

Data Journalism Meets Information Design:
Creating A Complex Infographic About The Yarnell Hill Wildfire

A Master's Thesis Project

Presented to
the Information Design and Technology Program

In Partial Fulfillment
of the Requirements for the
Master of Science Degree

State University of New York
Polytechnic Institute

By
Katelyn Godoy

May 2015

**SUNY POLYTECHNIC
DEPARTMENT OF COMMUNICATIONS AND HUMANITIES
CERTIFICATE OF APPROVAL**

Approved and recommended for acceptance as a thesis in partial fulfillment of the requirements for the degree of Master of Science in Information Design and Technology

DATE

Kathryn Stam, PhD
Advisor

Ibrahim Yucel, PhD
Second Reader

ABSTRACT

In June and July 2013, a large-scale wildfire, known as the Yarnell Hill wildfire, tore through the Yarnell community in Arizona. The fire claimed the lives of 19 firefighters—the greatest loss of firefighter lives since the September 11 World Trade Center attacks. This project, which details the events of the wildfire and its aftermath in a complex infographic, is an example of data journalism and complements the reporting completed by *The Arizona Republic*.

This paper explores the emerging field of data journalism within information design and provides an overview of the process used to create and design this project. In addition, it summarizes data collection techniques and application of graphic design best practices. It also details directions for future design opportunities related to this topic.

ACKNOWLEDGEMENTS

Many thanks to my colleague and friend, Jeri Wall, who consistently supported the pursuit of this thesis and who continues to show me that hard work and humility pays off. This paper is dedicated to my husband, my son, and my son-to-be.

TABLE OF CONTENTS

ABSTRACT	iii
ACKNOWLEDGEMENTS	iv
LIST OF FIGURES	vii
LIST OF TABLES	viii
I. INTRODUCTION.....	1
The Case for Information Graphics and Data Journalism	2
Project Goals.....	2
II. LITERATURE REVIEW.....	3
Information Graphics Defined	3
Historical Evolution of Information Graphics	4
Journalists as Information Designers	8
A Leader in the Field: <i>The New York Times</i>	9
Connecting Narrative to Data With Stories	11
Considerations for Designing Editorial Infographics	14
Conclusion	16
III. METHODOLOGY	17
Project Overview	17
Gathering Data	18
Preparing for Design Process.....	19
IV. PROJECT PRODUCTION.....	20
Storytelling Approach.....	20
Initial Design Process and Data Placement	21

Data Journalism Meets Information Design: The Yarnell Hill Wildfire

Artistic Process23

Design Considerations In Use.....25

V. PROJECT ANALYSIS35

Peer Reviews.....35

Project Limitations.....36

VI. CONCLUSIONS37

Meeting Objectives37

Future Project Directions37

Summary38

REFERENCES39

APPENDICES42

APPENDIX A: Resources Used for Infographic Data42

APPENDIX B: One-Page Project Rationale.....45

LIST OF FIGURES

Figure 1: First published chart by William Playfair, 17865

Figure 2: Florence Nightingale’s coxcomb illustration, 18586

Figure 3: Charles Minard’s multivariate infographic, 18697

Figure 4: Data-driven journalism and the importance of story12

Figure 5: Martini Glass story structure applied to infographic.....21

Figure 6: Illustrations from the Yarnell Hill infographic that detail the size and shape of the wildfire, drawn to scale.....24

Figure 7: Screen capture of A Tragedy for Heroes color palette25

Figure 8: An example of contrasting serif and sans serif typefaces27

Figure 9: An example of contrast using highlighting27

Figure 10: An example of repetition of header shape and typefaces28

Figure 11: An example of timeline alignment29

Figure 12: An example of overlaying information to show importance (figure-ground)..31

Figure 13: An example of overlaying information to show importance (figure-ground .. 32

Figure 14: Examples of typefaces used32

Figure 15: Example of symbolic icon use.....33

Figure 16: Fighting Flames pictograph example34

Figure 17: Fire containment pictograph example35

LIST OF TABLES

Table 1: List of data and data categories collected for consideration.....19

Table 2: Changes to data and justification for exclusion.....22

I. INTRODUCTION

On June 28, 2013, a lightning strike ignited a wildfire in the Yarnell Hill area of Yarnell, Arizona that forever changed the lives of countless people. By July 10, 2013 when the fire was declared 100 percent contained, it had already burned 8,400 residential and wild acres of land, destroyed 129 buildings, and injured 23 people. On June 30, 19 people died in the blaze—they were all firefighters with the Prescott Fire Department and members of the Granite Mountain Hotshots interagency crew. According to the National Fire Protection Association, the 19 deaths were the greatest loss of life for firefighters in a wildfire since 1933, and that day was the deadliest day for US firefighters since the September 11 World Trade Center attacks (Castellano, 2013).

The Arizona Republic was the primary news organization that provided continuous breaking news coverage of the disaster on social media, its website, and in print. This coverage earned the newspaper recognition as a 2014 Pulitzer Prize finalist. Most journalistic pieces (excluding social media posts) written by *The Arizona Republic* staff during and after the Yarnell Hill wildfire were long-form narrative that combined images and text. Other news organizations, including *Outside* magazine and *The Atlantic*, contributed documentary-style, in-depth reportage of the disaster and its aftermath with images, text, video, and interactive components. Although all of these pieces were well written and detailed, the content proves to be dense with numerical data and narrative. While these forms are appropriate for some types of storytelling and reporting, especially when it comes to the biographies of the fallen firefighters and the qualitative effects of the wildfire, it is difficult for audiences to quickly consume and understand the basic facts and consequences—essentially, the data—that surround the Yarnell Hill wildfire.

The Case for Information Graphics and Data Journalism

The Yarnell Hill wildfire, by its very nature, can be described with numerous pieces of data: acreage burned, spatial maps, the number of firefighters who responded, average response time, buildings destroyed, residents displaced, funds raised, etc. In the emerging field of data journalism, journalists collect these pieces of data and present them in a visually appealing format—an information graphic, or infographic. The benefit of this presentation is that audiences can view and understand large quantities of data by looking at one visual, rather than by reading all of the data as it's scattered within a long-form narrative. In my preliminary research, I found no existing infographics that fully told the story *and* presented the data of the Yarnell Hill wildfire. While some news organizations published interactive timelines and maps, each visual is lacking a potential dataset. Data journalism effectively combines aspects of storytelling and graphic design to tell a complex story in a visually compelling way. For this project, it was my intent to create an infographic that visually represented the story behind the Yarnell Hill wildfire by using as much data as possible.

Project Goals

Research statement. The purpose of this project is to create an information graphic using Adobe design software that combines data presentation, journalistic storytelling, and graphic design techniques to visually display information and details of the Yarnell Hill wildfire that took place during June and July 2013 in Yarnell, Arizona.

Audience. The intended audience for this project is composed of those who are likely to consume information or news about the Yarnell Hill (or any) wildfire, primarily in a print-based publication. Since this project reflects qualities of data journalism,

readers would probably be interested in newsworthy stories from a journalistic perspective. The Yarnell Hill wildfire meets this criteria and is a newsworthy story.

Research rationale. The Yarnell Hill wildfire was an event that touched the lives of many people not only in Arizona, but also across the country. Firefighting is a brotherhood—the death of 19 easily affected thousands. The wildfire, additionally, was tremendously damaging to the community it tore through, and it was a large-scale natural disaster in many respects. Natural disasters tend to draw curiosity from audiences, too. My project documents the disaster, recognizes the fallen heroes, and complements *The Arizona Republic's* reporting by providing data and details in one visual piece. It is important to bring attention to events that affect a great number of people, and once the data associated with those events is interpreted and understood, reflection and discussion among the public can emerge. I also chose to pursue this project because nothing of its likeness exists to date. The overarching project goal was to create a detailed infographic that was reflective of data journalism and provided information, promoted conversation, and proved to be a complete and thorough exercise in the field of information design.

II. LITERATURE REVIEW

Information Graphics Defined

Information graphics, or infographics, are often intended to convey complex information and data in a visual format. More recently, brands and news organizations have published infographics as a way of communicating messaging and news. In the field of journalism, specifically, using infographics to tell a story with data/information has come to be defined under the terms “data journalism” or “editorial infographics.”

Journalists, by craft, are well positioned to deliver accurate, informative infographics that combine information, data, and narrative storylines in an aesthetically pleasing form.

It can be difficult to fully define and set out rules for the creation of information visualizations (or graphics) because the term crosses several disciplines—including journalism, computer science, graphic design, and statistical analysis—in different ways. Some practitioners may believe it encompasses charts and graphs, while others might consider illustrations. Yau (2013) points out that there have been “heated debates within and in between subject areas” among academics and practitioners when it comes to defining the purpose of information graphics (p. 44). As an integrated solution, Yau (2013) defines information visualization as a medium, rather than a tool: “a way to explore, present, and express meaning in data... Where statistics, design, and aesthetics find a balance is where a lot of the best work comes from” (p. 44).

There is value in creating an infographic that speaks to an intended audience in a meaningful way (Yau, 2013). With editorial infographics, that value is present in narrative story, data, and information. Instead of trying to define “visualization,” it may be best to consider defining the intended audience and creating the best visual story, in any form, for them. According to Yau (2013) “...there is value in visualization that isn’t a traditional, just-the-facts chart. There is value in entertaining, putting a smile on someone’s face, and making people feel something, as much as there is in optimized [or highly technical] presentation” (Yau, 2013, p. 69).

Historical Evolution of Information Graphics

Although information graphics have evolved among varying disciplines, the earliest statisticians reported on data in a visual way. William Playfair is credited with

inventing traditional chart types, such as the line graph, bar chart, and pie chart, for representing statistical information (Yau, 2013). In 1786, he published the first bar charts, which showed Denmark and Norway's imports and exports, in *The Commercial and Political Atlas*, as shown in Figure 1.

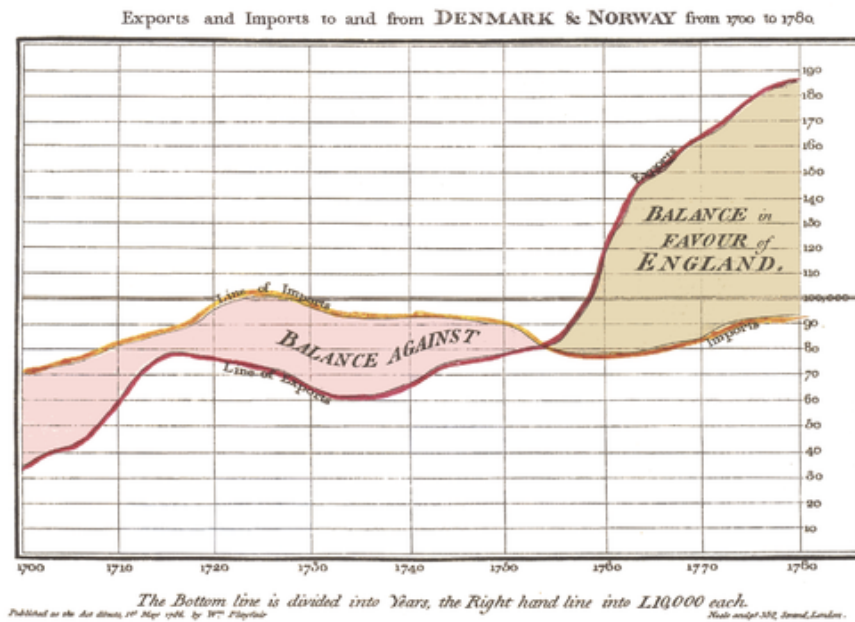


Figure 1: First published chart by William Playfair, 1786

Later, in 1821, the *Guardian* published a leaked table of schools in Manchester that listed each school's cost and number of pupils. Gray, Bounegru, and Chambers (2012) state: "As we might expect, the practice of using data to improve reportage goes back as far as 'data' has been around" (Data Journalism Handbook, "Data Journalism in Perspective," para. 12).

