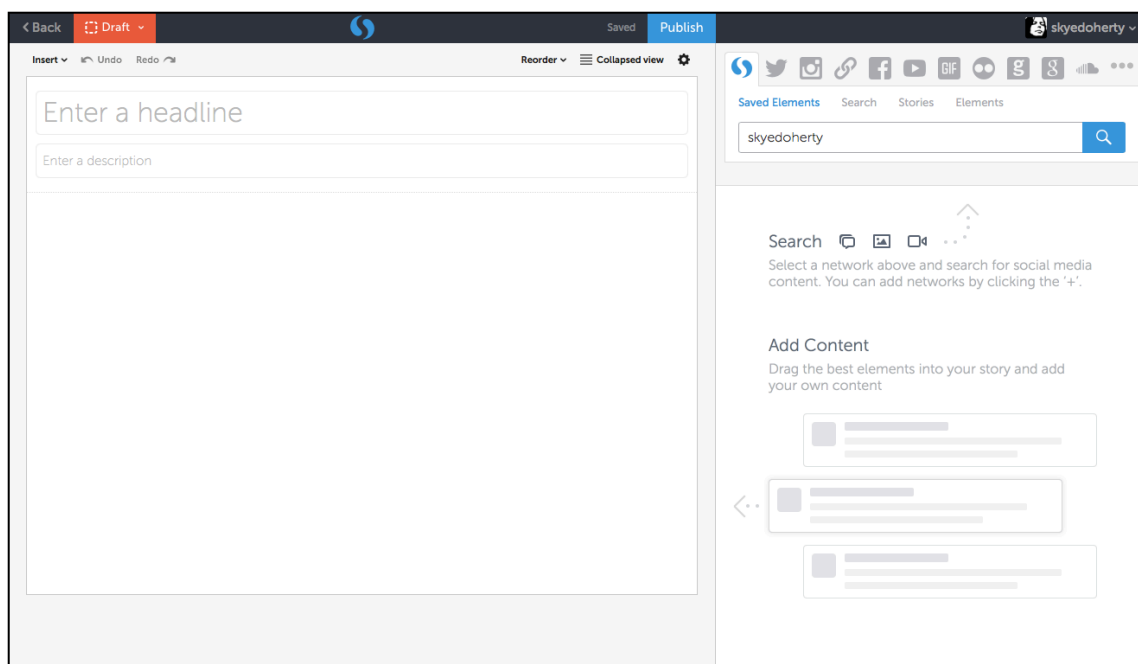
Figure 5
The Storify editing pane allows users to combine original content (left) with snippets from social media (right).

hypertext. Using Storify, for example, users can create a story and rearrange its components. Paper.li offers editing tools to story creators and Scoop.it also allows users to make annotations. Many of these tools are only available to the story curators, not readers.

Despite the potential for hypertext to "allow readers to share control of the text with the author" (Bolter, 2001, p. 122), this ability was not common, and there were few examples of what Joyce terms a constructive hypertext — one that allows users to "to create, to change, and to recover particular encounters within the developing body of knowledge" (Joyce, 2003, p. 616). Such hypertexts also require "visual representations of the knowledge they develop" (p. 616).

Story design

Among the sample there was widespread use of layering information so that users are given some details of the story then click through for more. Fredin (1997) refers to this a the rule of "a little then a lot" (p. 17). In news packages this generally takes the form of a headline and summary of content that the reader clicks on to read in full. Similarly, apps such as Flipbook, Pulse and News360 display a headline, thumbnail image, and in some cases a summary, of content that the user can drill into further. In terms of visual design, this characteristic might be considered a "drill-down story" in that the "visualization structure presents a general theme and then allows the user to choose among particular instances of that theme to reveal additional details and backstories" (Segel & Heer, 2010, p. 1146).

The use of layers and links, particularly in news packages, reflects the idea of a meta-story (Fredin, 1997; Vargo et al., 2000), although there was little evidence of the graphical overview maps suggested by Pohl and Purgathofer (2000).

Most news sites still fit with Rossi, Schwabe and Lyardet's (1999) guidelines for a "news" pattern where the page is structured in such a way that the "space is devoted to the newest additions, including a summary and a link to the information object" (p. 1670). Stories and packages from mainstream publishers, such as the *Financial Times, New York Times, The Guardian*, tend to be part of a strong hierarchical website, with extensive global navigation to other parts of the site. This is not the case with news curation apps, which tend to be more clearly focussed on the user's preferences, have minimal global

navigation (particularly on mobile versions), and do not offer the wide-range of original content that mainstream publishers do.

It is worth noting that while topic pages are features of news websites, they are not normally part of the publisher's mobile app: the *Financial Times* In Depth section is part of the FT's website, but not its iPad or iPhone app.

The examples from the mainstream publishers all linked to broader digital networks by providing tools for sharing a link to the story via email or on social networks such as Facebook and Twitter. In this way the publishers were using the network as a way of involving readers in content distribution. *Prison Valley*, by contrast, used social media as an extension of the story. To engage in the documentary, readers needed to sign in via Facebook or Twitter, thereby becoming part of a community connected to the story. Readers' own progress through the website is "told" to their followers via status updates (Dugdale, 2010).

The use of space as a design tool is mixed. Where apps such as Flipbook, Pulse and News360 can be seen a examples of the comic strip genre (Segel & Heer, 2010), many of the other examples studied do not fit easily into Segel and Heer's visual genres. In most, the story space is restricted to the computer or device screen — an example of "architectonic space" (Kaplan & Moulthrop, 1994, p. 207). But Kaplan and Moulthrop point out that hypermedia operates in semantic space and that users should be able to "situate themselves within a dynamic information space" (p. 215).

There is a body of work that considers shape as a way of understanding digital environments (Dillon, 2000; Dillon & Schaap, 1996; Dillon & Vaughan, 1997; Matias, 2005; van Dyke Parunak, 1989; Westerman & Cribbin, 2000), with Johnson-Sheehan and Baehr (2001) suggesting that the structure of hypertext "should also reflect a simple three-dimensional shape (for example, cube, sphere, pyramid) that the users can 'close' in their minds" (p. 26). Such ideas were not evident in the study sample.

While there is a trend among apps to organise stories groups in panels of square tiles, the concept does not extend to three dimensions. Rather, the space is broken up into content shapes much the same way has long been done in newspaper and magazine design. In the case of apps, users navigate the content by scrolling back and forward through the screens, or, in the case of Flipbook, flipping through pages.

This is an example of what van Dyke Parunak (1989) might call a linear typology, which has texture and comparability: "texture is the existence of some field or distinguished point relative to which directions can be established. Comparability is the existence of a relation ... between any two points of the space" (p. 44). Texture and comparability enable navigation.

New ideas for practice

The findings of this exercise suggest potential for news design to more fully exploit hypertext as a narrative device. The evidence shows marked differences in the way that traditional publishers and news start-ups approach the packaging of content in topic categories. The most obvious are in the use of original versus aggregated content, and the tendencies towards internal versus external hyperlinks.

Hypertext is supposed to provide online journalism with greater interactivity, credibility, transparency and diversity (De Maeyer, 2012). Yet, with some exceptions noted above, hyperlinks are not regularly used by traditional media companies to involve readers, incorporate information sources or include a range of perspectives. And while news curation tools allow users to create custom narratives, the sources of content are often restricted, so any diversity of views is often limited to social media.

There is potential for some of the ideas about narrative developed by scholars of hypertext fiction to find fertile ground in journalistic stories. Conklin (1987) has pointed out that the essential advantage of hypertext is the "ability to organize text in different ways depending on differing viewpoints" (p. 38). Bernstein (2009), Bolter and Joyce (1987), and Murray (1998) have all identified the possibility for hypertext to offer readers choices that vary story plot, and Bernstein (2009) has suggested scholars "contemplate the challenge of historical narrative" (p. 8). Matias's historical documentary (Matias, 2005) and Mulholland Collins and Zdrahal's Story Fountain (2004) are examples of multi-perspectival narratives in the this area.

This presents a design opportunity. Not all stories fit neatly into the journalistic inverted pyramid that organises information in order of perceived importance, and journalism, by its nature, covers news incrementally: stories are produced over time and around news angles — various perspectives of a story that together make up the coverage. As the

examples in this study show, hypertext has been used to aggregate such coverage, but there is scope for designs that facilitate the ability to switch perspective.

Such functionality leads to issues of control, and it would seem there is a case for a middle ground solution: one that combines journalist-driven and reader-driven narratives with the benefits of original and aggregated content. Segel and Heer (2010) have highlighted the tension between allowing users to control a story and the need for the author to drive the narrative. The challenge for designers is to strike a balance.

The concept of virtual space also provides scope for innovative news design. Currently, ideas of shape and space have not been exploited in journalistic narrative, yet the literature indicates that shape can aid navigation and comprehension of information spaces. Nürnberg, Leggett and Schneider (1997) argue that spatial hypertext, which places data in space, pushes the limits of hypertext and that structure in such systems is "dynamic and implicit", while work by several hypertext scholars (Dillon & Vaughan, 1997; Johnson-Sheehan & Baehr, 2001; Kaplan & Moulthrop, 1994; Matias, 2005; van Dyke Parunak, 1989) indicates there is potential for cubes to make complex hypertext stories easier to navigate and understand. The sides of a cube might also act to enable stories to be told from multiple perspectives.

Methods for innovation

A cubic, hypertext news story is a new idea for journalistic storytelling and creating a tool to achieve this would be a way of putting journalism at the centre of a design process. However, existing methods of journalistic research and production are not conducive to this type of technology-focused design and development.

As discussed in the previous chapter, journalism researchers have tended to use observational, content-focused approaches to study hypertext, rather than the experimental approaches of other disciplines. Similarly, as the ethnographies highlighted in chapter two, there is a reluctance among practitioners to break with entrenched modes of production and established views on the role of journalism. The story examples above reflect this through limited audience involvement and a tendency to restrict links to internal content.

However, as flagged at the end of chapter three, design methodologies are suited to experimental research and could be used to explore the possibilities of space, shape and control in journalistic storytelling. Design research and its relationship to journalism research is discussed in depth in the next chapter. However, it is worth noting how the investigation documented in this chapter relates to the broader thesis methodology.

While it is difficult to compare offerings from publishers that approach content creation and delivery from such different perspectives, in the context of design research, comparison is not a focus. Rather, the aim is to gather reference materials that can be used to inform design ideas. In this way, the work discussed in this chapter is an example of research for design: it is part of the process of collecting evidence to inform the broader design research, and enable the artefact at the centre of the project to be brought into being (Downton, 2003). The process of design research and the relevance of the work here is discussed further in the next chapter. As will be seen, this exercise, combined with the hypertext literature survey in chapter three, were hugely influential on the direction of the NewsCube prototype, as they revealed opportunities for news designs that allow greater reader involvement and to use shape as a tool for storytelling.

Chapter 5
Journalism, design & knowledge

*"Everyone is designing most of the time — whether
they are conscious of it, or not."*

Harold G Nelson and Erik Stolterman, 2012

The examination of hypertext in the last two chapters suggests there are systemic reasons behind the failure of journalists to fully exploit this basic digital technology. While scholars of computing and literature have experimented with authoring systems and explored the potential for space and shape to be used as narrative devices, journalism researchers and practitioners have perceived hypertext as a linking device. The result is that practice fails to exploit technology, and scholarship that focuses on content. While this is an observation that could be made of many creative industries, in journalism the challenge of remaining relevant seems particularly pertinent given its responsibilities to voting publics.

The work of newsroom ethnographers, discussed in chapter two, explains the cultural reasons that have inhibited innovation among practitioners: the values and tenets that give journalism meaning also inhibit its ability to exploit the rich, interactive and immersive experiences offered by emerging platforms. However, the technology literature tells us that the future of computing is likely to be more ubiquitous and immersive, and this means that traditional journalistic outputs may not be fit for the types of interaction demanded by new technologies.

The technological challenges facing journalism practice also impact journalism research and there is some uneasiness about whether established theoretical approaches are sufficient to deal with the changing news ecosystem. Some scholars have called for theoretical renewal (Mitchelstein & Boczkowski, 2009) and greater diversity (Singer, 2008), while others have argued that journalism should have a role in shaping the future of journalistic practice (Kopper, Kolthoff & Czepek, 2000) and suggested that practice itself is a form of knowledge production (Niblock, 2012). These latter arguments find fertile ground in design research.

As noted in the introduction, Design is both a practice and a field of study, and design researchers use the tools of designing to create artefacts that solve problems and, in doing so, produce insight into, and knowledge about, the situations and people involved. In design there is a focus developing new ideas — creating something new — and this is what is valuable to contemporary journalism.

This chapter examines journalism research and design research. It then explores the parallels between the two fields as well as the challenges of generating knowledge through practice. The chapter then outlines the thesis methodology in light of the issues discussed.

Journalism research

Journalism studies, as a field of research, is concerned largely with what journalism is and why it matters. Among its members are practitioners, educators, sociologists, historians, and others, who study journalism production, the artefacts created, and their reception by audiences. There is no agreed definition of journalism research, and Zelizer's (2008) five types of inquiry (sociology, history, language studies, political science, and cultural analysis) sit alongside Wahl-Jorgensen and Hanitzsch's (2009) four phases of research (normative, empirical sociological and global-comparative) and Domingo's constructivist tool kit (Domingo, 2008b). Meanwhile, Conboy (2013) identifies political, economic, historical, ethnographic and social science approaches to journalism research, and suggests they all have validity (p. 51).

There is a tendency for scholarship in the field to use analytic or critical methods to examine the attitudes of journalists (Weaver, 2008); analyse journalistic products (Kolmer, 2008); or observe what journalists do (Quandt, 2008). These are all good tools for understanding what journalism is and why it is important, but they are insufficient for shaping its future. Research, according to Kopper, Kolthoff and Czepek (2000), "should not only be retrospective but should help to shape the future of journalism" (p. 511).

Löffelholz (2008) argues that many of the theories common in journalism research are "not up to the task of modeling change adequately, nor are they interested in this ... [they] are not flexible enough to cope with the new media and communication world" (p. 24-25). Others suggest that despite the field's diversity, journalism research has become blinkered. Singer, for instance, argues that there has been a narrowing of analytic and

interpretative focus and that "the underlying diversity of the intellectual tradition needs to be reclaimed" (Singer, 2008, p. 154). She suggests that new paradigms "are most likely to emerge from a combination of traditionally disparate approaches" (p. 154). Writing with Quandt (2009), she also suggests that the converged media environment "poses a number of challenges and opportunities for journalism practitioners and scholars, who face both methodological and conceptual issues" (p. 140).

Mitchelstein and Boczkowsk (2009) call for theoretical renewal. They observe that the tension between tradition and change in newsrooms is also playing out in the academy as studies "continue to apply existing lenses to look at new phenomena" (p. 575). Steensen and Ahva (2015) argue that the interdisciplinary nature of journalism research means there is a need "to widen the scope of theoretical perspectives and approaches even further" (p. 13). And Karlsson and Strömbäck (2010) suggest "traditional research methods are not fully applicable in a setting where the news can change continuously" (p. 15). Traditional approaches are "not compatible with the fast-evolving internet" (Kopper, Kolthoff & Czepek, 2000, p. 510).

There is also a view that practice itself is a valid form of knowledge production (Bacon, 2006; 2011; Niblock, 2007; 2012) and that journalism can be researched through practice. This view has roots in Schön's (1983) notion of reflective practice and the idea that knowledge can be produced through action. This is a relatively recent notion in journalism scholarship and it challenges the traditional division between research and practice, where research "denotes systematic inquiry in order to gain new knowledge, while practice is deemed to be processes employed in professional activity other than the acquisition of new knowledge" (Niblock, 2012, p. 6). Yet journalism practice and research are evolving.

Journalism is at a point of "innovation and radical change" (Franklin, 2014, p. 469). Conferences on the future of journalism (Franklin, 2012; 2014), studies of how software is being used to create journalistic content (Clerwall, 2014; van Dalen, 2012), the possibilities for augmented reality (Pavlik & Bridges, 2013), and the influence of ambient computing (Hermida, 2010b) are now part of the research mix, alongside work on journalism production (Ryfe, 2012) and analyses of news content (Bachman, 2015) and audiences (Drok & Hermans, 2015; Picone, 2016). Indeed, Picard has observed evolution in the industry, with "journalists and enterprises adjusting to new conditions, undertaking regeneration and renewal, and pursuing new opportunities" (Picard, 2014, p.3).

In such a dynamic environment, there is scope for journalism research to play a greater role in driving change and exploring new possibilities rather than studying existing instances of practice. Deuze (2012) argues for greater creativity: "... more creativity and innovation on both the firm and the individual level means more success and a greater competitive advantage" (p. 5). This resonates with calls for journalists to develop new practice (Picard, 2009) and to find ways to offer new value to audiences (Christensen, Skok, & Allworth, 2012). While surveys, observations and analysis of content provide insight into what journalists do and why, they do not help develop new practice or find ways to exploit the rich, interactive and immersive experiences offered by emerging platforms.

Drawing on Bauman (2000), Deuze (2008) has framed the challenges for journalism research in terms of a liquid society, observing that uncertainty, flux, change and unpredictability, have "come to structurally define or even determine the way people, media, and society interact" (p. 860). This means journalistic value "will be increasingly determined by the interactions between users and producers rather than the product (news) itself" (p. 860). Deuze (2012) identifies a shift in the perception of technology among practitioners and academics from being described and analysed "strictly in terms of its success as defined by market penetration" to a more social view, a "gradual reworking from a presumably lifeless machine into a generally reproductive yet potentially transformative social tool" (p. 55).

Such a shift presents an opportunity to study technology from an enabling perspective. Rogers' argument for proactive people, in favour of proactive computing (discussed in chapter two) captures this: "people rather than computers should take the initiative to be constructive, creative and, ultimately, in control of their interactions with the world — in novel and extensive ways" (Rogers, 2006, p. 406). For journalists this means perceiving technology as an enabler of journalism. This also means recognising that while technology can create new types of interactions, such as those afforded by social media, it also means journalists themselves can design interactions that not only exploit the technology but do so in a way that embodies journalistic values. Hermida (2010b) hints at this when he suggests journalists become involved in designing tools for collection intelligence rather than for selecting and editing content.

To understand journalists as enablers of technology, it is useful to study interaction design, a field that sits at the boundary of technology and the people who use it.

Studying interaction

Interaction design (IxD) is concerned with how technology is used, and there is an emphasis on studying, and designing for, that experience: "it is about creating user experiences that enhance and augment the way people work, communicate, and interact" (Rogers, Sharp, & Preece, 2011, p. 9). A tendency to focus on digital technology — "the why as well as the how of our daily interactions using computers" (Thackara, 2001, p. 50) — means IxD is closely aligned with human-computer interaction (HCI), and some scholars use the terms interchangeably (Stolterman, 2008). However, the fields differ. Where HCI emerged from engineering and psychology, IxD is more firmly rooted in practice-led design research. This means that rather than the experimental approach of HCI, IxD researchers take an iterative approach: ideas are researched, designed, prototyped, deployed to users for evaluation, and then improved.

Interaction design research often draws on methods from social science to understand the issues around how people interact with technology. It encompasses fields such as computer-supported co-operative work (CSCW) and participatory design, where ethnography has been a key technique in studying the social context for human-computer interaction and involving stakeholders in the design process. Examples of research in the area of journalism and news production include Heath, Luff, Nicholls and vom Lehn's (2000) study of the asynchronous interaction among journalists at Reuters; Bødker and Petersen's (2007) study of cross-media news production; and Ehn and Kyng's (1991) efforts to improve relations between journalists and typographers.

Such projects fit with the general focus of work in the fields of CSCW and HCI in that they are concerned with "how the order of work is socially produced" (Martin & Sommerville, 2004, p.63). Historically, IxD research has oriented toward ethnomethodology — "the study of the methods people use for producing recognizable social orders" (Rawls, 2000, p. 546). Ethnomethodologists often use observational techniques, such as ethnography, to understand social action. The approach became established in CSCW through Suchman's (1987; 2007) idea of "situatedness", and design researchers often use ethnographic techniques to gather insights into users so they can create technologies for everyday use.

In this way IxD is interested in "shaping digital things for people's use" (Löwgren, 2014, n.p). Its focus on interactive technologies distinguishes it from other design disciplines, though it employs many standard design methods, including user research, sketching and

prototyping, and is interested in "changing situations by shaping and deploying artifacts" (Löwgren, 2014, n.p).

Wolf, Rode, Sussman and Kellogg (2006) note that within HCI, prototyping, iteration, and evaluation are used to provide scientific rigor, whereas in creative design these processes are about "presenting the designer with opportunities to analyze her work" (p. 524). In this sense, IxD fits with the creative tradition, in which the process is divergent and unpredictable, and the designer is considered part of the process, rather than an "objective instrument" (Löwgren, 1995, p. 88).

Parallels can be drawn here with journalism practice: a process that deals with divergent and unpredictable situations and in which the journalist makes judgements and decisions about action. Similarly, ideas around practice-led design research resonate with recent discussions in journalism research (Niblock, 2012). However, within journalism research, interaction design is rare, and, conversely, journalism has received little attention from design researchers. While there are a handful of studies that look at developing technologies for journalistic use (Jokela, Väätäjä, & Koponen, 2009; Väätäjä & Egglestone, 2012; Väätäjä, Vainio, Sirkkunen, & Salo, 2011), there is little work to date that uses practice-led design methods to address issues within journalism practice. In both the media industry and the academy there is a tendency to examine what is, rather than what can be.

Design research

Design, like journalism, is both a practice and a field of study, and design research "emerged from practitioners developing ways of working to help them cope with the problems they faced" (Dorst, 2008, p.4). Typically these problems are complex, ill-defined, and there is no clear solution, because every attempt to solve the problem will have consequences. Rittel and Webber (1973) refer to such problems as "wicked", and contrast them with the "tame" problems normally tackled by scientists and engineers.

"Wicked" is one way to characterise the problems designers face, and several scholars have suggested that design approaches are suited to tackling them (Buchanan, 1992; Cross, 1982; Gaver, 2012). Gaver (2012) observes that such problems are "complex enough that no correct solutions exist *a priori*" (p. 940) and Forlizzi, Zimmerman and Evenson (2008) suggest they "have too many dynamic and interconnected constraints to

accurately model and control using the reductionist approach found in science and engineering" (p. 24). While Schön refers instead to "messy situations", rather than problems, and Löwgren and Stolterman prefer the term "dilemmas", there is agreement that design is good for things that other approaches are not.

This is because unlike science or engineering, design does not seek to prove or disprove a hypothesis, or produce generalised theory. Instead, design is generative: "Rather than making statements about what is, design is concerned with creating what might be" (Gaver, 2012, p. 940).

This focus on creation is another defining aspect of design research: design "creates something new" (Löwgren & Stolterman, 2004, p. 9). Jones (1992) refers to this as "the initiation of change in manmade things" (p. 6), Bayazit (2004) describes design research as "study, research, and investigation of the artificial made by human beings" (p. 16), and Nelson and Stolterman (2012) suggest that to create is to design, arguing that design "is the first tradition among the many traditions of inquiry" (p. 12).

Writing with Löwgren, Stolterman has also argued that complexity of design and the nature of dilemmas make creativity fundamental: "a dilemma can only be resolved by a creative leap, by transcending the limitations of the present. Since design is inevitably concerned with dilemma situations, creative thinking becomes one of the fundamental aspects of the process" (Löwgren & Stolterman, 2004, p. 17).

To achieve this transcendence, designers use qualitative methods such as interview and observation to understand the situation. They then use this evidence to develop design ideas through sketching and prototyping. This is followed by a process of evaluation and iteration — improving the design. This process is not about creating something universal, rather is it about creating something unique and particular — an ultimate particular: "something in the world with a specific purpose, for a specific situation, for a specific client and user, with specific functions and characteristics, and done within a limited time and with limited resources" (Stolterman, 2008, p. 59).

For Nelson and Stolterman (2012), the ultimate particular carries the same dignity and importance as truth in science, but it cannot be created with a scientific approach, "because science is a process of discerning abstractions that apply across categories or taxonomies of phenomena, while the ultimate particular is a singular and unique composition or assembly" (p. 31).

There is also a view in design scholarship that there is a "designerly" way of working and interacting with situations. Cross (1982) discusses "designerly ways of knowing" as the tacit knowledge designers bring to problem solving and the knowledge residing in designed artefacts. Stolterman too suggests that while the design literature does not provide one clear theory of design, seminal works, (including Cross, 2001; Krippendorff, 2006; Lawson, 2006; Schön, 1983), "all argue that there exists something that we can label a designerly approach, and that design is a unique human activity deserving its own intellectual treatment" (Stolterman, 2008, p.60).

Implicit here is the notion that design is different to other types of intellectual inquiry: "... such an approach is different from the scientific approach and is solidly based in design practice and in the situated and the concrete. It is an approach that deals with particulars and with the richness of reality, and with the purpose of creating and forming new realities" (Stolterman, 2008, p.60).

This comparison with science is common in design theory, and design has often been defined in relation to science. At times it has struggled to justify its practice-based approach in contrast to more rationalist methods. Cross (2001) points out that design methods originated in science, with early scholars (Alexander, 1964; Simon, 1969) taking an objective and rationalist, process-focused, view. However, this "science of design" approach fell out of favour and there has since been a shift to seeing design as discipline (Cross, 2001; Schön, 1983); as a form of participatory, co-operative work (Ehn, 1989); and as a way of thinking (Brown, 2008; Dorst, 2011). Yet the tension with science endures, with Krippendorf (2006) calling for a semantic turn in design research towards a "science for design"— a proactive approach that enables design to "pursue its own paradigm of inquiry and ways to generate practical knowledge" (p. 210).

Much of the tension between design and science stems from whether design approaches can generate knowledge, as science does, and whether design inquiry can be considered research. Downton notes that "fields that employ non-quantative modes of research have to keep re-making the case for the value of such methods in research-related contexts" (Downton, 2003, p. 71). Meanwhile, Gaver (2012) observes "an undercurrent of questioning within the design community itself about the nature and standards of research through design" (p. 937). This uneasiness stems from concerns about a lack of clear expectations around quality and guidelines around how theory is developed.

Dorst (2011) points out that there are two fundamentally different ways of looking at design: rational problem solving, which is goal-oriented; and reflective practice, a process of learning. While the rational approach is more aligned with engineering design and assumes a problem can be solved, reflective practice takes its lead from Schön (1983) and his idea that knowledge can be produced through action. It follows that the outcome of that action — the artefact — contains knowledge.

Artefacts and knowledge

In practice-led research, such as design, the methods of professional practice are considered a form of inquiry and the resulting artefacts are seen as an ideal, or as opening a new space for research (Zimmerman, Stolterman, & Forlizzi, 2010). This does not mean that all practice is research, and scholars of practice-led research in design and journalism agree that to be considered research, practice must contribute to knowledge and relate to the relevant theory.

In the literature on interaction design and human-computer interaction there are several frameworks that aim to ensure that practice produces artefacts that make a contribution to knowledge. These include Research Through Design (Zimmerman, Forlizzi & Everson, 2007), the Interaction Design Research Triangle (Fallman, 2008), Concept-Driven Interaction Design (Stolterman and Wiberg, 2010) and Constructive Design Research (Koskinen, Zimmerman, Binder, Redstrom, & Wensveen, 2012). Within these approaches an artefact is produced that embodies the research and new understandings gained as a result. Koskinen et al (2012) argue that in design research, expression, such as through a prototype, epitomises analysis: "it crystallizes theoretical work, and becomes a hypothesis to be tested" (p. 60).

Others suggest that design research and artefacts produce intermediary forms of knowledge that sit between theory and practice. Several forms of such knowledge have been proposed, including strong concepts (Höök & Löwgren, 2012), annotated portfolios (Gaver, 2012) and bridging concepts (Dalsgaard & Dindler, 2014). Such knowledge takes various forms: strong concepts are design elements; annotated portfolios are annotations of realised design examples; and bridging concepts are theoretically informed design articulations and examples. Intermediary forms of knowledge are seen as both promising and as a liability because they can potentially undermine the importance of the designs

themselves, thereby "removing some of what makes IxD research insights unique" (Höök et al., 2015, p. 34).

