HOW INFORMATION GRAPHICS PROMOTE INTERACTIONS BETWEEN THE

MEDIA AND AUDIENCES

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QING TIAN

Sungkyoung Lee, Committee Chair

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The undersigned, appointed by the dean of the Graduate School, have examined the thesis entitled

VISUALIZATION AND CONNECTION: HOW INFORMATION GRAPHICS PROMOTE INTERACTIONS BETWEEN THE MEDIA AND AUDIENCES AT SIX NEWSPAPERS

presented by Qing Tian,

a candidate for the degree of master of arts

and hereby certify that, in their opinion, it is worthy of acceptance.

Professor Sungkyoung Lee

Professor Daryl Moen

Professor David Herzog

Professor Chi Ren Shyu

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Qing Tian

Dr. Sungkyoung Lee, Thesis Supervisor

ABSTRACT

The purpose of this study is to understand how employing information graphics in the traditional newsrooms takes place and how the uses of the information graphics facilitate the interactions between the reporters and the readers and among readers. In order to answer the research questions, first, interviews with reporters from the six news outlets (i.e., the Washington Post, the New York Times, the Chicago Tribune, the USA Today, the Wall Street Journal and the Guardian of London) were conducted to gain insights into the visual journalists' perceptions on the impacts of information graphics on facilitating conversations between the news organizations and the readers. Overall, the interviews showed that journalists in general consider information graphics as efficient and vital tools for data delivery and complex storytelling, and in each of the newsrooms, an increase in readers' discussion participation is observed when articles are accompanied with graphics. Secondly, a quantitative content analysis was conducted using 248 articles from the six news outlets. The articles selected are half with information graphics and half without. The comparisons between those articles (i.e., with information graphics vs. without information graphics) were made on the number of comments and the number of unique commenters along with the features of the graphics. The results showed that in general, articles with graphics received greater numbers of comments and higher numbers of unique commenters compared to articles without graphics. It was also evident that a

good information graphics is a product for a number of reasons. Yet no simple feature stood out as the prominent reason for the differences of comment numbers across different news organizations.

Chapter 1: Introduction

Information graphics have long been employed by media of all sorts to illustrate complex information and data with easy-to-read charts and illustrations. However, journalists have only recently begun to employ advanced digital technologies in creating graphics so that animation and interactivity can be incorporated and enjoyed by readers. With the growth of online media and the development of mobile devices, it is now obvious that information graphics, along with journalism, are heading toward a digital age. Compared to print information graphics, interactive graphics provide a more interesting and flexible means for readers to access and digest information.

Indeed, a number of studies have primarily examined the values and importance of information graphics in narrating news stories. Cairo (2012) stated that information graphics are meant to help readers understand content. Effectiveness and straightforwardness are the two key values in news reporting. In fact, Cairo believes that simple graphics may go a long way because special effects within graphics are only "eye candy," and they not only divert readers' attention away from the core contents but also fill spaces that could have been occupied by more useful information. Diakopoulos (2010) divided news graphics into two groups in his study: the landmark narrative and the undirected information visualization. The first kind of information graphic has limited interactivity and is led by the narrators or the makers of the graphics, but it is most widely used by journalists. One of the examples is the animated graphic produced by CNN to illustrate the voting results for various elections. On the other hand, undirected information visualization allows the readers to navigate and

explore the information based on their own interests and at their own pace. Compared to the traditional forms of information graphics, undirected graphics can be effective in breaking down the complex set of information and making readers take the lead in the exploration process. Social sharing is also possible. However, it can be daunting at first glance if the displays or the frames are too difficult to explore (Diakopoulos, 2010).

In addition, digital information graphics offer potential solutions for a number of issues present in traditional media. For instance, in the traditional models of print news, the communication model between the readers and the journalists was a one-way street, and readers were, in most cases, passive receivers of the information. The only way to offer opinions was through *Letters to the Editor*. Communication forums among readers were scarce, if not non-existent. However, with the help of online forums and discussion sections offered by online media, readers can not only express their own opinions on these digital platforms but also exchange and contribute knowledge to the stories. Despite criticism about the qualities of online discussions, a study done by Skogerbo and Winsvold (2008) revealed that out of 1,000 articles selected from four online news sites in Norway, 90 percent of the posts were supported by facts, and personal attacks were found only in 20 percent of all posts.

This model of communication between readers and journalists has also had an impact on a number of aspects within the media landscape, one of which is readers' brand loyalties. McDowell (2006) defined the term brand as "a name, term, sign design or a unifying combination of them intended to identify and distinguish a product or service from its competitors. Brand names communicate thoughts and feelings that are designed to enhance the value of a product beyond its product category and functional

value" (p. 234). When readers perceive the brand personalities to be aligned with their own personalities, their loyalty to the brand is likely to increase (Kressmann et al., 2006). Here, brand personality is defined as "the set of human characteristics associated with a brand" (Aasker, 1997, p. 347).

By using online surveys with 450 randomly selected readers who were exposed to both the print and online media brand of German newspapers *Spiegel*, *Stern,* and *Focus*, Nienstedt et al. (2012) discovered that over 58 percent of the participants preferred online media brands to print media ones. With an increasing number of readers getting used to digital reading, the percentage of readers with loyalties to online media is likely to increase as well.

The growth of online media has also had an impact on the business model of the journalism industry. Before the invention and wide use of online media, most of the profits for print and broadcasting media came from the traditional revenue model, which was "producing journalistic content that attracts readers who purchase newspapers, becoming targets for advertisements sold to companies and published in those newspapers" (Barland, 2013, p. 99). However, many news outlets have trouble surviving and adapting their old business model to the new digital world. As many online media have illustrated, digital storytelling helps newsrooms "achieve digital traffic, and this traffic is used as a marketing channel to expose other digital service that media outlets offer to users" (Barland, 2013, p.100).

The combination of shrinking print circulation as well as advertising has forced traditional media companies to experiment with digital reporting. In addition, as an increasing number of online media, such as the *Huffington Post* and *Buzzfeed*, extend

their coverage of hard news, traditional newsrooms are struggling to survive in the digital age. As a result, many of these traditional publications are turning to new technologies to compete with online media, attract more subscriptions and advertising revenue, and improve the quality of their reporting. By providing such components in their online editions, and sometimes including graphics in their print versions, traditional media are attempting to combine accurate reporting with a number of the advantages new media provide, such as audience participation, information sharing, and engagement. A number of print media have produced successful interactive graphics, such as the *New York Times* with its Olympics and presidential election packages in 2012. However, despite the fact that technologies, such as information graphics, are in the spotlight in the news industry, not many studies have been done on these topics. Related pre-existing literature is limited and outdated.

This study aims to add layers onto the current academic achievements and research on information graphics and to find the core values that could facilitate and encourage the interactions and social sharing among readers. In comparing articles with graphics and articles without graphics, the findings will shed light on whether or not graphic components within news pieces are helpful in encouraging discussion among readers. In addition, comparing articles with graphics will reveal the core values within graphics that attract the attention of and spur discussion between readers. Finally, interviews with professionals in the field will add the insight of reporters on the importance of having conversations with readers. Such research will focus on the analysis of how the use of new media, specifically static and interactive information graphics, encourages and promotes the interaction between the media and their

audiences as well as readers' interest in national news in six news organizations. Those

organizations are the *Washington Post*, *Chicago Tribune*, *USA Today*, *Wall Street*

Journal, *New York Times,* and *Guardian*.

Chapter 2: Literature Review

Uses and Gratification

  The theoretical framework of this study is uses and gratification. With its first

appearance and usage in the Payne Fund movie study in the 1920s (Blumer, 1933), uses

and gratification was based on a group of active and conscious audiences (Papacharissi,

2008). It was employed in the 1940s to find the reason why people loved listening to

the radio, including programs such as soap operas and quiz games (Cantril, 1942). This

theoretical framework was also used in the following decades to measure the

gratification resulting from television programming (Blumler & McQuail, 1969).

However, the early model of uses and gratification was criticized by scholars as being

too individualistic, making it nearly impossible to expand and generalize to the whole

society (McQuail, 1979).

  With an audience-centered perspective, uses and gratification is based on the

following five assumptions. First, the communication behaviors of audiences,

including preference of media type, are clearly goal and motivation oriented. Second,

audiences have the ability to select whatever media they wish to choose. Third, "a host

of social and psychological factors mediate people's communication behavior" (Rubin,

1994, p. 420), and audience choices are influenced largely by their social settings and

personal needs. Fourth, there is competition between media and other forms of

communication in meeting the needs and desires of audiences. Fifth, most of the time

audience choices are more influential in the relationship (Rubin, 1994).

  Contrary to other theories that focus more on media than audiences, the uses

and gratification theory states that audiences choose a specific medium simply because of their particular psychological and social needs and drives (Rubin, 2009). The gratification derived from the media is defined as "expectations and desires that emanate from, and are constrained by, personal traits, social context, and interaction" (Rubin, 2009, p.167). As a result, the gratification gained from a certain medium may not be due to the most prominent features of a certain news medium, but it rather stems from "a given user's pre-existing needs" (Sundar & Lumperos, 2013, p. 506). These needs will "generate expectations of the mass media or other sources, which lead to differential patterns of media exposure, resulting in need gratification and other consequences" (Katz et al., 1974, p. 20).

The gratification the audience gains from using media is often measured by surveys. One example of this is the study of gender differences in video game playing experiences. Lucas and Sherry (2004) first distributed surveys to 593 college students between the ages of 18 and 24 in two public universities located in the Midwestern United States. Each participant was asked to rank his or her preferences and likings for 13 categories of video games, such as strategy, puzzle, and arcade games. The preferences were measured using a Likert scale. In this survey, '1' was *extremely dislike*, while '6' was *strongly like*. Also, '0' was provided as the choice *I don't know* (Lucas & Sherry, 2004). Each participant was also asked to circle the reasons why he or she liked these games along with their number of playing hours per week. The results showed that young women were less likely to play video games compared to young men. Furthermore, female video game players were more likely to play fewer hours than their male counterparts. The results showed that the average number of hours of game

play per week among all participants was 8.54—for women players the mean game-play hours were 4.25, while it was 11 hours for men.

Using the uses and gratification model, Cheng and Lo (2012) examined the use of animation in news reporting, specifically the audiences' perceptions of the credibility of news pieces and the corresponding news outlets that utilize this technology. In addition, the study also looked at audiences' overall attitudes about the utilization of animation in the news. The study had 153 college-aged participants from Hong Kong who were randomly assigned news with and without animations. The researchers then measured five attitude dimensions: believability, accuracy, trustworthiness, bias, and completeness. The results suggested the following: first, audiences viewed news with and without animations as equally credible; however, news with audio only was rated as the least credible among all news pieces. In addition, the credibility of the news stories was highly correlated with the perceived credibility of the news organizations (Cheng & Lo, 2012).

This study employed uses and gratification to examine traditional newsrooms' choices in implementing interactive elements in their web versions and their advantages over online media outlets, such as *Buzzfeed* and the *Huffington Post*. One of the possible reasons for the advantages was the established accountability of traditional print publications. According to Galloway and Meck (1981), audiences' motivation to use any media for news consumption partly depended on the perceived reliability of the media. In addition, uses and gratification could be employed when comparing articles on the same topic with and without interactive elements. In this study, interactive information graphics were favored over print pieces since

"interactivity significantly strengthens the core users and gratification theory"

(Ruggiero, 2000, p. 15). Here the term "interactivity" is defined as "the degree to

which participants in the communication process have control over, and can exchange

roles in their mutual discourse" (Williams, Rice, & Rogers, 1988, p. 10). According to

Heeter (1989), interactivity can be shown and evaluated through the following

dimensions: the number of choices for readers, the effort needed in order to access

information, the level of responsiveness of the medium to audiences, the possibility for

audiences to add information to the system, and the level of interpersonal

communication among various users facilitated by the system. As a result, uses and

gratification theory can help in understanding the motives behind readers' preferences

of graphic elements, their degree of willingness to participate and engage in

discussions, and their desire to share the news with their social contacts.

Information Graphics and Their Characteristics

There are many reasons for the high level of attention information graphics

receive in the journalism industry. In this section, a number of reasons why information

graphics are attention grabbers will be discussed.

First, with the strong influence of Web 2.0, static and interactive information

graphics and news games are now no strangers to newsrooms around the nation.

Lankow, Ritchie, and Crooks (2012) defined the term "information graphics" as "the

practice of representing information in a visual format" (p. 20). Such information

presentation usually consists of three units of information, including text (such as key

words, introduction paragraphs, and short explanations), visual graphics (such as

shapes, data graphs, and vector images), and multimedia (such as photos and videos)

(Holsanova, Holmberg, & Holmqvist, 2009). These graphics have the characteristics of vertical orientation, large typefaces, and illustrations to transform complex datasets into simple visual elements (Lankow et al., 2012).

Secondly, information graphics is largely an interdisciplinary practice. A successful interactive graphic needs to contain a combination of the following components: photographs or multimedia to represent the news scenes; illustrative art to represent the data and key information; sound or music to add ambient sound; sound bites or narrations to add emotions to the story; and, finally, text to add introductions or further explanations to the information (Shedff, 1999). Thus, successful creations and executions of information graphics require the skill sets of computer scientists, statisticians, graphic artists, and journalists (Lankow et al., 2012).

Tankard (1987) introduced several basic forms of frequently used information graphics in newspapers, including bar charts, line charts, and pie charts. The bar charts were defined as vertical or horizontal bars to show the values or quantities of certain variables. These bars are usually shaped as rectangles and are oriented either horizontally or vertically. The bar chart is the most basic and best-known graphic type used in the news. Another form of graphic is the line graph, which uses the movements and directions of lines to represent either trends or the quantities of certain variables. These lines are placed on a coordinate grid with an x- and y-axis, and each axis represents the scale of the variables (Tankard, 1987). The last form of graphic is a pie chart. This kind of chart is identified as slices of pies within a circle, in which the areas of the slices represent the values of certain variables (Tankard, 1987). A broader definition of information graphics by Holmes also included fever charts, maps, and

diagrams (Holmes, 1984).

New technologies have allowed users to merge illustrations with data. Mogos (2012) introduced some of the advanced forms of information graphics in the modern age. One of the new tools is Newsmap, which is software that enables users to organize various stories and headlines into bands that help readers navigate and understand relationships and patterns in the news. Another tool is WikiMind Map6, which is similar to mind map techniques, in which different points or ideas are linked based on their logical relationships. The third technology is Akamai's real-time web monitor, which offers illustrations of the real-time status of the Internet around the world.

A number of media organizations have begun experimenting with information graphics in order to deliver complex numbers to the readers through simple-to-read graphics. Usher (2009) conducted a case study of an interactive graphic published in the *New York Times*. The research aimed at understanding the value of the graphics in delivering information on social controversies. Titled *Casualties of War*, the interactive graphic listed all the faces of American soldiers who were killed in Iraq and Afghanistan, and it had regular updates of the number of casualties over time. There are three elements in this graphic. The first part is also the establishing shot: a face of a killed soldier is composed of a montage of squares. Each of the squares is an image of a soldier who lost his or her life in the war. By hovering over these squares, information about other deceased soldiers will pop up, including their names, ages, branches of the army, hometowns, and head shots of the soldiers. In addition, there is a search bar available for the readers to locate a particular soldier with such search

criteria as their last names and hometowns and states. The second part of the graphic is

an analysis of United States casualties in the Middle East, including an animated map

of the distribution of the deaths and visual representations of the number of deaths.

The last component of the graphic is titled "Their Stories." It is composed of audio

pieces of other soldiers' narratives and thoughts on the deceased members within their

companies (Usher, 2009). This interactivity "creates a form of user engagement and

identification that transcends what was possible in static text" (User, 2009, p.118).

Lastly, interactive graphics have a greater chance of creating intimate

relationships with readers compared to static graphics, or traditional print news pieces

with text and photos. This is because participation is an essential component in

interactive graphics; without interaction with the reader, the content of the graphics

could not be consumed or revealed at all. "The graphic is incomplete without user

participation; the user becomes a producer of content as well as the recipient of a

message" (User, 2009, p. 120). Thus, the relationship between readers and interactive

graphics is a private one, whereas the relationship between readers and static graphics

and other components of print news products is comparatively public.

Interactive and motional graphics are just getting a toehold in journalistic

publications. From a content analysis of 643 information graphics and data

visualizations published on the *New York Times* website in 2012, Ng (2014) found out

that 85.1 percent of the published graphics were static, 12.9 percent were interactive,

and only 2 percent were motional. Most of the graphics were made for business and

economic stories, followed by government and political stories. Public affairs graphics

occupied third place. This, to some extent, explains the rationale for the heavy use of

static graphics in the *New York Times*, since business news needed "fast and simple graphics to comply with the frequent updates of the stock market and the market tax rate" (Ng, 2013, p. 24).

Much research has been conducted to show the relationship between the use of graphics and the levels of information retention and comprehension. Peterson (1983) used experiments to test the relationship between the use of data and graphics and readers' reactions to the information, including reading time, reaction, and information retention. During the fall semester of 1981 and the spring semester of 1982, a total of 625 students from 27 business schools were divided into experimental and control groups. In the experiment, the independent variables were gender, academic major, grade point average (GPA), and learning style. These variables were controlled in order to test the dependent variables of information retention, reader reaction, and reading time. The subjects were asked to read one of the four kinds of business reports: one with narratives only, one with narratives and the aid of tables, one with narratives and the aid of graphics, and, lastly, one with narratives and the aid of both graphics and tables.

The findings revealed that there was a significant correlation between the level of information retention and the data presentation format in the reports. The most effective method was to have narratives with tables, followed by narratives with graphics. Using narratives with both graphics and tables was found to be the least effective. When the participants read stories with graphics, they acted the most positively and had a higher level of information retention. Finally, graphics helped to reduce the time needed to read the narratives. All relationships tested were statistically

significant (Peterson, 1983).

The use of graphics to enhance information processing, retention, and comprehension is also of interest in the field of psychology. In order to measure the effectiveness of the use of graphics and visual images in information processing, Rosen et al. (2012) conducted an experiment with 55 undergraduate students. Each of the participants was asked to fill out a pre-test, post-test, and a transfer test to compare learning results through different means of information presentation.

Through the comparison, Rosen et al. (2012) found that students learned better when they were given two aids (for example, context sentences and pictures) compared to only one. However, there were no significant differences between offering two aids and three aids. As a result, these findings supported the claim that the use of graphics to accompany text articles could help the audience understand complex stories.

With all the benefits of incorporating information graphics in both print and online publications, it is almost a natural instinct for journalists as well as readers to ask: What, then, constitutes good information graphics? According to the theory of information processing, the most effective graphics would be the ones that "exploit properties of human information-processing abilities" (Stephen, 1985, p. 501). In other words, if the design of graphics follows the stages of the cognitive activities of human beings, there is a greater chance that readers could successfully process the information (Ramaprasad, 1991).

Ramaprasad (1991) suggested three stages of cognitive activities needed to read graphics. Firstly, readers will get a rough sketch of the images in their minds. In the second step, visual elements will be grouped into units and then stored in readers'

short-term memory. Consequently, information graphics will be much more effective if the designers can organize scattered elements into units when laying out information.

Holsanova et al. (2008) conducted an eye tracking experiment with a number of information graphic categories. For the experiment, the researchers recruited 31 native Swedish participants with normal vision. Each of the participants was assigned two sets of information graphics. Both versions of the graphics were embedded in a 30-page newspaper. The first set of graphics was used to make a comparison between separated and integrated visual formats. In the graphics with separated visual formats, the article and the graphics were separated into two boxes. In contrast, in the graphics with an integrated visual format, the information graphics were designed within the body of the text. Both graphics contained the same information and the same visual elements.

The second set of graphics was used to contrast information graphics with serial and radial visual formats. The information graphics with radial visual formats had a dominant central image and a series of small components, such as "lists of items, renderings with annotations, sequences of depictions and zooming boxes" surrounding the central piece (Holsanova et al., 2008, p. 1219). This form of graphic allowed the readers to choose their entry point and reading paths. On the other hand, the graphic with a serial visual format was designed with a top–down structure, where different units of information were grouped within their own units in a logical order. In this example, the information was ordered in the following categories: "introductory information," "everyday background knowledge," "expert knowledge," and "practical information" (Holsanova et al., 2008, p. 1220). By using the serial form of information

graphic, the readers were assigned an entry point into the graphic and a reading path throughout the article.

The results showed that information graphics were the first things that grabbed the attention of readers. If the text and graphics were separated, the text was much less often read than the graphics. When the graphics and text were integrated, readers tended to read locally, getting more information from the article. Such a format encouraged information integration between the graphics and the text (Holsanova et al., 2008).

