FOLD:

An open platform for adding context to stories

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Submitted to the Program in Media Arts and Sciences,
School of Architecture and Planning,
in partial fulfillment of the requirements of the degree of

MASTER OF SCIENCE IN MEDIA ARTS AND SCIENCES
at the **MASSACHUSETTS INSTITUTE OF TECHNOLOGY**

September 2015

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Abstract

News is important. It gives us the information we need to make decisions, provides common ground to share with others around us, and helps us become global citizens. However, there are many important stories we shy away from because we lack the background needed to understand them. Some of the most important news stories we encounter—like the Israel-Palestine conflict, the recent unrest in Ukraine, or the ongoing Ebola outbreak—are complex and require context to understand.

Traditionally, news relies on a storytelling structure called the inverted pyramid, where key facts are introduced in the first paragraph, with subsequent paragraphs providing background information. This structure worked well for the era of paper-based journalism, so the story could be shortened to fit space constraints without compromising emerging facts. But is this the way that news should be now, or is this the result of using ink and paper procedures in a world where digital technologies allow for more flexibility?

This thesis presents FOLD, a publishing platform that uses visual structure to address the problem of including context alongside stories. FOLD allows writers to tell stories by weaving together different pieces of information from across the web in the form of "cards." There are two types of cards: narrative cards, and context cards. Narrative cards are arranged vertically to form the "backbone" of a story. Context cards are positioned perpendicular to the narrative cards, providing alternate axes for reading. The use and reception of this tool within the context of a 3-month public beta is discussed, and opportunities for future work are presented.

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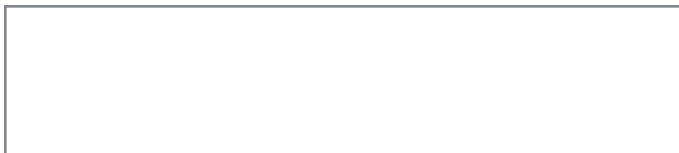
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Acknowledgments

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1. Introduction

1.1 Motivation

At its best, the World Wide Web provides us with breaking news, thoughtful analyses, and connections to people who live elsewhere and whose ideas we might not otherwise encounter. Though access to the Internet is unevenly distributed, there are currently an estimated 3 billion Internet users—more than 40% of the world's population.[1] Hyperlinks, the structure at the core of the Web, connect documents and elements together to build a network of information and context.

The influx of new web documents and connections between them has grown exponentially, but this growth leads to other problems. There is both too much information for one person to reasonably process, and important information that goes overlooked. In theory, social media provides a way of encountering diverse information and connections with people outside of our immediate sphere of influence. But in practice, we often limit ourselves by connecting with those most similar to us, leading to an echo chamber[2] in which the same voices are surfaced and promoted through personalized discovery mechanisms.[3]

The information we do encounter comes to us in a flood. We are moving from an age of content scarcity to one of content abundance.[4] Our attention is scattered, and many readers become impatient with long-form content, jumping from topic to topic and between contexts. Increasingly, we encounter "atomized" news and information that is broken into smaller pieces appropriate for quick consumption and on-the-fly delivery, and some argue that this has

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[1] International Telecommunications Union. "ICT Facts & Figures: The World in 2015." May 2015. http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2015.pdf

[2] Sunstein, Cass. "Republic.com 2.0. Princeton University Press." September 6, 2009.

[3] Zuckerman, Ethan. "Digital Cosmopolitans: Why We Think the Internet Connects Us, Why It Doesn't, and How to Rewire It." W. W. Norton & Company; 1 edition. November 10, 2014.

[4] Simon, Herbert. "Designing Organizations for an Information-Rich World", in Martin Greenberger, Computers, Communication, and the Public Interest, Baltimore, MD: The Johns Hopkins Press. 1971.

fundamentally changed the way that we read. Cognitive neuroscientists have identified that scattered attention and access to short-form content has encouraged "visual skimming" and non-linear reading behaviors.[5]

Despite the hunger for atomized and short-form content, narrative remains an important technique for contextualizing bodies of knowledge and connecting many different ideas in a coherent way. For instance, the Twitter trend of "Tweetstorming" is an effort to string together a narrative, 140 characters at a time.[6] Narrative makes best use of our ability to create new information and ideas by synthesizing and explaining the broader relevance of disparate pieces. Indeed, both history and contemporary research suggest that narrative is an important mechanism through which we learn about and navigate the world.[7]
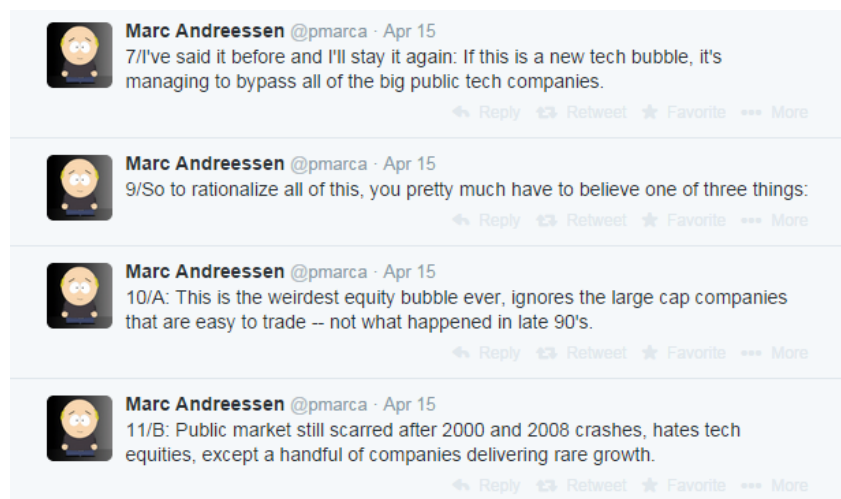
Figure 1.1: Numbered "Tweetstorm" by Marc Andreessen (@pmarca). April 15th, 2014.

Hyperlinking gives us the ability to reference other works and create structure out of separate elements (building on the academic principle of citation), but it also contributes to the problem of drawing our attention elsewhere—making it difficult to create for ourselves a coherent

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[5] Wolf, Maryanne. "Proust and the Squid: The Story and Science of the Reading Brain." Harper Perennial. August 26, 2008.

[6] Warzel, Charlie. "Why Twitter's Newest Tweetstorm™ Trend Must Be Stopped." Buzzfeed News. May 7, 2014. http://www.buzzfeed.com/charliewarzel/why-twitters-newest-tweetstormtm-trend-must-be-stopped

[7] Paul, Annie Murphy. "Your Brain on Fiction." New York Times. March 17, 2012. http://www.nytimes.com/2012/03/18/opinion/sunday/the-neuroscience-of-your-brain-on-fiction.html?pagewanted=all

representation of how events, actors, and concepts relate. This fragmentation can make it difficult to put new facts in the context of a larger whole.

We arrive at stories via content aggregators, search engines, and increasingly, social media.[8] Links shared on social media often come with commentary written by the individual or organization sharing them, but by design, our experience with a link on social media is often fragmented as it is one element in a stream of unrelated content and thus somewhat decontextualized. Many stories lack context because there's a need for publishers to push out content quickly and grab pageviews before their competitors. However, quick updates are only useful for people who are already following a story. The rest of us are left with a limited understanding of what's going on.

Some journalists have attempted to address this problem by creating helpful syntheses of information and links in a format called the "explainer." Explainers typically take a holistic view of a topic, and often use plain language to describe the complicated historical or technical aspects of a particular story.[9] Explainers—and other educational materials that predate the rise of this method as a named stylistic format—are still very linear, despite more flexible interaction paradigms made possible by digital technologies.
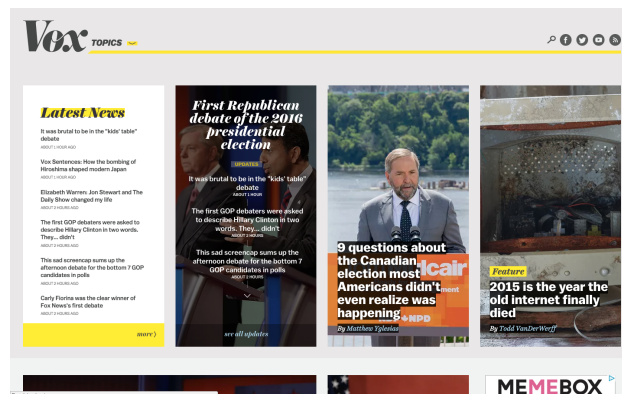
Figure 1.2: Vox, a site devoted to news explainers.

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[8] DeMers, Jayson. "Social Media Now Drives 31% Of All Referral Traffic." Forbes. February 3rd, 2015. http://www.forbes.com/sites/jaysondemers/2015/02/03/social-media-now-drives-31-of-all-referral-traffic/

[9] Rosen, Jay. "Building a Better Explainer: Help Us Out." PressThink. November 17, 2010. http://pressthink.org/2010/11/building-a-better-explainer-help-us-out/

Hyperlinks help us connect existing documents, but they can also distract and overwhelm readers. Although a fringe view, some online writers have begun to question whether or not to use them at all.[10] While hyperlinks can be used to provide annotation, there is a move towards supporting annotations that are layered on top of existing documents. In-line annotation is one strategy for bringing context directly where it's needed and not leading readers elsewhere, but existing tools typically do not handle multimedia as well as they do plain text. Increasingly, the best context for a given topic might be video, audio, or other non-text formats.

Atomization is a strategy that is well-suited to our patterns of information retrieval and the contexts in which we read, but it often eschews narrative in favor of something quickly consumable. If publishing tools were designed to help people create atomized narrative content, search for and incorporate multimedia annotations, and surface the relevance hidden behind hyperlinks so readers do not have to split their attention across many tabs, journalists, bloggers, and other online writers could create higher-quality content that is engaging and informative, and makes visible the semantic relationships between different pieces of media.

1.2 What is FOLD?

This thesis describes the design principles behind FOLD, a modular storytelling tool for adding multimedia context to narrative text.

FOLD uses visual structure to address the problem of including context alongside stories. FOLD allows writers to tell stories by curating and weaving together different pieces of information from across the web. FOLD writers can tell original stories and provide supporting context in the form of "cards." There are two types of cards: narrative cards, and context cards. Narrative cards are arranged vertically to form the "backbone" of a story. Context cards are positioned perpendicular to the narrative cards, providing alternate axes for reading. Context cards make heavy use of multimedia, allowing users to "stand on the shoulders of giants" by seamlessly including content hosted on other sites like YouTube, Twitter, Flickr, Giphy, and more.

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[10] Standage, Tom. "To link, or not to link? That is the question." The Economist. June 1st, 2010. http://www.economist.com/blogs/babbage/2010/06/pros_and_cons_hyperlinks

Stories on FOLD are "atomized," or broken into smaller pieces that can be reused and reorganized. This atomization allows FOLD stories to have a two-dimensional structure that is perfect for the branching nature of complex stories.

By making it easy for writers to create narratives that weave together media curated from across the web, FOLD helps people share and discover new fields of knowledge.

1.3 Contribution

The first contribution of this thesis is a set of design principles for creating a system that enables authors to craft a coherent yet modular narrative experience that prioritizes contextualization. The second contribution of this work is a an open platform with a new interface and associated user experience for adding multimedia context to stories in the form of "cards." The use and reception of this tool within the context of a public beta is discussed, and opportunities for future work are presented.

1.4 Overview of Thesis

The next two sections situate this work in relation to historical and contemporary themes related to creating, reading, and publishing content online. These sections also introduce prior work in creating innovative user interfaces for content experiences. Section 4 outlines the design principles behind FOLD, an overview of implementation, and current known limitations of the tool. Section 5 provides a detailed walkthrough of the user experience and user interface of the tool—core contributions of this thesis. Section 6 describes how the tool was piloted and presents an evaluation of the tool along qualitative and quantitative dimensions. Section 7 presents a categorization of the kinds of stories that were created on FOLD over the first three months of use. Finally, section 8 concludes the thesis with a discussion of future work.

2. Background

The design of FOLD is influenced by historical trends related to creating, curating, remixing, and annotating online content. This section provides brief historical background for each trend, tracing their non-digital origins to the present day.

2.1 Hypertext and hypermedia experiences

In 1945, just prior to the atomic bombings of Hiroshima and Nagasaki and the subsequent end of World War II, engineer and inventor Vannevar Bush published an essay in The Atlantic called *As We May Think*. In this essay, Bush challenged physicists to decide what they should direct their talents to during peacetime now that they were no longer making "strange destructive gadgets."[11] A challenge worthy of their talents, he argued, is figuring out how to make information accessible. He described the great body of knowledge scientists have produced thus far, but pointed out that researchers are bogged down by growing mountains of findings and conclusions that they do not have time to grasp or remember.[12] This vast amount of information is not accessible to scientists because it is indexed alphabetically or numerically, while the human brain operates by association. Inaccessible information leads to the replication of work and an inability to easily create new knowledge.

To solve this problem, Bush proposed a machine called the *Memex*. The Memex is a personal device that resembles a desk, and is built upon the information storage and retrieval technology of its era—microfilm. The Memex would allow users to feed in microfilm of books, newspapers, and more, and via a transparent plate on top of the materials, annotate and attach other media to them. Items stored in the Memex could be connected together through associative indexing, making it easier for scientists to record and recall the trails they made through information thus connecting ideas together. Bush proposed that such a technology

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[11] Bush, Vannevar. "As We May Think." Atlantic Monthly. July 1945. 47-61.

[12] A claim we sometimes feel was only proposed recently.

would inspire "wholly new forms of encyclopedias"[13] and a new profession of "trailblazers" who would establish useful trails through common information stores.
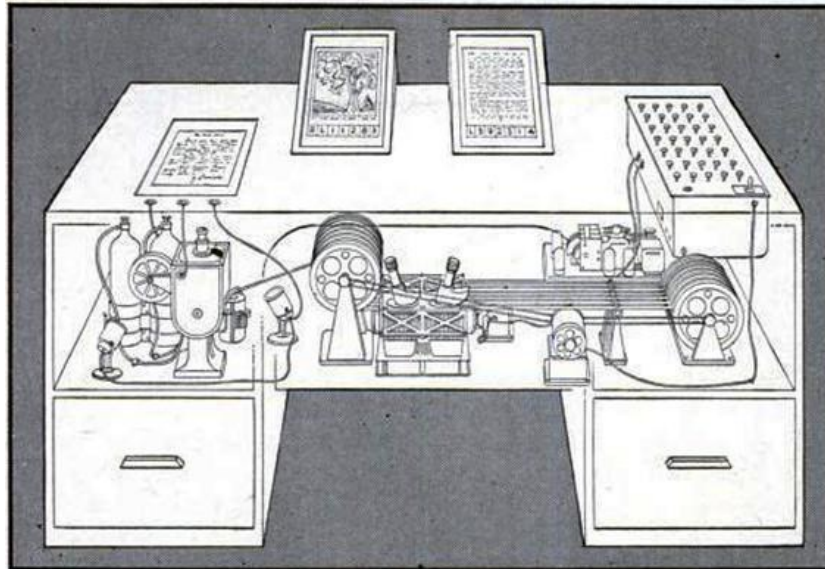
Figure 2.1: The Memex, as imagined by LIFE Magazine in 1945.

Bush's influential essay inspired creators of the next generation of information storage and retrieval systems to design tools to aid human memory and knowledge production. Doug Englebart, then a young radar technician with the Navy, stumbled upon a reprint of *As We May Think* in LIFE magazine while on deployment in the Philippines.[14] Though he is most remembered for innovations in graphical user interface, including the invention of the Mouse, Englebart was primarily interested in solving the same problems Bush described in his essay and particularly concerned with enabling collaboration. In the same 1968 presentation in which he introduced the Mouse—as well as prototypes for collaborative editing and teleconferencing—Englebart introduced underlined text that could link documents together and be navigated by the user. Computing historians often refer to this this presentation as the "Mother of All Demos,"[15] as it influenced almost every piece of computing technology we use today.

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[13] Wikipedia being the canonical contemporary example.

[14] Madrigal, Alexis C. "The Hut Where the Internet Began." The Atlantic. July 7, 2013. http://www.theatlantic.com/technology/archive/2013/07/the-hut-where-the-internet-began/277551/

[15] Levy, Steven. "Insanely Great: The Life and Times of Macintosh, the Computer That Changed Everything." June 1, 1994. Penguin Books.

In parallel with the work of Englebart, Ted Nelson and Andries van Dam developed a tool called the Hypertext Editing System (HES) at Brown University, which was intended to help format printed documents. Nelson coined the term *hypertext* in 1965 to describe non-sequential writing in which the text branches and readers can decide which path they follow according to links specified by the author. *Hypermedia* extends this definition by explicitly including images, sound, videos, and other non-textual content. Although the notion of hypertext is primarily used to describe electronic texts, literary theorists like Roland Barthes and Michel Foucault described how ideal texts of any kind should be conceived of as a network of relationships to outside texts.[16]
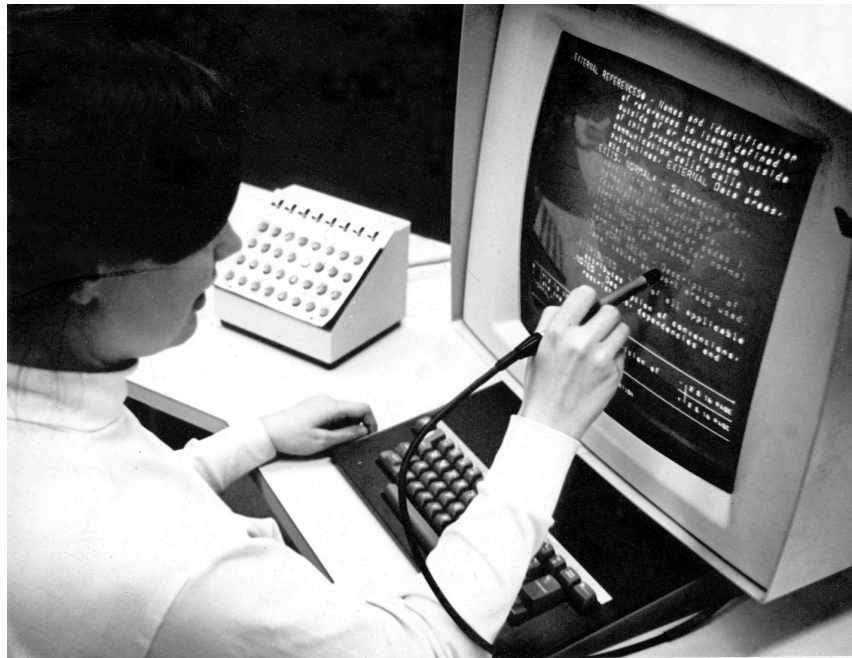
Figure 2.2: Hypertext Editing System (HES) display console (Greg Llyod, 1969)

HES enabled researchers to create both branching and linked content and tag information for later retrieval through boolean operations. The team behind HES was especially concerned with the tendency for readers to get lost in complex hypertext, and proposed a variety of features to make navigation easier: multiple windows, better input tools (HES employed a

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[16] Landow, George. "Hypertext 3.0: Critical Theory and New Media in an Era of Globalization." 3rd edition. January 3, 2006. Johns Hopkins University Press.

lightpen and a keyboard that many users found overwhelming at the time), and graphics capabilities.[17] Prior to working with van Dam on HES, Ted Nelson had imagined and begun designing a hypertext system called the Xanadu Project[18], which was to have two-way linking and version control. The system has undergone many variations; most recently, a prototype called OpenXanadu™ was made available in 2014.[19] While Xanadu was widely considered to be a brilliant idea, it has failed to gain traction as the current implementation of hypertext has become entrenched due to the Web's widespread adoption.