Yet there is debate about whether artefacts themselves are sufficient to communicate the knowledge generated through practice. Cross, while noting that design knowledge exists in products, argues that to qualify as research, "there must be reflection by the practitioner on the work, and communication of some re-usable results from that reflection" (Cross, 1999, p. 9). Similarly, Swann (2002) argues that the design process is a research process, and that "the action of designing is the same as the moment of synthesis that occurs in all forms of research, when the various parts of the data and analysis begin to make sense" (p. 55). However, he notes that this process must be made visible if it is to be recognised as research and makes a case for systematically documenting the design process.

Gaver (2012) argues that "rather than aiming to develop increasingly comprehensive theories of design, practice-based research might better view theory as annotation of realised design examples, and particularly portfolios of related pieces" (p. 937). "If artefacts embody theory, however, they do not encode it, and if they occupy a point in a design space, they do not highlight the salient or fruitful dimensions of variation that space offers … design theory is best considered a form of annotation, serving to explain and point to features of 'ultimate particulars', the truths of design" (p. 944).

Meanwhile, Solterman and Wiberg (2010) note a lack of research approaches within design that focus on theoretical advancement and are design oriented, and Fallman (2007) makes a distinction between design-oriented research — the practice of academic designers — and research-oriented design — the practice of applied researchers and designers.

In his view, the result of work by this latter group is an artefact, which "generates various kinds of knowledge, in terms of experience, competence, implicit knowledge, as well as, sometimes, the more general kind of knowledge that can be rather similar to that typically coming out of a research project" (Fallman, 2007, p. 198). But this is not the same as the knowledge generated by academic designers, who study designed artefacts, either in use or through bringing them into being. In this case, it is the knowledge generated through this research process that is the main contribution and "the artifact that has been developed becomes more of a means than an end" (p. 197).

This position differs from that of Zimmerman, Forlizzi and Evenson (2007), who see the creation of an artefact, designed to address a real-world issue, as a central component. In their Research Through Design (RtD) approach, design is used to address wicked, or complex problems and the resulting artefact is a concrete embodiment of theory and technical opportunity; communicates design activity; and facilitates knowledge transfer. Their approach draws on Nelson and Stolterman's (2012) view that design is a third research culture, distinct from science and the arts, and which produces wisdom that is "an integration of reason with observation, reflection, imagination, action, and production or making" (p. 18).

However, Zimmerman, Stolterman and Forlizzi (2010) do differentiate research artefacts from design artefacts: research artefacts should aim to produce knowledge, so commercial implication can be de-emphasised; and research artefacts should demonstrate a significant invention. In a critique of RtD they argue that knowledge implicit in an artefact hinders the development of theory and suggest a "more rigorous documentation of progress and evolution of RtD projects" (p. 316) to facilitate the development of theory and methodology. They argue that a lack of documentation can limit the value of research contributions.

Similarly, Dalsgaard and Halskov (2012) suggest that documenting design research acts to support reflection and provide evidence to support the insights gained as a result. This is a problem in longitudinal design studies where it can be difficult to make sense of the large volumes of data that are generated. A lack of established systems or examples for documenting design research means that designers develop their own routines, but this makes it difficult to compare findings across projects. Another issue is that design decisions are often interpreted retrospectively, which can result in "unintentionally skewed accounts" (p. 436).

To this end, Dalsgaard and Halskov (2012) propose a system of documentation that aims to capture design "events" and reflections as the design process unfolds. The Process Reflection Tool (PRT) aims to support Schön's (1983) notions of reflection-in-action and reflection-on-action by allowing designers to add reflections throughout, and at the end, of the design process. However, they found that their system did not capture the right type of data for later analysis: "PRT data may have less value than initially desired, because aspects [that] emerge as pertinent may not have been captured in sufficient detail" (p. 435).

Despite much inward reflection on the nature, and value, of design research, the IxD community does not appear to be clear about what it does and how: "there is curiosity and sympathy — but also a fair amount of confusion — about what design research looks like as a practice and what sorts of knowledge outcomes it can produce" (Höök et al., 2015, p. 36).

Arthur (2007; 2011) has another view on knowledge. In exploring the relationship between technology and innovation he considers the knowledge brought to a technology by the inventor. He argues that radically novel technologies arise from a "context of knowings":

> ... they arise from practice in working with — and knowing in a deep way — certain components and functionalities and certain newly uncovered effects. Such practice is really a form of craft. It consists not just in knowing functionalities and how to combine them. It consists in knowings of what is likely *not* to work, what methods to use, whom to talk to, what theories to look to, and above all of how to manipulate phenomena that may be freshly discovered and poorly understood. (Arthur, 2007, p. 285)

He uses the term "deep craft" to define this type of knowledge, and suggests it plays a role in redomaining: "the expressing of a given purpose in a different set of components" (Arthur, 2011, p. 73). Arthur considers redomainings as key to innovation because they "provide a wholly new and more efficient way to carry out a purpose. They allow new possibilities" (p. 73). In this context, deep craft "means knowing how to manipulate newly discovered and poorly understood phenomena" (p. 160).

This suggests tacit knowledge on the part of a designer becomes part of the knowledge in an artefact and that there is value in drawing on deep craft from other domains.

Designerly journalism

In journalism research the issue of knowledge production and theory development is also being debated, although discussion around practice-led approaches is more recent and less developed. Bacon has suggested that investigative and in-depth journalism meet the criteria of being "creative and original investigation" and that the "issue for journalism as academic research is not whether it is research, but how the nature and practice of its research is to be theorised" (Bacon, 2006, p. 151). She points out some of the challenges

of a practice-led approach in journalism research, including dealing with confidential sources and legal issues.

Meanwhile, Niblock (2012) has suggested two approaches to journalism research: theory-first, and practice-first. In theory-first the research is driven by a question that is interrogated using an appropriate methodology. Practice, in this case, is used to illustrate a point or process. In a practice-first approach, the research is driven by a problem and practice is used to solve it. The main output is a journalistic artefact; the research is inherent within the practice; and the resulting artefact is the solution. Niblock argues that both approaches seek to advance knowledge about practice or within practice, but the benefit of a practice-first approach "is that it permits practice from both within and without professional norms and offers a space to 'test' out theoretical concepts in practice" (Niblock, 2012, p. 11).

This notion of experimentation and the ability to "imagine that-which-does-not-yet-exist" (Nelson & Stolterman, 2012, p. 12) is a strength of practice-led inquiry, and one that could be better exploited to address some of the challenges facing journalism research and practice. In particular, it can go some way toward mitigating weaknesses of current methodologies, which often study what is, rather than what might be.

Like the wicked problems designers tackle, journalists deal with messy, unpredictable situations. Reporting or writing a news story can involve navigating a range of sources and conflicting information. On top of that, there may be ethical considerations around the impact of a story on a source, or legal challenges such as defamation. There is always a deadline, restrictions on information due to budgets, time, or the willingness of sources to talk. At times there may be an editorial agenda, and there is always the demands of the medium to consider. All of these impact a journalist's work and they must make decisions and judgements about how best to deal with and resolve those in the interests of the reader, and society more broadly. The result is a piece of journalism that accommodates these factors, and is particular to the situation.

In the design literature this process might be discussed in terms of creating a product that addresses the needs of a user while meeting the needs of the client. There is also the role of material to consider — with digital technologies there is the challenge of working with a "material without qualities" (Löwgren & Stolterman, 2004, p. 3) because its limitations are

so few. The design must also be attractive, and it must be responsible, because any change has consequences (p. 10). The result is a particular, designed artefact.

Creating these ultimate particulars requires a certain amount of creativity. In design much has been written about "designerly" ways of working (Cross, 2001; Krippendorff, 2006; Lawson, 2006; Schön, 1983), and design methodologies provide a framework that enables designers to accommodate the factors at play and create something new. In journalism, such frameworks for practice are less common. Instead, journalism is practiced within structures, ethics and conventions that determine things such as story formats, interactions with sources, how facts and opinions should be accommodated and whose interests should be served. These practices are so engrained that journalism is often perceived as "overwhelmingly constrained by rules and conventions, or structures, giving little licence for a journalist to exercise agency" (Fulton & McIntyre, 2013, p. 18).

Yet Fulton and McIntyre reveal a creative, almost "designerly", approach to storytelling by practitioners: rather than constraining activity, these structures "actually enable a journalist to produce their work" (Fulton & McIntyre, 2013, p.19). Journalists exercise creativity in their choice of language, style of writing, deciding who to interview and what questions to ask. The conventions and constraints of story format, ethics, news values, public interest, audience and media ownership, among others, are enabling: "creativity is always embedded in previous works, it is always the product of a system ... and there are always structures to constrain and enable an individual in their creative process" (p. 21).

To exercise creativity journalists make judgements. News judgement, or "gut feeling", is the "seemingly self-evident and self-explaining sense of newsworthiness" (Schultz, 2007, p. 190). Newsworthiness is what determines the importance of news stories and is largely determined by news values — lists of news criteria, such as power, celebrity, magnitude or surprise. While there are several such lists (Galtung & Ruge, 1965; Golding & Elliott, 1979; Harcup & O'Neill, 2001), it is also recognised that news values alone are inadequate for explaining or guiding journalistic judgment, with O'Neill and Harcup pointing out that it is not possible to examine news values in a meaningful way "without also paying attention to occupational routines, budgets, the market, and ideology, as well as wider global cultural, economic and political considerations" (O'Neill & Harcup, 2009, p. 171). That said, news judgment is a fundamental part of journalistic practice.

For Nelson and Stolterman (2012), judgement is a fundamental aspect of design and the knowledge it produces. Judgement, they argue, is at the heart of design wisdom and is "dependent on the accumulation of the experience of consequences from choices made in complex situations" (p. 139). They distinguish between intellectual judgement, which "may lead to an understanding of a general principle" and creative judgement, which "leads to new concepts", and design judgement, which "leads to a concrete particular understanding and concomitant action, within a specific contextual setting" (pp. 145-146).

Journalistic judgment is like design judgement in that it is built up over time and situated in the context of the story and methods used to obtain it. Like design, journalistic methods are tools, rather than strict protocols for process, and the practitioner makes judgments about how to use them in "suitable situations in the way afforded or dictated by the circumstances" (Löwgren & Stolterman, 2004, p. 168). A designer's tools include sketching and prototyping, along with qualitative approaches such as user interviews or observations. Designers use these tools to understand the design context and develop an idea that addresses a dilemma. There is no requirement to use specific tools, rather, the designer uses methods appropriate to the task and works within a broader iterative framework of establishing needs, designing, prototyping and evaluating.

Journalists generally use qualitative tools such as interviews, observations, and document analysis to gather evidence and facts on which to construct stories. Again, there are no mandated rules for using certain approaches and the journalist chooses the best methods for the job while working within a the established process of reporting, constructing a story, editing and distribution. Some scholars and practitioners have argued for a more rigorous approach to gathering evidence — through the use of computation (Flew, Spurgeon, Daniel, & Swift, 2012), social science research methods (Iorio, 2004; Meyer, 2001), or literary techniques (Wolfe & Johnson, 1990), for instance. These methods have found application in practice, but journalists choose how and when to apply them. They have creative agency.

Another aspect of design practice that resonates with journalism and is closely related to process is talk back — the idea that during the complex process of making, the designer navigates issues and problems and these decisions have unintended consequences that impact the final outcome. "When this happens, the designer may take account of the unintended changes he has made in the situation by forming new appreciations of it, the situation 'talks back', and he responds to the situation's back-talk" (Schön, 1983, p. 79).

Schön argues that in a good design process, this conversation is reflective: "In answer to the situation's back-talk, the designer reflects-in-action on the construction of the problem, the strategies of action, or the model of the phenomena, which have been implicit in his moves" (p. 79).

In journalism, situation back talk is common: a complex story will seldom go smoothly and journalists often need to navigate vested interests, secrecy, nervous sources and lies. As a result, the journalist might need to change their method of investigation or find a new way to tackle the story when a line of inquiry runs cold or is prevented. In such cases a journalist will reflect in action to determine the next move.

Journalism then, is designerly. Journalists use their creativity, agency, and judgement to create stories within established conventions and respond to, and accommodate, the unique characteristics of each situation. But while journalists design, journalism is not design. While it aims to reveal something new, journalism does not aim create something new. While journalists have agency in the way they research and construct their stories, they do so within strong cultural frameworks, which Ryfe (2012) argues, inhibit change. And journalism does not tend to test out ideas — there is little room for experimentation and evaluation: journalists produce texts according to established formats and are bound to "constitutive rules" that structure interactions with sources, editors and readers (Ryfe, 2012).

Design, by contrast, is about imagining possible futures and creating new things. This is why interaction design, with its focus on understanding the context for use, and developing prototypes that address problems within that context, is useful for developing new ideas about how journalism might better exploit technology and shape it's future.

Journalistic RtD

The NewsCubed project set out to use design methods to address a journalistic problem and generate new ideas for practice. Using Research Through Design it aimed to address the issue of journalistic hypertext and, in doing so, demonstrate how practice-led research can lead to insights about how journalism might evolve.

Hypertext, as the underlying structure of the internet, is a key technology in online publishing and storytelling. But, as noted in chapter three, it is a new media asset that

journalists have failed to fully exploit (Boczkowski, 2004; Domingo, 2008a; Ryfe, 2012). Using design, this thesis aims to create a new way of exploiting the interactive and narrative qualities of hypertext.

Research Through Design (RtD) is a design-oriented research model that uses methods from design practice as a form of inquiry and, through the process of designing, results in the creation of an artefact that demonstrates an ideal or "opens a new space for design" (Zimmerman, Stolterman & Forlizzi, 2010, p. 311). Its focus on solving a real world issue makes it logical for a discipline such as journalism that is grappling with technological disruption.

RtD has roots in "research through art and design", described by Frayling (1993) as including work such as materials research, development work, or action research. In this type of research, results and/or process are communicated separately to the designed artefact. RtD also draws on the idea that there is a "designerly" way of thinking and acting as distinct from scientific thinking (Cross, 1982), and which is good for solving wicked problems (Buchanan, 1992). As with Niblock's practice-as-research methodologies, RtD has strong links with reflective practice (Schön 1983).

RtD research projects include Hug's work on narrative sounds (Hug, 2010); Oznec's reverse alarm clock (Ozenc et al., 2007); and Zimmerman's designing for the self projects (Zimmerman, 2009). Though it is not an approach that has been applied to news design, the complex and systemic problems facing the news industry (Picard, 2014), coupled with the need to innovate and invent new practice (Christensen, Skok & Allworth, 2012), create a situation suited to design research.

In keeping with the RtD framework, the designed artefact — the NewsCube — was intended as a concrete embodiment of hypertext theory and the technical opportunity afforded by hyperlinks. The artefact aimed to communicate design activity and facilitate knowledge transfer through a transparent process of conceptualisation, designing, prototyping and evaluating.

Given the debate among design researchers about how best to document and extract knowledge from practice-led research, the project acts as an instance of this type of research activity. Uniquely, it demonstrates how a journalist-oriented researcher has deployed, documented and evaluated design techniques to extract knowledge about the future of interaction in a specific domain. Like Niblock's idea that practice can provide a

space to test out theoretical concepts, the project outlined in the following chapters uses design methods to create a journalistic tool. Rather than journalism representing "a movement towards a solution" (Niblock 2012, 506), it is design that provides the overarching framework and provides the new possibilities.

NewsCubed research

The project involved activities common in interaction design: contextual research; designing and prototyping; evaluating; iterating; and reflection. It employed a range of qualitative and practice-based methods, including: interviews; observation; sketching; and prototyping (figure 6).

Contextual research

The analysis of practice discussed in chapter four served as the project's contextual research phase. Like Frayling's (1993) idea of research for art and design, this work underpinned and enabled the subsequent design process (Downton, 2003). It resonates with Stolterman and Wiberg's (2010) idea of concept generation, which to be valuable must be "based on earlier theoretical work in the field" (p. 110).
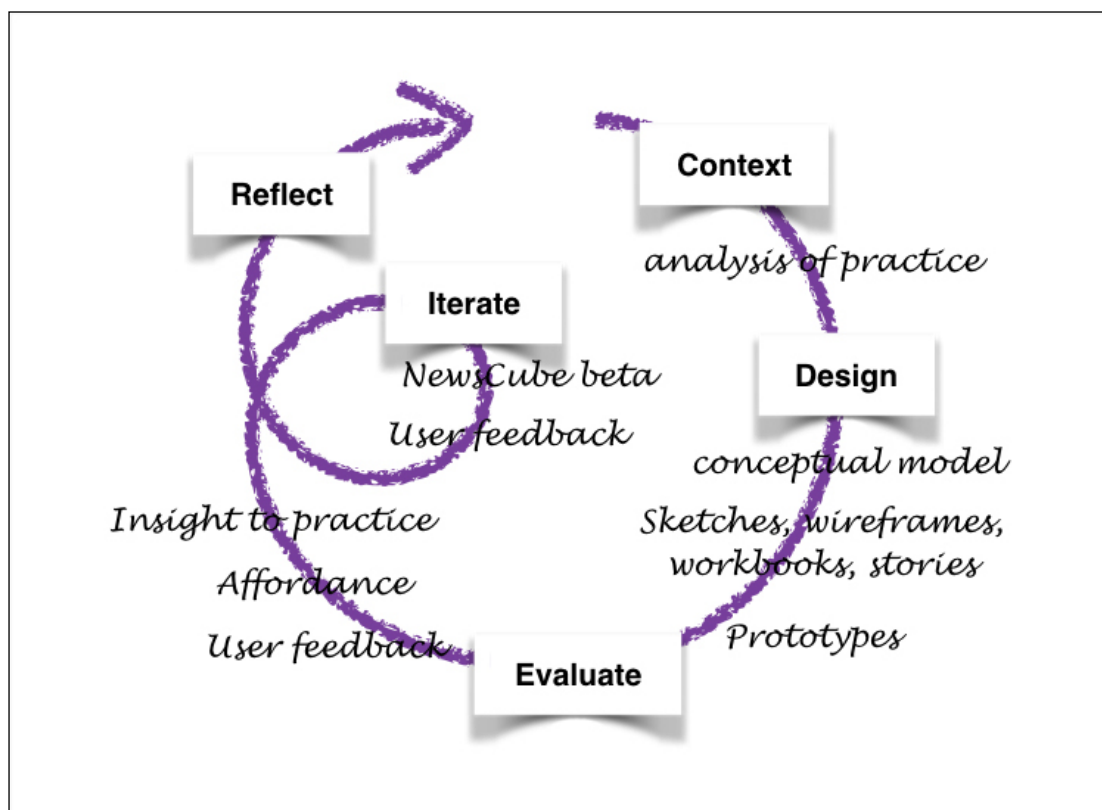

Figure 6
NewsCubed research design.

The review of the literature on journalism practice (chapter two) revealed a disconnect between the affordances of technology and their exploitation by practitioners. In the case of hypertext, a further review of the literature (chapter three) revealed that although computer scientists and literary scholars had developed a solid understanding of how hypertext impacts stories and comprehension, little of this knowledge had filtered into journalism scholarship. Ideas around comprehension, control, and the use of space and shape as narrative devices had not been examined in a journalistic context. The study of how hypertext is used in journalistic storytelling (chapter four) reinforced these findings and also revealed opportunities for news designs to allow greater reader involvement and to use shape as a tool for navigation.

Design and prototyping

The design phase of the project centred on creating a prototype iPad application that exploited some of the possibilities for hypertext narratives that emerged from the contextual research. This app, the NewsCube, used a cube shape to enable users to tell stories from multiple perspectives. A small iOS development company, developed the app based on the researcher's concepts and designs, which included low-fidelity prototypes, sketches, wireframes, stories and digital prototypes. The design process and evolution of the prototype was documented, and transcripts of meetings, emails with the developers, and design iterations were among the data collected[10]. The key output from this process was the iPad prototype that was deployed to users.

Evaluation

Between December 2013 and June 2014 the NewsCube prototype was deployed to eight people working in journalism or the digital publishing industry in Australia. Seven of the participants were based in the researcher's home city of Brisbane, one was in Sydney.

Following initial email and/or phone contact, there was a meeting at which the participants were introduced to the design concept, the theoretical motivations and the basic functions of the application. In the case of the local participants, this meeting and subsequent interviews, were done in person at the participants' place of work. In the case of the Sydney-based participant, both the introductory meeting and follow-up interview were conducted via a video Skype link.

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[10] An examination of the interaction between the researcher and the developers can be read in Andrew Dekker's PhD thesis (Dekker, 2015).

During this discussion, low-fidelity balsa cubes were used to explain the concept: that the sides could be used to show different perspectives on the story. The literature on hypertext and journalism was also parsed. At this meeting informed consent and gatekeeper clearances were sought.

Participants were then invited via email to join TestFlight[11]: a web service for distributing and testing beta mobile applications. Once signed up, the NewsCube app was deployed directly to the participant's device. In most cases the device was used only by the participant. In the case of one organisation, three participants used the same device.

The time between the initial meeting and subsequent interview varied from three weeks to 16 weeks. During this time the participants were free to use the application, with a view to providing feedback during a subsequent interview. These semi-structured interviews took between 30 and 60 minutes. Participants were asked to comment on their experience using the prototype. These interviews were recorded and transcribed. Selected quotes and conversations are reproduced in this thesis and participants have been given pseudonyms. Where my comments are included, I am identified as Skye.

Iteration

In June 2014 the NewsCube won a journalism innovation grant from Australia's Walkely Foundation. The money, AU$25,000, was awarded to develop the NewsCube as a web application. This phase of the project represented a design iteration — a chance to revisit the concept following external critique (Stolterman & Wiberg, 2010). Feedback was sought from two senior editorial staff of a major online newsroom, who were interviewed together about their experience of the design. Again, the semi-structured interview was recorded and transcribed and gender-neutral pseudonyms have been used here to identify their comments.

Limitations

One characteristic of this study has been the challenge of gaining access to industry; not because of a lack of interest, but because of a lack of time to invest. In all the cases presented here, finding an entry into a participant's schedule was difficult. They just didn't have time, and, more importantly, head space. In one case the interview time was moved

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[11] At the time of use, TestFlight was an independent, online application. It has since been acquired by Apple Inc and is now part of the iOS Developer Program.

four times in a single week as the demands of the workplace took over. This also limited the time available to her to test the prototype.

Because of these factors, data collection was designed to be as least intrusive as possible, and tailored to the individual's circumstances. In one case this involved three members of a team being interviewed together.

This is a characteristic of the industry. The 24-hour news cycle, and a focus on short-term outputs, means there is often little opportunity for practitioners to reflect on their own practice let alone the more fundamental nature of how news is structured and delivered. An implication of this is that the time between the initial meeting and the evaluation interview varied between three and 16 weeks. The longer times again indicate the challenge of accessing feedback from participants who are working in industry at a high level.

Another limitation is the absence of design alternatives. The early stages of design research focus on idea generation and will usually result in multiple concepts, of which one is developed further. In this project, the decision to design and evaluate a cube was made early. As noted at the end of chapter four, the NewsCube concept was strongly influenced by the scholarly literature on hypertext and an investigation of the use of hypertext theories in journalistic practice. It is likely that a more user-driven approach to contextual research would have produced a greater variety of design concepts.

The following chapters detail the design research undertaken in this project, including the phases of design, evaluation and iteration.

Chapter six
Designs for journalism

"... one can get more out of a sketch than was put into making it because of it's ambiguity. The fact that the sketch is, well, sketchy – that is, leaves a lot out, or leaves a lot to the imagination – is fundamental to the process"

Bill Buxton, 2007
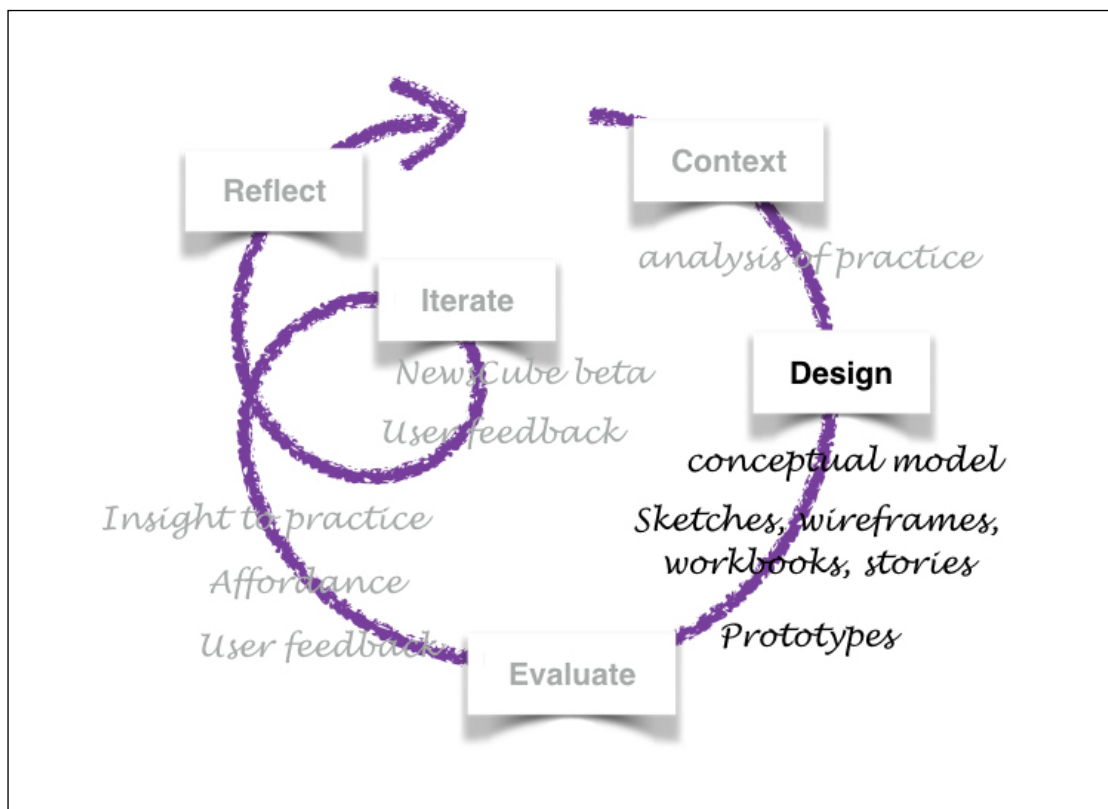
Figure 7
Research design phase.

The contextual research undertaken in chapter four, and the literature survey in chapter three, had a strong bearing on the direction of the design work that is outlined in this chapter. This phase of the research included developing a conceptual model, sketching and prototyping.

The NewsCubed project aimed to use design to push journalism practice in a new direction and make a creative leap in how hypertext might be used to tell journalistic stories. Using Research Through Design, design artefacts were created that embodied the

dilemma situation and the thinking around how to address it. This thinking was journalistic, not designerly: the process of designing and prototyping was driven by journalistic knowledge and practice and reflected a journalistic process, albeit one that did not readily map to the traditional process of reporting, story construction, editing and distribution. It is this journalistic approach to design research that makes this project distinctive.

What follows is an outline of the conceptual model and design artefacts and how they relate to scholarship in both design and journalism. The artefacts include sketches, wireframes, design workbooks, stories and a digital prototype. The first design step was the decision to adopt a cube as the conceptual model for the prototype.

Conceptual model

The challenge for the NewsCubed project was to design a piece of technology that used hypertext in a way that allowed readers to visualise the components of a complex or long-running story, and vary the perspective within them — what Joyce (2003) calls a constructive hypertext. It also aimed to design a way for journalists to more easily engage with audiences in the construction of those stories, to share control of the narrative without creating confusion.