When the information was scattered, there were no common reading paths among the participants. However, when the graphics were organized into different information units, readers had the tendency to follow the suggested reading path. In addition, readers spent more time on the graphics with a serial visual format than the graphics with a radial visual format (Holsanova et al., 2008).

Readers' Interactions with Media and Journalists

Long before the invention of online media, the interaction between readers and journalists already existed in the form of *Letters to the Editor*. However, such a form of communication was slow and unidirectional (Linlin, 2005). In the new forms of media, both journalists and readers enjoy a much higher level of interactivity, which has been defined as "the degree to which participants in a communication process have control over, and can exchange roles in, their mutual discourse" (William, Rice, & Rogers, 1988, p. 10). Thus, when compared with the old version of the communication model, in which journalists usually occupied superior positions in relationships, the current model of interaction is characterized by readers and

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journalists being in equal positions, with both being replaced by the term "participants" (Linlin, 2005, p. 4).

Bowman and Willis (2003) mentioned that participatory journalism encompasses contributions from both journalists and readers. It especially emphasizes the readers, or citizens in general, "playing an active role in the process of collecting, reporting, analyzing and disseminating news and information" (Bowman & Willis, 2003, p. 9). The authors also pointed out that these contributions sought to provide fair and well-balanced reporting, which, in turn, has led to the growth of democracy (Bowman & Willis, 2003).

Domingo et al. (2008) tried to find out how the participation of audiences in the news helped reshape and redefine the culture, values, and practices of journalism. As the authors pointed out, in the past traditional media regarded the readers more as receivers than active participants. However, in the participatory journalism era, readers also serve as information sources to other readers or even to the news media.

The authors then utilized the methods of qualitative content analysis to examine readers' comments on 16 online newspapers from nine countries in Europe and the United States. The aim was to determine the structural characteristics of audiences' participation. The results showed that most websites encouraged readers to comment, submit story ideas and raw story materials such as photos, and share on their own social network sites and blogs (Domingo et al., 2008). However, few sites had the tools to connect audiences with community building, helping them engage in the reporting of local communities as well as granting them a sense of responsibility when considering the quality of the contribution from readers (Schaffer, 2007). In summary,

these institutional media had not yet fully opened the gates to audience participation (Domingo et al., 2008).

Strandberg and Berg (2013) pointed out that the readers' online comments played vital roles in the formation and maintenance of democracy in society. These online comments usually had the characteristics of instant publishing, large comment spaces, and little to no censorship. These traits make the comment sections of online media even more popular than other independent discussion forums, as they facilitate open discussions among readers of all kinds of specific topics.

Through a content analysis of online comments on *Vasabladet*, an online Finnish newspaper, from March 29 to April 18, 2013, Stradberg and Berg analyzed the following aspects of online comments: "justifications of claims, reasoning of claims according to argument type, validations of claims and type of evidence used to support these claims" (Strandberg & Berg, 2013, p. 136). These measurements were made in order to determine readers' contributions to and interactions with media and democracy.

Among all the comments, around 97 percent were posted as anonymous or under nicknames. Forty-three percent of the comments had at least "a qualified or sophisticated justification" (p. 139), indicating that the internal logic of the comments can sufficiently support the conclusions of the comments (Strandberg & Berg, 2013). In addition, 70 percent of the comments had justified rationales behind their reasoning, with the majority of the claims being an "alternative argument" (p. 140) that was neither trying to contradict nor challenge opposite opinions (Strandberg & Berg, 2013). Twenty percent of the comments attempted to contradict the opposite opinions.

However, most of the comments in this study were biased; in particular, 73 percent of the comments were based on internal validations that were based more on the personal views of the commenters than external evidence such as data or facts (Strandberg & Berg, 2013). Lastly, among the discussants, personal experiences and comparisons were used most frequently in the comments (Strandberg & Berg, 2013).

In another study on the topic of interactions between journalists and readers, Santana (2011) contacted 1,498 reporters from the largest 139 newspapers in the United States and collected their opinions pertaining to their involvement in online interactions with readers. Around 98 percent of the reporters expressed that they read online comments to some extent: 37 percent said they did often, 32 percent said they did sometimes, and 12 percent said they did rarely. 1.6 percent of the reporters said they never read comments. Around half of these reporters would engage in these online conversations with readers.

However, around 45 percent of the reporters replied that they rarely took the readers' opinions into consideration when evaluating the newsworthiness of topics. In fact, 31 percent said they never took readers' opinions into consideration when reporting. In addition, a majority of the journalists had never successfully collected story ideas from readers in the comment sections (Santana, 2011).

Based on the reasoning provided in the previous literature, this study proposes the following research questions:

RQ1: What effects do static and interactive information graphics have on promoting interaction between the media and readers at six newspapers?

RQ2: What qualities and characteristics do graphics need to have in order to

promote interaction and exchange of ideas among readers and between readers and

visual journalists?

Chapter 3: Methods

This study employs (1) interviews with visual journalists or graphic designers from six news outlets and (2) quantitative content analysis of the news articles from these six news sources from which interviewees were recruited.

Interviews

The study conducted semi-structured interviews with professionals in the field. Semi-structured interviews were chosen to help the interviewees focus on broad topics. However, they could bring in information that they regarded to be important to the conversation without any limitations. The interview subjects were limited to visual journalists or graphic designers in the newsroom whose job descriptions included designing graphics for the print and online platforms of the chosen newspapers.

Interviews, in general, serve as vital tools in collecting qualitative research data. The method is useful in gathering individuals' experience and opinions about specific topics (Lambert & Loiselle, 2007). Semi-structured interviews are more flexible as compared to structured interviews. With only a limited set of predetermined questions to set up the main theme of the interview, more questions and information will emerge as the conversation progresses between the interviewers and interviewees (Dicicco-Bloom & Crabtree, 2006).

Further, semi-structured interviews have been widely used in the study of information graphics and reader interactions. For the purpose of understanding the pattern of information graphics utilization in the United Arab Emirates, Bekhit (2009) interviewed six leading newspapers nationwide regarding their implementation of the

latest technology and use of information graphics. With half written in English language and half written in Arabic, these newspapers have teams of journalists with very diverse backgrounds and languages. Bekhit conducted interviews with 19 graphic journalists and chief editors from these publications about their characteristics, backgrounds, job duties, and specific features of their information graphics, including the production software, sources of data, and types of information graphics.

The researcher in this study asked the interview subjects if the majority of the graphics in the newsrooms were individual projects or team efforts. If individual projects were most commonly used, one visual journalist within the newsroom was deemed to be sufficient for the interviews. Otherwise, multiple visual journalists were interviewed. The interview subjects also discussed some examples showing the effects of graphics on reader engagement and participation in discussions.

Content Analysis

A quantitative content analysis was also performed for the news stories selected based on the following criteria. First, these stories were published during the month of September 2014 and were accompanied with graphics. Second, they were based on the topic of national news. Finally, they were published on the online platforms of one of the six chosen newspapers. Based on these four criteria, the *Washington Post* had a total of 14 articles, the *Guardian* had 25, the *Chicago Tribune* had 15, *USA Today* had 8, the *Wall Street Journal* had 30, and the *New York Times* had 32. Aside from the articles with graphics, the same number of articles on the topic of national news was selected from these six news outlets. These articles were not accompanied with any sort of graphics and were also published during the month of

September 2014. They were selected based on reverse chronological order on topics similar to the articles with graphics.

A comparison of the number of shares, unique commenters, and number of comments was conducted between the articles with graphics and those without graphics. A cross-comparison on the characteristics of information graphics, such as the use of color (if the graphic is in color or in black and white) and form (if the graphic is static or interactive), was made among articles with information graphics published in the online versions of these six newspapers. Through these comparisons, the study examined how these characteristics of graphics facilitated interest and participation in the political arena among readers. Further, the comparisons between the different publications were considered in order to determine readers' preferred information graphic characteristics.

In order to verify consensus and the usability of the coding scheme proposed in this study, intercoder reliability was computed. Two coders sampled 30 articles from the six online media and compared the results. Based on the percent agreement, the intercoder reliability was 84.5 percent, which met the minimum requirement (80 percent) for the test. After completing the exercise, several clarifications and changes were also made to the coding schemes. Quantitative content analysis is defined as "the systematic classification and description for communicating content according to certain usually predetermined categories" (Berger, 2000, p. 173). A number of past studies have investigated the use of information graphics in the journalism industry through quantitative content analysis. For instance, Li (1998) employed the method of quantitative content analysis in his study of webpage design and the use of graphics of

three online newspapers in the United States.

In this thesis, six newspapers were chosen based on the following criteria. During the selection process, the top 10 largest newspapers were selected based on their circulation sizes. These numbers and rankings were provided by the Alliance for Audited Media, a non-for-profit organization providing data on newspaper circulation and industry information verifications. After a careful review, five newspapers were selected from the list based on two criteria. First, information graphics were used heavily in their reporting. Second, a large portion of the graphics was related to the topics of national and international news. The five selected newspapers, including the *Washington Post*, *New York Times*, *Wall Street Journal*, *Chicago Tribune*, and *USA Today*, are among the top newspapers in the nation with the greatest readerships. Compared to other regional and community newspapers, these five newspapers have more resources and capacity to report on national affairs and design digital components for their stories. In some way, they are leading development and experimentation in the field of digital media. The *Guardian* from the United Kingdom was added to the list in order to gain some perspective and insight into the use of information graphics in other regions of the world.

In order to compare the number of comments for the articles with graphics and the articles without graphics, an independent t-test was conducted using SPSS. For an analysis of the differences in the number of comments on certain characteristics of the graphics, chi-square tests were used for each of the newspapers.

In conclusion, by analyzing interviews with journalists and content from the selected news outlets, it is hoped that this thesis can provide an overview of the most

recent and advanced applications of static and interactive graphics in the industry, as well

as provide advice and suggestions for future improvement in information graphics design.

Chapter 4: Results

Interviews

This study employed semi-structured interviews to gather opinions from the industry professionals on the use of information graphics in their perspective newsrooms. Six journalists were interviewed in this study.

Overview. One visual journalist from each of the six newsrooms was invited to participate in the thesis interviews. Their names and titles are listed as follows: 1) Larry Buchanan, graphic/multimedia editor at the New York Times; 2) Seth Hamblin, deputy Global Visual Editor at WSJ.com and The Wall Street Journal; 3) Carolyn Aler, graphic visualization designer at Chicago Tribune; 4) Daan Louter, graphic designer and developer at the Guardian; 5) Kennedy Elliot, visual journalist at the Washington Post; 6) Tory Hargro, manager of visual design for the USA Today. All interviews were conducted through phone calls with the aims to gain industry insiders' opinions on the subject matter. The interview questions involved around the use of information graphics and its effects on readers' participations and discussions, daily workflows in the newsroom and pros and cons of static and interactive graphics. These visual journalists provided an array of interesting and fresh ideas to the research.

1. Larry Buchanan, graphic/multimedia editor at the New York Times. Buchanan agreed that overall, graphics had huge positive impacts on encouraging readers' participations in the New York Times. Like the rest of the newsrooms, the New York Times is now implementing policies of mobile and web first, as the online and mobile versions of the graphics come out faster and timelier than the print products. In addition, these online

graphics are sketched and produced in a much larger quantities than their print counterparts. Transferring mobile graphics into print graphics for the print newspapers of the day is also not rare and is practiced very frequently by the graphic designers.

There are a number of ways for the information graphic designers to obtain story and graphic ideas. Just like the reporters and editors, the information graphic designers will participate in the budget meeting every morning, and are informed of the news topics and stories in today's papers. After the meeting, graphic designers can either talk to reporters on the possible opportunities for graphics, or reporters can contact the designers and discuss details on possible projects. In addition, graphic designers are responsible for digging their own data for investigative graphics. Usually they pitch their own ideas for these long form graphics. Talking to journalists in related fields is another way of information sourcing mentioned by Buchanan. However, majority of the graphics produced are day turn graphics as graphic designers are facing constant pressures of deadlines. The information graphics designers will also try to convert the mobile or web graphics into print versions for the daily newspaper.

Buchanan said despite the fact interactive graphics have an array of more advanced features compared to the static graphics, there are also issues they are incapable of solving. One example would be the issue of font sizes. Now the readers are likely to consume content on a number of different platforms, including but not limited to tablets, smartphones, desktops and laptops. Each of these devices has its own display ratio and screen size, thus requires a certain font size or even font family for readability and legibility. In many cases, when the graphics are loaded with information and layers, users with smaller screens will likely to find the graphics hard to navigate and information hard

to consume. But this issue does not exist in static graphics. Buchanan said that it was not necessary to always include interactive graphics for stories. In fact, sometimes when stories need just straightforward and simple presentations of information and numbers, static graphics are always preferred options compared to interactive graphics.

Buchanan pointed out a number of graphics that produced by the New York Times, which received positive feedbacks from and readers and effects in engaging readers in the stories with active readers' participations. One of the examples is an interactive quiz on people's dialects and dialect maps in the United States. Buchanan mentioned that this interactive graphic remained as having the highest clicks and shares among all graphics for a long period of time. Titled as "How Y'all, Youse and You Guys Talk", the graphic was published on December 21, 2013. There are 25 questions in this quiz, asking readers their preferences and ways of expressions and references. For example, in one of the questions, the readers were asked how they usually referred to the bugs that glowed at night, and six multiple choices were given to the readers: "lightning bug", "firefly", "peenie wallie", "I use lightning bug and firefly interchangeably", "I have no word for this", and "other". To the left of the questions is a heat map of the United States showing the levels of similarities between the choices and the accents of the cities. The scale of the heat map is from least similar to most similar, with least similar as the color of blue, and red as the color of the highest level of similarities. By the end of the quiz, the reader were presented with a main heat map of the whole United States with the same scale as mentioned previously. Also, the cities with most and least similar dialects will be labeled in the map. Buchanan regarded the elements of interactivity and close ties to daily life as the main reasons for the high numbers of view counts and shares.

Buchanan pointed out that the graphic team tries to keep a very close eye on readers' participations and discussions online, and they will run corrections and make edits to the graphics if they receive complaints from the readers. These complaints mainly come from comments and emails, and occasionally from social media. Unfortunately, so far he was not aware of any reporters or information graphic designers to have story ideas from the readers in the comment sections yet.

2. Daan Louter, graphic designer and developer at the Guardian. In the digital age, readers have such shorter attention spans; Louter said that graphics helped to keep the readers engaged. In the Guardian of London, the majority of the graphics are published online rather than in print. These web graphics are published and updated frequently throughout the day. Depending on the print content, some of the graphics will then convert to print. Under such scenarios, readers can receive and consume the latest published and updated graphics on the go. Mobile publishing also makes it possible to the utilizations of some advanced features, including location services, motion sensors and hands-on interactions. One example is when readers interact with graphics, the smartphone or tablet devices can set up their locations automatically, and push local information regarding the news topics directly to the readers.

Louter mentioned that he loved to turn some "dull" or sophisticated stories into graphics in order to attract readers' attentions. One example is a recent graphic he designed on the issues of European refugees. He admitted that this was a controversial topic that would be hard to explain without the connections to the current political situations, the European Union laws and up-to-date conflicts around the world. However, he managed to turn the graphic into a mini game, in which the reader acts in the role of a Syrian mother

who needed to flee from Syria with her two kids. After a brief introduction on the current political situations in Syria and the refugee intake policies in the European Union, the reader is presented with two options: either heading to EU for shelter, or taking Turkey as an easier and safer route. Each option has its own advantages and dangers, and readers need to weigh in and make their own choices. After a series of choices, the readers then will reach to the final destination of their refugee settlement: the final location and a brief explanation of their possible future. By virtually going through the experience, the readers are now informed of the situations and refugee policies within European countries. They can also share their game results with friends on social media.

In addition to the previous example, graphics can also be employed to present information that is hard to describe with words. For example, in the recent news of the German airplane crash, the fly routes and related information such as height, speed and amplitude are hard to show with plain words. Consequently the designers from the Guardian created a visual model to illustrate the information to the readers.

Louter said that he had no preferences on specific forms of graphics, and he usually made decisions on the forms of graphic types and presentation forms after getting to know the stories. Just as most newsrooms, visual journalists can pitch ideas to the reporters, and reporters can also go to the visual journalists for graphic ideas.

When readers complain about errors within graphics, Louter said that the graphic designers would make modifications and corrections as soon as possible. Unfortunately, Louter does not check out the online comments section very often, but is very active in following up comments on social media and Google analytics.

3. Carolyn Aler, graphic visualization designer at Chicago Tribune. Aler

acknowledged a number of advantages graphics could bring to news products. For stories with too much information or too many numbers, graphics can reorganize the details and present them in an orderly fashion. And in many cases, these details are crucially important yet have no places to fit into the print story. Especially in terms of the content within the Chicago Tribune, ample local news pieces are reported daily, and in most scenarios these stories are flooded with minor details and graphics can be put to use in these cases. For example, a small locator map could help very efficiently pinpoint the locations that might be hard to describe with plain words.

In the Chicago Tribune newsrooms, graphic designers need to work on longer forms of investigative graphics by themselves, and in most cases, they are responsible for getting the data and brainstorm the compositions of the graphics, but many regard the reporters as good sources for background information and references. Aler shared a story about these investigative graphics in the Chicago Tribunes. A few months ago when the Chicago Bears was about to release the name and information about the newly appointed coach, Chicago Tribune designers happened to publish an investigative graphic about John Fox. As soon as the appointment of John Fox was released in the press release, the views and shares of the graphic increased at a dramatically fast rate. Aler said that it was to some extent a coincidence, but it was because the graphic designers at the Chicago Tribune constantly kept close eyes on trendy topics, put together long form graphics and published them frequently, the coincidence was not as surprising as it seemed.

However, most of the graphics produced in the Chicago Tribune are still day turn graphics, and thus are very straightforward when it comes to presentation forms. Aler said that she preferred line and bar charts to show the values and trends in the numbers, and

sports and financial news were great sources for graphics. She further added that the Chicago Tribune reporters generally are educated on data reporting. In cases where the numbers and data within a story do not call for graphics, the reporters can also work on their own to tell the stories without the help of the graphics. To Aler, this is the best way to convey numbers, as graphics are used on rationalized basis and these utilizations are not arbitrary.

4. *Seth Hamblin, deputy Global Visual Editor at WSJ.com and The Wall Street Journal.* Hamblin regarded the functions of sharing as one of the most prominent reasons why the millennials, or any avid readers in the digital age, love interactive graphics. Based on his experience in the Wall Street Journal, users love to share content that show their characteristics on social media. Consequently, it is very important to research readers' preferences and trendy topics in the brainstorming sessions. In terms of preferences for graphic types and top news topics for the graphic products, the Wall Street Journal has very flexible mindsets, and all kinds and categories of graphics can be employed for the purposes of storytelling.

When being asked about a particular example that helped readers understand the news, Hamblin referred to a graphic titled as "Democrats or Republican? Guess the Party." This graphic was designed by Stuart A. Thompson and published on October 10th 2014. It is a highly interactive graphic in the form of quizzes and news game. In the graphic, the readers are present with advertisements from five states in the United States: Minnesota, Michigan, Virginia, Massachusetts and Arkansas. Each state has six frames of a campaign advertisement from either the Democratic or Republican Party candidates. With the main characters or partisan signs blurred in the frames, readers need to make decisions on the

partisan sides of advertisements. After picking out the answers, the readers then get the correct answers and specific information about the advertisements, such as the name of the candidate and the party he or she is associated with. Hamblin explained that the graphic received high levels of popularities and attentions among readers for several reasons. The first reason is the publishing timing of the graphic. The graphic was published approximately a month before the midterm election in November 2014, when readers' interests on such news topics were cumulated to the peak. Secondly, the graphic gave readers a unique perspective to understand the ideological and campaign differences between the two parties.

Hamblin further explained that it was a great example to illustrate the dynamic flows of information graphic designs in the Wall Street Journal. In order to produce high quality graphics for both the print, online and mobile platforms, Hamblin said that the graphic designers at the Wall Street Journal were working on a third kind of the information graphic. It is compatible with both print and web, and will hugely save time and energies to produce for both platforms. When producing such kind of graphics, designers will consider the possibility of adding depth to the graphic to transition to the online platforms. And the graphics are also designed with the mindsets of adding the possibilities of flattening and adding these details for the print versions.

5. Tory Hargro, manager of visual design for the USA Today. What distinguishes The USA Today from the other news media is that readers link their social media accounts directly with their discussion accounts in the USA Today website, and editors make extra efforts to communicate with the readers on these channels. Even though the USA Today is an icon for visual journalism in the world of print news, Hargro said that the graphic

designers are also working on online presence of the graphics. In fact, online graphics give designers more freedom without the restrictions on space or content. White spaces and vibrant colors are some of the key elements in the USA Today graphics. These elements help readers ease in and understand the numbers.

