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Master's Thesis  
Academic Year 2014

Re-imagining the Display of News on  
Smartphones Using a Data Time Series Approach

Graduate School of Media Design,  
Keio University

Keita Saito

A Master's Thesis  
submitted to Graduate School of Media Design, Keio University  
in partial fulfillment of the requirements for the degree of  
MASTER of Media Design

Keita Saito

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Abstract of Master's Thesis of Academic Year 2014

# Re-imagining the Display of News on Smartphones Using a Data Time Series Approach

Category: Design

## Summary

The fundamental building block of a healthy democracy is a healthy media environment, one that is predicated on the effective dissemination of news on important current issues. As consumers continue to move towards the mobile space, journalism must also strive to maintain its integrity. With the intention to create an in-depth reading environment on Smartphones, this thesis proposes a novel design for news delivery: the *Data Time Series* format.

The primary goal of this format is to utilize data journalistic techniques in order to trigger user interest in news topics and to further enhance reader engagement with important current issues, but without disrupting reading style preferences on Smartphones. Furthermore, the combination of curated content and data visualizations serves as a method to facilitate the quick and holistic comprehension of an issue at hand.

Through an ethnographic study of a functional prototype, the proposed design of the Data Time Series format proved to be successful in triggering user interest under the condition of high topic involvement by the user. Implications of specific design decisions are further discussed.

## Keywords:

Data Journalism, Data Visualization, Mobile Apps

Graduate School of Media Design, Keio University

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# Chapter 1

## Introduction

In the last 10 years, a wave of smaller, faster and smarter communication devices have taken the world of news reporting by storm. The proliferation of network infrastructures and mobile devices such as Smartphones have enabled a state in which people are ubiquitously connected, with processing power increasing at an exponential rate in accordance to Moore's Law. Traditional news organizations have generally adapted slowly to this shift, while a multitude of tech startups are already providing news services suggesting new ways in which readers can consume news. There are numerous opportunities for news organizations to re-imagine the delivery of news content.

This thesis suggests a particular method of news delivery: the *Data Time Series* news format. This format was designed to address three key issues surrounding current trends in news consumption.

First of all, the rise of new digital technologies such as the Smartphone signifies a natural need for news content to adapt in accordance to the new medium. Smartphone adoption is increasing at a remarkably fast rate, with Smartphone users worldwide estimated to reach a total of 1.75 Billion by the end of 2014 (EMarketer, 2014). As a result, users will continue to shift towards consuming the news on Smartphones as a primary source to fulfill their daily information needs. According to a 2014 Reuters Institute report of worldwide news consumption, on average 20% of all users of digital devices already consider the Smartphone as their main method of accessing online news (Newman and Levy, 2014). Such changes are important as they signify a new era of reading styles for users, which

will inevitably impact the way news organizations should package, distribute and discover news content. Most major news brands have already recognized this trend and are attempting to stay relevant to today's consumers by re-imagining the news reading experience. The Data Time Series format aims to utilize interactive capabilities offered by Smartphones, while creating an alternative reading experience of news content on Smartphone news applications.

Second, the Data Time Series format addresses a key issue in current content delivery methods on Smartphone news apps: a low level of in-depth reading. Current news applications have effectively addressed the issue of news surplus and overload across a broad spectrum of digital content. The emergence of news aggregators, curation apps, news blogs and social networking sites have provided users with an array of options to encounter their most personalized news articles. In fact, iPhone news apps have been found to be negatively associated with perceived anxiety from information overload for its simplicity in information retrieval (Holton and Chyi, 2012).

However, this has arguably given rise to a particular reading behavior that is worth addressing. While the adoption of aggregators and news curation apps suggest a more frequent and 'intensive' exposure to news content, reading habits are increasingly shifting towards shorter and more fragmented reading sessions (Aggarwal, 2014). Arguably, people are not 'reading' the news, but are effectively 'snacking' on content that interests them during a particular time.

Based on these trends, this thesis makes the assumption that redesigning the current news format could have the potential to elevate the news reading experience, without significantly disrupting current reading style preferences. Accordingly, this thesis does not suggest a dramatic shift away from the current reading style preferences, underscored by the notions of convenience, mobility and personalization, but suggests an alternative content delivery format that could address more in-depth and holistic information needs for the user.

Third, a great opportunity exists in utilizing data journalistic practices to enhance user engagement on Smartphone news apps. Given the sheer scale of openly accessible data via sources such as the government, open source websites and research companies, as well as the ubiquity and power of software for data acquisition, processing and analysis, the utilization of data in news content has

the potential to increase the depth of reporting and significantly accelerate the process of journalism from source to delivery (Flew et al., 2012). Moreover, the current velocity of technological change will surely increase the importance of this topic in the near future. Despite its clear increase in currency, data journalistic practices are still quite limited in scope. The Data Time Series format provides a gateway into understanding and addressing certain niche needs that have yet to be served by current renditions of data-driven journalism.

A prototype was developed in accordance to the design specifications, which are grounded on theoretical techniques that have been provided by communication scholars. Through a comprehensive ethnographic study, the proposed design of the Data Time Series format proved to be successful in triggering user interest under the condition of high topic involvement by the user. Moreover, when interest was triggered, users consistently desired to look deeper into the topic and engaged with the content at a holistic level. Meanwhile, structural improvements on factors such as data visualization production and article selection are crucial to optimizing the proposed format's behavioral impact.

This thesis is divided into six separate chapters. Chapter 2, which follows, will cover the academic literature surrounding the design of the Data Time Series format. Then, Chapter 3 will define the design concept, as well as describe the theoretical context and design specifications. Chapter 4 will provide the methodology and results of the evaluation of the proposed format. Chapter 5 will discuss key learnings and insights from the evaluation. Finally, Chapter 6 will conclude with suggestions for future research.

# Chapter 2

## Literature Review

The *Data Time Series* format proposes a reproducible template for native Smartphone news applications with the intended purpose of drawing reader attention towards important current issues. Furthermore, readers are encouraged to engage with the given subject at a deeper level by understanding the facts and connecting several different sides of the story into a holistic picture. The following chapter will provide a multidisciplinary review of findings from three academic fields that are relevant to the proposed news format in an attempt to clarify the type of learning opportunities that exist within this research.

To build a theoretical context for understanding behavioral effects of the Data Time Series format, this chapter will begin with a review of Social Science research on the ecology of news consumption in the digital age, discussing the gap that exists between editor decisions and reader interest, studies on selective exposure and the so-called ‘Filter Bubble,’ followed by medium specific implications of Smartphone usage for news consumption.

The next section will cover the latest trends in data journalism, a field of study that emerged from the increasing attention towards combining data analytics and graphic design into the journalistic practice. The section will begin with an overview of literature on the state of news organizations today and how the news production process is in the midst of re-invention. This will be followed by a discussion of the transformative opportunities of data journalism, which will not only provide background for understanding the institutional reasons for re-imagining news content, but also to understand how the Data Time Series format

can work in tandem with the evolving newsroom.

Finally, this chapter will introduce current scholarship in data visualization research, particularly to understand the narrative techniques used within the Data Time Series format, as well as previous studies on how data visualizations affect its audience in different ways. Moreover, this section will introduce a number of general examples of previous research on designing data graphics specifically for Smartphones.

This chapter will conclude with a brief summary of how research on the proposed Data Time Series format can contribute to existing scholarship.

## **2.1. The Ecology of News Consumption**

Many of the design decisions of the proposed Data Time Series format are predicated on the rapid proliferation of new technologies and takes into consideration the shifting trends in news consumption. Information gathering and news delivery have changed remarkably through new technology applications, giving rise to discourses on the implications of introducing new formats. This section will begin by providing an overview of current research on the existing tensions between editor decisions and reader interest, followed by an assessment of the issue of selective exposure on the Internet. Finally, the potential utilities of Smartphones usage will be discussed.

### **2.1.1 Editor Decisions and Reader Interest**

A growing area of literature in journalism scholarship has been on the issue of whether or not a gap exists between news editor decisions on content and news reader interest. In a recent study of 11 online newspapers in Western Europe and Latin America, Boczkowski et al. (2010) observe that journalists considered public affairs news such as stories about politics, economics and international matters as the most newsworthy, while consumers were substantially less interested in those topics. The findings also suggest that the gap is likely to increase if audiences were continually presented with more nonpublic affairs stories. Singer's (2011) study of British newspapers also supports the existence of a choice gap in which only a third of editor's choices attracted news readers.

The thematic gap between news choices of journalists and consumers has given rise to discourses on the societal role of journalism to enhance political knowledge and civic participation in modern democracies. Boczkowski and Peer (2011) suggest that consumers are increasingly becoming a part of news production and that the function of media organizations as an agenda-setter is weakening. While this signifies an important shift towards the democratization of media content, especially through open platforms such as the Internet, scholars raise concerns on what might happen if consumers' choices shaped a large share of media content (Boczkowski and Peer, 2011; Singer, 2011). Singer (2011) notes that news readers "do seem drawn to accounts of mishaps and misdeeds, as well as to accord space on their news agenda to the quirky and the curious." Commonly referred to as 'soft' news content, scholars have pointed out the potentially negative consequences stemming from the decline of political knowledge, an issue readily associated with consumption of news stories with a comparatively low level of substantive informational value (Prior, 2003). While it is important for news organizations to follow market interests for survival, scholars agree that the media still plays a crucial role as a public watchdog over other powerful actors in society (Baker et al., 2002; Boczkowski and Peer, 2011; Lazarsfeld and Merton, 2000).

The body of research serves as a gateway into further conceptualizing news formats that are effective both as an informant of important current issues, as well as a piece of entertainment that genuinely triggers reader interest. Further research is essential to understand the prospects of curating news content in a way that matches user interest with valuable discourses surrounding public affairs.

### **2.1.2 Selective Exposure on the Internet**

An issue persistent among communication scholars is in the pessimistic outlook of the Internet as a potential driver for selective exposure to information. Selective exposure, or the act of filtering out information based on preferential biases, has been commonly associated with the induction of attitudinal polarization and political fragmentation in issue priorities (KnoblochWesterwick and Meng, 2011; Pariser, 2011; Stroud, 2010; Sunstein, 2001). The primary mechanism of information exposure on the Internet, which involves the heavy emphasis on individual user choices (i.e. choosing a website to visit and who to follow on social media)

and automated algorithmic choices (i.e. search engines, news aggregators and feed ranking algorithms), has been criticized as causing people to fall into a so-called ‘Filter Bubble’ (Pariser, 2011).

To resist negative consequences of political fragmentation and to promote civil discourse on the Internet, Kelly and Resnick (2013) suggest architectural changes to information delivery mechanisms based on the assumption that selective exposure is the product of a behavioral attraction to pro-attitudinal information paired with a much weaker aversion to counter-attitudinal information. The scholars suggest a number of design changes to personalized information services: to provide only high-quality challenging items; to provide challenging information only in the context of specific topics of interest; to inform people about the prevalence of challenging opinions; and to reinforce the norm of balanced exposure. Similarly, Resnick et al. (2013) also call for the development of systems that provide diversity when aggregating the news or that inform the user for their imbalances in news exposure.

Researchers have experimented with potential delivery formats that mitigate the risks of causing selective exposure. Nagulendra and Vassileva (2014) attempt to control selective exposure through an interactive visualization that tells the user of his/her information consumption imbalances. The system proved to be successful in promoting user awareness and understanding of personal biases towards selecting information. To provide a systematic delivery format that allows for effective navigation through different types of information, Yom-Tov et al. (2013) suggest a method of assisting people to read divergent opinions by providing content with a diverse set of viewpoints but with a similar language model. Through empirical analysis of user behavior on a search engine employing those tactics, the researchers were successful in significantly increasing the level of diversity in information consumption for each user. Similarly, Park et al. (2009) demonstrated that displaying multiple articles about the same news event, divided into clusters that illustrate different sides of the event, causes people to read more diverse news stories than a randomly selected list.