Rogers (2011), too, emphasized that data journalism "may be trendy but it's not new. [It] has been around as long as there's been data—certainly at least since Florence Nightingale's famous graphics and report into the conditions faced by British soldiers of 1858" (para. 5). Unlike Playfair's straightforward charts and graphs, Nightingale's

Data Journalism Meets Information Design: The Yarnell Hill Wildfire

approach to visually reporting data was more complex and illustrative. The most recognized graphic in her 1858 report to Parliament was the “coxcomb” spiral, displayed in Figure 2, which showed that the vast majority of soldiers’ deaths were from diseases rather than bullets (Gray, Bounegru, & Chambers, 2012).

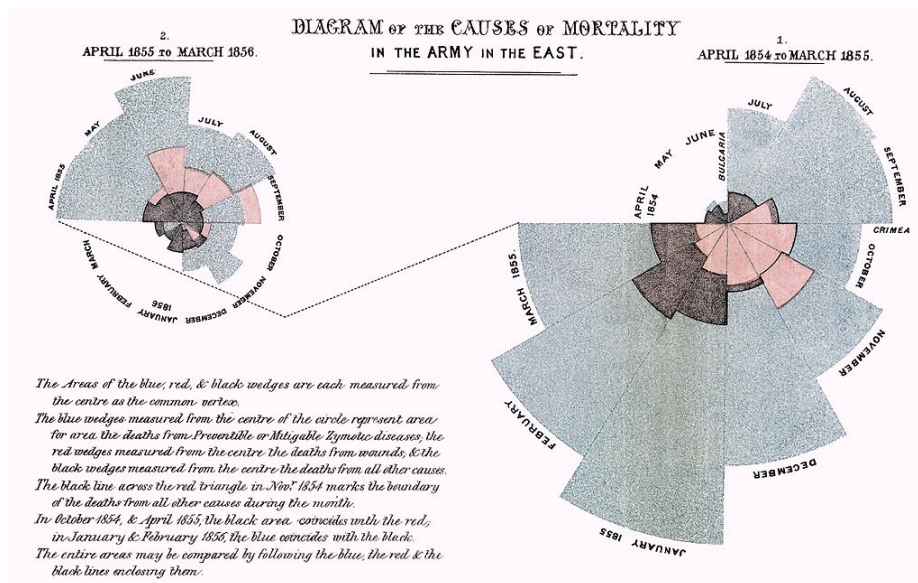


Figure 2: Florence Nightingale’s coxcomb illustration, 1858

In 1869, French engineer Charles Joseph Minard illustrated one of the most well-known, detailed infographics in the history of design: a diagram of the losses Napoleon suffered during his Russian campaign of 1812, shown in Figure 3. Tufte (2001) describes it as what “may well be the best statistical graphic ever drawn” (p. 40). It includes six variables in one visual representation. Tufte (2001) advocated for beautifully designed, complex, yet unobtrusive visualizations that communicate effectively: “Occasionally, graphics are belligerently multivariate, advertising the technique rather than the data” (p. 40). He said Minard’s infographic subtly represents multivariate complexity “so gently and unobtrusively that viewers are hardly aware that they are looking into a world of [multiple] dimensions” (p. 40).

enjoyment, delight, aesthetic appreciation and wit, and a friendly ‘you can understand this’ approach (as cited in Bailey & Pregill, 2014). (para. 11)

Furthermore, Bateman et. al. (2010) found that chartjunk makes charts more memorable and has no impact on reading comprehension of the information presented in the chart (as cited in Bailey & Pregill, 2014). These varying opinions of chartjunk can be considered representative of the general debate about what infographics are and how they are to be used in different professional fields.

Today, information graphics combine elements of each evolving historical period of information/data visualization. Although information visualization now spans many disciplines, an emerging trend exists among journalists. Infographics are becoming both popular and standard practice at several news organizations, including *The New York Times*, the *Guardian*, and the *Associated Press*, for the purpose of communicating messages or feature news stories. Yau (2013) writes: “As a medium, visualization has developed into a great way to tell stories. News organizations are learning to do this well in a budding field known as data journalism” (p. 61). The trend is also spilling over into the online sphere, in addition to print media, because more people are using the Internet to consume news (Lankow, Ritchie, & Crooks, 2012).

Journalists as Information Designers

Journalists are natural storytellers. They are able to take vast amounts of data and information and craft meaningful narratives for readers. Now, infographics and data journalism allow journalists to design meaningful *visual* narratives for readers. Segel and Heer (2010) found that “storytellers, especially online journalists, are increasingly integrating complex visualization into their narratives” (p. 1139). Infographics create a

way for readers to understand complex numerical data, spatial data, and other pieces of detailed information in one place.

News organizations generally follow a narrative infographic approach to present data. Lankow, Ritchie, and Crooks (2012) summarize narrative infographics as visuals that have a predetermined story, specific take-away messages for audiences, and audience appeal and aim for information retention.

Cynthia O'Murchu of the *Financial Times* sums up journalists' relationship to data journalism and creating information graphics:

I think it's important to stress the 'journalism' or reporting aspect of 'data journalism.' The exercise should not be about just analyzing data or visualizing data for the sake of it, but to use it as a tool to get closer to the truth of what is going on in the world. ... Ultimately, it is all about good reporting, and telling stories in the most appropriate way (as cited in Gray, Bounegru, & Chambers, 2012).

Rogers (2011) stresses that data journalism isn't just about graphics and visualizations, although both play an important role. He says: "If data journalism is about anything, it's the flexibility to search for new ways of storytelling" (para. 20). Journalists are well equipped to turn their data-rich narrative stories into visual infographics that accomplish the same communication goals.

A Leader in the Field: *The New York Times*

If Minard was the pioneer information designer of his time, *The New York Times* can be considered the pioneer news organization for data journalism and editorial infographics. The *Times*' data visualizations include everything ranging from basic

graphs and illustrations to interactive interfaces and computer-generated data imaging. According to Lankow, Ritchie, and Crooks (2012), the *Times* is known for “setting the benchmark for editorial infographic content. . . .this team of more than 30 journalists, designers, and programmers is responsible for some of the most well-executed editorial content you can find anywhere—period” (p. 122).

Weber and Rall (2012) studied newsrooms to determine what made teams of information designers most successful. “The crucial success factor in the production process of data-based visualization in journalism is the attitude that everyone on the team acts as a journalist—no matter whether programmer, designer, or statistician” (p. 349). Weber and Rall’s (2012) case study at *The New York Times* illustrated these findings: programmers and designers see themselves as journalists responsible for a journalistic task. Based on interviews with other newsrooms in the study (including some German and Swiss media companies), the *Times*’ vision of clarity was strongest: everyone working on telling the story is a journalist (Weber & Rall, 2010). This sense of purpose brings the team together and helps them create some of the best information graphics.

Segel and Heer (2010) cited *The New York Times*’ exemplary approaches to data journalism through analysis of its 2006 graphic “Steroids or Not, the Pursuit is On,” which showed changes in Major League Baseball’s Barry Bonds’ hitting patterns amidst allegations of periods of steroid use. And this infographic was produced nearly ten years ago. The *Times* continues to win Gold and Best of Show honors for both print and online graphics categories at the prestigious Society for News Design’s Malofiej Infographic awards. In 2014, *The New York Times* was awarded Gold and the Premio Peter Sullivan Award Best of Show for their printed infographic “State Gun Laws Enacted in the Year

Since Newtown” and for their online information presentation of “Front Row to Fashion Week” (“Malofej,” 2015). Each of these visual presentations takes extraordinary amounts of data and breaks it down into manageable portions that help audiences understand the purpose of the story.

Because the *Times*’ graphics staff sees themselves as journalists, each person can provide important details in the narrative aspects of the infographics they design.

Yamkovenko (2013) summarizes this point: “Journalists need to get involved to provide something that can easily go missing in data visualization: the story. Data visualization should not only describe a dataset, it should also provide context and depth to the data. It should tell a story” (p. 31).

Connecting Narrative to Data With Stories

Integrity and robust narrative help data journalists create infographics that best serve audiences. An approach that serves these journalists well will emphasize storytelling for the benefit of readers. Some journalists (but certainly not those at *The New York Times*) miss the mark when creating information graphics. Vallance-Jones (2014) emphasizes that current-day data journalism is more than just the publication of stand-alone charts and graphs: “More than a little bit of what some call data journalism isn’t so much journalism as it is the use of data visualization tools to make charts, graphs, and maps that look good, but don’t necessarily tell a story. ...It’s good and important, but not really journalism” (p. 19). According to Figure 4, below, the greater the story in an information graphic, the greater value it provides to an audience. The accompanying visual pieces are important, too, and should support the story at large.

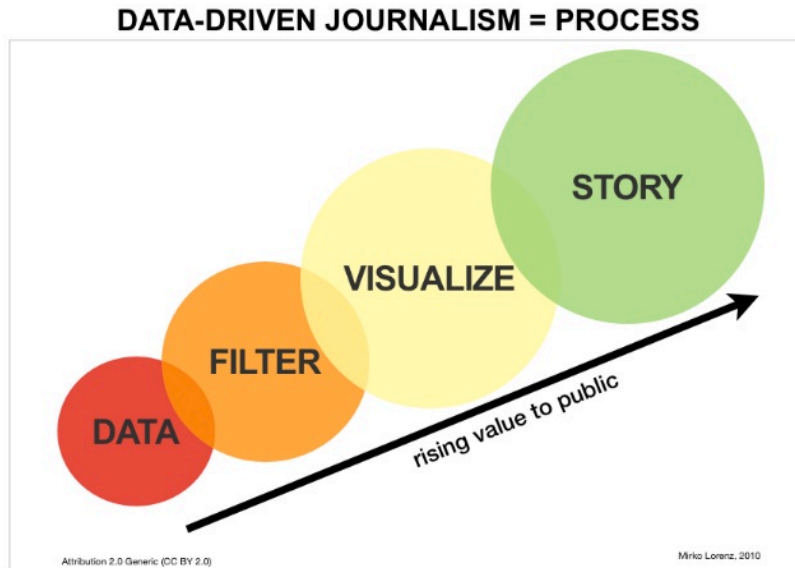


Figure 4: Data-driven journalism and the importance of story

While computers and data-analysis programs can help sort through pieces of information to be represented and reported in editorial infographics, the creative process still requires human storytelling, which journalists are apt to do. Segel and Heer (2010) point that these analysis tools are important, but they don't craft the narrative—journalists need to do that: “Currently, most sophisticated visualization tools focus on data exploration and analysis ...they provide powerful vehicles for discovering ‘stories,’ but do little to aid narrative communication of these findings to others” (p. 1139). Communicating findings to the audience in a way they can understand is the most vital part of designing such infographics. Yamvenko (2013) writes that journalists are able to do this because designing visualizations has a process similar to writing long-form feature stories: “With every story we tell, we are using the skills necessary for data visualization: gathering information (data) from multiple sources, examining the facts, arranging it coherently, and providing readers with context and depth that will help them understand the story” (p. 33).