One of the examples is a graphic on the congressional support on the military strike for Syria. Titled as "How congressional support lines up for Syria Strike," the graphic starts with congressional seating map with different colors of dots representing opposing stances on the issues. The color green stands for the support for the military strike, and the color red stands for the disapproval of the strike. The color yellow stands for the stance of "undecided". Lastly, the white dot is for congressmen with no responses. Below the congressional seating map is a table detailing each congressman with his or her state, district, party, vote, vote date and quote. This graphic is shared 647 times on Facebook, and 127 times on twitter. Three users on LinkedIn shared the graphics. This graphic is simple, yet has an abundance of information. With the white space and the color scheme, readers can understand the divisions of stances on their first glance. This graphic very well represents the design styles of the USA Today.

As the rest of the news outlets, when readers contact the reporters or editors on the errors within graphics, editors will verify and make corrections within graphics that were published online. For print graphics, a correction notice would be published in the print version.

6. Kennedy Elliot, visual journalist at the Washington Post. Elliot agreed that information graphics helped readers dive in and understand the stories, as they provided visual attractions for the readers. When applied with design principles, the graphics ease

readers' difficulties in understanding complex issues, and also provide pleasing reading experiences for them. In addition, with the visual attractions, complex issues and long stories can be broken down into segments and information in stories is then easier to digest and consume by the readers. The readers always prefer graphics with following characteristics: firstly, the graphics that give readers a summary of the important information; secondly, the graphics that offer surprising trends or numbers readers don't know or are not aware of; and lastly, timely graphics on everyday life activities.

However, interactive graphics are not always superior to the static graphics. Elliot agreed that the best graphic for the story were the ones that fulfill the job. Graphics should only be used when the numbers or details are complex and are hard to convey with plain words. One example is a series of sketches by Richard Johnson on scenes he witnessed during the journey to Afghanistan. A total of 35 sketches were published in this information graphic, and each details a scene with explanatory words, dates, and a short introduction. These scenes can be described with words, however, the sketches give the readers vivid scenes and experiences with strong emotions that can be hardly shown with plain words.

Occasionally, the numbers could be embedded in the articles. In the Washington Post, many reporters are data literate and can do data analysis using excel functions or SQL languages, thus they are able to present data and detail information without the help of the graphics.

Just as the other newsrooms, graphic designers from the Washington Post are responsible for producing both online and print graphics, and these ideas may come from the reporters, or the designers can pitch ideas to the editors and work on investigative

projects. The majority of the graphics are still produced daily, and most of the graphics are static.

Graphic designers and editors are keeping close attentions on their social media accounts, as the graphic team has a Twitter account and a Tumblr account. For the Twitter account, Elliot said that they would push contents to the social network sites as soon as the graphic projects were finished. In addition, all graphic designers have their own social accounts to post their works. Tumblr is a social account to showcase their workflows and stages of production. When readers contact the designers about errors in the graphics either through the social media channels or through emails, the editors would verify and issue corrections as soon as possible. They also welcome all kinds of communications with the readers through all channels.

Content Analysis

Content analysis results are presented in this section, within which there are two sections. The first section uses three examples to illustrate the coding process for all sampled articles and graphics. The second section provides the results for the chi-square tests and the independent t-test results.

Three examples to illustrate the approach of the study. The following section explains the mechanism behind the content analysis. Three articles were selected as examples to illustrate the approaches and processes in classifying the information graphics from the six newspapers.

1. The Rise of Men Who Don't Work, and What They Do Instead. In order to find out the distribution pattern of the unemployed males in the United States, the New York Times online published this article on December 11th, 2014. Accompanied by three

graphics, it received a total of 298 comments as of December 16th, 2014 from 188 unique commenters.

Figure 1. The Rise of Men Who Don't Work, and What They Do Instead (The New York Times, 2014). This figure illustrates the coding process for graphics with low levels of interactivity.

The first graphic comes right beneath the bold headline. It is a color graphic with interactive features. With the help of the bar charts, the graphic illustrates the quantitative percentage of unemployed males from age younger than 20 to older than 80. The horizontal axis is age in numbers while the vertical axis is the percentage of unemployed males. The total percentage of male unemployment is then further broken down into six groups: first, *officially unemployed*; second, *in school with no job*; third, *disabled*; fourth, *retired*; fifth, *taking care of family or home* and lastly, *something else*. Each of the categories is labeled with a unique color for easy navigation and identification.

The graphic is categorized as having low level of interactivity for several reasons. Firstly, the only option for content selection for the readers is to switch between the 2000

and 2014 data. And these two frames will switch automatically if the readers do not pause the function. In addition, readers do not have any options to click on the bar graph and get the exact number of a certain point on the bars.

The graphic has the intent of instructive. Even though readers have the ability to switch between the 2000 and 2014 data, the graphic starts with the automatic transition between the two sets of numbers. The author has already set the scene and readers will follow his steps to understand the intention of the comparison.

In terms of visual structuring, the graphic has a consistent visual platform with the checklist function in the form of a navigation button. Overall it has a linear ordering of information since the whole graphic is author driven. The readers do not have much freedom to decide the sequence of the information flow - what to look first and what should come second.

Figure 2. The Rise of Men Who Don't Work, and What They Do Instead (The New York Times, 2014). This figure illustrates the coding process for static graphics.

The second graphic is situated under the second subhead around halfway through the article. It is a static information graphic with no interactivity. It serves very well as a supplement or a deeper analysis for the comparison between the 2000 and 2014 data.

The graphic follows the same color scheme as the first graphic, dividing the male unemployment population into six categories. Similar as the previous graphic, this bar chart has the X-axis as the age span, and Y-axis as the unemployment rate among men. Due to its static character, it is not interactive and has a consistent visual frame. And as the graphic is trying to show the data on unemployment, these numbers are classified as quantitative data.
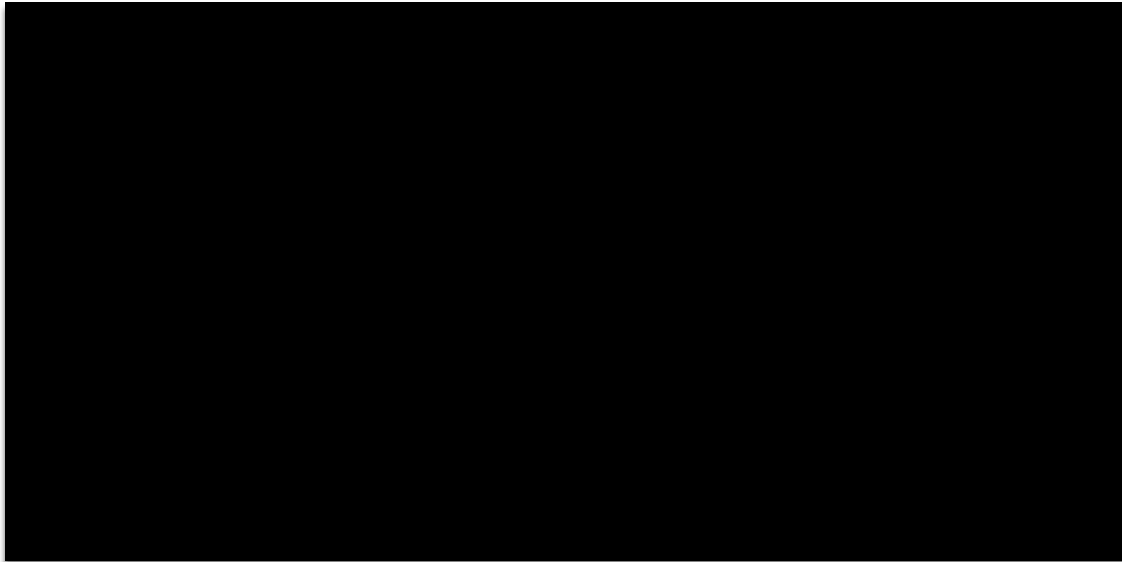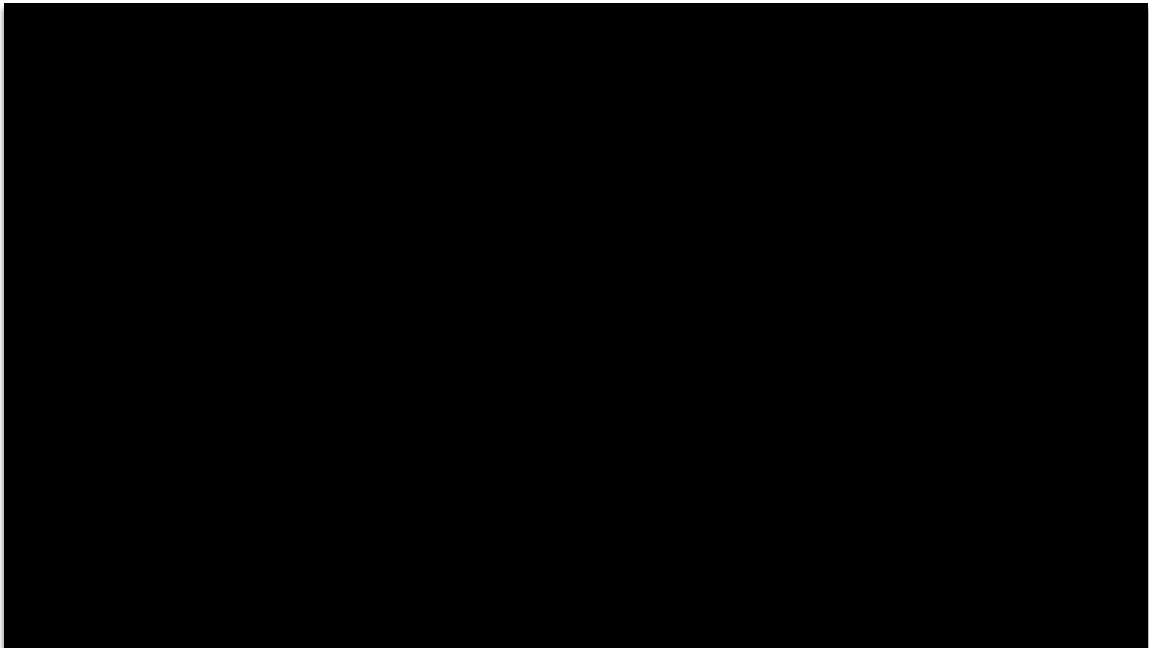

Figure 3. The Rise of Men Who Don't Work, and What They Do Instead (The New York Times, 2014). This figure illustrates the coding process for graphics with high levels of interactivity.

The last graphic is an interactive map embedded at the end of the article. Based on the map of the United States, each county is labeled with a color to show the percentage of unemployed men between ages 25 and 53. The color ranges from light green to dark blue. When clicking on each of the counties, a pop up box appears with the following information: the name of the county, the total male population between 25 and 54 years old in the given county, the percentage of such population who are not working, and the margin of error.

This graphic is categorized as having high level of interactivity for the following reasons. With no prescribed paths in the graphic, the readers can start exploring on any part or any locations to start the journey. If the national map of the United States is not specific and zoomed in enough, seven additional in-depth regional maps are displayed below the main graphic for more careful and interested readers: these are maps of San Francisco, Los Angeles, Chicago, Detroit, Atlanta, Washington D.C. and New York. There is also a search bar function in the graphic, where readers can type and search their concerned areas without zooming in from the map.

2. How many people in UK work on Christmas Day? In order to find out the number of people working on Christmas Day and their corresponding occupations, the Guardians of London published this article on December 22 titled "How many people in the UK work on Christmas Day?" It has a total of 2 graphics, both of which are static.

The article has a total of 198 comments as of December 26 2014.
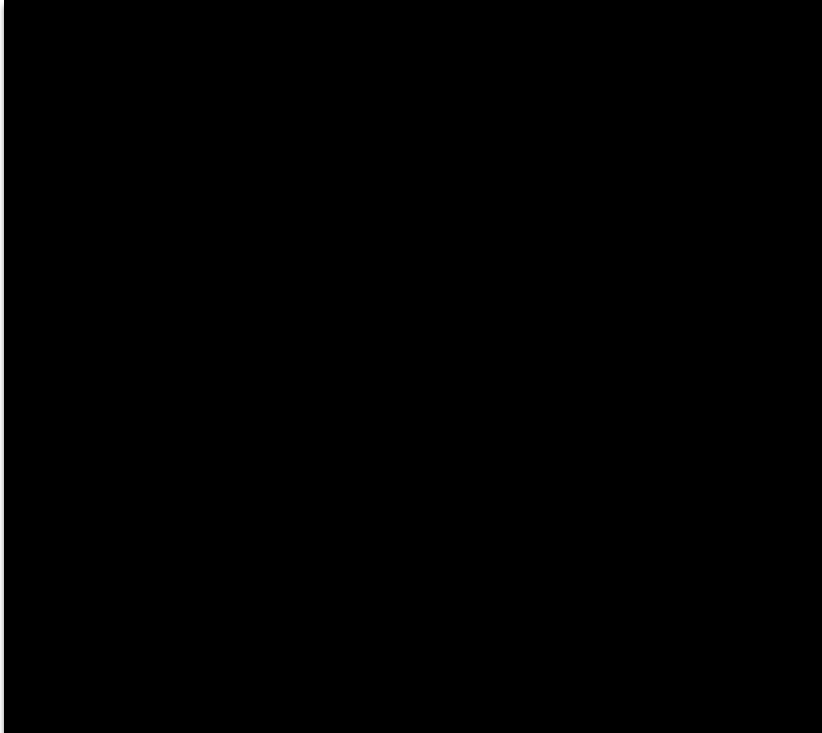
Figure 4. How many people in UK work on Christmas Day? (The Guardian, 2014). This figure illustrates the coding process for static graphics.

The first graphic is a bar chart with a subhead "Christmas Day who's working?" The graphic has 15 jobs listings with the highest percentages of people working on Christmas Day. All bars are labeled with the color blue, and each is noted with the occupation as well as the percentage. The whole graphic is straightforward as a standard bar chart. As the most static graphics, this graphic is author driven, thus the readers do not have options to control the flow and the sequence of the information.
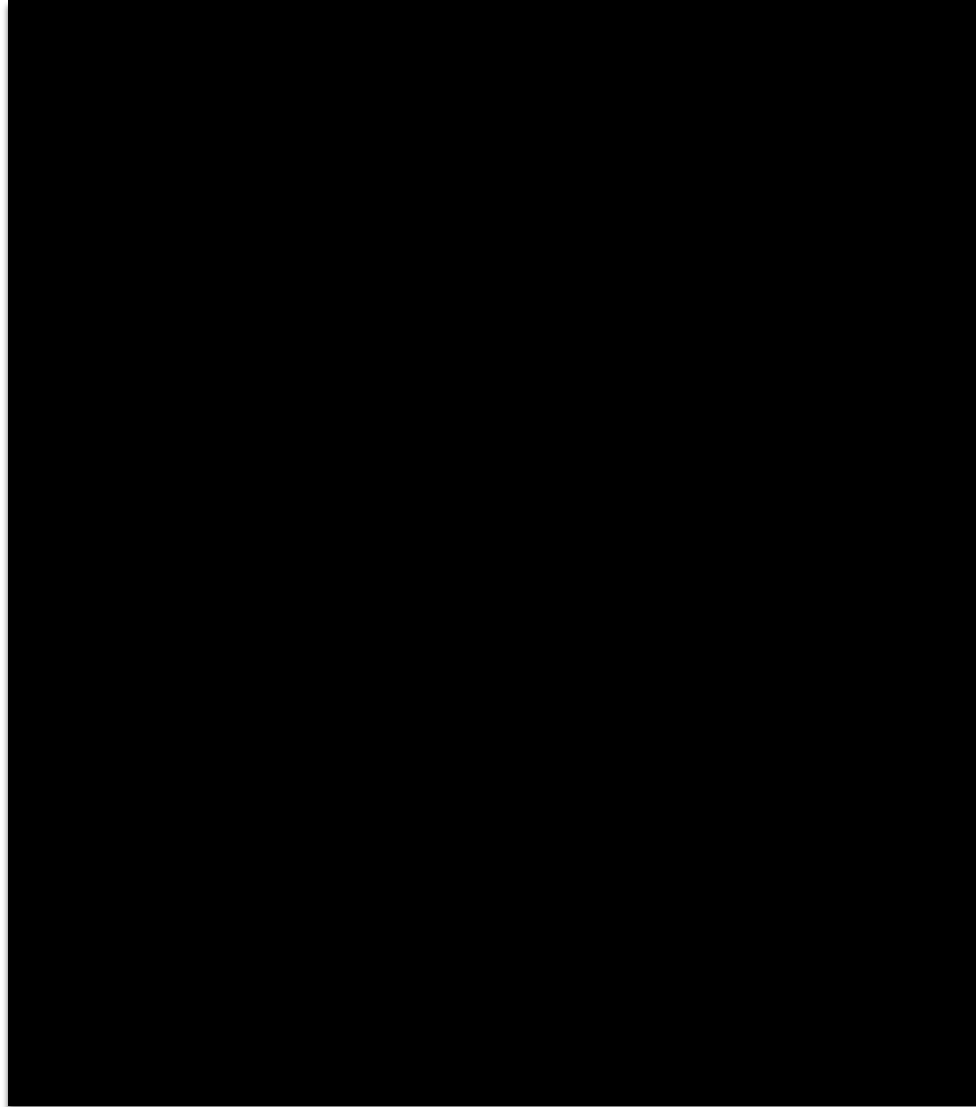
Figure 5. How many people in UK work on Christmas Day? (The Guardian, 2014). This figure illustrates the coding process for static graphics.

      The second graphic is a typical map detailing the percentage of the workforce who are working on Christmas Day in different cities within the Great Britain. It still has the same title as the previous graphic "Christmas Day who's working?" as well as the same overall color scheme. Each area within the map is labeled with a degree of color blue, with the lightest blue as 2.0 percent to 2.4 percent, and darkest blue as 3.5 to 3.9 percent. Each

area on the map is only labeled with the number of percentages and the color corresponding to the percentage number, but not the name of area.

        3. Who is really winning the Senate so far? The next graphic published in the New York Times online is an example of the interactive graphics with median levels of interactivities. Published on November 11, 2014, it has a total of 13 comments from 12 unique commenters. The graphic is consisted of a series of interactive mini graphics organized into groups based on their contents. 11 units are present based on their geographical states: North Hampshire, Virginia, Arkansas, Colorado, Georgia, Iowa, Kansas, Kentucky, North Carolina, Louisiana and Alaska.
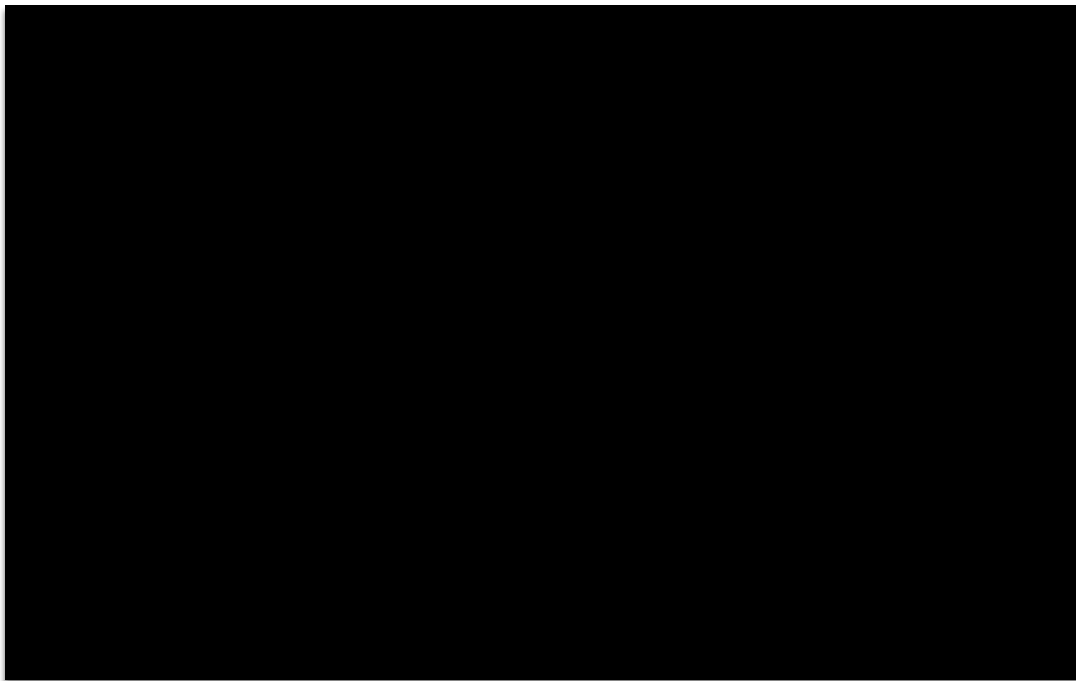
Figure 6. Who is really winning the Senate so far? (The New York Times, 2014). This figure illustrates the coding process for graphics with median levels of interactivity.