While Internet users have more freedom than ever to selectively seek information, previous research suggests technological and design opportunities to mitigate the risks of users falling into a ‘Filter Bubble.’ However, practical and

user-oriented design propositions are scarce.

### **2.1.3 Addressing Niche Needs with Smartphones**

With news readers now given a considerable amount of choices in utilizing a media platform for gathering information, scholars have identified the need to understand market dynamics across different types of media. Smartphones have especially changed news reading behavior, enabling information seekers to install and use applications according to their own needs and interests (Verkasalo et al., 2010). Moreover, the introduction of mobile devices in the domain of news has shifted the way in which different platforms serve niche needs of their users.

The theory of the niche was first applied to the study of media economics by Dimmick and Rothenbuhler (1984), purporting that, like plants and animals in nature, media firms depend on scarce resources for survival and must compete to occupy a niche in its overall market. The shift in market dynamics and development of niches are determined by the pattern of consumption on different resource dimensions within the domain. Dimmick et al. (2010) applies the theory of the niche by observing the recent introduction of mobile media and how users were accessing news content across multiple platforms.

The study involved a survey of over 2000 mobile technology users, measuring their activity during an assigned 24-hour time period (Dimmick et al., 2010). The scholars conclude that newer mobile media and traditional news media occupied different time and space niches within the news domain. Traditional channels such as television and newspapers occupied a clear pattern of consumption in the morning and afternoon, and appropriately, these channels served as a source for general news, weather and sports news. On the other hand, mobile channels were described to occupy a ‘transit’ niche, serving information needs during interstices within a user’s daily routine.

Shim et al. (2015) further explores the users’ motivations for mobile news usage through a survey of Smartphone users based on their perceived suitability of mobile news, their motivations for news usage and overall consumption patterns. The scholars found that while entertainment news was the most prevalent type of content offered by mobile apps and Social Networking Sites, Smartphone users perceived political news as equally suitable for consuming via mobile devices as



entertainment news. This perhaps suggests a gap between the utility of Smartphone usage for news reading and currently available news formats, and more importantly, a market niche yet to be occupied by news organizations.

## **2.2. Re-inventing the News through Data**

The Data Time Series format attempts to take advantage of the emerging trend of ‘Data Journalism,’ both in terms of developing its theoretical grounding and suggesting a concept put into practice. The first part of this section will discuss literature surrounding the re-invention and recomposition of news organizations. This will be followed by a close look at how scholars have discussed the concept of data journalism in relation to meeting timely organizational challenges and how this has influenced news organizations to fundamentally transform their production process.

### **2.2.1 Re-imagining the Business of News**

The rapid proliferation of digital technology and of Internet usage has triggered remarkable changes in the way people generate, disseminate and consume information. These changes have become the driving force of organizational transformation in many industries. In particular, news organizations have found themselves in the epicenter of this disruption, with significant uncertainties arising from the introduction of disruptive technologies. Picard’s (2008) analysis of the relationship between U.S. GDP and newspaper advertising expenditures revealed a steady weakening and that expenditures will likely plateau and decline in the future. A general agreement exists that the crisis has had negative implications for democracy as it undermines the watchdog role traditionally played by the press and its significance as a vehicle for free speech (Blumler, 2010; Jones, 2009; McChesney and Pickard, 2013; Siles and Boczkowski, 2012).

Siles and Boczkowski (2012) have closely examined the ‘newspaper crisis,’ explaining that there is a general consensus that the phenomenon stems from the interrelated effects of declining profitability of print journalism, the inability of news organizations to cope with the transition to the Web and the loss of trust and credibility of content provided by newspapers. Moreover, news organizations

are experiencing a dilemma due to their inability to innovate. Lowrey (2011) contends that levels of innovation are low across news organizations because of their institutionalist tendencies to follow existing pervasive practices under conditions of high uncertainty. Thus, product change is less based on strong ties with their audiences and market, but rather on strong ties with institutionalist tendencies to follow the present status quo.

Under these conditions, scholars generally agree that the survival of traditional news organizations depends upon a re-invention of the outdated newspaper business model (Siles and Boczkowski, 2012). Doyle's (2014) recent study of the UK national newspaper sector indicates how organizations are adopting a new business model that combines the traditional 'high cost, high revenue' advertising model of print journalism with the 'low cost, low revenue' model through digital distribution. As the transformation continues, it is increasingly important to provide adequate research on imagining new formats for news content.

### **2.2.2 Transforming How News is Made**

Trends in the worldwide media industry have clearly shown that long-term success is dependent upon the media organizations' ability to change from a single product oriented to a multimedia, content and user-oriented approach. Appropriately, a large body of literature has developed surrounding the transformation of the news production process. Three types of transformations are particularly of interest: organizational transformation, technological transformation and content transformation.

The challenges and prospects of organizational transformation in news organizations have been widely cited by journalism scholars (Doyle, 2014; Erdal, 2011; Lowrey, 2011; Weber and Rall, 2012). In separate studies, both Doyle (2014) and Weber and Rall (2012) highlight the importance of effectively integrating journalistic practices within IT, commercial and editorial functions, as well as an organizational willingness to experiment and innovate in relation to harnessing the benefits of two-way connectivity. Schlesinger and Doyle (2014) analyze two cases of structural reform in UK-based news companies, the *Financial Times* and *The Telegraph*. The study concludes that while managers in both companies recognized that the shift towards digital was high priority, structural issues still exist

in parting from the traditional journalistic process especially under a different production time cycle.

The wide discussion of the promises of data journalism has also given light to the challenges of implementing technology into the newsroom. Aitamurto et al. (2011) recognize that significant advancements must be made in obtaining, formatting and analyzing large sets of data. In particular, technical challenges exist in dealing with ‘dirty data’ or datasets that include statistical anomalies, misinterpretations, conflicting data standards and incomplete data.

Finally, the migration towards delivering a multimedia package has also re-configured the ways in which content is conceptualized (Erdal, 2011; Schlesinger and Doyle, 2014). Jacobson (2012) found that the shift towards digital content at *The New York Times* involved completely new interfaces that incorporated elements native to digital environments such as interactivity, social media tools and elements from digital games. Furthermore, news organizations are increasingly recognizing the need to find creative ways to apply computer science, data analytics and information visualization to articles as a differentiating factor against competing brands (Aitamurto et al., 2011; Cohen et al., 2011; Flew et al., 2012).

Further research is needed to understand how new ways of delivering news can be achieved under the current conditions of the evolving newsroom.

### **2.2.3 The Promise of Data Journalism**

Gray et al. (2012) describes the term *Data Journalism* simply as “journalism done with data.” The general principles behind data journalism are not new, with early manifestations pioneered in seminal works by scholars such as Philip Meyer on ‘Computer Assisted Reporting’ (Meyer, 2002). Gray et al. (2012) note on the timeliness of applying the concept, stating that what defines data journalism is “the new possibilities that open up when you combine the traditional ‘nose for news’ and ability to tell a compelling story, with the sheer scale and range of digital information now available.” Moreover, Coddington (2014) stipulates that another defining factor of data journalism is in its high level of transparency and a shared vision of a participative and interactive public as opposed to a more traditional, passive conception of news.

Aitamurto et al. (2011) elaborate on three essential roles that data journalism

plays in news organizations. First, data journalism can be a tool to enhance the quality of news reporting. The use of data can aid in uncovering hidden stories and discovering more facts to support more evident narratives. Second, news organizations perceive data journalism as part of a transition towards interactive information platforms in which readers not only consume journalism, but interact with data visualizations and raw data sets. Third, news organizations have recognized the value in transparency that data journalism adds to the journalistic process, increasing the credibility of a news story. Data journalism has been regarded as part of a larger strategy to re-invent the newsroom to effectively address the needs of today’s consumers.

Flew et al. (2012) argue that when successfully implemented, the application of software and technologies to the activities of journalism can reduce costs and increase the speed of investigative research. Moreover, the authors note that using data in news content can address different niche interests that are not being met by current mass market offerings. Based on a study of online news users in Australia, Flew et al. (2009) found that users loyal to a masthead brand and users who actively customize their news online are more valuable to a news site as they appreciate investigative news content and are more likely to interact with news media. The authors discuss data journalism as an appropriate tool to capitalize on the demands of such a user base.

It must be noted that little research exists on the actual beneficiaries of news organizations implementing data journalism in relation to news consumer retention. Moreover, proponents of data journalism have traditionally focused on the ‘breaking of news’ in which the presentation of a dataset plays a significant role in revealing the story behind a particular event or issue (Aitamurto et al., 2011; Cohen et al., 2011; Gray et al., 2012; Meyer, 2002). Exploring new possibilities of data presentation in distinctive contextual settings could be fruitful for understanding other appropriate use cases of data in the news.

### **2.3. Data Visualization and Information Design**

The design elements of the proposed Data Time Series format build upon several existing theories surrounding data visualization. Reviewing the concepts of nar-

rative visualization, cognitive psychology and medium-specific research on Smartphones are useful in developing a theoretical context and technical grounding of this thesis.

### 2.3.1 Narrative Visualization

The fundamental purposes of data visualizations are twofold: to display information for quick comprehension and to facilitate the creation of valuable knowledge and insights to its viewers. Contrary to traditional storytelling with words, data visualizations are considered the ‘language of the eye’, and scholars have begun to identify narrative structures unique to those told with data and graphics (McCandless, 2010). Segel and Heer (2010) suggest a strategic framework for designing such stories by defining distinct genres of narrative visualization.

Segel and Heer’s (2010) empirical content analysis of data graphics from various sources revealed salient dimensions of visual storytelling. Figure 2.1 shows seven distinct genres of narrative visualization as described in the research. The scholars postulate that each genre can be combined with interactivity and messaging to produce varying effects on reading experience.

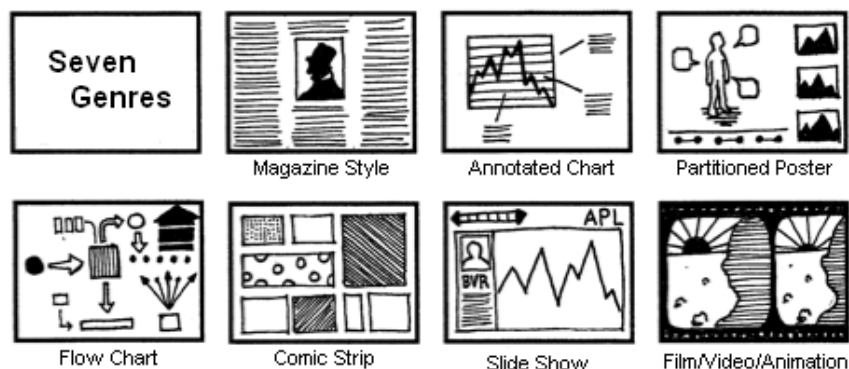


Figure 2.1: Genres of Narrative Visualization (Segel and Heer, 2010)

Certain genres of narrative visualization were found to have a strong affiliation with a different degree of interactivity based on a spectrum of author-driven

and reader-driven storytelling. For instance, The Martini Glass structure, which incorporates visualizations through a linear narrative, heavily prioritizes author-driven storytelling over The Drill Down Story, which essentially allows users to freely navigate through the data. The Interactive Slideshow format, which incorporates interaction mid-narrative within the confines of a slide show, was found to promote a combination of the two narrative techniques.