Information graphics are a good “fit” in the field of journalism because they aid in communicating messages, news, and data that might be too confusing or complex for readers when presented in only chart or narrative form. In newsrooms where infographics are created, a focus on the data, its story, and underlying journalistic principles brings about the most effective designs. Weber and Hall (2012), in their study about graphics departments and newsrooms that create information visualizations, quoted *New York Times* staff members¹ who insisted that journalistic integrity and truthful storytelling is the key to good information graphics and there is no conflict between integrity and visual appeal.

In this case a clear primacy of journalistic integrity over any speculative artistic interpretation for dramatic effect was formulated and it demonstrates the general work ethic at *The New York Times* newsroom. It is all the more remarkable that the graphic editors there still manage to come up with highly entertaining and visually appealing information graphics which preserve absolute factual accuracy (Weber & Hall, 2012, p. 354).

According to Kosara and Mackinlay (2013), visualizations should allow stories to lead the way: “As a starting point [in creating information graphics], we propose the concept of storytelling affordances—features of a visualization that provide a narrative structure and guide the reader through a story” (p. 48). Designers and journalists alike, when reporting, should consider the facts, data, and story before focusing on visual components. Yau (2013) summarizes this point by saying designers should start by

¹ Xaquín Gonzalez Veira, former graphics editor at *The New York Times* and current editor of visuals at the *Guardian*, and Graham Roberts, senior editor in graphics at *The New York Times*

exploring data and designing a visual to complement it, rather than trying to squeeze a dataset into a predetermined visual. Yamkovenko (2013) also recommends that once journalists and designers have figured out what the story is, they can then use visual pieces to enhance it and help readers see the results: “The story will dictate how you present the findings, whether it’s an infographic, an article with charts and illustrations, an animated graph, etc.” (p. 34).

For centuries, storytelling has been a way of passing information on from generation to generation. Kosara and Mackinlay (2013) propose that information visualizations have the same potential as “visual data stories” (p. 50):

In addition to being a good way to present data, stories also offer an effective means of packaging information and knowledge in a way that is easy for another person to understand. Perhaps visual data stories will become the way to preserve information about complex data and processes and pass on knowledge in the future... (p. 50).

Considerations for Designing Editorial Infographics

Lankow, Ritchie, and Crooks (2012) believe infographics have a good chance of standing out among media types during a time when data can be overwhelming for audiences. When creating information visualizations, Lankow, Ritchie, and Crooks (2012) recommend a focus on goals and objectives, including what the audience is to take away from the information and what the designer wants the audience to *do* with that new information.

In addition to goal and objective considerations, three categories of process stand out among the literature: research, storytelling, and design considerations.

Research considerations. In order to design an information graphic, data may need to be researched and collected from varying sources. When considering a storytelling opportunity first, Lankow, Ritchie, and Crooks (2012) suggest searching for data that will serve the purpose of the story. According to Lankow, Ritchie, and Crooks (2012), “if you’re not ‘telling a story’ with your infographics ... then you’re doing it wrong” (p. 132). Sources and data need to be reliable and authentic: “A good gauge when conducting research is to ask yourself if *The New York Times* would be satisfied with your employed methodology, as well as the quality of the content that your research yields” (Lankow, Ritchie, & Crooks, 2012, p. 132). They also suggest limiting sources to those that provide the most consistent data across interpretations.

Storytelling considerations. Segel and Heer (2010), who researched the successful attributes of visualizations produced by news organizations, recommend a strongly author-driven approach when the goal of the information graphic is to tell a story or communicate facts efficiently. Author-driven approaches are more narrative and guide the reader through the information, rather than initially allowing the reader to dive into the data at their own pace. According to Segel and Heer (2010), a reader-driven approach may be a good consideration for a highly interactive infographic (but that is outside of the boundaries of this project). Segel and Heer’s (2010) study labeled their author-driven narrative approach as a “Martini Glass” visualization structure. “The structure resembles a martini glass, with the stem representing the single-path author-driven narrative and the widening mouth of the glass representing the available paths made possible through reader-driven interactivity” (p. 1146). In the case of this project, the considerations would include reader-driven exploration of information rather than reader-driven interactivity.

Design considerations. Once the objectives are set, research is complete, and the story is defined, the infographic can be designed to best reach communication goals. Lankow, Ritchie, and Crooks (2012) summarize the process: “We also tend to take a primarily ‘form follows function’ approach to design, meaning that the design of an infographic is dictated by the message we are trying to convey and the communication objectives” (p. 135). Although the design phase can be the most creative and exciting, Yau (2013) warns that each design decision needs to aid the message of the piece: “Aesthetics isn’t just a shiny veneer that you slap on at the last minute. It represents the thought you put into a visualization, which is tightly coupled with clarity and affects interpretation” (p. 248). Lankow, Ritchie, and Crooks (2012) borrow Vitruvius’² three principles of architectural design and apply them to infographic design: utility, soundness, and beauty. Utility is measured by how well the infographic accomplishes its defined objectives—the design should support these objectives. Soundness is measured by the quality of the message the infographic communicates: “Communicating a message worth telling provides readers with something of value” (p. 200). And lastly, beauty applies to the format and the quality of the design itself. Design should help to communicate the information graphic’s purpose and story and should not reflect individual preferences: “the design is the application of a visual solution to a problem” (Lankow, Ritchie, & Crooks, 2012, p. 201).

Conclusion

This project aims to apply the relevant literature to create an infographic that detailed the 2013 Yarnell Hill wildfire. Interestingly, Holovaty (2006) summarized the

² Vitruvius was a Roman author, architect, and civil engineer during the first century BC.

importance of journalists publishing data in a way that readers can understand. His comments relate directly to what this project attempts to do:

For example, say a newspaper has written a story about a local fire. ...But what I really want to be able to do is explore the raw facts of that story, one by one, with layers of attribution, and an infrastructure for comparing the details of the fire — date, time, place, victims, fire station number, distance from fire department, names and years experience of firemen on the scene, time it took for firemen to arrive... (as cited in Gray, Bounegru, and Chambers, 2012).

Although these recommend pieces of data may or may not be included in the project, Holovaty's comment reinforces a journalist's advantage in reporting large events, like fires, to the public in a data-based, narrative, sequential, *and visual* way.

III. METHODOLOGY

Project Overview

This project involved the creation of one infographic that tells the story of, and presents the data associated with, the Yarnell Hill wildfire. The infographic was designed as a print piece and does not contain any interactive components. It is viewable in pdf format on the web. Despite the importance of aesthetically pleasing design, there is an equal, if not greater, focus on the aspect of journalistic storytelling. This focus helped to create a piece that not only presents data in a beautiful way, but also tells a visual story in a compelling fashion. A print piece was the optimal approach, especially since most of the data came from *The Arizona Republic*, which is a print-based newspaper with a less-robust online component.

Gathering Data

The first step in beginning this data journalism/infographic project was to fully research and consume all of the data that could potentially be included in the visualization. It was my intent to fully understand the Yarnell Hill wildfire—its beginning, middle, and aftermath—in order to communicate the event in the clearest way possible. Based on the literature reviewed for this project, a recurring theme was to focus on the aspects of storytelling first and the aesthetic design second. I read through more than 20 articles written by *The Arizona Republic*, *USA Today*, and *The Atlantic*. These articles were mostly narrative pieces, some long-form features and others strictly hard journalism, that described the timeline of events, the stories of the fallen firefighters, the amount of acreage burned by the fire, and more. I began by constructing my own timeline of events that incorporated data from all of the articles. From this, it was clear that a timeline should be the focus of my infographic.

The challenge was to use the event's data to create a visual story. Sorting through that data required several days, or more, spent reading, writing, and fact checking. Most of the information came from *The Arizona Republic* newspaper, but in order to maintain accuracy and fill in missing pieces of information, I relied on a few other sources as well.

My intent was to design a piece that was full of information, yet easy to understand. While initially collecting data, I choose to include anything that could aid in telling the story of the wildfire. Once the design process began (see next section), it became clear that not all data collected was important or necessary to the substance of the story itself.

I collected the data that is summarized in Table 1, below, through review of the sources mentioned above:

Category of information	Related data to include
Time	<ul style="list-style-type: none"> • Timeline of events • Time between events • Changing weather patterns (wind, etc.) • Major points of change • Duration of fire vs. percentage contained
Space	<ul style="list-style-type: none"> • Map of damaged area • Location related to the state of Arizona • Highways closed • Communities affected • Percentages contained • Direction and placement of firefighters
Firefighting and emergency response	<ul style="list-style-type: none"> • Agencies responding (some) • Firefighters responding • Details about the Granite Mountain Hotshot Crew and its founding
Physical damage	<ul style="list-style-type: none"> • Acres burned • Buildings lost • Property damage estimates
Firefighter lives lost	<ul style="list-style-type: none"> • Names of men lost • Demographic details (age, years of service, etc.) • Timing related to space, time, and percentage contained • Information about fire shelters
National/community reaction	<ul style="list-style-type: none"> • Funds raised and where they were distributed • Donated items from organizations and businesses • Public figures who made statements • Memorial service dates and attendance (informal and formal)

Table 1: List of data and data categories collected for consideration

Preparing for Design Process

After collecting the data that would aid in telling the story of the Yarnell Hill wildfire, I started the design process. To begin, I looked at existing infographics available on the web. I focused on one platform in particular: *GOOD* magazine (<http://magazine.good.is/infographics>). The artists who work for this magazine create

outstanding infographics that include a variety of data. I looked through this publication's designs for ideas on how to organize information and use color, fonts, and text versus imagery, among other things. I knew that I wanted the Yarnell Hill wildfire infographic to feature a timeline, so I also searched within *GOOD* for infographics that included timelines or data based on space and time. After familiarizing myself with published graphics, I was able to begin designing mine based on the data I had collected from various news sources.

IV. PROJECT PRODUCTION

Storytelling Approach

I set out to create an infographic that followed a Martini Glass storytelling structure, as proposed by Segel and Heer (2010). The storytelling structure resembles a martini glass in that the stem represents a single author-driven narrative (a starting point), and the widening mouth of the glass then represents reader-driven investigation. The infographic tells the story of the Yarnell Hill wildfire, but the reader has the opportunity to explore it in any order after the introduction of the visual narrative.

After reading through the data and several accounts of the wildfire's path, I chose to make the focus of the infographic a timeline—the author-driven narrative. The timeline was important because the wildfire lasted 13 days, but most of its damage occurred within two days, and the Granite Mountain Hotshot Crew perished within the span of only one hour. I wanted to show the significance of a short period of time within a longer timeframe of 13 days. After leading the viewer/reader through the timeline of the story, my design allows them to shift their attention to other elements of the infographic

in any order—the reader-driven investigation. Figure 5, below, shows the placement of both types of information.

