



UNIVERSITY OF <sup>TM</sup>  
**KWAZULU-NATAL**  
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**EXPLORING THE EFFECTIVENESS OF INTERACTIVE INFORMATION AND  
DATA VISUALISATION FOR NEWS WEB INTERFACES IN THE ADVENT OF THE  
FOURTH INDUSTRIAL REVOLUTION: A SOUTH AFRICAN PERSPECTIVE**

**By**

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**Submitted to the School of Arts, College of Humanities, University of KwaZulu-Natal, in  
fulfilment of the requirements of Master of Arts in Media and Cultural Studies (2021)**

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As the candidate's Supervisor, I agree to the submission of this dissertation:

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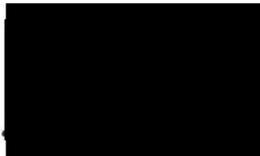
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## ABSTRACT

From a global perspective, news production and consumption is becoming increasingly digitised. The world is changing very fast, and big will not beat small anymore, but rather the fast beating the slow (Murdoch, 2016). Comparatively, South African news media organisations are not adapting fast enough to the new normal with respect to the deployment of innovative solutions to revamp their online platforms. They, therefore, need to adapt quickly and innovatively to the accelerated demands of the digital revolution in order to compete with international online news disrupters. The problem that this research identifies is that information and data visualisation for online news in South Africa is somewhat deficient regarding the use of non-linear interactivity for innovative news graphics. In South Africa, online news is a digital replica of a traditional newspaper, extensively relying on the use of still photographs that accompany text in a linear format despite the acceleration in digital development whereby the nonlinearity and interactive nature of Web 2.0 allows for interactive user engagement. While it is true that digital technology has beaten down the entry barriers to publication, it is also true that publishers need to do everything in their power to raise barriers that will prevent people from leaving their world of meaning. This research study undertook to comparatively review the information and data visualizations used in two international online news sites: The New York Times (NYT), and The Straits Times (ST) and the information and data visualisations used in two national online news sites: Times Live (TL), and E-News Channel Africa (eNCA) online to determine novel ways in which information visualisation can be incorporated into news websites in South Africa. The key finding was that non-linear interactive information and data visualisation is a neglected area of specialisation notwithstanding the fact that it can enhance the multimedia narrative output for South African news websites if implemented appropriately. Since this is a fairly new creative discipline, and with the increasing information and data deluge due to the advancement of technology, the results of this study underline the impact of visualizing an influx of information and data, providing a roadmap for an innovative and interactive execution of information and data in the advent of the Fourth Industrial Revolution.

**Key words:** Information Visualisation, Data Visualisation, Non-Linear Interactivity, Interactive Narrative, Fourth Industrial Revolution (4IR), Information, Communication and Technology (ICT), Human Computer Interaction (HCI).

## ACRONYMS

BD	The Business Day
BRICS	Brazil, Russia, India, China and South Africa
DTP	Desktop Publishing
EM	Effective Measure
ENCA	E-TV News Channel Africa
FNB	First National Bank
4IR	The Fourth Industrial Revolution
GP	Gestalt Principle
GD	Graphic Design
HCI	Human Computer Interaction
ICT	Information Communication and Technology
ID	Information Design
IG	Information Graphics
IV	Information Visualisation
JPEG	Joint Photographic Experts Group
KE	Knowledge Era
NEMISA	The National Electronic Media Institute of South Africa
NICD	The National Institute of Communicable Disease
NYT	The New York Times
SA	South Africa
ST	The Straits Times
TB	Tiso Blackstar
WP	Washington Post

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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

Media experts have stated that “visual images mediated through the web are no longer static, but increasingly offered as an interactive experience that invites and requires user assent and participation” (Usher, 2009: 1). Accordingly, many newspapers are now operating on the basis of the “digital first” principle, prioritising their digital editions, and thereafter consider their costly print editions (Franchi, 2014: 49). This study delineates web interfaces due to the advancement and the subsequent impact of digital technology on traditional media. This study seeks to determine whether or not media companies in South Africa are innovative within the context of information and data visualisation for their online news platforms. This study also focuses on the effectiveness of interactive Information Visualisation for news web interfaces in South Africa. A comparative case study was undertaken to compare South African and international news websites and thus evaluate the extent to which these online news websites incorporate non-linear Interactive Information Visualisation initiatives.