Like the team behind HES, other researchers were concerned with creating ways for people to navigate hypertext more intuitively. The genre of "spatial hypertext" tools tried to make hypertext and hypermedia experiences that had orientation and could be navigated visually as much as semantically. Storyspace, by Jay David Bolter and Michael Joyce, was the first publicly available software for creating, editing, and reading hypertext fiction. HyperCard, which will be discussed in section 3.2, was one of the most successful hypertext creation tools prior to those enabled by the World Wide Web.
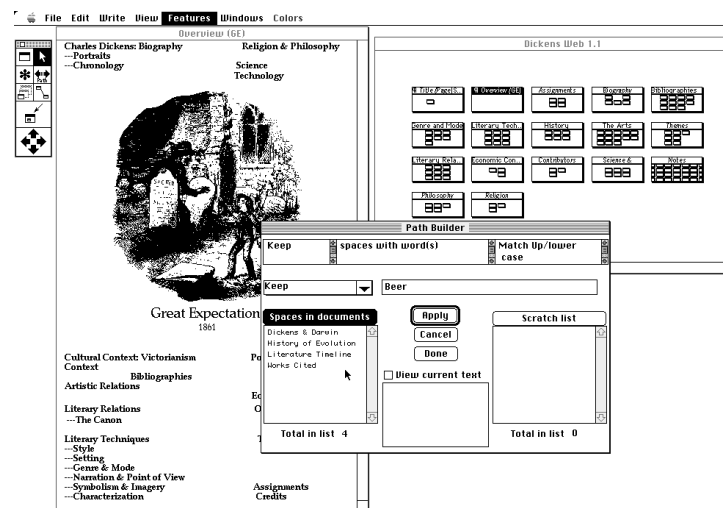
Figure 2.3: Storyspace (Landow and Kahn, 1992)

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[17] van Dam, Andries. "Hypertext '87 keynote address." July, 1988. Communications of the ACM, 31, 887–895.

[18] Nelson, Ted. "Literary Machines: The report on, and of, Project Xanadu concerning word processing, electronic publishing, hypertext, thinkertoys, tomorrow's intellectual revolution, and certain other topics including knowledge, education and freedom." 1981. Mindful Press, Sausalito, California.

[19] Project Xanadu. http://xanadu.com

In 1989, Tim Berners-Lee—then a researcher at CERN[20]—developed a proposal for what would ultimately become the World Wide Web, marrying hypertext with the Internet. Berners-Lee and his colleagues created the first web server and web browser, as well as standards for uniquely identifying and publishing web content (the URL and HTML) and the protocol for communication between servers and clients (HTTP)[21]. In 1994, Berners-Lee founded the World Wide Web Consortium (W3C) to develop web standards, write software, and engage in education and outreach.

Thanks to fundamental standards and protocols, the Web has enabled people from all over the world to produce and interact with networked media and content. The influx of content has also given rise to new forms of participation at the level of sorting, preserving, and presenting information through digital curation.

2.2 Curating digital content

Curation, coming from the Latin word *curare* meaning "to take care of," is a term that has been used throughout history to describe caretaking work in other contexts: for example, civil servants in Rome overseeing public infrastructure, or Medieval priests charged with the stewardship of souls.[22] In a contemporary context, curation is a task that considers the selection, arrangement, preservation, and interpretation of artifacts. The role of artifact curator has typically been held by individuals at institutions like museums, galleries, and libraries, though the definition is changing to include digital curation in non-institutional contexts. Curators are often experts in their topic areas—whether that is 18th century paintings or 1950's American Soul music—and may conduct original research on selected artifacts to provide a layer of interpretation for viewers.

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[20] The "European Organization for Nuclear Research"

[21] Massachusetts Institute of Technology: MIT School of Engineering. "Inventor of the Week Archive: The World Wide Web." November 1999. Archived from the original on 8 July 2010. Retrieved 1 July 2015. https://web.archive.org/web/20100608081841/http://web.mit.edu/invent/iow/berners-lee.html

[22] Morton, T. (n.d.). "A brief history of the word 'curator.'" Phaidon Agenda. http://www.phaidon.com/agenda/art/articles/2011/september/09/a-brief-history-of-the-word-curator/.

The rise of curation on the web is preceded by a history of curation as the solution to content abundance. Before the rise of public art museums, most art was commissioned and collected by wealthy patrons. Johann Wilhelm II von der Pfalz, for example, was a German prince who built a separate gallery attached to his Düsseldorf palace to house his vast art collection. The art was arranged to take up the entire wall—quite different from the way museums are arranged today. Wilhelm hired a director for his gallery who opened the gallery to the public and broke with the Baroque tradition of covering an entire wall with paintings. Instead, the curator selected a limited number of paintings for each wall, arranged them symmetrically, and specifically juxtaposed different pieces to encourage viewers to draw comparisons between them. By selecting what he considered the most evocative works and arranging a guided viewing experience, the curator created a visual art history lesson for visitors.[23]

Figure 2.4 (Left): Example of typical Baroque display of art at Pommersfelden Palace, Johann Georg Pintz, 1728
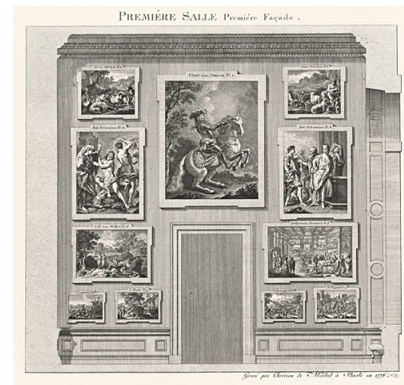
Figure 2.5 (Right): First Room of the Düsseldorf Gallery, etching. Nicolas de Pigage and Christian von Mechel, 1778

Though the role of curator has typically been associated with institutions and physical artifacts (and there remains tension about who is allowed to call themselves a curator[24]), the Web has enabled digital curation of online content by journalists, designers, fans, and people with niche expertise. Human categorization of information (e.g. library classification systems) has been

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[23] Portner, Jessica. "The First Modern Catalogue of an Art Collection: Q&A with Curator Louis Marchesano." August 17, 2011. The Getty Iris. http://blogs.getty.edu/iris/the-first-modern-catalogue-of-an-art-collection-q-and-a-with-curator-louis-marchesano/#sthash.keZQT8lB.dpuf.

[24] Schlatter, Elizabeth. "A New Spin: Are DJs, rappers and bloggers 'curators'?" Museum magazine, American Association of Museums, Jan/Feb 2010.

supplemented with automated, digital organization (e.g. search engines).[25] Both of these organizational methods require people to know what they are looking for, and curation offers a potential solution for information overload as well as a way for people to encounter vetted content. Digital curation can be performed via a top-down approach—with publishers or an editorial board making decisions about what content to highlight and distribute—or it can be done by users themselves as a way to connect socially around niche content.

While Yahoo, early directory sites, and Site of the Day awards were an early form of digital curation, new platforms have emerged to enable curation at a wide scale. Pinterest[26] is a social curation site, where primarily visual content is curated by its nearly 50 million users.[27] Pinterest users tag, organize, and share their content publicly or specifically with people who follow them. Communications scholar Debora Lui argues that individual acts of curation on Pinterest add up to a new kind of public construction of knowledge online.[28] She draws a distinction between the two practices that inform people's use of Pinterest: the private practice of collection (as with stamp collecting or scrapbooking), and the public practice of curation (as with museum exhibits). Curatorial practice invokes notions of taste and expertise, and because private collection on Pinterest becomes outward-facing, individual judgements about what is worth sharing can become authoritative—especially in cases where a Pinterest user has amassed a large audience.

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[25] Rosenbaum, Steven. "Curation Nation: How to Win in a World Where Consumers are Creators." March 8, 2011. McGraw-Hill.

[26] Pinterest. https://www.pinterest.com.

[27] Fiegerman, Seth. "Pinterest to hit 50 million active users in US next year, new data says." February 25, 2015. Mashable. http://mashable.com/2015/02/25/pinterest-usage/.

[28] Lui, Debora. "Public Curation and Private Collection: The Production of Knowledge on Pinterest.com." April 23, 2015. Critical Studies in Media Communication. 32:2, 128-142, DOI: 10.1080/15295036.2015.1023329
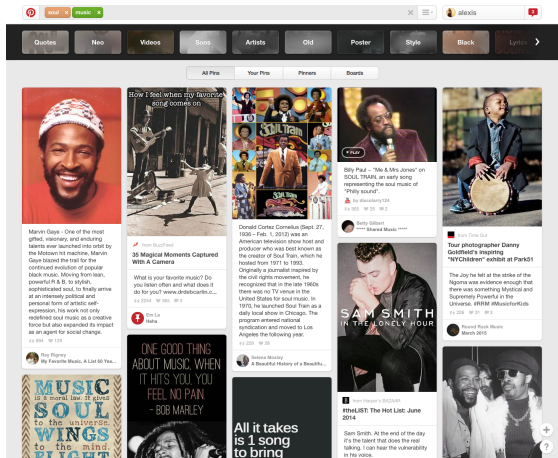
Figure 2.6 (Left): Public Pinterest search results for "soul music"
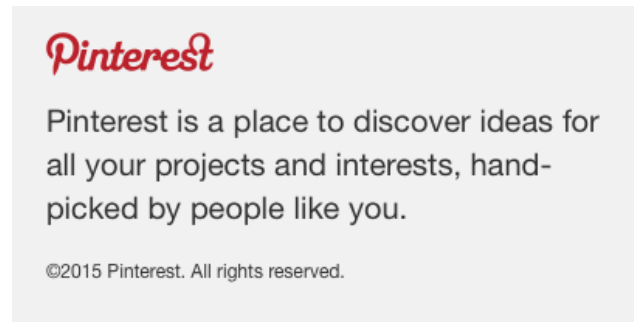
Figure 2.7 (Right): Description from Pinterest's About page (https://about.pinterest.com/en)

2.3 Remixing digital content

Though the term "remixing" is most commonly applied to sound—as the technique has been used since the proliferation of recorded music and related technologies—it has also been applied to other media types like video, static visuals, text, and computer code. Remixing refers to the process in which separate media elements are combined to create a wholly new form with a different meaning than each individual component.

While we may think of remixed music as a digital phenomenon, the form dates back to Jamaican dance halls of the late 1960s. Thanks to analog multitrack recording technologies, allowing separate recordings to be layered and combined, sound engineers and producers like King Tubby and Lee 'Scratch' Perry created new songs by shifting the emphasis of different instruments, adding sound effects, and changing the arrangement.[29] These techniques allowed artists to tailor music to the mood of the crowd to keep people on the dance floor. Later, Jamaican dancehall culture helped spawn hip hop culture in New York City, and now the remix is a standard component of popular music[30].

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[29] Burgess, Richard James. "The History of Music Production." Oxford University Press. July 25, 2014.

[30] Beta, Andy. "Dub in This Club: Jamaican Dancehall Rises Again." Rolling Stone. August 16, 2013. http://www.rollingstone.com/music/news/dub-in-this-club-jamaican-dancehall-rises-again-20130816
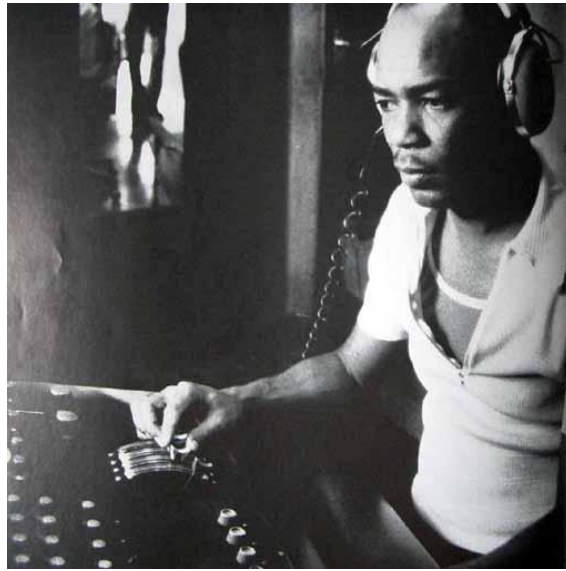
Figure 2.8: Producer and sound engineer King Tubby mixing tracks

Remixing techniques have also been used extensively throughout the history of film. Early examples of remixed videos were often used for subversive and political purposes. As early as the 1920s, Soviet filmmakers recut American Hollywood films to deliver sharper class critique[31]. Later, in the 1940s, Charles A. Ridley's famed "Lambeth Walk"—combining edited, looping footage with a song from a popular musical—mocked Nazi soldiers by making it appear as if they were dancing. Ridley's remix was distributed to newsreel companies for presentation at movie theaters.[32]

Decades later, in the 1970s and 80s, fans remixed popular television shows and recordings through a laborious process of cutting film and music together using VCRs and multiple VHS cassettes. Popularly called "vidding," this process was taught and shared within predominantly female communities. Vids explored relationships, sexuality, and slash fandom[33], often bringing

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[31] McIntosh, Jonathan. 2012. "A history of subversive remix video before YouTube: Thirty political video mashups made between World War II and 2005." In "Fan/Remix Video," edited by Francesca Coppa and Julie Levin Russo, special issue, Transformative Works and Cultures, no. 9.

[32] The Public Domain Review. "Lambeth Walk - Nazi Style (1942)." http://publicdomainreview.org/collections/lambeth-walk-nazi-style-1942/. Accessed July 10, 2015.

[33] fan fiction that explore relationships between characters of the same sex. The "slash" refers to romance between two characters (e.g. Kirk/Spock).

homosexual subtext in popular shows to the surface. While YouTube is a modern dissemination tool for these and other kinds of fan-made remixed videos, vids were widely shared by mail or in-person prior to the Web. In 1975, Star Trek fan Kandy Fong performed live what was considered the first vid at a convention using a slide projector. By cutting together leftover and damaged footage with a fan-made folk song, Fong centered Spock's perspective and offered an exploration of his sexuality.[34]

Figure 2.9: Scene from Kandy Fong's "Both Sides Now" (1980)

Remixing also has a long tradition in the visual arts. Whether it's repetition and tweaking of portraiture forms throughout history, Pablo Picasso reinterpreting Diego Velázquez[35], or Pop Artists of the 1960s recontextualizing imagery from advertising in their works, remixing provides a means of deconstructing dominant forms and creating something new. Like the past, in a contemporary context, this "something new" is sometimes met with skepticism.

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[34] Coppa, Francesca. 2008. Women, Star Trek, and the early development of fannish vidding. Transformative Works and Cultures, no. 1. http://journal.transformativeworks.org/index.php/twc/article/view/44.

[35] Guggenheim. "Picasso Black & White." 2012. http://web.guggenheim.org/exhibitions/picasso/artworks/maids_of_honor

Artists like Richard Prince[36] and Ryder Ripps[37], drawing on photos on Instagram for their source material, have been subject to critique as they remix and reuse photographs of women without their explicit permission.

Figure 2.10 (Left): Ryder Ripps stands in front of his paintings of model Adrianne Ho. Zach Sokol/VICE.

Figure 2.11 (Right): Adrianne Ho's original Instagram photo. Zach Sokol/VICE.

Due to new affordances for production[38], greater access to the raw materials of remixing, and new media types, the term remix has taken on more of a rhetorical than prescriptive meaning in a digital context. In *Remix: Making Art and Commerce Thrive in the Hybrid Economy*[39], Lawrence Lessig articulates the difference between "Read/Only" and "Read/Write" cultures. Where "Read/Only" culture involves only passive consumption, "Read/Write" sees consumption as the jumping off point for further cultural production. The remix, Lessig argues, is critical to the creativity necessary for a Read/Write culture to thrive—as existing source material becomes the ingredients for new art forms. At the core of Lessig's argument is the notion that current copyright laws are at odds with the realities of modern content consumption and creation, which remains a point of tension for the remix. Citation, as is common with

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[36] Sprigman, Christopher. "Richard Prince, Instagram, and Authorship in a Digital World." Bloomberg Business. June 17, 2015. http://www.bloomberg.com/news/articles/2015-06-17/richard-prince-instagram-and-authorship-in-a-digital-world

[37] Sokol, Zach. "Looking into the Instagram Abyss with Artist Ryder Ripps." Vice. January 23, 2015. http://www.vice.com/read/looking-into-the-instagram-abyss-with-artist-ryder-ripps-111.

[38] e.g. Cut/Copy and Paste

[39] Lessig, Lawrence. "Remix: Making Art and Commerce Thrive in the Hybrid Economy." The Penguin Press. 2008. Available under Creative Commons Attribution Non-Commercial License at http://www.scribd.com/doc/47089238/Remix.

writing, could be a model that protects intellectual property while encouraging transformative works.

In the digital space, the word remix has also been applied to new media forms like computer code. Scratch[40], a project from the Lifelong Kindergarten group at the MIT Media Lab, is an online community targeted at children who share stories, games, and animations they create with code. On Scratch, code can be remixed, giving the remixer access to the raw materials and inviting them to add to the piece to create something new. Attribution happens automatically when code has been copied, but there is also a widespread practice of manual acknowledgement. While some remixes show incremental changes, others are "component-based," where underlying blocks of code are used to create something very different.[41]

Remixing is transformative and multi-authored by nature. Annotation, though it can also be multi-authored, creates a new layer on top of existing media that adds commentary without changing the original work.