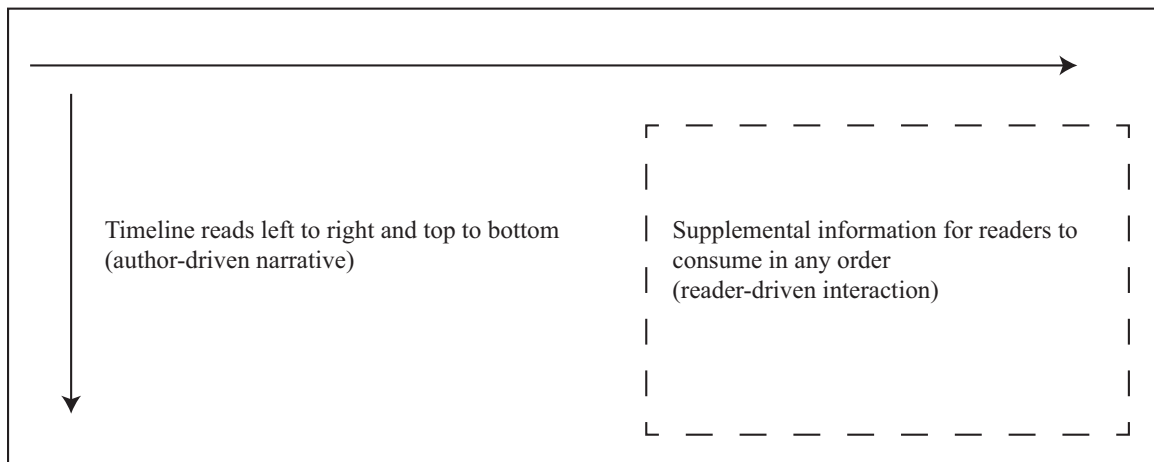


Figure 5: Martini Glass story structure applied to infographic

Initial Design Process and Data Placement

I decided to create the infographic at a standard tabloid size (11x17) and oriented horizontally (landscape). Digital infographics are best consumed by readers when positioned vertically, but I intended for this project’s infographic to be consumed as a print piece. The landscape format works best in this arena. I began to hand-sketch where I wanted to place each piece of data I had collected. At this point, I was forced to review which pieces of data were absolutely essential for inclusion based on space restraints. Rather than allow for an unlimited art board size and approach, I chose to reduce the amount of data in order to tell the most complete story in the space allotted. Each category of data was assigned, on paper, a place within the overall infographic design. This included both timeline and supplemental storytelling data.

After thoroughly researching the articles on the Yarnell Hill wildfire, I had a good idea of which pieces of data were most important. Many stories had been written about

Data Journalism Meets Information Design: The Yarnell Hill Wildfire

serious incident investigations, distribution of funds raised, and lawsuits that were filed on behalf of the firefighters’ families and widows. These pieces of data were not included, because they did not fit into the original scope or goal of the project, which was to tell the story of the wildfire up to and including only its immediate aftermath. In Table 2, below, I show how and why I refined the data to be included in the final infographic, even though I had collected information on each item listed. Changes are listed in red, while items in black were included in the final project.

Category of information	Related data included or excluded
Time	<ul style="list-style-type: none"> • Timeline of events • Time between events <ul style="list-style-type: none"> ○ The time between events was self-explanatory because the timeline was drawn to scale • Changing weather patterns (wind, etc.) • Major points of change • Duration of fire vs. percentage contained
Space	<ul style="list-style-type: none"> • Map of damaged area <ul style="list-style-type: none"> ○ This information required too much detail for the space allotted and was not necessary for understanding the story as a whole • Location related to the state of Arizona • Highways closed • Communities affected • Percentages contained • Direction and placement of firefighters
Firefighting and emergency response	<ul style="list-style-type: none"> • Agencies responding (some) <ul style="list-style-type: none"> ○ There were too many agencies that responded from all around the country; this was not essential detail and it was difficult to determine which agencies responded with aircraft vs. land efforts • Firefighters responding • Details about the Granite Mountain Hotshot Crew and its founding
Physical damage	<ul style="list-style-type: none"> • Acres burned • Buildings lost • Property damage estimates
Firefighter lives lost	<ul style="list-style-type: none"> • Names of men lost • Demographic details (age, years of service, etc.) <ul style="list-style-type: none"> ○ The only demographic detail per firefighter that was included was age; things like years of service and rank were only provided sporadically and were not consistent from man to man

	<ul style="list-style-type: none"> • Timing related to space, time, and percentage contained <ul style="list-style-type: none"> ○ This information became obvious after construction of the timeline • Information about fire shelters
National/community reaction	<ul style="list-style-type: none"> • Funds raised and where they were distributed <ul style="list-style-type: none"> ○ There was an abundance of information provided on this subject, but dollar amounts became ubiquitous, and complicated lawsuits were filed about how funds were to be distributed/allocated • Donated items from organizations and businesses <ul style="list-style-type: none"> ○ I chose not to highlight any specific businesses that donated supplies because that would imply favoritism for particular organizations; from a journalistic standpoint, all or none should be mentioned to show fairness of contributions; additionally, this information was not necessary for storytelling purposes • Public figures who made statements • Memorial service dates and attendance (informal and formal)

Table 2: Changes to data and justification for exclusion

Appendix A lists the details of all sources referenced for the final data that was included in the design.

Artistic Process

After determining what items should be included in the timeline, the focal point of the infographic, I began to draw and assemble its parts. I used Adobe InDesign to organize images related to the shape and spread of the fire and Adobe Photoshop to resize images and create clipping paths that could be manipulated. All of the fire outlines included in the timeline are drawn to scale—I thought this was important in order to show how quickly the fire spread out of control and overtook the hotshot crew. See Figure 6, below, which shows the area of the beginning of the wildfire versus its final size and the actual shape it burned.

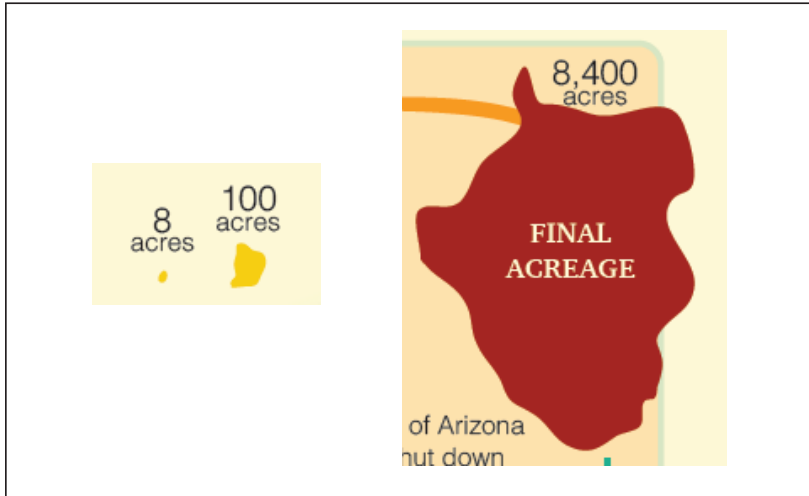


Figure 6: Illustrations from the Yarnell Hill infographic that detail the size and shape of the wildfire, drawn to scale

I ultimately chose Adobe Illustrator as the platform for designing the entire infographic. Illustrator allows the most flexibility for drawing, text, alignment, and color swatches and offers the most useful tools when it comes to transferring a hand-drawn sketch into a digital format.

The initial design process also involved searching the web for free vector art that would complement the style and tone of my infographic. These vectors (which were available for free, un-credited use in the public domain) included firefighting symbols and weather-related icons. Because these files were downloaded as vectors, they could easily be manipulated into the size, shape, and color needed to match the infographic. Illustrator recognizes vector files and allows them to be copied, pasted, and edited very easily—another advantage to using this program for the design.

And finally, before fully diving into the design elements, I searched for appropriate color palettes. The website COLOURlovers: Color Trends + Palettes (<http://colourlovers.com>) offers thousands of user-generated color palettes that are tagged and searchable. I initially began searching for color palettes that represented the subject

Data Journalism Meets Information Design: The Yarnell Hill Wildfire

matter: wildfires, firefighting, etc., while keeping in mind various aspects of color theory (discussed below). In my searches, I happened to come across a color palette that a user designed specifically on July 1, 2013 in dedication to the Granite Mountain Hotshot Crew, called [A Tragedy for Heroes](#). See Figure 7. I chose to use these colors as the focus of my infographic because they matched my intended use of color theory (within reason) and had a special meaning that defined the purpose of my data visualization design.

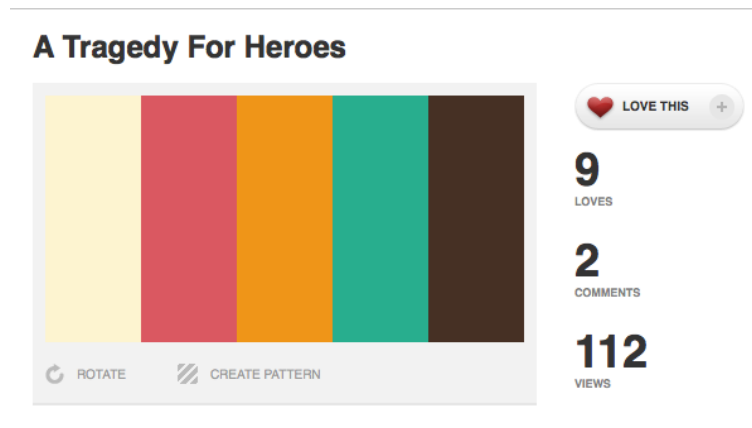


Figure 7: Screen capture of A Tragedy for Heroes color palette

Design Considerations In Use

While designing this infographic, I attempted to balance the use of visuals and text in order to tell a complex story in the clearest way possible. I accomplished this by including limited narrative where needed. Although infographics may or may not include text, I found that the best approach was to combine both text and visuals to accomplish the project's goal: to tell a story.

My thesis proposal had outlined several design-specific elements that I planned to consider when creating the Yarnell Hill wildfire infographic. As proposed, I referred to many of graphic designer and blogger Curtis Newbold's (2014) Top 50 Most Important Rules of Document Design. His list was compiled based on the graphic design recommendations of seven authors: Bang (2000), Katz (2012), Lidwell (2003), McWade

(2010), Tufte (1990), Weinschenk (2011), and Williams (2008). Below is a summary of how his points were applied in my final project design.

Color. I chose a color palette that reflected the subject matter of the infographic, which relates to color psychology. I used warm colors (yellows, reds, and oranges) to show caution and danger. These colors are also analogous (adjacent) on the color wheel. In general, I stayed within the boundaries of warm colors and chose shades of those colors for contrast, rather than entirely new hues. Newbold (2014) discusses emotion-saturation and suggests using dark, de-saturated color to express seriousness, rather than bright colors that can connote friendliness or grab attention. I believe the warm colors used in the design show seriousness and match the subject matter.

Contrast. Newbold (2014) writes about contrast as it relates to color, size, typeface, and highlighting. He suggests using colors that are obviously different for clarity, visual interest, and to prevent confusion when contrasting information. All of the narrative text in the infographic is black, except for the list of firefighters' names, which was deliberately made a shade of red, to stand out as important and different. I used contrasting font sizes to differentiate between headers and narrative text. Most of the narrative text is 9 point, while headers are 12 point, and important numbers are 12 point. The title of the entire infographic is the largest point size—this is meant to draw attention and invite viewers to read the introductory paragraph at the top of the page, which sets up the storyline. Contrasting typefaces included serif and sans serif fonts. Serif fonts were used sparingly. An example of contrasting serif and sans serif typefaces can be seen in Figure 8, below. Within the timeline, I wanted to show the importance of two dates: June 30 and July 1. These dates are a different size and typeface when compared to the others.