While the study conducted by Segel and Heer (2010) provide an initial basis for understanding existing strategies to convey a story through data graphics, the field of narrative visualization is still in its infancy. However, numerous opportunities exist in building on this body of research. Hullman and Diakopoulos (2011) found promising opportunities to incorporate rhetorical devices in improving understanding and interpretation of a visualization. Conventional rules in data visualization dominated by principles of simplicity and minimalism are being readily questioned, giving rise to larger interpretations of what constitutes ‘good graphics’ for its target user (Gelman and Unwin, 2013). Scholars insist on more focused research on developing techniques in data visualization for specific goals and desired effects on the viewer (Gelman and Unwin, 2013; Kosara and Mackinlay, 2013; Pandey et al., 2014; Segel and Heer, 2010).

### **2.3.2 Cognitive Psychology of Data Visualization**

Empirical studies conducted by the visual cognition community are useful in answering research questions raised by narrative visualization scholars. The intrinsic properties of an image such as memorability, persuasiveness and knowledge creation are key factors that drive the effectiveness of a news story.

Several researchers have considered memorability as one of the defining factors of optimizing the communicative power of any type of image. Based on computer vision techniques, which tracks the probability that the viewer will detect a repeat of an image within a stream of pictures, Isola et al. (2011) found that memorability is a stable property of an image that is shared across all users. Building on this research, Borkin et al (2013) examine a taxonomy of data visualizations to seek commonly memorable groups of graphics. Higher memorability scores were found to be correlated with visualizations containing pictograms, low data-to-ink ratios, high visual density and more color. Interestingly, the study provided suggestive

evidence that ‘chartjunk,’ or visual elements of a graph not serving any functional use, was one of the defining factors that made a graphic more memorable. While an overwhelming amount of literature considers the inclusion of visual embellishments in data visualizations is verboten, scholars have taken this debate seriously and claim the need for continued empirical research (Bateman et al., 2010; Li and Moacdieh, 2014).

The next step in cognitive psychology should involve experiments on intrinsic properties of user preference, as well as understanding design elements that facilitate knowledge creation.

### **2.3.3 Data Visualization on Smartphones**

Albeit its growing importance, very little academic research exists on approaches to data visualizations on Smartphones. Where it exists, researchers tend to focus particularly on the task of designing interaction techniques for multi-touch devices (Drucker et al., 2013; Isenberg and Isenberg, 2013; Lee et al., 2012). For instance, Drucker et al. (2013) compared two interfaces with different types of touch-based interactions on tablets. The study concludes that users preferred and performed better on data visualizations with higher levels of gesture-based interactivity, rather than conventional desktop metaphors with a control panel, push buttons and checkboxes.

A more unexplored domain is research on visual properties of data visualizations on Smartphones. Sadowski (2014) provides a working study of a visual survey of information visualizations on Smartphones. The author collates over 70 data graphics of different styles on the website *mobileinfovis.com* in an attempt to provide a visual reference and inspirational source for graphic designers. However, specific effects of using different graphical features remain unexplored.

Commercial applications of data visualizations on Smartphone news readers are most prevalent on financial topics such as market, industry and commodity trends. Figure 2.2 illustrates a few examples of well-known news brands applying data visualizations to their mobile apps. While literature is scarce on this topic, such renditions seem to account for a more advanced reading for a highly targeted audience, which in this case are those with a high appreciation of and demand for financial news.

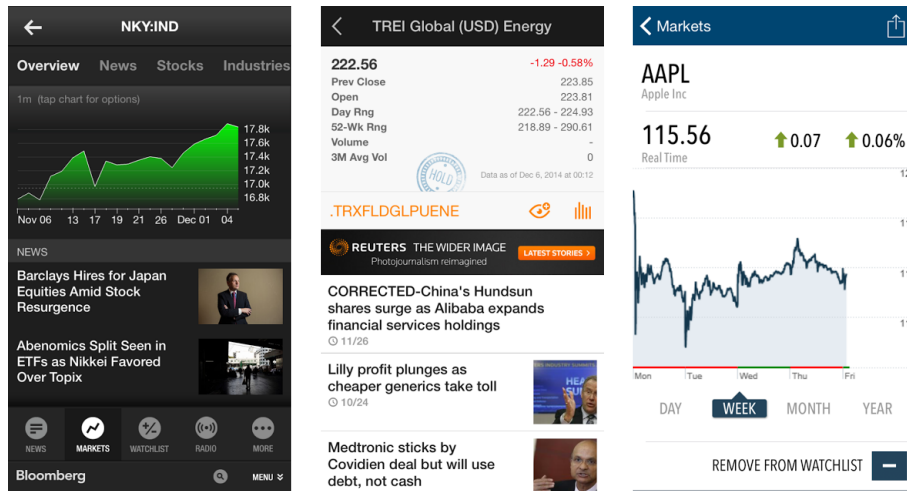


Figure 2.2: DataViz on news apps from *Bloomberg*(2014), *Reuters*(2014) and *CNN*(2014)

Further research on assessing the use of datasets and graphical elements for different contextual settings should create fruitful insights into the range of storytelling techniques offered by Smartphones.

## 2.4. Summary

This Thesis will make three academic contributions within the context of the aforementioned literature.

First, a design proposition will be made through the Data Time Series format that addresses the practical needs of today's news consumers. With a strong emphasis on the theoretical value of news as a tool to enhance public discourse, the proposed design will be an attempt at conceptualizing a news format that provides adequate informational value of important current issues, while triggering reader interest and controlling selective exposure. The thesis will argue that current renditions of Smartphone news formats are inadequate at producing this impact or is highly inaccessible, if any. The focus on Smartphones will also serve as an initial study into the opportunities of news delivery on the platform, and whether or not there are any underserved niche groups.

Second, this thesis will examine a particular design proposition of data jour-



nalism that goes beyond the confines of current practices. More specifically, the use-value of data visualization as a ‘trigger’ to foster reader interest will be observed. Additionally, the current setting of news production will be closely examined in order to provide adequate grounding that suggests that the proposed design is achievable within the resources of news organizations.

Third, this thesis will attempt at uncovering the effectiveness of specific design elements in producing a desired impact on the user. More specifically, the Data Time Series format utilizes a number of unique visual elements that may or may not enhance the communicative power of the graphic.

Overall, this design thesis should be considered as a user-oriented approach into re-imagining news content for today’s news consumer, in hopes of serving as a starting point for further exploration into discovering solutions for challenges in areas such as public discourse, organizational change and narrative visualization.

# Chapter 3

## Design

The *Data Time Series* method of news delivery was designed to propose a simple and reproducible layout for Smartphone news applications that integrates real-time data visualizations with curated news content. The primary goals of this format are to trigger user interest in news topics and to further enhance reader engagement with important current issues, but without disrupting reading style preferences specific to the Smartphone. Furthermore, the combination of curated content and data visualizations from a variety of sources serves as a narrative method to facilitate the quick and holistic comprehension of an issue at hand.

Perhaps the most unique aspect of the Data Time Series format is in its layout of curating news content (Figure 3.1). Existing Smartphone aggregation websites and native news applications typically display a group of similar news headlines nested within broader news categories such as politics, business, entertainment and so on. While value propositions for the consumer may differ based on the technicalities of aggregation algorithms to carry out contextual analysis or usability features of the user interface, there are very few successful outlets that curate news content with the intention of in-depth reading. In fact, data has consistently shown a behavioral shift away from in-depth reading on the Smartphone and towards a habit of ‘news snacking,’ whereby users prefer frequent yet shorter sessions for reading the news (Aggarwal, 2014; Mediabistro, 2013). Furthermore, very few news applications provide data visualizations as a primary focal reference for the viewer in an accessible manner. The premise of the Data Time Series format is to act as an alternative news source for in-depth reading on the Smartphone, while

controlling for potentially negative implications stemming from fragmented and biased exposure to information.

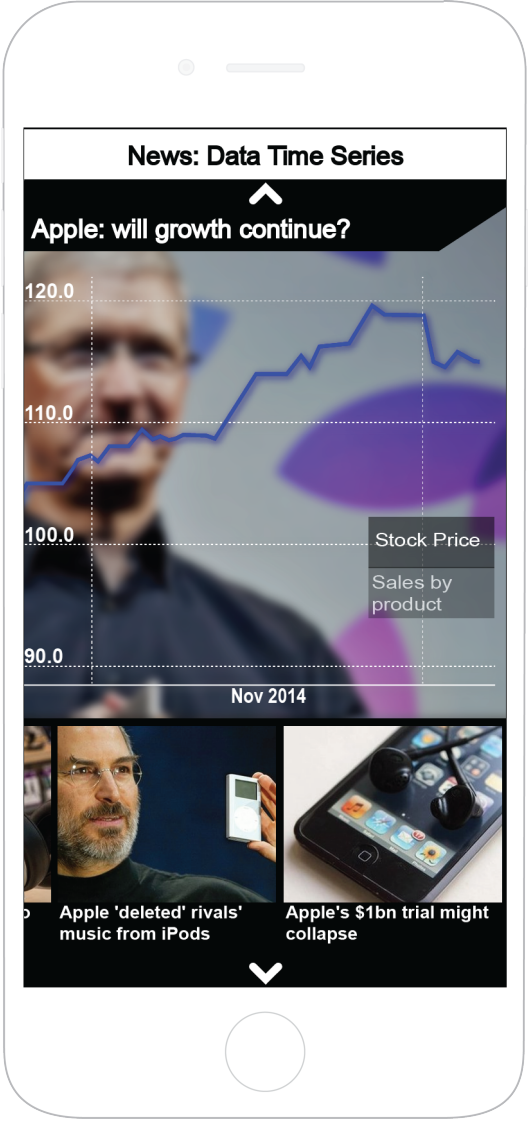


Figure 3.1: Screenshot of the Data Time Series format

The concept of the Data Time Series method can be described as ‘in-depth news snacking.’ The proposed format utilizes data journalistic techniques as primary vehicles to trigger user interest into a news topic and guide readers through a more complete view of the issue at hand. The most prominent element of the overall layout is a simple visualization of different types of data trends relevant to the given topic.

While existing news apps also offer visual references to data graphics, such applications usually display graphics that are embedded within individual news stories and do not serve as a reference point to the overarching topic. Contrarily, each screen on the Data Time Series layout makes the data graphic the most prominent feature of the news topic, from which users are encouraged to begin by gaining a general insight; readers are confronted with data graphics that illustrate data points based on a function of time, enabling them to readily monitor changing historical trends about an issue before reading further into different individual news stories. Moreover, the reader is invited to look into multiple datasets, freely comparing and analyzing a topic in order to make their own connections and conclusions.

Accompanying the data graphics are a set of news stories from several different news sources, which are curated in a way that allows users to read the most updated stories from multiple perspectives. To gain an objective and neutral view of a topic is an essential factor to the development of a constructive opinion about an issue. For instance, international news should provide views from both foreign media and local on-ground reporters, as reporting competencies may differ drastically between different outlets. On the one hand, large foreign news organizations may provide a general overview and macro perspective of an event, while local reporters are more competent at telling a detailed story about how an event unfolded.

The Data Time Series layout displays content from different sources side by side, accompanied by data visualizations as evidence-based reference points. As a result, a natural flow is created for readers to discover and critically compare a plural of viewpoints in order to formulate their own, more balanced viewpoint.

The standardized layout is reproduced for several different news topics and is arranged in a magazine style reading experience in which visual graphics are

primary drivers of the narrative structure. As such, the Data Time Series format accommodates for reading style preferences on Smartphones, whereby users are given the convenience to quickly move back and forth between different news topics. Moreover, the proposed design is aimed at shifting the way people should read the news by viewing information by ‘topic’ rather than by each ‘story’ in order to resist the unbalanced consumption of information.