2.4 Annotating digital content

Annotations have been used throughout history to provide a layer of context on documents. The Talmud[42], for example, is a densely packed and complex book that contains many obscure words and a web of interconnected thoughts on topics including law, philosophy, history, customs, and more[43]. Throughout history, Rabbis have provided commentary to enable people to study and understand the text. One of the most comprehensive commentaries was penned by Rashi (Rabbi Solomon ben Isaac, 1040-1105). Rashi's commentary runs along the margins of the pages, explaining specific words and how ideas connect to one another.[44]

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[40] Scratch. https://scratch.mit.edu

[41] Monroy-Hernández, Andrés. (September 2012). "Designing for Remixing: Supporting an Online Community of Amateur Creators (Doctoral dissertation)." https://llk.media.mit.edu/papers/andres-dissertation.pdf

[42] a central text of Rabbinic Judaism

[43] Talmud. https://en.wikipedia.org/wiki/Talmud. Wikipedia.

[44] Unsworth, John. "Annotation: A Very Brief History." Presentation. Poynter Annotation Summit at the New York Times. May 20, 2015.

Figure 2.12: Margin Annotations in the Vilna Talmud. Wikimedia Commons.

Annotation typically refers to location-specific comments that address particular pieces of a text (e.g. a word, phrase, or paragraph), but the term is also used to refer more generally to the concept of metadata. Although we have yet to see a widespread digital annotation layer, annotations were part of Tim-Berners Lee's original specifications for the CERN research tool that became the Web[45]. Mosaic, the first widely distributed web browser (commercialized as Netscape) included a feature called "group annotations," allowing people to add commentary and discussion on any page. Annotations would be hosted on a separate "group annotation" server that would be queried with the URL of the document being viewed, returning any inline

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[45] Berners-Lee, Tim. "The original proposal of the WWW, HTMLized." W3C. March 1989. http://www.w3.org/History/1989/proposal.html

annotations to Mosaic. Due to technical and funding challenges, this feature was not fully implemented, and the web has lacked an integrated annotation layer since[46].

A number of organizations have taken on the challenge of providing annotations in the digital space. Hosted at the Harvard Berkman Center, Wendy Seltzer's 1998 "Annotation Engine" was a set of Perl scripts and a database that allowed users to post and view notes on web pages. The project was later used to annotate legal documents in the OpenLaw project[47]. In 1999, startup Third Voice created a browser plugin allowing users to annotate sites with comments. Two years later, after criticism from a number of web hosts that they were enabling "Web graffiti" and an inability to sustain themselves financially, Third Voice discontinued the service[48].

Today, the most common form of annotation we see online is commenting. Typically, comments are buried at the bottom of the page, hard to sort through, and challenging to moderate. Location-specific annotations, when they exist, are often platform-specific. Medium[49], a publishing platform created by Twitter and Blogger co-founders Ev Williams and Biz Stone, includes marginal annotations for commenting, discussion, and crowd-sourced copy-editing. Comments can be approved or rejected by the text's original author. Livefyre, a company that provides tools for publishers to manage and display user-generated content, offers an annotation plugin called Sidenotes[50]. Livefyre's tools are incorporated into publishers' existing Content Management Systems (CMS). Genius[51], a conceptual successor to Third Voice, provides annotation tools for content hosted on their site, as well as a browser plugin providing an annotation layer for content hosted elsewhere. Genius began as Rap Genius, a

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[46] Andreessen, Marc. "Why Andreessen Horowitz Is Investing in Rap Genius." n.d. http://genius.com/1107425/Marc-andreessen-why-andreessen-horowitz-is-investing-in-rap-genius

[47] Berkman Center for Internet & Society. "Annotation Engine." Aug 12, 2008. Retrieved July 11, 2015. https://cyber.law.harvard.edu/node/92394#

[48] Kumar, Aparna. "Third Voice Trails Off…" April 4, 2001. Archived from the original on 11 March 2009. Retrieved 11 July 2015. http://web.archive.org/web/20090311235720/http://www.wired.com/techbiz/media/news/2001/04/42803

[49] Medium. https://medium.com
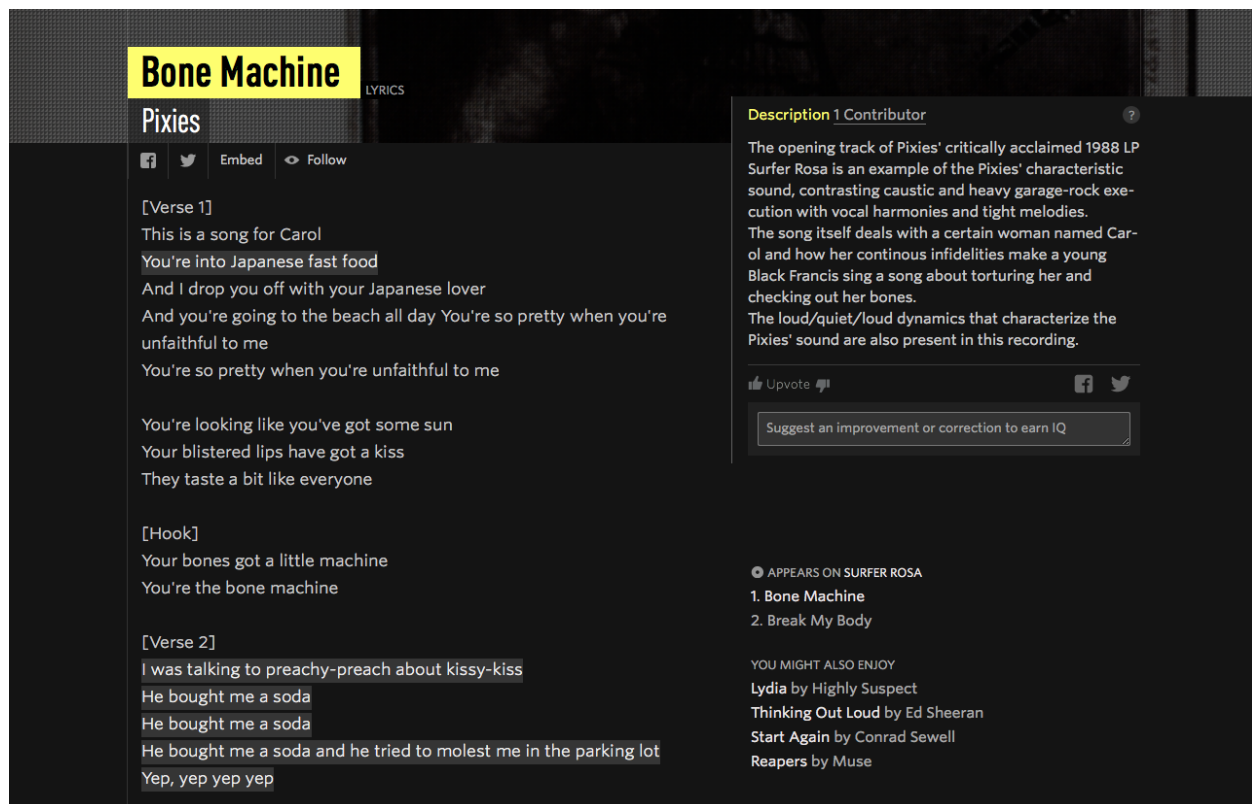
[50] Livefyre Sidenotes. http://web.livefyre.com/apps/sidenotes/

[51] Genius. http://genius.com

destination for people to annotate the references in rap lyrics, and has grown to include news, law, and literary texts.

Figure 2.13: Annotation of a song on Genius.

http://genius.com/Pixies-bone-machine-lyrics/

Though annotation of physical texts is often a personal practice, digital annotations have the potential to be shared with a much wider audience and possibly archived for future use. However, widespread digital annotation has been difficult to achieve due to awkward user input techniques, copyright and privacy concerns, incomplete web standards, and challenges related to locating reference points in a digital context[52]. As of now, the W3C is working on open standards for annotation data models so different systems can potentially be interoperable. Hypothes.is[53], a non-profit, is one of the few annotation projects basing their

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[52] Carpenter, Todd A. "iAnnotate — Whatever Happened to the Web as an Annotation System?" April 30, 2013. http://scholarlykitchen.sspnet.org/2013/04/30/iannotate-whatever-happened-to-the-web-as-an-annotation-system/

[53] Hypothes.is. https://hypothes.is

work on these emergent standards. In addition to building technologies, Hypothes.is hosts conferences and gatherings to build community around open standards.

Beyond informal, user-generated annotations, formal metadata can be generated algorithmically and attached to specific pieces of text or an image as a kind of annotation. This semantic data provides computer-understandable descriptions of web elements, classifying them in a shared social conceptualization called ontology[54]. As an example of the usefulness of this kind of metadata, computer vision techniques could be used to identify people and objects in photos, thus making them more accessible via search queries.

Annotation offers the potential for text to be augmented with additional meaning, and can be useful for making complex information more understandable for humans and retrievable by machines.

2.5 Synthesis

FOLD is being created in dialog with and in response to the history of hypertext, curation, remixing, and annotation. FOLD articulates one vision for a modern day Memex, helping writers bring together knowledge embedded in existing user-generated content to create new and original stories. On FOLD, authors curate the best context for a given topic, and annotate text with the multimedia context cards they have created. Though remixing is not yet possible on FOLD, its modular design (outlined in Chapter 4), lays the groundwork for cards to be reused across stories while also preserving original authorship. In future versions, FOLD could allow users to collaborate on associative, multimedia-rich documents and find connections between information that once existed in separate universes.

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[54] Oren, E., Moller, K. H., Scerri, S., Handschuh, S., and Sintek, M. 2006. What are semantic annotations? Technical report, DERI Galway.

3. Related Work

While the previous chapter outlined historical trends that influence FOLD conceptually, this section describes related work that informs FOLD's interaction design and feature set: explanatory and instructive digital content, card-based interaction design, existing digital storytelling tools, and innovation in online news presentation.

3.1 Explainer journalism

News is important. It gives us the information we need to make decisions, provides common ground to share with others around us, and helps us become global citizens. However, there are many important stories we shy away from because we lack the background needed to understand them. Some of the most important news stories we encounter—like the Israel-Palestine conflict, the recent unrest in Ukraine, or the ongoing Ebola outbreak—are complex and require context to understand. There is an overabundance of news, and readers have a tendency to engage with light, superficial news at the expense of heavier, in-depth stories.

Traditionally, news relies on a storytelling structure called the inverted pyramid, where key facts are introduced in the first paragraph, with subsequent paragraphs providing background information[55]. This structure worked well for the era of paper-based journalism, so the story could be shortened to fit space constraints without compromising emerging facts. But is this the way that news should be now, or is this the result of using ink and paper procedures in a world where digital technologies allow for more flexibility?

FOLD was originally designed to support the creation of explanatory news content. An "explainer" is a journalistic genre that focuses not just on breaking news, but tries to address a gap in the reader's understanding. This gap may be the result of an issue having a very long history, involving complex and interconnected systems, or containing unfamiliar science and

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[55] Pottker, Horst. (2003) "News and its Communicative Quality: The Inverted Pyramid – When and Why Did It Appear?" Journalism Studies, 4(4): 501-511.

technology[56]. Explainers are a well-established genre, with a Pulitzer awarded annually for exemplary journalism of this nature.

In the modern era of high-velocity news content, outlets fight over who breaks a story first, not who unpacks it the most deeply. Journalism scholars and emerging platforms alike are testing the assumption that people want emerging facts in context. The market is changing—increasingly, consumers want news, explained. In his 2008 article, *National Explainer: A Job for Journalists on the Demand Side of News*, Journalism professor Jay Rosen describes the value of this format for both news producers and consumers. For many newsworthy stories, people feel like they're entering into them in the middle or at the end, which can make it difficult to understand the issue, let alone care about it. Rosen introduces an example of a popular episode of the radio show and podcast *This American Life* that explained the mortgage crisis[57], and how after listening to it, he became an ongoing "customer" of news about the issue. He argues that there is demand for explanatory content on the side of readers but too little supply.

In the years following these discussions by media scholars, many newsrooms have begun experimenting seriously with this genre of journalism. Vox, whose tagline is "explain the news," was co-founded in 2014 by Ezra Klein, Melissa Bell (both formerly at the Washington Post) and Matthew Yglesias (formerly at Slate). Vox is owned by Vox Media, publishers of influential sports[58], technology[59], and gaming[60] news websites. Vox offers explainer pieces about newsworthy topics as well as an embeddable library of "context cards." Vox has made considerable effort to keep their explainers "evergreen"—a concept in journalism that refers to

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[56] Rosen, Jay. "Building a Better Explainer: Help Us Out." PressThink. November 17, 2010. http://pressthink.org/2010/11/building-a-better-explainer-help-us-out/

[57] This American Life. "The Giant Pool of Money." May 9, 2008. http://www.thisamericanlife.org/radio-archives/episode/355/the-giant-pool-of-money

[58] SB Nation. http://www.sbnation.com.

[59] The Verge. http://www.theverge.com.

[60] Polygon. http://www.polygon.com.

stories that will be true and relevant for long periods of time—and asks their staff to refine at least one old story per week so stories remain useful to their readers[61].

Timeline, a mobile-first news site, also seeks to put facts in context. Timeline's focus is on offering historical background on newsworthy events, pop culture, and seemingly mundane aspects of daily life (e.g. "The surprisingly tumultuous history of socks"[62]). Currently, Timeline hires a staff of professional writers to create its timelines, but hopes to "scale up to a user-generated content system.[63]"

Even venerable news outlets are beginning to experiment with providing digital explanatory content. The New York Times explainer site The UpShot, offers news analysis and accompanying data visualizations. Designed to fill a hole left by Nate Silver's FiveThirtyEight[64] blog, which drew many readers during the 2012 presidential election before moving to ESPN, The UpShot focuses on explaining political and economic content with a "direct, plain-spoken" voice and engaging readers in dialog with reporters[65].

Explanatory content can also come in the form of a tutorial or a "how-to." This type of content also seeks to address a gap in the reader's knowledge, though tends to be more oriented to teaching the reader how to do or make something rather than understand a topic. YouTube is home to many video tutorials, and sites like Instructables[66], edX[67], and Skillshare[68] are

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[61] Yglesias, Matthew. "Refreshing the evergreen." Vox. January 15, 2015. http://www.vox.com/2015/1/15/7546877/evergreen-experiment

[62] Spinrad, Paul. "The surprisingly tumultuous history of socks." Timeline. n.d. https://timeline.com/stories/socks-manufacture-retail-weaving-hosiery-stockings

[63] DeAmicis, Carmel. "New app Timeline brings explainer journalism to mobile." GigaOm. February 3, 2015. https://gigaom.com/2015/02/03/new-app-timeline-brings-explainer-journalism-to-mobile/

[64] FiveThirtyEight. http://fivethirtyeight.com

[65] Leonhardt, David. "Navigate News With The Upshot." The New York Times. April 22, 2014. http://www.nytimes.com/2014/04/23/upshot/navigate-news-with-the-upshot.html

[66] Instructables. http://www.instructables.com.

[67] edX. https://www.edx.org.

[68] Skillshare. http://www.skillshare.com.

evidence of digital audiences hungry for material that helps them learn from the expertise of others.

3.2 Cards in Interaction Design

"Cards," which form the basis of FOLD's storytelling structure and design, are a useful format for making information modular. The term can refer to both aesthetic and architectural characteristics of digital information; cards can be both a visual metaphor for presenting information as well as a container for third-party content hosted elsewhere but made available via the card structure[69]. In many ways, cards are a return to design paradigms introduced in the early days of the GUI, and have resurfaced as a common trend in contemporary interaction design.

When cards are used as a metaphor for presenting information, concise content is displayed as visually distinct from other content on a given page. Sometimes, cards are arranged in a 3d stack, giving them a skeuomorphic[70] appearance. Cards in the physical world have long been used as a means of organizing information—from notecards, to library card catalogs, to rolodexes—and they are an entrenched digital design paradigm, particularly useful for mobile experiences and scenarios in which information is aggregated from multiple sources (e.g. in a feed or a stream).

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[69] Vinh, Kohl. "What is a Card?." Subtraction. August 26, 2014. http://www.subtraction.com/2014/08/26/what-is-a-card/

[70] emulating the appearance of physical objects
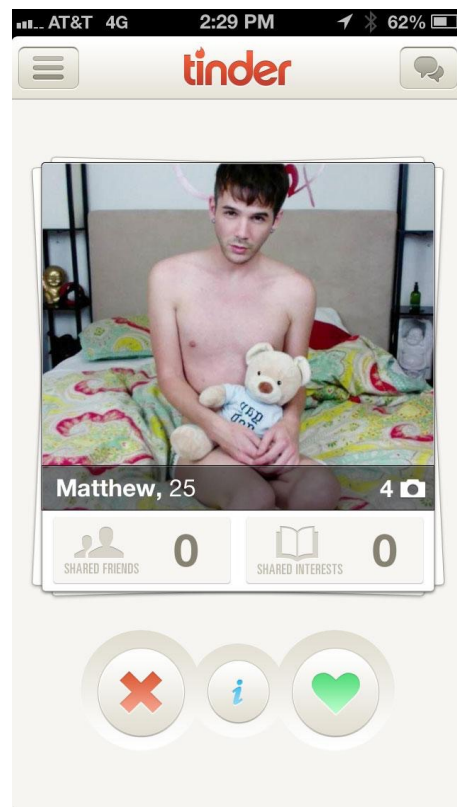
Figure 3.1: Card stacks on Tinder, a popular dating app.

Users can swipe left or right to advance to the next card.

Cards as containers for third-party content can range from brief descriptions of a linked site that don't require a user click a link, to embedded content like videos, to much more interactive experiences. Though most Tweets contain text, photos, videos, and links, Twitter has been experimenting with making cards embedded within Tweets more interactive. For example, a 2014 Tweet from Acura allowed viewers to "configure their dream car" without leaving their Twitter feed[71]. In this case, cards are containers for an interactive experience that can be displayed across multiple timelines. Although this may not seem revolutionary at first glance, users can interact with this information in the context of their aggregated feed, instead of going to an external site. Twitter has also begun rolling out article preview cards, which display a few lines of text from linked stories[72].