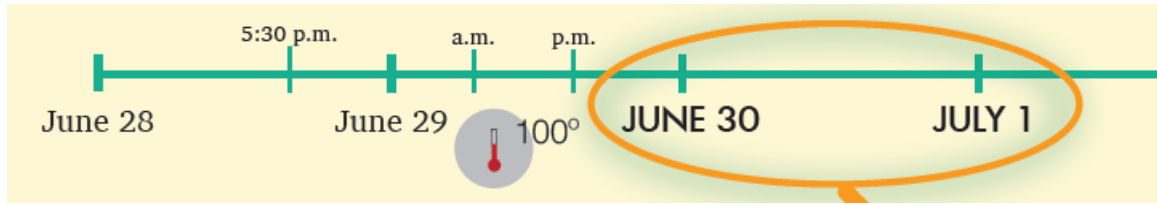


Figure 8: An example of contrasting serif and sans serif typefaces

Finally, I contrasted elements using highlighting (bold type, larger size, etc.). Newbold recommended no more than 10 percent of the information should be highlighted within a document, and I believe my design stayed within this boundary. Over-highlighting items can cause the reader confusion and make it difficult to understand which pieces of data are important, since highlighting usually connotes importance (as in the significant dates in Figure 8, above). Figure 9, below, shows an example of contrast using highlighting.

The number 30,000 in the paragraph was intentionally larger than the rest of the information because it is an important piece of data.

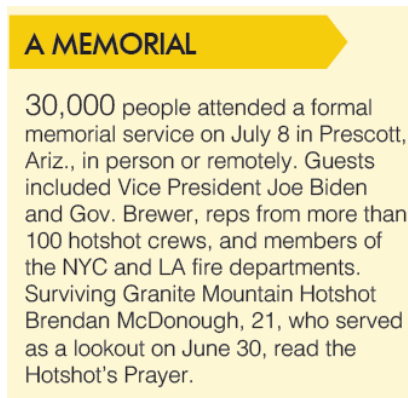


Figure 9: An example of contrast using highlighting

Repetition. Newbold (2014) recommends repeating visual elements, like shapes and icons, to group and organize information. Each of the headers used in the infographic are the same—they help to organize the information that falls underneath each group. The

typeface and the shape surrounding the headers are the same, too. Figure 10, below, shows two of the six headers.

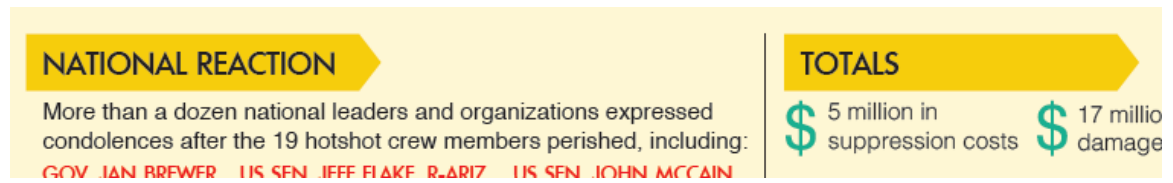


Figure 10: An example of repetition of header shape and typeface

Repetition can also be reflected in a design’s personality, according to Newbold (2014), by keeping the design of the document consistent in tone, layout, and content. A reflective, somber tone is reflected throughout the entire infographic, and the layout supports a consistent Martini Glass storytelling approach. Each section is labeled appropriately and the reader is guided along. Repetition of style of tone helps the reader understand the story as one cohesive piece.

Arrangement. When arranging objects, Newbold (2014) considers the importance of purpose, alignment, and proximity. Information and objects, he says, should be placed with thought and purpose, rather than arbitrarily “floating” on the page. This helps to provide visual connection between design elements. The Yarnell Hill wildfire infographic focuses on a timeline structure: it is sequential, drawn to scale, and reads from left to right. The supplemental information that helps tell a more robust story is located to the right of the timeline. These two groups of information (author-driven and reader-driven) are placed with a clear purpose. Newbold (2014) states that every element on the page should be aligned to something else. My infographic follows this rule as well. All headers are aligned vertically and horizontally with one another, and each timeline element is aligned above or below its corresponding time marker. An example in Figure

11, below, shows how three pieces of data: time, fire containment, and community impact are aligned consistently.

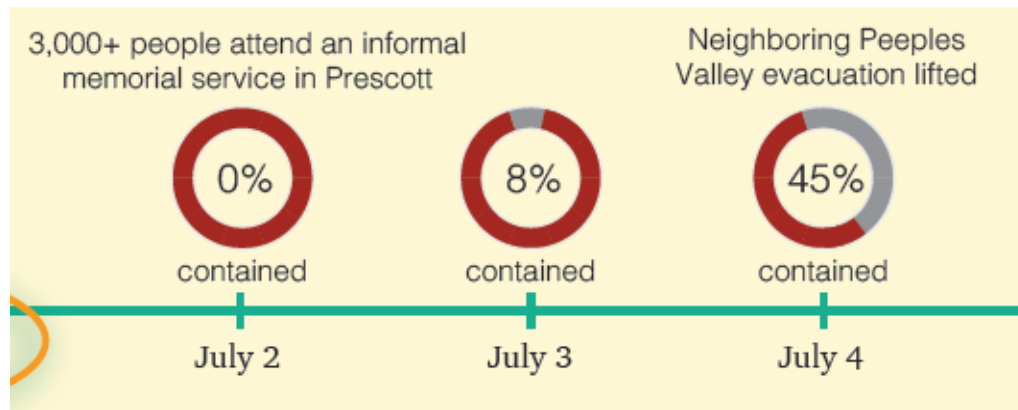


Figure 11: An example of timeline alignment

And lastly, Newbold (2014) suggests arranging items while considering proximity. For example, placing related items near one another and avoiding “random” placement of information. In my design, all data that is relevant to the unfolding of the wildfire is placed within the timeline, while all subsequent information (national reaction, number of firefighters, fire shelter statistics, damage totals, memorial service dates, and hotshot demographics) is separate.

“Why.” This design characteristic speaks to the storytelling functionality of the infographic. Newbold (2014) describes credible complexity, a part of the “why” category, as increasing the complexity of a design and its content to heighten credibility. The Yarnell Hill wildfire infographic is very complex and includes a large amount of data. By organizing the complex data in a coherent and clear way, it appears as if it is highly credible, (which it is, as many hours of research went into data collection). Propositional density refers to simplifying the visual design elements used while increasing the ideas communicated (Newbold, 2014). He recommends using more ideas, data, and story than

design elements. My infographic demonstrates propositional density because it first and foremost focuses on data and storytelling. Design elements complement the story, but do not override its importance. There is far more data included in the infographic than design elements. Another characteristic in Newbold's (2014) "why" category is appealing to the audience's "rhetorical four:" ethos (credibility), pathos (emotion), logos (logic), and kairos (timing). The design appeals to each of these in the following ways: The data is credible because it is complex and well researched; the subject matter evokes emotion because of its true tale of human sacrifice and valor; the data presented is logical, especially within the timeline format; and the timing of the developing story is consistent from beginning to end.

Organization. Newbold (2014) recommends following the five hat racks, or LATCH, system of organization and paying close attention to hierarchy. LATCH organization separates information by location/space, alphabet, time, category, or hierarchy. My design incorporates all five of these organizational systems. Location and space is used as the acreage of the wildfire is shown as getting larger and larger—the more space the outline takes up, the larger it has become. Alphabet is used in the list of Granite Mountain Hotshot Crew member names—I did not want any one person to appear more important than another, so the names are organized alphabetically, showing that they are all equal. Time is obviously used throughout the entire timeline presentation. Category is used to separate six pieces of data, and they are clearly labeled with headers: national reaction, totals, fighting flames, the hotshot crew, taking shelter, and a memorial. And lastly, hierarchy gives visual cues to guide the audience to the most important information (Newbold, 2014). The shaded lower portions of the timeline show how those

moments are most important in the development of the wildfire. The shading provides a visual cue. Also, the large type size in the infographic's title gives a visual cue and invites the reader to see the title and read the introductory paragraph at the top of the page.

Negative space. Newbold (2014) cites figure-ground as a way to make designs stable. He says that objects in lower regions or that overlay other objects are perceived as more important. The information in the lower-left quadrant of my infographic is the most important—it tells the story of how the fire changed direction so quickly and took the lives of 19 firefighters. Using circles that direct the eye and that overlay the timeline show the importance of this time period. See the example in Figure 12, below.

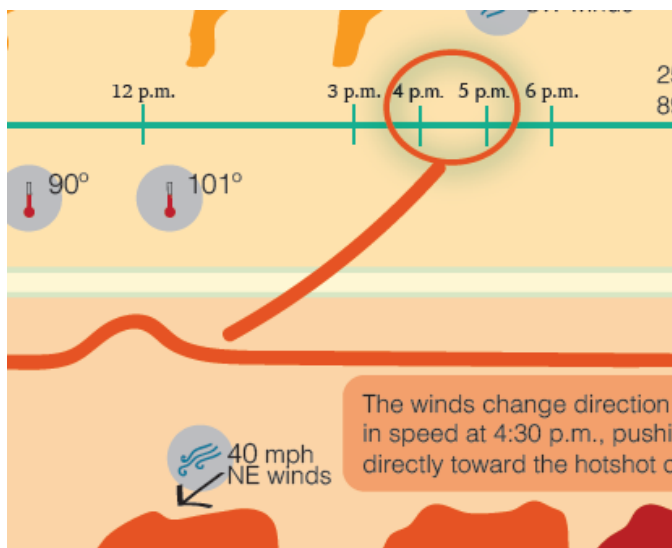


Figure 12: An example of overlaying information to show importance (figure-ground)

The path the firefighters took as they were trying to escape the oncoming flames and reach their safe zone is also drawn in the foreground of the map (see Figure 13, below).

This path is in the foreground, which draws attention to its significance.

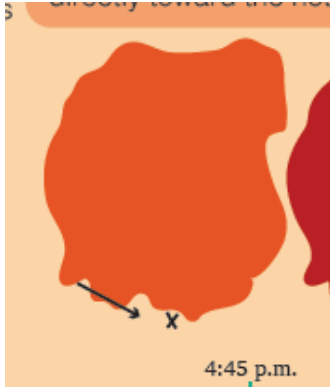


Figure 13: An example of overlaying information to show importance (figure-ground)

Typography. Newbold (2014) writes that when choosing typography, designers should use two fonts and appropriate font families (differentiating between serif and sans serif fonts) and consider personality, legibility, and readability. I chose two different fonts for headings and body text. Headings are in Limerick-Medium and running text is in Helvetica. Within these two fonts, I differentiated between types of text by using various forms from the font families: regular, light, medium, italic/oblique, and different sizes. I also used a serif font, Charter, in a few instances for text that was not quite as important to the subject matter, and therefore it was downplayed when next to varying forms of sans serif typefaces. See examples in Figure 14, below.