This goal called for a design that was potentially very different from the story formats commonly used in news media and so required a strong, alternative, conceptual model. Conceptual models, like mental models, are the "models people have of themselves, others, the environment, and the things with which they interact" (Norman, 2002a, p. 17). They are important because they shape our understanding of how things work. A good model can mean the difference between a design that is intuitive to use and one that is difficult. The conceptual model for most online news stories is a standard journalistic inverted pyramid, with hyperlinks. The inverted pyramid is designed for "quick readability" (Pöttker, 2003) and can be easily shortened. It is commonly used for news writing. But as we have seen, simply adding links to this type of storytelling does not exploit the affordances of the underlying technology, or the potential for using shape as a narrative tool.

Based on the hypertext literature and review of contemporary practice (chapters three and four), a story cube was designed: the NewsCube. The NewsCube was essentially a virtual, three-dimensional container that could be used to aggregate, edit, create and share news

content on a specific story or theme, and could be manipulated via touch gestures. The sides of the cube would provide perspectives on a story and a simple way of navigating through it. This was the conceptual model.

This idea aimed to exploit the familiar and tactile qualities of physical cube interfaces. It imagined a workflow in which the publisher of news story, or a content creator, would create the cube to package a story, or collection of information, and users could add to and customise the cube. They could also tag or share content with the original cube such that it becomes a evolving, "breathing" story.

This type of treatment would be best suited to long-running, in-depth or investigative journalism, which has multiple components and is constructed over time. The NewsCube would be a visual representation of the hyperlinks between stories. Each face of the cube could be used to cluster related content. However, these relationships would be fluid and could be changed by journalists or readers as the story evolved. Users would also be able to share cubes and link cubes together.

A key characteristic of the NewsCube idea was its ability to allow users to switch between the points of view within a narrative. Users could vary plot by categorising related content and exploring a news story from these perspectives. For example, a story about an election might be divided into categories dealing with particular policy areas, poll results or the track record of candidates. Within these categories there could be a combination of original and aggregated content from diverse sources. The main feature of the user interface would be a cube that could be manipulated using gestures.

On cubes

A cube is by no means an original invention: it is a common geometric shape that any set of children's building blocks would be deficient without, and the Rubik's Cube, or Magic Cube as it was originally known (Carlssile, 2009), was a hugely successful toy. But the simplicity of the form masks features that make the cube a fascinating, and particularly interactive shape.

Reflecting on the Rubik's Cube, Singmaster (1987), notes how its apparent simplicity conceals great complexity, something that is characteristic of masterpieces of art and literature. Similarly, Vekerdi (1987) has observed how, as an archetype, the cube pairs

chaos with freedom: "it has square faces and leads from order to chaos and then, with great effort, back to the seemingly irretrievable order" (p. 189). Meanwhile, Rubik himself did not initially see the playful and commercial qualities of his invention:

> The cube had already been made in its final form when I realised that it was more that a tool for theoretical purposes — it had originally been conceived for illustrating spatial moves — it was also a good game that could be marketed. (Rubik, 1986, p. 17).

Toys aside, cubes have also been used in interactive media, research projects include Display Blocks (Pla & Maes, 2012), pCubee (Stavness, Lam, & Fels, 2010), Navigational Blocks (Camarata, Do, Johnson, & Gross, 2002), The Cubic Mouse (Fröhlic & Plate, 2000), ToolStone (Rekimoto & Sciammarella, 2000), and mediaBlocks (Ullmer & Ishii, 1999). These projects deal with physical cubes, or rectangular blocks in some cases, and explore the shape as a way to navigate, transport, or input data to a computer. While the projects do not address shape directly as a narrative device, they provide some insight into the affordances of cubes and suggest uses in storytelling.

Camarata, Do, Johnson and Gross (2002) used physical blocks, embedded with electromagnets, as a way of enabling users to find and retrieve information from tourist kiosks. Each block represented categories of who, what, when and where, with titles on each face. Users rotated and slide the blocks to request more information. They could also combine blocks to draw information from both categories. The team used cubes because the shape was "easy to understand and therefore easy to use to manipulate complex digital information" (p. 31). The physical blocks were a "means of navigation that encourages exploration" (p. 31).

Fröhlich and Plate (2000) also note the simplicity of the cube. Their physical, Cubic Mouse, was created for controlling virtual models and featured rods that represented the axes of a co-ordinate system, as well as control buttons. However their users found the tool "natural and easy to manipulate" (p. 529) and became proficient using it within seconds. Meanwhile, Ullmer and Ishii (1999) experimented with physical blocks as a way of capturing, transporting and retrieving online digital media, and suggested their mediaBlocks revealed potential for physically interacting with online information.

More recently Stavness, Lam and Fells (2010), and later Pla and Maes (2012) have noted the potential for cubes to be used in storytelling. Again, both projects developed physical

cubes, but unlike earlier work, the pCubee and Display Blocks were designed as visualisation tools and have screens on each face.

With their pCubee prototype, Stavness and co-authors were interested in studying interaction techniques for static and dynamic 3D content and found their prototypes had potential "in 3D visualization and interactive applications such as games, storytelling and education, as well as viewing 3D maps, medical and architectural data" (Stavness, Lam & Fells, 2010, p. 1381). Similarly, Pla and Maes noted the potential for their cubic displays to be used as a storytelling tool. Their Display Blocks are a set of tangible cubic displays, where each face is a screen that can be used for data visualisation, manipulation and exploration. Their shape and size meant they could be stacked together to build bigger structures.

Pla and Maes (2012) explored the idea of using cubes to show multiple points of view, and suggested the possibility of looking at data from different perspectives was "one of the most prominent affordances of a cubic display" (p. 2016). They described how current events, for example, would be reported differently by various media, which could be mapped to the faces of the display. This "intuitive alignment between multiple perspectives and different sides of a cubic display" meant the application "proposes a new way to visualize and explore a story ... If a story is visualized in this way, the viewer will be able to explore it by manipulating and rotating the display" (p. 2019).

It is this notion of multi-perspectival storytelling, also suggested by Bernstein (1998; 2009) in relation to hypertext, that inspired the NewsCube. The work on cubic interfaces (Camarata, Do, Johnson and Gros, 2002; Pla & Maes, 2012; Stavness, Lam & Fells, 2010), coupled with scholarship suggesting potential for hypertext narratives (Dillon, 2000; Johnson-Sheehan & Baehr, 2001; Kaplan & Moulthrop, 1994; Matias, 2005; van Dyke Parunak, 1989) and the design opportunities identified in the study of news stories, led to the idea of an interactive, hyperlinked cube as a way of telling and navigating complex journalistic stories.

The literature suggests that beyond their simple geometry, cubes have qualities of playfulness, perspective, familiarity, extensibility and ease of manipulation — all affordances that could be exploited for telling news stories with greater interactivity.

Figure 8
Balsa wood cubes captured the NewsCube conceptual model and were an important communication tool.

Low-fidelity prototype

The design work underpinning the NewsCube began with a pair of balsa wood cubes (figure 8) onto which were glued paper images on the theme of coal seam gas. One cube displayed images and text from news sites, reports, social media, among other sources. The second showed possible categories, or ways of labelling the cube faces.

The balsa cubes were initially designed for the PhD confirmation committee, as a way of communicating the conceptual model of the NewsCube, but they were subsequently used throughout the design process to explain the model to both developers and research participants.

Lab82, a Brisbane-based iOS development company was hired to create the digital prototype used in the evaluation phase. This company consisted of two people:

- Sam: Lab82 developer;
- Chris: Lab82 project manager.

All interactions with the Lab82 during the development were recorded. The data included: emails; recordings of phone calls and meetings; sketches; prototypes.

I developed a concept document and low-fidelity prototype prior to my initial meeting with them, which focused on the project's conceptual model, users and lifecycle. The balsa cubes came in handy about 10 minutes into that meeting when I explained my idea of using cube to better exploit hypertext. While this prototype was rudimentary, and the mocked-up content was organised along traditional, newspaper-like lines, it provided a starting point for discussion and exploration:

> Chris: "I see this [referring to the balsa cubes] actually as quite a good visualisation, because ultimately you are going to need a starting point, and in my mind something that traditional media uses maybe isn't such a bad place to start."

Lab82 raised the issues of a lack of hierarchy, with Sam identifying the problem "of putting up to, you know, 16 things on a side of the cube and not knowing what is more important, so what's the starting point?"

The prototype facilitated a discussion around hierarchy and the idea of bounding the space in which a potentially endless story can exist: "No there isn't a hierarchy, and I suppose that is part of its quality".

These cubes had a different use in later meetings with participants. While the the development team handled them at various times throughout the scoping meeting, using them to focus on the idea and how it worked, the participants did not. The cubes were available at the initial meetings but the users did not tend to interact with them. Rather, I used them to illustrate the cube concept and explain the thinking behind it, before demonstrating the digital prototype. They formed part of the instruction through which the participants could form a mental model (Norman, 2002a) of the NewsCube.

Within the low vs high-fidelity paradigm that is common within the literature on prototyping (Bojic, Goulati, Szostak, & Markopoulos, 2011; Hare, Gill, Loudon, Ramduny-Ellis, & Dix, 2009; Hartmann et al., 2006; Jones, Spool, Grudin, Bellotti, & Czerwinski, 2007; Lim, Pangam, Periyasami, & Aneja, 2006; Sefelin, Tscheligi, & Giller, 2003), these cubes would be considered low-fidelity: they were cheap and fast to construct; focused on the look and feel of the interface; contained no functionality; and were constructed to communicate and inform, rather than form the basis for developing code (Rudd, Stern, & Isensee, 1996).

This meant they were effective for communicating the idea that a news story would be displayed on six surfaces and that content could be grouped thematically on each side as well as via links between sides.

However, the low-high definition does not fully capture the qualities of these cubes. McCurdy and co-authors (McCurdy, Connors, Pyrzak, Kanefsky, & Vera, 2006) have suggested that prototypes can exhibit various levels of fidelity and can be designed with a combination of low and high-level implementation along any of five dimensions. The balsa cubes were most highly developed in terms of visual refinement and richnesses of the data model. They were lowest in terms of breath and depth of functionality and richness of interactivity. This meant they were most effective for communicating the idea that a news story would be displayed on six surfaces and that content could be grouped thematically on each side as well as via links between sides.

The purpose of the prototypes then was to capture the design's conceptual model and illustrate how data would be represented. In this sense, they were the "right fidelity for their purpose" (Buxton, 2007, p. 295). From a journalistic perspective, they clearly reflected established ways of organising content, both online and in print. But they provided a high-level concept of how that established practice might be adapted to a new format.

Sketches

Sketching has been used several times in the design process. I've drawn countless squares, triangles and cubes in the corners of notebooks throughout the project as a way to clarify my thinking. But more pertinent are the sketches that emerged as part of the scoping meeting mentioned above. During this meeting Lab82 needed to understand the lifecycle of the application. To do this they needed to explore who was the user, how was content added, how was it organised, shared, changed and how did it the is process end?

Some of these issues had been addressed in an initial briefing document, but the process of discussion and sketching raised issues such as ownership and control. In a traditional news paradigm, these are not generally topics of concern: publishers and broadcasters own stories and control them. But in a digital ecosystem it is not so clearcut, and during the scoping meeting I was forced to think who owns the cube; how to deal with more than six categories; who has control of a public cube; how and when does a cube stop?
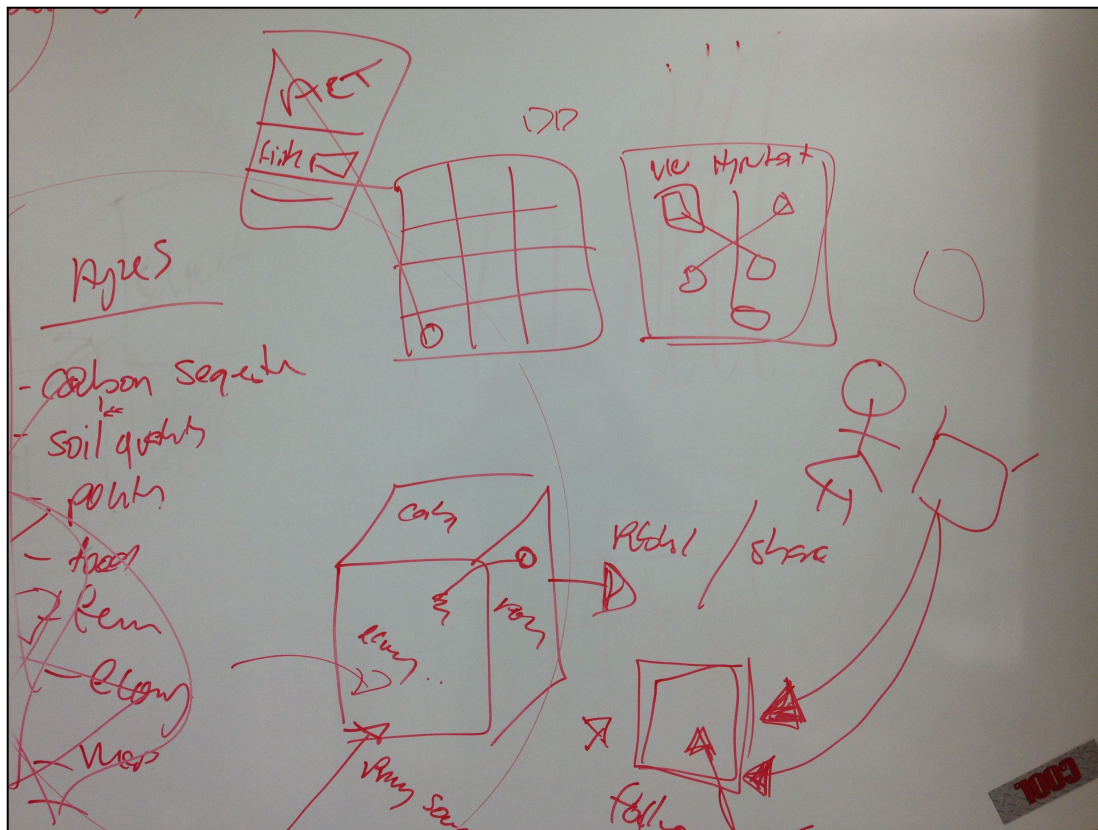
Figure 9
Sketches captured part of the design process and were used to work through problems.

During this meeting several sketches were drawn on a whiteboard (figure 9). They included an outline of a cube, five squares, a stick user figure, several arrows and several notations. Some of the diagrams I drew as I either explained, or tried to answer questions from the development team. For instance, the developers needed to get their head around who "owned" the cube:

> Chris: "And so we come back to this ownership issue of the cube: who is the owner, and I am imagining in the first instance the journalist creating the cube is the owner. At what point, does that journalists at all points in time control that cube?"

> Skye: "No. And this is a thing ... I suppose initially I thought I would, the user would be able to make a copy, a version of the cube, so there might be different versions."

At this point I work though an example while drawing on the whiteboard:

> Skye: "So just say I make a copy of the cube ... and I want to share my cube. Then, how do I get any feedback. How is there a relationship between my cube, my copy, my clone, and the real one, so how does that begin to grow?"

The two squares on the right with the arrows between them and the stick figure are part of this explanation (figure 9).

At another point discussion focused on how to visualise the relationships created between content and annotations:

> Skye: "In some way I imagine all those relationships are inside, but ... it needs to be visible at some level."

> Sam: "My initial thought is that you would put it on an article, like at the top of an article or something like that, you would have a view which explains any annotations and links to other articles."

I suggest using a network diagram to visualise what is inside the cube, but the developer says annotations make that difficult: "Where are you going to put the annotation?"

> Sam: "My initial reaction is to pull back to listing these things as a list of relationships or list of links that also contains the annotation, like taking away the visualisation of it to start with."

He then used the whiteboard to sketch his thinking. The two diagrams in the top left illustrate how a story on the side of a cube would have a related list of links and annotations.

These diagrams, and the dynamic context in which they were created, fit Buxton's (2007) anatomy of sketching: they are quick, timely, inexpensive, disposable, and plentiful; they have a clear vocabulary, distinct gesture, minimal detail, an appropriate degree of refinement; they suggest and explore, rather than confirm; and are ambiguous, in that they can be interpreted in different ways.

A spreadsheet created during the design process is another example of sketching, albeit, not in the traditional drawing sense. I created the document ahead of the scoping meeting with Lab82 as I tried to visualise how a story might work in a six-sided, hyperlinked format, in particular, what data would need to be captured. The document was a sketch, in that it fitted Buxton's anatomy, but it was also a form of visual storytelling. Rather than communicating the "look or character" of the design approach, it "helped explore the dynamics and flow" (Buxton, 2007, p. 283).

The spreadsheet was on the topic of soil security and included rows for topic categories. These included: food security; farming; politics; agriculture; carbon sequestration and research. The columns detailed the individual stories, including data that would be captured when a story was added to the app: headline; URL; source; date; as well as data that would be created by the user: annotations; keywords; related content.

In the meeting with Lab82 the spreadsheet was used to illustrate the type of data the application would need to collect and address the mechanics of how the application worked:

> Chris: "So thinking mechanically about how that works within the app is going to be one of the key things we need to do to make this work in the way it's intended."

The spreadsheet sketch illustrates the processes underpinning the NewsCube design: it captures the thinking behind the organisation and use of journalistic data, and it leaves space for interpretation — how to manage and display that data. This ambiguity (Gaver, Beaver, & Benford, 2003) provided space for the design to develop because Lab82 needed to interpret the sketch.

Wireframes

Two sets of wireframes were created during the development phase. These were created using the interactive wireframe software FluidUI[12]. The wireframes capture the initial conceptual model of the NewsCube and also show "structure, information hierarchy, controls and content" (Saffer, 2010, p.151). The first set was completed after the initial scoping meeting with Lab82; the second set was done part-way through the development phase.

The first set of wireframes (Figure 10) — 11 frames in total — focussed on the content workflow: aggregating content; allocating cube sides; linking content to other items. There were also frames that suggested content layout, social media integration and account management. The second set of wireframes (Figure 11) — 13 frames — was based on an implementation of the original wireframes, rather than on those frames directly. The later set of wireframes aimed to solve some of the issues with the initial prototype and to communicate those ideas to the developer. The process of creating the wireframes forced

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[12] FluidUI is a web-based interactive wireframing software. It is available via: http://fluidui.com/
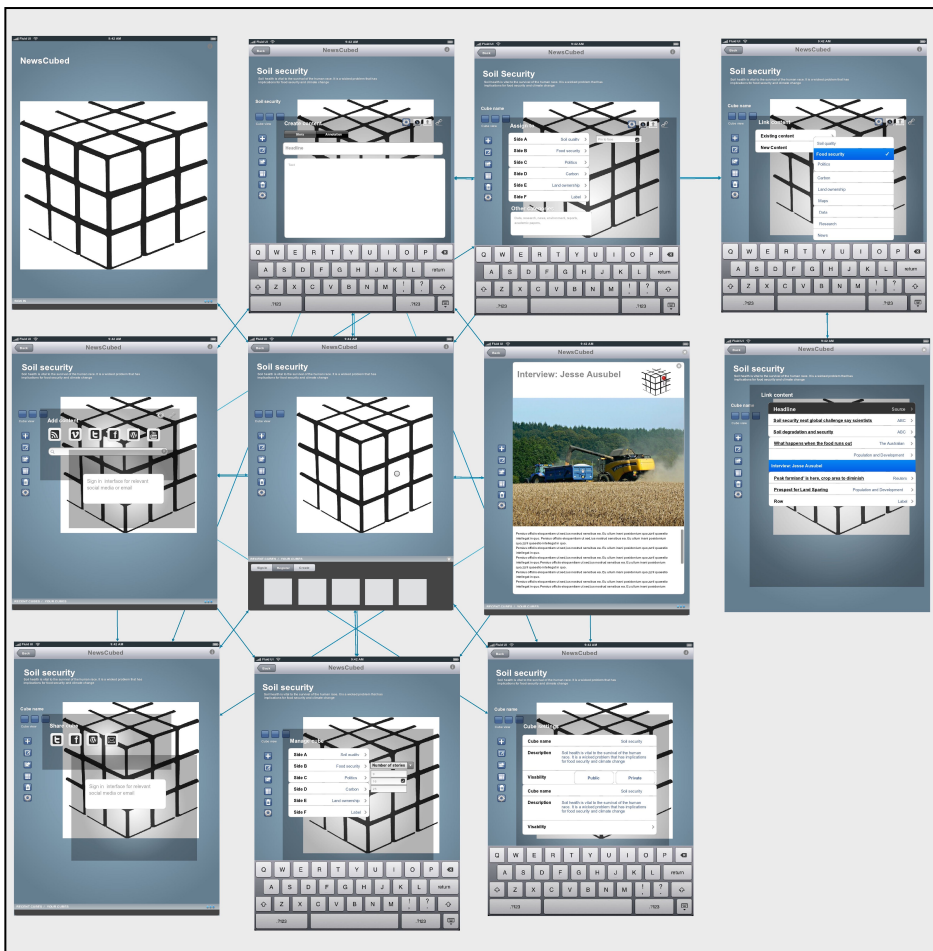
Figure 10
The first set of wireframes focused on content workflow.

me to consider the problems and possible solutions in a concrete way e.g.: this goes here; I need a way to do this; what is the best use of this space.

In March 2013 the first implementation of the of the prototype, based on the first set of wireframes, sketches, and meetings was partly complete. A large, interactive, virtual cube dominated the screen. Users could create cubes, organise content within a cube, add annotations and link to other content. The prototype was in black and white and was working, but the functionality wasn't organised or rendered in a way that reflected the wireframes (figure 22, see page 102).

Instead of the story, related links, annotations and metadata being viewed on separate screens or pop-up overlays as outlined in the wireframes, it was all contained on a single screen. As Sam explained: "I've just thrown everything on there to start with, but haven't really thought about how it could look."

However, he did address issues that had not been considered. For instance, he had added labels to the sides of the cube that would help users know what side they were on. I had not thought through that process: "I think it is good that you have labelled the sides, that's
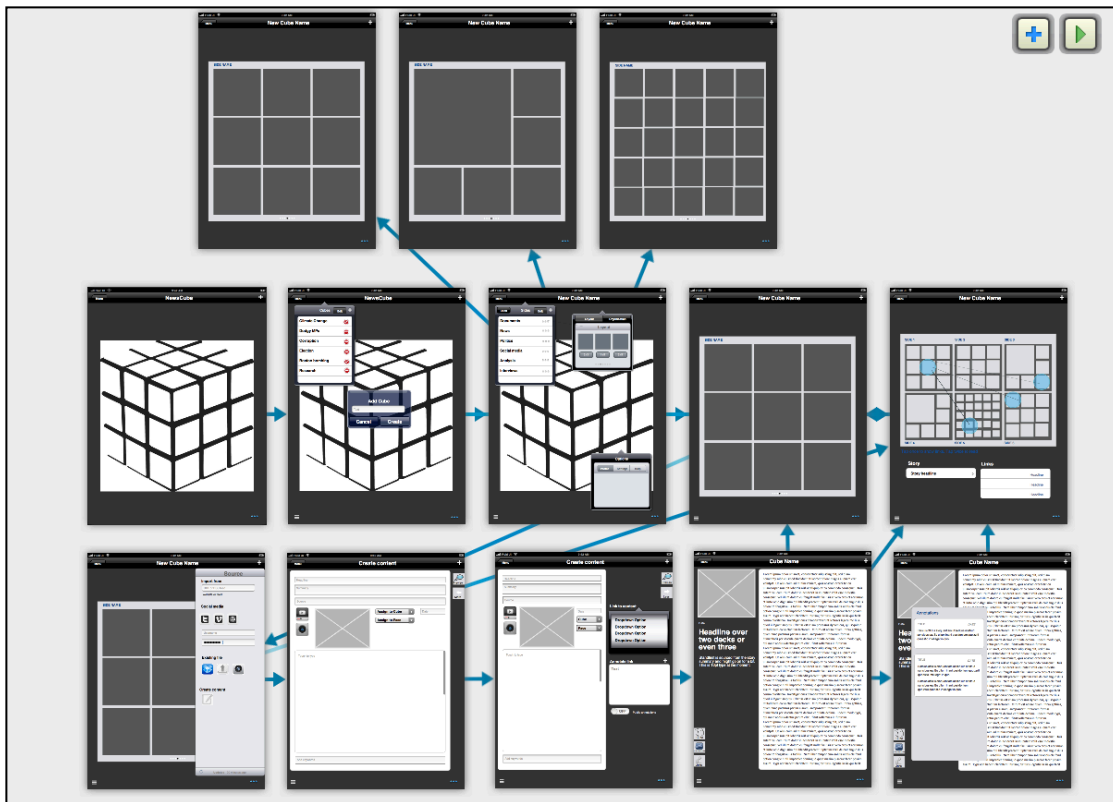
Figure 11
The second set of wireframes addressed issues such as how to visualise hyperlinks.

going to be quite important isn't it, otherwise you're going to have to imagine what you labelled them." He also decided to use "today's date" as the default for content after finding there was no standard way of dating news content. Both logical and useful decisions.

This incomplete prototype helped inform the future development of the digital artefact in two other important ways. First, it enabled the developer and designer to discuss the practicalities of features such as visualising hyperlinks and the limitations of screen space. Second, it gave me the chance to get some informal feedback that informed the second set of wireframes, a process Stolterman and Wiberg (2010) refer to as a project's internal concept critique.

The NewsCube groups related content in six categories, the six sides of the cube. But what is seen on the faces of the cube obscures a complex network of links and annotations on the inside of the cube: the shape helps users to "close in their minds" (Johnson-Sheehan & Baehr, 2001, p. 26) to prevent them getting lost in the narrative. However, being able to able to visualise the relationships created is valuable and the possibility of making the outside of the cube translucent so the links emerge, or opening it to reveal the hidden network was raised with the developers.

Skye: "I think that inside this cube, if we open it up is like a network map, like a web, that shows that this goes to that, and I imagine it's quite messy like it would be, over time, it would be quite messy ... But I imagine that the inside of the cube is the engine room."

The challenge of visualising the hypertext inside the cube emerged once the prototype was under construction:

Skye: "The only other thing, and ... I know we talked about it early on, and I don't know if it was ever really, whether it's possible, was the idea that there was ... on the inside of the cube there would be all these relationships and whether there is any way of visualising that network at some level, that showed, that visualised these links. Is that something we can incorporate?"

Sam: "Yeah, I imagine that at the moment it's not really possible to do it on the cube itself, but from within an article, like when you're looking at it or editing it, it will have a strip of some sort that shows the links."

Skye: "Yes, ok. That article view would be fine I think at the moment. ... I'm not sure how you would even navigate that space to be honest. But if we can show visually — the list of links is good but it would be great to be able to show a network."

Sam: "I'll think about it ... we could do it as a categorised list or something like that, which would give you more information."

Skye: "I've kind of got in my mind some kind of network map that says this story is related to that. So the story you are on, this story, is related to that and that and that [drawing at same time, referring to sketch]. Is that something that can be generated?"

Sam: "You can generate it, it's just a matter of how. [It's] doing the visualisation that's complicated. I'd try and give it more thought as to how you would display it and come up with a wireframe, given the constraints of the small screen space."

I began working on this problem too, and put the challenge to research colleagues. One suggestion was to flatten the cube and show the relationships two-dimensionally, rather than render a three-dimensional network. Westermann and Cribbin (2000) have suggested that for navigating information two dimensions is often sufficient.

I developed this idea for the second set of wireframes: one of the frames shows a button at the bottom left that would display the cube as six squares. Users would be able to tap a story and see how it is related to other content.

Again, practical issues arose. The developer was concerned about rendering lines and screen real estate:

> Sam: "In the mock-up you had lines between content, um, I can't really do the lines very simply. But what I can do is say, colour match. So I could put a border on the stories where the colours match up when they're linked."

> Skye: "Yeah, any kind of way. I suppose the point is if I click on a story I want to be able to identify other stories it's related to. Now whether that's a line or just a pulsing glow or a whatever, I don't know. So if you can't do lines that's fine, that was more just trying to show relationships. And then some type of text relationship down the bottom as well ... So that was my solution for getting around that problem of trying to show what was going on inside. So whether that works or not, I'm not sure but, what do you reckon?"