        Within each unit, there are two kinds of graphics: a bubble graph paired with a base map and a static line chart. The bubble chart has median level of interactivity as readers can click on each of the bubbles and reveal the names and the numbers for each of the

counties. Each bubble has the name of the county, the voter turnout, the name of the candidate, and the leading number of votes. And bubbles are also labeled either as red or blue depending on the winning parties -- red as Republicans and blue as Democrats. The other form of graphics is the line chart. It is a static chart that shows the areas in which the New York Times predicts to have votes left, its predicted turnout, and the reported share of the current winning party.

Figure 7. Who is really winning the Senate so far? (The New York Times, 2014). This figure illustrates the coding process for graphics with median levels of interactivity.

These 11 units, as shown in the screen captured above, are separated and stand on their own. An icon chart is present at the top of the graphics right next to the main headline, offering summaries for all states. Eleven states were divided into four categories with distinctive colors: Democrats ahead, which is labeled blue; Republicans ahead, which is labeled red; likely runoff, which is labeled grey and no estimate yet with no color labels. When clicking on the icons, the page will then jump to the section about that particular state with the bubble chart and the line graph.

The graphic is categorized as having median level of interactivity because of the following reasons. Firstly, readers have a certain level of freedom to control and decide the sequences of the information flow, as they could choose which states to start at the top of the graphics. However, for each individual state, it is mainly author driven. Readers do not

have any controls over the sequence of information in this section of the graphics. As implied in the codebook, the median level of interactivity has two characteristics: first, readers have the freedom to choose a specific path to access the content, as they can choose the states to study at the beginning of the graphics. Readers also have the freedom to access the abundance of the information at their own paces in the bubble map. However, the path throughout the whole graphic is still predefined by the author as readers only have a set of choices for the graphics.

The graphics contain mainly quantitative data, as all maps and line charts within each unit are counting votes within the state and making predictions. The graphic is overall categorized as having the intent of explorative. By reading through all voting statistics of the provided states, the readers can make their own informed opinions on the current election situations. But if we look at each individual unit, it can be characterized as the intent of instructive, as readers are taken step by step to investigate the voting data, first the statistics on the voted areas, then the predictions on the areas yet to vote, and finally a roundup of previous sections.

The graphic has the filter and detail on demand task of the graphics. It also employs a consistent visual platform. The layout remains unchanged for all states. In addition, it has an establishing shot at the beginning of the graphics, that it gives the readers a headline, some introductory text, and a checklist structure.

For the balance of narratives, the graphics has the hybrid use of author driven and reader driven approach, and specifically, it has the model of interactive slideshow -- readers have the freedom to arrange the order of the information at first, but within each unit, they have to follow the orders established by the author.

Main results of content analysis. This section offers the results of the quantitative content analysis, specifically the chi-square tests and the independent t-tests among the six newspapers on the effects of information graphics on readers' interactions.

In summary, a total of 248 articles from the six news outlets were analyzed and coded in nine characteristics: news types, data types, level of interactivity, narrative balances, graphic types, intent of graphics, order of information, task of graphics and visual structuring. For the comparisons, chi-square tests, cross tab function and independent t-test were used.

I. Effects of the graphics on number of comments. In order to examine the relationships between the use of information graphics and the rate of readers' participations, comparisons were made for the number of comments and unique commenters among the six newspapers. This comparison was between the standalone articles and the articles with graphics.

In general, the Washington Post, the Wall Street Journal, the USA Today and the New York Times had higher number of comments and unique commenters from articles with graphics when compared with the articles that are not accompanied with graphics. On the other hand, the Chicago Tribune and the Guardian showed the opposite results – the articles without graphics had higher numbers of comments and unique participants than the graphic-accompanied articles.

Descriptive for the Washington Post. Table one and table two summarize the statistical profiles of the articles from the Washington Post. A comparison on the key numbers between the articles with graphics and without graphics reveals that for the Washington Post readers, the graphic-accompanied articles have greater numbers of comments and

unique commenters than the articles without graphics.

Table 1

Statistical profiles of the Washington Post articles with graphics

	Mean	Median	SD	Min	Max	Sum
Total number of unique comments	240.17	8	381.39	0	1328	3370
Total number of comments	345.21	10	573.36	0	2090	4833

Table 2

Statistical profiles of the Washington Post articles without graphics

	Mean	Median	SD	Min	Max	Sum
Total number of unique comments	51.29	12.5	99.17	0	340	718
Total number of comments	93.07	14.5	194.46	0	669	1303

During the month of September 2014, the Washington Post published a total of 14 national news articles online with graphics, and 14 national news articles without graphics were sampled respectively for the analysis. For the articles with graphics, a total of 4833 comments were received from the readers, and the most popular article collected 2090 comments. On average, the mean number of the comments for all graphic-accompanied articles is 345.21, with the median number of comments as 10.

In terms of the unique commenters for these 14 graphic-accompanied articles, a total

of 3370 unique readers participated in the discussion, and the most discussed article drew 1328 users to voice their opinions. On average, each article received comments from 240.71 unique users, and the median number of unique readers for all articles is 8.

For the stories without graphics, the 14 articles received a total of 1303 comments, and the most popular article received a total of 669 comments. On average, each article received 93.07 comments, and the median number of comments is 14.5. A total of 718 readers commented on these 14 standalone articles, with the most discussed article attracting 340 unique commenters. Each article received an average of 51.29 unique commenters, and the median number is 12.5.

Descriptive for the Chicago Tribune. Table three and table four show the statistical profiles of the Chicago Tribune articles. For the Chicago Tribune, there are a total of 15 national news articles with graphics published in the month of September 2014, and 15 articles of similar topics without graphics were chosen for the analysis.

For the articles accompanied with graphics, they received a total of 278 comments. The most popular article has a total of 77 comments. On average, each article received 18.53 comments, and the median number of comments for these articles is 4 comments.

Table 3

Statistical profiles of the Chicago Tribune articles with graphics

	Mean	Median	SD	Min	Max	Sum
Total number of unique comments	14.67	4	20.87	0	60	220
Total number of comments	18.53	4	26.88	0	77	278

Table 4

Statistical profiles of the Chicago Tribune articles without graphics

	Mean	Median	SD	Min	Max	Sum
Total number of unique comments	11	4	18.94	0	72	165
Total number of comments	19.93	7	36.20	0	136	299

In specific, a total of 220 unique readers commented on the 15 articles with graphics. The highest number of unique commenters for a single article is 60. The average number of the unique commenters is 14.67, while the median number of the unique commenters is 4.

For the stories without graphics, there are a total of 299 comments with an average of 19.93 comments for each story. The highest number of comments for the stories is 136. The median number of comments is 7 for these 15 standalone articles.

There are a total of 165 readers in the discussions on these stories without graphics. The most popular story attracted 72 readers to comment and participate. On average, each story draws 11 users to leave their opinions in the comment section, and the median number of comment is 4.

Descriptive for the Wall Street Journal. Table five and table six list the statistical profiles of the Wall Street Journal articles. A comparison on the key numbers between the articles with graphics and articles without graphics shows that, overall, the articles with graphics receive a higher number of comments and unique commenters when compared with the articles without graphics.

Table 5

Statistical profiles of the Wall Street Journal articles with graphics

	Mean	Median	SD	Min	Max	Sum
Total number of unique comments	41.27	37	35.69	1	135	1238
Total number of comments	82.97	60	91.93	1	372	2489

Table 6

Statistical profiles of the Wall Street Journal articles without graphics

	Mean	Median	SD	Min	Max	Sum
Total number of unique comments	16.4	5	24.43	0	87	492
Total number of comments	24.07	6	43.61	0	189	722

For the Wall Street Journal, a total of 2489 comments were received for the 30 articles with graphics. These 30 articles were published during September 2014, and were on the topics of national news. Among these 30 articles, the most popular article has 372 comments. On average, each story has 82.97 comments, and the median number of comments is 60.

A total of 1238 users commented on the 30 articles with graphics. The most popular article has 135 unique commenters. The average number of unique commenters for the articles is 41.27, while the median number is 37.

For the purpose of comparison, 30 articles without graphics were selected in the

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Wall Street Journal. They were published during September 2014 as well and were on the topics of national news. These stories have a total number of 722 comments, with an average number of 24.07 comments for each of the stories. The median number of the comments is 6, and the highest number is 189.

A total of 492 unique readers participated in the discussions for the articles without graphics. Among these 30 articles, the most popular article has 87 participants. On average, each story has 16.4 users leaving comments in the comment section, and the median number of the unique readers is 5.

Descriptive for the New York Times. Table seven and table eight show the statistical profiles of the New York Times articles. The articles with graphics in the New York Times receive more comments and have higher numbers of unique commenters than the ones without graphics.

Table 7

Statistical profiles of the New York Times articles with graphics

	Mean	Median	SD	Min	Max	Sum
Total number of unique comments	111.34	34.5	168.09	0	685	3563
Total number of comments	171.31	47.5	270.89	0	1131	5482

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Table 8

Statistical profiles of the New York Times articles without graphics

	Mean	Median	SD	Min	Max	Sum
Total number of unique comments	17.31	5.5	24.42	0	79	554
Total number of comments	23.59	6	38.42	0	163	755

A total of 5482 comments were received for the 32 articles with graphics in the New York Times. Just as the selected sample articles from the other five newsrooms, these 32 articles were published during the month of September 2014, and were on the topics of national news. With 1131 comments for the most popular article, each story on average has 171.31 comments, and the median number is 47.5.

In terms of the unique commenters, 3563 participants left their opinions for the 32 articles. And the most popular article has 685 unique commenters. On average, each story has 111.34 participants, and the median number of the unique participants is 34.5.

For 32 articles without graphics, there are a total of 755 comments. The most popular article has 163 comments. The average number is 23.59, and the median number of comments for the 32 articles is 6.

In addition, 554 people took part in the discussions for the articles without graphics. The highest number of unique participants for a single article is 79. The average number is 17.31, and the median number of participants is 5.5.

Descriptive for the USA Today. Table nine and table ten show the statistical profiles of the 16 articles from the USA Today. Eight articles are with graphics and 8 articles are

without graphics.

Table 9

Statistical profiles of the USA Today articles with graphics

	Mean	Median	SD	Min	Max	Sum
Total number of unique comments	109.5	31.00	143.59	2	346	876
Total number of comments	188.13	65.50	224.25	3	519	1505

Table 10

Statistical profiles of the USA Today articles without graphics

	Mean	Median	SD	Min	Max	Sum
Total number of unique comments	17.31	5.5	24.42	0	79	554
Total number of comments	23.59	6	38.42	0	163	755

A total of 1505 comments were received for the 8 national news articles published with graphics in the USA Today during the month of September 2014. The most popular article has 519 comments. An average of 188.13 comments have left in the comment sections for each of the articles, and the median number of comments for these 8 articles is 65.5.

876 users exchanged their ideas in the 8 articles. The most discussed graphic-accompanied article has 346 unique participants. The average number of unique

commenters is 109, with 31 as the median number of commenters for all of the articles with graphics.

On contrary, for the 32 articles without graphics, there are a total of 755 comments submitted by 554 unique commenters. The highest number of comments for a single article is 163. The average number of comments for the articles is 23.59, and the median number is 6.

The highest number of the unique commenters for the articles without graphics is 79. Here the average number of the unique commenters is 17.31, and the median number is 5.5.

Descriptive for the Guardian. Table 11 and table 12 show the key numbers in the comparison between the articles with graphics and the articles without graphics from the Guardian. However unlike the majority of the newspapers, the readers from the Guardian do not have the tendency to participate more in the discussions with the presence of the graphics. In fact, the articles without graphics have a larger number of comments and a larger number of unique commenters than the articles with graphics.

Table 11

Statistical profiles of the Guardian articles with graphics

	Mean	Median	SD	Min	Max	Sum
Total number of unique comments	99.88	61	145.81	0	537	2497
Total number of comments	170.12	95	249.11	0	924	4353

	Mean	Median	SD	Min	Max	Sum
Table 12						
Statistical profiles of the Guardian articles without graphics						
Total number of unique comments	189.83	92	264.15	0	1031	4556
Total number of comments	350.96	212.50	472.70	0	2049	8774

The Guardian has a total of 25 published national news articles with graphics during the month of September 2014. In these 25 articles, the highest number of comments for a single article is 924. The total number of comments received for the 25 articles is 4253. On average, each story receives around 170.12 comments, while the median number of comments is 95.

A total of 2497 unique participants left comments for the 25 graphic-accompanied articles. The most popular article attracted 537 readers. The average number of unique commenters is 99.88, and the median number is 61.

Comparatively, the 25 articles without graphics receive a total of 8774 comments from 4556 unique commenters. The most discussed article has 2049 unique commenters. An average of 350.96 commenters left messages for each of the articles, and the median number is 209 for each of the articles.

Among the 25 articles without graphics, the highest number of the unique commenters for a single article is 1031. The mean number is 182.24 commenters and the median is 83.

Comparisons among outlets. This section offers the analysis results of the

independent t-test. Independent t-tests were conducted to compare the number of comments for the articles with graphics and the articles without graphics from each of the six newspapers. Table 13 illustrates the outcomes of the independent t-test analysis.

Table 13

Independence t-test results for the six newspapers

	With graphics		Without graphics		t-test	P-value
	Mean	SD	Mean	SD		
The Chicago Tribune	18.53	26.88	19.93	36.20	0.12	n.s. (P=0.12)
The Wall Street Journal	85.52	92.47	24.86	44.16	3.19	P<0.05
The Guardian	170.12	249.11	350.96	468.49	1.70	n.s (p=0.10)
The New York Times	171.31	270.89	23.59	38.42	3.05	P<0.05
The USA Today	188.13	224.25	22.75	26.89	2.07	P=0.05
The Washington Post	345.21	573.36	93.07	194.46	1.56	n.s (p=0.13)

In the case of the Wall Street Journal, the result shows that the articles with graphics receive more comments than the articles without graphics. There was a statistically significant difference between the number of comments from the articles with graphics (M=85.52, SD=92.47) and the number of comments for articles without graphics (M=24.86, SD=44.16), (t (56) =3.19, P<0.05). That is, the articles with graphics have more comments from the readers, and the use of graphics may help articles attract more readers

to communicate and express their opinions.

For the Washington Post, there are no statistically significant differences between the articles with graphics and the articles without graphics in terms of the number of comments from the readers.

For the USA Today, there is a statistically significant difference between the articles with graphics and the articles without graphics in terms of the number of comments from the readers (t (14) =2.07, p=0.05). The articles with graphics have more comments (M=188.13, SD=224.25) compared to the articles without graphics (M=22.75, SD=26.89).

There was a statistically significant difference between the articles with graphics and articles without graphics in the New York Times in regards of the comments received (t (62) =3.05, P=0.003). The articles with graphics have larger numbers of comments (M=171.31, SD=270.89) compared to the articles without graphics (M=23.59, SD=38.42).

For articles from the Guardian, there is not any statistically significant difference between the articles with graphics and the articles without graphics in terms of the number of comments from the readers.

There was no statistically significant difference found between the articles with graphics and articles without graphics in the Chicago Tribune in terms of the number of comments from the readers.

II. Graphic features and the number of comments. This section offers the results for the Chi square (X^2) test results. Results show the relationship between the total numbers of comments with the following elements: interactivity, data type, narrative balances, news types, graphic types, intent of the graphics, order of information, task of the graphics and visual structuring for each of the newspapers. In order to conduct the analysis, the articles

with the numbers of comments lower than the median number was coded as 1, meaning articles with low numbers of comments. The rest of the articles are then coded as 2, meaning articles with high numbers of comments.

New types. The element of news types is defined as the main topic of the articles. It is further broken down into six categories: politics and policy news, economics and financial news, healthcare related news, education news, crime news and others. In nearly all of the six newspapers, politics and policy news pieces appear most frequently, and occupy the largest percentage of all topics in most news outlets. The only exception is the Wall Street Journal, in which the economic and financial news pieces occupy the biggest segment.

Table 14

Distribution of news types in six newspapers

	Politics and policy	Economics	Healthcare	Education	Crime	Others
The USA Today	6	1	1	0	0	0
The Chicago Tribune	6	3	2	1	2	1
The Wall Street Journal	6	19	2	0	1	2
The Washington Post	7	3	4	0	0	0
The New York Times	13	8	6	1	3	1
The Guardian	21	1	0	1	0	2

Table 15

Distribution of news types in six newspapers

	Chi-Square (X^2)	P-value
The Washington Post	8.17	$P<0.05$
The Guardian	3.57	n.s. (P=0.31)
The Chicago Tribune	8.97	n.s. (P=0.11)
The New York Times	3.58	n.s. (P=0.61)
The USA Today	1.60	n.s. (P=0.45)
The Wall Street Journal	3.22	n.s. (P=0.52)

In the case of the Washington Post, out of the 14 articles, 7 articles, or 50 percent, are about politics and policies; 3 articles, which is 21.4 percent of all articles, are business related news, and the rest four articles are healthcare or related news. The results of chi-square showed there is a significant difference in the number of comments based on the news types ($X^2 = 8.17$, $p < 0.05$).

The opposite results are revealed for the samples from the Guardian. Out of the 25 articles, 21 are politics and policy news, and one article is business and economics news, one article is about education, and the rest of the 2 graphics are about topics not included in the previous categories, and they are coded as others. As a result, 84 percent of the articles are politics and policy related, and 4 percent are business news. 4 percent of all articles are about education, and all of the remaining 8 percent are about topics not mentioned in the categories. However, there is no significant difference on the total number of comments among the element of news types.

For the Chicago Tribune, out of the 15 articles with graphics, 6 articles are politics news, and 3 are business news. 2 more articles are on the topics of healthcare, one article is about education, and 2 articles are on the topics of crimes. The remaining one article could not be classified into any of the mentioned categories, thus is coded as others. In another word, 40 percent of all articles are politics news, 20 percent are business news and 13.3 percent are healthcare related news. Moreover, 6.7 percent are on the topic of education, 13.3 percent are about crime, and the remaining 6.7 percent are on other topics. However, there is no significant difference on the total number of comments among the element of news types.

The New York Times has a total of 32 articles with graphics. Among these 32

articles, 13 of them are on the topics of politics and policy, and 8 are economics news, 6 articles are healthcare related news, only 1 graphic is on the topic of education. For the rest of the articles, 3 are on the topics of crime, and the last one could not be classified as any of the previous categories. To calculate them into percentages, 40.6 percent are politics news, 25 percent are business news, and 18.8 percent are healthcare related news. In addition, 3.1 percent are news about education, 9.4 percent are crime news and the last 3.1 percent are graphics with other topics. The result shows that there is no significant difference on the total number of comments among the element of news types.

For the 8 articles with graphics in the USA Today, 6 are politics related news, one article is on the topic of finance and economics, and the last article is on the topic of healthcare. In terms of percentages, 75 percent are politics news, 12.5 percent are about economic news, and the remaining 12.5 percent are healthcare related news. There is no significant difference on the total number of comments among the element of news types.

The Wall Street Journal has a total of 30 articles, and among them 6 are on the topics of politics, and 19 are about the finance and economics topics during the month of September 2014. And lastly, 2 articles are on the topics of healthcare, one graphic is about crime and the last two graphics could not be categorized thus are labeled as others. In terms of percentages, 20 percent of all graphics are politics and policy news, 63.3 percent are economics and finance news, 6.7 percent are healthcare related news and 3.3 percent are about crimes, and the remaining 6.7 percent of all articles are on other topics that are not mentioned previously. Through the analysis of chi square test of independence, no significant difference exists on the total number of comments among the element of news types.

Comparison among newspapers. Chi square tests were also run to examine the differences and similarities in the proportions and distributions of the news types among the six newspapers. The result suggests that in general, the articles with graphics published in the Guardian and the Wall Street Journal possess distinctive compositions in terms of news types when compared to the graphics published in other newspapers as shown in Table 16.