The primary goal is to encourage a reader to build fact-based and critical personal opinions about important current issues and moreover, make constructive decisions based on that knowledge. Overall, the Data Time Series format should serve as a humble yet important journalistic vehicle for encouraging and maintaining healthy democratic discourse and civic participation among people in the Smartphone age.

### **3.1. Theoretical Use-Value for News Readers**

This section will provide a detailed definition of the target users, establish a theoretical grounding for the use-value of the Data Time Series format for its intended behavioral effects and conclude with a user scenario that illustrates general user interactions.

#### **3.1.1 Target User**

The target user of the Data Time Series format can be described in three dimensions: user demographic, user interests and news consumption patterns.

##### **User Demographic**

The target demographic of the Data Time Series news format has been identified as Smartphone users between 25-40 years old. While the demographic distinction should be understood more as a flexible guideline than a strict rule, the age range was determined based on the high proliferation rate of mobile devices among this age group. Moreover, this particular age group recorded a significantly higher frequency of news app usage on Smartphones rather than on tablets (Newman and Levy, 2014). This indicates a user group with a lifestyle akin to the consumption of digital content and a presumably higher level of literacy in digital platforms.

In terms of occupation, the Data Time Series format is targeted towards those with knowledge-intensive jobs as it signifies a higher education, a moderate to higher level of disposable income and a keen interest towards making investments for personal development such as on educational expenses (Newman and Levy, 2014). Moreover, sector-based occupational distinctions are deliberately kept broad as news readership is relatively consistent among such variables. The Data Time Series format is premised upon usage across different news categories, ranging from politics to social matters, thus should serve a wider audience of general interest news consumers.

Within the user profile, gender, nationality, ethnicity and language distinctions have not been made. This is because research has consistently shown little to no correlation between such variables and the suggested reading experience of the Data Time Series format.

### **User Interests**

The target user regularly consumes news and has a curiosity to delve into a wide range of news topics. Moreover, there should be a higher level of attentiveness and knowledge about public affairs, as well as a preference to develop personal opinions about different current issues. Such user groups are also unique in their preference of news content, whereby neutrality and a holistic coverage of different views are essential factors to good reporting of a story (Newman and Levy, 2014). However, the target user is also undergoing a stage of continued learning and thus, has yet to establish a clear method of synthesizing different news articles into a holistic picture of the issue at hand. As a result, the user is energetic about experimenting with different news delivery methods.

For these users, fulfilling intellectual curiosity leads to a sense of self-gratification and it is rewarding to discover new insights on a topic of interest. Moreover, when presented in an intriguing way, news gathering is not considered as a daily chore, but a source for genuine entertainment and enjoyment. Essentially, there is a desire to apply information constructively for purposes including, but not limited to, educational development, professional decision making and social engagement. The target user will notice content that is well-curated for such information needs.

## **News Consumption Patterns**

As the Data Time Series format is designed for mobile usage, the target user must own and consume news content on Smartphone news applications. Moreover, the consumption pattern should occupy a particular time/space niche in the user's daily news consumption routine. Specifically, the target user will consume news content on his/her Smartphone during a short interval between different daily activities. Commuting time, short breaks during work and right before going to bed are a few examples of possible usage settings. As a result, it is crucial for news content to adapt to these circumstances, calling for attributes such as quick comprehension and broad coverage of issues within a short amount of time.

In terms of delivery format, the target user has a high preference for curated content in which news articles are intentionally chosen to meet the user's information needs. This may be in the form of editorial decisions by major brands or by aggregation algorithms, which sift through and choose relevant articles from a vast surplus of available online content.

### **3.1.2 Behavioral Effects**

The Data Time Series format takes a design approach to facilitate the transformation of news reading behaviors on Smartphones from 'news snacking' towards a higher level of in-depth reading without disrupting reading style preferences. Based on rigorous research from communication and journalism scholars (see Section 2.1), this thesis makes inferences based upon the following preconceived theories:

- A thematic gap between reader interest and editor choices is causing a barrier to effective dissemination of news on public affairs.
- Technological and design-oriented changes in content curation can mitigate risks of selective exposure.
- A potential opportunity exists to address a niche need arising from a gap between the utility of Smartphone usage and available content.
- Data journalism is gaining currency as a tool to create news content that engages news consumers.

In effect, the transformation of user behavior is arguably a product of the combined factors of triggering user interest in news topics, controlling selective exposure to information and adapting to the utility of Smartphones.

While the thematic gap between reader interest and editor choices is an institutional issue that must be addressed by transforming the reporting behavior of news organizations, reader behavior also plays a crucial role in shaping the dissemination of public affairs information. Reader behavior is heavily determined by the affordances of the technology to facilitate knowledge creation (Gaver, 1991). Online technologies have unique properties with a biased knowledge system that possesses its own propensities, thus building a contextual basis and improving usability are essential tasks in designing interfaces for a particular behavioral attitude (Day and Lloyd, 2007; McLoughlin and Lee, 2007).

The Data Time Series format utilizes data journalistic techniques as potential features of the interface that can act as triggers to drawing user attention towards current issues. Proponents of data journalism are especially excited about the richness of visual storytelling and its efficiency to uncover facts about an issue (Gray et al., 2012; Aitamurto et al., 2011). Strausfeld and Cannon (2014) mention that “Data visualizations have historically served two distinct purposes for two distinct audiences. . . to either provide explanation for the uninitiated or to guide exploration for the expert.” When utilized in journalistic practice, a richer level of audience participation, both author-driven and reader-driven, can be achieved through data visualizations. The Data Time Series format was designed to achieve a balance between the experiences of explanation and exploration.

Specifically, the proposed design utilizes data graphics as visual references to broader news topics. The purpose is to engage readers at a meta level and to provide adequate contextual information before inviting them to read further into more investigative stories. Rather than displaying a randomly selected list of headlines, the Data Time Series utilizes a funnel concept (Figure 3.2) to systematically and gradually guide readers from broader news categories towards specific news topics, finally reaching relevant news stories. This first contact point is to serve as a simple buffer against a key driver of selective exposure: a non-informed reading of individual news articles. Importantly, the format should not explicitly enforce an agenda-infused reading about a topic, but should instead facilitate the



readers' critical investigation into a news topic as a whole and not in terms of its fragments.

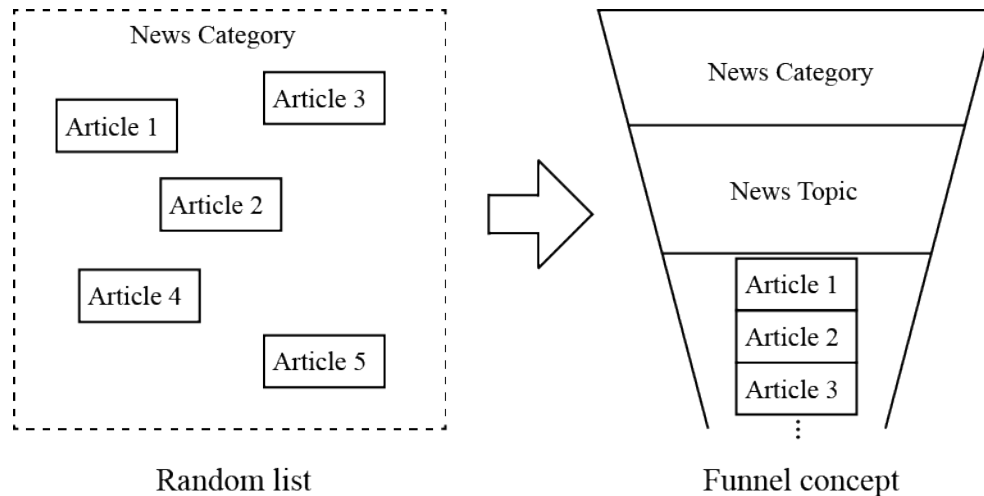


Figure 3.2: Funnel concept to guide reader attention

Furthermore, the Data Time Series format also employs a number of design approaches that have been suggested by scholars to control selective exposure to the news. In particular, Garrett and Resnick (2011) make three suggestions based on the assumption that selective exposure is the product of an attraction to pro-attitudinal information paired with a much weaker aversion to counter-attitudinal information: 1) to provide only high-quality challenging items; 2) to provide challenging information only in the context of specific topics of interest; and 3) to reduce cognitive dissonance associated with challenging information by making counterarguments accessible.

The Data Time Series format integrates all three approaches in its layout to structurally control the level of selective exposure and fragmented news consumption. Each article is chosen from a variety of sources by means of curation based on a strict criteria for proper coverage. Moreover, this is presented with data visualizations that have been identified as relevant to the topic through factors such as citations to the dataset or by identifying similarities in keywords. This allows for a high level of quality assurance to display enough viewpoints of a topic

in order to encourage holistic comprehension. Additionally, the layout is designed to trigger reader interest on a broader topical basis, which theoretically acts as a vehicle to reduce cognitive dissonance by making several viewpoints accessible to the reader at once.

For the user, the combination of time series data visualizations and a curation of news content provides a new method of translating short news consumption sessions into meaningful opportunities for knowledge acquisition. The layout also accounts for the utilities of Smartphones in terms of how people prefer to read the news on their devices. As the Smartphone occupies a ‘transit’ niche, it serves information needs during interstices within a user’s daily routine (Dimmick et al., 2010). As such, users need to be able to effectively consume the news within a short interval of around four to five minutes (Aggarwal, 2014; Mediabistro, 2013). The Data Time Series format adopts a magazine style delivery method, a visually intensive layout, for this reason, as it provides a simple guidance for readers on a topical basis rather than based on a random list of aggregated headlines, which merely provide fragments of information about a given topic.

The aim of the Data Time Series format is to act as an alternative source of news for readers who want to engage in a deeper reading experience during each session of news consumption on their Smartphones. The design is also charged with a number of theoretical social agendas to encourage behavioral effects that direct readers towards a more balanced and diverse reading of the news, while controlling against low reader interest and media bias.

### **3.1.3 User Scenario**

Figure 3.3 illustrates an example of the scenario by which a user interacts with the Data Time Series Format. the basic flow would involve the user first encountering a choice of different news categories such as World Issues, Economy, Politics and so on. Upon choosing a category, the user will have the freedom to flip through different news topics, each with different data visualizations and associated news articles.

For instance, when a user chooses the World Issues category, he/she will be directed to a number of different news topics such as the ‘Hong Kong Protests’ and the ‘Ebola Outbreak in West Africa.’ If the user is interested in the topic, ‘Ebola

Outbreak in West Africa,' he/she will have the opportunity to look deeper into the issue with a number of different time series-based data visualizations such as historical trends in 'total cases,' and 'total deaths.' Furthermore, users can engage with more investigative and distinctive news stories about the Ebola outbreak. Overall, by creating an orderly flow the format acts as a conceptual funnel that guides users from a broader scope towards a specific news story.