> Sam: "It could be a little, I'll do a mock up where we have the sides laid out in a grid. I'm not sure, we might need to make it scroll or something. We don't really want the story to appear under a certain size. I'll play with it and we'll see how big it has to be."

This functionality was not implemented in the final prototype. The challenge of screen size and scope creep meant it was put on the list for future development. This was unfortunate, but the the design idea was later validated by users. During the evaluation phase (discussed further in chapters seven and eight) participants had the opportunity to use the prototype before giving feedback during semi-structured interviews. Among the issues raised in these sessions was the difficulty of understanding the relationships between content on the NewsCube.

Two participants — Charlie and Tyler — suggested opening the cube up to show those relationships, and sketched their idea to demonstrate (Figures 12 and 13):

> Charlie: "I think that it would be interesting, of course this is a three-dimensional thing, but if you could just open it, into something like that [sketches on notebook] and the oh, it's another cube, and just link it like that … I would really find that interesting as well, to open it up."
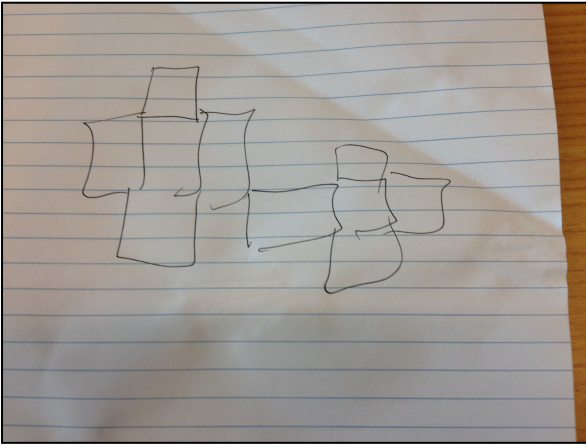
Figure 12
Charlie's idea to open up a cube.
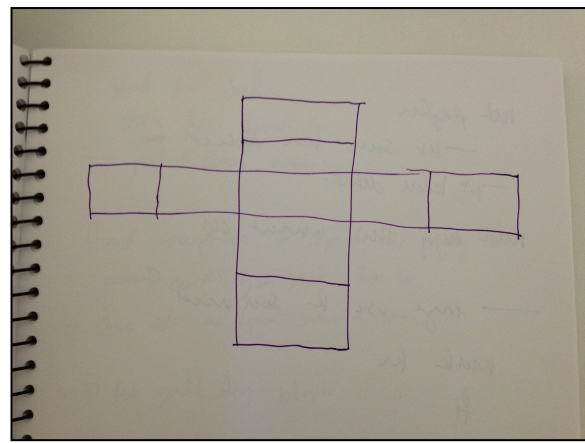
Figure 13
Tyler's cork board idea.

> Tyler: "An interface that would have been better for me for that story at least would have been more like just a cork board almost, where nothing would be obscured based on what you're looking at at the moment, because when you are looking at one side of the cube you can't see any other side whereas you can look at a cork board and kind of draw links between all the articles and have them in different sections and annotate on them."

Both sets of wireframes embodied knowledge and understanding gained through the research and design process. The first set drew predominantly on data collected via an initial study of current practice (Doherty, 2013b) and of a review of the hypertext literature (Doherty, 2013a). The second set drew on the experience of creating and using the digital artefact created from those wireframes, and so embodied that insight. For example, in creating the digital prototype, the developer added labels to the sides of the cube that would help users know what side they were on. This was not considered in the initial wireframes, but was included in the later set.

Design workbook

A type of design workbook was used to communicate my ideas about the design to the developers. This digital canvas had characteristics of a mood board, in that it captured the feel of a product (Rogers, Sharp, & Preece, 2011; Saffer, 2010), but it was collated over time and used text to develop the design ideas (Gaver, 2011). Lucero (2012) suggests mood boards and design workbooks have common characteristics, as both are "useful in trying to understand the nature of design tasks, and are primarily social" (p. 440). However
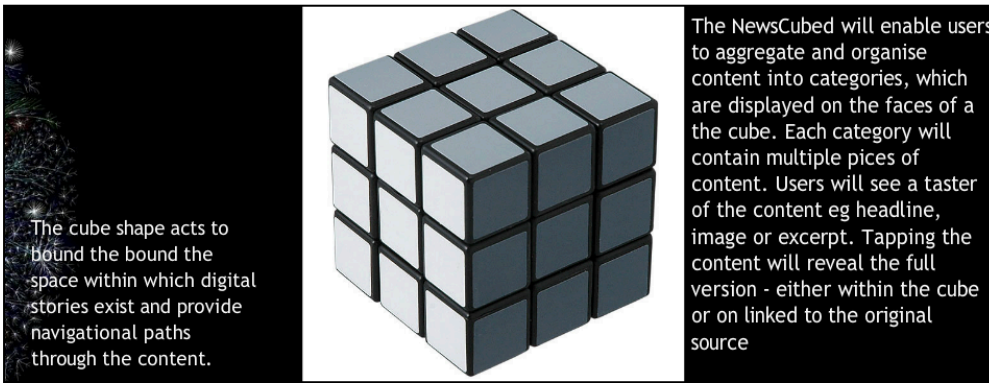
Figure 14
Description of the NewsCube concept and design.

The cube shape acts to bound the bound the space within which digital stories exist and provide navigational paths through the content.

The NewsCubed will enable users to aggregate and organise content into categories, which are displayed on the faces of a the cube. Each category will contain multiple pices of content. Users will see a taster of the content eg headline, image or excerpt. Tapping the content will reveal the full version - either within the cube or on linked to the original source

Figure 15
Ideas for content creation from Evernote and Wordpress.

Creating and editing

A unique feature of the NewsCube is the ability to create a hypertext narrative. This means the ability to import content but also to create it within the app. The Evernote and WordPress apps have clean editing panes that allow users to write on the tablet and also to include images and videos that are either in a library or created using the iPad's built-in camera.

Figure 16
The referencing software Papers provided inspiration for the NewsCube annotation function.

Annotations

The personal libary software Papers allows users to crea notes attached to documents and annotations related to specific areas of text. The NewsCube needs similar functionality, if only at story/document level.
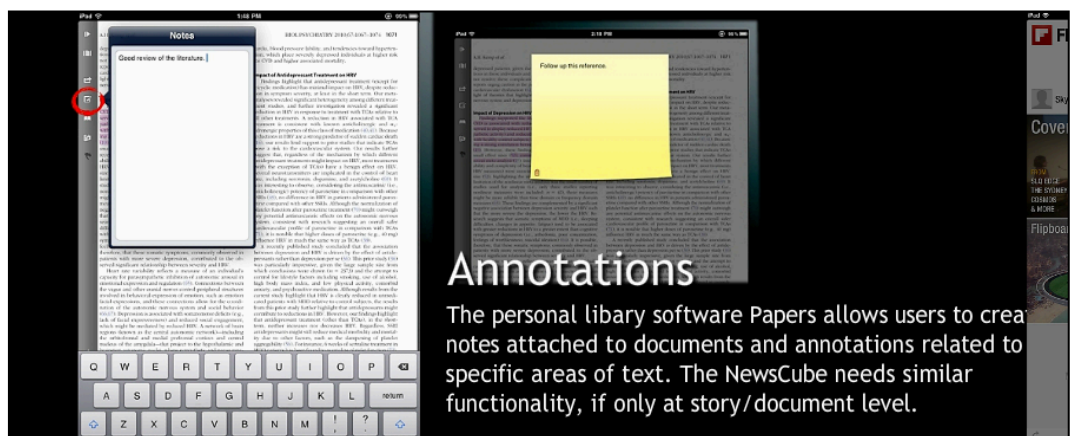
Figure 17
Account management ideas from Flipboard and News360.

accounts

Apps such as Flipboard and News360 have settings or profile icons that provide access to account have settings or profile icons that provide access to account information.

Minimal account function is needed now but eventually the NewsCube should enable integration with social media to facilitate sharing. This could be controlled via the

Interface
The Solar Walk mobile app is a good example of how the 3D interface should behave. Users should be able to manipulate the cube with gestures - roatating, selecting and zooming.

Figure 18
The NewsCube aimed for interaction like the the Solar Walk application.

he notes the linear structure and more "sketchy" process of design workbooks sets them apart from mood boards.

The NewsCubed workbook was created using Vuvox. This web-based visual collage tool is now defunct, but at the time it allowed me to collate images, annotate them, and provide links to the original source. It had a linear structure in that it was a landscape space that moved horizontally to reveal additional content. The canvas included: a description of the NewsCube (figure 14); screen shots of content creation, annotation and account management functions on existing applications (figures 15, 16, 17); and a link to the Solar Walk application, as an example of the type of user experience the NewsCube should deliver (figure 18).

Inspiration was taken from content aggregators including Flipboard[13] and News360[14] to work through the problem of limited space on the side of a cube. These ideas were documented in the workbook and discussed later with the developers:

> Skye: "I was looking at Flipboard and News360. What they do is you have a side swipe, where there is multiple pages. So, you know how we were talking about how to deal with more [content] than could fit on one cube, well we could create this back-forth linear swipe, so you got another screen of squares. So, if you had 200 items on

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[13] Flipboard is available at: https://flipboard.com

[14] News360 is available at: http://news360.com

Figure 19
The prototype content creation pane with options to import from a URL, social media, or write an article.
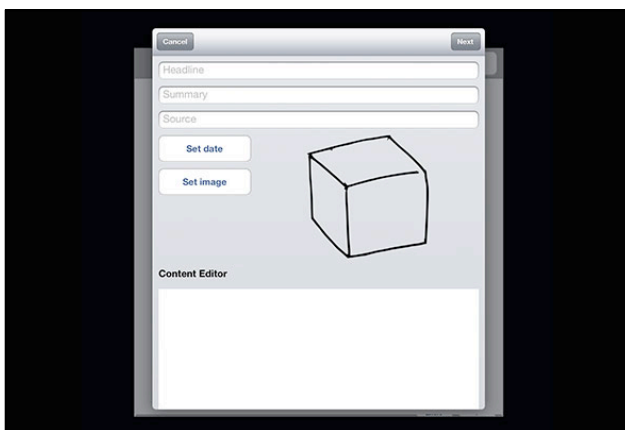
Figure 20
The prototype content editor.
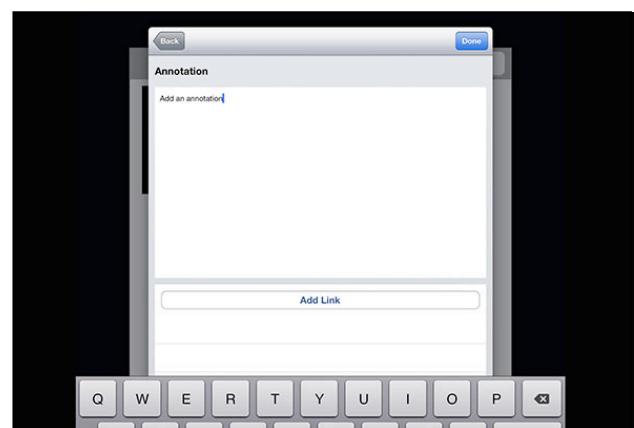
Figure 21
The annotation function allowed a user to create relationships between content.

the side of a cube but potentially you could only see 25 at once, but then if you swiped across you'd get the next lot."

Sam did not think the idea would translate: "It might not be possible to swipe given the nature of the cube ... it can only really detect touches for one thing at a time."

Ideas for content creation translated more easily. The workbook included screen shots of the editing panes from Evernote and WordPress (figure 15), and the annotation functions from Papers (figure 16). The simplicity of these informed the layout of the NewsCube content management functions (figures 19, 20, 21).

The workbook was was updated several times during the eight-month development phase. Parts were completed as the first implementation was being developed. Other sections were created to complement the second set of wireframes, in particular those showing how to create original content and manage sides of the cube that fill up.

Because the developers and I did not work together physically, and communicated mostly via email or Skype, the workbook performed a social function as the developer needed to interpret the ideas it contained (Lucero, 2012). Further, it performed an important methodological function: it is evidence that "ideas develop slowly over time, that important issues and perspectives may emerge from multiple concrete ideas" (Gaver, 2011, p. 1551).

Stories

During early development of the prototype, a complementary journalistic process was underway to generate content. The NewsCube was conceived to package long-running or complex journalism topics. So began a process of reporting and aggregating content around the issue of soil security. Material included links to previous coverage, primary data, research and original stories. Without a NewsCube to work with this material was again collated in a spreadsheet. This was a convenient way to send URLs and metadata to the developer to add to the prototype. However, adding it to the digital prototype revealed fresh insight into the potential of the NewsCube: that it could be used as a reporting tool as well as a storytelling tool.

This was a new insight that came as a result of creating content, through doing — reflection in action.

> Skye: "Because I suppose, as I am working on these stories I am kind of thinking a lot of what I am doing, the process I am going though, is actually like a journalistic backgrounding process anyway ... So it actually could document a process in some ways ... it could be a tool that's used throughout a whole process, rather than just a finished publication. And I hadn't thought of that before but until I've started thinking about it and putting things together."

The idea of a journalist sharing a cube with users was part of the initial concept, and was discussed in the scoping meeting. However, the idea that the cube could evolve with the journalist's own reporting process was new.

Once the final prototype was created my focus shifted to creating NewsCubes to demonstrate the application to participants. I created one around the Queensland VLAD Act[15] and one that replicated the *Tech Street Journal*, a local digital publication. The process of creating the VLAD cube revealed the potential for the cube to evolve over time. Initially I added stories under categories of 'laws', 'judiciary' and 'politics', which reflected the story to that point: the passing of the VLAD legislation; reaction from the judiciary, and political backlash. However, as the story developed I added sides dedicated to unintended consequences of the laws; public reaction, and news on outlaw motorcycle clubs.

Beyond specific stories the NewsCube reflected journalistic practice in a more subtle way. In the early scoping meeting, and again in development meetings, practice was often drawn on to explain design decisions or work through a problem. For instance, in the scoping meeting there was discussion around how to control the editing process:

> Chris: "How do we control the editing process?"

> Skye: "... What exists at the moment is someone does have to be in control of the cube ... so if I am a newspaper I publish a story, I open that up for comment, but I moderate actually, now there are various rules and laws about it but the fact is that there is that process. If you let something be a free-for-all, I don't think that's, that's another way of doing it but what is the point of having a crafted story in the first place? So, I think maybe yes, the ownership ... the original creator becomes the owner of the cube."

Similarly, in a development meeting a month later, the developer was unsure how to handle the annotation function. Again journalistic practice was used to work through the issue:

> Sam: "What do you think about adding an annotation at this point? Should we grab the article and then let you annotate it later?"

> Skye: "I think that probably, ideally, there'd be an option to do both. So just say I'm, because I suppose I'm just thinking the way that I would work. Say as I've been researching the soil stuff I've been doing a lot of backgrounding and then I would be making notes at the same time, as I come across things. So it would be good to be

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[15] The Vicious Lawless Association Disestablishment Act 2013, or so-called Bikie Laws, were introduced to crack down on outlaw motorcycle clubs. They included harsh prison sentences for club members and their associates and were broadly criticised for being unfair and unworkable.
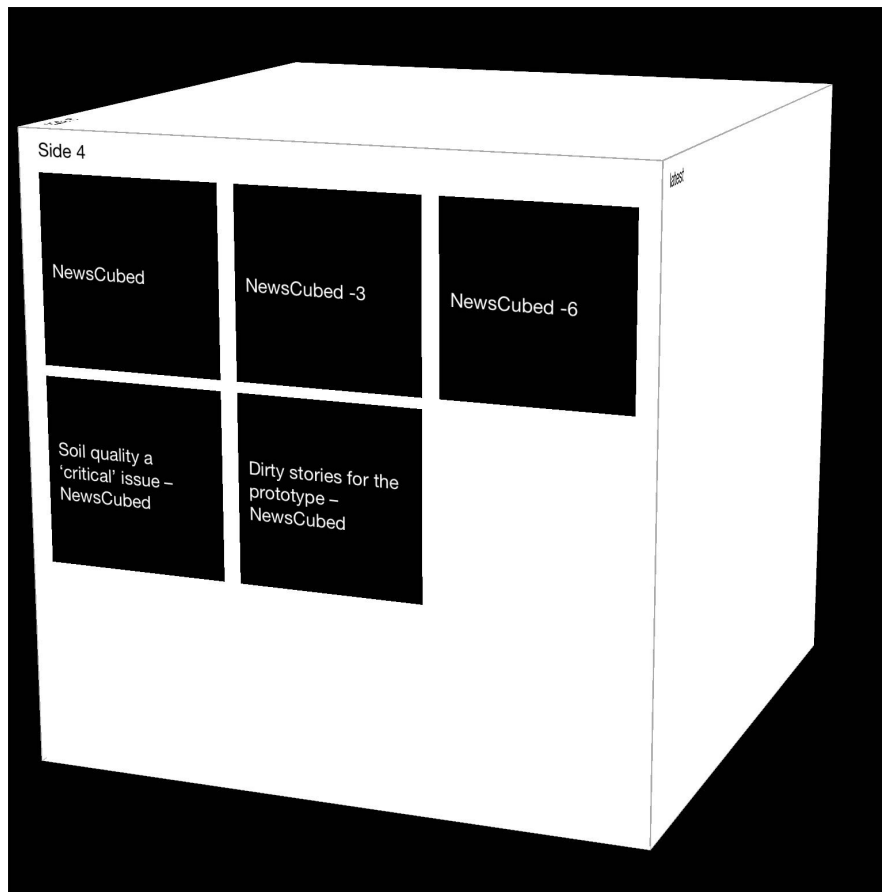
Figure 22
*The first digital
implementation of
the NewsCube.*

> able to annotate at the time when you imported it, particularly if you've got thoughts
> or as you're doing it. But also to go back later, because sometimes you don't see
> connections between things immediately. So maybe that ability should be there at
> this point but also should be able to be accessed again at a later point."

These interactions suggest parallels between design research and journalistic research
and illustrate how design and journalistic practice is contributed to and is embodied in the
NewsCube artefact.

Digital prototype

Multiple versions of the NewsCube were created during the development process, most of
which were incremental variations. The most important of these was the first and the last.
As discussed earlier, the first implementation (figure 22) was an opportunity for the
developer and designer to solve some problems with the concept execution. It was also
the point at which the design process intersected with the journalistic process in a concrete
way i.e.: the NewsCube was used to tell a story.
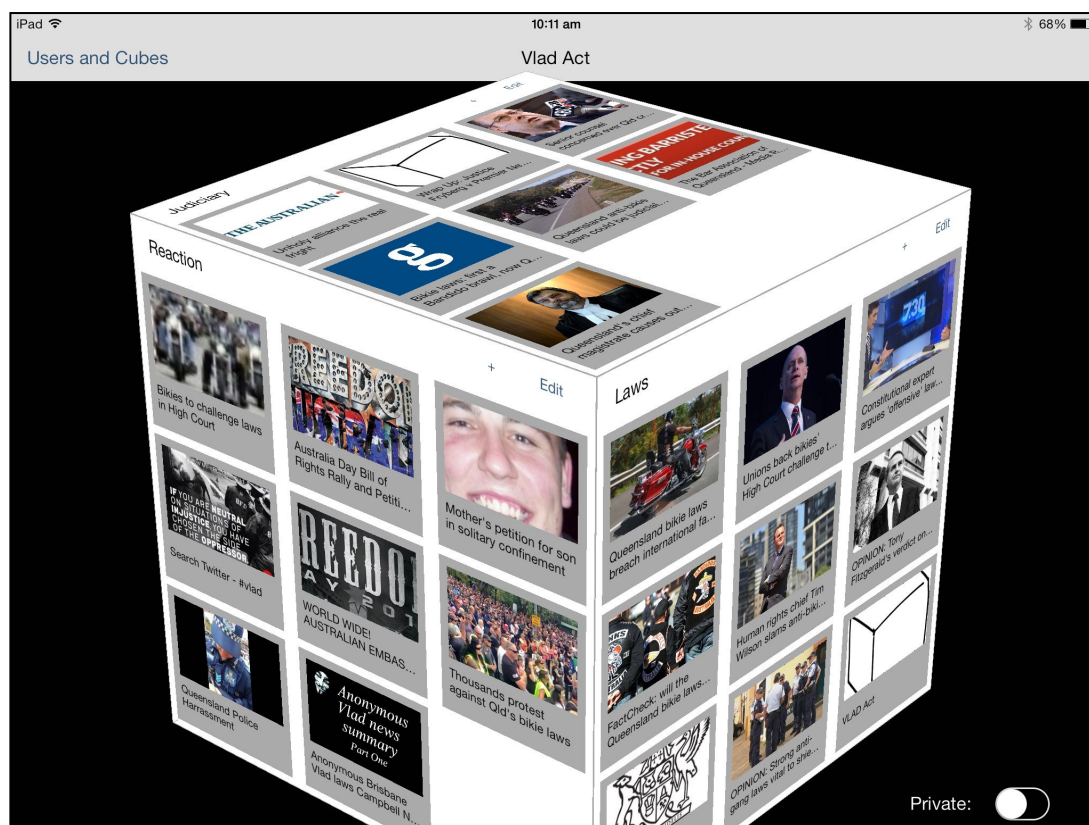
Figure 23
Second implementation showing a VLAD NewsCube.

The second prototype (figure 23) was result of the design, development and journalistic processes: it embodied all of the previous problems, solutions, decisions and ideas. Delivery of this prototype in August 2013 was the point at which the NewsCubed project moved from design to external concept critique: participants were invited to use the NewsCube and provide feedback.

In both prototypes, a large cube dominated the design but the second version featured the ability to create content directly on a NewsCube, editing functions, images, privacy and suggested sharing. These changes captured important characteristics of the NewsCube concept: the ability to create a constructive hypertext; and the ability to develop a story over time, potentially with the input of others.

One of the observations from the study on how hypertext is used in news stories (chapter four) was the predominance of exploratory hypertexts, which is a way of presenting information. By contrast, a constructive hypertext is an invention, or analytic tool (Joyce, 2003). The NewsCube aims to achieve this by allowing users to create and organise

content themselves and generate relationships between individual items via links. The ability to annotate provides an analytic function.

Although not fully implemented, the digital prototype suggested the ability for collaboration. A public/private button enabled users to make their NewsCubes visible to other participants, and inactive buttons on the content creation pane suggested the ability to incorporate social media. This mixed fidelity model (McCurdy, 2006) meant that users could experience a substantial depth of functionality for the core tasks (creating hypertexts), and a rich experience interacting with the cube interface. Similarly, the data model was highly developed, in that users interact with real data, published on the web.

The prototype was less highly developed in its breadth of functionality, such as the inactive social media and sharing functionality, and in its level of visual refinement — the NewsCube was still black and white and did not have any graphical design. Feedback from one participant in particular — Shannon — highlighted weaknesses in the design of elements:

> Shannon: "... well obviously as it's a prototype it's not completely finessed, and obviously as a designer I noticed the finish of it, but all of the actual components were understandable, ... maybe the add sign, the plus sign, was a bit small, so that could be increased, plus it's also small on the top navigation bar, to the point where you almost don't see it … So I think that could just have the actual work 'add'."

And later:

> Shannon: "I guess on the source window, the write article, that seems a key component, so that's where you are actually doing your research and writing down your notes, um, that's sort of right at the bottom, but the social media window is taking up quite a lot of the real estate of that window. So I think that just that interface could be tweaked a bit in order to maximise the key component of that page."

Similarly, while the hypertext aspects of the functionality were fairly well developed, other aspects were not developed to a similar depth. Adding stories, for instance, was a clunky process that participants commented on:

> Tyler "... we always started from inside NewsCube and then went looking for articles from inside the adding article window, which is a little tricky because it is a tiny little window and you have to go to Google inside that window and search ..."

Within HCI it is fairly well accepted that there is a relationship between fidelity and feedback, that the quality of the prototype will elicit certain types of responses (Hare, Gill, Loudon, Ramduny-Ellis, & Dix, 2009; Lim, Pangam, Periyasami, & Aneja, 2006; Liu & Khooshabeh, 2003; Rudd, Stern, & Isensee, 1996; Sefelin, Tscheligi, & Giller, 2003; Virzi, Sokolov, & Karis, 1996; Wiklund, Thurrott, & Dumas, 1992). The general view is that the higher the level of fidelity the more the user focus moves away from the core concept to focus on experience and that users are less likely to be critical of designs they think are finessed.

This was evident to some extent in the NewsCubed case. The responses above illustrate participants' attention to the detail of functionality and design, comments that would not have been possible if participants were using the balsa cube. Similarly, the greater breadth and depth of functionality and richer interactivity of the digital prototype meant participants could comment on affordance and relate the concept to practice. The mixed fidelity approach also meant that functions such as sharing, which were outside the development scope, could be rendered in a way that prompted feedback.

Journalistic thinking for design

The NewsCube is the product of design practice, although one positioned within journalistic knowledge, practice and thinking. Through the process of designing and prototyping the NewsCube, artefacts such as sketches, wireframes and stories played an important role in communicating ideas, passing on knowledge, and facilitating thinking. Lim has discussed design artefacts, and prototypes in particular, as "design-thinking enablers", and as "tools for traversing a design space" (Lim, Stolterman, & Tenenberg, p. 2). This was evident in the discussion and interaction around the NewsCube artefacts: sketches helped the project move from a concept to tackle some of the implications for use; wireframes threw up issues of visualsation and navigation; and the stories facilitated reflection on the journalistic process, revealing new affordances in the NewsCube.

But the artefacts, and the design process that produced them, also enabled journalistic thinking. Issues around control and workflow were often addressed by reference to the formats, conventions and constraints of journalism practice. Questions around ownership, organisation and process were answered with references to the norms of the newsroom and its culture. In this way the process of designing revealed an underlying reflection-in-

action (Schön, 1983). The knowledge produced as a result was fed back into the design process, and embodied in the artefacts.

The approach taken here resembles Niblock's practice-first approach, in that the research is driven by a problem, in this case, how to better exploit hypertext. But instead of journalism representing "a movement towards a solution" (Niblock 2012, 506), it was design that provided the overarching framework for practice and that provided new possibilities for journalism. It was a design process that led to the idea of a virtual, storytelling cube, and a design process that enabled that idea to develop into a prototype. Journalistic thinking, though allowing scope for creativity within established constraints, does not encourage the type of divergent thinking that encourages the invention of new things.

Creation of a prototype does not mark the end of a design process though, and without evaluation there is no way to know whether a designer's judgment is valid. In the case of the NewsCube the design was given to both journalists and news designers to evaluate. This provided deeper insight into some of the issues raised through the design process as well as fresh challenges. It also revealed quite a lot about the affordances of digital cubes.

The design of the NewsCube was ambitious, and as will be seen in the next chapter, not all of the desired functions were implemented in the prototype or subsequent beta version. As with all design processes, there is a balance to be struck between the what is envisaged and what is can be achieved within the bounds of budget, skill, time, and technical possibility. There is also the design process itself to accommodate. This is a process in which materials "talk back" (Schön, 1983). Certainly this was the experience in this project.