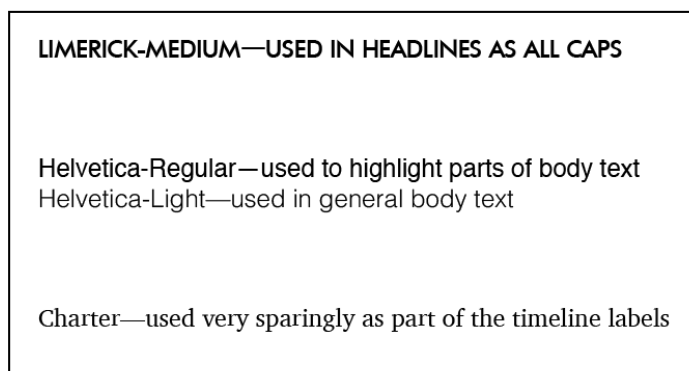


Figure 14: Examples of typefaces used

Data Journalism Meets Information Design: The Yarnell Hill Wildfire

The Limerick-Medium font has a unique “personality” in that it is not used often; it is narrow, yet formative, which is why it was a good choice for headline text. Helvetica is a commonly used typeface, perhaps with less “personality,” but it is highly legible (allows understanding, even through complexity) and is readable. I increased readability by widening line spacing where applicable, shortening line length (except for in the top introductory paragraph, since the space available dictated line length), and contrasting foreground and background (using dark colors, mostly black, on light-colored backgrounds).

Iconography. Newbold (2014) recommends using icons, lines and path, and pictographs to appeal to wider audiences and make content easier to understand. My design uses symbolic icons to make pieces of data more recognizable. Whenever I placed a weather-related event on the timeline, I accompanied it with an icon that was associated with that type of weather condition. See examples of temperature and wind icons in Figure 15, below.

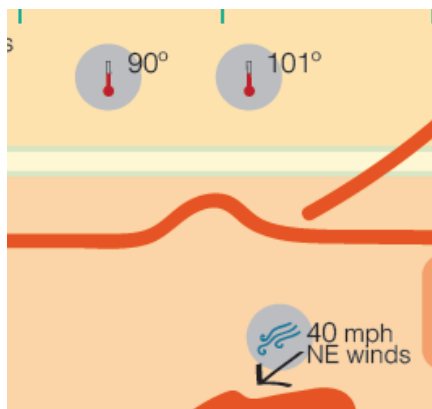


Figure 15: Examples of symbolic icon use

I also used lines and paths to draw the reader’s attention to the more significant parts of the timeline. Paths and lines were only used in the timeline section of the infographic

because it is considered the author-driven portion of the design. The rest of the infographic does not instruct readers to read in any particular order because the intent was to create reader-driven interaction. This is referring to the Martini Glass storytelling approach (Segel & Heer, 2010). Additionally, arrows were used to indicate wind direction, which was a very important piece of data. They were also used to indicate direction of travel among the firefighters in the lower half of the timeline. Lastly, I applied pictorial versions of data in a few places. For example, each map is drawn to proportion, therefore symbolizing acres in a picture. I chose to create a graph using icons to display the number of firefighters who responded to the wildfire (see Figure 16, below) and a simple circle graph paired with the timeline to show how long it took to contain percentages of the blaze (Figure 17, below). The firemen icons help to show how the quantity of responders increased very quickly, while the fire containment graphs show how it took several days to gain control of the fire.

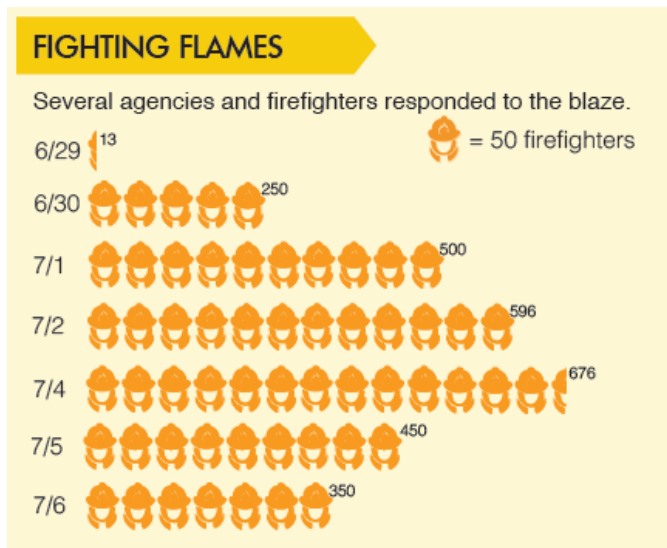


Figure 16: Fighting Flames pictograph example

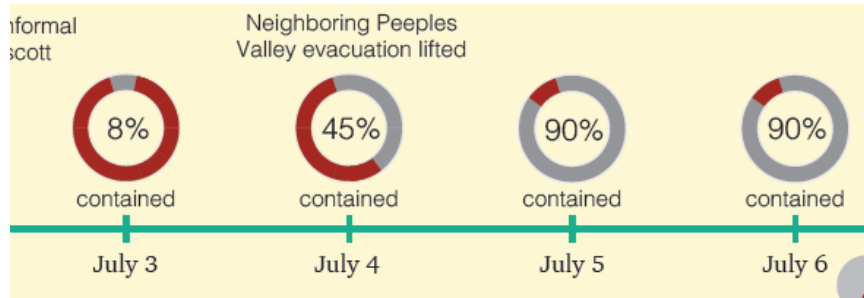


Figure 17: Fire containment pictograph example

V. PROJECT ANALYSIS

I had initially intended for my project to go through several rounds of reviews and redesigns based on peer reviews, but time limitations did not allow for such a robust analysis period. However, I did consider a few revision opportunities.

Peer Reviews

Informal peer reviews were conducted throughout my design process. I am fortunate to work with a team of writers, web developers, and designers every day, and I was able to ask them for advice at the moment it was needed. I found that their perspective was invaluable because I was so close to the elements of the story. By bringing in an outside perspective, I was able to see inconsistencies in storyline and identify parts of the design that were confusing or unnecessary.

A somewhat formal review process was conducted once I was satisfied with the infographic design. I gave a group of six people (four designers and two editors) a printout of the completed design and a one-page rationale (Appendix B) that outlined the goals of the piece. I asked them to evaluate the design from a storytelling and aesthetic point of view and to compare its execution to the original goals I had in mind. I was able

to incorporate suggestions for four out of the six participants, who suggested editorial, alignment, color, and content changes.

Project Limitations

An overarching challenge I faced when creating this infographic was how to balance sensitive subject matter while still reporting the facts of the story, which happens to be a horrific one. These limitations were overcome by balancing content matter—telling the facts of the story while highlighting the heroic risks taken by the Granite Mountain Hotshot Crew. Rather than highlighting the details of the crew’s path to death, I chose to focus on the aftermath: a memorial, national reaction, and a summary of their elite rank within the firefighting community. Within the data available existed transcripts of radio calls, details of how survivor Brendan McDonough spent his day as a lookout for the crew, exact timing as to when the crew learned they would need to deploy fire shelters, and details of how the bodies were found. This data, while interesting from a forensic point of view, would not be appropriate to include in an infographic that is meant to reflect qualities of data journalism: reporting necessary facts while telling a story.

A second limitation I found was based on my intent to create a print piece rather than an interactive one. Creating an interactive infographic was outside the scope of this project, but as I was working I found that an interactive timeline would have told the story in an interesting way. An interactive infographic could allow readers to scroll through the timeline and closely see how the fire changed shape in relation to time. There would also be potential for “pop-up” data, showing other facts related to a particular moment in time—data that I could just not fit into a tabloid size print piece. However, I believe that my finished project accomplishes its objectives for the intended audience.

VI. CONCLUSIONS

Meeting Objectives

The original project objective was to create an information graphic that combined data presentation, journalistic storytelling, and graphic design techniques to visually display information and details of the Yarnell Hill wildfire that took place during June and July 2013 in Yarnell, Arizona. The finished project meets these objectives because it tells the story of the wildfire, presents the facts of the event, and incorporates several graphic design best practices. A secondary objective was to use the infographic to encourage conversation about the event and reflect on the lives of the 19 firefighters who died during the wildfire. After showing the infographic to a variety of people, they all became interested in learning more about the Yarnell Hill wildfire, the town itself, and the Granite Mountain Hotshot Crew.

Future Project Directions

If this project were to be revisited in the future, I offer three recommendations. First, as stated previously, I believe there is great potential in turning the data presented into a web-friendly, interactive infographic. This would require design skills and web knowledge that are outside the scope of this project, but could certainly be applied in the future. Second, I would work to incorporate comments from peer reviews that I did not have the time or resources for. One colleague suggested a vertical design, which would be more web-friendly since users scroll from top to bottom rather than side to side. However, at the time the idea was presented, the infographic was already in its final form. It would have taken too much time to reimagine the design in a vertical format. I would

Data Journalism Meets Information Design: The Yarnell Hill Wildfire

be interested to see what the data would look like in a vertical presentation. And finally, the staff at *The Arizona Republic* may be interested in seeing this infographic, as they spent many hours (throughout 2013 and 2014) documenting the wildfire and its effects on the community.

Summary

I believe my infographic acts as a useful tool for any audience who is looking to understand and learn about the Yarnell Hill wildfire, an event that impacted many people across the country from fire personnel to emergency preparedness crews. Throughout the design and research process, I was able to apply many skills I have acquired during my time in the Information Design and Technology program. The final project is reflective of these skills.

Overall, the infographic combines complex data and narrative story and is an artifact that has not yet been developed for this particular event. As shown, data journalism and information design go hand-in-hand in order to tell stories to wider audiences in a compact way. My hope is for anyone viewing this infographic to have a better understanding of the magnitude of the Yarnell Hill disaster—its physical and emotional effects on a community and a nation.

REFERENCES

- Bailey, J. & Pregill, L. (2014, Fall). Speak to the eyes: the history and practice of information visualization. *Art Documentation: Journal of the Art Libraries Society of North America*, 33(2), 168–191. doi: 10.1086/678525
- Castellano, A. (2013, July). 19 Firefighters killed in Arizona wildfire. *Good Morning America*. Retrieved March 24, 2015, from <https://gma.yahoo.com/19-firefighters-killed-arizona-wildfire-061451471--abc-news-topstories.html>
- Gray, J., Bounegru, L., & Chambers, L. (Eds.) (2012). *The data journalism handbook*. Sebastopol, CA: O'Reilly Media, Inc. Retrieved February 21, 2015, from <http://datajournalismhandbook.org/1.0/en/>
- Kosara, R., & Mackinlay, J. (2013). Storytelling: the next step for visualization. *Computer*, 46(5), 44–50. doi: 10.1109/MC.2013.36
- Lankow, J., Ritchie, J., & Crooks, R. (2012). *Infographics: the power of visual storytelling*. Hoboken, NJ: John Wiley & Sons, Inc.
- Lorenz, M. (2010). Data-driven journalism process. Licensed under CC BY-SA 3.0. Retrieved February 23, 2015, from Wikimedia Commons http://commons.wikimedia.org/wiki/File:Data_driven_journalism_process.jpg
- Malofiej graphics. (2015). M22 awards final list. Retrieved February 21, 2015, from <http://www.malofiejgraphics.com/m22-awards-final-list/>
- Minard, C. J. (1869). Figurative Map of the successive losses in men of the French Army in the Russian campaign 1812–1813. Public domain. Retrieved February 21, 2015, from Wikimedia Commons <http://commons.wikimedia.org/wiki/File:Minard.png>

Data Journalism Meets Information Design: The Yarnell Hill Wildfire

Newbold, C. (2014, October). The 50 most important rules of document design: color CRAYON-TIP method. *The Visual Communication Guy*. Retrieved March 24,

2015, from <http://thevisualcommunicationguy.com/2014/10/23/the-50-most-important-rules-of-document-design-color-crayon-tip-method/>

Nightingale, F. (1858). Diagram of the causes of mortality in the army in the east. Public domain. Retrieved February 21, 2015, from Wikimedia Commons

<http://commons.wikimedia.org/wiki/File:Nightingale-mortality.jpg>

Playfair, W. (1786). Exports and imports to and from Denmark & Norway from 1700 to 1780. Public domain. Retrieved February 21, 2015, from Wikimedia Commons

http://commons.wikimedia.org/wiki/File:Playfair_TimeSeries-2.png

Rogers, S. (2011). Data journalism at the Guardian: what is it and how do we do it? *The Guardian*. Retrieved February 21, 2015, from

<http://www.theguardian.com/news/datablog/2011/jul/28/data-journalism>

Segel, E., & Heer, J. (2010). Narrative visualization: telling stories with data. *IEEE*

Transactions on Visualizations and Computer Graphics, 16(6), 1139–1148. doi: 10.1109/TVCG.2010.179

Tufte, E. R. (2001). *The visual display of quantitative information* (2nd ed.). Cheshire, Connecticut: Graphics Press.