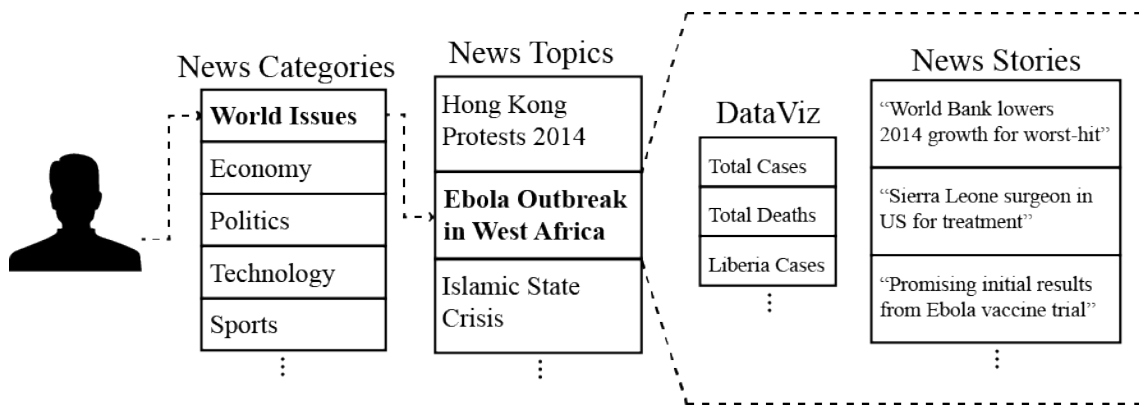


Figure 3.3: Flow chart of user scenario

## **3.2. Theoretical Use-Value for News Producers**

This section will provide a detailed definition of the target producers, as well as establish a theoretical grounding for how the design of the Data Time Series format borrows concepts from discourses surrounding news production and journalistic practices. Moreover, this section will conclude with a newsroom scenario.

### **3.2.1 Target Producer**

The production of the Data Time Series format requires a certain level of journalistic expertise and availability of technical and operational resources. As such, the format is targeted towards news professionals involved in the aggregation, curation and delivery of the news to the public via mobile applications. News organizations developing news aggregators and curation apps may be the most suitable target producers of the proposed layout as it requires a high level of automation during the processes of gathering, processing and displaying both news articles and real-time data feeds. Moreover, IT expertise, graphic design and journalistic techniques are essential skills needed to realize the designed layout in a consistent and continuous manner. As the Data Time Series format was designed as a basic layout, it is also important for the news producer to be able to continue to apply additional features and enhancements to the usability.

### **3.2.2 Organizational Effects**

Based on rigorous research from existing scholars on journalistic practices and news production (see Section 2.2), this thesis draws inferences based on the following preconceived theories:

- News organizations are in need of re-imagination and re-invention of the current operational model.
- The news production process is undergoing deep structural reforms to cope with demands for digital content.
- Data journalism is showing promise among news professionals with actionable technical and design strategies.

News organizations have been caught in an institutional dilemma. Current on-line platforms have surfaced salient ideological tensions between the dissemination of well-reported public affairs news and the market-driven need to attract viewership against a host of content with sensationalist headlines and little comparative informational value.

Under the current advertising model, news organizations need more people to ‘click’ on their content, and this has to be scalable to the degree of millions in order to generate any considerable revenues for the business. In effect, ‘good’ news is in direct competition against content that is readily described as ‘click bait’, or content that exists only to lure viewership in order to generate online advertising revenue (Lock, 2013). To initiate both institutional change and business model innovation, an alternative outlet is needed, especially within the domain of Smartphones in order to provide a platform with a controlled environment for accuracy and quality of news content.

However, dissemination of well-reported public affairs news has been met with a substantial dilemma of attracting reader interest. Reasons are manifold, ranging from the low attention span of the current generation of readers to a decline in credibility and trust towards large media brands (Aggarwal, 2014; Pew Research Center, 2011). News organizations have been caught in a vicious cycle, which can only be escaped through content innovation.

While the art of reporting and storytelling have substantially improved over the history of news production, there is room to suggest a re-imagining of how news content is delivered to its users, ensuring high quality content while keeping strong ties with the users to ensure audience retention. Employing data journalism as the primary vehicle, the Data Time Series format is designed as one of many tools that can be incorporated into the digital delivery platform of news.

Newsrooms are increasingly adapting to the digital age, with several major news organizations investing in data journalism teams and placing them in close proximity to the news desk (Zanchelli and Crucianelli, 2014). As a result, news organizations are effectively competing with one another to produce the most intriguing and interesting data-driven content. Data-driven stories about topics affecting the lives of news readers have proven to produce both social impact and drive web traffic (Zanchelli and Crucianelli, 2014). By increasing the accessibility

of historical data and displaying them at scale, the Data Time Series format should be understood as part of an attempt to present data-driven content from a different perspective than compared to traditional outlets. For news organizations embracing data journalistic activities, the proposed design may prove to be a point of content differentiation against competition.

Additionally, for the news producer, the Data Time Series format was developed to overcome the issue of information asymmetry, which arises from the inability to take in information and process it with the speed and volume that it comes (Gray et al., 2012). Data journalism in its most traditional and investigative sense is indeed time-consuming and labor intensive. Each story is constructed carefully with the use of data analysis as key revelations to a news story.

While this allows for each story to be charged with reliable statistical figures and grounded on evidence, it is difficult to present data-driven information at the pace that is increasingly being demanded. By automating the process of publishing and updating data trends at scale, the Data Time Series format was established to serve as an alternative platform with considerably lower investigative involvement, but can still be presented in a meaningful way for readers.

Overall, the Data Time Series format should not be understood as a replacement to the ever-increasing production of high quality data-driven investigative reporting, but as an alternative delivery outlet with the potential to trigger reader interest, while providing supplementary information about a news topic for the reader.

### **3.2.3 Newsroom Scenario**

The essence of journalism is in its ability to put forth a question or theory that engages civic participation in important public discourses. To ensure that journalistic integrity is protected, data journalistic practices must ensure a balance between ‘computer-assisted’ and ‘human-assisted’ reporting, or reporting that accounts for the same rigour in human inquiry as in data analysis (Zanchelli and Crucianelli, 2014). As such, during the production process, the newsroom should adapt structural mechanisms that effectively eliminate the skills gap between reporters, editors, software engineers and web designers.

The production of the Data Time Series format requires a considerable amount

of coordination between the editor, software engineer and user interface (UI) designer. As shown in Figure 3.4, each individual provides a different skill set, with a high level of multilateral communication required to effectively execute the project. While the editor is in charge of determining the holistic narrative and curation of each news topic, the software engineer must manage a complex database of aggregated news articles and acquired online datasets. Meanwhile, the UI designer must develop and continue to evaluate attractive data graphics based on the curated content, as well as ensure usability and clarity in the design layout.

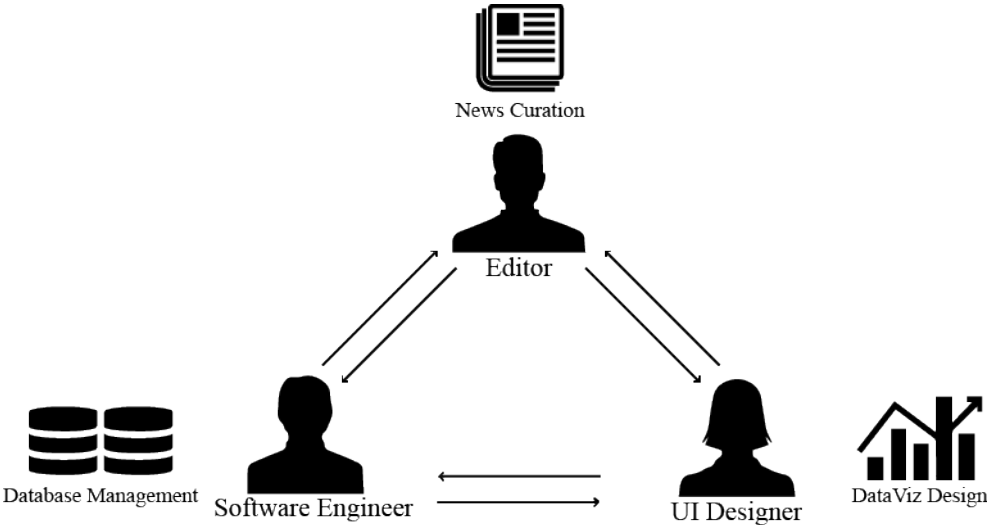


Figure 3.4: Flow chart of work flow

### **3.3. Design Specifications**

The following section will outline the design specifications for the Data Time Series format, touching upon the content selection process, curation standards, data visualization techniques, general layout and suggested interactions.

#### **3.3.1 Content**

The content selection process is twofold: data selection and news article selection.

##### **Data selection**

Data is chosen based on two criteria: availability and relevance. In terms of availability, there must be at least 10 data points available within a respectable time frame, usually dispersed within five to six months, in order to correctly display the data trend. Moreover, the dataset should be updated at least once per month in order to provide real-time historical trend lines.

The relevance of the dataset is determined by factors such as citations within the text of articles, as well as overlapping keywords. Checking for the credibility of data sources is also crucial to maintain a high level of transparency and quality of the displayed data. Some recommended sources may include, but are not limited to, government releases, open source and crowd sourced data, data from research institutes and data from in-house data acquisition teams. It is assumed that the editor will provide adequate guidance on identifying the most important historical data trends.

##### **News article selection**

The criteria for selecting news articles to display on the Data Time Series format is adapted from a news type classification system developed by Lehman-Wilzig and Seletzky (2010). The scholars argue that news content should not be understood as a simple dichotomy between ‘hard’ and ‘soft’ news, but rather as a spectrum with an intermediate category known as ‘general’ news at the center. Depending on the level of importance and urgency of the story, a news story is to be placed on either side of the spectrum. The theoretical distinction is particularly useful within the context of the Data Time Series format as it allows for a clear



methodology of quality control by filtering out undesirable content.

The following are the news type criteria for differentiation between ‘soft’, ‘general’ and ‘hard’ news, as described by According to Lehman-Wilzig and Seletzky (2010):

### **Soft News**

- Light or spicy news that need not be reported on immediately or at all.
- Light news that needs to be reported immediately not for its intrinsic importance but rather because of its wide public interest or for professional reasons.

### **General News**

- Recent economic, social or cultural news that should be published but not necessarily immediately.
- Important news that is relevant or influential, not for society in general but only for a specific group.
- Important news not on the present public agenda, so that if not immediately reported would not readily be missed.
- Personally useful information for the reader that need not be reported right away.
- Important demographic data, academic reports, scientific discoveries or technological inventions that should be reported but not necessarily right away.

### **Hard News**

- Important news, especially in the fields of politics, society, economics or the environment that needs to be reported as soon as possible due to its influence or ramifications on the public and surrounding world.
- A breaking, unexpected event of great importance for most of the public and/or the environment.

- New findings, discovery or report regarding a continuing story of great significance for most of the public and/or the environment.
- Significant news on the national plane.
- Significant news on the international plane.

As the Data Time Series format was designed for the dissemination of general interest news, news articles should include at least two to three attributes of either the ‘general’ or ‘hard’ news classifications. Moreover, all articles that can be classified under the ‘soft’ news type are not considered suitable for display on this format due to low informational value.

### **3.3.2 Curation**

As news topics are assumed to continuously change depending on the importance and timeliness, a broad hierarchy must be established in order to effectively curate and display the content. While the editor is responsible for the detailed decisions on selection and ranking of different news topics, the curation process can be broadly divided into two elements: 1) topic selection and 2) topic ranking.

#### **Topic Selection**

The Data Time Series format relies heavily on editor intuitions for topic selection, a variable that differs significantly between news organizations and their strategic intent. However, a simple guideline can be used in order to facilitate editor decisions. The following checks can be made by the editor in order to establish topical distinctions:

- The topic has a high level of informational value and importance to readers.
- The topic has enough specificity to provide focus towards an issue at hand.
- The topic is suitable to encompass a breadth of different news stories within the context of the issue at hand.
- A variety of historical data trends are available to facilitate the comprehension of the issues at hand.

- The topic has a high level of interrelated citations and hyperlinks.

A high level of informational value is not only needed to display meaningful news to the reader, but also in order to ensure that newsroom resources are not wasted for topics of low newsworthiness. Moreover, the editor should establish topics based on the ability to construct enough contextual grounding on different issues that surround the given topic. In other words, news topics should have the specificity to ensure a focused discourse, while having brevity to encompass several different relevant issues. The availability of datasets, as well as the density of interrelated citations and hyperlinks should also serve as supplementary guidelines into producing topical distinctions.