Table 16

Chi square test results for the comparison of news types

Compared Newspaper one	Compared Newspaper two	Chi-Square (X^2)	P-value
The Chicago Tribune	The Guardian	16.73	P<0.05
The Chicago Tribune	The New York Times	5.61	n.s (p = 0.47)
The Chicago Tribune	The Washington Post	5.97	n.s. (p = 0.31)
The Chicago Tribune	USA Today	4.73	n.s. (p = 0.45)
The Chicago Tribune	The Wall Street Journal	10.96	P=0.05
The Guardian	The New York Times	16.04	P<0.05
The Guardian	The Washington Post	12.93	P<0.05
The Guardian	The Wall Street Journal	29.91	P<0.05
The Guardian	USA Today	4.87	n.s. (P=0.30)
The Guardian	The New York Times	16.04	P<0.05
The Guardian	The Washington Post	12.93	P<0.05
The Guardian	The Wall Street Journal	29.91	P<0.05
The New York Times	USA Today	3.43	n.s. (p = 0.63)
USA Today	The Washington Post	4.80	n.s. (p = 0.19)
USA Today	The Wall Street Journal	11.37	P<0.05
The Washington Post	The New York Times	6.11	n.s.(p = 0.30)
The Washington Post	The Wall Street Journal	14.27	P<0.05
The Wall Street Journal	The New York Times	12.25	P<0.05

A significant difference in the proportions of news types was found in the comparison between the articles published in the Chicago Tribune and the Guardian. For the comparison between the graphics published in the Chicago Tribune and the New York Times, no significant difference is detected in this comparison. Also, no significant differences were found in this comparison between the news types of graphics published in the Chicago Tribune and the graphics in the Washington Post. There was a significant difference for the comparison between the Chicago Tribune and the USA Today. No significant differences were found in this comparison between the Chicago Tribune and the USA Today in regards to the compositions of the news types of the articles with graphics. For the comparison between the articles published in the Chicago Tribune and the Wall Street Journal, a significant difference was found in the news types. A significant difference was also found in the comparison between the articles published in the Guardian and the ones published in the New York Times. Further, it's the same case for the comparison between the Guardian and the Washington Post. There was also a significant difference found between the articles published in the Guardian and in the Wall Street Journal. However no significant differences were found in the comparisons between the articles with graphics published in the USA Today and in the Guardian. For the comparison between the New York Times and the USA Today, no significant differences were found. Also, no differences were found in the comparison between the articles published in the USA Today and in the Washington Post. For the comparison between the USA Today and the Wall Street Journal, a significant difference was found. For the comparison between the articles published in the Washington Post and the New York Times, no significant differences were found. A significant difference was found in the comparison between the

articles published in the Washington Post and the Wall Street Journal. The last comparison

between the articles published in the Wall Street Journal and the New York Times yielded

a significant difference in the news types of the sampled articles with graphics.

Data Types. The element of data types is a vital component in the composition of an

information graphic. It is the way data delivers and describes the information. This study

defined two categories of data: qualitative and quantitative. For the quantitative data, it is

mostly numbers, and can be measured and scaled numerically. For the qualitative data, it

cannot be measured but only be observed and described with texts. In addition, some of

the graphics also use combinations of both data types.

Table 17.

Distribution of data types in six newspapers

	Qualitative data	Quantitative data	Combination
The USA Today	0	6	5
The Washington Post	3	12	5
The Chicago Tribune	5	11	6
The New York Times	5	48	11
The Wall Street Journal	7	23	3
The Guardian	11	50	8

	Chi-Square (X^2)	P-value
Table 18.		
Chi square test of independence results for six newspapers		
The USA Today	0.11	n.s. (P=0.74)
The New York Times	2.16	n.s. (P=0.34)
The Washington Post	2.88	n.s. (P=0.24)
The Chicago Tribune	3.92	n.s. (P=0.14)
The Wall Street Journal	4.97	n.s. (P=0.08)
The Guardian	6.13	P<0.05

For the 14 articles with graphics in the Washington Post, there are a total of 20 graphics as there are multiple graphics for two of the articles. Out of the 20 graphics, 12 graphics are based on quantitative data, and 3 graphics use qualitative data. The remaining 5 graphics have the hybrid data forms. As a result, the percentages of the data types are as follows: the majority of the graphics, specifically 60 percent, have quantitative data. 15 percent of the graphics employ the qualitative data, and the remaining 25 percent build on both quantitative and qualitative data for their visualizations. The chi square test of independence showed that there awere no statistically significant differences in the number of comments based on the data types.

The Chicago Tribune has a total of 15 articles, and among them, six articles have multiple graphics. Consequently, there are a total of 22 graphics, and six are using a combination of quantitative and qualitative data, five are employing qualitative data. The rest of the 11 graphics are using quantitative data for the visualizations. In another word,

27.3 percent of the Chicago Tribune graphics have both qualitative and quantitative content, and 22.7 percent have qualitative data. The majority of the graphics, 50 percent, are using quantitative data only. The chi square test of independence test showed that there was no significant difference in terms of the data types and the number of comments for the Chicago Tribune.

The Wall Street Journal has a total of 30 articles and 33 graphics. Among them, seven of the graphics are using qualitative data, 23 are using quantitative data instead, and three are using a combination of both qualitative and quantitative statistics for the contents of the graphics. Thus, 21.2 percent of all Wall Street Journal articles are using qualitative data only, and 9.1 percent are employing both numbers and texts to convey information in their graphics. The majority, 69.7 percent specifically, are using only numeric values in their graphics. Through the calculation of the chi square test of independence, there was no significant difference in terms of the data types and the number of comments in the case of the Chicago Tribune.

For the Guardian, there are a total of 69 graphics from the 25 articles. 11 of these graphics are using qualitative data alone for the content, while 50 of them are using numbers. The rest of 8 graphics are using both categories of data as the bases of the visualizations. The majority of the graphics, specifically 72.5 percent of all graphics, are quantitative data based graphics. Roughly 16 percent of the graphics employ qualitative data for the content. The least used data type for the graphics is the combination of qualitative and quantitative categories, which occupies around 11.5 percent of all graphics. Through the calculation of the chi square test of independence, there is a significant difference in the number of comments based on the data types ($X^2 = 6.13$, $p < 0.05$).

The New York Times has a total of 64 graphics from the 32 articles. In these 64 graphics, five are based on the qualitative data. Additionally, there are 11 graphics with both qualitative and quantitative data, and 48 graphics have the quantitative data. The majority of the graphics, 75 percent, are using the quantitative data; 17.2 percent are using a combination of both data types, and the remaining 7.8 percent are employing just the qualitative data. However there is no significant difference between the number of comments articles receive and the data types of the graphics.

The USA Today has a total of 11 graphics from 8 articles. In these 11 graphics, six are using quantitative data, and five are using a combination of qualitative and quantitative data. The majority of the graphics are still using numbers, as 54.5 percent are quantitative, and 45.5 percent are using both numeric and descriptive data. In the case of the USA Today, there is no significant difference on the data types and the number of comments for the articles.

Comparison among newspapers. In order to understand the similarities and differences in regards to the proportions of the data types among the graphics published in the six newspapers, a chi square test was conducted for each pair of the two newspapers and 15 pairs were established. The results of the chi square tests are listed below in table 19. The chi square test results indicate that majority of the newspapers have homogenous compositions in terms of data types of the graphics. The only two significant differences are between the USA Today and the Guardian, and between the USA Today and the Wall Street Journal.

Table 19.

Chi square test results for the comparison of data types

Comparison Newspaper one	Comparison Newspaper two	Chi-Square (X^2)	P-value
The Chicago Tribune	The Wall Street Journal	3.27	n.s. (p=0.20)
The Chicago Tribune	The Guardian	4.36	n.s. (p=0.11)
The Guardian	The New York Times	2.58	n.s.(p=0.28)
The Guardian	The Wall Street Journal	0.57	n.s (p=0.75)
The New York Times	The Chicago Tribune	5.47	n.s. (p=0.07)
The New York Times	The Wall Street Journal	4.38	n.s. (p=0.11)
The New York Times	USA Today	4.92	n.s. (p=0.09)
USA Today	The Chicago Tribune	3.26	n.s. (p=0.20)
USA Today	The Guardian	8.88	p<0.05
USA Today	The Washington Post	2.61	n.s. (p=0.27)
USA Today	The Wall Street Journal	8.39	p<0.05
The Washington Post	The Chicago Tribune	0.54	n.s. (p=0.76)
The Washington Post	The Guardian	2.63	n.s. (p=0.32)
The Washington Post	The New York Times	1.80	n.s. (p=0.41)
The Washington Post	The Wall Street Journal	1.15	n.s. (p=0.56)

In terms of the proportions and distributions of data types in the graphics from the Chicago Tribune and the Wall Street Journal, no significant differences were found. In addition, no significant differences on the proportions and distributions of data types were found in the comparison between the Chicago Tribune and the Guardian. In the case of the Guardian and the New York Times, no statistically significant differences were found. No significant differences were found in the comparison between the Guardian and the Wall Street Journal in regards to the compositions of the data types. And it is the same case for the comparison between the New York Times and the Chicago Tribune. No significant differences were found between the New York Times and the Chicago Tribune when it comes to the distributions of data types among the articles with graphics. No significant differences were found between the graphics in the New York Times and ones in the Wall Street Journal in terms of the proportions of the data types. When comparing the data types between the graphics from the New York Times and the graphics from the USA Today, no significant differences were found. No significant differences in the proportions of data types were found among the articles with graphics in the USA Today and the Chicago Tribune. For the comparison between the USA Today and the Guardian, a significant difference was found in terms of the distributions of data types among the articles with graphics. No significant differences were found between the articles in the USA Today and the ones in the Washington Post in regard to their data types. As for the comparison between the articles with graphics in the USA Today and the Wall Street Journal, a significant difference was found in terms of the distributions of data types. Between the articles with graphics published in the Washington Post and the graphics in the Chicago Tribune, no significant differences in the data types' distributions were found. In addition,

no significant differences in the data type distributions were found. And for the comparison between the Washington Post and the New York Times, no significant differences were found in the distributions of the data types in the sampled articles with graphics. Lastly, no significant differences were found among the articles from the Washington Post and the Wall Street Journal when it comes to the distributions of the data types.

Interactivity. Interactivity is the mode of communication between the graphics and the readers. If the readers and the graphics could not exchange ideas, and only the graphics can deliver information to the readers, then it is a static graphic. If there is limited communication, but the users need to follow the preset paths or story lines set by the graphic creator, then it has low level of interactivity. If the readers are presented with a number of choices and paths, and the readers are free to choose the paths to follow throughout the graphics, then the graphic has medium level of interactivity. If the readers can make choices on their own and influence the content of the graphic, then it is a highly interactive graphic.

Table 20 details the distributions of the levels of interactivities among the graphics in the six newspapers, and table 21 are the chi square test analysis results for the relationships between the element of interactivity and the number of comments for the graphics.

Table 20.

Distribution of levels of interactivity in six newspapers

	Static	Low level	Intermediate level	High level
The Washington Post	12	5	2	1
The Chicago Tribune	19	3	0	0
The New York Times	55	4	3	2
The Wall Street Journal	27	5	0	0
The USA Today	4	6	1	0
The Guardian	63	5	0	1

Table 21.

Chi square test of independence results for six newspapers

	Chi-Square (X^2)	P-value
The Washington Post	1.81	n.s (P=0.61)
The Chicago Tribune	0.21	n.s. (P=0.65)
The New York Times	0.44	n.s. (P=0.93)
The Wall Street Journal	0.01	n.s. (P=0.94)
The USA Today	4.61	n.s. (P=0.1)
The Guardian	1.28	n.s. (P=0.53)

For the 20 graphics from the Washington Post, 12 of them are static graphics with no interactivity at all. Five graphics have low levels of interactivity, two have intermediate levels of interactivity, and the last graphic is highly interactive. To calculate them into percentages, 60 percent of the graphics are static graphics, which occupy the majorities of all graphics. 25 percent of all graphics have low interactivity levels, 10 percent have intermediate interactivity, and the remaining five percent are highly interactive. Using the chi square test of independence, there is no significant difference on the total number of comments the articles receive based on different levels of interactivity of the graphics.

Most of the graphics published in the Chicago Tribune articles are static graphics. Out of the 22 graphics, only 3 are interactive graphics with low levels of interactivity. The rest of the 19 graphics are all static graphics. No graphics with medium or high levels of interactivity are found. Consequently, the majority of the articles, specifically 86.3 percent, are static graphics, and the graphics with low levels of interactivity occupy 13.6 percent of all the graphics. The chi square test of independence reveals that in the case of the Chicago Tribune, no significant difference was found in the number of comments in regards to the graphics' levels of interactivity.

Static graphics occupy the majority of all the graphics in the New York Times. Out of 64 graphics, 55 are static, four graphics are with low interactivity, three graphics have intermediate levels of interactivity, and two graphics are highly interactive. To calculate these proportions into percentages, 85.9 percent of all graphics are static, 6.3 percent are graphics with low interactivity, 4.7 percent are graphics with intermediate interactivity, and only 3.1 percent are with high levels of interactivity. Through the calculations of the chi square test of independence, no differences in the number of comments stemming from the

levels of interactivity were found in the case of the New York Times.

In the case of the Wall Street Journal, there are a total of 32 graphics, 27 of them are static graphics, and the remaining five are graphics with low levels of interactivity. There are no graphics with intermediate or high levels of interactivity. Consequently, 84.4 percent of all graphics in the Wall Street Journal are static graphics, and 15.6 percent are then interactive graphics with low levels of interactivity. In order to understand the relationships between the readers' discussion rates and the interactivity level, a chi square test of independence was conducted. The analysis result suggested that there was no significant differences on the number of comments for the articles in regards to the levels of interactivity for the Wall Street Journal articles.

It's the same case with the graphics sampled from the USA Today. Out of the 11 graphics, four graphics are static, and six are with low levels of interactivity. The last graphic is with medium level of interactivity. To put these numbers in percentages, static graphics occupy 36.4 percent of all graphics, 54.5 percent are with low levels of interactivity, and the last 9.1 percent are the graphics with medium level of interactivity. Using chi square test of independence, the analysis results showed that no significant difference was found in the number of comments for graphics in terms of the levels of interactivity.

The last test is for the case of the Guardian. Out of the 69 graphics published during the month of September 2014, 63 graphics are static without any interactivity at all. Five are graphics with low interactivity and the last one is highly interactive. No graphic in this case is categorized as with medium level of interactivity. To put these numbers into perspectives, a high percentage of all graphics, specifically 91.3 percent, are static graphics.

Only a very small percentage, 8.7 percent, are interactive graphics, in which 7.2 percent are with low levels of interactivity and only 1.5 percent are graphics with high levels of interactivity. Through the examination of chi square test of independence, no significant differences were found for the number of comments graphics receive from readers when considering the different levels of interactivity of the graphics.

Comparison among newspapers. In order to compare and understand the differences in distributions and proportions of the levels of interactivity in the graphics, chi square tests were conducted among the six newspapers. 15 pairs were established. Table 22 illustrates the results for these analysis.

Table 22.

Chi square test results for the comparison of levels of interactivity

Comparison Newspaper #1	Comparison Newspaper #2	Chi-Square (X^2)	P-value
The Chicago Tribune	The Wall Street Journal	0.04	n.s. (P=0.84)
The Chicago Tribune	The Guardian	1.14	n.s (P=0.57)
The Guardian	The New York Times	3.80	n.s. (P=0.28)
The New York Times	The Chicago Tribune	2.20	n.s. (P=0.42)
The New York Times	The Wall Street Journal	4.51	n.s. (P=0.21)
The New York Times	The USA Today	20.04	P<0.05
The USA Today	The Chicago Tribune	9.13	P<0.05
USA Today	The Guardian	25.29	P<0.05
USA Today	The Washington Post	3.07	n.s. (P=0.38)
The Washington Post	The Chicago Tribune	5.00	n.s. (P=0.17)
The Guardian	The Wall Street Journal	2.13	n.s. (P=0.34)
The Washington Post	The New York Times	7.16	n.s. (P=0.07)
The Washington Post	The Wall Street Journal	3.43	n.s (P=0.18)
USA Today	The Wall Street Journal	10.37	P<0.05
The Washington Post	The Guardian	13.92	P<0.05

No significant differences were found in the comparison between the distributions of levels of interactivity between the graphics in the Chicago Tribune and the ones in the Wall Street Journal with the results from the chi square test. For the comparison between the Guardian and the Chicago Tribune, still no significant differences were found in the comparison for the distributions of levels of interactivity among graphics in the two newspapers. There were no significant differences in the comparison between the Guardian and the New York Times in terms of the levels of interactivity within the graphics. For the comparison between the New York Times and the Chicago Tribune, no significant differences were detected in terms of the distributions and proportions of the levels of interactivity among graphics. No significant differences were found on the levels of interactivity between graphics published in the New York Times and the ones in the Wall Street Journal. A significant difference was found between the levels of interactivity in the graphics published in the New York Times and the graphics from the USA Today. For the comparison between the graphics published in the USA Today and in the Chicago Tribune, a significant difference was found in the compositions of levels of interactivity between the graphics in the two newspapers. A significant difference was found in regards to the distributions of levels of interactivity in the comparison between the graphics from the USA Today and the graphics from the Guardian. The chi square test result showed no significant differences in this comparison between the graphics from the USA Today and ones in the Washington Post. For the comparison between the graphics in the Washington Post and the Chicago Tribune on their levels of interactivity, no significant differences were found. No significant differences were found in the comparison between the Washington Post and the New York Times. The chi square test result for the comparison

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between the Washington Post and the Wall Street Journal revealed no significant differences in the distributions of levels of interactivity in the graphics. For the comparison between the graphics in the USA Today and the Wall Street Journal, the chi square test result indicated a significant difference between the graphics published in the USA Today and the Wall Street Journal in terms of the levels of interactivity. For the comparisons between the graphics in the Washington Post and the Guardian, a significant difference was found.

Narrative balance. Narrative balance indicates the balance between the content authors control and the content readers can control. If the author controls and presets most of the content, leaving readers few choices, then the graphic is author driven. However if readers have more control over the content, then the graphic is driven by the readers. There are also graphics where hybrid forms are used in the narrative balances, including Martini glass structure, in which graphics start with overviews set by the authors, and readers resume controls after the initial introductions; interactive slideshows, in which readers can choose the ordering of information or slides within the graphics, however in each of the slides there are author controlled content. And lastly, there are drill-down stories. This form of narratives starts with a general theme set by the author, and readers can zoom in to a small segment of the graphics to study on their own paces and orders of interests. They can choose their paths through the graphics completely on their own. Narrative balances do not possess the independent relationships with readers' participation in the case of the six newspapers as the chi square test of independence results implied.

Chi square test of independence is conducted for each of the newspapers to understand the relationship between the number of comments graphics receive from

readers and their elements of narrative balances. Table 23 records the distributions of narrative balances of the graphics for the six newspapers and table 24 illustrates the chi square test results.

Table 23.

Distribution of narrative balance categories in six newspapers

	Author Driven	Reader Driven	Martini Glass (Hybrid)	Interactive Slideshow (Hybrid)	Drill-down stories (Hybrid)
The Chicago Tribune	21	0	0	0	1
The Wall Street Journal	30	1	1	1	0
The Washington Post	16	1	0	1	2
The USA Today	8	0	0	2	1
The New York Times	58	4	1	0	2
The Guardian	65	1	0	0	3

Table 24.

Chi square test of independence results for six newspapers

	Chi-Square (X^2)	P-value
The Chicago Tribune	0.87	n.s (P=0.35)
The Wall Street Journal	3.11	n.s (P=0.38)
The Washington Post	4.38	n.s. (P=0.22)
The USA Today	1.42	n.s. (P=0.49)
The New York Times	0.96	n.s. (P=0.81)
The Guardian	4.58	n.s. (P=0.10)

In the 22 graphics published by the Chicago Tribune, most of them are with low interactivity levels. Specifically 21 of the graphics are author drive, and only one graphic is using the hybrid form, specifically the form of the drill-down stories. Here the author driven graphics occupy 95.5 percent of all graphics in the Chicago Tribune, and the hybrid graphic are only 4.5 percent. In order to understand the relationships between the narrative balances and the readers' participation rates, a chi square test of independence was conducted, and for the articles in the Chicago Tribune, there was no significant difference on the total number of comments among the element of narrative balances.

Author-driven graphics with low levels of interactivity are still the major components in the sampled Wall Street Journal graphics. In the 33 graphics, 30 are classified as author driven, one graphic is readers driven and two graphics are hybrid — one with martini glass structure and one with the form of interactive slideshow. The last graphic is reader driven.

As a result, 91 percent of all graphics are author driven, three percent are with the martini glass structure, and three percent are with interactive slideshow. The last 3 percent are reader driven graphics. No significant differences in regards to the narrative balances were found in the Wall Street Journal graphics.