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[71] Vinh, Kohl. "A Twitter Card That Does Something." Subtraction. August 20, 2014. http://www.subtraction.com/2014/08/20/a-twitter-card-that-does-something/

[72] Ellis, Justin. "Twitter's new article preview cards could be a boost for publishers." NeimanLab. July 15, 2015. http://www.niemanlab.org/2015/07/twitters-new-article-preview-cards-could-be-a-boost-for-publishers/

In 2012, Google also introduced interactive cards with a service called Google Now. Billed as an intelligent personal assistant and a way to get "the right information at just the right time,"[73] Google Now cards are presented automatically to users. Google infers from the user's context, repeated actions, search queries, and stored data which cards would be most relevant to display (e.g. cards showing nearby events, or upcoming flights surfaced from emailed flight confirmations). Beginning in 2015, Google Now cards began to integrate with a variety of third-party services including Spotify[74], Airbnb[75], Circa[76], and more. Google Now can currently be used on mobile devices, wearables like watches or augmented reality glasses, and on desktop computers.
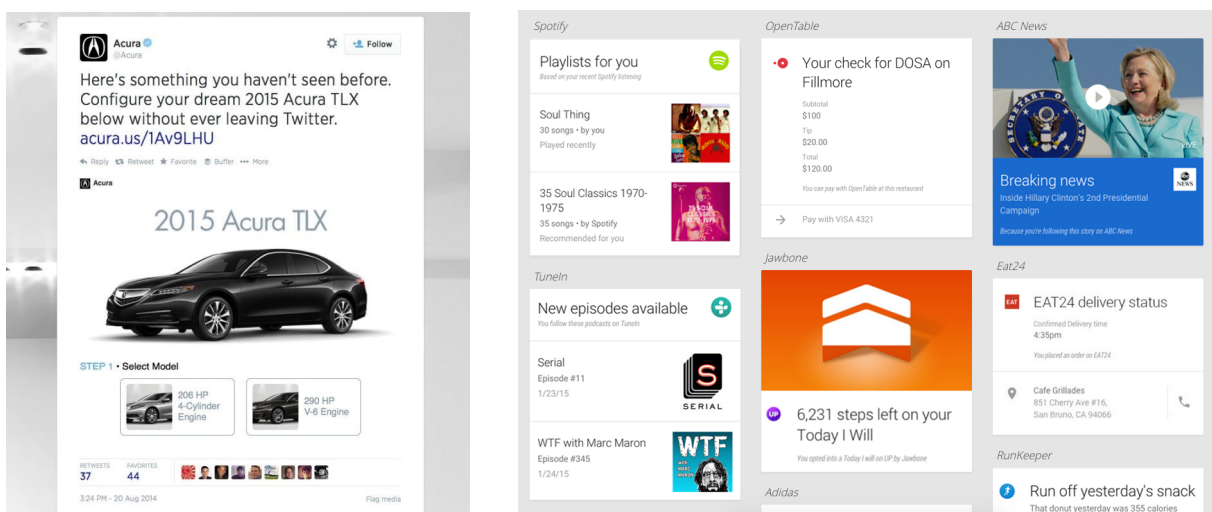
Examples of interactive cards: Acura's tweet (Figure 3.2, left), Google Now cards (Figure 3.3, right)

Currently, cards are being used across various news sites, as both a conceptual and technical mechanic depending on the implementation. Vox, described in the previous section, uses "card stacks" (which can be embedded on articles that are not hosted by Vox) to deliver contextual information, typically in a question-and-answer format. Each card can link to other cards in a

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[73] Google Now. https://www.google.com/landing/now/

[74] Spotify. https://www.spotify.com.

[75] Airbnb. https://www.airbnb.com.

[76] Circa. https://circanews.com.

given stack, or across stacks entirely. AJ+, a news app from Al Jazeera targeted at Millennial news readers, also uses cards to bring readers up to speed. And Circa, a popular but recently shuttered mobile news site, used cards to deliver "atomized" news on mobile devices. The technique of atomization (which "breaks down a story into its core elements: facts, stats, quotes and media"[77]) works well with the format of cards as stories could be stitched together from different pieces and rearranged over time.
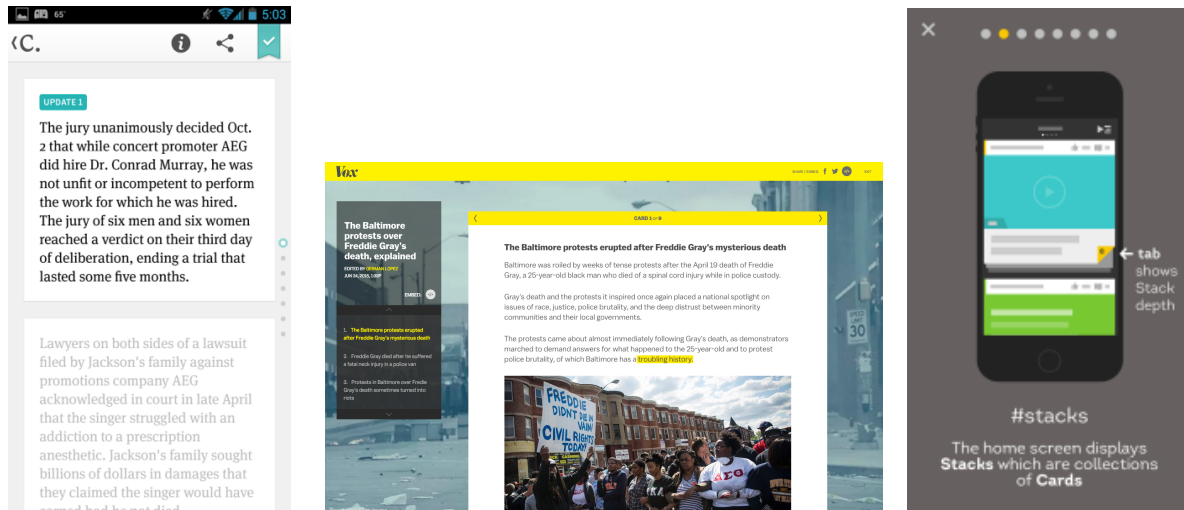
Cards on Vox (Figure 3.4), Circa (Figure 3.5), AJ+ (Figure 3.6).

Cards have a long history in digital design, dating back to software released after the graphical user interface (GUI) became widely available in the 1980s. Apple's HyperCard, mentioned in section 2.1, was released in 1987 and included for free with all new Macs purchased at the time. HyperCard enabled users to create interactive, card-based applications based on its associated scripting language HyperTalk. In many ways, HyperCard was a predecessor to the Web, as HyperTalk allowed people to link together separate documents and pieces of data (though HyperCard was not networked)[78]. Users could add text, images, and buttons that linked to other cards in the stack—making the program useful for creating games, educational materials, and presentations. Myst, one of the most popular early PC puzzle adventure games,

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[77] Cohn, David. "At Circa We Write Stories, Not Summaries, Take Two." Circa Blog. April 1, 2014. http://blog.cir.ca/2014/04/01/at-circa-we-write-stories-not-summaries-take-two/

[78] Lasar, Matthew. "25 Years of HyperCard—the missing link to the Web." ArsTechnica. May 30, 2012. http://arstechnica.com/apple/2012/05/25-years-of-hypercard-the-missing-link-to-the-web

was originally created as a HyperCard program. Although HyperCard was used by many, Apple discontinued the product in 2004. Tim Oren, one of HyperCard's early developers, argues that the tool never saw mainstream use because it did not have a clear use—it sat somewhere between a programming environment, an interface design tool, and a hypertext document management system[79].
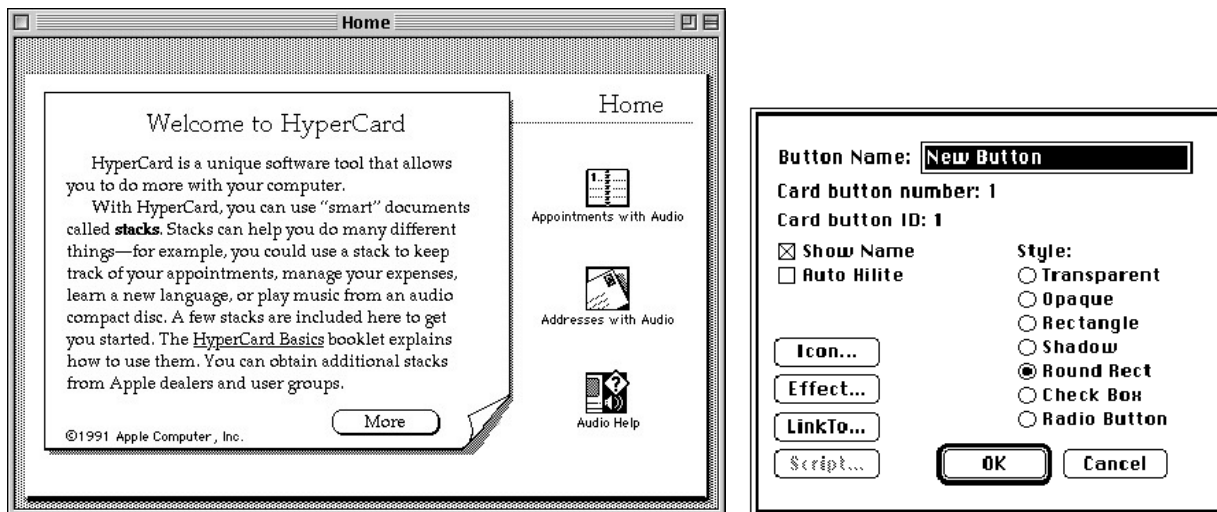

Figure 3.7 (Left): HyperCard tutorial screen

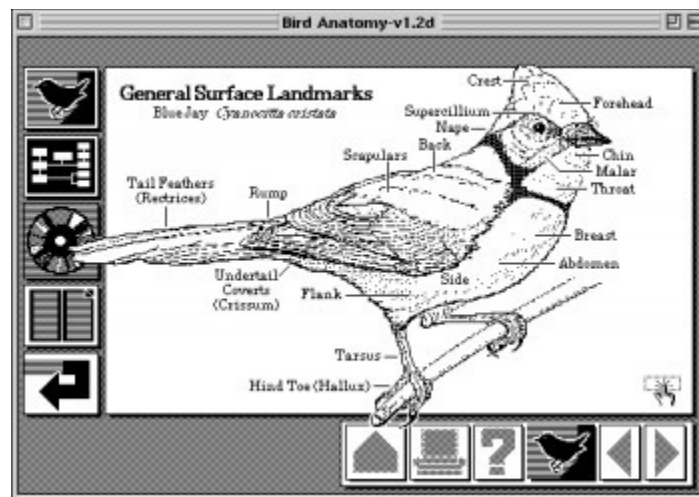*Figure 3.8 (Right): UI for linking a button in HyperCard*

Figure 3.9: HyperCard bird, by MdN Design Interactive

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[79] Oren, Tim. "A Eulogy for HyperCard." Tim Oren's Due Diligence. March 26, 2004. http://due-diligence.typepad.com/blog/2004/03/a_eulogy_for_hy.html

Despite it's disappearance, HyperCard has a lasting legacy for both digital design and programming. Universe, a startup that launched in 2014, is developing a card-based programming language for mobile devices in the tradition of HyperCard. On Universe, cards are "interactive spaces that you can shape to be anything, from a game to a recipe.[80]"

3.3 Digital Storytelling Tools

FOLD's design has been inspired and influenced by contemporary digital storytelling tools, particularly those that simplify 1) authoring and presenting text and media, 2) searching for and incorporating social media, and 3) annotating text.

Medium[81] is a publishing platform created by Twitter and Blogger co-founders Ev Williams and Biz Stone in 2012. Medium is an open platform, meaning anyone can use the service to create and publish elegant, linear essays. The company's early focus was not just to lower the barrier to publishing online, but to "raise the quality of what's produced.[82]" Medium organizes posts into categories they call "channels," and once an article is published it can be recommended to others. Medium is closely linked with Twitter—when you log in to Medium, your Twitter contacts follow you. Users then have the option of following new people and pruning the list imported from Twitter. While Medium is an open platform, it is also a publisher with an editorial arm of its own. Medium has published several collections on the platform, including Matter, Backchannel, The Nib, and The Message, and also creates sponsored content for brands (like re:Form, a collection about design that was initially sponsored by BMW). As of late, however, Medium has shifted from positioning itself as a publishing platform to positioning itself as a network[83]. Stories written on Medium are published and hosted there, but the service has recently begun experimenting with hosted deployments of the tool.

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[80] Universe. http://un1verse.co

[81] Medium. https://medium.com

[82] Letzing, John. "Twitter Founders Unveil New Publishing 'Medium.'" August 15 2012. *The Wall Street Journal*. http://blogs.wsj.com/digits/2012/08/15/twitter-founders-unveil-new-publishing-medium/

[83] Williams, Ev. "Medium is not a publishing tool." May 20, 2015. The Story on Medium. https://medium.com/the-story/medium-is-not-a-publishing-tool-4c3c63fa41d2

Medium has a WYSIWYG interface, meaning there are limited visual differences between the authoring experience and the finished piece. The platform also includes marginal annotations for commenting, discussion, and crowd-sourced copy-editing. Initially intending to offer several template types for different kinds of posts, Medium ultimately focused on making the experience center around text with inline photos[84].

Figure 3.10: Story on Medium (Everything Is Broken, by Quinn Norton).

While Medium is primarily platform for publishing original text, Storify is a platform focused on the aggregation of existing social media. Storify, which launched in 2010, is a web service that allows users to create timelines and stories by curating posts from social media. Storify connects with a variety of services like YouTube, Twitter, Instagram, Facebook, and more and through search, users can retrieve and include media in their stories. Media elements can be reordered, and the user can add text to the post to contextualize the elements they have selected. Some services, like Facebook and Instagram, require users to login to access any content through search. The finished Storify story exists on Storify's website, but most often

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[84] Teehan + Lax. "The Making of Medium." n.d. http://www.teehanlax.com/story/medium/

stories are embedded elsewhere (e.g. News organization websites, blogs). The service was acquired by Livefyre in 2013[85].

Storify has been widely used to aggregate information about breaking news events, social movements, conversations, reactions, and extreme weather[86]. For example, Storify has been used by CBC to cover the 2011 London riots, by NPR to cover the shooting of Representative Gabrielle Giffords in Arizona, and by Al Jazeera to explore conversations about fear of Islam in the United States[87].
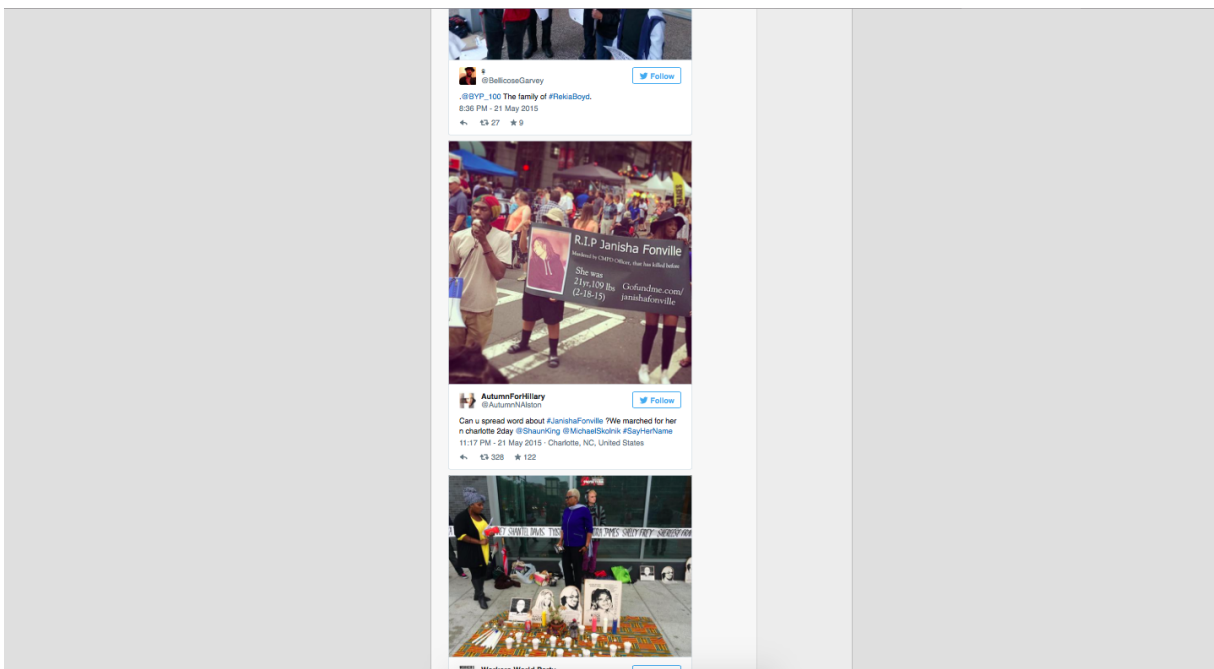
Figure 3.11: Example of an embedded Storify, used on Black Youth Project website to show photographs on social media from events associated with the 2015 National Day of Action for Black Women and Girls/#SayHerName. (http://www.blackyouthproject.com/2015/05/powerful-photos-from-sayhername/)

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[85] Ha, Anthony. "Livefyre Acquires Storify, Says The Social Curation Service Will Still Operate As Standalone Product." TechCrunch. September 9, 2013. http://techcrunch.com/2013/09/09/livefyre-acquires-storify/

[86] Tenore, Mallary Jean. "The 5 types of stories that make good Storifys." November 25, 2014. http://www.poynter.org/how-tos/writing/153697/the-5-types-of-stories-that-make-good-storifys/

[87] Miller, Claire Cain. "Filtering the Social Web to Present News Items." New York Times. April 24, 2011. http://www.nytimes.com/2011/04/25/technology/internet/25storify.html?_r=0

Genius (formerly Rap Genius), discussed previously in Section 2.4, is an online knowledge base and annotation system for existing text. Founded in 2009, the service originally focused on allowing users to annotate and provide interpretations of rap lyrics. In 2014, the site expanded its focus to include other kinds of texts (e.g. news, law, pop culture, etc.) and allowed users to annotate off-site texts via a plug-in annotation layer called "Genius beta". To use this feature, users write "Genius.it/" in front of any URL, or they can also activate the annotation layer by using Genius' Chrome extention[88].