### 1.2 Background to research area

The radical advent of digital communication has disrupted and overhauled traditional communication formats, particularly the manner in which news content is broadcast and consumed. Evidence shows that the format of news distribution is changing and adapting due to the rapid advancement in digital technology. In South Africa, the Tiso Blackstar Group is undergoing a restructuring process and that is expected to affect its print and digital publications. Gill (2017:7) explains: “management was now of the view that The Times as a print product and cannot continue in its current format. The company proposes that the current printed publication of The Times be ceased and that it be replaced by a digital only product.” This demonstrates ongoing considerations to reconfigure and reposition the distribution and consumption of news content in South Africa.

Information visualisation for online news in South Africa has somewhat lacked in innovation in terms of presentation format for both print and online news platforms. If a picture is worth a thousand words, a good infographic is worth a thousand pages (D’Efilippo, 2013). The idiom makes reference to a picture conveying a story more effectively than words. In the similar light,

the idiom makes reference to a visualised information graphic conveying information to a user more effectively than purely words. This presents an opportunity for piloting interactive narrative or information visualisation only for the digital version of The Times and other South African news media, enabling a unique and innovative experience around the consumption of online news.

Globally, narrative visualisations have been adapted for recent media, and are fast becoming more dynamic owing to the way in which digital content is now being consumed. Galloway, (2012:30) termed “significant surface”, to have a two-dimensional plane with meaning embedded in it or delivered through it. Interactive visualisations for the online platform embody the same characteristics as what Galloway termed “significant surface”. Interactive Information Visualisation (IIV) is a visual representation of information that integrates different modes of interactivity. The different modes refer to the different layers of information in a visualisation or graphic that can be engaged with in an interactive manner by the user. In this context, an image which is a constitutive element has a written text, sound, and layout integrated into a coherent whole offering at least a navigation option to control the graphic. Weber (2013) describes communication as explaining a phenomenon or narrating a factual story. This is useful especially when dealing with complex information and volumes of textual or numerical information. The text can then be transformed into visuals, thus enhancing the process of communicating information.

This study delineates web interfaces resulting from the impact and advancement of digital technology on traditional media. This study investigates whether media companies in South Africa use innovative graphics content for configuring their online news web platforms. This study also focuses on the effectiveness of Interactive Information Visualisations for web interfaces.

Online platforms can be categorised within the Information, Communication and Technology (ICT) sub-structure. Web interface interactivity, enhanced through Web 2.0 advancements, allows for digital dialogue, with government, and online users. While social media appears to instil and nurture social division, it can alternatively play a role in building communities and giving all South Africans the opportunity to access and absorb a wide range of information, ideas and analyses. With interactive news visualizations, the target audience for the online platform is also less geographical, cultural or politically bound, in contrast with traditional

media, such as newspapers (Pavlik, 2005). Therefore, Web 2.0 advancements and consequently, communication via the IIV solutions presents flexibility in accessing information during the current digital renaissance.

### **1.3 Research problem**

According to Abad (2014:63), “it is a fact that the 2.0. online media has changed our vision on how information is used and accessed through the internet”. From a global perspective, traditional news production and consumption have become increasingly digitized; therefore, new approaches must be considered regarding easy and effective transfer of information via the digital platform. However, a digital interface is worthless if the user lacks effective experience, particularly in the transfer of information. Xin (2007:7) confirms this view, positing that “Information is a multidisciplinary field that is strongly related to graphical user interface design, information architecture and human computer interaction (HCI). Visual design and interactivity can play an integral contribution for an effective user experience and the transfer of information and data visualisation for an online user”. Bollini (2017:593) avers that “the first generation of web designers were artists who were keen to mould technologies as a design tool, able to shape a new visual culture, an interactive and hypertextual language, and a multimodal aesthetic”. Aligning this view to online news information design, Ayerdi et al. (2014:12) assert that “analysis of design in online journalism has received relatively little attention in comparison to other research areas”. Furthermore, Lopez et al. (2005) argue that the mainstream online media have to use a multimedia language, be interactive, hypertextual and continuously updated and have an online distribution platform.