The Washington Post has 16 author driven graphics out of the total 20 graphics. For the remaining four graphics, one is readers-driven, one is with the narrative form of interactive slideshows, and the last two graphics are the drill-down stories. To put the proportions into perspectives, 80 percent of the graphics are author driven, and five percent are reader driven. Graphics with interactive slideshows occupy five percent of all graphics. Lastly, ten percent are the graphics with the form of drill-down stories. The result of the chi square test for the relationship between the narrative balance and the readers' participation rates for the Washington Post revealed to be statistically insignificant.

The USA Today had a total of 11 graphics, in which eight graphics, or 72.7 percent, are author driven; two graphics, or 18.2 percent of all graphics, are with the narrative balances of interactive slideshows; and the last graphic is a drill-down story, which occupies 9.1 percent of all graphics published in the month of September 2014 in the USA Today. The chi square test of independence result showed that there were no significant differences on the total number of comments among the element of narrative balances.

In the case of the New York Times, out of the 65 published graphics in the month of September 2014, 58 graphics are author driven graphics, four graphics are reader driven graphics. The remaining three graphics all have hybrid forms of narrative balances — one is a graphic with the Martini glass structure, and two are the drill-down story graphics. Clearly, for the New York Times, the majority, 89.2 percent, of the graphics are still with

low levels of interactivity and are author driven. Only a very small percent of the graphics have content for the readers to control, and 6.2 percent of the graphics are reader driven. In addition, 1.5 percent are with the Martini glass structure and 3.1 percent are with the drill-down story formats. The chi square test of independent result revealed that there was no significant difference on the total number of comments among the element of narrative balances.

The Guardian has a total of 65 author driven graphics out of the 69 graphics sampled in this analysis. Like the rest of the six newspapers, author driven graphics are still the major components. These graphics occupy 94.2 percent of all graphics published in the Guardian. Three graphics, or 4.3 percent, are categorized as the hybrid drill-down formats, and the last one is with the reader driven format. It is only 1.5 percent of all graphics. The element of narrative balances in this case yielded no significant difference on the total number of comments in the case of the Guardian graphics.

Comparison among newspapers. Just as the previous comparisons, chi square tests were conducted for each pair of newspapers. These tests were for the purposes of understanding the similarities and differences in terms of the distribution of narrative balances in the given newspapers. The results are recorded in table 25.

Table 25.

Chi square test results for the comparison of distributions of balances of narratives

Comparison newspaper #1	Comparison newspaper #2	Chi-Square (X^2)	P-value
The Chicago Tribune	The Wall Street Journal	2.10	n.s (P=0.35)
The Chicago Tribune	The Guardian	91	P<0.05
The Guardian	The New York Times	3.34	n.s. (P=0.34)
The Guardian	The Wall Street Journal	6.04	n.s. (P=0.20)
The New York Times	The Chicago Tribune	86	P<0.05
The New York Times	The Wall Street Journal	3.66	n.s. (P=0.46)
The New York Times	The USA Today	13.62	n.s. (P=0.09)
The USA Today	The Chicago Tribune	33	P<0.05
The USA Today	The Guardian	13.61	P<0.05
The USA Today	The Washington Post	1.88	n.s. (P=0.60)
The Washington Post	The Wall Street Journal	6.56	n.s. (P=0.16)
The Washington Post	The Guardian	7.47	n.s. (P=0.06)
The Washington Post	The New York Times	5.21	n.s. (P=0.27)
The Washington Post	The Wall Street Journal	3.99	n.s. (P=0.41)
USA Today	The Chicago Tribune	42	P<0.05

No significant differences in the distributions of the graphics' balances of narratives were found in the comparison between the Chicago Tribune and the Wall Street Journal. For the comparison between the graphics from the Guardian and the graphics from the Chicago Tribune, a significant difference in the distribution of narratives of balances was detected by the chi square test. No significant differences in the distributions of the balances of narratives were found in the comparison between the Guardian and the New York Times. For the comparison between the Guardian and the Wall Street Journal, no significant difference was detected in terms of the distributions and proportions of the balances of narratives in the graphics. A significant difference was found between the articles in the New York Times and the Chicago Tribune with the comparison for the distributions of narrative balances. For the comparison between the New York Times and the Wall Street Journal, no significant difference was found with the chi square test results. Between the New York Times and the USA Today, no significant difference was found in terms of the distributions and the proportions of balances of narratives within the graphics. For the comparison between the graphics in USA Today and the Chicago Tribunes, a significant difference in the distributions of balances of narratives in graphics was found. It's the same case with the comparison between the USA Today and the Guardian, as the Chi square test result indicated significant difference in the distribution of balances of narratives in the graphics of the two newspapers. No significant differences in the distributions of balances of narratives were found in the comparison between the USA Today and the Washington Post. For the comparison between the USA Today and the Wall Street Journal, still no significant difference was found in terms of the distributions of the narrative balances in the graphics in the two newspapers. A significant difference was

detected in the comparison of distributions of narrative balances between the Washington Post and the Chicago Tribune. For the comparison between the Washington Post and the Guardian, the chi square test result suggestd that no significant differences were found in terms of the distribution of narrative balances among graphics. For the comparison between the Washington Post and the New York Times, the chi square test result showed no significant difference in the distribution of the graphics' balances of narratives. The Chi Square test result for the comparison between the graphics in the Washington Post and the Wall Street Journal showed no significant differences in the balances of narratives.

Graphic Types. The element of graphic types is the form in which a graphic delivers information. For the convenience of coding and analysis, eleven categories of graphics are included in this research. These categories are all widely used and commonly seen in the information graphics industry. As the foundations to the visual and information presentation, graphic types are vital components and determining factors in how readers respond and process the information. The eleven categories of graphics are classified as follows: **line charts**, in which movements and directions of lines are employed to represent the trends and the quantities of the variables within the graphics. These lines are placed in the x-axis and y-axis, and each of the axes will represent the scales of variables; **bar charts** show the values of the variables with the help of the vertical and horizontal bars; **pie charts** are graphics with slices of pies within a circle, and the areas of the pies represent the amount of values of the variables. **Table charts** are sheets that document information in tabular or diagrammatic forms. **Pictograms** are charts in which icons represent numbers to make it more visually appealing and easier to understand. **Maps** are geographical depictions detailing the locations of the news events. **Timelines** are displays of events in a

chronological order. **Illustrations** are art renderings, drawings or sketches within graphics.

Multimedia is defined as the use of audio, video, animations or still images in the graphics.

And **area graphics** are using the comparison of the values of the space or areas to show

the values of the variables. Table 26 shows the distributions of graphics types in the six

newspapers. And table 27 records the results of the chi square test of independence for the

six newspapers.

Table 26.

Distribution of graphics types in six newspapers

	The Washington Post	The Guardian	The USA Today	The New York Times	The Wall Street Journal	The Chicago Tribune
Line charts	7	8	0	14	12	2
Bar charts	4	23	4	26	9	6
Pie charts	0	2	1	0	2	0
Table charts	0	13	1	6	1	2
Pictograms	1	0	1	0	0	0
Maps	5	18	3	7	5	10
Timeline	0	0	1	0	0	0
Multimedia	0	1	0	2	1	1
Area map	1	2	0	2	2	0
Illustrations	1	0	0	0	1	0
Others	1	2	0	4	0	0

Table 27.

Chi square test of independence results for six newspapers

	Chi-Square (X^2)	P-value
The Washington Post	9.24	n.s. (P=0.24)
The Guardian	12.77	n.s. (P=0.17)
USA Today	6.97	n.s. (P=0.22)
The New York Times	9.20	n.s. (P=0.24)
The Wall Street Journal	10.22	n.s. (P=0.18)
The Chicago Tribune	7.22	n.s. (P=0.30)

In the case of the Guardian, for the total of 69 graphics published during the month of September 2014 under the topics of the national news, eight graphics are employing the format of line charts to deliver information to the readers, 23 are using bar charts. There are two graphic with the forms of pie charts, and table charts occupy a total of 13 graphics in the whole poll of graphics sampled in the Guardian. In addition, 18 are with the graphic forms of maps. Multimedia is used in only one of the graphics. Two graphics are classified as area graphics, and two more are classified as categories that are not mentioned previously. Putting these numbers into percentages, 11.6 percent of all graphics published during the month of September 2014 and with the topics of national news are using the lines charts to deliver numbers; 33.3 percent are employing bar charts. 2.9 percent are graphics with the forms of pie charts, and 26.1 percent of the graphics are using maps to illustrate locations. 18.8 percent are using table graphics to list out numbers. 1.5 percent of all graphics are with the help of the multimedia. 2.9 percent of the graphics are area graphics, and the remaining 2.9 percent are graphics that could not be categorized into the

10 graphic forms mentioned above, thus they are labeled as others. Through the calculations of chi square test of independence, no significant differences were found in the number of comments based on the graphic types.

For the USA Today, four graphics are coded as bar charts; three graphics are with the categories of maps. The rest of the four graphics are each categorized as a pie chart, a table chart, a pictogram and a timeline. As a result, the majority of the graphics, specifically 36.4 percent, are bar charts. The second most frequently used form is the map, which occupy 27.3 percent of all graphics. Each of the rest of the categories then takes 9.1 percent of all graphics. A calculation of the chi square test of independence showed no significant difference on the total number of comments in regards to the elements of graphic types.

The New York Times has a total of 14 graphics that are classified as line charts, which occupy 21.9 percent of all graphics. 40.6 percent are bar charts, totaling 26 graphics in the category. Six graphics are categorized as table charts, which have the percentage of 9.4 percent. There are seven graphics with the graphic types of maps, which is 10.9 percent of all graphics. There are two graphics for the categories of multimedia and area graphics, each occupying 3.1 percent among all graphics. Lastly, four graphics are categorized as graphics other than the categories listed before, taking up 6.3 percent of all graphics. Using the chi square test of independence, the result suggested no significant difference in regards to the number of comments among the element of graphic types.

There are seven graphics in the Washington Post with the graphic types of line charts, and four are categorized as bar charts. The type of maps has five samples. For the remaining four graphics, one is a pictogram, one is an illustration, one is with area graphic, and the last one is labeled as "others." To calculate the percentages of the graphic types, the

majority of the graphics, or 35 percent, are line charts, 20 percent of all graphics are line charts, 25 percent are counted as maps, and pictograms, illustrations, area graphics and others all occupy 5 percent of all graphics. The chi square test of independence showed that no significant difference of the number of comments was found in regards to the graphic types in the case of the Washington Post.

In the case of the Wall Street Journal, 12 graphics are coded as line charts, and nine are categorized as bar charts. There are five graphics with maps, and two more are coded as area graphics. Two graphics have the elements of pie charts. In the remaining graphics, one is recognized as table chart, one is an illustration, and one is multimedia. Thus to put the proportions into percentages, 36.4 percent are line charts, taking up the majority of the graphics. 27.3 percent are bar charts. 15.2 percent are maps. Area graphics and pie charts each take up 6.1 percent of all graphics. And for table chart, illustrations and multimedia, each category occupies three percent. Through the calculations of the chi square test of independence, no significant difference was found for the number of comments of the articles in regards to the graphic types for the Wall Street Journal graphics.

The Chicago Tribune has a sample size of 22 graphics, in which ten are categorized as maps. There are six graphics with the elements of bar charts. Line charts and table charts each have two graphics. There is one graphic with illustrations and one with multimedia. In another words, the majority, or 45.5 percent, are maps. Line charts and table charts each occupy 9.1 percent of all graphics. 27.3 percent of all graphics are bar charts. And there are 4.5 percent of graphics categorized for illustrations and multimedia. Still no significant differences of the number of comments were found in terms of graphic types for the Chicago Tribune graphics.

Comparison among newspapers. Table 28 illustrates the results of the chi square test comparisons for each pair of the newspapers concerning the similarities and differences of the distributions of the graphics types among all graphics.

Table 28.

Chi square test results for the comparison of news types

Comparison Newspaper #1	Comparison Newspaper #2	Chi-Square (X^2)	P-value
The Chicago Tribune	The Wall Street Journal	11.43	n.s. (P=0.20)
The Chicago Tribune	The Guardian	13.08	n.s. (P=0.22)
The Guardian	The New York Times	19.45	P<0.05
The Guardian	The Wall Street Journal	19.32	P<0.05
The New York Times	The Chicago Tribune	28.83	P<0.05
The New York Times	The Wall Street Journal	13.86	n.s. (P=0.13)
The New York Times	USA Today	17.68	P<0.05
USA Today	The Chicago Tribune	11.55	n.s.(P=0.24)
USA Today	The Guardian	16.72	n.s. (P=0.12)
USA Today	The Washington Post	13.09	n.s. (P=0.22)
USA Today	The Wall Street Journal	12.48	n.s. (P=0.19)
The Washington Post	The Chicago Tribune	9.88	n.s. (P=0.36)
The Washington Post	The Guardian	19.84	P<0.05
The Washington Post	The New York Times	23.32	P<0.05
The Washington Post	The Wall Street Journal	8.22	n.s. (P=0.51)

When comparing the Chicago Tribune with the Wall Street Journal on the distributions of graphic types among the graphics published in the month of September 2014 and on the topics of national news, no significant differences were found with the chi square test result. And it is the same case with the comparison between the Guardian and the Chicago Tribune. As the chi square test result indicated, no significant differences were detected when comparing the distributions of the graphics types. For the comparison between the Guardian and the New York Times, a significant difference was found in terms of the distribution of graphic types among the graphics. It's the same case with the comparison between the Guardian and the Wall Street Journal on the distributions of graphic types, a significant difference was found. A significant difference was also found in the comparison between the New York Times graphics and the Chicago Tribune graphics. However, no significant difference was found between the articles published in the New York Times and the Wall Street Journal. For the comparison between the New York Times and the USA Today, a significant difference in proportions and distributions of the graphic types was found. No significant difference was found in the comparison between the articles with graphics published in the USA Today and the Chicago Tribune. It's the same case for the comparison between the USA Today and the Guardian, as no significant difference in the distributions and proportions of the graphic types was indicated by the chi square test result. For the comparison between the USA Today and the Washington Post in terms of the distributions of graphic types, no significant differences were found. No significant difference was found in the case of the USA Today and the Wall Street Journal when it comes to the distributions of the graphic types among the sampled articles with graphics. It's the same case for the comparison between the articles

with graphics from the Washington Post and the Chicago Tribune. No significant difference is found with the chi square test. However, significant differences were found in the comparison between the graphics published in the Washington Post and the Guardian. And for the comparison between the Washington Post and the New York Times, a significant difference was found in terms of the distributions and proportions in the graphics types among the articles. No significant difference was found between the Washington Post and the Wall Street Journal.

Intent of graphics. The element of intent of graphics is the purpose behind all the numbers and stories told by the graphics. It is the information or the experience that the information graphic creators hope to instill in the minds of the readers. For the purpose of effective communications, three forms of graphics intents are coded in this analysis. Firstly, some of the graphics are narratives, telling readers the information through the experiences of a story. Then there are graphics used with the intent of instructive, guiding the readers through tutorials in order to offer newest updates or stories. Lastly explorative graphics grant readers the opportunities to explore on their own and dig information they are interested in. Since most of the graphic intents are inherently interactive, as a result, static graphics are coded as not available. Table 29 illustrates the distributions of the intent of graphics in six newspapers, while table 30 gives details of the chi square tests of independence results.

Table 29.

Distribution of intent of graphics in six newspapers

	Not available (static graphics)	Narrative	Instructive	Explorative
The Washington Post	12	1	2	4
The Chicago Tribune	20	0	0	2
USA Today	3	1	2	5
The Wall Street Journal	28	0	0	4
The New York Times	58	1	2	5
The Guardian	63	0	0	6

Table 30.

Chi square test of independence results for six newspapers

	Chi-Square (X^2)	P-value
The Washington Post	5.56	n.s. (P=0.14)
The Chicago Tribune	1.83	n.s (P=0.18)
The USA Today	5.76	n.s. (P=0.12)
The Wall Street Journal	0.31	n.s. (P=0.58)
The New York Times	1.21	n.s. (P=0.75)
The Guardian	0.07	n.s (P=0.79)

For graphics in the Washington Post, as discussed in the previous sections, majority are static graphics. 12 graphics are coded as not available, taking 63.2 percent of all graphics. In the seven interactive graphics, four, or 21.1 percent, are categorized as with the explorative intents. Two graphics are instructive, and the last graphic is narratives. As a result, aside from the 63.2 percent of static graphics, 21.1 percent are explorative graphics, instructive graphics are 10.5 percent of all graphics, and 5.3 percent of all graphics are narrative graphics. As Chi Square test of independence indicates, no significant differences on the total number of comments among the element of intent of graphics were found in the case of the Washington Post.

Putting aside the 20 static graphics out of the total 22 graphics for the Chicago Tribune, the remaining two graphics are all explorative graphics. Putting the proportions into perspectives, 91 percent of all graphics are static graphics and thus coded as "not available", and nine percent are explorative graphics. Using the chi square test of independence, for graphics published in the Chicago Tribune, there were no significant differences on the total number of comments in regards to the element of intent of graphics.

In the total 11 graphics published in the USA Today, only three graphics are static graphics and thus coded as "not available". In the remaining eight graphics, five are classified as explorative graphics with high levels of interactivity. Two graphics are instructive and the last graphic is with the intent of narratives. Thus, roughly 27.3 percent of all graphics are static graphics, 45.5 percent are graphics with the intent of explorative. Graphics with instructive intents occupy 18.2 percent of all graphics published in the USA Today, and the last nine percent are graphics with the intent of narratives. A chi square test of independence was conducted to determine the relationship between the intent of

graphics and the readers' eagerness of participations in online news discussions. Through the calculations of the chi square test of independence, no significant differences of the number of comments were found among the element of intent of graphics for the USA Today graphics.

The Wall Street Journal has a total of 32 graphics, in which only four are interactive graphics and all are classified as graphics with the intents of explorative. To calculate the proportion into percentages, 14.3 percent of the 32 graphics in the Wall Street Journal are interactive graphics with the intents of explorative, and the remaining 85.7 percent are all static graphics. The chi square test of independence indicated no significant differences in the number of comments for the articles with graphics in the Wall Street Journal among the element of intent of graphics.

Among the 64 graphics sampled from the New York Times, few are interactive graphics that can be classified with the element of graphics intents — eight graphics are interactive and the rest 58 are static graphics. To be further broken down, five graphics are coded as with the intents of explorative, and two graphics are with the intents of instructive, and the final one is a graphic with the intent of narratives. In another word, 87.5 percent of all graphics are static graphics, and around 7.8 percent are graphics with the intent of explorative. Then there are instructive graphics that occupy around 3.1 percent of all graphics. Lastly, the narrative graphic is 1.6 percent of all graphics. Through the use of the chi square test of independence, the result showed no significant differences in the number of comments regarding the element of intent of graphics.

The last case for the intent of graphics is the Guardian. For the 69 graphics published in the month of September 2014 with the topics of national news in the Guardian, six

graphics are classified as ones with the intent of explorative, the rest are all static graphics. Thus 8.7 percent of all graphics are with the intent of explorative, and 91.3 percent are static graphics. Just as the graphics published in rest of the newspapers, the Guardian graphics do not have the significant differences in number of graphics among the element of intent of graphics.

Comparisons among newspapers. Chi square tests were conducted in the 15 pairs to understand the differences and similarities in the distributions of intent of the graphics among all samples. Table 31 illustrates the results of the comparisons.

Table 31.

Chi square test results for the comparison of intent of graphics

Comparison Newspaper #1	Comparison Newspaper #2	Chi-Square (X^2)	P-value
The Chicago Tribune	The Wall Street Journal	0.15	n.s. (P=0.66)
The Guardian	The New York Times	3.32	n.s. (P=0.39)
The Chicago Tribune	The Guardian	0.03	n.s. (P=0.96)
The Guardian	The Wall Street Journal	0.36	n.s. (P=0.55)
The New York Times	The Chicago Tribune	1.09	n.s. (P=0.78)
The New York Times	The Wall Street Journal	2	n.s. (P=0.57)
The New York Times	USA Today	21.62	P<0.05
USA Today	The Chicago Tribune	13.83	P<0.05
USA Today	The Guardian	32.86	P<0.05
USA Today	The Washington Post	3.77	n.s. (P=0.29)
USA Today	The Wall Street Journal	17.10	P<0.05
The Washington Post	The Chicago Tribune	4.53	n.s. (P=0.21)
The Washington Post	The Guardian	19.49	P<0.05
The Washington Post	The New York Times	7.47	n.s. (P=0.06)
The Washington Post	The Wall Street Journal	3.99	n.s. (P=0.14)

The first comparison is between the graphics in the Chicago Tribune and the Wall Street Journal. However, no significant difference was found with the chi square test result. In addition, no significant difference was found in the comparison between the graphics published in the Guardian and the New York Times. It's the same case for the comparison between the Guardian and the Chicago Tribune, no significant relationship was found in the distribution of the intent of graphics in these two newspapers. For the comparison between the graphics published in the Guardian and the Wall Street Journal, no significant differences were detected by the chi square test. Still no significant differences were found in the comparison between the New York Times and the Chicago Tribune, as the chi square tests indicated. For the comparison between the New York Times and the Wall Street Journal, no significant differences were discovered with the chi square test result. A significant difference was found in the case of the New York Times and the USA Today. The comparison between the USA Today and the Chicago Tribune followed the same pattern, as there was a significant difference in terms of the proportions of intent of graphics in these two newspapers. A significant difference was found with the comparison between the USA Today and the Guardian. However for the comparison between the graphics published in the USA Today and the Washington Post, no significant differences were found with the chi square test result. A significant difference was found in the comparison between the USA Today and the Wall Street Journal in terms of the intent of graphics. However in the case of the comparison between the Washington Post and the Chicago Tribune, no significant differences were detected by the chi square test. For the comparison between the Washington Post and the Guardian, a significant difference was found with the help of the chi square test. However, for the comparison between the Washington Post

and the New York Times, the chi square test result showed no significant differences in regards to the distributions of the intent of graphics in the two newspapers. And the last comparison is between the Washington Post and the Wall Street Journal. No significant difference was found with the chi square test result.