Registered users can upload primary text, edit it, and add annotations to words and sentences by highlighting them. A team of editors and moderators attempt to assess quality, and users generate "IQ" points according to both the quality and quantity of their annotations. If a user earns enough IQ points, they are also invited to become a moderator. Annotations can also be up- and down-voted by other users.
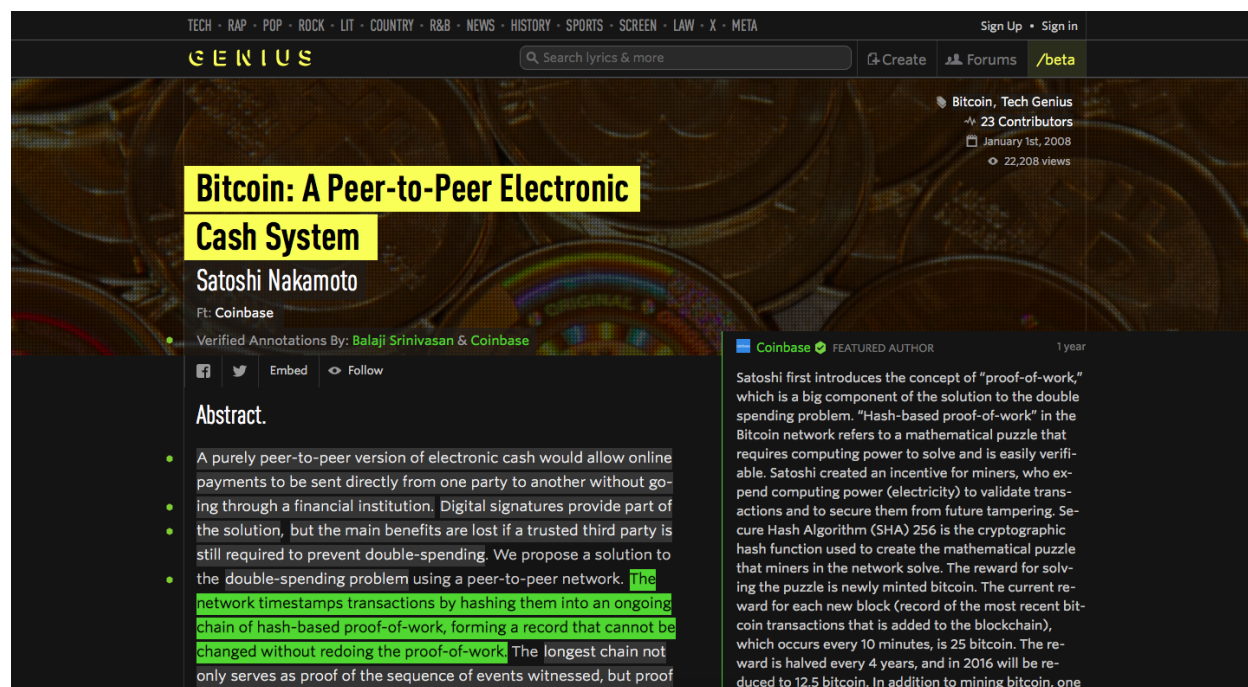
Figure 3.12: Original white paper about Bitcoin by Satoshi Nakamoto, annotated on Genius.

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[88] Genius beta. http://genius.com/beta

3.4 Synthesis

FOLD is inspired by efforts to explain and contextualize the news, and associated platforms like Vox, Circa, and Timeline. On all three, background information is offered through digital cards. Cards contain modular context that can be reused across stories. However, cards on these platforms cannot be authored by the general public—they are still the product of an editorial process. While professionally authored cards have many merits, FOLD aims to create a system that allows individuals with niche expertise to author cards that could potentially be used by others. FOLD also aims to blend the best of Medium, Storify, and Genius by offering a WYSIWYG experience that outputs an elegant story, integrates tools that allow writers to search for and incorporate multimedia, and adds an annotation layer to tightly link context with granular topics.

4. Design Rationale

This section outlines the design principles behind FOLD, provides an overview of implementation, and describes current known limitations of the platform.

4.1 Design principles

As we began to develop FOLD, we created a number of principles that guided our design process. These principles were drawn from the affordances and limitations of existing tools, as well as our desire to make a new and unfamiliar storytelling paradigm attractive to readers and writers. We developed these design principles as we developed A brief summary of the six principles that influenced the design of the tool are offered below:

Keep the presentation layer in mind

FOLD has a WYSIWYG[89] interface. Because FOLD stories are more complex than linear blog posts offered by most other CMSs, the UI strives to allow writers to have the presentation layer of stories in mind as they construct a narrative and context cards. This allows writers control over the presentation layer of their stories. To achieve this, authors type directly into cards, building narrative cards linearly and context cards to the side of each section. Writers can re-arrange cards within and between rows by "zooming out" to see a meta view of the story. The cards can be moved through a drag-and-drop interaction.

Stand on the shoulders of giants

FOLD aims to make it easy to build on top of the immense contextual resources that exist on the Web. To integrate this content, authors are able to search for, preview, and include web hosted content from a variety of different services in their stories (e.g. YouTube). A complete list of integrations can be found in section 5.3.

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[89] What You See Is What You Get. http://en.wikipedia.org/wiki/WYSIWYG.

Promote a culture of playfulness

FOLD proposes that complexity need not be overwhelming or unapproachable. Playfulness can be disarming—important for projects that propose a radical new interface that could otherwise feel daunting to learn how to use or interact with. On FOLD, playfulness is achieved through graphic elements (e.g. typography, bold colors, and iconography), interactivity and light "gamification"[90] (e.g. context type badges at the top of stories), example content we've put on the site (e.g. *Mr. Spock to the rescue: How a Star Trek star earned the admiration of a young fan*[91]), and the media types we've chosen to make embeddable (e.g. animated GIFS and videos) .

Balance consistency with flexibility

Cards on FOLD are meant to be modular and potentially reusable across stories on the platform. To achieve this, a measure of consistency in terms of card size and appearance is necessary to help readers and writers better understand the new storytelling paradigm proposed by FOLD. Though FOLD has an opinionated layout, requiring a uniform context card size and a cross-like story structure, we tried to make it flexible in the ways that matter to readers and writers. Writers can rearrange cards as they are writing, link specific cards directly to words and phrases in the text as they see fit, and integrate a wide variety of content types into the story.

Help readers and writers navigate multiple dimensions

Non-linearity can help stitch together related concepts and allow for helpful branching, but it can also be confusing if readers do not know where they are in the story. To help make stories more coherent and navigable, each story has an automatically generated minimap in the bottom corner which shows the breadth and depth of the story in terms of number of rows and number of cards per row.

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[90] Gamification. https://en.wikipedia.org/wiki/Gamification

[91] Carroll, Matt. "Mr. Spock to the rescue: How a Star Trek star earned the admiration of a young fan". https://readfold.com/read/MattCarroll/mr-spock-to-the-rescue-how-a-star-trek-star-earned-the-admiration-of-a-young-fan-v5Rr3gGf

Strive for openness and reusability

As we hope for FOLD authors to stand on the shoulders of giants and eventually build off one another's work, we aim to mirror this with the design of FOLD itself. The source code for FOLD is open, and freely accessible on Github. Licensing of FOLD content is CC-BY[92] by default,[93] so others are free to share and adapt FOLD content so long as attribution is preserved and users indicate if any changes have been made to that content. The modular nature of FOLD cards also leaves open the potential for their reuse by authors themselves or others in the FOLD ecosystem.

4.2 Context cards

Context cards, inspired by much of the work in the field of interaction design proposed by projects in section 3.1, are designed to be modular, reusable, and containers for many different kinds of media. At launch, there are nine types of context cards: videos, images, animated gifs, maps, tweets, audio recordings, interactive data visualizations, plain text, and links to external websites. These context cards are created by integrating with Application Programming Interfaces (APIs) for various web services, described in detail in the following section.

While narrative cards have a flexible height depending on the amount of text within, context cards are a fixed size, with the content inside scaling to fit the height and width constraints. The fixed size of context cards makes it easy to create a modular structure for stories.

4.3 Implementation overview

FOLD is developed using the Meteor web framework[94] with a Mongo[95] database. Meteor is an open source platform for building web and mobile applications entirely in JavaScript.

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[92] CC-BY 4.0. https://creativecommons.org/licenses/by/4.0/.

[93] with an option for writers to retain copyright of the narrative core of their story if they desire

[94] https://www.meteor.com/

[95] https://www.mongodb.org/

Meteor supports "hot deploys,"[96] which allows developers to push changes on the fly with minimal impact on users. On top of this, the FOLD development team built further tools to fix bugs and make live improvements, prompting users with a notification in their web browsers to reload to update to the latest code whenever they were ready. Because many of our users may be actively writing a story when changes are pushed to production, giving them the agency to decide when they update helps keep the user experience cohesive.

FOLD integrates a variety of web services through publicly-accessible APIs. The APIs FOLD integrates with include: YouTube[97], Vimeo[98], Flickr[99], Imgur,[100] Giphy,[101] Google Maps,[102] Twitter[103], Soundcloud[104], and the Observatory of Economic Complexity[105]. Consistent with our efforts to allow users to 'stand on the shoulders of giants," our implementation also reflects this design principle. Without these well-documented, powerful APIs, FOLD would not be able to leverage the tremendous resources of user-generated content that already exist online. FOLD's current implementation would not have been possible prior to now, as it would have been much more difficult to allow users to search for, retrieve, and include this material.

Additionally, FOLD make use of Cloudinary[106]—an image hosting and resizing service—to allow writers to upload their own photos as a profile image, as context cards, or as a header image for their stories. Images uploaded to FOLD and the text of the story are the only media hosted on FOLD itself; other story content is hosted on and embedded from other websites.

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[96] the ability to push changes into production code, updating all applications simultaneously

[97] https://www.youtube.com

[98] https://vimeo.com

[99] https://www.flickr.com

[100] http://imgur.com

[101] http://giphy.com

[102] https://www.google.com/maps

[103] https://twitter.com

[104] https://soundcloud.com

[105] https://atlas.media.mit.edu

[106] http://cloudinary.com/

FOLD is open-source, and the repository is located on Github[107].

4.4 Assumptions and limitations

Because we anticipate that many users may write the text of their stories outside of the web browser itself, FOLD strives to support both a copy-and-paste scenario, as well as people writing natively into the browser. In the copy-and-paste scenario, we attempt to preserve formatting that is also supported by FOLD (e.g. bold, underline, and italics), but strip out any hyperlinks and line-breaks at this time. The decision to not support plain hyperlinks in the main text was an effort to create a situation that asks users to try the FOLD way of hyperlinking— creating a "link card" from the context card builder. While this may change in the future, we wanted to intentionally create a situation that would encourage writers to try hyperlinking through context cards. A link card can link to any page outside of FOLD, and the decision to strip links from the main text was not intended to discourage hyperlinking, but to encourage users to try a different way of linking out.

Other limitations of the current version include: stories must be authored by individual users, stories exist only on FOLD and cannot be embedded on other websites,

Our APIs also have various limitations as specified by their terms of use, including the amount of content they release to us per request, and the number of requests within a particular time frame. One notable limitation is from the Twitter API—in order to have a higher number of requests for Tweets per hour, Twitter requires that users link their individual Twitter accounts to their FOLD accounts. Many other limitations related to the number of requests per hour or day could be overcome by paying the services for greater access.

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[107] https://github.com/readfold/fold

5. User experience and user interface

FOLD provides a new interface for creating stories along two axes, as well as tools to search for an incorporate multimedia that exists across the Web. This section provides an overview of the UI and describes in detail how a writer constructs a story on FOLD, and how a reader can interact with that story.

5.1 Overview of a FOLD story

On FOLD, stories have a cross-like structure, with a backbone of modular Narrative Cards, each of which can be associated with multiple Context Cards. Readers progress vertically through a story to read the narrative, and side-to-side to selectively access contextual information. Context Cards can be linked to words and phrases in the narrative cards. When a user clicks on the linked word or phrase, the associated context card zooms into view alongside the text backbone. Context Cards can also be navigated manually using the arrows on the left and right edges of the Context Card row. Figure 5-1 shows a completed FOLD story.
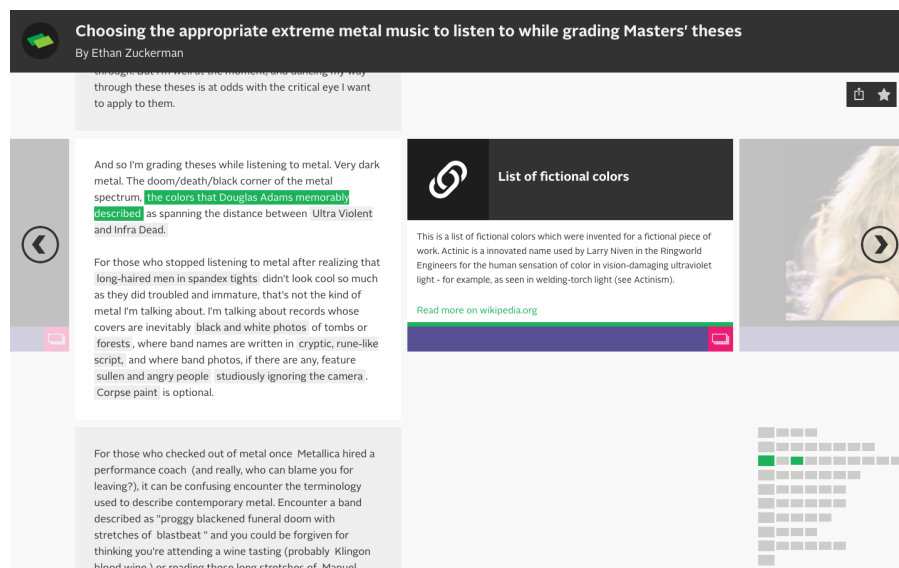

Figure 5.1: Published FOLD Story

As described in section 4.1, FOLD's authoring interface is WYSIWYG and mirrors the final form of the published story. Figure 5-2 provides an overview of FOLD's authoring interface. The blue labels on the figure highlight the five building blocks of a FOLD story, which will be explained in greater detail in the next section:

i.   *Narrative Card:* Writers can either type directly into the card, or copy and paste text.

ii. *Add a new Narrative Card:* Writers click this button to append a new narrative card to the story. When the story has multiple Narrative Cards, the button also appears on hover between existing cards.

iii. *Context Card:* All context cards are attached to individual Narrative Cards, creating a different row of Context Cards for each narrative card. When the reader focus on a new Narrative Card, the row of Context Cards changes to match the Narrative Card in focus. Cards stack from left to right, and can be navigated with arrows that appear when there is more than one card.

iv. *Add a new Context Card:* Writers click this button to open the Context Card builder which allows them to add a new Context Card to the row by searching through different web services.

v.   *Minimap:* As the story is constructed, a minimap that shows the number of cards per row is automatically generated. Writers can click this minimap to access a zoomed-out view that allows them to rearrange the cards at will.
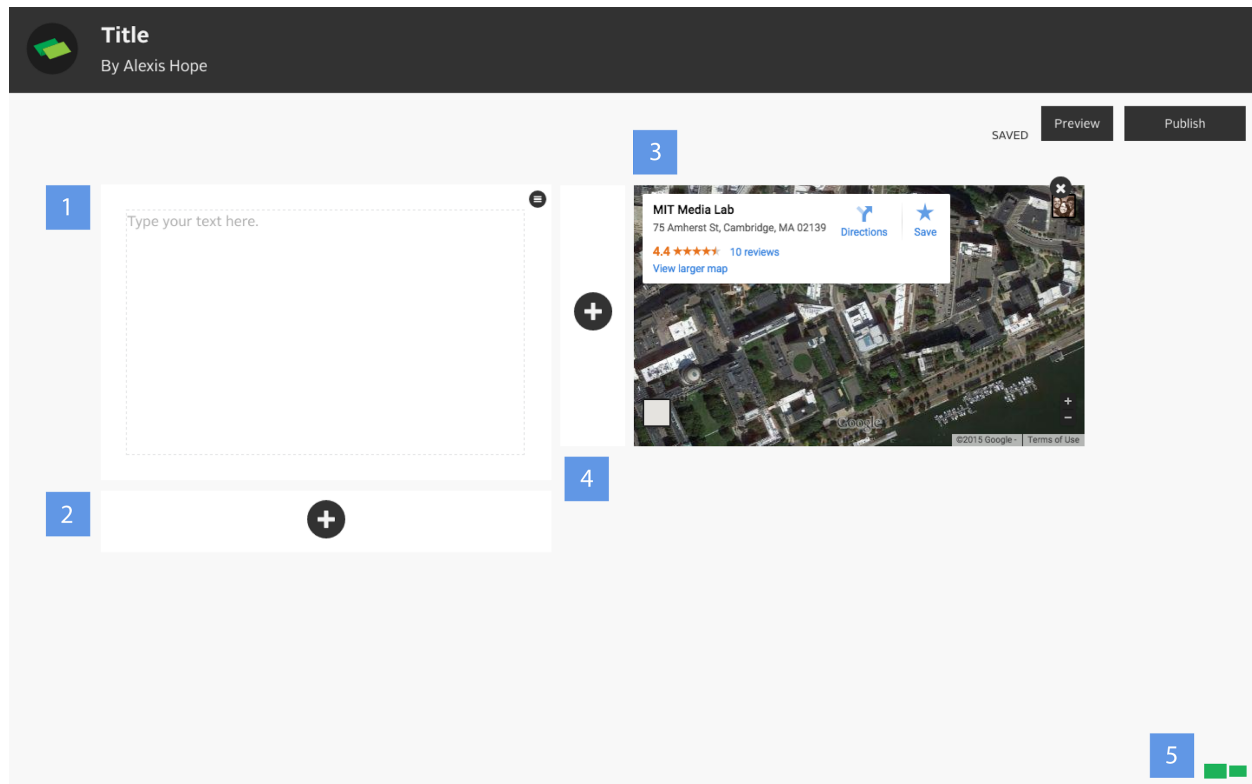
Figure 5.2: Overview of a FOLD Story

5.2 Overview of FOLD homepage

Once published, FOLD stories live on the homepage (Figure 5-3). They can be promoted to the front page by site administrators which appears when users first load the page. Stories that appear on site load are called "curated" stories. All other stories can be accessed by changing the filters on the main page. Stories can be filtered by trending (most popular over time), favorited (according to logged-in users of FOLD who use the internal favoriting system), or newest (all stories, sorted by date edited).