Vallance-Jones, F. (2014, Spring). Data journalism continues to gain popularity: there are more opportunities than ever to learn. *Media* [Canadian Association of

Journalists], 16(2), 19. Retrieved February 21, 2015, from

<http://go.galegroup.com.proxy.library.cornell.edu/ps/i.do?id=GALE%7CA374811>

Data Journalism Meets Information Design: The Yarnell Hill Wildfire

[065&v=2.1&u=nysl_sc_cornl&it=r&p=AONE&sw=w&asid=4846615cbd78ad48c8776f28d4c1303d](https://www.nytimes.com/2013/07/07/technology/data-journalism-meets-information-design-the-yarnell-hill-wildfire.html?_r=1&v=2.1&u=nysl_sc_cornl&it=r&p=AONE&sw=w&asid=4846615cbd78ad48c8776f28d4c1303d)

Weber, W., & Rall, H. (2012, July). *Data visualization in online journalism and its implications for the production process*. Paper presented at the 16th International Conference on Information Visualization, Montpellier. doi: 10.1109/IV.2012.65

Yamkovenko, S. (2013, January/February). Five tips for journalists doing data visualization. *Quill* [Society of Professional Journalists]. Retrieved February 21, 2015, from <http://syamko.heliohost.org/pdf/dataviz1.pdf>

Yau, N. (2013). *Data points: visualization that means something*. Indianapolis: John Wiley & Sons, Inc.

APPENDIX A: Resources Used for Infographic Data

Coe, J. & Merrill, L., (2013, July 1). 19 firefighters killed battling Arizona blaze. *USA*

Today. Retrieved April 7, 2015 from

<http://www.usatoday.com/story/news/nation/2013/06/30/fire-in-arizona-prompts-evacuation-of-120-homes/2477469/>

Corbett, P. & Kuhney, J. (2013, July 6). Arizona wildfires: Yarnell evacuees await word

to go back. *The Arizona Republic*. Retrieved April 7, 2015 from

<http://www.azcentral.com/news/arizona/articles/20130706arizona-wildfires-yarnell-hill-fire-evacuees-brk.html>

Harris, C., Holstege, S., & Ortega, B. (2013, July 2). Arizona officials seeks answers after

19 firefighters die. *USA Today*. Retrieved April 7, 2015 from

<http://www.usatoday.com/story/news/nation/2013/07/02/yarnell-hill-fire-investigation/2483571/>

Hensley, J. (2013, July 9). Yarnell Hill Fire: timeline of critical events. *The Arizona*

Republic. Retrieved April 7, 2015 from

<http://www.azcentral.com/news/arizona/articles/20130705yarnell-fire-time-critical-events.html>

McKinnon, S. (2013, December). Alone on the hill. *The Arizona Republic*. Retrieved

April 7, 2015 from [http://www.usatoday.com/story/news/nation/2013/06/30/fire-](http://www.usatoday.com/story/news/nation/2013/06/30/fire-in-arizona-prompts-evacuation-of-120-homes/2477469/)

[in-arizona-prompts-evacuation-of-120-homes/2477469/](http://www.usatoday.com/story/news/nation/2013/06/30/fire-in-arizona-prompts-evacuation-of-120-homes/2477469/)

McKinsey, R. (2013, July 9). Yarnell Hill Fire memorial likely to draw 30,000. *The*

Arizona Republic. Retrieved April 7, 2015, from

<http://www.azcentral.com/news/arizona/articles/20130708yarnell-hill-fire-prescott-valley-memorial.html>

Mockenhaupt, B. (2014, June). Fire on the mountain. *The Atlantic magazine*. Retrieved April 7, 2015, from <http://www.theatlantic.com/features/archive/2014/05/fire-on-the-mountain/361613/>

Merrill, L. (2013, July 1). Yarnell Hill Fire: signs of support pop up around nation. *The Arizona Republic*. Retrieved April 7, 2015, from <http://www.azcentral.com/news/arizona/free/20130701yarnell-hill-fire-support-nation.html>

O'Connor, E. (2013, July 10). Yarnell Hill Fire 100 percent contained, officials say. *The Arizona Republic*. Retrieved April 7, 2015 from <http://www.azcentral.com/news/arizona/articles/20130710yarnell-hill-fire-crews-mopup-abrk.html>

The Republic (2013, July 8). Yarnell Hill Fire: memorial service details released. *The Arizona Republic*. Retrieved April 7, 2015, from <http://www.azcentral.com/news/articles/20130705yarnell-fire-firefighters-memorial-service.html>

The Republic (2013, July 1). Yarnell Hill Fire: reactions. *The Arizona Republic*. Retrieved April 7, 2015, from <http://www.azcentral.com/news/politics/articles/20130701yarnell-hill-fire-officials-reactions.html>

Walsh, J., Kuhney, J., Corbett, P., Ye Hee Lee, M., Hensley, J., Woodfill, D. S., & Lang, E. L. (2013, July 5). Yarnell fire 90% contained, not expected to grow. *The*

Data Journalism Meets Information Design: The Yarnell Hill Wildfire

Arizona Republic. Retrieved April 7, 2015, from

<http://www.azcentral.com/news/arizona/articles/20130705arizona-yarnell-fire-containment-update-abrk.html>

Walsh, J., Ye Hee Lee, M., & Woodfill, D. S. (2013, July 4). Yarnell Fire containment up to 45 percent; some in area can go home tonight. *The Arizona Republic*. Retrieved April 7, 2015, from

<http://www.azcentral.com/news/arizona/free/20130703yarnell-hill-fire-damage-widespread-random.html>

Walsh, J., Ye Hee Lee, M., & Woodfill, D. S. (2013, July 2). Yarnell Hill Fire now 8 percent contained. *The Arizona Republic*. Retrieved April 7, 2015 from

<http://www.azcentral.com/news/free/20130702yarnell-hill-fire-air-tankers-abrk.html>

Wang, A. B., Hensley, J., Collom, L., Ye Hee Lee, M., & Clancy, M. (2013, July 1).

Yarnell Hill Fire continues to burn out of control. *The Arizona Republic*.

Retrieved April 7, 2015, from

<http://www.azcentral.com/news/arizona/free/20130701yarnell-hill-firefighters-die.html>

Welch, W. (2013, July 3). Investigation of fatal Arizona fire getting underway. *USA*

Today. Retrieved April 7, 2015 from

<http://www.usatoday.com/story/news/nation/2013/07/02/arizona-fire-investigation-underway/2484231/>

APPENDIX B: One-Page Project Rationale

My thesis project will explore the intersection of storytelling and data reporting with the creation of a complex infographic that details the events of the 2013 Yarnell Hill wildfire in Arizona. I want to research best practices in storytelling, visual data representation, data journalism, and graphic design to develop the project.

Visual representations of news events can be described as “data journalism,” which involves a combination of storytelling and data reporting in one graphic piece. With the prevalence of computer design software, data journalism is becoming more popular among leading news organizations like the *New York Times*, the *Economist*, and the *Associated Press*. So what makes visual representations of news stories effective? I propose that it is the appropriate combination of storytelling, graphic design, and data presentation.

One of the first known depictions of data visualization was by information designer Charles Minard in 1861: a detailed map and timeline of Napoleon’s disastrous Russian campaign of 1812. However, literature relevant to data journalism in its current definition was published beginning around 2010, thus demonstrating the “newness,” or reinvention, of this concept. In 2012, Gray, Chambers, and Bounegru published *The Data Journalism Handbook*, which details the steps in reporting news stories with a data component from collection to presentation. Just in December 2014, Lupi’s chapter “The New Aesthetic of Data Narrative” in *New Challenges for Data Design*, outlines how to tell news with complexity of both story and data.