According to Segel and Heer (2010:1), “data visualization is regularly promoted for its ability to reveal stories within data, in some cases, allowing the visualization to function in place of a written story”. Digital journalism in South Africa includes a strong focus on user-generated content with traditional news media using Twitter and other social media platforms (Bosch, 2010). Stassen (2010:120) further confirms that “In 2008, News 24 started making use of social media and is active with platforms such as Facebook, Twitter and You Tube”. News 24 made use of these social media channels in order to reach out to users that would not, as a rule, visit the website (Momberg, 2009b). However, Stassen (2010) further explains that News 24’s only interface was its website, where users could read stories, view photographs and publish videos onto the You Tube platform. However, this approach is currently the main option of

disseminating information and online news in South Africa. New media methods lack in innovation and visual creativity for online news in South Africa, in comparison to the new media approaches in The New York Times and The Straits Times, whereby the graphics are integrated with rich nonlinear interactivity and exceptional quality graphic design. Thus, South African news media organisations are not adapting fast enough with respect to the deployment of innovative, new media visual solutions such as the application of a non-linear interactive multimedia design for their online platforms in comparison with their international counterparts. Online new media offer a high degree of interactivity, sociability, autonomy, playfulness and personalisation than earlier forms of traditional linear media that is linear and does not allow for nonlinear interactivity (Fourie, 2001). Therefore, South African news media organisations need to adapt quickly and innovatively to compete with instant international online disrupters, such as The New York Times (NYT) and The Straits Times (ST), spurred on by the digital revolution to produce powerful digital communication tools that are harnessed by online news media to interact with audiences. The adaptation of these two online news companies to new digital technology may drive South African readers away from their online medium.

The problem that has become the main cause for concern is that information visualisation for online news in South Africa lacks innovation in terms of presentation format despite the acceleration in digital development. In South Africa, online news is a digital replica of a traditional newspaper, extensively relying on still photographs that accompany text. An apt analogy is the dawn of the internet – where static linear information would simply be posted online. This had benefits of reach and accessibility as well as hypertext, but little else. The reader often finds uninspiring, static Joint Photographic Expert Group (JPEG) images that do little to arrest and retain their enthusiasm. Blewett (2014) refers to this scenario as skeuomorphism, where elements of the traditional form are retained, even though they have no functional value and do not enhance the digital form. The interactive nature of Web 2.0 allows for reader engagement and Interactive Information Visualisation; if online news organisations embrace these visualisation techniques, they will enhance the audio-visual experiences of their audiences.

The sample for this study comprises websites of news media organisations in South Africa. A cursory analysis of South African online news websites reveals rare use of Interactive Information Visualisations that visually communicate information about a particular story.

This suggests the need for a more structured in-depth analysis. Websites of international news media organisations will also be consulted in order to determine the extent to which Interactive Information Visualisations are being used in South Africa. In substantiation, Royal (2010:1) is of the view that modern news organizations are using a variety of technologies to assist in telling stories in ways that combine media, data and user engagement and that the New York Times (NYT) is one of the most progressive of these organizations in developing online, data-driven interactive news presentations. Therefore, the sample news websites from The New York Times and The Straits Times have served as a sort of benchmark of how Interactive Information Visualisations may be integrated into online news. This leads to the research question: How can media companies in South Africa be innovative and unique visually, with information for their online news platform?

#### **1.4 Contribution to study field**

The second Industrial Revolution witnessed a paradigm shift to mass production and automation. However, the knowledge era (KE), particularly in visual media, continued with its artisan model. From about 1910, some artists began to assemble collages and montages. It was at this period that mass production which characterised the Industrial Revolution impacted on the realm of art. Manovich (2001) suggested that this shift coincided with the transition from analogue electronics to digital computerisation, which expanded at great momentum. The shift towards digital technology has mutated the storytelling nature and spurred on the consumption of visual journalism. This study leverages this comparison of the gradual impact of the Industrial Revolution towards the fine arts. This cyclic influence is applicable to the current scenario, where the digital revolution in the fourth industrial revolution (4IR) holds the potential to impact information visualisation in several beneficial ways, particularly with the enormous access and availability of information and data. The research therefore contributes to the existing body of knowledge on information and data visualisation by highlighting the ways in which information visualisation has become significant for the web platform ushered in by the digital renaissance.