Furthermore, news topics are chosen based on their continuity. The news topics must have a moderate to high level of reporting from a variety of sources. This not only allows for the aggregation of several articles, but also ensures that a news topic is of high importance. As described in Figure 3.5, the ideal content type for the Data Time Series format is within the spectrum of ‘general’ to ‘hard’ news classifications, as well as higher frequency of reporting.

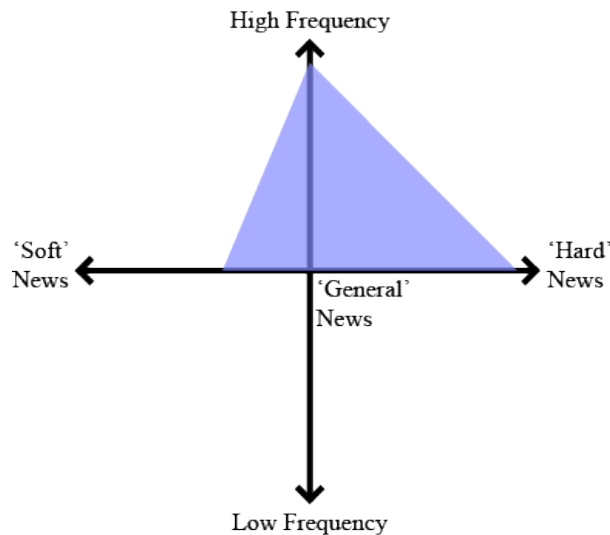


Figure 3.5: Content matrix of the Data Time Series format

It is important to note that the selection of individual news articles is not mutually exclusive and collectively exhaustive, which means that intentional overlaps may exist if a news topic shares properties of multiple categories. The important factor is purely in facilitating the user to news stories that are in their interest.

### **Topic Ranking**

The editor must also create a ranking system for different news topics in order to establish a hierarchy for displaying content. As several ranking systems and algorithms already exist and strategies differ significantly between news organizations, it is difficult to recommend strict rules. However, a number of specific metrics have been identified as useful reference points for the development of a ranking system unique to each news organization. The following is a list of potentially useful metrics:

- The number of articles produced by a news organization during a particular time period.
- The average length of an article from a news source.
- Usage patterns of readers.
- Circulation statistics of relevant news articles.
- Newsroom involvement and resource allocation of the topic.
- The frequency of updates to the dataset.

### **3.3.3 Data Visualization**

The narrative visualization technique used in the Data time Series format can be described as a combination of Magazine Style and Interactive Slideshow format as defined by Segel and Heer (2010). The main reason for this choice was that the reading experience with a balanced effect of explanation and exploration required the use of both author-driven and reader-driven storytelling.

Figure 3.6 illustrates a few examples of how data visualizations would be designed on the proposed format. Data visualizations may be in forms such as line and bar graphs displayed on a function of time. More than one dataset can be

displayed in each graph if a comparison between data is relevant to the given topic. Overall, there are little strict rules involved in the type of graph, as long as it is able to convey a historical trend and a narrative associated to the issues.

Additionally, a prominent feature of the data graphic on the Data Time series format is the use of background imagery. As seen in the examples (Figure 3.6), the background image should be relevant to the given topic. For instance, the news topic ‘Ebola Outbreak in West Africa’ may be presented with an image of on-ground humanitarian aid workers, while the news topic ‘US Politics’ would be presented with an image of the United States President Barack Obama. While data visualization designers have consistently argued against the use of imagery with little correlation to the data or so-called ‘chartjunk’ (Tufte and Graves-Morris, 1983), the Data Time Series format embraces the use of background imagery as a technique to draw user attention, which is grounded on cognitive psychology research that insists on its efficacy to enhance memorability of a data visualization (Borkin et al., 2013; Isola et al., 2011). However, a certain level of visual density and data-ink ratio must also be achieved to ensure readability.



Figure 3.6: Examples of data visualizations

### 3.3.4 Layout

While there are no strict rules to the detailed aesthetic decisions in the Data Time Series format, the general layout can be described in terms of its primary and peripheral elements.

#### Primary elements

There are three main design elements in the Data Time Series format: 1) the news topic headline; 2) the data trend; and 3) thumbnails to relevant news articles (Figure 3.7). The ordering of elements is simply based upon natural reading patterns from top to bottom and from left to right.

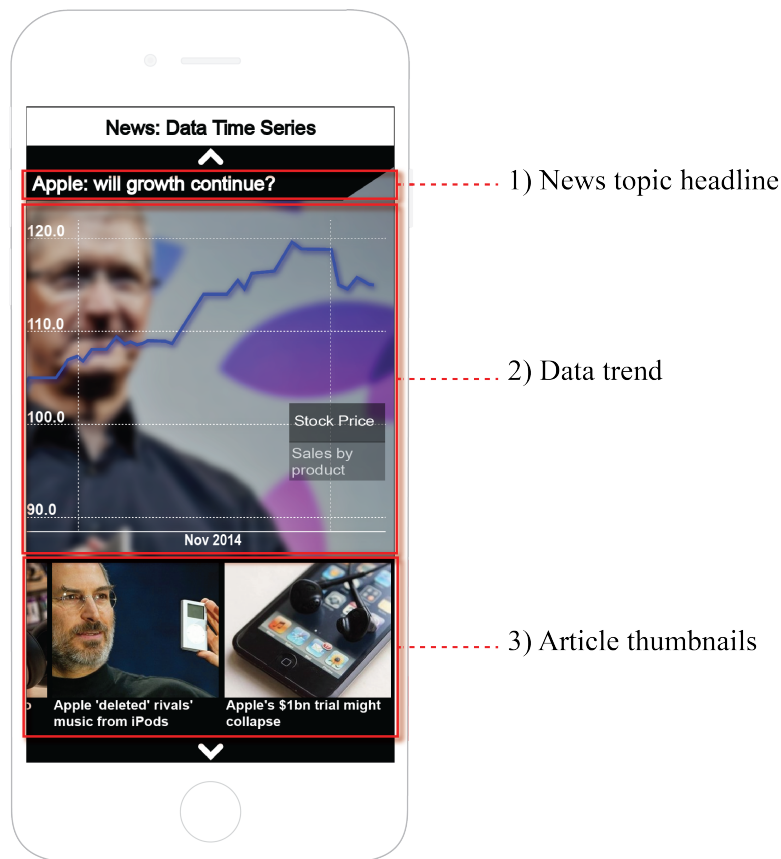


Figure 3.7: Content layout of the Data Time Series format

### **Peripheral elements**

Other than the four primary elements, a number of peripheral elements are employed in the layout design to facilitate comprehension and usability. These include the navigation bar at the top of the screen and two buttons on either side of the content to switch between previous and subsequent news topics.

### **3.3.5 Interaction**

In the beginning, the user is directed to a menu of broad news categories. Each category represents an overarching theme for a group of related news stories. For instance, the category of ‘World Issues’ will house news stories that have an international focus. On the other hand, the category of ‘Economy’ will include topics related to macroeconomic trends.

Upon selection of a category on the first page, the user is led to a page displaying a news topic. As this news topic is the first contact point for the user to engage with the news format, it should encompass the most important and urgent news topic of that particular time. Much like a magazine style news reader, users are given the freedom to flip to the news topic that follows.

Upon arrival to a news topic, readers are invited to navigate through a given set of data graphics relevant to the topic (Figure 3.8). By tapping on the legend on the lower right hand side of the graph, readers are encouraged to interact with different datasets from numerous news topics while further engaging in deep reading for news stories particularly of interest. Furthermore, the data trend begins at the most recent trendline, thus users will scroll to the left in order to view past trends. Likewise, the articles are also arranged chronologically with the most recent displayed on the right. Users will scroll towards the left in order to see older articles.



Figure 3.8: Flow chart of the Data Time Series format



### 3.4. Implementation

The implementation of the proposed Data Time Series format involved the development of a semi-functional prototype. The working prototype was developed through a prototyping tool called *Pixate* (Pixate Inc., 2014). Launched in 2012, the browser-based prototyping tool provides sophisticated animations and interactions that are made available through native iOS prototypes. The tool was chosen for its rich environment to produce highly interactive designs and workable prototypes specifically for Smartphone applications (Figure 3.9). Moreover, as it did not require any writing of software code, the researcher was able to produce several iterations of the design at a high speed.

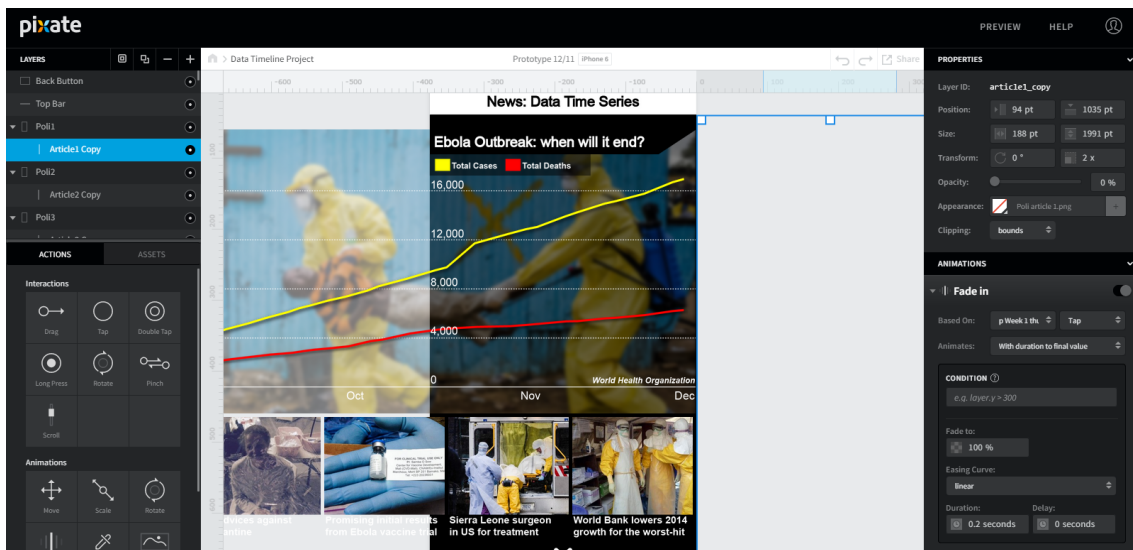


Figure 3.9: Prototyping tool used for implementation

Over a course of two months, the researcher developed a functional design layout with four news topics to be evaluated by target users: The Ebola outbreak in West Africa; Company news on Apple Inc.; latest news on Japanese economy; and latest news on US politics (Figure 3.10).



Figure 3.10: Screens of developed news topics

### Data and Article Selection

Based on the criteria for content selection and curation, the researcher manually chose data trends and individual articles from an array of online sources. Moreover, full readability was ensured for each data trend and associated articles. Table 3.1, 3.2, 3.3 and 3.4 describe the data trends and articles selected for the prototype.