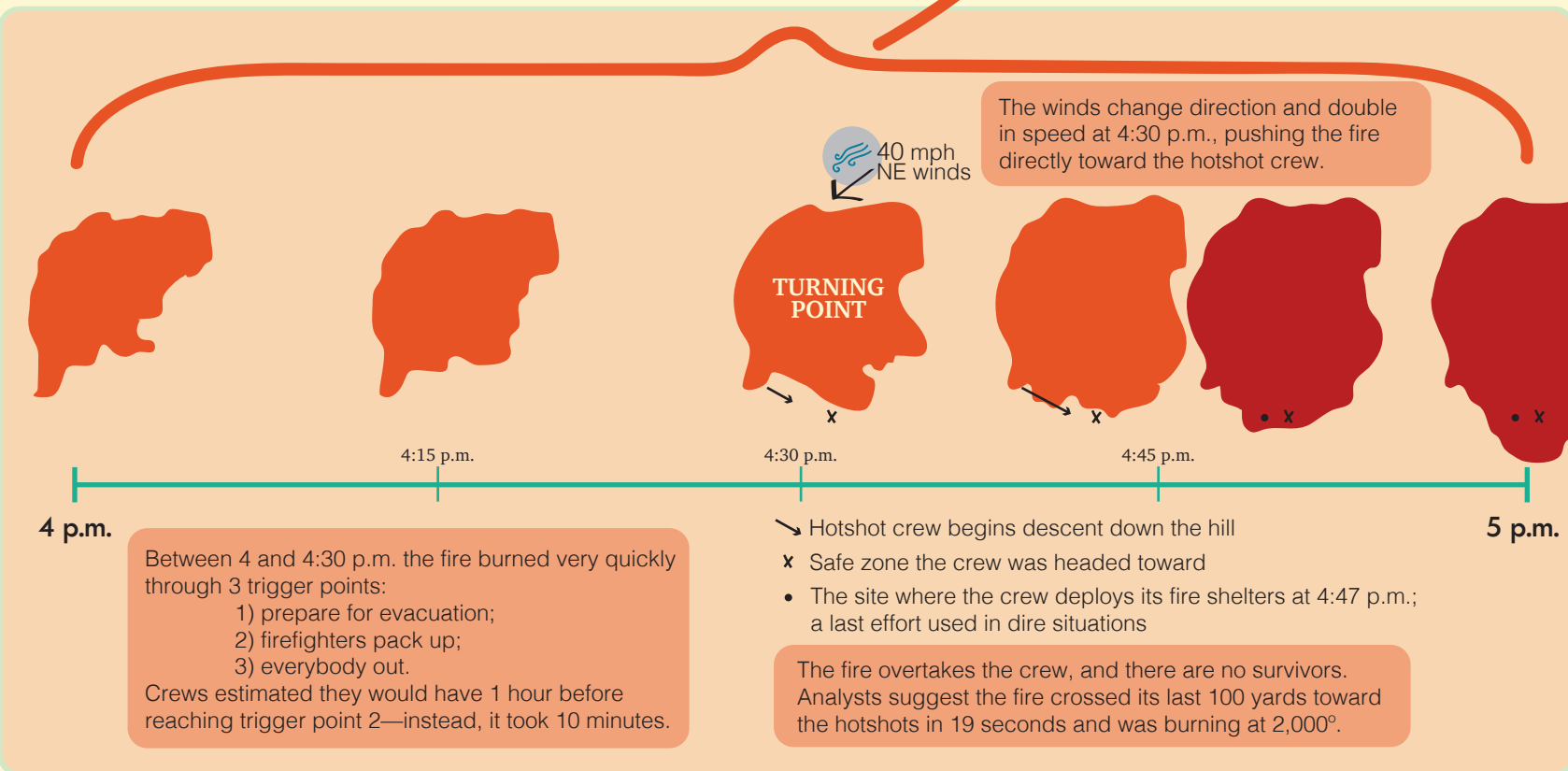
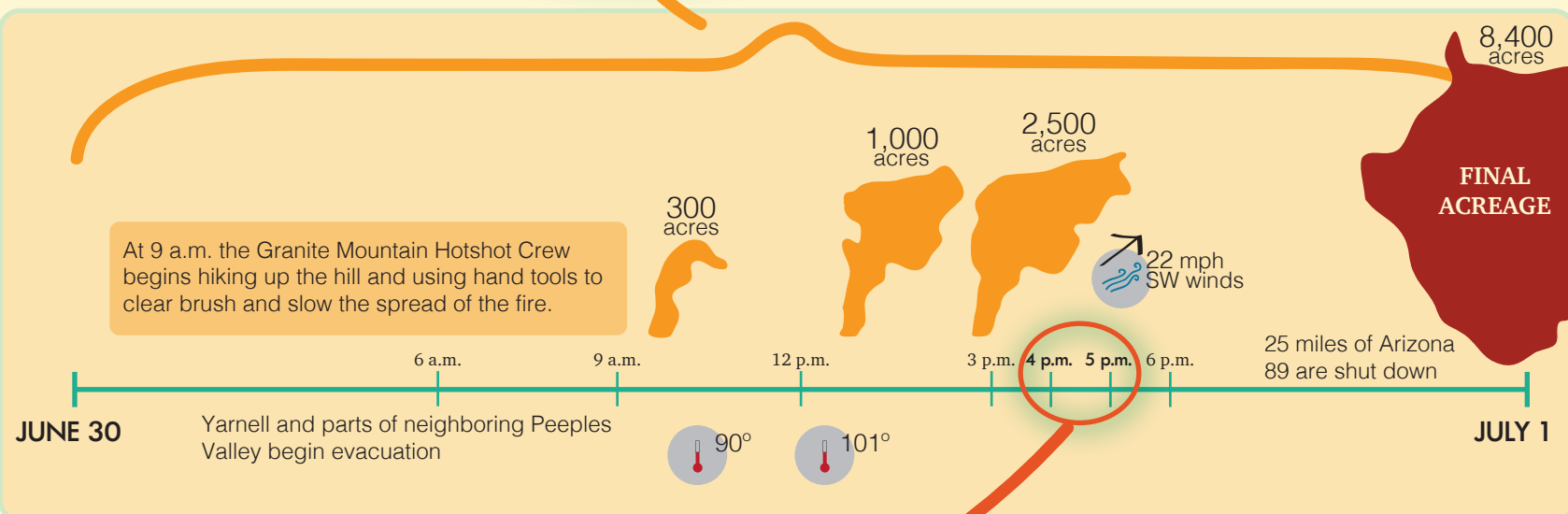
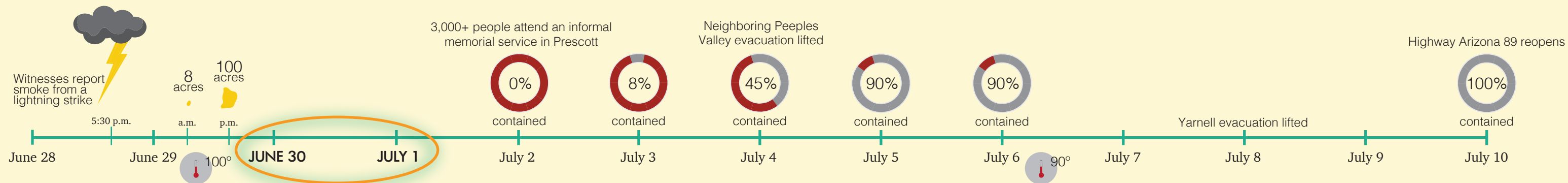
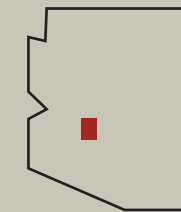
My project will attempt to take a complex event such as the Yarnell Hill wildfire and tell its complete story with factual accuracy and appealing design. After searching for visual representations of the Yarnell Hill wildfire, it seems there are no current infographics that tell the complete story or report on all associated data. The challenge will be to include all relevant information in a well-designed infographic—a depiction of data journalism. I plan to use the Adobe Creative Suite to design the visualization, which will be viewable in both print and digital formats.

My intent is for my project to take a story that touched the lives of many people across the country and tell it in a new way. I want my infographic to tell the story of the fire, its destruction, and its implications for the Yarnell Hill community. Elements to include may be a timeline, a map, charts, and firefighter details. Ultimately, I would like to share the data visualization with the *Arizona Republic*, the news organization that was nominated for a 2014 Pulitzer Prize for its breaking news reporting of the disaster.

A HERO'S JOURNEY THROUGH FIRE

A LOOK AT THE UNFOLDING AND AFTERMATH OF THE YARNELL HILL WILDFIRE

On the evening of June 28, 2013, a thunderstorm near Yarnell, Ariz. produced a lightning strike that would rapidly grow into an 8,400-acre wildfire: the Yarnell Hill wildfire. The Granite Mountain Hotshot Crew, an elite group of 20 firefighters based in Prescott, Ariz., was called to help fight the fire on the morning of June 30. Only one would survive the day. The nation grieved this loss of 19 lives—the Yarnell Hill wildfire was the deadliest day for firefighters since the September 11 terrorist attacks and was the deadliest wildfire Arizona had ever seen.

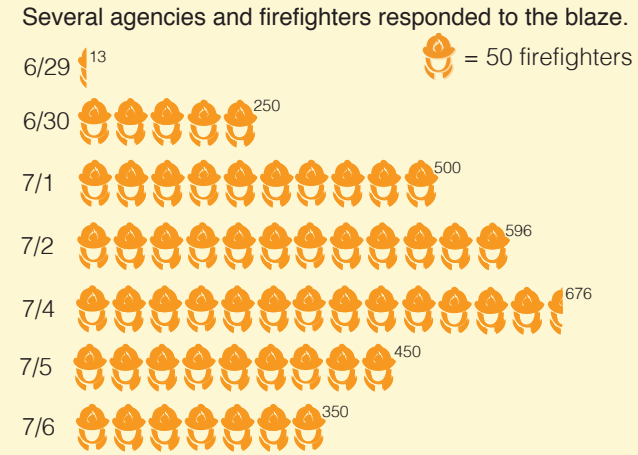


NATIONAL REACTION

More than a dozen national leaders and organizations expressed condolences after the 19 hotshot crew members perished, including:

GOV. JAN BREWER US SEN. JEFF FLAKE, R-ARIZ. US SEN. JOHN MCCAIN, R-ARIZ. PRESIDENT BARACK OBAMA JANET NAPOLITANO US SECRETARY OF HOMELAND SECURITY SEN. RON WYDEN, D-ORE. SENATE ENERGY AND NATURAL RESOURCES CHAIRMAN REP. TRENT FRANKS, R-ARIZ. REP. RAÚL GRIJALVA, D-ARIZ. REP. ED PASTOR, D-ARIZ. REP. MATT SALMON, R-ARIZ. REP. RON BARBER, D-ARIZ. REP. KYRSTEN SINEMA, D-ARIZ. NATIONAL PARKS SERVICE PATCHES PHOENIX POLICE DEPARTMENT ARIZONA DIAMONDBACKS THE STATE OF ARIZONA FLEW FLAGS AT HALF STAFF THROUGH JULY 19

FIGHTING FLAMES



TAKING SHELTER

Layers that compose fire shelters can deflect up to 95% of a fire's radiant heat, but the fire shelters deployed by the Granite Mountain Hotshot Crew broke down and were ineffective because of the wildfire's intensity.

Humans can breathe 300° air for a very short time.

- at 500° shelters start to delaminate
- at 1,200° foil layer starts to melt
- at 1,400° fiberglass layer starts to break down
- at 2,200° silica layer breaks down

When the fire overtook the crew, it was burning at 2,000°.

TOTALS

- \$ 5 million in suppression costs
- \$ 17 million in property damage
- 127 structures lost in Yarnell
- 2 structures lost in Peoples Valley
- 23 non-fatal injuries
- 19 firefighters killed

THE HOTSHOT CREW

The Granite Mountain Hotshot Crew was an elite group: In 2008, the group received **Type 1 status** and was attached to a city (Prescott, AZ), rather than a federal agency—the only crew of its kind in the nation.

Physical fitness was a requirement. An example: Complete a 3-mile hike carrying a 45-pound pack in less than 45 minutes.

- 10 were married
 - 3 were engaged
 - 7 were already fathers
 - 13 children were left fatherless
 - 3 children were on the way
- ANDREW ASHCRAFT, 29
ROBERT CALDWELL, 23
TRAVIS CARTER, 31
DUSTIN DEFORD, 24
CHRISTOPHER MACKENZIE, 30
ERIC MARSH, 43
GRANT MCKEE, 21
SEAN MISNER, 26
SCOTT NORRIS, 28
WADE PARKER, 22
JOHN PERCIN, 24
ANTHONY ROSE, 23
JESSEE STEED, 36
JOE THURSTON, 32
TRAVIS TURBYFILL, 27
WILLIAM WARNEKE, 25
CLAYTON WHITTED, 28
KEVIN WOYJECK, 21
GARRET ZUPPIGER, 27

A MEMORIAL

30,000 people attended a formal memorial service on July 8 in Prescott, Ariz., in person or remotely. Guests included Vice President Joe Biden and Gov. Brewer, reps from more than 100 hotshot crews, and members of the NYC and LA fire departments. Surviving Granite Mountain Hotshot Brendan McDonough, 21, who served as a lookout on June 30, read the Hotshot's Prayer.

"...Lord, bless my hotshot crew; my family, one and all."

Sources: The Arizona Republic, (www.azcentral.com), various; The Atlantic magazine, (www.theatlantic.com/magazine), "Features: Fire on the Mountain"; USA Today, (www.usatoday.com), various