#### **1.5 Aim of study**

This research study aims to determine the importance and effectiveness of visualizing information and data together with nonlinear interactivity for online news graphics in South Africa.

## **1.6 Research study objectives**

The objectives of the research study to:

1. Review the data visualisations used in two online news sites: The New York Times (NYT), and The Straits Times (ST).
2. Review the data visualisations used in two South African online news sites: Times-live and E-News Channel Africa (eNCA) online.
3. Determine novel ways in which information visualisation can be incorporated into news websites in South Africa.

## **1.7 Significance of the study**

This study is important in so far as its results could determine the impact of disruptive digital technology on creative media industries (media, advertising), and could thus provide a roadmap for the appropriate use of creativity and technology following the advent of the Fourth Industrial Revolution.

The study will also be beneficial to the relevant government agencies (such as The National Electronic Media Institute of South Africa) that focus on ICT, media training and development, and academia, especially creative media departments within universities that focus mainly on theoretical and traditional practical outcomes.

The study is mostly significant to media organisations as it provides an understanding of and possible solutions to the challenges facing the Fourth Industrial Revolution.

## **1.8 Justification of the study**

In South Africa, there is a dearth of research on the impact of technological advancement on creative and media industries. There has also been little innovation and disruption on how to capitalise on merging technology and creative and media industries. For example, according to the article Tiso not closing, Business Day Print Edition, there was consideration to permanently shut down the print edition of The Business Day (BD) due to stagnant sales. Furthermore, the daily publication, The Times, also published by Tiso Blackstar (TB) entirely shut down its print edition to focus on a solely digital offering for the reader. In the examples cited above, it is evident that media organisations are under pressure to enhance their digital offering to capture

their market share. It is an opportunity the media takes to integrate skills to develop innovative digital offerings. However, the current digital offering in South Africa is not innovative enough to capture the attention of the audience. As a result, it becomes a change management challenge in terms of diverting customers from the traditional newspaper towards a digital platform, and thereafter maintaining the volume of readership. Visual innovation for the digital content can alleviate and possibly solve the change management challenges that media organisations currently face by attracting the millennium customer base as well. However, in South Africa (SA), no attempt has been made to solve this challenge.

This study fosters a general understanding of how to access information through digital interactive visualisations, thus encouraging further research towards innovation targeting digital multimedia for the online news platform.

### **1.9 Ethical considerations**

Ethical clearance to conduct this study was granted by the University of KwaZulu-Natal – Howard College (Addendum 1). Participation in the study was strictly voluntary and all the information about the respondents was confidential. Raw and personal data will be stored securely for five years, and they will be destroyed thereafter. This study uses information in the public domain; hence, all ethical protocols were observed.

### **1.10 Overview of research methodology and research design**

This study falls within the interpretivist paradigm. A qualitative case study approach was used to solicit data for the study. Hence, the study purposefully sampled four online news sites.

### **1.11 Structure of the dissertation**

The dissertation comprises six chapters as summarised below:

#### **Chapter 1: Introduction**

This chapter presented an overview of the study. It presented the background to and aim and objectives of the study. It further presented the justification for the study and outlined the structure of the study.

#### **Chapter 2: Literature Review**

This chapter reviews related literature solicited from journals, online and traditional newspaper reports, books, and conference proceedings. It also highlights the application of non-linear

interactivity in news visualisations for the online platform. It also provides an overview of the higher retention rate when absorbing information when news content is distributed in that format. The chapter further explains why South African news organisations should adopt this approach for their online platform, especially with the advent of the Fourth Industrial Revolution (4IR) and the rapid global advancement in technology.

### **Chapter 3: Theoretical Framework**

The chapter explicates the key theories used for this research project. The Critical Constructivist Theory and Habermas's Theory on Communication are explored together with Gestalt's principles on aesthetics. These theories were deemed relevant to both the journalistic and aesthetic elements of the research study.

### **Chapter 4: Methodology**

This chapter outlines the methodology for the research. A qualitative case study approach was used. The study applied purposeful sampling method to select four online news. Two sites were international while the other two were South African.

### **Chapter 5: Data Analysis and Discussion**

The chapter presents the results in the form of graphics and discussion. The discussion also makes reference to videos of the infographics, demonstrating the extent to which these apply interactive information visualisation.