Chapter seven
The affordance of shape

"I have handled magic spheres and they are much less satisfying than the cube"

David Singmaster, 1987
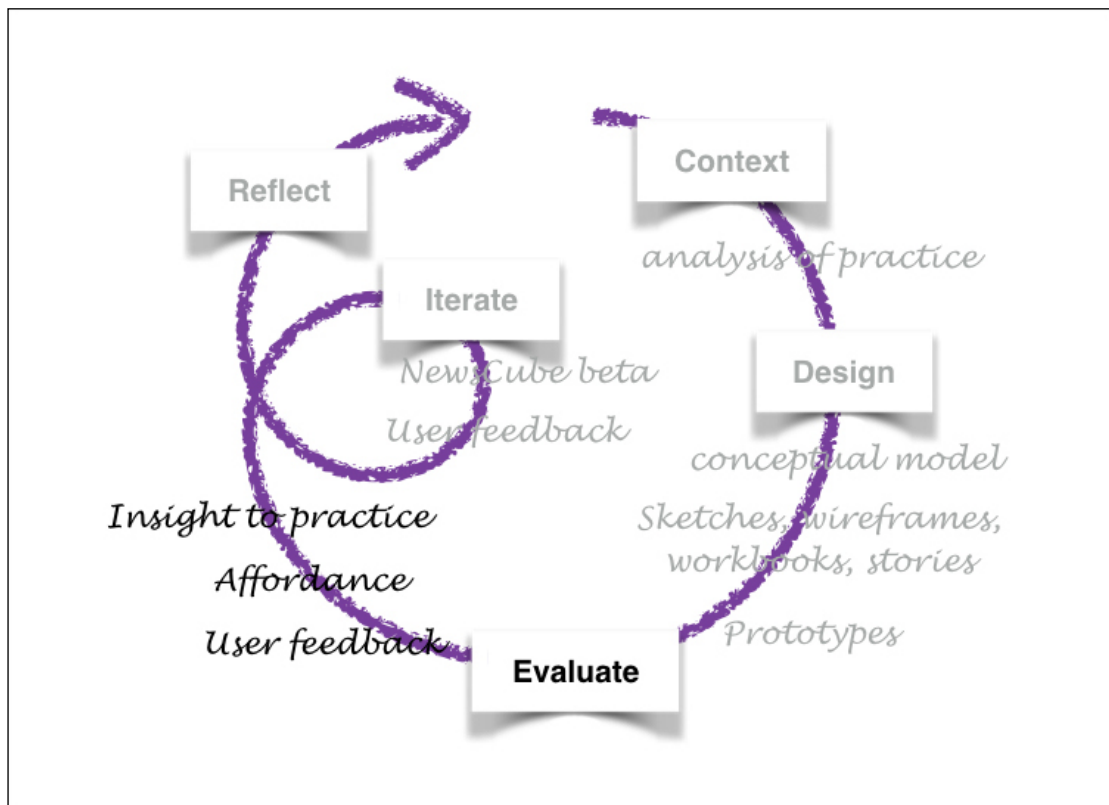
Figure 24
Research evaluation phase.

The cube is a tricky shape to work with in a journalistic context because its qualities do not meet an obvious need. The qualities of playfulness, perspective, familiarity, extensibility and ease of manipulation that cubes exhibit are great for interactivity, but as the journalism ethnographers tell us, this is an industry grappling with the technical and cultural challenges brought about by digital technologies, and greater interactivity has not been readily accepted. This chapter examines the user feedback on the NewsCube prototypes in terms of affordance.

From pyramid to cube

In journalism practice pyramids are the dominate shape. News stories are typically structured as up-side-down triangles, known as the inverted pyramid (Pöttker, 2003). The style demands that narrative is organised in an order of importance — with the information of greatest news value (O'Neill & Harcup, 2009) at the top. It is a truly great design: it is efficient; it focuses on facts and so facilitates objectivity; it is easily edited for length; and it is great for breaking or hard news.

But stories do not always fit neatly into triangles — inverted or otherwise. News stories, by their nature, follow events over time[16]. The narrative can become complex and context can be lost. We know that hypertext can remedy this, it can create narratives that "respond to the the readers' touch" (Bolter, 2001, p. 42), but we also know that journalists don't exploit the technology well. So the challenge for the NewsCube is to use hypertext and shape to do a better job, and to make a creative leap in how hypertext might be used to tell journalistic stories.

The design processes of contextual research (chapter four), designing and prototyping (chapter six) show how a study of the literature around hypertext and narrative, combined with an examination of how hyperlinks are used in a journalistic context, revealed the potential for shape, in particular a cube, to achieve these goals. This led to a conceptual model of a cube that could visualise a perspectives within a story and allow for greater collaboration between authors and readers. The idea was developed through a process of design and prototyping, and resulted in a digital artefact that could be given to others to use. In this case, the NewsCube was deployed to eight practitioners, who used it and were interviewed about their experience.

Feedback on the NewsCube prototype covered a range of topics, among them the interactivity of the interface, its fidelity, potential for storytelling and difficulty of use. But the most dominant themes centred around shape and issues of ownership. These are closely related: the shape of the prototype gave the users a feeling of control over it. It was like a building block that could be manipulated, it was tactile and responsive. But it also made

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[16] My attention has been drawn to the work of Sus Lundgren (2013), who has investigated temporality in interaction design. Lundgren argues there is value in exploring temporal behaviours as a way of adding functions or changing how people interact with artefacts. She outlines several themes for design and design analysis that focus on time and the organisation of events. Given the temporal aspects of journalism practice, eg: production deadlines and the value of immediacy, the notion of designing with temporality in mind presents an interesting area for Journalism Design research.

demands on the user that they did not anticipate: there were only six sides but they set up an expectation that needed to be fulfilled.

In design research these characteristics can be discussed in terms of affordance. Affordance is a way of knowing how to use something. It was conceived as a way to explain the "complementarity" of animals and the environment, the process of perceiving the "value and meaning" of things in the natural world (Gibson, 1979), and has since been used to explain how users interact with man-made objects (Hutchby, 2001; Norman, 1999).

Norman considers affordance, alongside conceptual models and constraint, as the three dimensions to understanding how to operate a novel device. For him, affordances "specify the range of possible activities" and "reflect the possible relationships among actors and objects" (Norman, 1999, p. 41). Affordances, he argues, must be visible and he distinguishes between real and perceived affordances, referring to what a user perceives to be possible rather than what is.

The idea of perception is common in affordance, and runs throughout Gibson's explanation of the theory. Gaver (1991), in a design context and drawing on Gibson, points out that while affordances are independent of perception — "They exist whether the perceiver cares about them or not" — they *need* to be perceived by the user (p. 80). He suggests that perception of an affordance will "be determined in part by the observer's culture, social setting, experience and intentions" (p. 81).

Norman (1999) points out that culture can also act as a constraint. Constraints prohibit some activities and encourage others, and can be physical, logical or cultural. Conventions, he argues, are cultural constraints that evolve over time and require a community of practice: "They are slow to be adopted and, once adopted, slow to go away" (p. 41).

Because of its relationship to use, affordance is a good way of analysing designs. Gaver (1991) sees it as a way to focus on the strengths and weaknesses of a technology, suggesting affordance provides "a useful tool for user-centred analyses of technologies" (p. 79). Hutchby (2001) argues that affordance provides a "third way" between constructivist views of technology that focus on human agency and realist approaches, which emphasise a technology's constraining power.

Looking at the NewsCube in terms of affordance means the design can be considered both in terms of what was intended by the creator and how it was interpreted by the user. And, as Hutchby (2001) explains, it is in the dynamic between these processes that the meaningful social reality of technologies can be identified (p. 445).

By looking at the NewsCube this way, not only does the designed artefact reveal qualities about itself, but it provides insight into the perceptions and conventions of its users.

Participants

In this phase of the research, the NewsCube prototype was deployed to eight news designers, editors, journalists, and communication professionals, working in media companies or independently. They were:

- Charlie: an interaction designer ABC [17] mulitplatform, Brisbane;
- Shannon: a senior designer, ABC Innovation, Sydney;
- Tyler: marketing consultant, Liquid State, Brisbane;
- Val: a communications intern, Liquid State, Brisbane;
- James: administrator, Liquid State, Brisbane;
- Dale: a communications consultant and former newspaper editor, Brisbane;
- Alex: digital editor at at The Courier-Mail, Brisbane;
- Riley: freelance journalist, book author and communications consultant;

The ABC participants, while employed by the same organisation, work in separate units, in different cities, and do not share reporting lines. The Liquid State team work in a digital publishing startup and were valuable because of their involvement with developing innovative technology. The last three participants are indicative of the types of people the NewsCube was envisioned for: they currently or previously engage in daily journalism; they understand the reporting, production and dissemination phases of news and they have experience of both legacy and digital media.

Affordances of a cube

Given that a cube dominated the design prototype it is not surprising that shape was central issue during the evaluation interviews. Participants identified several challenges in

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[17] ABC: Australian Broadcasting Corporation, the public broadcaster.

working with shape, but also found it engaging and fun, suggesting the NewsCube had affordances that other forms of digital storytelling did not.

The literature suggests that cubes have qualities of playfulness, perspective, familiarity, extensibility and ease of manipulation (Camarata, Do, Johnson, & Gross, 2002; Fröhlich & Plate, 2000; Pla & Maes, 2012; Stavness, Lam, & Fels, 2010; Ullmer & Ishii, 1999). This was reinforced by the NewsCubed participants, who identified all these affordances in their feedback. They also identified qualities such as a sense of ownership, speed, storage and providing context as particular to the design, and their feedback also suggests shape can be used to understand digital environments (Dillon, 2000; Dillon & Schaap, 1996; Dillon & Vaughan, 1997; Johnson-Sheehan & Baehr, 2001; Matias, 2005; van Dyke Parunak, 1989; Westerman & Cribbin, 2000).

Familiar, playful, tactile

Most of the NewsCube users (Charlie, James, Dale, Alex and Riley) liked the cube, they found it fun, playful, familiar, and easy to understand, all qualities that resonate with literature. Charlie in particular, noted the familiarity and playfulness of the interface and the sense of ownership that the tactile nature of the interface gave:

Charlie: "I like it in the sense that it is very straightforward and very familiar, something that is very physical and something we see every day."

Charlie: "I think is it a good thing that it is something very visual and very playful and very tactile in the sense that you can manipulate the artefact and you can see different sides of the content you have been gathering. I like that stuff in the sense that you can easily go from one subject to another. That's a positive thing. I quite enjoyed the fact that you could move it. I mean, the tactile element is quite important and psychologically the concept that when you touch a thing it becomes yours — the ownership of touching the information is quite important."

Charlie: "… in terms of the concept, I mean playfulness for me is a big thing, in my work and everything, and being able to manipulate something is quite important, and make it yours, because you touch it … it's a very strong psychological concept."

Dale: "…It's a fun thing to use. Fun and informative, and what I hadn't expected was the tangible side of it. People talk about newspapers being tangible and having that,

well this cube's pretty good for that. It's the best thing I've seen in the digital world for it."

Dale also thought the cube's tactile, interactive qualities could potentially engage audiences in a story and therefore achieve business goals:

> Dale: "And I thought the cube was a fantastic way to engage. And one, because you could feel it, with your finger, you can feel it and push it around, and I just found that worked really good. It's one of the few things you could do online to actually manipulate something, almost like turning a page in a paper. That was really good. It was simple to use and it was a great smorgasbord, so again, giving the reader something they can, to take a choice from."

While the functionally was in some ways no different to a list of links, the design made it engaging in a way that standard, linear practice is not. The interaction created an experience:

> Riley: "I think for a start, the shape, because it is 3D, it gives you that sense of dimension. So, and you can flick it around. Again, in many ways it's just another system of filing, in that you could have the links all listed on a page, but it's much more, I find it much more user-friendly, because you can flick it around, and I guess there is also that, again there's an accessibility thing, an interactive element that makes it almost fun, it allows you that visual display element."

One participant, Alex, did not create a NewsCube. He looked at the interface on several occasions but decided he "did not have time to do one of these things well". Nevertheless, he "... liked the tactile idea of it".

Extensible, accessible, fast

Beyond tactility, the cube also suggested the ability to build, and several participants noted its similarity to a building block. Charlie, for instance, suggested the shape facilitated clusters of information, which is different to traditional hyperlinking, and he saw potential in being able to combine groups of links in the form of multiple cubes:

> Charlie: "… it's all about clusters. And I might have this cube that is related to this other cube and then make a little group of cubes, it's just expansion, and expansion is quite important, the expansion with basic hyperlinks is really easy because there is

a list of things you can point to and it's not constrained by shape. This, because it has a shape, it would be really useful to cluster, to somehow, it's like building bricks."

This idea of extensibility and clustering was also reflected in comments about packaging, and some users saw value in being able to curate and archive information. Dale liked the storage aspect and the ability to build an in-depth story:

Dale: "And I look at Scott Driscoll[18], if you went back, and you wouldn't fit all that in a cube, you'd have to break the cubes down, or you'd have a cube of cubes."

Riley liked the idea that material sourced from multiple locations could be collated and visualised in one place. The cube, in this situation, had advantages over traditional formats:

Riley: " …but if you try to present that on a page traditionally you would either have to have a series of web pages that people click though or even worse you would have a series of text pages, magazine pages."

Dale identified speed as a handy affordance. He thought the shape would make packaging news faster:

Dale: "And I guess that's the beauty, one of the things I really liked about this was the speed of it, because, if you had a big issue happening, you could get stuck into this really quickly. And that, to me, is what it's all about."

This contrasts with Alex who did not make a cube because he did not have time, though he did see potential in archiving:

Alex: "... it's almost like a library and so that you could come back to it two years later and said 'oh yeah, I wanted to read something about why did that government fail'. And so here's a thing that has, you know, them getting in, them hitting trouble with with, the budget going to crap, big scandal with the such and such, here's the election defeat, you know, and maybe you could pull it all together that way, so it might be a good archive. In terms of a real-time thing on a real-time site where people come to read the next thing, the newest thing, they might not find that overly compelling."

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[18] In 2013 Dale's newspaper exposed corruption by Scott Driscoll, a sitting member of state parliament.

Dale also saw potential in the NewsCube as a storage device:

> Dale: "Now like, I can find a few stories online, but unless I go back into the archive of the physical paper it doesn't exist now. … Normally it's there forever, but it's trying to find it through search engines and that's when the links help me. I went back and found some stories and clipped off the links from those pages and tried to recreate what we'd done in 2009. But if you had a cube it's just there, you can keep it. … I guess one of the things I didn't expect was that storage. Because I was getting really pissed trying to get all that info together, all those stories that we'd done what are just somewhere now. So it's probably a good storage device actually."

Perspective and context

One aim of the cube design was to facilitate storytelling from multiple perspectives. The idea is that content could be grouped according to a point of view. Charlie thought this was possible, but limited:

> Charlie: "... I think the concept is that one side of the cube is one perspective, or one angle, and another side is another one, but sometimes you have in-between items. These items might belong to this perspective and this perspective, so identifying that some items are in between sides, or domains, or perspectives is quite important. It works well that way, but I think it can improve if it shows that things can move from one place to another or be part of two at the same time, to show different perspectives. Because it feels that is is quite constrained."

James liked the idea of showing different sides to a story:

> James: "I liked it. I like the cube in that it was a different way of portraying different sides to a story, or not even sides because they could be quite disparate I guess, mine weren't necessarily that connected. Like, I was looking at some of the spy stuff with Indonesia and that, I was trying to track it back to Wikileaks and try to draw some parallels, and the boat people stuff and the implications of that so they're really not the same story at all in a way, but they sort of are inter-related in a very obscure way possibly, so I liked it. I liked the fact that it was a cube in that it wasn't something you could necessarily draw direct parallels with."

The ability to provide background or contextual information was also identified: Tyler saw potential to use it to tell others about a complex story:

Tyler: "So say if I had family overseas who didn't know about the NBN and stuff, because they weren't hearing about it, I could put together a cube with a lot of different information and email a link, and they could get a quick praise of the different sides. I thought that could be cool."

Both he and Val saw potential for a cube to be a repository of background or contextual information about a story (or blog post in their case):

Val: "I find I spend half the blog going ok this is what these people said, this is what these people said, here's what I think, you could probably save yourself a bit of writing and say here's a news cube about it, and here's what I think."

Charlie saw potential in the ability to explain topics to younger audiences:

Charlie: "Younger audiences. Kids, I mean, someone who is learning about how to make connections between information types. Because it's very playful, it's very, I mean for educational purposes, for playing with something, I think there is a massive potential there. If I am trying to understand how something about politics relates to a game … understanding those connections …"

Charlie: " ... I see something like this more interesting or more useful for the audience, to share my cube with your cube, or just to publish my cube."

Dale thought it mapped to a journalistic way of organising information:

Dale: "…it challenged me to get back into that old thing about what elements are there to this story, what do readers what to know about? So I found it quick to do, I love the aggregation side of it, because let's face it, there's plenty of stuff out there, take me to where it is. I guess I used to rebel a bit when the topic came in that editors were curators, I'd think what a bunch of shit that is. But in a lot of ways it is true. You're a curator …"

Riley thought it redesigned standard newspaper techniques but in an interactive and non-linear way:

Riley: "… if I was working on a big story for a newspaper and they had a cube like this, it would be absolutely awesome for things like the big features that I used to work on. Because essentially what it's doing is what we have tried to do in the past

with things like break-out boxes, you know, follow-on stories, and things like that, but the idea of people being able to interact and get the information as they need it, and also the visual way of doing it is just so much more usable."

Riley: "from a media, a straight traditional media perspective I can imagine them using a cube on an issue of the day and using one side, or linking off to — I'll go down one path first — using one side of a particular cube for essentially a discussion board or readers' input or things like that as a new way as you can then say 'alright, I've examined the issues now I can visit the discussion board page', or potentially if it is a bigger issue linking to whole other cubes because there might be people who want to put tougher their own cube on the same issue from a different perspective."

Synthesis and comprehension

A related theme was the ability for the NewsCube to aid thinking and analysis. Riley used it as a research tool, rather than a storytelling tool and saw potential in the ability for linking and annotating to aid synthesis and understanding:

Riley: "… I work in fairly complex policy areas, similarly when I was doing journalism it was larger, more extensive investigation features, that sort of thing. Yeah, I definitely wanted to be able to say 'this links to or draws attention to [this]', or you know, and sometimes it's multiple paths, it's not necessarily the one link."

Riley: "it allows you to draw up a web of connections when you're doing analysis that's beyond just a linear way of analysing."

She also saw benefits for the reader:

Riley: "… when you're trying to lead somebody through a chain of reasoning, … I also wanted to sort of say, 'actually, have a look at this modeling that has been done independently, or, this links to the union position on this, is picking up on, you know, the government policy here, or whatever', and to give the reader or the user or the visitor enough information to be able to say, because obviously I'm not just providing a curated sort of site, I'm trying to give them my take or analysis or position on it."

But she was not sure how to do this best: "where do I present my hypothesis and how do I lead readers or users through it?

Dale thought the NewsCube could play a role in aiding comprehension for big stories:

Dale: "I'm thinking back to some of the investigations we did. We did a big one on hospital emergency departments, you could have filled up a cube really easily with that. I mean, we had days of stories, some were the staff, some were the stats, some were the FOI [Freedom of Information] requests we'd done, you could fill it up really easily."

By contrast, Alex thought too many voices could cause confusion:

Alex: "And I think if you had streams where every man and his dog had the ability, equal ability to influence what it would look like, one, it would be unwieldy and it would be a mess, two, like everything else designed by a committee, it would not be very satisfying, because it would satisfy no one, three, ultimately it would probably be a game won by the special interests, people who are paid to promote a point of view."

Ownership and control

The tactility of the interface and the agency users had to craft their stories gave them a sense of ownership over their NewsCubes and, by extension, a reluctance to let others alter their creations. Val, for instance was concerned about maintaining some level of control over something she had created:

Val: "I guess I'd be happy to have people do as they wished, but I wouldn't want to lose access to the way that I had set it up. Particularly if I'd put a lot of hours into it. So if I could just duplicate the cube and make one public, then I'd be happy to go completely *laissez faire* with that one."

She also wanted to reorganise content:

Val: "I found myself adding stories that I then wished I could change the order of how they were presented."

And Tyler wanted to maintain the integrity of his work:

Tyler: "I'd be tempted to do two versions and have a private one for myself that was complete, or at least was satisfying to me, and then a shared version to see how people changed it but so that I wouldn't lose what I had done."

Participants generally did not like the self-righting function: when you moved the NewsCube it spun to be the right way up once you let go.

Tyler: "I got lost a couple of times when I only had about three sides set up, I'd try to just keep moving through in one direction, and eventually the cube would right itself and I'd be a bit lost. … In some ways I'd rather be able to be in control of whether it was upside down, because if I was just scrolling though I wouldn't care if it was upside-down because I would just want to move on."

Val: "I wouldn't mind if it was upside down, or whatever, as long as I could control it better."

Shannon: "… as soon as I moved to a face and then it sort of rotated on me, I was a little bit startled."

James wasn't worried about this: "I just expect that with technology, I never really see it as an issue, it's just something you get used to."

Potential for collaboration

Part of the NewsCube concept was the idea that stories could be constructed collaboratively: that authors could share control with readers (Bolter, 2001; Fredin, 1997; Joyce, 2003; Landow, 2006). This ability was not fully functional and instead was suggested by the ability to make a cube public or private. Users of the prototype could see other user's NewsCubes, but could not edit or control them.

This collaborative aspect emerged as a feature that participants would value. Shannon, for instance, saw potential for building community, and referred to the ability to see other users cubes.

Shannon: "I can see how the social structure could make it much more organic, like I can look at your cubes and the signed-in people can contribute."

James thought collaboration "adds a whole new dimension to, it makes the process a bit more fun and engaging," and Charlie saw the ability to create something and share it as highly valuable:

Charlie: "… sharing, and making something that you share, I mean not making something in terms of I took this picture, [but] sharing a collection of things that I did, it has high high value for people. Because, I mean, creating something takes a bit of interest and then being able to share this, yeah, I think it is quite important."

For Tyler, collaboration could have changed his overall perception of the NewsCube. He initially created a NewsCube about an obscure news story about an elaborate hacking in Japan that sent police on wild chase, arresting innocent people. Eventually the hacker sends message to police about a sim card on the collar of a cat. He had been following the story for some time and had collected all the stories he could on it. These files — links and PDFs — were organised into folders.

He was disappointed with the results:

> Tyler: "I didn't ever feel I'd gained a new understanding, but maybe that's because I'd been following it so intensely that I already had a good understanding."

In this case, he already had all the documentation available, so there were no primary documents or other sources, only published articles, so lack of new insights maybe due to nature of data input. However, he thought the ability to collaborate would provide new insights:

> Tyler: "I think it would be cool if you could make it public and have people collaborate with you, say, I'm building a cube on this. So actually that would have, in terms of that first story, the Japanese story, it would have been great, because there is obviously a dearth of information about it in English, and I don't read Japanese. So I could have put that out there and said 'hey I'm really interested in info on this can anyone who reads Japanese share some translated articles on the cube, or something'."

Cubic constraints

Not everyone liked the NewsCube or found it useful and a recurring theme was that the shape did not map easily to current practice. There was a tendency among all the participants to work in a linear way when dealing with information. Although some participants indicated that they liked to organise files in groups, they couldn't relate that directly to a cube. Instead, they found the shape limiting.

Restriction

Shannon outlined a process in place at the ABC where content is aggregated from across the platforms and programs under topics:

> Shannon: "So basically, instead of going to a particular brand, so let's just say ABC3 or News Online or something like that, then we bring that content from both local radio, RN, all of the different content divisions, so if a story is produced in 7.30 or if it's produced Four Corners or Lateline, for example, and it's on a particular topic, then it would be aggregated into a particular are based on its content."

She also described her own approach to research, which focussed on collating information and annotating it, but not creating relationships between those items. She drew on researching an essay topic to relate to the cube and mentioned using tools including: Evernote; Google Scholar; Adobe Bridge:

> Shannon: "I mostly use Evernote, because it means I can just organise my thoughts a little bit more, in a more open manner, it doesn't feel limiting."

> Shannon: "I'm sort of more familiar with being able to, you know, tab between collections, or ideas."

Tyler too found the NewsCube's non-linear approach challenging:

> Tyler: "I found it a little bit hard conceptually to separate stories into many sides. I think I kind of touched on this before, but I felt like I couldn't really get past three or four. And I usually kind of did one side as one topic within the story. And I suppose getting up to four is not that bad, it's not like you have to fill the cube, yeah, but I don't think that's necessarily a problem with the NewsCube I think it's that I'm not used to thinking about stories in that way."

Shannon didn't like six sides:

> Shannon: "I feel like the actual cube as a shape is a little bit limiting because I feel like I have to use it rather than I want to use it. So I could then, like having to use something like that, then I feel like I would structure my ideas, I would structure my collection of information around six ideas, I mean you don't need to use up to six, but if I had more than six for example, then would that be a problem? I'm not sure."

Many participants found the cube restricted the scope of their exploration. This is interesting because none of the participants filled a cube, and only one filled a whole side.

Charlie: "I found it limiting in the sense that there is a maximum number of items per face. Because I got really exited with climate change and I just want to add some items here, but then I went more that nine, it's like 'oh do I go to another side with the same subject, or how does it work, or there's a maximum number of items per face'. That's the limiting side of things. But in terms of the shape I like it, because it is very familiar to me, and to most users."

Shannon: "I was wondering about the limitation of the metaphor of the cube or the actual, the structure of the cube in only having six faces, I feel a little bit limited I guess when I've been researching a particular article or area of interest, or you know if I am writing an essay for example, I'd collect up to, let's just say 40 or 50 research papers, and I guess this mechanism feels like it is a little bit limiting, but the cube mechanism, it feels like I have to limit my structure into either what will fit onto a face or into six particular areas of groupings."

She also saw 3D space as a limitation:

Shannon: "I can certainly appreciate working in the 3D space, but it feels like ... there's a few hurdles that I'd have to get over to use it effectively. Like, for example, if I was collecting information like URLs and articles and writing my own notes on one particular face and the face that's on the opposite side of the cube, so diametrically opposed, it feels like that physical shape will effect how I can collect information. So is it completely opposite, or is it, it's sort of two faces removed from the face that I'm already working with."

Shannon: "... you have to physically move the cube in order to get a second face, it feels like it's a little bit of a hurdle."

To her, the idea of constraining space was a limitation:

Shannon: "I guess my main impression is that enforcing a 3D space onto a methodology of collecting information, it feels like that space is always there, mentally, when I am trying to think about how I would pull information together."

Expectation

A related thread was that the shape set up a task to be completed. Tyler thought the cube set up an expectation that he needed to fill the cube:

Tyler: "I thought I would need to know something about the topic initially, I would need to not be totally ignorant of it in order to have a decent idea on how to set up the sides of the cube."

Val felt she had a goal to achieve:

Val: "I kind of wished I didn't have to have six or however many sides. I felt I wasn't really doing a story justice by not filling up all the sides. I felt a bit guilty ... I think even just visually filling up the space it would help. And I guess, having a few stories on each side it would be fine, but if sometimes there was just one side to a story, I don't know, I just felt as though I hadn't finished that side, it was an incomplete side."

Val: "I felt like I had to do more research to finish that side and it started to annoy me a little bit."

And Alex felt he didn't have time to do a good job:

Alex: "I sat down several times over the last six weeks or so to play with it. And I would typically get into it and I would get into some of the other users and their cubes, sort of have a bit of a fiddle and have a look at things, and then I'd, ultimately I'd kind of would decide each time, I'm not sure I've got time to do one of these things well. And I would not get started."

Culture

Comments by some users suggest journalistic conventions could act as cultural constraints. In discussing the potential for collaboration, for instance Dale, Riley and Alex note how attitudes about audiences might restrict the use of collaborative features.

Riley: "I gained a lot looking at other people's cubes. From a media, a straight traditional media perspective, I can imagine them using a cube on an issue of the day and using one side ... for essentially a discussion board or readers' input or things like that as a new way as you can then say 'alright I've examined the issues now I can visit the discussion board page', or potentially if it is a bigger issue linking to whole other cubes because there might be people who want to put together their own cube on the same issue from a different perspective, although that would be challenging again from a media organisation."

Dale: "I think it is a real challenge for journalists to actually see their audience and understand the audience. I don't know how many journalists want to do that."

Alex noted that barriers to content meant barriers to communication.

Alex: "I think, and the reality of going behind a metered system is that, people are far less inclined to engage with something where they think they are paying for the privilege."

Alex: "… it's not a right, it's a bit of a privilege, I think, to help shape any sort of site."

At the same time, he sees commenting as audience collaboration with commercial benefits:

Alex: "I think what they do now is they, by leaving comments on a story that is an indicator that, a virtual indicator to other members of the audience that this is an important story, they see a big number on something and say 'oh gee, that's important enough to leave a comment on', so that's good. But I think it's what they do on social media where they like it, they share it and they comment on it, that is doing all of those things. That is telling someone that this is something that I should pay attention to because a whole lot of other people are paying attention to it, this is interesting because a whole lot of other people are commenting on it and the comments are more interesting than the story was."