Order of information. In order to understand the information contained in a graphic, readers need to consume the cluster of information in a logical order. In some cases, the author will set the path, or several options, for the readers to follow and go through the whole graphic. In this way, all the necessary points can be learned by the readers. This option is usually taken by static graphics or graphics with low levels of interactivity. On the other hand, in graphics with medium and high levels of interactivity, the graphic creators grant readers the freedom to go through the graphics by themselves. There are often cases with no clear defined and preset paths, and readers can start the exploration anywhere they like. Here in the coding scheme, three categories of ordering of information were identified and classified. Firstly, there are graphics with random access, in which no suggested paths are present throughout the graphics, thus readers need to identify and select the paths by themselves. Another option is user directed path. In this case, readers can choose one among several options set by the graphic creators. And lastly, when readers only have one path to follow for the whole graphic, the graphic then has the linear path. Table 32 illustrates the distributions of orders of information in the six newspapers. And table 33 are the results of the chi square tests in order to understand the relationship between the number of comments of the articles and the element of orders of information.

Table 32.

Distribution of orders of information in six newspapers

	Random Access	User Directed Path	Linear Path
The Washington Post	2	2	15
The Wall Street Journal	2	1	29
The Chicago Tribune	1	0	21
The USA Today	1	2	8
The New York Times	6	0	58
The Guardian	4	0	65

Table 33.

Chi square test of independence results for six newspapers

	Chi-Square (X^2)	P-value
The Washington Post	0.21	n.s. (P=0.90)
The Wall Street Journal	3.11	n.s. (P=0.21)
The Chicago Tribune	0.87	n.s. (P=0.35)
The USA Today	1.42	n.s. (P=0.49)
The New York Times	1.21	n.s. (P=0.55)
The Guardian	1.55	n.s. (P=0.21)

Since the graphics in the Washington Post are mostly static graphics, out of the 19 graphics, two graphics have the random accesses for the readers, and two more graphics have the user directed paths, that readers can choose one among a few paths for the whole graphics. All of the rest 15 graphics are the ones with linear paths. These graphics are mostly static graphics or graphics with low levels of interactivity, thus readers only have one choice to consume information. To put these numbers into percentages, 79 percent of all graphics have the linear paths, 10.5 percent are the ones with user directed paths, and 10.5 percent are graphics with random accesses. With the result of the chi square test results, there was no significant difference on the total number of comments among the element of order of information.

Among the 32 graphics published in the Wall Street Journal, two graphics are highly interactive and thus have the random accesses for the readers. One graphic has the user directed path and the rest of the graphics are all with the low levels of interactivity and are with linear paths. Consequently, 6.25 percent of all graphics have random accesses, 3.13 percent have user directed paths and 90.62 percent have the linear paths. There was no significant difference in the number of comments for the articles in terms of order of information, as the chi square test result suggested.

The Chicago Tribune only has one graphic with random access for the readers to consume information. All the rest of the graphics are classified as linear paths, in which readers are confined with nothing but one choice to go through the graphics. In terms of the proportions of percentages, 4.5 percent of all graphics are with random accesses and 95.5 percent are with linear paths. Through the calculations of the chi square test of independence, no significant differences on the number of comments were found in regards

to the orders of information in the case of the Chicago Tribune.

The USA Today has a total of 11 graphics, and among them one graphic is classified as with a random access; two graphics are with user directed paths, and the rest of the eight graphics are all with linear paths. The majority, specifically 72.7 percent, of all graphics are with low levels of interactivity and have linear paths for the readers. 18.2 percent are with user directed paths and 9.1 percent are the one with random accesses. Through the calculations of the chi square test of independence, no significant differences were found in the number of comments in terms of the element of orders of information..

The New York Times has a total of 64 graphics, among which six graphics are classified as the ones with random accesses, and all the rest of the 58 graphics are the graphics with linear paths. As a result, 9.375 percent of all graphics are with the random accesses and 90.625 graphics are with linear paths. The chi square test of independence indicated no significant differences in the readers' participations among the element of orders of information.

The Guardian has a total of four graphics that are classified as with random accesses for the readers, which occupy 5.8 percent of all the graphics published in the month of September 2014 and are about the topics of national news. On the other hand, there are 65 graphics with linear paths and they count as 94.2 percent. Graphics with low interactivity and few paths options are still the main pieces for the Guardian graphics. With the help of the chi square test of independence, no significant difference was found in the number of readers' comments in case of the Guardian in regards to the element of order of information.

Comparison among newspapers. Chi square tests were conducted for the 15 pairs of comparisons for the understandings of the orders of information within the graphics. Table 34 illustrates the results of the comparisons.

Table 34.

Chi square test results for the comparison of orders of information

Comparison Newspaper #1	Comparison Newspaper #2	Chi-Square (X^2)	P-value
The Chicago Tribune	The Wall Street Journal	0.79	n.s. (P=0.67)
The Guardian	The New York Times	1.32	n.s. (P=0.52)
The Chicago Tribune	The Guardian	0.05	n.s. (P=0.82)
The Guardian	Wall Street Journal	2.19	n.s. (P=0.33)
The New York Times	The Chicago Tribune	0.64	n.s. (P=0.73)
The New York Times	The Wall Street Journal	2.57	n.s. (P=0.46)
The New York Times	USA Today	12.17	P<0.05
USA Today	The Chicago Tribune	4.68	n.s. (P=0.10)
USA Today	The Guardian	13.19	P<0.05
USA Today	The Washington Post	0.42	n.s. (P=0.81)
USA Today	The Wall Street Journal	3.06	n.s. (P=0.22)
The Washington Post	The Chicago Tribune	2.92	n.s. (P=0.23)
The Washington Post	The Guardian	7.65	P<0.05
The Washington Post	The New York Times	7.00	n.s. (P=0.07)
The Washington Post	The Wall Street Journal	1.47	n.s. (P=0.48)

The first comparison is between the Chicago Tribune and the Wall Street Journal. The chi square test result showed that no significant differences were found in the distributions of orders of information in the two newspapers. No significant differences were found in the comparison between the Guardian and the Chicago Tribune in terms of the distributions of orders of information either, as the chi square test result suggested. For the comparison between the Guardian and the New York Times, no significant differences were found. It's the same case with the comparison between the Guardian and the Wall Street Journal, no significant differences were detected when comparing the graphics and their orders of information in the two newspapers. No significant differences were found in the case of the comparison between the New York Times and the Chicago Tribune in terms of the order of information in the graphics. For the comparison between the graphics published in the New York Times and the Wall Street Journal, still no significant differences were found with the help of the chi square tests. A significant difference in the distributions and proportions was found in the comparison between the New York Times and the USA Today. The comparison between the USA Today and the Chicago Tribune yielded the result with no significant differences in terms of the order of information in the graphics. There was a significant difference found in the comparison between the USA Today and the Guardian. However in the case of the comparison between the USA Today and the Washington Post, no significant differences were found with the chi square test result. It's the same case for the comparison between the USA Today and the Wall Street Journal, no significant differences were found. For the rest of the four comparisons, three pairs had no significant differences while one had significant different distributions in the orders of information in the graphics. When comparing the Washington Post with the

Chicago Tribune, no significant differences were found. A significant difference in the distribution of the orders of information was found in the comparison between the Washington Post and the Guardian. When comparing the graphics in the Washington Post and the New York Times graphics, no significant differences were found with the chi square tests. The last comparison is between the Washington Post and the Wall Street Journal, no significant differences were found.

Task of graphics. It is the task of the graphics to deliver information efficiently to the readers, and in order to fulfill the purposes, graphics employ a number of functions to better serve the readers, making the complex datasets more accessible for them to understand. Among these functions, two features stand out and are widely used in interactive graphics. The first one is the function of zooming, that the users can zoom in or out in order to control the area that the frame covers. The second function is filtering and details on demand. With this function, readers can filter out unwanted numbers and details and only focus on the ones they are interested in.

Table 35.

Distribution of tasks of graphics in six newspapers

	Not Available	Zooming	Filtering and details	Both
The Chicago Tribune	1	1	20	0
The Guardian	4	2	63	0
The USA Today	1	0	3	7
The Washington Post	2	0	13	5
The Wall Street Journal	2	0	29	1
The New York Times	2	0	56	3

Table 36.

Chi square test of independence results for six newspapers

	Chi-Square (X^2)	P-value
The Chicago Tribune	1.83	n.s. (P=0.4)
The Guardian	3.1	n.s. (P=0.21)
The USA Today	7.54	P<0.05
The Washington Post	4.30	n.s. (P=0.23)
The Wall Street Journal	2.28	n.s. (P=0.32)
The New York Times	2.29	n.s. (P=0.51)

The Chicago Tribune has one graphic with the function of zooming, and another one with the function of filtering and details on demand. The rest of the graphics are coded as 0, that they do not have any of the functions. To put the numbers into percentages, 4.5 percent of all graphics have the function of zoom, and 4.5 percent of all graphics have the function of filter and details on demand. The rest of the graphics are with low interactivity level, and thus do not have any of the functions mentioned above. A chi square test of independence suggested that no significant difference was observed in the number of comments for the articles in terms of the element of tasks of graphics.

For the graphics published in the Guardian, out of the 69 graphics, four graphics are categorized as with the functions of zoom, and two graphics enable the readers to filter out the unwanted details. Other than the six graphics, the rest of the graphics do not possess any functions for the readers. As a result, 5.8 percent of graphics in the Guardian samples employ the function of zoom for the readers, 2.9 percent have the ability of filter and details on demand. 91.3 percent of all graphics are plain ones without any functions at all. To understand the relationship between the task of graphics and the readers' participation patterns, a chi square test of independence was calculated and the result showed no significant difference in the number of comments for the Guardian graphics in regards to the element of tasks of graphics. In the total of 11 graphics researchers collected in the USA Today, one graphic is categorized as with the function of zooming, while seven graphics have both of the functions available for the users to utilize. Lastly, three graphics have neither zoom nor details on demand functions. To put the proportions into percentages, 9.1 percent of all graphics have the function of zooming, and 63.6 percent have both functions. Only 27.3 percent have no functions available. A chi square test of

independence was calculated in order to understand the relationship between the task of graphics and the number of comments for the articles. The result revealed a significant difference in the number of comments based on the element of task of graphics ($x^2 = 7.54$, $p<0.05$).

The Washington Post has five graphics that are equipped with both of the functions for the purposes of easy accesses and understandings for the readers. Two more graphics are identified as having the function of zooms. The rest of the graphics then are counted as having none of the functions available. In another words, 25 percent of all graphics have both of the functions, ten percent are having only one function — the function of zoom. Unfortunately, 65 percent of all graphics do not have any functions at all. A simple calculation made by the chi square test of independence suggested that no significant difference in the number of comments from the readers in terms of the element of task of graphics.

The Wall Street Journal has a total of two graphics with the functions of zoom, while only one graphic stands out with both function of zoom and filters and details on demand. For the rest of the 30 graphics, they are all plain graphics without any functions at all. To calculate the percentages, 6.1 percent of all graphics in this case are with the zoom function, and 6.1 percent are with the filter on demand function. The rest of the 87.9 percent are all plain graphics with no advanced functions. Through the calculation of the chi square test of independence, no significant difference was found in the total numbers of comments readers leave for the articles among the elements of task of graphics.

Among the 63 graphics in the New York Times, seven possess the advanced functions for the readers to use during the information consumption process. Thus, 56

graphics are classified as having no functions at all. Three are with the functions of filtering and details on demand, while two graphics are with the functions of zooms. And lastly, 2 graphics are coded as having both functions. To calculate these numbers into percentages, 88.9 percent of all graphics are plain graphics without any functions, 4.8 percent are with functions of filtering and details on demand. While 3.2 percent of the graphics have the functions to zoom in and out, the rest of the 3.1 percent are with the functions of both for the readers to utilize. The result of the chi square test of independence showed no significant differences in the numbers of comments from the readers in regards to the elements of task of graphics.

Comparison among newspapers. Table 37 gives out details on the comparisons among newspapers on the distributions of task of graphics.

Table 37.

Chi square test results for the comparison of tasks of graphics

Comparison Newspaper #1	Comparison Newspaper #2	Chi-Square (X^2)	P-value
The Chicago Tribune	The Wall Street Journal	0.14	n.s. (P=0.93)
The Guardian	The New York Times	2.98	n.s. (P=0.39)
The Guardian	The Chicago Tribune	3.82	n.s. (P=0.28)
The Guardian	The Wall Street Journal	3.10	n.s. (P=0.38)
The New York Times	The Chicago Tribune	1.23	n.s. (P=0.75)
The New York Times	The Wall Street Journal	2.01	n.s. (P=0.57)
The New York Times	USA Today	34.47	P<0.05
USA Today	The Chicago Tribune	15.07	P<0.05
USA Today	The Guardian	49.11	P<0.05
USA Today	The Washington Post	6.32	n.s. (P=0.10)
USA Today	The Wall Street Journal	20.62	P<0.05
The Washington Post	The Chicago Tribune	4.53	n.s. (P=0.21)
The Washington Post	The Guardian	19.49	P<0.05
The Washington Post	The New York Times	12.78	P<0.05
The Washington Post	The Wall Street Journal	5.67	n.s. (P=0.13)

For the comparison between the Chicago Tribune and the Wall Street Journal on the tasks of the graphics, the chi square test result indicated no significant differences in the distribution of tasks of graphics in the two newspapers. No significant differences were found in the comparison between the Guardian and the Chicago Tribune either. For the comparison between the Guardian and the New York Times, no significant differences were found in this case. There was no significant difference in the distribution of task of graphics in the comparison between the Guardian and the Wall Street Journal. For the comparison between the New York Times and the Chicago Tribune, no significant differences were detected by the chi square tests. No significant differences were found between the graphics published in the New York Times and the Wall Street Journal. A significant difference in the distribution of task of graphics was found in the comparison between the New York Times and the USA Today. It's the same case for the comparison between the USA Today and the Chicago Tribune, as the chi square test result for the comparison indicated a significant difference in the comparison between the USA Today and the Chicago Tribune. There was also a significant difference between the graphics in the USA Today and the ones in the Guardian in terms of the task of graphics. For the comparison between the USA Today and the Washington Post, there were no significant differences between the graphics in the USA Today and the Washington Post when it comes to the task of the graphics. A significant difference was detected by the chi square test in the case of the comparison between the USA Today and the Wall Street Journal. In the case of the Washington Post and the Chicago Tribune, no significant differences were found. For the comparison between the Washington Post and the Wall Street Journal, no significant differences were found. Significant differences were found in the last two

comparisons, between the Washington Post and the Guardian and between the Washington Post and the New York Times. And in the case of the comparison between the Washington Post and the New York Times, a significant difference was found.

Visual Structuring. Visual structuring is defined with the visual elements within a graphic. These visual elements all have functions that help deliver information to the readers. In this study, the following visual elements are coded. Firstly, the visual platform is the structure or the frame that holds the visual content. Two categories of visual frames are presented as some graphics use the consistent visual platforms, in which the general layout remains unchanged throughout the graphics. Changed visual platforms, however, are graphics with more than one layer of the visual elements. The content as well as the visual frames changes within the panels, and the interactions between the readers and the graphics are done through the visual frames and the texts within the layout. Secondly, progress bar indicates the overall length of the graphic and readers' progress within the length. Thirdly, establishing shots is a screen or a frame that gives the readers overviews of the graphics. Lastly, checklist structure is a form of establishing shots that summarize all the content to be covered in the graphic. Table 38 shows the distributions of visual structuring in the six newspapers, and table 39 shows the results of the chi square tests of independence.

Table 38.

Distribution of visual structuring in six newspapers

	Consistent visual platforms	Changed Visual Platform	Progress Bar	Establishing shots	Checklist Structure	Not available (Static graphics)
The Washington Post	0	3	0	0	0	12
The Wall Street Journal	3	0	0	0	0	30
The Chicago Tribune	2	0	0	0	0	20
The Guardian	6	0	0	0	0	63
USA Today	6	2	0	0	0	3
New York Times	3	2	1	1	1	56

Table 39.

Chi square test of independence results for six newspapers

	Chi-Square (X^2)	P-value
The Washington Post	6.06	n.s. (P=0.20)
The Wall Street Journal	1.11	n.s. (P=0.57)
The Chicago Tribune	1.83	n.s. (P=0.18)
The Guardian	0.07	n.s. (P=0.79)
USA Today	5.62	n.s. (P=0.06)
The New York Times	3.35	n.s. (P=0.65)

The Washington Post has five graphics that possess the consistent visual frames, and three graphics with the changed visual platforms. The rest of the 12 graphics do not have any advanced visual elements to aid the reading processes for the readers. To put these proportions into percentages, 25 percent of all graphics have the consistent visual frames, 15 percent are with the changed visual platforms and the rest of the 60 percent do not have any visual elements at all. The calculations of the chi square test of independence indicated no significant differences in the number of comments from the readers among the element of visual structuring.

Among the 33 graphics sampled in the Wall Street Journal, three have the advanced visual elements of the consistent visual structuring. However, the rest of the graphics are all classified as having no advanced visual elements at all. In another words, 9.1 percent of all graphics have consistent visual structuring, while 90.9 percent are plain graphics with no advanced visual elements. No significant difference was found in the number of comments in regards to the element of visual structuring in the graphics.

There are only two graphics with advanced visual elements in the samples from the Chicago Tribune, and both are with the consistent visual structuring. The rest of the 20 graphics are all classified as having no advanced visual elements. Thus 9.1 percent of all graphics have consistent visual frames, while 90.1 percent are graphics without any visual elements at all. Through the calculations of the chi square test of independence, no significant difference was found in the number of comments for the articles in terms of the element of visual structuring.

For the graphics in the Guardian, 6 graphics are classified as having consistent visual platforms, while the rest are all graphics without any visual elements. To calculate the

proportions into percentages, 8.7 percent of all graphics have the visual elements of consistent visual platforms, while 91.3 percent are plain graphics. As the chi square test of independence showed, no significant difference was found in the number of comments from the readers among the element of visual structuring.

The USA Today has six graphics with the elements of consistent visual platforms, while two more are equipped with changed visual platforms. The rest of the three graphics are with no visual elements at all. Thus, 54.5 percent of all graphics have consistent visual platforms, 18.2 percent are with the changed visual platforms. 27.3 percent are then graphics with no visual elements at all. Through the calculations of the chi square test of independence, there was no significant difference in the number of comments regarding the element of visual element.

Comparison among newspapers. Table 40 illustrates the chi square results for each pair of comparisons in terms of the distributions of the element of visual structuring.

Table 40.