### **Chapter 6: Conclusions and Recommendations**

The envisaged strengths, weaknesses and challenges associated with the integrated analysis are presented in this chapter. The chapter discusses the conclusions drawn from this study. The chapter summarises the main findings and provides recommendations for future research.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

This chapter reviews literature on information and data visualisation and online news. In the context of South Africa, there has been a dearth of literature generated on these areas. Globally, however, more journalists are considering the use of data visualisation to influence audience retention for their online news sites. The chapter outlines the key themes emerging from the literature. Given the paucity in the South African context, the researcher offers an account of the disruptive potentials of Fourth Industrial Revolution in relation to online news.

#### 2.2. A global context of online news interactive information visualisations

According to Seyser and Zeiller (2018:402), “journalism is steadily changing, and especially online journalism leads to new types of digital storytelling. Online media provide new ways of presenting such complex issues using interactivity and visual narrative in multimedia content”. Besides images, audio, and video content, spoken texts and animated graphics, which constitute the digital long form of storytelling, heavily depend on information visualisation in enhancing the narrative text. Seyser and Zeiller (2018) further confirm that The New York Times is a pioneer in the use of information visualisation in the long form. For example, in 2012, The New York Times published a non-linear interactive multimedia report called “Snow fall”, which set the standard for this innovative type of online media storytelling (<https://www.nytimes.com/projects/2012/snow-fall/index.html?searchResultPosition=0#/?part=tunnel-creek>).

Another example that followed was a report on the Beirut bomb blast (<https://www.nytimes.com/interactive/2020/09/09/world/middleeast/beirut-explosion.html>).

Other trend-setting examples were frequently used in Europe by Zeit Online, the German national weekly newspaper, since visualisation, such as information graphics, has a positive influence on the cognitive processing of information (Seyser and Zeiller, 2018).

Wilson (1995) opines that information visualisation provides new tools for comprehending complex bodies of information that are characteristic of this information age, with

technological development being mainly valued for its ability to create information. Because of digital media convergence, data visualisation and journalism have merged into a new form of news coverage: data-driven journalism, which is extremely visual and interactive in a non-linear manner. However, Wilson (1995) emphasises the view that despite the technological advancements, art can also be considered a form of information since many artists are exploring organisations that have been created during the digital information age, owing to the convergence of research, technology, telecommunication, marketing, and media.

In consonance with Wilson's (1995) point of view, Data Journalism has been defined as "a field combining spreadsheets, graphic data analysis and the biggest news stories" (Rogers, 2011: 110). Knight (2015) defines it as a story whose primary source is numeric, or a story which contains a substantial element of data or visualisation. Since visual journalism can be regarded as a consequence of digital media convergence, it is clear that emphasis is on a multidisciplinary approach in the production of interactive information and data graphics combining two areas of specialisation. Interactive information graphics are accurately defined as visual representations of information consisting of elements such as: verbal elements (text and audio) and visual elements (photo, illustration, diagram, map, symbol, icon, pictogram, video, moving image), which are combined to create a new and hybrid form (Weber and Rall, 2012). This particularly occurs when the user's interaction with the visualisation is non-linear and simultaneously combines some or all those elements in the information visualisation.

Interestingly, Hawkes (1972:1) avers that figurative language does not mean what it says, in contrast to literal language, which is intended to be or rather, taken as denotative, bearing in mind that the visual language is figurative while the written one is largely regarded as literal. While this point of view relates to the classical times, Chandler (2007) asserts that tropes may foster understanding if this is interpreted as a process of rendering the unfamiliar more familiar. This mirrors the influence of European semiology that transcends the Saussurean legacy, therefore drawing upon the Peircean tradition in recognising that meanings depend on referential contexts and systemic codes. Hawkes' (1972) view could be interpreted as representative of the viewpoint of a literate society from a classical period when semiotics was the main source of communication for an illiterate society to access information and absorb knowledge in the classical era. Testifying Chandler's (2007) point of view of rendering the

unfamiliar more familiar, Rogers (2008) <sup>1</sup>posted onto The Guardian Insider blog (<https://www.theguardian.com/help/insideguardian/2008/dec/18/unemploymentdata>) that:

“As of yesterday, our development team has come up with an application which takes the raw data and turns it into an editable map. Which meant that we could produce a fantastic interactive graphic based on these figures”.