Stories on the FOLD homepage have badges on the top edge that describe the different content types included in the story (i.e. video, gifs, etc.). When users mouse-over these "content type bubbles", a number appears, reflecting the amount of cards of each type included in the story.
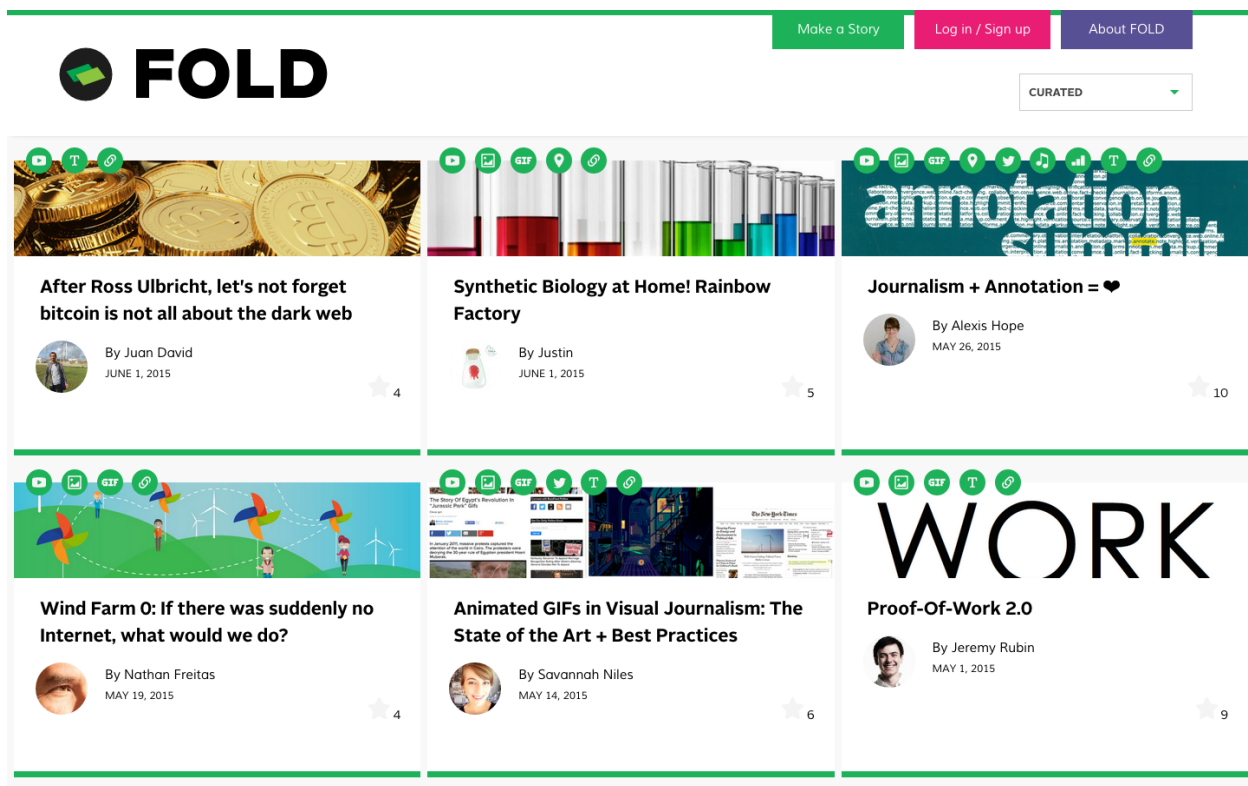
Figure 5.3: FOLD homepage

5.3 User experience

This section describes the user experience and associated user interface elements to create a story on FOLD. This section also describes some of the ways that readers can interact with the story once it has been published.

Creating a new story, adding a title and a header image

Users begin by clicking "make a story" on the main page of FOLD. Once they enter the authoring platform, they are presented with a blank canvas that highlights the building blocks at their disposal (Figure 5-4). First, they can add a title by typing into the dark colored box [1], and upload a header image by clicking on the button at top right [2].
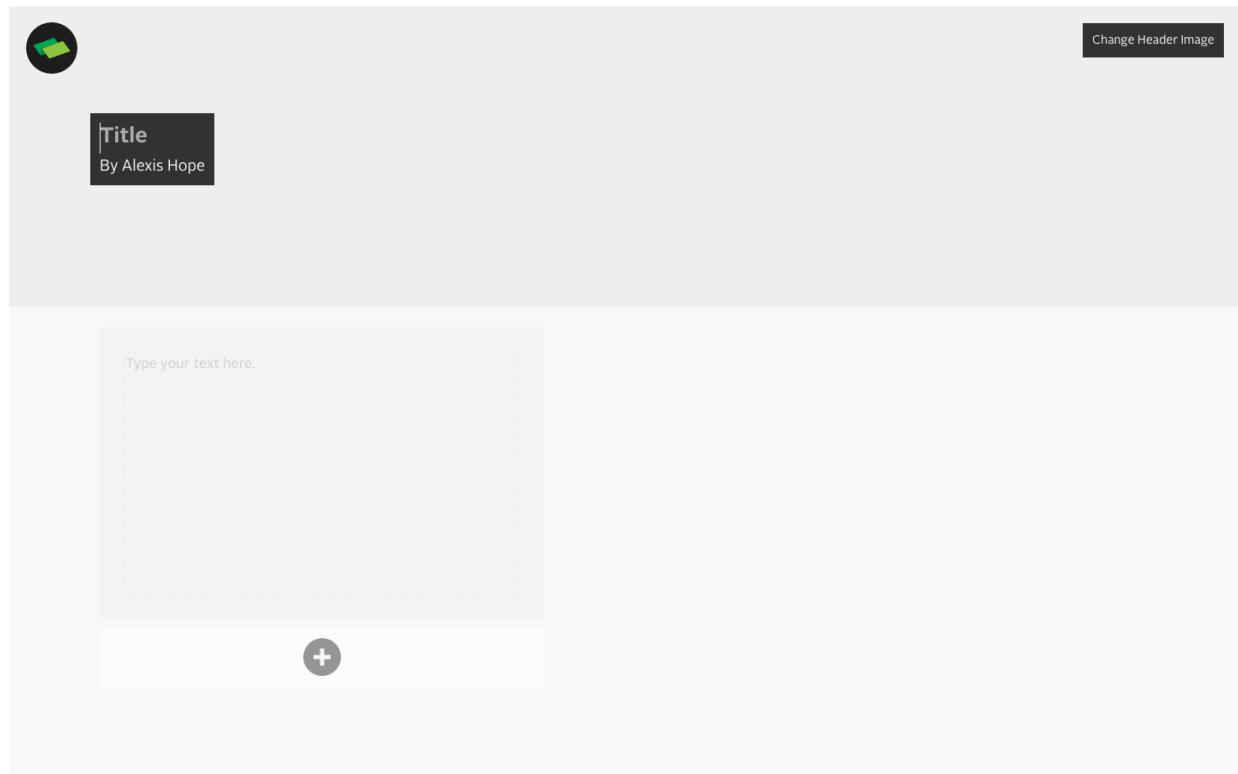
Figure 5.4: First view of creating a new story

Adding a narrative card with an optional section title

At any time, the user can click into the first narrative card they see and begin typing (Figure 5-5). To add an optional title [1], they can click the small "burger" menu[108] in the top right corner of the narrative card, which makes the section title area appear or disappear upon toggling.

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[108] Freyre, Antonio. "A brief history of the hamburger icon." Placeit blog. October 29, 2014. http://blog.placeit.net/history-of-the-hamburger-icon/
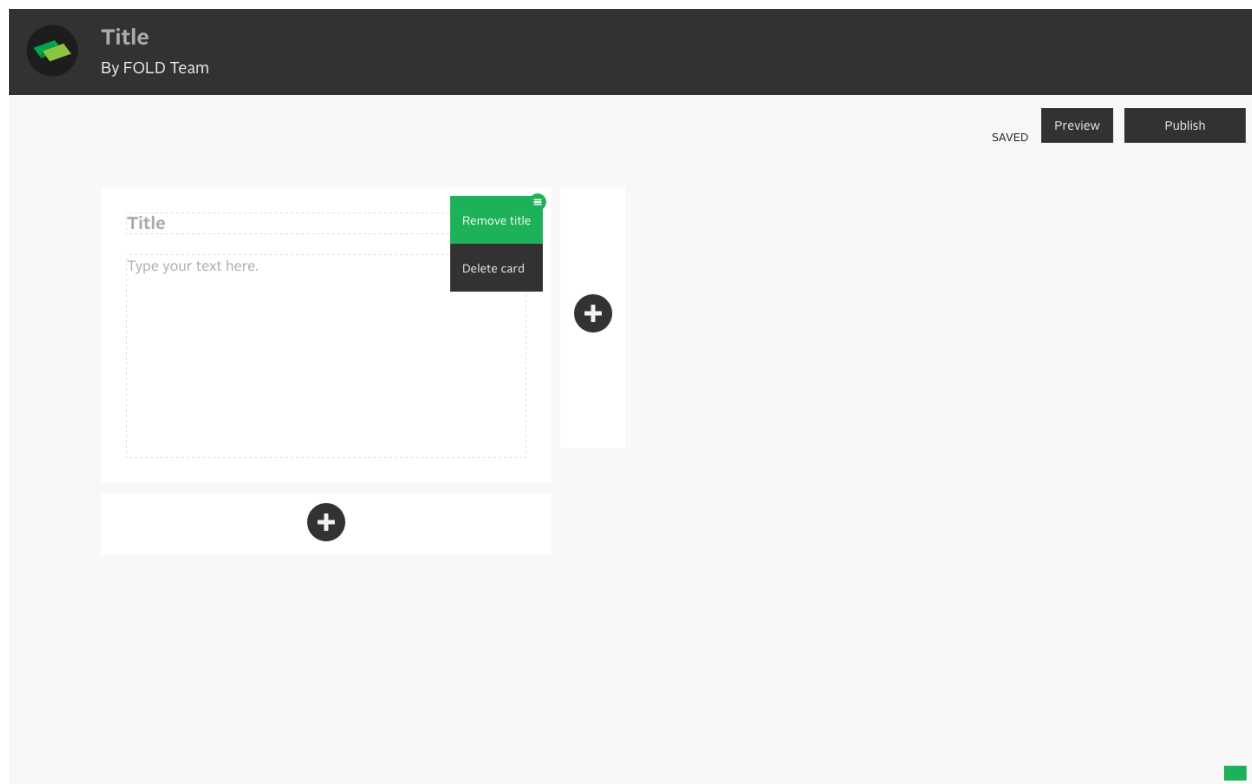
Figure 5.5: Toggling section title on and off

Formatting text

Writers can make use of light text formatting options as they type: bold, underline, and italics.
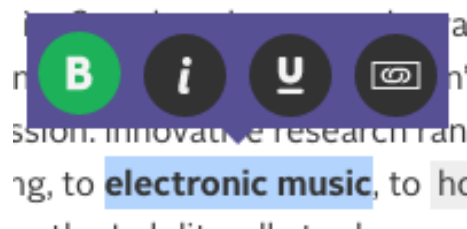
Figure 5.6: Text formatting options

Searching for content and adding a Context Card

When writers click the plus button to the right of each Narrative Card, the Context Card builder opens in that spot. From the Context Card builder, writers can choose a content type (e.g. video or map) and search from one of the web services described in Section 4.3.

When the search results are returned, they can preview them before adding the card to the row. For example, they can watch a clip of a particular video or listen to a song before adding it. If they have selected an image or a GIF, they are given the opportunity to add a caption, which remains editable after they've added the card. Bringing in content is designed to be as flexible as possible: if a writer has a particular video or photo in mind, they can paste the URL for that content directly into the search box and FOLD will retrieve the appropriate media through the APIs of each service.

To switch between different context types and repeat their searches, writers can click on the icons in the purple bar that represent each content type.
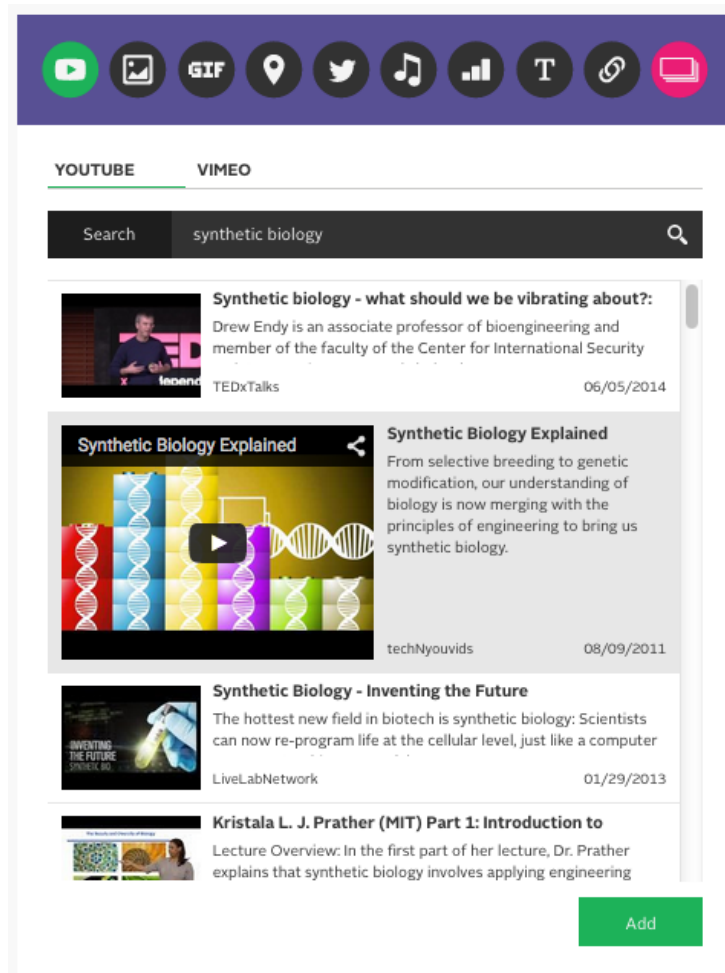

Figure 5.7: Searching for and adding a video context card

Rearranging a Context Card

Authors can flexibly rearrange cards within and between rows by clicking the "minimap" while they are editing the story. This opens the zoom out view, and writers can drag and drop the card where they would like it to be. Writers can also rearrange Narrative Cards up and down the stack, and when they do, all of the attached Context Cards also move with the anchoring Narrative Card.
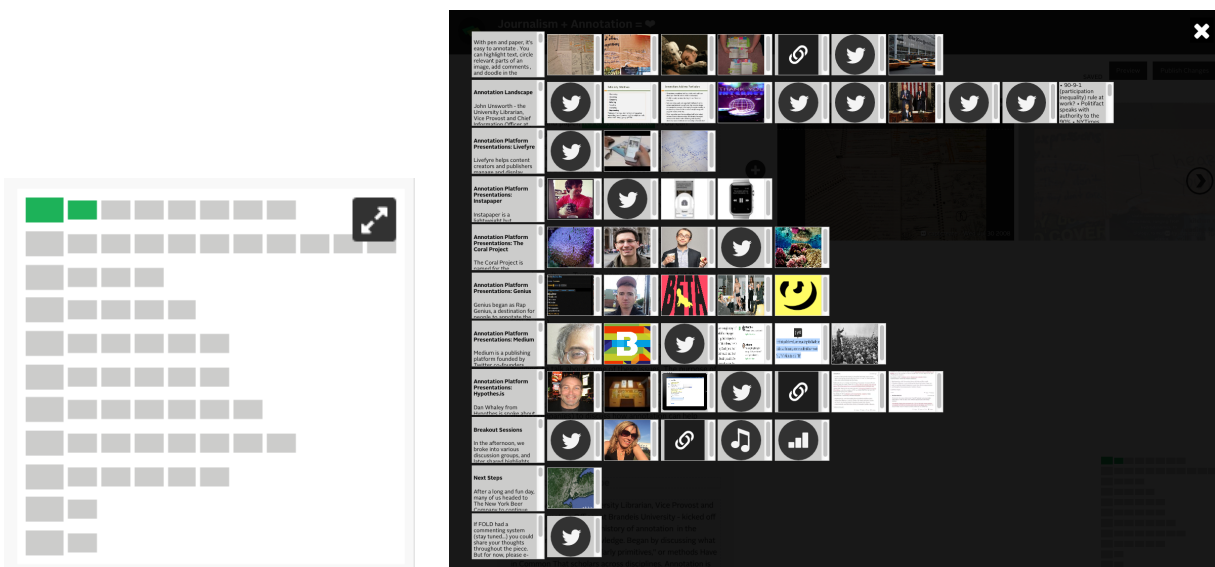
Figure 5.8, (Left): Minimap, found in the bottom right corner. Clicking opens the zoom-out, rearrange mode.

Figure 5.9 (Right): Zoom out mode, showing cards that can be rearranged individually, or by row.

Linking to a Context Card

Writers can link to a Context Card by highlighting a word or phrase in the Narrative Card. This opens a small menu which allows writers to either select from existing cards in the row, or add a new card that has not yet been created. If they elect to link and add a new card, the Context Card builder opens. Any Context Card they create will then be automatically linked to the text that was highlighted. To remove a link, writers can click the "X" that appears when they click on an existing link. Deleting a link does not delete the actual card that was linked. However, deleting a Context Card severs any existing link it has to the text.
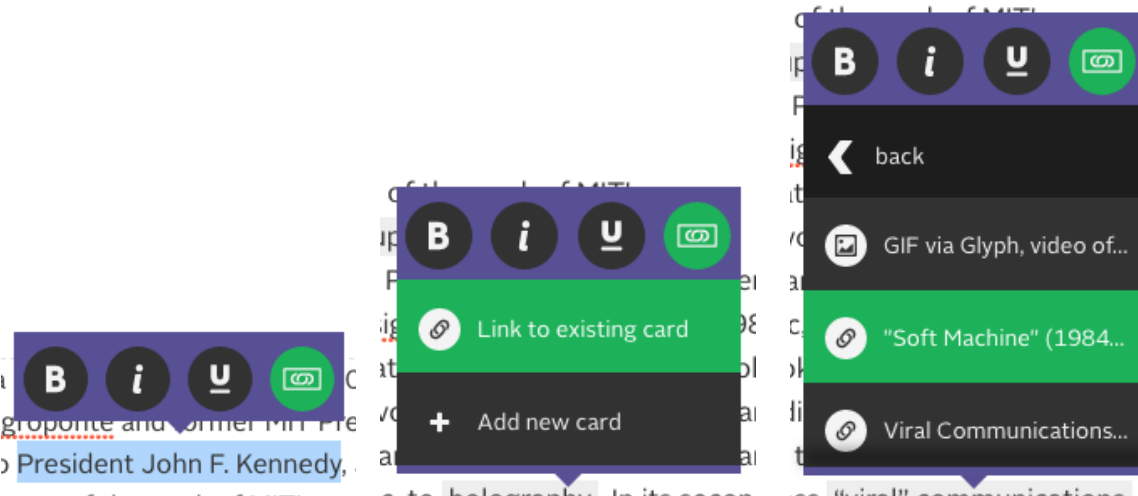
Figure 5.10, (Left): Context menu to link card to highlighted text

Figure 5.11 (Middle): The writer is prompted to link to an existing card or create a new card

Figure 5.12 (Right): List of existing context cards, with icons representing context types

Toggling between edit and preview mode

Although the authoring interface is very similar to the finished story, a writer can toggle between edit and preview mode to see exactly what their readers will experience.
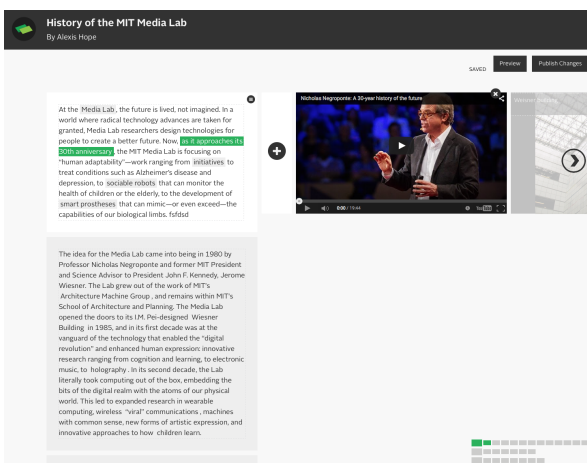
Figure 5.13, (Left): Edit mode with toggle in top right corner
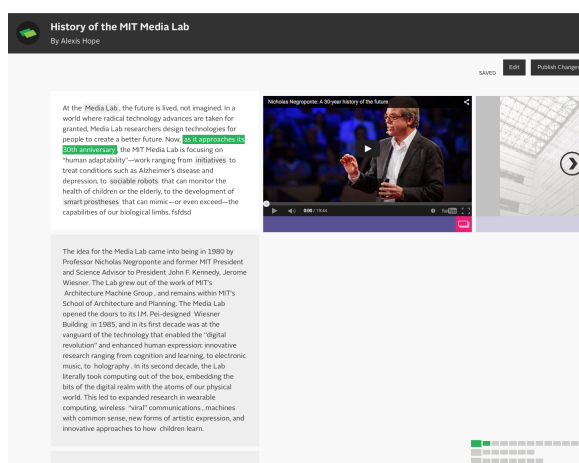
Figure 5.14 (Right): Preview mode with toggle in top right corner

Publishing a story

Once writers are ready to publish their story, they are asked to confirm both the title and header image (or invited to upload a header image if they have not done so already). They are also asked to provide tags for their story so it can be discovered later when site search is implemented. At this point, they are also given the opportunity to retain copyright of the Narrative Cards. As per the FOLD terms of use[109], Context Cards remain CC-BY by default, as they are designed to be re-used by other authors in the future.