Chi square test results for the comparison of visual structuring

Comparison Newspaper #1	Comparison Newspaper #2	Chi-Square (X^2)	P-value
The Chicago Tribune	The Wall Street Journal	49.03	P<0.05
The Guardian	The New York Times	124.99	P<0.05
The Chicago Tribune	The Guardian	0.20	n.s. (P=0.65)
The Guardian	The Wall Street Journal	91.76	P<0.05
The New York Times	The Chicago Tribune	79.70	P<0.05
The New York Times	Wall Street Journal	5.25	n.s. (P=0.51)
The New York Times	USA Today	51.03	P<0.05
USA Today	The Chicago Tribune	14.51	P<0.05
USA Today	The Guardian	30.56	P<0.05
USA Today	The Washington Post	11.44	P<0.05
USA Today	The Wall Street Journal	32.49	P<0.05
The Washington Post	The Chicago Tribune	32.46	P<0.05
The Washington Post	The Guardian	67.70	P<0.05
The Washington Post	The New York Times	68.15	P<0.05
The Washington Post	The Wall Street Journal	36.438	P<0.05

A significant difference was found in the comparison between the Chicago Tribune and the Wall Street Journal on the topics of the visual structures within graphics. However, no significant differences were found in the comparison between the Guardian and the Chicago Tribune. A significant difference in the distribution of the element of visual structuring was found in the comparison between the graphics published in the Guardian and the ones in the New York Times. The chi square test result for the comparison between the graphics in the Guardian and the Wall Street Journal showed a significant difference. The next comparison was between the New York Times and the Chicago Tribune. The chi square test result for the comparison showed significant difference in terms of the distribution of visual structuring. No significant differences were found in the comparison between the graphics in the New York Times and the Wall Street Journal showed no significant differences in the comparison. Between the graphics in the USA Today and the Chicago Tribune, the chi square test result showed significant differences in the distributions of the element of visual structuring in the two newspapers. It's the same case with the comparison between the USA Today and the Guardian. Through the calculations of the chi square test, the result revealed a significant difference in the distribution of visual structuring among graphics. A significant difference was found in the comparison between the graphics in the USA Today and the Washington Post. The chi square test result for the comparison between the USA Today and the Wall Street Journal yielded a significant difference in the distribution of visual structuring among graphics. A significant difference was found in the comparison between the graphics published in the Washington Post and the Chicago Tribune. For the comparison between the Washington Post and the Guardian, a significant difference was found with the chi square test result. In addition, a significant

difference was found in the comparison between the graphics published in the Washington Post and in the New York Times. The last comparison is between the graphics published in the Washington Post and the Wall Street Journal. The chi square test result indicated a significant difference.

Chapter 5: Discussion

The interviews and the content analysis revealed several thought provoking points on the use of graphics on readers' participations as well as the relationships between the features of a certain graphic and the number of comments the graphic receives from the readers.

Firstly, with the statistics from the six news outlets, the majority of the studied media had higher numbers of comments and unique commenters for the articles with graphics when compared to the articles without graphics. However there were two exceptions: the Guardian and The Chicago Tribune, in which articles without graphics have higher numbers of comments and unique commenters when compared with articles with graphics. In addition, the USA Today and the Guardian have different compositions in a number of graphic features when compared with other newspapers.

There are several possible reasons that contribute to the differences. The Guardian and the USA Today have comparatively different demographics in readerships compared to the rest of the news outlets. According to the media kits published by the six news organizations, for the New York Times, the Washington Post, the Chicago Tribune and the Wall Street Journal, the users are described as educated, comparatively affluent working professionals in their 30s or older living in the United States, and there are more male readers compared to the females. However, the majority of the USA Today readers are identified as younger professionals between 25 and 34 years old. The Guardian has more female readers compared to the male readers. The average age of the Guardian readers is older than the rest of the papers too, with the highest percentage distributed among readers

65 years or older.

Because of the demographic differences, readers respond to graphics differently. One instance is that the USA Today is the only newspaper that lists the number of social media shares on their websites, and the readers mostly leave comment through their social media accounts.

Another reason for the differences is the publishing timing of the articles. For the news outlets in the United States, there are several big and breaking news and topics in the month of September 2014, such as the Ferguson shooting and the shooting in the White House. However, none of the news were read and concerned as the news of the Scotland independence for the British readers. Despite of the older demographics for the Guardian, there were heated debates and discussions for all articles concerning the topic, regardless of the article types.

Lastly, according to the comparisons among newspapers for the graphic characteristics, the USA Today and The Guardian have different compositions when compared to other newspapers in almost every feature. The USA Today is different from the rest of the newspapers in the following features: levels of interactivity, balances of narratives, intent of graphics and tasks of graphics. And the Guardian is different in the following characteristics: news types and orders of information.

In the case of the Chicago Tribune, most of the news pieces have local perspectives, and overall readers pay more attention to local news than the other five news outlets. This may contribute to the discrepancies in the comparisons.

According to the content analysis, only a limited number of elements within the graphics have significant differences on the number of comments readers leave for the

graphics. Specifically, the following tests yielded significant differences in the chi square test results: the element of news types for the sampled graphics from the Washington Post; the element of data types for the graphics in the Guardian, and the element of task of graphics for the graphics from the USA Today. This means that statistically for the combinations mentioned above, graphics with the specific elements have more comments than the rest of the graphics. However, all of the remaining chi square tests of independence yielded no significant differences.

There might be a number of reasons for this result. For one, this might show that in order to win the popularities from the readers and to produce an effective information graphic, a number of factors need to be taken into considerations. Not a single element stands out as the main reason for the readers' participation rates. This coincides with the interviews with the information graphic designers in the industry. A graphic is a well-rounded product of information that could not survive on only one part of the characteristics. Thus the information graphic designers need to serve diverse roles and satisfy needs from the readers and enrich themselves with a numbers of disciplines, such as design, journalistic reporting and coding skills. This echoes the opinions many journalists express in the interviews.

In addition, because of the limited pool of the graphics selected for the study, static graphics are still the majority among all, and the results may be skewed because of such nature of the study.

Besides the content analysis, the interviews also revealed a number of points and findings about the roles of information graphics in aiding the discussions among readers and journalists.

Along with the results from the content analysis, it is revealed that interactive graphics are not always preferred. Several journalists, such as Buchanan and Elliot, contended that the best graphics for the stories are the ones that tell the stories the best. Both static and interactive graphics have their own advantages and disadvantages, thus visual journalists should accompany the stories with the graphics that fit the needs the most. For example, straightforward financial news may need simple static graphics to show the numbers. Making the graphics interactive will only waste users' time and is deemed as unnecessary. In addition, the content analysis also shows that the level of interactivity within a graphic does not affect the number of comments stories have on the online platform.

However, the online discussion platform did not function as much as we have originally hoped, such as providing story ideas and engaging journalists and readers into discussions and debates. The majority of the discussions in the comment sections are among readers, and occasionally the reporters will respond back very briefly, either to correct a fact, or to express gratitude to the readers who point out errors in the articles and graphics. So far, no visual journalists in the interviews had ever considered getting story ideas from the comment sections. And many admitted that they are most likely to monitor the users' activities through web analytics instead of viewing the comment sections.

There are several lessons future industry professionals can gain from this research. Firstly, the use of information graphics greatly increase the number of comments from the readers, thus it helps attract more readers to the news pieces. As a result, for smaller news rooms where only limited resources can be attributed to graphic productions, even simple and straightforward graphics can contribute immensely to the readers' participations

online. These simple graphics include but are not limited to line graphics and bar charts to show the trends of the data, and maps for geographical information. Tables can also be used to present the numbers.

In addition, news games, a subcategory of interactive graphics, are most frequently mentioned by the visual journalists during the interviews. Larry Buchannan from the New York Times, Seth Hamblin from the Wall Street Journal and Daan Louter from the Guardian of London both referred to graphic examples of such sorts as their favorite graphics or graphics that best facilitate interactions among readers. These game-like graphics require readers to put in or make choices in the process of consuming information, and the readers are actively engaged in the graphic making process. The involvement boosts the readers' participations and also turns plain news stories into interactive experience.

And finally, it is always key to pay close attention to the trendy topics and readers' interests through social media, and to produce graphics on these topics ahead of time. News types, data types and task of graphics (the zoom functions and filter-on-demand functions) are some of the key characters to think about during the production process. But after all, straightforwardness and simplicity are always the best strategies for successful graphics.

Limitations

There are still a number of limitations in this study. First of all, only six news outlets are included in the study, and each has a readership with distinctive preferences for stories and content. Due to such differences, disparities in the reading habits, the preferences of topics, and the use of social media are observed, and the limitations for generalizations arise. Even though some trends have been revealed through the study of content analysis,

these results could not apply to the rest of the newspapers. However, this study provides a useful example for the follow-up investigations for other publications.

Suggestions for Future Researches

    I. Diversify the categories of publications. In this study, all newspapers are either national news outlets, or local news outlets in the metropolitan areas, such as Chicago and Washington D.C. All of the newspapers have national impacts and are the leaders in the information graphics industry. However, in the future researches, more emphasis could be put on other categories of newspapers, such as daily newspapers with smaller circulations, or even community weeklies. The topics of the articles could also expand to local news and entertainment news.

    In addition, five US newspapers and one British newspaper are included in the study. If further studies aim to expand to newspapers in other countries, researchers could increase the number of news outlets, and limit the news outlets to one specific region for more accurate results.

    II.   Increase the sample sizes of each publication. The sample sizes within this study are comparatively small and could hardly generalize to other news media. As we have mentioned previously, further studies can include more news outlets, and also increase the sample sizes for each of the media.

    III. More interactive graphics. As mentioned previously, due of the nature of the daily newspapers, most of the graphics are static and they are produced on a day-turn nature. As a result, majority of the graphics in this study are static, and are of simple and straightforward forms such as bar charts and line charts. If possible, further studies can include more interactive graphics, or focus on just the interactive graphics or long form

investigative graphics. In this way, the use of specific features within the interactive graphics and their impacts on the readers' participations in discussions can be analyzed more closely.

Conclusion

In a digital age where the readers are craving for more fresh and innovative ways of storytelling and data presentation, information graphics are for sure to stay and to evolve in the coming decades. This study confirms the belief that graphics help the newspapers serve the functions of modern town halls to the readers, and facilitate conversations between the journalists and the readers. The journalists, after all, are watchdogs and gatekeepers in the society. And their decisions to whether include or exclude graphics for certain articles will greatly affect the readers' digestions and consumptions of news and their perceptions of the society. This study is only a start and urges an increasing amount of efforts to look into the topic. This will benefit the study and understandings of the information graphics in the long run.

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Appendix A

Codebook

1. *General information regarding article*

Title of the article: Code in the headline / title of the story.

Note: if the graphics have more than one graphics, please code as follows: Protesters United against Ferguson Decision, but Challenged in Unity (1) Protesters United Against Ferguson Decision, but Challenged in Unity (2)

…..

Year Published: Code in the year in which the story was published. Month Published: Code in the month in which the story was published. Day Published: Code in the date in which the story was published.

Published Newspaper: Code in the number corresponding to the newspapers

1.   Washington Post

2.   The Chicago Tribune

3.   The USA Today

4.   The Wall Street Journal

5.   The New York Times

6.   The Guardian

Number of graphics: Code in number of graphics within this article.

Number of total comments: Code in the number of comments

Number of Unique Commenters: Code in the number of commenters who participated in the discussion. Here the commenters will only count once even if they have more than one reply in the discussion.

Number of total shares: Code in the total number of shares for the story, this may include Facebook, Twitter and other social media listed on the website.

Number of shares through Facebook: Code in the total number of shares via Facebook for the story. Code in N/A if Facebook is not listed as a way to share on the website.

Number of shares through Twitter: Code in the total number of shares via Twitter for the story. Code in N/A if Twitter is not listed as a way to share on the website.

Number of shares through other social media: Code in the total number of shares via social media other than Facebook and Twitter for the story. Code in N/A if no other social media are listed as ways to share on the website.

Type of articles: If the article is accompanied with an information graphic, code in number "1", if it is not accompanied with information graphics, then code "2"

Type of News: Code in the number corresponding to the type of the news in the story. This is a multiple-choice cell. If the story contains segments on multiple categories, multiple numbers can be coded into the cell. For example, if the story is economic news and education news, it should be coded as 2,4.

1. Politics and policies; 2. Economics and business; 3. Healthcare; 4. Education; 5. Crime; 6. Other

2. *Interactivity*

In this study, interactivity is defined as "a process-related construct about communication" and "the extent to which messages in a sequence relate to each other, and especially the extent to which later messages recount the relatedness of earlier messages." (Rafaeli and Sudweeks, 2006, page 1).

Weber and Rall (2014) further define the interactive graphics as creating a dialogue for the readers. Firstly, there should be an object activated by using a mouse or other pointing devices. When the reader clicks on it, there should be audio or visual responses. Every click should provide access to new information or to the next information sequence. As a result, if a click would only lead to an image enlargement, that would not count as an interactive graphic.

Level of interactivity: please code interactivity based on following definition.

1. Non-interactive

2. Low interactivity allows the users to move in a predefined narrative frame designed by the author. In this mode of interactivity, readers do not have any freedom to choose content, but rather just follow the storylines defined by the author.

3. A medium level of interactivity contains hierarchical and hyperlinked interactivity. Hierarchical interactivity provides users with a predefined set of options from which the user can select a specific path or structure of accessing the content. Hyperlinked interactivity pro- vides access to a wealth of information that the user is allowed to navigate at will.

4. A high level of interactivity is when users can influence the content or choose their own navigation path through the information graphics. The users can manipulate

component objects to achieve specific goals.

3. *Types of graphics*

The forms of graphics employed in this study are not mutually exclusive. One graphic may contain several types of graphics. For example if a graphic has both line charts and the bar

1. Line charts

Line chart uses the movements and directions of the lines to represent either the trends or the quantities of certain variables. These lines are placed in the x-axis and y-axis, and each of the axes will represent the scales of variables.

2. Bar charts

Bar charts were defined as vertical or horizontal bars to show the values or quantities of certain variables. These bars are usually shaped as rectangles and start either from left to right or from bottom.

3. Pie charts

This kind of chart is identified as slices of pies within a circle, in which the areas of the pie represent the amount of the values of the certain variables.

4. Table charts

A sheet that gives information in tabular or diagrammatic form.

5. Pictograms:

Pictograms are charts in which icons represent numbers to make it more interesting and easier to understand.

6. Maps: Geographical depictions showing the locations of events, places or stories.

7. Timeline: A display of events in the chronological order.

8. Illustration: the use of art renderings, drawing or sketch of animated objects or real objects, any graphical representations.

9. Multimedia: The use of audio, video, animations or still images in the graphics.

10. Area graphic

11. Other

4. Color Mode

Code 1 if the graphic is color, or 2 if the graphic is black and white.

5. Data Type

Code 1 if the data within the graphic is qualitative, code 2, quantitative, and code 3, hybrid. Each category is defined as following:

Qualitative: Data that are descriptive texts, which can be observed but not measured.

Quantitative: Data with numbers, which can be measured.

Hybrid: A combination of the two data types

6. Intent of the graphics:

Code 1 if the graphic contains intent as narratives, code 2, instructive, code 3, explorative and N/A if it is a non-interactive graphic. Each category is defined as following:

Narrative

Objectives: to explain by giving the reader experiences of the events or news through a story. *Characteristics:* Stories (fact, fiction, faction) told with views. These include anecdotes, personal stories, business stories, case studies, personal interviews etc.

Example: http://www.nytimes.com/interactive/2014/07/15/world/middleeast/toll-

israel-gaza- conflict.html?ref=multimedia

Instructive

Objectives: The objective is to explain by enabling the reader to sequentially step through the intent. In this study, this kind of graphic will be author driven, and readers will follow the steps. One example would be readers have to click instruments such as "next buttons" to follow the steps.

Characteristics: Step-by-step instructions explaining how things work or how events occur.

*Example:*http://www.nbcnews.com/id/9007188/ns/weather-weather_news/t/birth-tornado/#.U-i0XY1dXds

Explorative

Objectives: to give the reader an opportunity to explore and discover the intent. Readers can go through all the content based on their own pace and interests. This form of graphics is reader driven, and does not follow linear order.

Characteristics: These usually allow readers to discover the intent themselves by active exploring and sense making.

Example: http://www.becominghuman.org/node/interactive-documentary

N/A for non-interactive graphics

7.Task of the graphics:

Code 1 if the graphic has the zoom function.

Code 2 if the graphic has detail on demand

function. Code N/A if the graphic is non interactive.

Zoom (1): Zoom in or out on items of interests

Zoom in or out on items of interest. Users typically have an interest in some portion

of a col- lection, and they need tools to enable them to control the zoom focus and the

zoom factor. Filter and detail on demand (2): Filter out uninteresting items

Filter out uninteresting items or filter the qualitative or quantitative data based on

certain criteria. By allowing users to control the contents of the display, users can

quickly focus on their interests by eliminating unwanted items. Possible instruments

include sliders, buttons, or other control widgets.

3: none above

N/A: if it is a non-interactive graphic.

8. *Visual Structuring*:

Code 1A if the graphic has consistent visual platform, 1B if it has changed visual

platforms.

2 if it has progress bar

3.   if the graphic has establishing shots or splash page

4.   if the graphic has checklist structure

Visual platforms (1): The frames for the visual content.

• Consistent visual platform: (1A): In this form, the presentation has an unchanged

general layout of the visual elements, changing only the content within the panels.

The interactions between the readers and the graphics are done only through the text

within the layouts. Most of the non-interactive or low interactive graphics have this

platform.

• Changed visual platforms: (1B): In this form, the presentation has more than one

layout of the visual elements. The content as well as the visual frames changes within the panels, and the interactions between the readers and the graphics are done through the visual frames and the text within the layout.

Progress Bar (2): A bar indicating the length of the visualization and providing the user with a mechanism to navigate between slides.

Establishing shots/splash screen (3): this image or frame serves as an overview to introduce or set the scene, just like a introductory or splash page for the print publication. Since information graphics often contain an abundance of information, and not all elements in a scene are of equal importance throughout a story, an establishing shot then helps to direct the attention of the readers to a point of interest.

Checklist Structure (4): It provides an establishing shot of all the content to be covered and serves as a reminder of what each section contains in the information graphics.

N/A for non-interactive graphics

9. Ordering of information: The ways of arranging the path that readers will take throughout the process of reading the information graphics.

Code 1 if the graphic has random access, 2 if it has user-directed path, or 3 if it has a linear path.

Random access (1): no suggested paths throughout the graphics at all

User Directed Path (2): the readers need to select a path to read throughout the information graphics by themselves

Linear (3): A preset path is already prescribed by the author.

10. Balance of Narratives:

Code 1 if the graphic is author driven. Code 2 if it is reader driven. Code 3A if it has the Martini glass structure; 3B if it has interactive slideshow structure; code 3C if it has Drill Down structure; 3D if it has other hybrid forms that could not be categorized in the previous structures.

Author Driven (1): Author-driven narratives have the following features: the scenes are arranged in linear orders, and low levels of interactivities are within the graphics, thus it relies heavily on messaging to convey the information. Most of the non-interactive or low interactive graphics have this balance of narratives.

Reader Driven (2): Reader-driven stories have no preset ordering of information, and a high level of interactivity, so that the readers can access information based on their own wills, thus it does not rely on messaging to convey the information. The graphics (http://trendsmap.com/) is one example.

Hybrid (3): A hybrid use of author-driven narrative approach and the reader-driven approach.

- Martini glass structure (3A): this form of narrative usually starts with the author-driven approach, providing an overview of the information graphics. This can be done by using images or text. When the initial introduction, the readers can then have the reader driven narrative structures, getting the freedom to explore the graphics on their own.

- Interactive Slideshow (3B): This form of narrative starts with slideshows or similar structures that readers can choose the order of the information or the frames. But each slide or frame will have author-driven content and narrative. This allows

readers to move forward to the next step when he or she is ready to do so, and allows readers to repeat the information or steps if necessary.

- Drill-down Stories (3C): this form of narrative presents a general theme, and then allows the readers to zoom into a particular segment of the graphic to study on their own. One ex- ample would be to create a map of prisons within the United States, and allow readers to click on one of the locations to study more on their own. This kind of narrative has a comparatively high level of interactivity and freedom for the readers; however, the authors have the authority to select what information to include in the graphics.

- Other (3D): All the other hybrid narratives that could not be categorized in the previous narrative forms.

Appendix B

Interview questions

1. Do you think information graphics and visualizations help foster conversations and audience engagement? Can you elaborate on why is that?

2. In your own experience in the news outlet, are there any graphics you can think of that re- ally help foster the conversation and exchange of ideas?

3. Why do you think these graphics achieved the goals? What elements within the graphics do you think are most important in fostering the conversation? Is the graphic a team effort or an individual project?

4. What key elements do you think the readers value the most in information graphic?

5. What is the daily workflow of the graphic designers in your newsroom?

6. Do the graphic designers work more on day-turn stories or in depth investigative graphics? For these graphics, do designers pitch stories ideas or do the reporters pitch the ideas to the designers?

7. What are some of the most common types of graphics you work on in your newsroom? Why?

8. In terms of static and interactive graphics, can you list some of the advantages and disadvantages of the two types of graphics?

9. Which kind of stories do you think needs graphics the most? Why?

10. Do you and your colleagues usually communicate with the readers? What kind of communication do you usually use, for example through social media, the

comment sections, or through mails and emails? How do the readers reach out to
the reporters?

11. Did any of the reporters or the designers ever find story ideas or graphic ideas
from the readers' comments or emails?