Impact of fidelity

The prototype was in many ways rudimentary — much of the required functionality was there but some of functions were clunky. A risk of this is that the level of fidelity (higher, digital prototype, rather than paper or wood) moves the focus away from core concept to the experience. This seemed to be happening at one level, but it also enabled comments on affordances of the experience e.g.: playfulness and ownership.

One consistent piece of feedback was that it was difficult to get content on to the cube. Most participants commented on this. They didn't like that the browsing experience was inside the cube, rather than in the standard browser.

Tyler: "I think [James] and I both said when we were using it we always stared from inside NewsCube and then went looking for articles from inside the adding article window, which is a little tricky because it is a tiny little window and you have to go to Google inside that window and search, and it was to my embarrassment, only towards the end of building my cube that I realised I could just copy paste the link from Safari. Yeah, so it would be good if you could go both ways, either start from Safari or start from NewsCube. Um, and it would be excellent if NewsCube could be part of the sharing in Safari."

Shannon: "I wouldn't be doing my browsing from the app interface, I would be collating the information."

As discussed in the previous chapter, some users wanted to open the cube up and see the relationships that had been created. Charlie, for instance, wanted to open then cube up and turn off any content that wasn't related:

Charlie: " ... I mean the whole thing about this is understanding relationships between things."

He also had problems with adding links and embedding videos and found it difficult to get used to:

Charlie: "In terms of adding the content to the cube, sometimes getting used to how it works and how you can edit or modify the information takes a little bit of time to get used to because some the tools are not what you are used to for the iPad … so it takes a bit of time to get familiar with how you do it. But once you do, I think it is quite intuitive, once you get used to it then it works ok."

Shannon had suggestions about the size of buttons and noted the space allocated to functions needed to be rethought to better reflect tasks:

Shannon: "I guess on the source window, the write article, that seems a key component, so that's where you are actually doing your research and writing down your notes, um, that's sort of right at the bottom, but the social media window is taking up quite a lot of the real estate of that window. So I think that just that interface could be tweaked a bit in order to maximise the key component of that page. I guess the first one you've got in bringing in the website address, but I think that could be secondary to compiling your article."

She didn't like that some faces were not visible:

> Shannon: "At the moment you can only see the first face and you don't really get a hint of the fact that you can touch it and move it around fluidly."

Val wanted the sides to fill up to avoid the feeling that she had't finished the task. This issue of filling the cube was something discussed at one point in the development phase, and Sam suggested he could make make any volume fill a side. However it was not implemented:

> Val: "I think even just visually filling up the space it would help. And I guess, having a few stories on each side it would be fine, but if sometimes there was just one side to a story, I don't know, I just felt as though I hadn't finished hat side, it was an incomplete side."

Riley was frustrated that the NewsCube wasn't easier to use:

> Riley: "I was actually left with sort of an appetite, for one, I want to use this all the time because it was so useful to me in the sort of work I do, and two, the only frustration was that I want these technical things ironed out so that I can use it quickly and more efficiently, because I could see me using it."

Alex thought the design of the sides was too confusing:

> Alex: "If I look at it and each side of it has a heading and it's got nine different things in each one of those has got headings and they are all telling me, and everything's screaming at me and I'm like 'ahhh' I don't know where to start off."

Intention, perception, shape

The NewsCube is a cube because it was designed to bound hyperspace, to make it navigable and to facilitate storytelling from multiple perspectives. It also aimed to design a way for journalists to more easily engage with audiences in the construction of those stories, to share control of the narrative without creating confusion. These were its intentions and formed the core of the conceptual model on which the design was developed.

To some extent the feedback validated the conceptual model. Most of the participants understood that they could use the NewsCube to create hyperlinked stories that were organised around different perspectives. Using the balsa wood prototype to explain the concept before deploying the digital prototype helped in this regard. For Dale the shape mapped easily to journalistic ways of organising information and for Riley it allowed her to take a reader through a chain of reasoning. And although Tyler found it difficult to think about topics from six perspectives, he grasped the concept.

But the idea did not resonate with all. For instance, Shannon's mental model of how to organise and synthesise content did not map well to a cube and she did not see value in the interface. Although the cube afforded six points of view, with the intention of providing a big picture view of a story, she could only see one face at a time, so did not perceive that affordance.

This was not the only time when the perceptions of users did not match the intention of the designer. The ability to add up to nine items to each side, was intended to allow scope for exploration, but users instead perceived a task that had to be completed. Similarly, the idea of collaboration intended a NewsCube to become an evolving, constructive hypertext. While users saw potential in collaboration they also perceived the shape to be ideal for storage and archiving — for stasis, not evolution — and not intended.

This disconnect might be explained in part by the fidelity of the prototype. As discussed earlier, the NewsCube was a mixed-fidelity prototype, and collaboration was one function that was rendered in low-fidelity: the possibility was suggested but not implemented. So while users had a rich experience interacting with the interface, which was reflected in the comments and insights about the shape and it's tactility, feedback on its collaborative intention was speculative, and in some cases (Tyler, Alex, Riley) based on previous experience rather than use of the prototype.

Another intention of the shape was to bound the space in which a hyperlinked story could exist and so help structure information and aid comprehension (Johnson-Sheehan & Baehr, 2001; van Dyke Parunak,1989). While users did perceive affordances such as perspective, context, synthesis and comprehension, which reflected those intentions, they did not see them all as positive. Rather than provide navigation, the shape was perceived as restricting the ability to explore. Similarly, although the NewsCube could accommodate

more content than any of the users added to it, there was a perception that the shape limited the scope of a story.

This is an illustration of Norman's (1999) real and perceived affordances: a real affordance was that users could add up to nine items on each side, more than any user achieved; the perceived affordance was that this was limiting. The shape created a restriction. However, the NewsCube also revealed another perspective on real and perceived affordance. Norman argues that with "graphical, screen-based interfaces, the designer primarily can control only perceived affordances" (p. 39), because the real affordances such as clicking, touching and pointing are of little interest to the designed application.

The NewsCube had both: the real affordances of the iPad screen meant users could use their hands to interact with the interface. It afforded touch, and unlike Norman's example where such qualities are not useful to an interface designer, in the NewsCube case it was important: the touch screen enabled the visual feedback from the NewsCube interface — the perceived affordance of the cube to be manipulated. This, in turn, created the tactility that most engaged the NewsCubed users and enabled them to perceive affordances of familiarity, extensibility, perspective and playfulness.

While Norman (1999) suggests that good design makes desired actions "readily perceivable" (p. 41), Hutchby (2001) makes the point that just as creators can design for affordance, users can perceive qualities that were not intended: users, "may seek to produce readings of the technology-text which best suit the purposes they have in mind for the artefact" (p. 445). This is evident in the affordance of ownership that emerged from the NewsCube users. This was not designed for. By contrast, the conceptual model of the NewsCube was for a collaborative, breathing story that evolved through the contributions of others. A constructive hypertext (Joyce, 2003) in which authors and readers shared control.

Insight to practice

Beyond affordance, prototypes can also probe a situation and act as a way of examining practice. Wensveen and Matthews (2015) suggest that "anything that treats design as an intervention in the world and studies its consequences, or work that deploys prototypes in the field and analyses their use" (p. 268) works in this way. This type of information is valuable in design because it provides insight into the context of use.

In the case of the NewsCube, feedback from participants revealed aspects of culture and practice that could limit the ability of journalists to exploit the affordances they identified through using the artefact. This is a strength of design research and by embedding the NewsCube in the context of use it was possible to understand other factors that might help, or hinder, its adoption. Such insight into practice helps explain what might need to change among users, or the organisations in which they work, for them to be able to take advantage of the NewsCube's playful and tactile qualities.

While this chapter analysed user feedback in terms of what the NewsCube revealed about itself, the next chapter examines the feedback in terms of what the NewsCube reveals about those using it. It does this through the idea of tradition and transcendence, that is, how the designed artefact might enable new practice to emerge.

Chapter eight
A probe into practice

"We know this much: people want to be immersed. They want to get involved in a story, to carve out a role for themselves, to make it their own. But how is the author suppose to accommodate them?"

Frank Rose, 2011
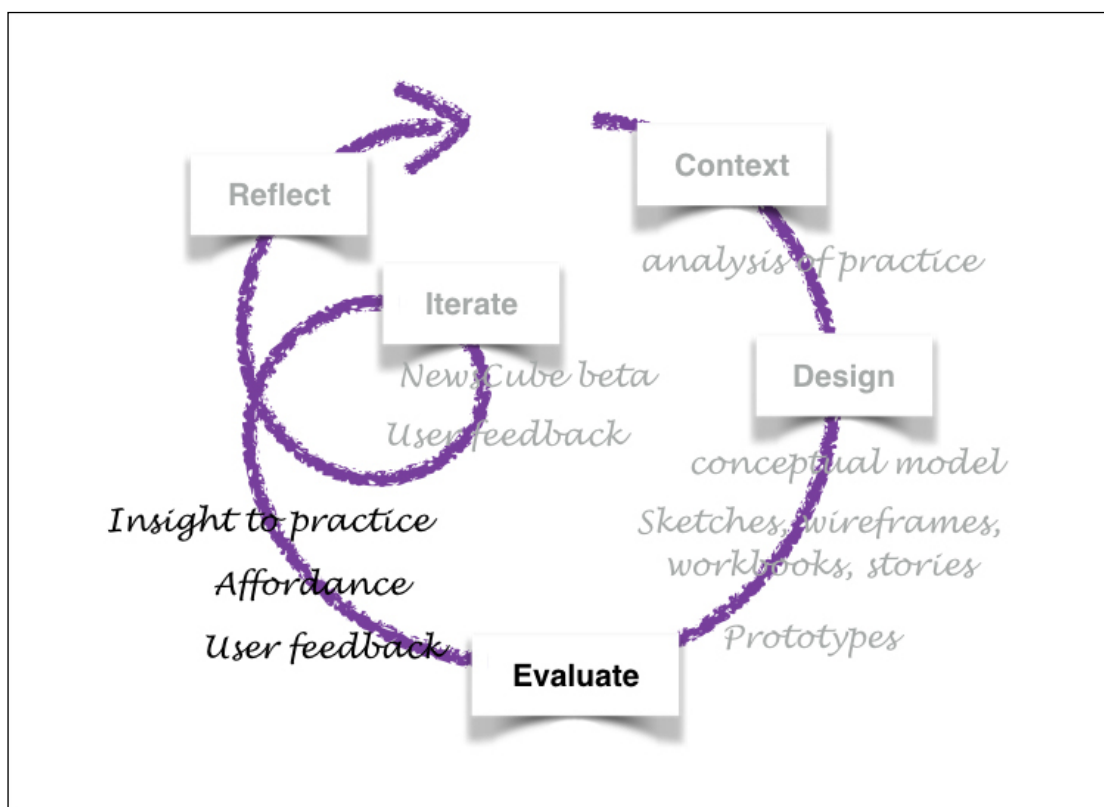
Figure 25
Research evaluation phase

Technological innovations can be confronting because they can challenge the existing paradigm, and design artefacts, which imagine possible futures, can have a similar effect. In aiming to create something new, design artefacts transcend the limitations of the present (Löwgren & Stolterman, 2004, p. 17) and so can prompt reflection on current practice. It is this ability for a design to challenge existing and entrenched ways of doing things that is interesting to researchers, and potentially, practitioners.

Through a process of developing, deploying and evaluating prototypes, it is possible to understand how practitioners can develop new ways of working, or thinking. For Ehn (1989) this is a key motivation for design and he sees the question of "tradition or transcendence" as central: designers need to decide whether to design for old skills, old values and old divisions of labour, or to design for the new, made possible by new technologies and designs. However, Mogensen (1992) recognises the need for a middle ground. He sees the question as being that of "tradition *and* transcendence": "we are always to some degree bound in our tradition and, at the same time, have to transcend the present in order to solve our problems" (p.2).

This view recognises that tensions can exist between current practice and the future practice that prototypes make visible. Mogensen (1992) suggests the concept of provotyping — provocative prototyping — to address the challenge of designing systems that require new practice, while at the same time ensuring their usability within the existing context. Provotypes are "ethnographically rooted technically working and robust artefacts that deliberately challenge common stakeholder conceptions" (Boer & Donovan, 2012, p. 74). Like technology probes, (Hutchinson et al., 2003) they are working versions of technologies that need to be deployed into the field. But where probes are deployed to collect information about users, with the aim of inspiring the development of future technologies, provotypes "are seen as a 'bridge' between the worlds of design and use and between technology and human perceptions" (Boer & Donovan, 2012, p. 390).

Crabtree's breaching experiments are another way to discover how new ideas might disrupt old ways of doing things. Like provotypes, breaching experiments are provocations in the form of artefacts, that can trigger analysis of practice. New technologies can create "entirely new possibilities, and practices for their use have yet to emerge" (Crabtree, 2004, p. 67). In this way a prototype can reveal how users might need to change their behaviour and so inform decisions about what to design: they can tackle how to transcend traditions.

The NewsCube is not a breaching experiment or a provotype, but as a design artefact, deployed into the field and analysed, it acted as a means of provocation (Wensveen & Matthews, 2015). It prompted users to think about how the design might challenge their established ways of working and gave the designer insight into some of the barriers to transcendence. The comments discussed below provide insight into how the users perceived the design and how their habits and conventions work to limit their ability to exploit the design. Control was among the strongest themes to emerge.

Narrative control

Whether they were concerned about narratives, audiences, or journalism more generally, all the participants discussed how the NewsCube challenged control in some way. In this sense the prototype reinforced existing studies into journalism practice: ethnographies of newsrooms identify an unwillingness by journalists to give readers control over editorial processes (Anderson, 2013; Boczkowski, 2004; Brannon, 2008; Domingo, 2008; Ryfe, 2012; Steensen, 2011); and at the heart of hypertext narrative is the idea that readers "can share control of the text with the author" (Bolter, 2001, p 122).

However, the feedback also revealed participants' thoughts on how practice might change. These comments were prompted as a result of using the NewsCube and understanding its affordances. In this way, the prototype provided a new way of seeing things and so presented new possibilities for practice.

Although story ownership and control were discussed in terms of affordance in the previous chapter, the issue impacts editorial judgement and so highlights important aspects of journalistic practice. Among the participants there were concerns about how less author control impacted editorial integrity and also how the dynamic between authors and readers might change as a result.

> Dale: "I think if you want to control it [the NewsCube], you know, make it read only or whatever, otherwise take it for a spin. I would. Take it for a spin and see where it goes. One of the problems you've got is the amount of cynicism on social media, especially Twitter, deeply cynical. But kick it around, see where things go, you know."

Riley wanted both authors and readers to be able to exploit the potential of the design:

> Riley: "… I am hesitant to take something that allows a reader or a user freedom and then start imposing rules on them."

> Skye: "Why is that?"

> Riley: "Because I think that, certainly in my experience, both as a user of media and as someone who provides content, is that people are now, particularly people more savvy with digital, they are attracted to it because it's kind of, it gives you a certain amount of independence and I suppose respect, they see it as 'I don't want to be forced down a certain path, I want to gather the information the way I need it'. So

something like this that prepares, allows you to prepare a topic or story in a certain way, but then give the reader, pays the reader the sort of, I guess, respect to say 'we realise you're going to use this information in the way that suits you'. I think that's really important."

She noted the tension between reader control and author control that is made possible with hypertext:

Riley: "... you want your reader to have a certain amount of freedom but on the other hand you want to guide them through enough by saying, you know, 'this is why I think this matters and I think this is why the union's doing this, or this is why the government has commissioned this modeling, and this independent economist is has taken this perspective on the government move, that sort of thing."

Controlling the narrative therefore became more challenging:

Riley: "… that would challenge, one, your ownership of a story and how do you take it beyond just a mere curation of these are the things that I found interesting and what is my hypothesis, I think that's the key, where do I present my hypothesis and how do I lead readers or users through it? And, as we've just said, I think, you know, you relinquish a certain amount of control when you do it that way, unless you are forcing them down a certain sequence, which I don't think is the best way to use it."

But she saw potential in the ability for greater interaction to create engagement with news, and for links to aid comprehension:

Riley: "What I am now seeing is the power of, one, the visual, but two, the interaction, as a way of people, as a way of not just presenting your argument but getting people to take in information that they, because when you're that physically engaged I do believe that you actually then become more engaged with the argument."

Riley: "I think people who are out there using the internet more freely than traditional media, it's a conversation and you're actually there to serve your readers."

Riley: "I definitely wanted to be able to say 'this links to or draws attention to, or you know, and sometimes it's multiple paths, it's not necessarily the one link."

Dale discussed comprehension also. He thought the ability to curate a complex story on a NewsCube would help show it's depth:

> Dale: "I guess that was one of the things that, and especially the links were really important with those investigative pieces, because if we're doing four and five days of stories, well, if you just come in late you can catch up on it a bit and, I mean I don't expect everyone to go the journey with you but if they can catch up that's good. You could do that really well with a cube because you work for three months getting a series up and it would be beautiful to showcase it like that."

These comments suggest a willingness to involve readers in the storytelling process at some level and a recognition that a different format, in this case a cube, could improve the narrative experience for readers. However, established practices dominate and Dale wanted to use it to package existing stories and designs, rather than recreate them in a way that exploited the NewsCube.

Commercial concerns

Dale's comments on how an investigative story could be packaged together using the surfaces of a cube and hyperlinks demonstrates the strength of the conceptual model. This is what the NewsCube was designed for. However, what he describes also underscores the tendency of journalists to view hypertext as a way to retain readers, rather than a tool for narrative construction.

His comments indicate strong underlying traditions that limit the ability for the NewsCube to be exploited. These traditions seem driven largely by commercial factors and entrenched views of the role of the audience. Riley, for instance, noted a "paranoia" in news organisations about readers leaving their websites to go to others via links, and Dale said that in his former role as a newspaper editor, he would not have condoned the use of external links:

> Dale: "Because we are the biggest news source in Queensland and I wanted to package what we had. Like we were in a real battle there to try to get a niche audience, so I didn't want to send them anywhere else, it was a commercial decision. I'm not saying the other copy wasn't good but it was a commercial decision to say

'hey, if you stay with us you get access to all this stuff and more journalists in Queensland than anybody else."

Alex was also selective in how he used links:

Alex: "We will use hyperlinks inside the story to link to earlier versions of that story if it's one of those things, and not all stories offer that opportunity or really deserve that treatment, you know, sometimes the thing is what it is, it's a quick story, read it, it's news for about 45 minutes and never heard from again. Other things might be part of some sort of long-running saga and it serves to remind people that you've been covering this for three months and here's links to the earlier versions and this is what happened last time, and that sort of thing."

However, he did not see strategic benefits in using hyperlinks because of the way his organisation counted them. A story published by his masthead might be picked up by another in the the same group and published on that site. In this case, traffic to the story on the sister site did not benefit him. In his experience, readers who came to a story via a link rarely explored beyond that item.

Alex: "But you might find that if I had linked to more coverage or another story and someone clicked on that link, that might bring them off to an earlier story that might be on *The Courier-Mail* site, so in terms of an overall goal of trying to increase my audience, that might have a role, not a very big one though, we don't see a lot of people, they are there for what they're there for, they are not interested in clicking off to other stuff."

His view differed to Dale's, who saw link traffic as a way to gauge who was reading his stories and whether they were his target audience:

Dale: "I used to say stories were *Courier-Mail* stories because a lot of links came from the home page, stories that were junk traffic when you would have 600 people on a story and 550 were coming from news.com.au [the parent website]. That's junk traffic from my point of view."

Dale: "Now, I was judged by time on site. Now they are being judged by, I think, eyeballs, which is really different, but I was judged by time on site. And therefore the links were really important because if you got someone into a story, the Allison Baden-Clay story was link heavy, I mean, Allison Baden-Clay, links everywhere."

Skye: "Was there a relationship between number of links and time on site?"

Dale: "Yeah, because people would spin off to another story that they saw. I remember times, and I'm not joking about this, where at the height of the Allison Bayden-Clay search and then discovery of her body, ... the five most read stories were all Allison Bayden-Clay stories. And they're spinning off links there."

By contrast, Alex's approach had been to chase "junk traffic" via social media. He pursued a strategy of actively posting stories on Facebook and had grown the audience there by more than five times.

Alex: "Whereas the change we made six months ago was that if unless Facebook can be used as a tool to drive traffic to our website and to our journalism, then it really wasn't worth pursuing ... So now our site, if we're posting there, it's to provocatively invite somebody to come and click on a link that brings them to our site."

But he did not see that as a result of effective hyperlinking:

Alex: "I guess it's activating your audience to play their part in the dissemination of news."

These comments demonstrate the influence of commercial objectives in decisions about storytelling and engagement. Dale and Alex had different goals in using hyperlinks and these had little to do with the narrative or interactive affordances of hypertext. This suggests that any new idea for storytelling and audience engagement might find resistance from the organisation's key performance indicators.

Views of the audience

Alex's comment about the reader's role in dissemination is interesting, because it points to acceptance of the idea that there is a role for the audience in journalism, beyond consumption. Though in his case this did not extend to story creation:

Alex: "I don't think I actually need people to be getting up into the business of the story and rewriting it in order to have an effect on it."

He also viewed his readers as passive, wanting to be told what is important:

Alex: "... they're there ... to consume stuff not to actually come there and try and make sense of it and then consume stuff. They're assuming, I think just like a newspaper was a curated experience in that we took the most important stuff and we put it in the front or the most obvious places, when you did that really well someone enjoyed the paper more."

This view also extended to audiences on social media:

Alex: "And I think that's, to a degree, what the strength of social media is, that someone else has made a choice, someone else has made a choice that I like this and you'll like to too and they've shared it with you."

Dale pointed out that journalistic practice did not provide journalists the opportunity to understand their audiences or communities. This meant there was a disconnect between products and readers:

Dale: "I think one of the big problems that journalists have is actually working out how the real world lives. ... I think it is a real challenge for journalists to actually see their audience and understand the audience. I don't know how many journalists want to do that."

These comments reinforce Ryfe's (2012) view that dominate traditions underpin practice and that journalists need to become more involved with their communities.

Despite strong views about readers and the need to achieve business goals, the participants did acknowledge that the relationship between journalists and readers had changed and there was a need for greater engagement.

Alex: "No it has changed. It's changed forever and I guess the reality for us is constant change, forever. You know it will always tweak, every time someone comes out with a new little gizmo, like NewsCube or the next thing, or the next device we consume it all on, or whatever, it is going to subtly change the relationship. But I think that anyone who goes onto Facebook and Instrgram and decides to take a feed from a news site, and then on that feed communicate to other people on it, leave their thoughts on it, or share it or not share it, or ask that it be banned, or dislike a site, I think they are participating in media."

Alex saw technology and a networked environment changing the role of the news editor:

Alex: "I kind of think of myself more, I want to be Unilever or Procter and Gamble, and I want to be the guy that creates the products and puts them in everyone else's supermarkets. And Facebook and Reddit and all those things being the supermarkets. I want my product in all of those places and I worry less about maintaining my own supermarket because that is the least efficient way to grab a big audience."

Other participants saw hyperlinks as key part of audience engagement. Dale, for instance saw his role as ensuring readers had a valuable experience:

Dale: "I'm big on niche audiences. I'm just not big on the junk traffic. I am big on the audiences where you can really engage with them and therefore the links make that really valuable, because yes, they're interested in this story, but 'what else have you got for me? that I can maybe go and read some more on'."

He sees the audience experience as a journey and hyperlinks as the enabler of that journey:

Dale: "Because if you focus on the junk traffic, the bounce rate, they weren't going to go to any links, so how could you then, with your own audience, make the journey as rewarding as you could."

Dale: "links are a really interesting part of the experimental stage to say 'ok, how are we going to further engage readers and keep them on the journey?"

Riley also saw the audience as being on an independent journey and thought they deserved a level of respect from content creators:

Riley: "It [digital media] gives you a certain amount of independence and I suppose respect, they see it as 'I don't want to be forced down a certain path, I want to gather the information the way I need it'. So something like this [the NewsCube] that prepares, allows you to prepare a topic or story in a certain way, but then give the reader, pays the reader the sort of, I guess, respect to say 'we realise you're going to use this information in the way that suits you'. I think that's really important."

Riley: "We are on a track now where people what to engage, they don't have much patience with one way communication."

These comments reflected a recognition that technology was forcing change in journalism practice. Dale explained how he had adapted the traditional daily news conference to accommodate audiences and Alex explained the dominant role of social media in his operation:

> Dale: "Going back to when I was chief of staff starting in November 2006, online was starting to become a key part of how we did the newsroom then, so I guess organising the parts of stories around online, from my point of view back then, to it becoming, when I was editor, a very key part of what I did. I introduced a 7am news conference in addition to a 10:30, 2.30pm, 5.30pm, mainly because to me the online audience was becoming so integral into what we were doing as a newspaper, and I use newspaper in a very broad term. And stories being dissected very early in the day and we would get a handle very early through our live traffic data on what stories people were interested in, and furthermore, with that online audience data we could also break down who were our readers and who were coming in through links".

> Alex: "… we might have once spent five per cent of our day, if that, thinking about social media and connecting our audience there, now I expect our guys to probably spend 30 to 40 per cent of their time making sure that not just that the journalism is being produced on our platforms to a high standard, but that the story is taken to an audience of interest. Now the most effective way to do that, and there are lots of different audiences and ways to find them, but the most effective one that we've grown in the past six months has been our Facebook profile."

Riley noted that she only appreciated some of the affordances of digital media since leaving a traditional news organisation:

> Riley: "… one of the things I've got a whole new regard for, having come from traditional print, is just how you can present very complex, get people to engage with quite complex material visually. And that's something I've just got a whole new regard for, you know in terms of info graphics, in terms of interactive material. So, something that as a traditional print journalist I might have taken a thousand words to explain, to put something up visually and to be able to allow people to be able to engage with it both visually but also in an interactive way, just personally I found it but I suspect with readers and visitors, it's amazing how much more quickly the concepts can be presented."

Riley's comments indicate a challenge to adoption:

> Riley: "if you had given me this two years ago, when I had no exposure beyond traditional media sites I'm not sure how I would have responded because it would have been so new to me."

In this way, the designed artefact played an important role in revealing to users aspects of their own practice that could change. The artefact acted as a probe into practice and through interacting with it, and reflecting on it, the users perceived possibilities for transcending their traditions.

Tradition and transcendence

The NewsCube, as a prototype designed and deployed to practitioners, tells us something about journalistic practice. Like the the newsroom ethnographies (discussed in chapter two), it tells us that journalists are constrained by established practice and that the cultural dynamics of journalism can inhibit change (Ryfe, 2012). But, as discussed in chapter seven, the affordances of the NewsCube tells us that there is value in stories that incorporate physicality and emotion, such a playfulness, into their design, and there is potential for greater collaboration with the audience.

It is not that journalists have not considered such things: games, for instance, have long been part of the newspaper experience (Bogost, Ferrari, & Schweizer, 2010) and social networks (Hille & Bakker, 2013) have been used to distribute reporting work. But by using the NewsCube as a probe into practice, we can see that designs that reduce a journalist's control over the storytelling process are confronting, largely due to the strong traditions that underpin established practice. For instance, Alex's views of the audience and Dale's resistance to external linking demonstrate how journalism's "constitutive rules" structure interactions and show how investment in prior success — in this case reader retention — means it would be difficult for new ideas about audience involvement to be considered without a measurable benefit.

The feedback in this chapter also reinforces the economic, organisational, and cultural barriers to hyperlinking identified by Anderson (2013): Dale used commercial objectives to justify internal linking; Alex explained how the internal reporting made linking less attractive; and his views about passive audiences reinforce a view that "the journalists are

us" (p. 130). Interestingly, the issue of truth did not arise in the participants' feedback. Russell's (2011) point that networked journalism has implications for what is true was not as pressing as how much control over a story a reader should have.