Table 3.1: Dataset and article selection for ‘Ebola Outbreak’ topic

<b>Dataset Selection</b>	<b>Article Selection</b>
Total Ebola Cases	“World Bank lowers 2014 growth for worst-hit nations”
Total Ebola Deaths	“Sierra Leone surgeon in US for treatment”
	“Promising initial results from Ebola vaccine trial”
	“US advises against quarantine”
	“Ebola winning the race says UN official”

Table 3.2: Dataset and article selection for ‘Apple’ topic

<b>Dataset Selection</b>	<b>Article Selection</b>
Apple Stock Price	“Apple’s \$1bn trial might collapse”
Sales by product	“Apple ‘deleted’ rivals’ music from iPods”
	“Apple to push Beats to all iPhones”
	“Biometrics in smartphones need more control - ex-GCHQ boss”
	“Watchmakers take aim at smart copies”

Table 3.3: Dataset and article selection for ‘Japanese Economy’ topic

<b>Dataset Selection</b>	<b>Article Selection</b>
National GDP Exchange rate	“Polls point to convincing Shinzo Abe win” “Japan’s Nikkei marks sixth day of gains” “Japan downgraded by Moody’s” “Japan’s economy falls into recession” “UK, Japan and 1% inflation”

Table 3.4: Dataset and article selection for ‘US Politics’ topic

<b>Dataset Selection</b>	<b>Article Selection</b>
Presidential approval Economic conditions	“Prince William holds first talks with Obama” “CIA torture report: US raises security” “Obama: Ashton Carer as new defence chief” “US adds 321,000 jobs in November” “Obama chided for remarks on Xi Jinping”

### **Access to Prototype**

The prototype was made accessible through an associated native iPhone application provided by *Pixate* (Pixate Inc., 2014). Scroll, tap and move gestures, as well as transition animations were associated with each element, making the experience extremely close to the actual proposed design layout. Moreover, the prototype was developed under a cross-platform and adaptive environment, making it possible to adjust the prototype for any screen size and any pixel density on both iOS and Android.

While hardware and software specifications can be flexibly adapted by the developer, the implemented design was found to properly function on the following conditions:

- **Hardware**  
iPhone 6
- **Software**  
iOS 8

## **3.5. Summary**

This section clarified the concept behind the Data Time Series format, while providing theoretical grounding in terms of the target user and target producer; furthermore, design specifications were described. The Data Time Series format is a reproducible news format with the aim to guide readers through a more in-depth reading of news during short sessions on Smartphones. Triggering user interest, controlling against selective exposure and addressing the Smartphone niche were identified as the essential components for behavioral transformation. Moreover, data journalistic techniques showed promise in achieving those factors. Meanwhile, the target producer was identified as news organizations with resource capabilities in IT, user interface design and editorial expertise. Based on the implemented prototype, the following chapter will provide an overview of the evaluation of the proposed news format.

# Chapter 4

## Evaluation

To evaluate the efficacy of the proposed *Data Time Series* format, qualitative research was conducted on a semi-functional prototype through a series of ethnographic studies combining observations and semi-structured interviews with target users. The study borrows ethnographic research techniques purported by Ladner's (2014) *Practical Ethnography: A Guide to Doing Ethnography in the Private Sector*. The literature was chosen for its practical application of rigorous ethnographic practices within the private sector context. Ladner (2014) utilizes common sociological techniques in behavioral observation and analysis by ethnography scholars such as Spradley (1979) and McCracken (1988).

Ladner's (2014) technique is useful within the context of this particular research, as there is a strong emphasis on producing actionable outcomes for a business-oriented and strategic use. Moreover, the author provides research design guidelines that are updated for the current era through the use of the latest mobile and digital technologies as measurement and analytical tools in order to optimize the reliability and validity of the study. The method is also unique for its velocity of experimentation, allowing the researcher to gain fruitful insights within a short period of time as opposed to conventional academic research methods. As the design of the Data Time Series format is grounded on both theoretical development and practical application, such methodological attributes should provide adequate revelations for further discussion.

As described in Chapter 3, the Data Time Series format was developed in order to facilitate in-depth comprehension of news during short sessions of news reading on Smartphone news applications. As such, the primary objective of the user test is to observe and evaluate user behavior of the Data Time Series format based on the following assumptions:

1. The Data Time Series format will trigger user interest in important current issues.
2. The Data Time Series format will trigger user desire into a deeper reading of a current issue.
3. The Data Time Series format will facilitate the holistic comprehension of a given current issue.

## 4.1. User Study

The user study was conducted based on three interrelated ethnographic research techniques: observation, interview and survey.

### **Observation**

Ladner (2014) emphasizes the importance of observational techniques in ethnographic study, calling it a “key ethnographic differentiator.” The observation enables the researcher to recognize and evaluate the gap between what participants say and what they actually do. Moreover, by playing the role of a ‘cold ethnographer,’ the researcher is able to hide in plain sight, mitigating risks of drawing unwanted attention or genuinely altering the experience of everyday life for the participant. With that in mind, the observation was conducted in the following standardized steps:

1. Give briefing of project and purpose (1 minute)
2. Teach navigation of prototype (1 minute)
3. Let the interviewee use the prototype and record observation (4 minutes)

The observation begins with each participant given a short briefing on the purpose of the study and an explanation of the concept of the Data Time Series format. Next, the participant was given a hands-on tutorial on how to use the prototype. The participant was further asked to freely navigate through the prototype for four minutes, a time frame chosen based on studies that indicate the average time a user spends on each session for Smartphone news consumption (Aggarwal, 2014).

This process was conducted strictly without intervention by the researcher in order to ensure a reliable and true response to the prototype. During the four minutes, the researcher observed the participants' overall usage patterns, looking closely at gestural patterns in navigation, as well as behavioral responses to the prototype. Upon completion of the observation, the researcher further analyzed each input, categorizing interpreted results based on usability successes and usability failures.

### **Interview**

To draw important connections between observed results and user perception, the observation process was followed by a semi-structured interview with each participant. In Social Science research, a semi-structured interview has a flexible and fluid structure for themes to be explored, allowing the conversation to take several different paths depending on user responses (Ladner, 2014).

In this study, the researcher asked a set of preconceived questions aiming to uncover the efficacy of the prototype based on the aforementioned assumptions. Each interview question was kept contextual in nature, asking for insights on different topical and design elements of the Data Time Series format. Moreover, the researcher asked additional questions based on different gestural patterns and behavioral responses recorded during the observation process. As such, the interview was conducted with a high level of flexibility in order to draw constructive interpretations based on different keywords and gestural cues. A standardized guide was used for data collection, with each interview taking around 10 minutes to complete.

The following are some examples of interview questions in no particular order:

- What was the first element in the design that caught your attention?



- Which topics interested you the most and why?
- Did you read further into any of the articles? What made you look further?
- Did you find any data trends particularly memorable or interesting?

## Survey

The researcher concluded the user study by asking each participant to fill out a user profile survey (Figure 4.1). The survey asked each participant for details on his/her demographic, occupational and academic backgrounds, as well as general news consumption patterns. The purpose of the survey was to ensure that the researcher had enough background information when conducting a comparative analysis between the different results of the observation and interview.

Date: \_\_\_\_\_ # \_\_\_\_\_

**User Profile Survey**

**Name:** \_\_\_\_\_

Age: \_\_\_\_\_ Gender: M / F Nationality: \_\_\_\_\_

**Occupation:** \_\_\_\_\_

Industry: \_\_\_\_\_

Years Worked: \_\_\_\_\_

**Training/Academic Background:** \_\_\_\_\_

Highest Degree Achieved: \_\_\_\_\_

**1. Interested News Topics (circle all that apply)**

-National Issues	-International Issues
-Local Issues	-Finance/Markets
-Economy	-Politics
-Technology	-Sports
-Entertainment	-Other (please specify): _____

**2. Which types of news media do you prefer? (circle all that apply)**

-Smartphone	-Tablet	-Desktop/Laptop
-Print (i.e. newspapers)	-Television	-Radio
-Other (please specify): _____		

**3. Which format of news do you prefer on Smartphones (circle all that apply)**

-Traditional brands	-Aggregators/Curation apps	-Social Media
(ex. BBC, Nikkei)	(ex. Flipboard, NewsPicks)	(ex. Facebook, Twitter)
-Other (please specify): _____		

**4. When do you read news during the day on your Smartphone?**

-In the morning	-At night	-On the way to work/school	-During breaks at work/school
-Other (please specify): _____			

**How often during the day?:**

- 1-2 times	- 2-5 times	- 5-10 times	- More than 10 times
-------------	-------------	--------------	----------------------

**5. Where do you read news on your Smartphone?**

-At home	-In transit (ex. Train)	-At work/school	-Other (please specify): _____
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Figure 4.1: Standardized user survey

### 4.1.1 Data Collection

The ethnographic study was conducted over two weeks in mid-December 2014 with four participants randomly chosen from the predefined target group (see Chapter 3.1.1). All respondents were English speakers and the interviews were conducted in English. The tools used for the study include the aforementioned standard research documents, a voice recorder, a camera, a notebook and an iPhone 6 with the Data Time Series prototype pre-installed on the device. The study was conducted within a short time frame (around 1-2 weeks) after implementation of the prototypes in order to maintain the timeliness of the news topics. Additionally, the study was conducted within a controlled environment such as at the respondents' home or at a quiet public space, utilizing the same mobile device for each study for consistency (Figure 4.2). For each respondent, describing the underlying concept of the proposed format was kept minimal until after the completion of the study in order to control for biased views and preconceptions that may cause skewed result.



Figure 4.2: Environment for data collection

## User Profiles

Based on the user survey, the general profile of the participants were found to be varied in terms of age, gender, and occupational and academic backgrounds. As Table 4.1 illustrates, both genders were equally represented, while the participants' age was well-dispersed within the target age group. Moreover, each participant had different academic backgrounds, allowing for a sample with varied areas of intellectual knowledge. Finally, each participant was employed in knowledge-intensive jobs, signifying a higher education, a moderate to higher level of disposable income and a keen interest towards making investments for personal development such as on educational expenses.

Table 4.1: Basic profile of user test respondents

	<b>Age</b>	<b>Gender</b>	<b>Industry</b>	<b>Academic background</b>
<b>Participant 1</b>	34	Female	Finance	Law
<b>Participant 2</b>	39	Female	IT	Music
<b>Participant 3</b>	35	Male	IT	Mechanical Engineering
<b>Participant 4</b>	28	Male	Banking	Commerce

Additionally, all four participants showed interest in at least four different broader news categories including, but not limited to, news stories on international affairs, national affairs, local affairs, technology, finance, politics, entertainment and sports news. This signifies a generally higher demand to meet a broader range of information needs. As available time to consume news was restricted to short intervals during the day such as during transit and lunch breaks, the Smartphone was readily the preferred news outlet for all participants for its mobility and connectivity. On the other hand, traditional media such as television and print play the role of providing supplementary information. Interestingly, traditional news brands such as *BBC* and *Nikkei* were the most trusted format, perhaps indicating a strong demand for quality and credibility of coverage. Frequency of consumption was also high; on average, each participant checked the news 5-10 times during a single day.

## 4.2. Results

In this section, the interpreted results of the user study will be discussed based on usability successes and usability failures. Here, usability successes are defined as behavioral effects that were positively associated with the initial assumptions, based on gestural patterns and behavioral responses that were readily justified during the interview process. On the other hand, usability failures are defined as behavioral effects that were negatively associated with the given assumptions, also readily justified during the interview process.

### 4.2.1 Usability Successes

During the observation, a number of gestural cues signaled that users were interested with certain types of news topics. For instance, the data trend was the first contact point for all participants. Each participant aptly scrolled through the data trend from the outset, looking into past trends. During the interview, both Participant 1 and 3 admit that the data trend was the first part of the design that caught their attention. Furthermore, Participant 1 also notes on how the background image of the news topic ‘Ebola Outbreak in West Africa’ especially caught her attention, literally describing it with the words “cool” and “interesting.” This indicates the successful use of imagery as a trigger to user interest. Similarly, Participant 2 was especially intrigued with the data trends on “US Politics,” stating that it was an “interesting graph to see especially as a non-American,” suggesting how there was a sense of discovery during the reading experience. Meanwhile, Participant 4 notes on the novelty aspect of the design, mentioning how the design was “interesting because I have never seen something like it,” which caused him to interact with the data trend from the beginning. Participant 3 states that the design was better than existing formats, which were “boring,” and the Data Time Series format had an interesting user interface combining data graphics and imagery.