Figure 5.15: FOLD publishing flow, including tagging and licensing options.

Social features: sharing stories, favorite stories, viewing and editing a user profile

Users can share stories directly on the page through integrations with both Facebook and Twitter. They can also favorite stories if they are logged in with their FOLD account. Stories that each user favorites appear on their user profile, and the number of favorites is incremented on the story browsing pages, indicating that a particular story has resonance with FOLD users.

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[109] https://readfold.com/terms

User profiles also include all stories a particular user has written, as well as brief biographical information and a photo. If the user has logged in through Twitter, this biographical information is imported directly to FOLD, but remains editable by users.
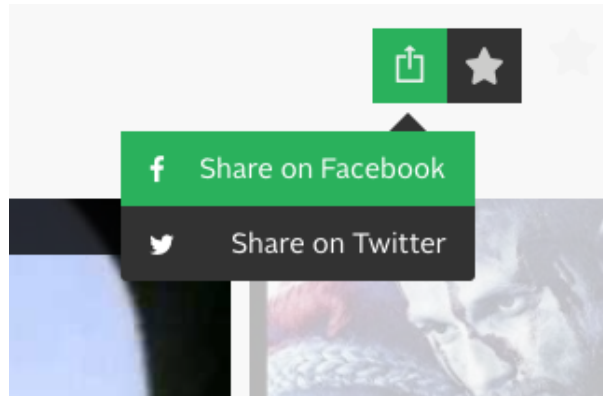
Figure 5.16: Integrated social sharing, favoriting features on FOLD.

Call to action

At the end of each FOLD story is a "call to action" in the form of an invitation to write a story. If a logged-in user clicks this button, they will be taken directly to the authoring interface to start making a new story. If the user is not logged in, they are prompted to either log-in or create an account.
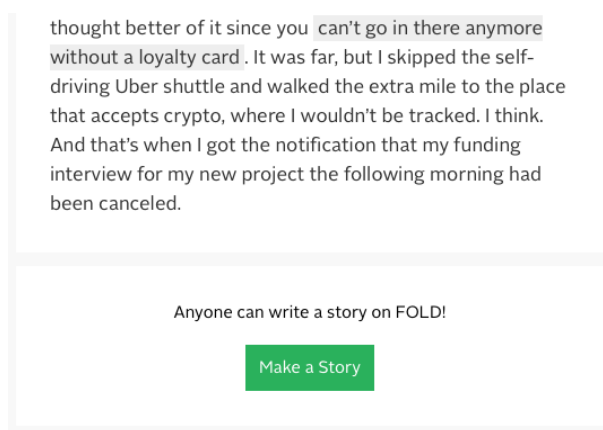
Figure 5.17: Call to action inviting readers to write their own story.

6. Evaluation

The public launch of FOLD was preceded by a short private beta, which began on April 5th, 2015. Participating authors were social and professional contacts of members of the FOLD team and were contacted to join the beta via e-mail. There were three main goals of the beta period: 1) to identify bugs that might appear under production-level use, 2) to collect initial user feedback to prioritize which features to implement before launch, and 3) to seed the site with initial content for launch.

An informal workshop, with open "office hours" for writers to drop by with questions or to co-write together, was held on April 17th. Seven writers attended the workshop, and bugs identified by these users were fixed in real time. Writers in attendance were a mix of professional journalists, bloggers, and people who seldom published long-form content online. In addition to the workshop, we also held individual meetings with writers to provide support and answer questions.

On April 22nd, 2015, FOLD was launched to the public, seeded with 16 stories written by writers who participated in the beta.

6.1 Quantitative observations

FOLD is integrated with Google Analytics, as well as instrumented for manual event tracking. This section will report on data collected over a three-month period following the launch. Unless otherwise noted, the period of data collection is from April 22nd to July 22nd.

This section will provide an account of use over this period (both in terms of reading and creating stories), which stories were the most widely read, and when possible, which specific features were used or not used. Additionally, this section will explore the geographic dimensions of site visits. In the following section (6.2 User feedback), I will contextualize these quantitative observations with qualitative data collected from interviews.

High-level metrics

In the first three months of use, FOLD has had 56,270 sessions and 36,301 users[110]. These visitors viewed an average of 2.1 pages per session, totaling 118,400 pageviews. Traffic peaked in the week following launch (thanks largely to social referrals) and has since declined, though several traffic peaks have occurred in the past three months when particular stories became popular.
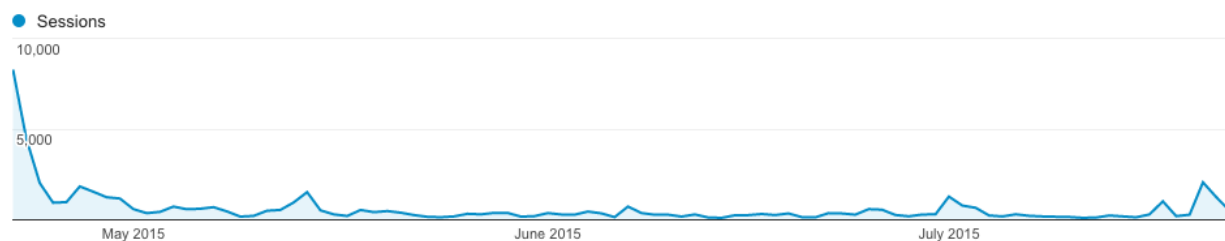
Figure 6.1: FOLD's web traffic during the three months following the launch on April 22nd, 2015

2,120 users have signed up for an account on FOLD thus far. Of these registered users, 1,080 (50.90%) either signed up through or linked their accounts with Twitter. The remaining users (49.10%) signed up with an e-mail address. In the three-month period, 454 stories were written by 336 unique authors. Of the 336 authors, the vast majority (88.70%) wrote only one story. The remaining 38 authors (11.30%) wrote more than one story, ranging from 2 to 19 stories.

Most popular stories

The top 5 most popular stories (according to number of page views) were:

i.   "Notes on Trekonomics" by J. Bradford DeLong (4,273 pageviews, 01:08:29 average time on page)

ii. "Animated GIFs in Visual Journalism: The State of the Art and Best Practices" by Savannah Niles (2,819 pageviews, 15:59 average time on page)

iii. "Dada Data and the Internet of Paternalistic Things" by Sara Watson (2,159 pageviews, 04:02 average time on page)

iv. "Fifty Years of Walking in Space and What We Found There" by Ru/Science (2,105 pageviews, 03:25 average time on page)

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[110] number of users in this context is based on Google Analytics normalization of sessions with unique IP addresses

    v.   "Choosing the Appropriate Metal Music to Listen to While Grading Master's Theses" by Ethan Zuckerman (2,088 pageviews, 07:45 average time on page).

Unpublished stories

Many users have begun writing stories on FOLD but never published them. There are 2,028 unpublished stories that exist in a draft state. While the majority of these stories were likely experimental and never intended for public publishing, we hypothesize (based on communication from users) that many people wanted to write stories to organize their own thoughts, to share with small groups, and to use internally within organizations that they are a part of. Although FOLD did not offer small-group or private publishing at launch, it is a feature we are considering based on this data and our conversations with users. Further, this data suggests that it would be worth incorporating additional features to make it easier to finish a story and otherwise encourage users to publish. This will be discussed in more detail in the Future Work section (8.2).

Evaluating FOLD's "Call to Action"

The "Call to Action" feature was implemented several weeks after FOLD's launch. As individual stories began to draw traffic to the site, we recognized a need to let people coming to the site to read stories know that they could also write them. While a prompt to "Make a Story" is prominent in the top righthand side of the homepage, that navigation bar currently disappears on an individual story. To remedy this, we automatically appended an invitation that read "Anyone can write a story on FOLD!" to bottom of every FOLD story, along with a button for this action (described in more detail in Chapter 5). While the vast majority of users start a story from either the homepage or their profile (exact numbers are unavailable due to a lack of granular detail in this case), 194 users clicked on FOLD's Call to Action at the bottom of a story that they read. Though we do not know how many of these users successfully published a story from this path, we are confident that these users may not have otherwise known they could write a story on FOLD at all, and the Call to Action serves as a way of informing users about FOLD's nature as an open publishing platform.

User Acquisition

Our users were mostly referred through social media (35.90%), with others arriving via referral (20.30%), organic search (7.90%), and e-mail (7.50%). An additional 28.40% of visitors arrived by either directly typing in the url, or via an unspecified referral path. For the users who arrived via a search engine, search terms are mostly not provided via Google Analytics, but when they are provided, the queries are typically "fold," "readfold," or search terms that lead to individual stories. The majority of our visitors used desktop (73.57%), though mobile and tablet traffic were also significant (21.63% and 4.80%, respectively).

Reader Behavior

Apart from the obvious up and down scroll, clicking the right arrow (51,196 events captured) was the most used micro-interaction on any page of FOLD, signaling that people were using this feature to explore context blocks. Readers also followed hyperlinks in the form of the link context card (1,718 referrals to outside websites). Internal FOLD hyperlinks--which bring context cards of all types into focus--were also heavily used (21,198 events captured). Lastly, logged-in users (who only represent a subset of overall readers) used the ability to favorite stories (376 favorites in total), though this action does not yet add value beyond listing favorited stories on individual profile pages. However, this suggests a willingness on the part of some users to engage with FOLD as a social system.

Writer Behavior

Writers made extensive use of available writing features. Toggling the preview view on and off occurred 2,280 times, demonstrating interest in seeing exactly what readers would see. Though FOLD's writing environment strives to be WYSIWYG, there are subtle differences between the author's view, and the published view.

There were multiple pathways to adding context cards. Though adding a context card using the large "plus" button was the most common (7,048 times), adding a new card by highlighting text within the narrative card was also used significantly (2,360 times), demonstrating useful redundance. Adding a context card by highlighting text within a narrative card results in an automatic link between the highlighted text and the context card. This link could also be made

manually by highlighting text and selecting an existing card from a drop-down list; this method was used 873 times by writers.

Global use

Though the majority of visits were from the United States (54.74%), FOLD was accessed from 154 other countries. Of the remaining 45.26% of non-U.S. visitors, the next largest country of origin was the United Kingdom (5.48%), followed by Canada (3.60%), Germany (3.20%), and France (2.40%).
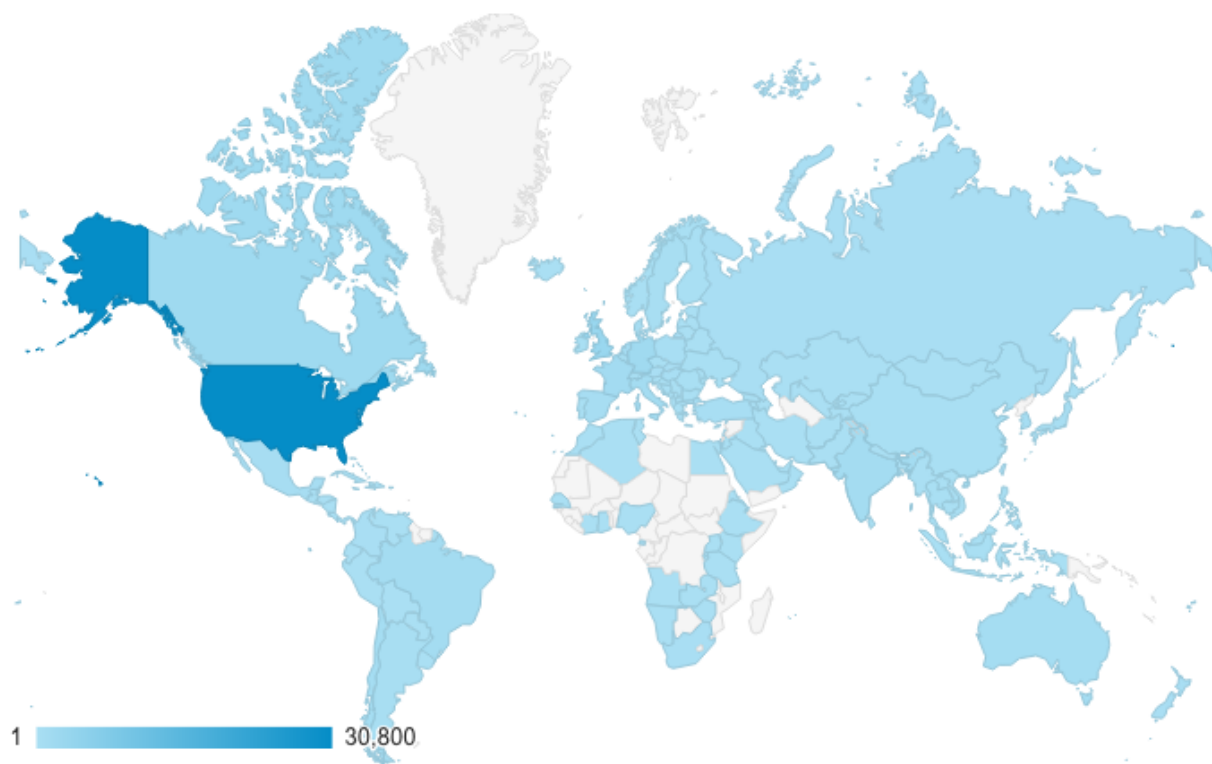
Figure 6.2: Heat map of sessions by country (via Google Analytics)

Though we do not have data about the number of stories written from countries outside of the United States, according to a manual count of all published stories, FOLD stories were written in 12 different languages.
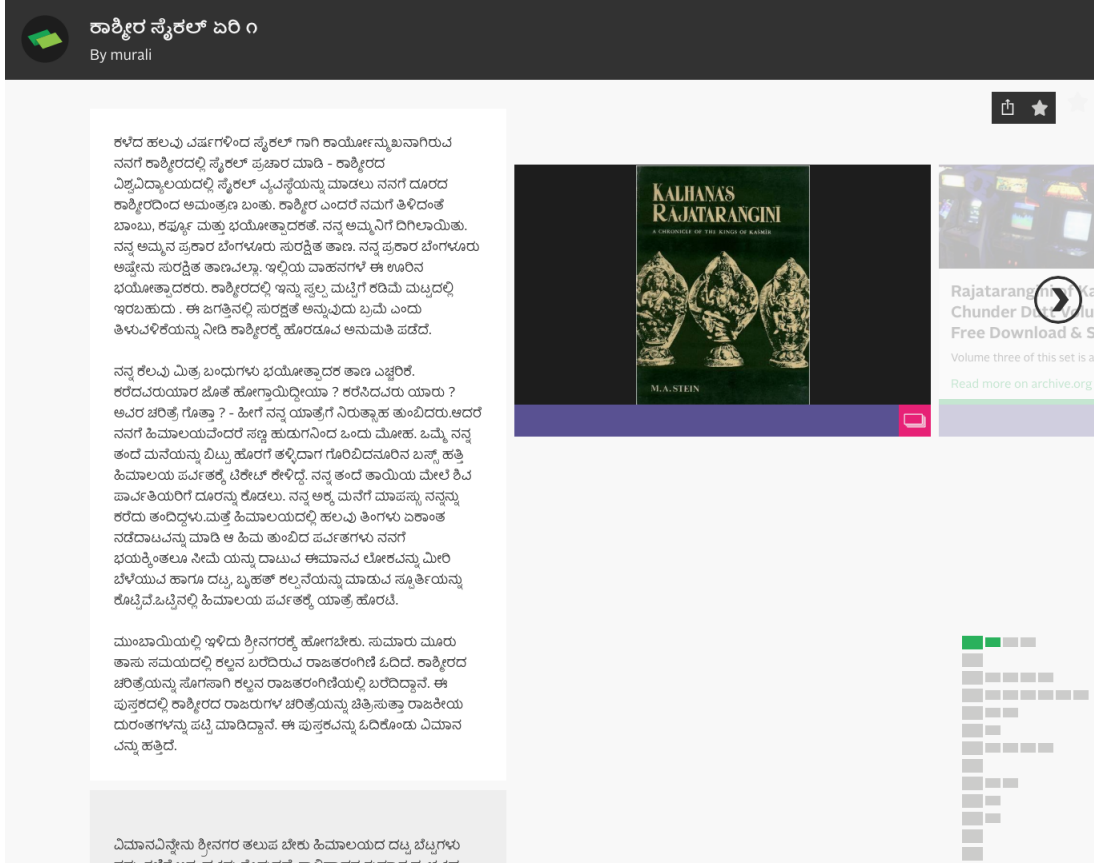
Figure 6.3: Story written in Kannada script, from a writer in South India

(https://readfold.com/read/muralihr/52ajbJu9)

6.2 User feedback

In early July 2015, I conducted 10 semi-structured interviews with writers who had published stories on FOLD to better understand their unique use cases and experiences using the tool. As part of these interviews, I also gathered background information about each participant's occupation, level of experience with online writing, and opinion about FOLD's applicability within their domain (a sample interview protocol can be found in Appendix 1).

6.2.1 Method

To recruit participants, I intentionally selected authors with different occupations, relationships to writing, and who had written stories across a wide variety of topics. Included in the population are professional journalists, long-time bloggers, activists, students, researchers, an artist, and a scientist. While many participants were new to online writing, some had been writing for the web for over 20 years.