However, there was a view among the participants that journalists' roles were changing and Riley's comments that the reader deserved a level of respect indicate a shifting power relationship. Dale too, suggested journalists, via links, acted to enable a reader's journey. This view resonates with Hermida's (2010b) idea of journalists as sense-makers. Similarly, Alex's comments about the importance of social media indicate a more collaborative and ambient approach to storytelling (Hermida, 2010b), but here the cultural dynamics at play mean social networks are seen as a way to achieve commercial objectives rather than a way to develop new journalistic practice.

Alex's comments were the most rooted to traditional practice and attitudes. He was also the only participant who did not make a NewsCube. This is noteworthy because in design research, it is the use of the prototype (provotype or breaching experiment) that provokes new ideas for practice: possibilities that new technologies provide, but that are yet to emerge (Crabtree, 2004).

Despite the commercial and cultural challenges highlighted here, the process of deploying the NewsCube to users, who could consider it within their work context, provided insight into the design itself and how practitioners might transcend current ways of working in order to exploit the design. The result is three new ideas for journalistic practice: distributed control, physicality and emotion.

Distributed control

Distributed control is a theme that runs throughout the feedback both in terms of the physical affordance of the NewsCube and the cultural issues outlined above. The participants all liked the physical control they had over a cube and this reinforced their sense of ownership over a story, however, there was an awareness that the NewsCube would be more effective if others were involved. In Tyler's case, without collaboration he could not achieve the insight he was looking for in his story. Riley, too, saw that relinquishing some level of narrative control could allow for greater interaction.

The challenge is to maintain some level of narrative coherence: to design for tradition and transcendence. Segel and Heer (2010) identify a tension between author-driven and

reader-driven narratives and Riley's comments about how to present a hypothesis highlight the reality of this from an author's point of view. Riley thought this might be possible by using one side of the NewsCube to set up and frame a story: "... you preface it with a block of copy that says this is my ... hypothesis and you know invites readers to follow you and join you in your analysis of certain things." But she noted that working out how to use it best would come with experience and "probably it would change depending on the task".

Sheller makes the point that the traditional newsroom is not capable of adapting to the new situation simply by incorporating it" (Sheller, 2015, p. 17), and Riley's comments suggest a need for a more flexible attitude to new technologies, one that allows for new practice to emerge through experience and is open to the possibilities of relinquishing some narrative control.

Physicality

News experiences that involve physical interaction is another idea provoked by the prototype. Nearly all the participants liked the physical qualities of the NewsCube. They liked the way they could manipulate it and Dale made the point that it was tangible, reminiscent of a newspaper. Crabtree argues that "mixed reality, tangible and ambient computing, ubiquitous, mobile and wearable computing, etc., have seen the emergence of a range of technological innovations that have little or no grounding in existing practice" (Crabtree, 2004, p. 59), yet, as Dale points out, traditionally news was delivered in a tangible format.

This suggests potential for new designs that exploit some of the affordances of traditional media. Rather than adapting third-party platforms to journalistic purposes, there could be value in embracing some of those traditions and designing new interactions for them.

Emotion

Playfulness could be one driver of new news experiences. The fun, familiar characteristics of the NewsCube are qualities that are not readily associated with hard news or current affairs, but many of the participants noted how they enjoyed the experience. These qualities were driven by the cube shape and the tactile interaction of the interface.

As discussed earlier, playfulness was not something that was intended in the design, but it is certainly something that could be consciously designed for. Charlie pointed out the

strong psychological effect of playfulness and suggested it was a quality that might be attractive to younger audiences. This type of insight suggests there is potential for thinking about stories as experiences.

Norman (2002b) makes the case for emotional design, arguing that attractive things and pleasurable experiences work better. He identifies three aspects of design: visceral; behavioural; and reflective, and argues that while all are necessary in good design, "no single product can hope to satisfy everyone" (39). The NewsCube, it seemed, showed potential in the behavioural category (users enjoyed the interaction), but its appearance and ability to appeal to journalists' self image was weaker.

New possibilities

This chapter, along with chapters six and seven, demonstrate how design research can be used in a journalistic context to imagine, deploy and evaluate a new idea for practice. It shows how design can accommodate journalistic traditions, and push those in an unfamiliar direction with the aim of transcending them. This is an important insight in this thesis, and contributes to the idea of Journalism Design, which is discussed in chapter ten.

The NewsCube took the journalistic reporting process and conventions for telling stories, combined them with theories of hypertext and proposed a three-dimensional, interactive and collaborative interface. The result was a design that challenged some established practices but opened the possibility for tangible, playful, interactions that gave readers some control over a story.

However, while the feedback revealed a willingness on the part of journalists to relinquish some level of narrative control in return for greater audience engagement, strong commercial demands emerged as a real impediment to change. Comments from Dale and Alex, in particular, reveal the impact of an organisation's internal measures of success on the extent to which editorial staff might experiment with new formats: Dale was motivated to engage with niche audiences, while Alex chased "junk traffic". So, while individual journalists might be willing to involve readers in collaborative storytelling, or experiment with greater tactility, such activities may not result in measures that meet business goals.

In the context of a challenging business environment, where news organisations are losing influence to technology companies, there is a need to experiment with new ideas even if

they do not produce a return. This is the "innovators dilemma" that Christensen, Skok and Allworth (2012) say mires news companies: new entrants are stealing audiences and revenues from legacy organisations, which are reluctant to take a chance on change.

But design can help mitigate some of this risk. As has been shown here, the process of designing something, deploying it into the world and evaluating it, reveals new possibilities and how current practice might hamper those possibilities. So while the NewsCube tells us that news could be designed for distributed control, tactility and emotion, it also suggests that these qualities need to produce measurable results.

A different perspective on audience engagement emerges from senior staff at Australia's national broadcaster. At the ABC digital editorial staff are focused on reader behaviour, rather than traffic, and are experimenting with new tools. In doing so, they are facing challenges of producing content for multiple platforms.

The next chapter details the redesign of the NewsCube and discusses further feedback.

Chapter nine
Designing for new value

"The professionalism and popular values in journalism have led to the determination by journalists that certain types and presentation styles of news and information are valuable."

Robert G Picard, 2010
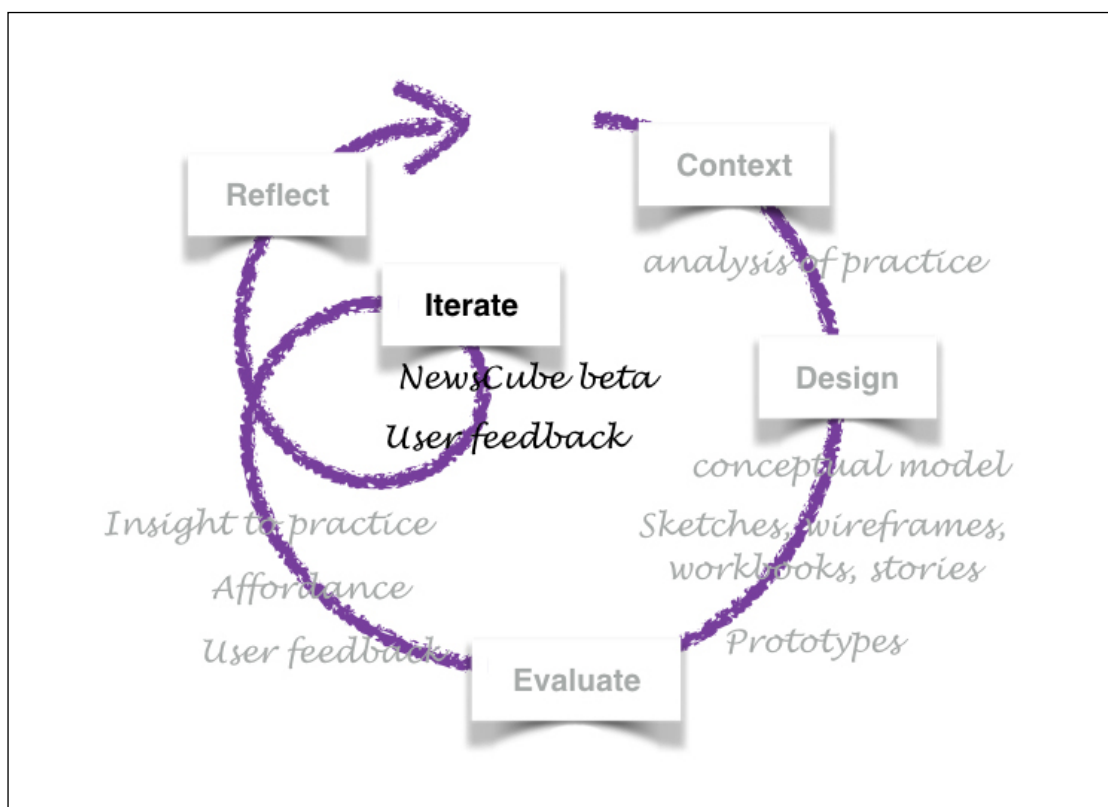
Figure 26
Design iteration and evaluation.

The design process discussed in the last three chapters reveals how the creation and use of a prototype generated new ideas for journalistic practice: that stories could be collaborative, physical and fun. These are not values readily associated with journalism, a profession with deeply engrained notions of news value (Galtung & Ruge, 1965; Harcup & O'Neill, 2001) that determine whether a story is worthy of publication.

As discussed in chapter two, there is a view that technology can challenge these historically embedded views (Deuze, 2005, p. 455), and certainly the affordances of the

Figure 27
The NewsCube website at http://newscube.io

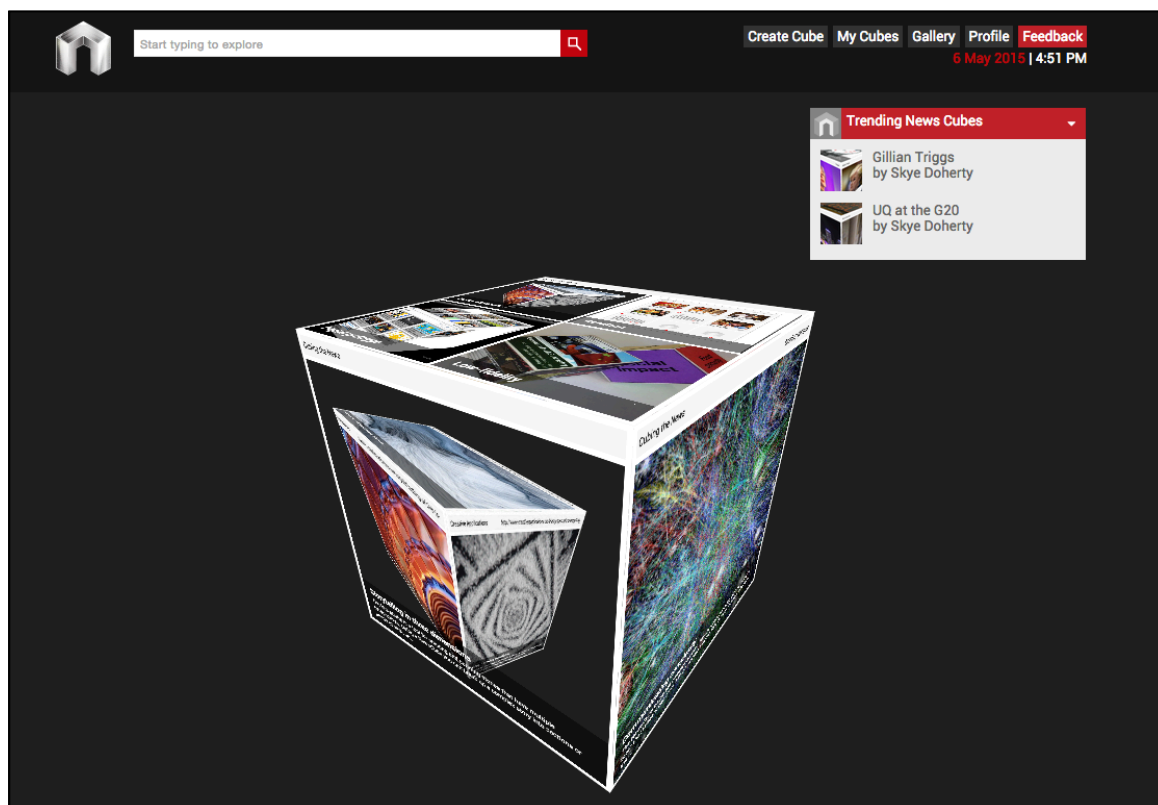NewsCube suggests there could be value in fun, physical news designs. These views were reinforced through further development and user feedback.

In some ways this next phase of the project is auxiliary to the thesis, as the goal was to design and deploy a prototype directed towards opening up new possibilities and enabling established practice to transcend from the old to the new. However, in 2014 the NewsCube won an inaugural Walkley Grant for Innovation in Journalism. The AU$25,000 grant meant further work could be done on the tool and a closed beta version of the NewsCube (figure 27) launched in January 2015. This version was developed by a freelance developer and freelance graphic designer.

The Walkley grants provide seed funding for projects that will benefit journalism in Australia. The Foundation aims to "nurture a community of innovators within the Australian media" (The Walkley Foundation, n.d.). Judges were "intrigued by this ambitious concept and Doherty's vision for 'cubes', or multi-faceted digital stories, which can be added to and built upon" (The Walkley Foundation, n.d.).

This gives me the opportunity to discuss the development of the NewsCube beta and the feedback received from senior members of the News Digital team at the Australian Broadcasting Corporation (ABC). Feedback was sought from two members of that team:

- Max: Managing editor, ABC News Digital, Brisbane;
- Drew: Product manager, mobile, ABC News Digital, Brisbane.

These participants work in the same unit and share a reporting line. They were interviewed together.

Redesign

One of the requirements of the Walkley grant was to create a responsive, web-based version of the tool, the logic being that this would make it easier for the platform to scale to a broader user based than would be possible if it was only accessible to users of an iOS platform. This meant diverging from the tactility of the tablet-based prototype, and it meant that the redesign was not a direct iteration of the previous prototype. However, the process did offer the opportunity to refine parts of the prototype design and evaluate it further.
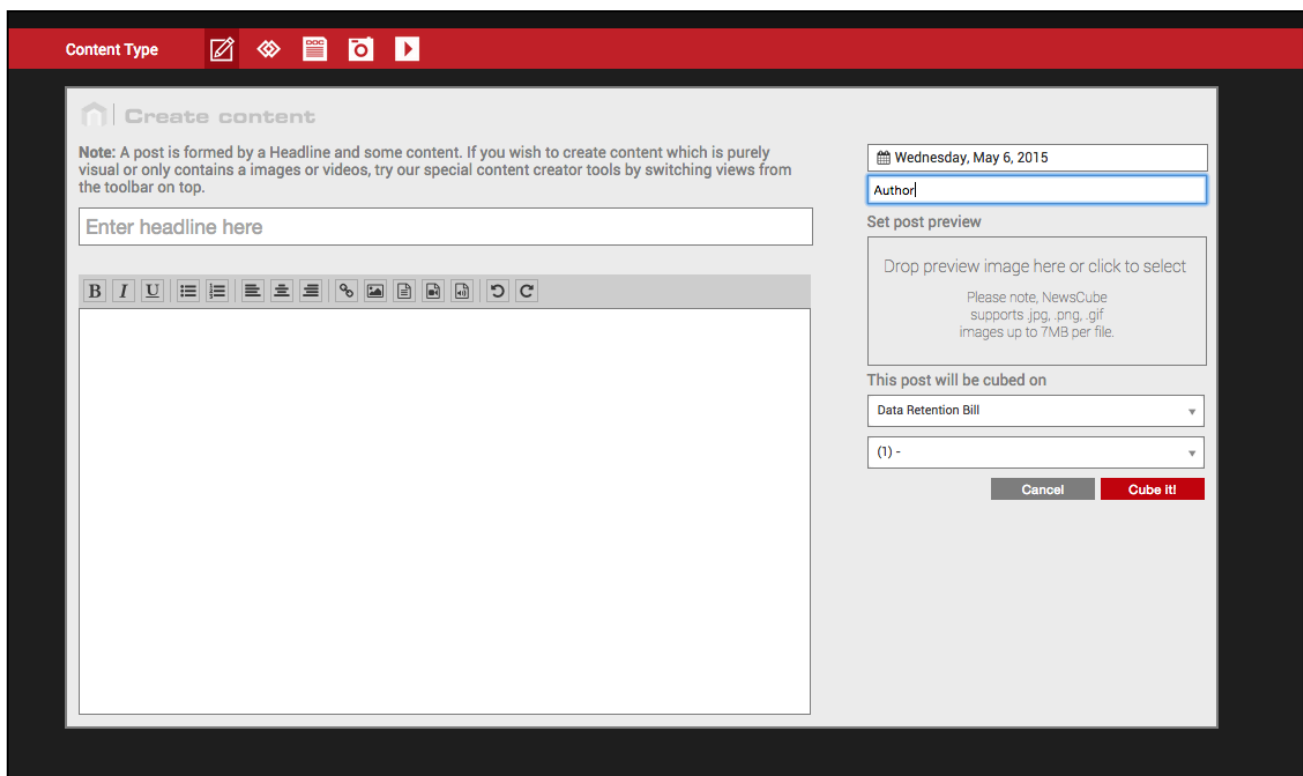

Figure 28
NewsCube content management system.

Figure 29
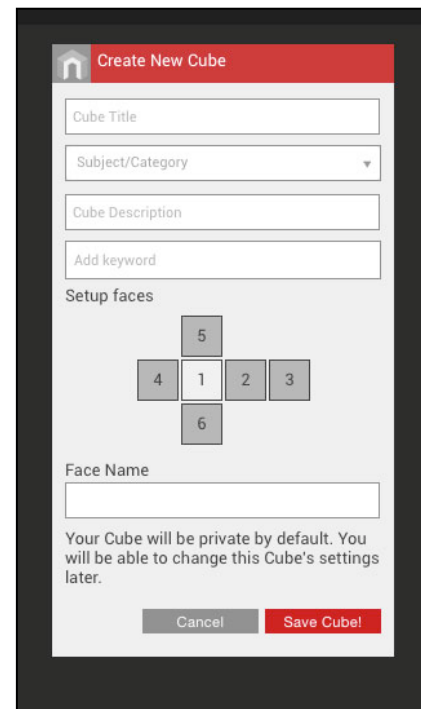*A NewsCube using templates of nine and four items.*

Figure 30
Cube creation panel.

The change in technical requirements meant a change in development team, and a freelance programmer and freelance graphic designer were recruited to build the beta website. The goal was to recreate the functionality of the prototype but with a more streamlined way of adding content as well as the ability to share and collaborate[19]. Together, we also took the opportunity to address other problems raised in by participants, including: the difficulty of adding content; feeling of expectation around filling a NewsCube; and issues of ownership. We also incorporated the flattened cube idea and designed a full-screen "play" mode.

Several participants pointed out the difficulty of getting stories onto a NewsCube. In the prototype a web browser opened in the application and this restricted the ability to browse. In the beta, we developed a bookmarklet that enabled users to add content to a cube on the fly. We also designed a content management system for uploading stories and media: links; images; video; documents; or original posts (figure 28).

We wanted to remove the expectation to fill a NewsCube that users felt with the prototype. To that end, four face templates were designed so that a side would fill with one, four, six or nine items (figure 29). The annoying self-righting function was removed, replaced by a

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[19] The ability to collaborate and share NewsCubes was suggested, but not operational on the prototype.

slow default spin on the homepage to reveal the 3D surface, and we incorporated the idea of flattening a cube, albeit not as participants envisaged. Rather than flattening out an entire cube, with content, we designed a flat cube structure as a way of managing a cube. From a cube creation panel, users can identify and name the sides of a cube using a cube map (figure 30).

The idea for a full-screen option was driven in part by a comment by Riley that she would like to use it as a presentation tool, and in part to mitigate the shift to a browser-based design. While the iPad prototype featured minimal functionality and limited menus, the website design needed to accommodate user accounts, menu items, legal notices and other content, that cluttered the screen somewhat. We wanted to show a NewsCube without distraction. These relatively minor changes were important for the usability of the NewsCube. Participants consistently said the interface was clunky and difficult to use, so the opportunity to smooth out some of the functionality was welcome. However, redesigning the NewsCube for a web-based browser created new challenges.

Shape

Throughout this project the conceptual model has remained consistent: the NewsCube is a virtual, three-dimensional container that can be used to aggregate, edit, create and share stories. In this later iteration the cube shape continued to dominate the design. This shape has been simultaneously the NewsCube's strongest feature and biggest challenge. On the one hand the cube has familiar, interactive qualities that make it appealing. Like a building block, it is tactile and easy to understand. But on the other hand, the feedback from users tells us that it makes demands that other story formats do not: it is a space to be filled, or, depending on your view, a space that limits scope.

Restricting, or defining, space was one of the motivations for using a cube. As an experiment in non-linear, hypertext storytelling, the NewsCube aimed to bound hyperspace: to give it clear dimensions and help readers navigate complex stories with multiple points of view.

That was the theory. In practice, juggling these characteristics proved difficult. As the NewsCube evolved from rudimentary prototype to functioning, responsive website, grappling with the demands of the shape were constant. In the balsa wood prototypes (figure 8) the physicality of the cube was the key feature. This translated fairly well to an iPad prototype (figure 23) because it was a defined size and people still used their hands

to manipulate it. But on the web, tactility is mediated by a mouse or trackpad, and the size changes depending on the size of the user's screen.

This illustrates a challenge of dealing with real affordance (Norman, 1999) across devices. While creating a web version meant the design could take advantage of desktop interactions, such as the ability to click on navigation buttons and enter text with a keyboard, these qualities did not translate well to tablets. As a result, and given budget constraints, we decided to create a limited mobile experience, one that only exploited the touch interaction: NewsCube on mobile is read-only.

This meant the tactile qualities of the NewsCube were not dominant in this new iteration, although the sense of playfulness were still evident in feedback from the next group of users. However, the new design did provide an opportunity to add the collaboration features that were suggested, but not active, in the iPad prototype.

Collaboration

Adding collaboration and sharing functions was a priority for the new version of the design, because it meant the collaborative aspects of the conceptual model could be realised. The goal of the NewsCube was to create a collaborative, breathing story that evolved through the contributions of others. A constructive hypertext (Joyce, 2003) in which authors and readers shared control.

Despite mixed feedback from the first group of participants about the idea of collaboration there was a recognition among them that this type of interaction could be valuable, potentially adding "a whole new dimension"[20]. The key in designing for this was to strike a balance between giving authors creative control and allowing readers to contribute.

Recall that among the hypertext theories discussed in chapter five was Bernstein's (1998; 2009) idea that stories can be constructed so that readers have a level of control over the narrative and can alter the plot, or switch perspective within them. The NewsCube aimed to design for this possibility and it was envisaged that a publisher or author would create a NewsCube in the first instance and that readers would be able to make contributions at will — add stories, commentary, or media — so creating an evolving, "breathing" story. Such additions might shed light on an unreported aspect of a story, or show how an issue

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[20] See comment by James on page 118.

changed over time. This was certainly something Tyler would have found useful in trying to find out more about the mysterious Japanese hacker[21] .

To a large extent the beta version achieves this, although the fluid, breathing vision has been tempered so that story creators to retain ultimate control. The function that was rolled out allows a user to share the production of a NewsCube with others. It means a group of "cubers" can access the content creation and editing functions on a single NewsCube, although the original creator retains control over publishing and some settings. Cubes that are shared appear in each user's personal gallery.

This type of collaboration means story cubes can be compiled by more than one person, but by erecting a barrier to entry — contributors need to be invited to collaborate — it falls short of the fluid, breathing story experience. This solution would still not allow Tyler to find out more about the hacker, because he would need to know who had more information and invite them to contribute.

Sharing

The ability to share and embed NewsCubes was another feature of the redesign. Sharing tools were added to the settings of each cube (figure 31) as well as the full-screen "play"
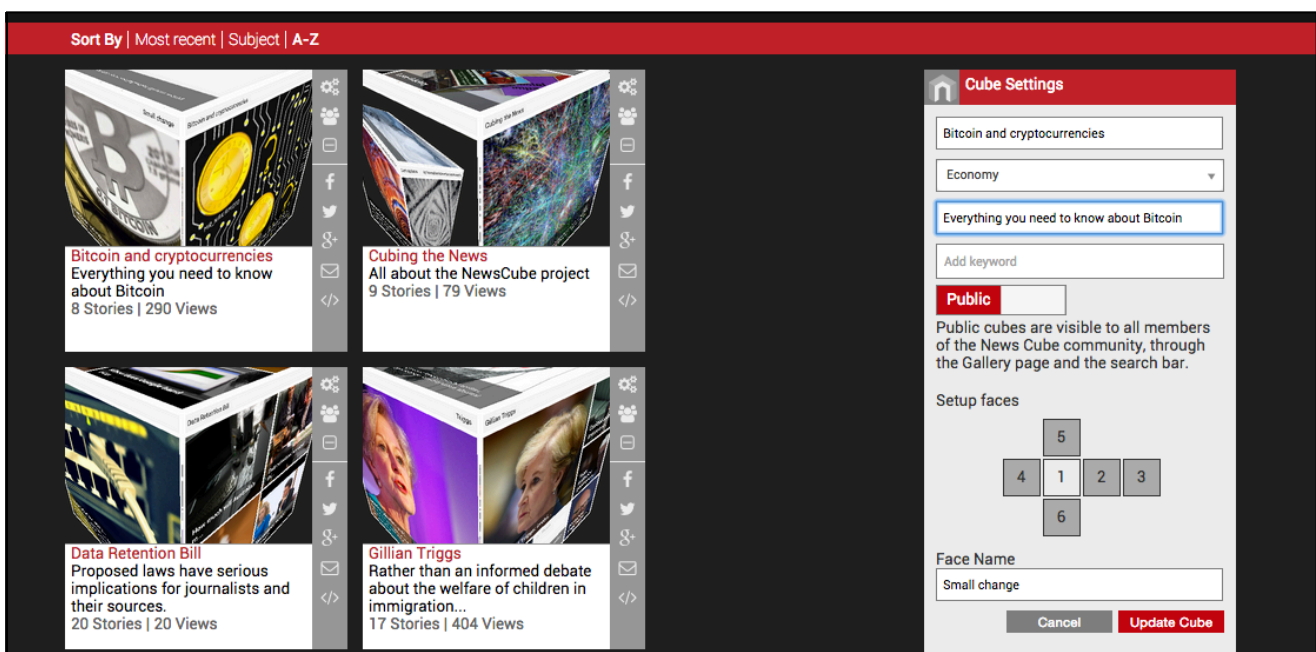

Figure 31
NewsCube settings page with sharing tools.

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[21] See comments on page 119.

mode. Users could post a link to a NewsCube to Twitter, post to Facebook, email to friends, and embed a NewsCube on a website in a player, similar to a YouTube video. These functions meant NewsCubes could be read, played and distributed by users who did not have an account.

Given the NewsCube was released as a closed beta (users needed a code to sign up) these tools were an important way to build awareness and adoption of the technology. In the innovation literature this process is called diffusion, and it refers specifically to the communication of innovations and new ideas through a social system (Rogers, 2003). Rogers' seminal work on the topic points out that getting new ideas adopted is difficult and many innovations "require a lengthy period of many years from the time when they become available to the time when they are widely adopted" (p. 1). In his model, and later ones (Downes & Nunes, 2013), communication through the social network in key in diffusing new ideas. While Rogers discusses the role of the mass media in this process, the digital, networked community now plays a vital role, and so sharing tools were essential for the NewsCube.

Response

The NewsCube beta was rolled out behind a barrier: although it was free to use, a sign-up code was needed to gain access to the creation tools. This was intended to enable us to test the platform while ironing out bugs. Also, limited resources meant we were not in a position to support a broad user base. Unfortunately, the barrier also prevented casual experimentation and sharing, and so reach has been limited. However, the NewsCube has been presented at an industry conference[22], digital storytelling workshop[23], and exhibited as part of an exhibition about storytelling and technology[24]. Potential users in the media, eduction, and communication industries have requested access and the ABC News Digital team are experimenting with the tool.