Another gestural cue that signaled user interest and a desire to look further into a topic was in terms of the amount of taps made on each article subsequent to interacting with a data trend. Participant 1 and 3 both browsed through more than three articles for topics that interested them. During the interview,

Participant 3 followed with an explanation, mentioning that he wanted to “get a broader understanding” of the issue at hand, but “did not want to take time reading each article.” Participant 1 also mentions that she was more interested in reading through the headlines for each article of a given news topic. This suggests how the participants were interested in grasping the macro trends of different news topics and acquiring as much brevity as possible.

While not at the same frequency as other participants, Participant 2 and 4 also looked into a few articles, but took a considerably longer time to read compared to Participant 1 and Participant 3. For instance, Participant 2 mentions that an article about the downgrading of Japanese credit rating by Moody’s was especially interesting to read as she was concerned about the country’s negative growth rate. This not only suggests a cue for user interest, but also a connection made between the data trend and articles, which is a sign of comprehension. Participant 4 mentions that he read through an article on US Politics because he was already aware about the macro trends, but did not know the details of the subject. As a result, a concerted effort was made to read further into an article.

User comprehension about the data trends was also observed. All participants mention that the graphical representations of the data trends were readily accessible and easy to digest. Moreover, as described above, users had the literacy to make their own connections between the data trends and individual articles. Participant 1 noted on how the layout made logical sense in terms of being guided through a news topic. When asked whether or not she reader further into any articles, Participant 3 made a number of comments about the topic on ‘Apple’ based on facts that were taken from multiple sources.

It is possible to make conclusions that both user interest and user comprehension were observed based on the user study. However, there were a number of conditions that were also observed in which user interest and user comprehension was not equally perceived throughout the evaluation. This will be discussed in the following section on the usability failures.

### **4.2.2 Usability Failures**

A number of conditions exist to the efficacy of the Data Time Series format to trigger user interest and further enhance user comprehension about an issue.

A prominent factor was that the users' personal interests heavily determined the efficacy of triggering user interest towards news topics. Topic involvement was a clear factor that influenced all participants. For instance, Participant 2, 3 and 4 explicitly mention that they were uninterested in topics that did not matter to them personally. Similarly, during the observation, Participant 1 also showed signs of selective reading in which high engagement was limited to a limited number of news topics. This indicates that while the Data Time Series format was able to engage users 'after' user interest was triggered, it was not successful in controlling for selective exposure between different news topics. Specific factors that influenced topic involvement included the readers' proximity to the issues in terms of their background and ability to invoke surprise.

Furthermore, a number of comments were made in terms of the efficacy of the presented data trends. Participant 1, 2 and 4 state that there were "not enough" available data trends, indicating the need for more information in order to acquire a true sense of holistic comprehension. Participant 1 similarly mentions that the "data was not rich enough to make a conclusion." In other words, the data trends were not optimally presented for user comprehension on the issue. However, interestingly, this also indicates a desire for more information from the users. Participant 1 also mentions how certain decisions on the layout such as the display of values on the axes and the design of the legend "could have been better." Structural factors seemed to substantially influence the communicative strength of the design.

Participants also questioned the direct correlations between data trends and individual news articles. Participant 1 states that she had trouble understanding whether or not the data was directly related to the articles, making the suggestion that inserting captions for different "turning points" of the topic would have helped. Additionally, Participant 4 notes that because news articles can be charged with a certain biased view, he did not know whether the data trends were also biased. A clear distinction was needed between objective and opinionated narratives.

Other structural factors that acted against the effectiveness of the Data Time Series format include long articles, uninteresting imagery and usability issues with the user interface. In particular, user interface improvements were suggested by

participants, with a stronger preference for gesture based interactions rather than push buttons.

### 4.3. Summary

Overall, the following conclusions can be made based on the initial assumptions:

1. **The Data Time Series format will trigger user interest in important current issues.**

The format will trigger user interest on the condition of high topic involvement by the user.

2. **The Data Time Series format will trigger user desire into a deeper reading of a current issue.**

The format will trigger user desire into further reading once reader interest is triggered. However, the effect is split between those who seek brevity and those who seek a detailed reading of a few stories.

3. **The Data Time Series format will facilitate the holistic comprehension of a given current issue.**

The format will facilitate the holistic comprehension on the condition that there is enough information on data trends combined with structural readability.

# Chapter 5

## Discussion

With the concept of ‘in-depth news snacking,’ the purpose of this research was to suggest an alternative news delivery method for Smartphones with the intention to trigger user interest towards important current issues, and moreover, facilitate the holistic comprehension of an issue at hand. Through the *Data Time Series* format, users are guided through the news on a topical basis, with historical data trends and a variety of news articles curated in a way that enables a deeper reading on the issue at hand. The design utilizes data journalistic techniques to trigger user interest, while controlling selective exposure through its design layout. A magazine style reading experience was employed in order to adapt to reading style preferences on the Smartphone, defined by routinely frequent yet shorter news consumption sessions.

For the news producer, the Data Time Series format serves as an alternative outlet for delivering data-driven news content, and was developed as a method of news delivery premised on good reporting while attempting to attract the current generation of news readers. The velocity of production and journalistic involvement inherent in the design are also key factors in reducing risks of information asymmetry deriving from a vast surplus of available digital data. Furthermore, by re-imagining the current operational model for news production through the invention of novel types of content, the proposed format is an attempt to differentiate against current offerings by other news organizations.

On the issue of journalistic integrity, a particular focus was placed on design specifications of the content selection and the curation process. For instance, the



basis for news article selection must be guided by a clear classification system that accounts for a news story's intrinsic informational value based on public interest principles, as well as timeliness and scale of reporting. To present these stories effectively, an equal significance is to be placed on the broadness of coverage both in terms of the diversity of representation and historical developments. Through the systematic implementation of the Data Time Series format, one that requires a fundamental shift in institutional tendencies combined with extensive developments in the technicalities of automation, it is possible to disseminate data-driven news content at considerable scale.

The user study revealed usability successes in triggering user interest on the condition of high topic involvement by the participants. Moreover, signs of deeper reading and holistic comprehension were observed for topics that successfully drew the reader's attention. However, structural issues seemed to act against the effective transmission of information.

Balanced exposure to information was, expectedly, driven by the quality of selected content coupled with the necessity to provide structures that resist fragmented dissemination of information. As appropriately purported by Garrett and Resnick (2011), "the technology and how people use it are still malleable; subtle architectural changes could have far-reaching implications for future news consumption patterns." These structural changes can be addressed in two fronts: institutionally and individually.

On the institutional side, the implementation of the Data Time Series format must eliminate the inherency of media bias that may be structurally embedded within the news production process (Park et al., 2009). For instance, a politically and ideologically biased curation of content, often as a result of personal views by the editor, could result in underserving or fundamentally neglecting a group of readers. On the same token, catering news content only to draw reader interest will inevitably spawn preferential treatment towards the highest paying class of readers (under the current economic model).

While concrete solutions are yet to be developed, a recommendation may involve instituting checks, similar to a stage-gate process, at every stage of production from gathering, writing to editing. Furthermore, the removal of hierarchical structures in the newsroom can aid multilateral communication among a diversity

of expertise. A transformational process is already under way in many newsrooms (Zanchelli and Crucianelli, 2014).

On the individual side, topic involvement seems to be influenced by a multitude of factors surrounding cultural upbringing and accessibility to information (Garrett and Resnick, 2011). While cognitive dissonance will continue to exist on different levels, infrastructural and educational factors may play significant roles in fostering civic participation and public discourse among an otherwise politically stagnant population. By increasing accessibility to information and reducing barriers to entry, discourses on important current issues can flourish even further.

As such, along with improvements to the design, the successful implementation of the Data Time Series format requires a broader use of strategic channels in marketing and user education. For instance, through inbound marketing strategies that enhance the awareness and interest towards a critical reading of public affairs news, users may feel less aversion towards encountering counter-attitudinal information. The success of Social Networking Sites such as *Facebook* and *Twitter* prove that networking effects are strong drivers of community development. The strategic use of Social Media to educate the public, informing people about the prevalence of diverse opinions and reinforcing the norm of balanced exposure, will provide the foundation for the Data Time Series to optimize its effects. Additionally, technological developments in broadband networks should instill a higher level of trust in using the Smartphone as the primary source of meeting daily information needs.

## 5.1. Limitations

Limitations to this research include functionality of prototype, testing period and empiricism of the study.

While able to capture the essential features of the proposed design of the Data Time Series format, the prototype was not complete in its functionality. For instance, there were a limited amount of available news topics that users could view, making it difficult to conduct an evaluation that encompassed broader news categories and a variety of different news topics. Additionally, aggregation algorithms and curation techniques were not personalized based on each participant of the

study. As a result, the scope focused heavily on uncovering the efficacy of the general design layout, as well as curation techniques specific to each news topic.

The evaluation was also conducted within a relatively short time period. While the velocity of study was accounted for through the use of practical ethnographic techniques purported by Ladner (2014), ethnographic studies over a longer period of time with a continuously updated news feed could reveal a deeper understanding of long term behavioral effects on mobile news consumption. Furthermore, user tests on iterative changes to the user interface could uncover the degree of impact for each specific design element based on visual cognition studies that uncover the intrinsic properties of an image such as memorability, persuasiveness and knowledge creation.

Finally, this thesis evaluated the efficacy of the Data Time Series format solely based on a comprehensive qualitative analysis. Empirical research such as analysis of click patterns, user logs and A/B testing for different variables may be fruitful in further providing concrete evidence for the conclusions made during this study. Quantitative research is an essential tool for further analyzing the construction of aggregation algorithms and curation techniques that account for different usage patterns. Moreover, each design element can be isolated as a specific variable to be studied.

# Chapter 6

## Conclusion

The fundamental building block of a healthy democracy is a healthy media environment, one that is predicated on the effective dissemination of news on important current issues. The results from this research indicate that a design proposition in news delivery, with an emphasis on content and curation, is an effective approach to improving the reporting of news. Moreover, a clear theoretical grounding proved to inspire positive results in a practical setting. Although structural issues still exist, the research revealed the efficacy of the *Data Time Series* format in having a positive effect on triggering user interest, user desire to read further and encouraging a holistic comprehension of a topic at hand.

### 6.1. Suggestions for Future Research

To conclude, the following are a number of areas for further research that provide gateways into understanding both the theoretical and practical applications of the Data Time Series news format.

#### **Personalization**

Further research on understanding the variables involved in producing personalized content will be useful in developing methods to design for addressing selective exposure on a topical basis. Topics of interest include dataset and article selection, as well as topic ranking systems to promote higher topic involvement.

### **Design Elements**

A further exploration into the architectural changes to control selective exposure based on a topical basis is essential to increase reader exposure to otherwise ignored news topics. A particularly interesting area of study would be to uncover design elements that trigger serendipitous encounters, fostering positive emotional cues such as ‘discovery.’ Moreover, elements of design in data visualizations should be approached in an empirical manner, with room for research on topics such as the efficacy of ‘chartjunk’ as interest triggers and optimal layouts for Smartphone-oriented data graphics.

### **Automation**

The development of a fully functioning prototype will allow for empirical investigation to assess specific variables of usability. Partial or full automation of the content and curation processes involved in the Data Time Series method will enable further empirical investigation into the issues involved in real-time data provision, as well as developing strategies for continuous engagement by news consumers.

### **Production**

In order to establish an effective work process, bringing the Data Time Series format to test by actual news organizations will further uncover the opportunities and challenges involved within a professional environment.

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