Participants were recruited via e-mail, and interviews were conducted using telephone, Skype, or Google Hangouts according to each participant's preference. I took notes during each interview, with special care to capture short quotes and unique turns of phrase. Interview notes were analyzed using a thematic approach,[111] and shared with participants after they had been synthesized. The intention of these interviews is not to provide an exhaustive assessment of FOLD's usability, but rather offer an exploration of how the tool was used in a variety of contexts and by a diverse audience. Results presented in the following section are anonymized.

6.2.2 Findings

Through inductive analysis, I iteratively identified themes in the data. My analysis of the interviews pointed to five dominant themes, each of which is analyzed below.

For some, FOLD changes the writing process
While several users mentioned that FOLD did not change their writing process much (explaining that the narrative cards mirror paragraphs, and the context cards are hyperlinks), other users described the ways in which writing for FOLD was different. For example, the narrative cards encouraged one writer to "keep [his] writing economical," and another mentioned that it made her keep every paragraph as a "distinct idea."

Several participants explicitly mentioned that the tone of FOLD differed from other writing tools they had used. One reported that the "biggest revelation" of the tool was that it was "fun to

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[111] Glaser, B., and Strauss, A. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Aldine Publishing Company, Chicago, 1967.

write on," which made him "play with the cards." Another participant, who has limited experience writing online, reported that being able to search while writing reduced the burden of finding information to include. This same participant mentioned that experimenting with the search function inspired him to include animated GIFs in his piece (a synthetic biology tutorial) in order to make it more engaging and entertaining for his audience (participants in a workshop).

FOLD added extra work for some writers. For example, one participant (who was republishing a story on FOLD that his organization had published elsewhere) mentioned that he had to remake some of the graphics that they had used in the original story because they were formatted vertically, when only horizontal photos fill up an entire card on FOLD. Another participant mentioned that he began writing a story on Microsoft Word and collecting the links he wanted to include there, but halfway through switched to writing natively on FOLD (requiring him to copy and paste his text) because he "couldn't visualize the structure until [he] saw it."

Intended audience impacts use

When asked about the audience for their stories, most participants reported that they were targeting a "general audience" who might have limited familiarity with the topic they were writing about. Thus, context cards were often used to explain basic facts and provide pointers to more in-depth resources. One participant, a self-described activist and blogger, explained that the format of a FOLD story lends itself to "building a case" which worked well for how he was trying to communicate to his audience.

While most participants wrote stories intended for a public audience, one participant (who has written 22 stories) wrote some stories for the public, but many for himself to "organize [his] thoughts and citations." For these personal stories, there is less emphasis on formatting, grammar, and presentation. Another participant—a journalist—echoed FOLD's potential as an organizational tool, explaining that she could imagine using it to keep track of her notes about a complex crime story.

There are both barriers and opportunities for newsroom use

Four out of ten participants were professional journalists, and discussed potential uses for FOLD within a newsroom context. All of the journalists interviewed mentioned embedding as a necessary feature for the tool to be used by a news organization. One journalist mentioned that in order for FOLD to be widely used, it would take "someone big to try it and then they all would follow."

All of the journalists mentioned how it can be difficult to incorporate videos, audio, gifs, and photographs in their writing, as multimedia typically gets short shrift with other writing tools. Two journalists from different organizations explained that due to the editorial structure of their newspaper, they are not even allowed to add multimedia as that is done by "the digital team" who has greater access to the CMS. Perhaps because their existing tools make multimedia difficult to incorporate, all of the journalists reported that the ease of adding multimedia was one of their favorite features. One explained that he was "mindful while writing that he could use videos to provide context that might otherwise exist in his piece as "clunky background information."

One journalist described how context cards allowed her to "strip out the stuff [she'd] normally have to include in the main text." This was especially important for complex stories like the one she had written—an update about an unresolved murder trial that had been unfolding over 20 years. She stated that "every news organization has some stories like the one I wrote, where there are lots of aspects but they don't want them all there in the narrative...I can't think of a story that adding links and extra info wouldn't be helpful."

However, one journalist reported some ways in which FOLD could cause tension in newsrooms. He mentioned that many newsrooms dislike hyperlinks (as they take readers elsewhere), and some journalists might be wary of adding additional media to their stories. He explained that he told a reporter friend about FOLD and that friend rolled his eyes and said "oh great, something else to distract from my writing."

Participants see connections between FOLD and its design inspirations

When asked to compare FOLD to other tools they had used or heard of, the most frequently referenced tools were Genius, HyperCard, Medium, Wikipedia, Storify, and Vox Cards. Some participants likened the interface to non-specific examples that they had seen elsewhere on the web that pushed content to the side of a main story as annotations. One participant saw similarity between FOLD and task management tool Trello, which organizes discrete elements as cards that can be rearranged, commented on, shared, and archived. The same participant also referenced Xanadu, the Memex, and the Talmud (all discussed in chapter 2) as conceptually similar to FOLD.

Giving authors more control could improve the writing experience

Participants had many ideas for features to add to improve FOLD, across three broad categories: improving the writing experience, adding ways to interact with readers, and improving the reading experience. Unsurprisingly, most of the proposed features related to improving the experience for writers, including: the ability to write in markdown, analytics for authors, embedding, making link descriptions editable, an option to select only a clip of a video, support for full-header gifs, the ability to edit fonts, improving the card reordering experience, and more ways to structure the narrative (e.g. group certain cards as sub-sections, or prioritize a context card for a particular row). Proposed features for interacting with readers included commenting, annotations, and better integration with social media. To improve the reading experience, participants suggested the addition of a newsfeed (to see new stories on FOLD written by people you know), the ability to enlarge images, and an improved mobile experience.

7. Authors and Audiences

FOLD was originally designed to support the creation of explanatory news content, explained in Section 3.1. Although our initial group of users in the beta test period included many journalists and bloggers, the tool has seen wide use across a number of other story genres, many of which we did not anticipate. This section 1) highlights 6 general categories of stories published on FOLD to date, 2) provides a count of stories of each type, and 3) introduces representative stories for each category to illustrate how the structure and features were used differently across genres. Each story (of 454 published stories) was hand-coded and assigned to a category. Stories which appear to have been published simply to test FOLD are excluded from this taxonomy.

7.1 Education

FOLD was used both by students and teachers, and 77 stories make up this category. Several teachers used FOLD to display syllabi or describe an assignment. One innovative story, "Organen en Weefsels,"[112] (*Dutch: Organs and Tissues*) used the context cards to structure a quiz associated with curriculum about human anatomy.

Many assignments posted on FOLD were then expected to be completed on FOLD. For example, 41 students in a high school Advanced Placement Biology class each wrote a story about a different topic related to their upcoming exam[113]. Students used context cards primarily to include videos, images, and animated GIFS. Fourteen students at Molloy College in New York used FOLD to experiment with "Glitch Art" as instructed by their professor[114]. In these stories, the students used context cards to showcase original and glitched images alongside a text description of how the changes were made.

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[112] Malmberg. "Organen en Weefsels." FOLD. June 13, 2015. https://readfold.com/read/mz2/organen-en-weefsels-KvkvtEEF

[113] Laura. "Assignment for AP Biology 2015." FOLD. May 5 2015. https://readfold.com/read/lborrelli/assignment-for-ap-biology-2015-xr7HRArE

[114] Applegate, Matt. "A Short History Lesson in Digital Writing & Design." FOLD. July 12, 2015. https://readfold.com/read/mapplega/a-short-history-lesson-in-digital-writing-design-SLekv42X

During FOLD's beta (before the tool was made publically available on April 22nd), a journalism class at Columbia College in Chicago was invited to use FOLD as part of a class about Online Journalism. The aim of the class was for students to explore new roles for journalists, and new ways of presenting their work. Eight students wrote stories using FOLD, on topics including sports[115], coverage of local protests[116], and upcoming events[117].

Students in other journalism courses used FOLD to write stories as a team. For these stories, (e.g. "Jyllands-Posten Muhammad cartoons controversy[118]"), students signed up for a single account that included multiple names in the byline. Although FOLD does not currently support collaborative writing, students circumvented the limitation by signing up for a joint account.

7.2 Journalistic pieces, explainers, and event reporting

Journalistic pieces and explainers were common uses for FOLD, and 66 stories make up this category (9 coded explicitly as examples of explainers).

One of the most popular stories on FOLD was an explainer that provided background information on bitcoin ("After Ross Ulbricht, let's not forget bitcoin is not all about the dark web"[119]). This story was an attempt to provide context for a newsworthy event; earlier that week the creator of Silk Road, Ross Ulbricht, was imprisoned for the sale of illicit drugs. In this piece, the author made heavy use of context cards as annotations to explain specific words and phrases, which he made bold to signify that they were distinct concepts.

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[115] Ryne, Michael. "Blackhawks Look to Capture Stanley Cup Again." FOLD. April 22, 2015. https://readfold.com/read/MichaelRyne/blackhawks-look-to-capture-stanley-cup-again-Swdodgxx

[116] Vinston, Samantha. "#AdjunctTruth and the fight for 15." FOLD. April 22, 2015. https://readfold.com/read/SamVinton/adjuncttruth-and-the-fight-for-15-FyLcMQmD

[117] Rajnicek, Hannah. "Earth Day in Chicago." FOLD. April 22, 2015. https://readfold.com/read/HannahRajnicek/earth-day-in-chicago-KgSJtkoP

[118] Buckley, Morgan; Cagle, Sara and Cachero, Paulina. Jyllands-Posten Muhammad cartoons controversy. May 8, 2015. https://readfold.com/read/mcbuckle/jyllands-posten-muhammad-cartoons-controversy-w8Z4Nasp

[119] David, Juan. "After Ross Ulbricht, let's not forget bitcoin is not all about the dark web." FOLD. June 1, 2015. https://readfold.com/read/JuanDavid1891/after-ross-ulbricht-lets-not-forget-bitcoin-is-not-all-about-the-dark-web-6jYTBHLX

Several science writers used FOLD to create photo essays (e.g. "Of Microbes and Men[120]"). These stories were heavily narrative-driven, and each horizontal row typically had one or two photos as context cards. Another piece, by a science and environmental reporting team from Russia, covered 50 years of spacewalks and associated discoveries[121]. This story made heavy use of context cards, showcasing videos, animated GIFs, and many links to external websites —particularly pointing to official sources of information about space from organizations like NASA and the Canadian Space Association.

Other journalistic pieces on FOLD included sports reporting[122], historical context for newsworthy events (e.g. U.S. and Cuban relations[123]), photography accompanying reporting[124], and political coverage[125].

FOLD was used at several events and conference as a live-blogging or event reporting tool, with 10 stories in particular demonstrating this use case. These stories, covering events like discussions at the Harvard Berkman Center[126], the Global Editors Network Summit[127], a panel

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[120] Schwartz, Sarah. "Of Microbes and Men." FOLD. May 11, 2015. https://readfold.com/read/schwartzies/of-microbes-and-men-tZzRCQpp

[121] Ru/Science. "Fifty Years of Walking in Space and What We Found There." April 22, 2015. https://readfold.com/read/riascience/fifty-years-of-walking-in-space-and-what-we-found-there-uRTtQWQo

[122] Darlet, Boris. "Tirages au sort, OM, Top 14, NBA : l'actu sur un plateau." FOLD. April 24, 2015. https://readfold.com/read/Boris_D/tirages-au-sort-om-top-14-nba-lactu-sur-un-plateau-ozW2bnWm

[123] Kalan, Jonathan. "U.S. and Cuba: The Storied History From Columbus to Obama." FOLD. April 22, 2015. https://readfold.com/read/KalanThinks/us-and-cuba-the-storied-history-from-columbus-to-obama-MHqxywk2

[124] Chanelle, Andy. "Migrants on the Mediterranean Sea." FOLD. April 24, 2015. https://readfold.com/read/andychannelle/migrants-on-the-mediterranean-sea-PrL4Tf2u

[125] Jacob, Oliver, and Aziza. "Puppet Politics." FOLD. May 8, 2015. https://readfold.com/read/joa/puppet-politics-jour-201-qpbeJomd

[126] Freitas, Nathan. "Wind Farm 0: If there was suddenly no Internet, what would we do?" FOLD. May 19, 2015. https://readfold.com/read/n8fr8/wind-farm-0-if-there-was-suddenly-no-internet-what-would-we-do-hGCcDRnh

[127] Auguste, Sumi Saint. "GEN Summit 2015." FOLD. June 26, 2015. https://readfold.com/read/sumi/gen-summit-2015-8E6CduD6

at the Open Data Conference[128], and a virtual campus walk[129], combined original photos with links and tweets.

7.3 Tutorials, Experiments, and Recipes

FOLD was occasionally used to teach the reader how to do something, and 7 stories make up this category. Included are explicit tutorials, science experiments, and recipes. Generally speaking, stories of this nature had a step-by-step structure.

Justin Pahara, COO of synthetic biology company Synbiota, used FOLD to create a tutorial explaining how to engineer E. Coli to be colorful[130]. This step-by-step tutorial, aggregating video resources the company had created previously, was used in several in-person workshops. Other writers used FOLD to present recipes, which including ingredients, photos, and instructions (e.g. "A Culinary Vacation"[131]). Two other writers, scientists from Berkeley, used FOLD to describe experiments they conducted using a 50-cent microscope called the "Foldscope[132]." These pieces blended the scientist's personal narrative with replicable steps so that readers could conduct the experiments on their own.

7.4 Artistic and expressive works

Many FOLD stories fall under the broad category of "artistic and expressive works," and 48 stories make up this category. This category includes annotated poetry, short stories, personal narratives, humor writing, and more.

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[128] Mejabi, Ome. "Data+Elections session at 3rd International Open Data Conference 2015." FOLD. May 28, 2015. http://readfold.com/read/ovmejabi/dataelections-session-at-3rd-international-open-data-conference-2015-sfe7ntCt

[129] Blaylock, Vanessa. "Jane's Cyberspace Walk 2015." FOLD. May 8, 2015. https://readfold.com/read/vanessa/janes-cyberspace-walk-2015-2sDrcHYP

[130] Pahara, Justin. "Learn Synthetic Biology! Synbiota's Rainbow Factory." FOLD. July 6, 2015. https://readfold.com/read/jpahara/learn-synthetic-biology-synbiotas-rainbow-factory-NPeboFiq

[131] Chou, Sophie. "A Culinary Vacation." FOLD. April 22, 2015. https://readfold.com/read/mpetitchou/a-culinary-vacation-taPuwCfd

[132] Hata, Tom. "Melting a seaweed skeleton in the name of frugal science." FOLD. June 16, 2015. https://readfold.com/read/tamatoh/melting-a-seaweed-skeleton-in-the-name-of-frugal-science-wXFWCkwS

Poetry, which was a significant subset of this broader category, typically combined text with images and animated GIFS (e.g. "A Compilation of my Poetry"[133]). Other works of fiction took the form of short stories, like Sara Watson's "Dada Data and the Internet of Paternalistic Things"[134]—a speculative fiction piece. As the story was extrapolating from many present-day news stories and technologies, context cards included both images and links to external articles that provided present-day context. Some expressive stories were non-fiction, like Sophie Chou's "A Completely Unbiased Autobiography by my Great-Aunt Lenore,"[135], which combined family history with archival photos.

Many stories were humorous, like Ethan Zuckerman's piece "Choosing the appropriate extreme metal music to listen to while grading Masters' theses"[136], a description of the death metal music he selects to accompany grading theses. Another piece, "Dating in China vs U.S"[137] offered cultural commentary alongside comedic photographs.

7.5 Other

FOLD was used for many diverse purposes that did not achieve critical mass, such as book reviews, activist pieces, advertisements, resumes and portfolios, personal note-taking, travel writing, and many more. Each of these uses pushed the tool in new and unexpected directions, and in the future, we may develop tools to further support some of these use cases.

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[133] Harter, Lauren. "A Compilation of my Poetry." FOLD. June 5, 2015. https://readfold.com/read/Quirky_Llama/a-compilation-of-my-poetry-G96LWEzw

[134] Watson, Sara M. "Dada Data and the Internet of Paternalistic Things." FOLD. April 22, 2015. https://readfold.com/read/smwat/dada-data-and-the-internet-of-paternalistic-things-TsZQXLjK

[135] Chou, Sophie. "A Completely Unbiased Autobiography by my Great-Aunt Lenore." FOLD. July 11, 2015. https://readfold.com/read/mpetitchou/a-completely-unbiased-autobiography-by-my-great-aunt-lenore-eTKBD32N

[136] Zuckerman, Ethan. "Choosing the appropriate extreme metal music to listen to while grading Masters' theses." FOLD. May 2, 2015. https://readfold.com/read/EthanZ/choosing-the-appropriate-extreme-metal-music-to-listen-to-while-grading-masters-theses-SESbL2qK

[137] Thumbmedia. "Dating in China vs U.S." FOLD. July 9, 2015. https://readfold.com/read/Thumbmedia/dating-in-china-vs-us-sZGTHQj4

8. Conclusion and Future Work

8.1 Future Work

Based on interviews with users and analysis of early usage data, there are an number of avenues for future development. Specific features to improve the writing experience could help promote wider use, such as providing analytics for authors, adding an option to select only a clip of a video, improving the card reordering experience, supporting collaborative writing, and including more ways to structure the narrative (e.g. group certain cards as sub-sections, or prioritize a context card for a particular row). FOLD's mobile experience is still rudimentary, and more design iterations should be explored to provide an optimal experience. Context cards on FOLD are designed to be modular and potentially reusable and remixable—currently, stories on FOLD exist as separate universes, and further research will shed light on opportunities for linking independent stories through shared context.

8.2 Concluding Remarks

FOLD uses visual structure to address the problem of including context alongside stories. By making it easy for writers to create narratives that weave together media curated from across the web, FOLD helps people share and discover new fields of knowledge.

The first contribution of this thesis is a set of design principles for creating a system that enables authors to craft a coherent yet modular narrative experience that prioritizes contextualization. The second contribution of this work is a an open platform with a new interface and associated user experience for adding multimedia context to stories in the form of "cards." Quantitative evaluations of the system were presented, as well as results from an interview study with 10 FOLD users.

Appendix 1: Sample semi-structured interview protocol

i. How long have you been writing? Writing online?

ii. How did you hear about FOLD?

iii. What did you use FOLD for?

iv. Why did you choose to write that particular story?

v. How was the piece you wrote for FOLD different than other stories you've written?

vi. Did the card format change how you write?

vii. Who was the main audience you were targeting with your piece?

viii. Did you get any feedback on your post from someone who didn't know about FOLD already?

ix. Are there any tools FOLD reminds you of?

x. What other writing or publishing tools do you use?

xi. What are 1 - 2 features you liked?

xii. What are 1 - 2 features you'd like to see?

xiii. Do you think a newsroom (blogger/activist/scientist) could use something like FOLD? Why or why not?