This team is a department within the ABC News Division and is responsible for the delivery news on digital platforms. Feedback from senior members of this team (Max and Drew)

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[22] Storyology, Sydney, December 2014

[23] Hub4010 Digital Storytelling Workshop, Brisbane, June 2015

[24] TEXTure, Brisbane, October 2015

reinforce earlier comments about the NewsCube concept but also point towards changing journalism practice.

Affordance and value

The feedback suggests the qualities of tactility, fun and perspective identified by the users of the NewsCube prototype were still valued in the web version and that these were qualities that the organisation was actively trying to add to the news "experience".

> Max: " ... it's fun and certainly interactive, so it lends itself to stories that are best told in that way. ... one of the use cases that occurred to me was for a story like the budget for example where you might have a variety of different people giving their reaction to the budget and how it is going to effect them. That is a use case that I could see the cube would be quite an innovative and innovative way of presenting those things."

> Drew: "And perspectives was the one that leapt out at me. The cube's got faces, to explore perspectives on the one story … That's what I was looking for, things that would, content that would lend itself to that, angles on a story ... people or angles on a story that were primarily visual."

The visual quality was attractive to Drew and he thought the idea of using the NewsCube to link deeper into story content was unnecessary:

> Drew: "It is supposed to be a visual tool, so putting normal articles in there I wasn't so thrilled with, and the clicking through to basically an article behind it, to me I'd lose that and just focus on the visual experience of it, particularly around video and atmosphere, because I think if you could add potentially some music or something around the back of it and that it responded more atmospherically to you movement that would make it a more immersive experience."

> Skye: "Atmosphere, that's an interesting word to use in terms of storytelling. Do you equate that kind of thing to news generally or any other type of stories that you produce here?"

> Drew: "I'd equate it to news, TV current affairs being a prime example, look at what *Four Corners*[25] does with music and atmosphere. So that's the type of thing, because

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[25] Four Corners is the ABC's flagship television current affairs program.

the actual literal storytelling can be done through text so when you're wanting to add something you're wanting to add something that is quite immersive. And we're seeing that with 360 degree video and virtual reality type stuff, it's about immersion, so music and things like that add immersion, so that would add to the value of it as basically an enhanced form of illustration. Facebook are doing stuff that they call ambient video in Instant Articles, which as you scroll down towards it the sounds starts to come up and as you scroll away the sound goes down, so there is a whole area around that to explore around online storytelling."

Immersion, playfulness and atmosphere emerged not only as qualities of the NewsCube, but also as something the ABC was actively trying to instill in stories as a way of counterbalancing the "seriousness" of news.

Drew: "... news being overwhelmingly serious is seen as a bit of a negative in general, so adding fun, and that is what we are doing with some other interactive elements such as quizzes, is trying to bring a bit of fun and engagement, it's not just an exploration, it's not just doom and gloom … it's a range of experiences."

Both Drew and Max discussed the value to the audience in controlling their narrative experience:

Drew: "Exploration, finding out about stuff. That feeling of finding out about stuff at you own pace I think is valued. I mean that's one of the reasons people come to digital it's because they can choose what stories they want to dig into and so I suspect that other elements that give them the ability to explore something they're interested in is valued.

Max: "Yeah, I agree. I think anything that is fun and interactive and allows a degree of people being able to make their own decisions about where to take something works really well. Particularly ... where the vision does a lot to tell you a story I think works particularly well, or in the specific example of the cube anyway."

There was a view that the web interface altered the tactile experience of the NewsCube.

Drew: "To me it is better suited for an iPad where it is a swipe and a flick. Whereas the mouse you are off to the side and moving it around and you've got to work out what the mouse's relationship with the cube is and I've had some problems with that, it could be upside down, so all the text and stuff is useless, absolutely useless to you

upside down, you've got to get it around the right way, which is a bit of a hassle, whereas potentially on an iPad where it is a much more fun, direct experience, of manipulation."

Changing practice

Among the ABC News Digital team there appeared to be a strong focus on the user and a willingness to embrace new tools. Max pointed out that there was a recognition that "things are changing all the time" and so staff were "very open to processes and new storytelling formats":

> Max: "You know, there's a real focus on trying to give the audience the best experience that we can and if there is a new tool that helps us do that, then generally speaking people are very keen to grasp it."

He also noted that the digital audience was fragmented and so meeting the needs of those people across multiple platforms was challenging.

> Drew: "But we are trying to customise for the medium. So, Facebook is a medium in it's own right basically, so the tone you take, the way to take to people, the relationship with your audience is different, and you've got to take that into account to be successful."

> Max: "And that's an important point too for us, so for us we used to have a proposition here where we created one piece of content and pushed it out in lots of different ways to lots of different audiences, and that doesn't work any more."

> Skye: "So what are you doing?"

> Max: "Well, we're struggling because we have this proliferation of different platforms so our desktop audience, which has slightly different user behaviours to our mobile audience, which has different user behaviours to our app audience, which has different behaviours to the people who are finding our stories on Facebook or on Twitter, on Apple News, or on Facebook Instant Articles even. So you've got all these on and off platforms, if you like, experiences that each have different user behaviours and different market segments and you know the ideal scenario is that you are taking one story and tailoring it for each of those. And that becomes very labour intensive very quickly."

Among the News Digital team there was a willingness, and resources, to experiment. An interactive storytelling team was available to develop story experiences and they drew on a combination of bespoke digital tools developed in-house as well as commercial propriety platforms and open source code to develop news products:

> Max: "There are some things that we build ourselves things that are bespoke, or where we're being quite innovative. But there is a lot to be said for buying functionality in, so, for example, live blogging functionality or comments on stories functionality. Because if you are going to build that you'll get exactly what you want but what comes with that is that you need to become a software development house basically, because you've got to maintain and continue to develop those applications, and that's where we've struggled in the past as an organisation because it is resource hungry. So we are running both strategies and just choosing whichever is most appropriate for whatever it is we are trying to do. Generally speaking, for something that is well-established we tend to buy in, for things that are new we tend to figure out ways of doing it ourselves."

While they were happy to invest resources in developing computer code for one-off projects stories, the team did look for opportunities to abstract the ideas for broader use.

> Drew: "Well once something becomes established, and that's part of the role of the interactive team to a degree, to pioneer something and doing it for once big hit is fine and, but if they find themselves reusing something then it becomes a candidate for something that needs to be turned into something that is reusable by the general desk, and that's the flow that's going on. So eventually it comes back into common practice if it survives."

Programmers also regularly contributed code to open source projects.

Evolving articles

Drew and Max saw the NewsCube as something that would be used to compliment a standard news article, rather than a stand-alone feature, so the ability to embed was important.

> Drew: "... it is something we would normally embed into an article, less likely to have as a stand alone thing, though I know that's it's intention. Articles are what bring a lot of traffic to us, they're the core, but having another element in there that people could

explode out or interact within an article would be its primary use and what we would be looking for in order to illustrate something, that wouldn't necessarily be a stand alone thing but be part of a broader context."

However, although the article was the primary mechanism for delivering news, there was a view that its format and function would change and the ABC was extending traditional stories with interactive content.

> Drew: "I don't know how they necessarily see the future, but Facebook, Google, everything is based around the article and there is a lot of discussion around what the article becomes in the future. But I see that as mainly an iterative process that's mainly around the article. Like we won't recognise it in the future but it will be a step-by-step process. So something like this is interesting, but for our focus to a degree, it's more like how you would use a video or an image, it's more like an interactive element within an article."

Social and mobile technologies were the key driver of how articles would evolve. Drew and Max explained the "snacking" habits of mobile news consumers and how that had prompted the introduction of formats such as pull quotes, with the aim of encouraging the reader to move through the story.

> Max: "A lot of what we're talking about is basic newspaper and magazine layout, what you try to do is drag the person through to the end of the piece."

The atomisation of news across platforms, driven by mobile consumption, was another trend and there was a view that notifications would be vital as news delivery evolved.

> Drew: "The first thing would be notifications. Like shorter, punchy, keep you informed. Primarily mobile, but that will stick around, because you'll always be connected ... We'll find ways to keep you up to date if you want, as things happen."

> Max: "Each one of these technologies brings different capabilities, which manifest themselves in different user behaviours and we've got to adapt to that as opposed to people, in the old paradigm, having to adapt to whatever we were putting in front of them."

These comments demonstrate the fluid environment in which journalists now operate, and suggest a need for flexible approaches to news delivery. While the news article is still a

standard unit of production, new technologies and user behaviours are making new demands on the format, to the extent that they are becoming fragmented and delivered diffusely. In this context the NewsCube, which was designed to synthesise complex, evolving stories, could be a valuable concept. Alternately, the "snacking" behaviour of readers could deem the idea irrelevant as they seek out snippets of information rather than coherent narratives.

New directions

The redesign of the NewsCube and the subsequent feedback suggest there is an appetite in established news organisations for new ideas about how to engage audiences. The ABC team was attracted to the interactive qualities of the NewsCube and the idea of perspectives mapped well to their conceptual models of how to treat certain stories. This resonates with comments by Dale and Riley who also found the cube related easily to their journalistic models of storytelling.

Again the physical characteristics of the NewsCube were seen as positive, but the mouse-driven interaction introduced a level of learning before a user could properly understand and enjoy that experience. The feedback also reinforced the value of emotion in news design, with Drew highlighting the importance of atmosphere and suggesting immersive stories were something digital technologies made possible.

Despite the additional sharing and collaboration functions, the value of this was less evident here than in feedback on the iPad prototype. While Max and Drew were clearly focused on the user experience, and recognised that news organisations needed to respond to user behaviour, there appeared to be an emphasis on adapting news delivery to the requirements of various social and mobile platforms. This was challenging and something the newsroom was struggling with.

It is possible that this struggle was driven in part by strong links to traditional practice, in particular a reliance on news articles as the key delivery mechanism: each platform required a different style of article and these required intensive labour to create. So while there appeared to be an experimental attitude, this was centred on adapting existing outputs to evolving technology. A proactive approach might be more effective.

As discussed in chapter two, Rogers (2006) advocates for a shift away from proactive technologies that drive human action, to a focus on proactive people, and creating user experiences that "extend what people currently do" (p. 406). Ubiquitous computing technologies, she argues, should be developed for particular domains rather than generic users. To achieve this, she calls for more accessible ubicomp technologies and a changed research agenda.

Surely access to tool kits and sandboxes (Rogers, 2006, p. 413) that allowed newsrooms and journalists to experiment with new ideas would be a valuable step towards enabling them to imagine new possibilities. However, it is the deep domain knowledge, combined with technical understanding that will truly enable journalists to design innovative news experiences that augment the way they work and embody their core tenets of practice.

This suggests the need for a new practice that draws on practice from both journalism and interaction design: Journalism Design.

Chapter ten

Journalism Design

"Deep craft is more than knowledge. It is a set of knowings. Knowing what is likely to work and what not to work. Knowing what methods to use, what principles are likely to succeed, what parameter values to use in a given technique."

W Brian Arthur, 2011
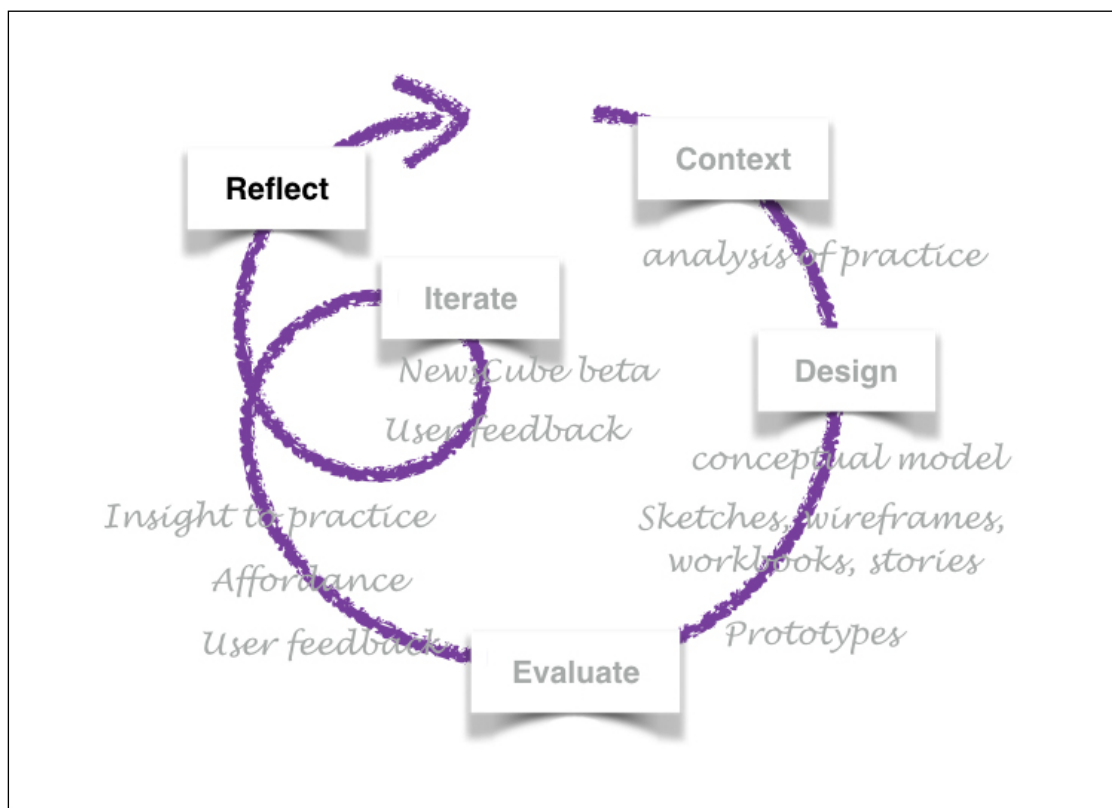
Figure 32
Reflection and knowledge contribution.

This thesis set out to explore the potential for design to inform new forms of journalism. The research questions focused on whether interaction design could enable journalists to create new forms of storytelling; what journalism could learn from practice-led design research; and, in turn, whether journalism could contribute to interaction design. It has resulted in a designed artefact, new ideas for practice and the potential for further research into Journalism Design.

The application of design research methods to a journalistic dilemma is arguably original in journalism research. Similarly, the resulting artefact — the NewsCube — is a unique storytelling format and represents an original contribution to journalism practice. As a Research Through Design (RtD) artefact, the NewsCube was designed to address a real-world issue (Zimmerman, Forlizzi & Evenson, 2007). It is a contribution that also exists outside the confines of research: it has been deployed into the world as a free online tool and as open source code.

Using RtD a new journalistic tool was created, deployed and evaluated. This process revealed the potential for tactility, emotion and distributed control in the telling of news stories. Given the current state of disruption in the news business, journalists will need to develop new ways of interacting with information as computation and communication technologies become increasingly powerful and pervasive.

The contribution of this thesis is, in the first instance, to journalism: that it is through design that journalism can innovate. But there is a contribution to design also. The design process revealed a distinctly journalistic way of thinking, which, when combined with design methods, led to a new concept of news interaction. This process demonstrates how a domain-oriented researcher can draw on their own "deep craft" (Arthur, 2011) to produce knowledge about interaction. As design researchers grapple with how to legitimise the knowledge they generate, this project represents an instance of design research with specific knowledge outcomes for specific users.

These contributions are discussed here in greater depth. This final thesis chapter synthesises the findings of the research and addresses the research questions by examining the new ideas for value that the NewsCube prompted, the value of design to journalism, and the value of journalism to design. It proposes Journalism Design as an emerging area of research and practice that addresses the technological possibilities for journalism and the journalistic possibilities for technology. The thesis concludes with suggestions for future research.

Valuable interaction

The first research question posed in this thesis was whether interaction design could enable journalists to create new, tangible, forms of storytelling that exploited digital platforms and embody their values. The short answer to that is yes: the design process

enabled a prototype to be created that represented a new proposition for journalism, one based on physical interaction.

The NewsCube showed that stories could be told in three dimensions, in a way that afforded physical and emotional interaction and that gave readers some control over the narrative. Feedback from the research participants revealed that the shape had tactile, familiar, and playful qualities that they valued, and which could be used to inform new ideas for news interaction — interactions centred around emotion, physicality and distributed control. Charlie and Dale both noted the playfulness of the interface and Val and Tyler liked that they could control the story. Such ideas are not readily associated with journalism, which is underpinned by news values (Harcup & O'Neill, 2001) and core tenets (Deuze, 2005), however, the fact that experienced journalists appreciated these qualities suggests potential in augmenting established values with new values.

As discussed early in the thesis, journalism is at a point of radical change (Franklin, 2014; Picard, 2014) it needs to come up with new ideas and new forms of interaction if it is to innovate and remain relevant to audiences (Boyles, 2015; Christensen, Skok, & Allworth, 2012; Pavlik, 2013; Raetzsch, 2015). Picard (2010) points out that "efforts to add value should build upon the foundation of journalistic values, not seek to be substitutes for them" (p. 84). He has argued that one problem is that news content is not as valuable as it once was. Linear, journalistic stories focus "on *telling* audiences things rather than engaging them in conversations or facilitating interaction" (p. 115), and they are concerned with delivering information and knowledge, rather than higher-value goals of experience and understanding. Riley touched on this when she discussed the potential of the NewsCube to aid synthesis and understanding, and Charlie, Val and Tyler saw potential in providing readers with story context.

In this way, the NewsCube shows the potential for new designs to offers greater opportunities for audience interaction (Picard, 2010). Indeed, feedback from Dale suggested the NewsCube's physical qualities were reminiscent of newspapers. This resonates with calls for journalists to be more personally engaged with their audiences (Ryfe, 2012) and the expectation that emerging technologies will enable more creative forms of engagement (Harper, Rodden, Rogers, & Sellen, 2008). Interaction design offers a method for creating news experiences that could address higher-value goals.

From this perspective, Journalism Design is about using interaction design to generate new ideas about how to create new value in journalism. It sees design as way for journalists to engage proactively with technology: to design user experiences that "creatively, excitedly, and constructively extend what people currently do" (Rogers, 2006, p. 406). Rather than simply incorporating existing technologies to their practice (Sheller, 2015), journalists can, though design, create software, devices and interactions that achieve journalistic goals and embody their values.

Design for journalism

The second research question focused on what practice-led design research could contribute to journalism in its current state of disruption. Beyond new ideas for interaction, it is the practice-led approach to investigating how technology shapes practice that is valuable to journalism research.

The scholarship on practice tells us that established approaches are not effective for dealing with technological change: journalists are constrained by conventions, entrenched production habits, and are unable to disrupt core tenets. Similarly, journalism research tends to study existing instances of practice rather than imagining how that practice might evolve. However, the future-focused nature of design represents a way forward for both practice and research. It provides "tools for thought" that journalists can use to address the challenges posed by disruptive technologies. Design also highlights the need for a more informed and reflective journalistic practice that enables practitioners to consider new possibilities.

Schön (1983) points out there is a "disturbing tendency for research and practice to follow divergent paths", which means that practitioners and researchers "have little to say to one another" (p. 308). Yet, given that the technological challenges facing journalism impact both scholarship and industry, there is value in seeing research as an activity of practice. Discussion around practice-led journalism research (Niblock, 2012) and the need for research to help shape the future of journalism (Kopper, Kolthoff & Czepek, 2000) reinforce this notion. Meanwhile, suggestions that theoretical renewal could emerge from combining disparate approaches (Singer, 2008) opens a space for new methodological approaches in the field.

Design, with its focus on wicked problems, idea generation and practice-led methods, offers one possibility. The NewsCubed project demonstrates how design thinking and design methods can be used to explore journalistic dilemmas and generate new ideas about how to address them. The reflective, iterative approach to understanding the problem space, generating a conceptual model, prototyping, evaluating and redesigning, meant that concepts from one field — in this case hypertext theory — could be applied in another context — journalistic storytelling.

In the NewsCubed project, contextual research in the form of a review of the literature on hypertext and a study of how those theories were used in practice, led to the idea that stories could be told via an interactive cube. In turn, the process of designing the artefact meant grappling with the wickedness of the problem, in this case the tension between the greater control that hypertext affords to reader and the need for the journalist to own the narrative. The design process outlined in chapter six revealed how sketches, wireframes, low-fidelity prototypes and stories facilitated reflection-in-action on the part of the journalist-designer.

Design theory tells us that this divergent and iterative approach is good for addressing difficult problems and that design artefacts act as "design-thinking enablers" (Lim, Stolterman, & Tenenberg, 2008). Where journalism has attempted to control the wickedness and unpredictability of its own practice through industrialised methods of production, interaction design seeks to understand the context of use, the affordance and possibilities of a technology, and create a solution: an ultimate particular.

However, it is in the use of, and reflection on, the particular design that the strength of design methods is evident. In the case of the NewsCube it was through using and reflecting the designed prototype (chapters seven and eight) that users were able to properly consider the affordances of the tool and perceive its implications for practice. The ideas of distributed control, physicality and emotion emerged as paths for transcendence — a way of moving beyond the limits of established practice and create new ways of working. Through using NewsCube and reflecting on its affordances the users saw new possibilities.

In this way, Journalism Design draws on the reflective, iterative and problem-solving qualities of design research to probe practice and reveal new ways of thinking about, and working within, that practice. It suggests a way for research to "permit practice from both

within and without professional norms" and to offer "a space to 'test' out theoretical concepts in practice" (Niblock, 2012, p. 11). It shows the benefits of practice-led inquiry to imagine things that do not yet exist (Nelson & Stolterman, 2012) and it enables journalism research to "help shape the future of journalism" (Kopper, Kolthoff & Czepek, 2000, p. 511).

Journalism for design

The thesis also set out to understand what, if anything, journalism could contribute to interaction design practice and research. This is probably the most challenging contribution to articulate, as the project primarily used design to address a dilemma within a domain and did not seek to adapt the methods. However, the fact that the researcher was strongly oriented as a journalist, a distinctly journalistic way of thinking emerged throughout the project.

In keeping with the Research Through Design framework, the designed artefact — the NewsCube — was intended as a concrete embodiment of hypertext theory and the technical opportunity afforded by hyperlinks. The artefact aimed to communicate design activity and facilitate knowledge transfer through a transparent process of conceptualisation, designing, prototyping and evaluating. However, this process was informed by the knowledge and practices of the target domain: journalism.

The strong underlying values and core tenets of journalism have been discussed and it was this "journalistic thinking" that drove the early development of the NewsCube prototype. This was evident at several points in the design process. Issues around control and workflow, for instance, were often addressed by reference to the conventions and constraints of journalistic practice eg: dealing with truth and legal issues. Similarly, feedback from professional users also revealed journalistic approaches to organising content, attitudes to reader involvement in stories, and the newspaper-like tactility of the interface. This is the "deep craft" Arthur (2007) identifies, and it is a strength of design prototypes that they can reveal such aspects of practice.

In this project, this knowledge was revealed through discussions with the developer during the design and prototyping process (chapter six) and through recorded interviews with users (chapters seven, eight and nine). These interactions were recorded and transcribed, allowing a level of refection-in-action (Schön, 1983). The process of transcribing recorded

interactions played an important role in capturing data for later analysis and reflection. This was also valuable in identifying the role of specific domain knowledge in the design of the artefact. However, there was a parallel journalistic process at work: that of information synthesis. The process of identifying key quotes from interviews and integrating them with other evidence is part of journalistic storytelling and this was a practice the researcher relied on in making sense of the data collected during the design process.

Given the debate among design researchers about how best to document and extract knowledge from practice-led research (Bardzell, Bardzell, Dalsgaard, Gross, & Halskov, 2016; Dalsgaard & Halskov, 2012; Fallman, 2007; Höök et al., 2015) this project suggests that design knowledge is not the only type of knowledge that exists within a designed artefact, and that tacit knowledge on the part of the designer and the users can become part of the knowledge developed through design research. There may also be value in journalistic-style narrative to communicate design knowledge. Bardzell et al (2016) suggest the RtD community needs to "develop discursive genres" (p. 105) and they note formats such as design workbooks (Gaver, 2011) and annotated portfolios (Gaver & Bowers, 2012) as examples of how design can be aggregated to create a narrative. In the NewsCubed project, the journalistic process of working with evidence from primary and secondary sources — interview quotes, design artefacts, scholarly literature — with the aim of creating a narrative working as a form of sense-making and communication.

As an instance of domain-led design research, the NewsCubed project could also be seen as an example of redomaining: "the expressing of a given purpose in a different set of components" (Arthur, 2011, p. 73). In Arthur's view, redomainings allow new possibilities, and in the NewsCubed case, this redomaining was possible because of strong understanding of the problem space on the part of the researcher, whose "knowing" (Arthur, 2011; Schön, 1983) drove the design. It was "journalistic thinking", informed by design practice and ideas from hypertext theorists that informed the NewsCube prototype.

Given the strong value system that underpins journalism, there could be scope for journalists to inform design projects in more concrete ways. The internet of things, virtual and augmented reality have the potential to drive new ways to interact with and consume news and information. Similarly, recent work in the area of urban informatics, for example, suggests there is a role for social and mobile technologies to foster community activism, civic engagement and cultural citizenship (Foth, Forlano, Satchell, & Gibbs, 2011).

Combined with ideas of the ubiquitous, or smart, city (de Waal, 2011) there is potential for urban interfaces or civic technologies to encourage public engagement and enable citizens to be more active in society (Foth, Tomitsch, Satchell, & Haeusler, 2015; Golsteijn, Gallacher, Capra, & Rogers, 2016).

There is a role here for journalistic thinking. The scholarship tells us that ideas public service, objectivity, autonomy and ethics underpin the work of journalists (Deuze, 2005), and the NewsCubed project shows that journalistic thinking can inform a design process. Perhaps there is a role for journalists in creating interactions that serve the public good.

In this way Journalism Design recognises the contribution journalistic value can make to the design of technologies to serve democratic functions; that the "deep craft" of journalists could be incorporated into the design of new technologies, particularly those that aim to serve the public interest or address high-value information platforms.

Current and future work

Journalism Design offers several opportunities for future research, in particular in the areas of practice-led journalism research, journalism education, and physical news interactions.

While designers are not in agreement about how practice-led research creates knowledge, there is broad acceptance in the field that practice is a form or research. Journalism scholars might find value in drawing on design to develop discipline-specific frameworks. As this thesis has highlighted, practice-led research is good for solving problems and imagining new things. With further disruption likely in the news business there is likely to be greater need for future-focused research that can translate into practice.

The future of journalism education is related to this, as the next generation of journalists will need to design new ways to engage their readers. We have begun exploring this at the University of Queensland. The Journalism + Interaction Design (J+IxD) initiative (Angus & Doherty, 2015) aims to introduce journalism students to interaction design and there is scope for further curriculum development in this space. If journalists want to be a part of the ubiquitous, tactile future of computing, they will need to be able to think about, and experiment with, new forms of practice.

On the flip side, designers grappling with ideas of civic engagement and public spaces may find journalistic thinking useful in informing their concepts of how to use technology to serve the public interest. The NewsCubed project reveals the potential for physical news interaction prompts interesting questions about the future of journalistic interfaces particularly in the context of ubiquitous computing. Can everyday objects or urban landscapes be used to serve the public interest and how would the physical properties of those interfaces impact the style of journalism they delivered? Would users become more involved in the news if they were physically engaged with it? And how would this engagement impact journalistic values?

Answers to questions such as these have the potential to further disrupt established journalism practice, but they are important, because technology, and the way we use it, will continue to evolve. Journalism needs to evolve with it.

This thesis argues that design methodologies can give journalists a way to innovate and create new forms of storytelling that exploit their own deep craft and embody their values. The design work and underlying journalistic knowledge documented here demonstrates how a journalist-oriented researcher has deployed and evaluated design techniques to extract knowledge about the future of interaction in a specific domain.

Fredin (1997) suggested the need for a new model of the news user, one who is actively engaged in a story. Perhaps we also need a new model of the journalist: one that is user focused, designerly, and willing to push the boundaries of established practice in order to transcend established notions of news and journalism.

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Appendix

Data sources

News stories, news packages and news curation analysed in chapter four.

Stories

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