It is therefore clear that Data Journalism is currently an emerging form of storytelling, whereby traditional methods of journalistic work are mixed with data analytics, programming and visualisation techniques (Nygren, Appelgren and Huttenrath, 2012).

Rogers’ (2008) view is that through the implementation of semiotics, complex data that would not necessarily be understood by a larger audience is transformed into an understandable format for a larger audience, which contrasts with Hawkes’ (1972) point. Therefore, data visualisation can be referred to as the visual technique that makes data or information more comprehensible and memorable for the entire audience (Frost and Sturt, 2015).

Rettberg (2020) further explains that data visualisations are a form of communication that emphasises data and presents reality as understandable models. Kennedy, Weber and Engebretsen (2020) add that visual representation of data plays a central role in the recent expansion of data-driven news. From simple bar charts and line charts to more sophisticated chart types, data visualisations have the capacity to engage audiences. The New York Times, The Guardian and The Zeit Online affirm this with their interactive graphics and features, thus playing a pioneering role in applying data visualisation that underpins online journalism (Weber and Rall, 2012).

Comparatively, Peter, Chen, and Carrasco (2017) capture the Chinese experience, indicating that as the economic future of online news was unclear, most news websites remained hollow shells that hardly generated any substantial change. However, technological advancement resulted in the growth of the online community. This has been necessitated by the close co-operation between newspapers and internet companies. Thus, newspapers had to change their online strategies due to their critical economic situations particularly resulting from a reduction

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<sup>1</sup> <https://www.theguardian.com/help/insideguardian/2008/dec/18/unemploymentdata>

in the sales of physical newspapers. Peter et al. (2017) further elaborate alluding to the example of the Pengpai Newspaper in China, which operating as a similar model to Boczkowski's (2004:206) view of "we publish – you read model", a traditionally linear approach to storytelling, in the use of digital technologies in news.

Projects such as The Panoramic Scene Channel which visualise content in 360-degree images offer a new narrative full of non-linear labelling, layers, and hyperlinks and that is only possible in a digital environment. Evidently, at an international level, there is a need to adapt to a digital immersive multimedia level with news graphics. This has been pursued and trialed extensively despite the challenges it presents.

The New York Times adopted the Convergent Journalism approach, pioneering the collaborative approach between journalists, designers, and programmers. Weber and Rall (2012) confirm that this collaborative production process in the newsroom is a crucial condition for the production of data-based visualisations such as interactive graphics. They further confirm that The New York Times admits to overcoming the gap of isolated working practice by building a team of people that includes journalists, designers and programmers for special projects and testimony to this are the interactive visualisation feature of the Beirut bombing (<https://www.nytimes.com/interactive/2020/09/09/world/middleeast/beirut-explosion.html>).

Correspondingly, Weber and Rall (2012) argue that in an environment exhibited by The New York Times, experts with competences in several areas work closely, supporting each other with specific strengths needed to complement certain areas. The collaborative approach results in a change of specialisation delivery, disrupting the norm. Visualisation methods that are not normally applied in the newsroom become more important to the production of interactive data stories and visualisations. Production techniques, such as the creation of scripts and storyboards, further enhance the translation of the story into successful visualised narratives. As exemplified by Pallant and Price (2015) in Vincent LoBrutto's (2002:62) words, "storyboards visualize a film shot by shot, comprised by expressive drawings or little more than stick figures". Pallant and Price (2015:5) further articulate the view that Fionnuala Halligan (2015:1), in her study of storyboards from an art history perspective, sees storyboards as "blueprints for a finished feature", demonstrating that this approach has been favoured by practitioners in the film industry. Similarly, this approach can enhance visualisations for online news narratives.

Simon (2013) maintains that the producer and director make the final decision on a film production, and without a good set of storyboards to represent exactly how they want the scene to appear, the filming may go wrong. Comparatively, these visualisation techniques become woven within the newsroom and that enhances the quality of the output or story. This evinces an increasing convergence of the fields of journalism, design, creative storytelling, and programming, thus stimulating the appetite for non-linear interactive news narratives.

Chandler (2007:86) adds that “the structure of any text or cultural practice has both syntagmatic and paradigmatic axes”. Barthes (1967:27) outlined the paradigmatic and syntagmatic elements of the ‘garment system’, describing the paradigmatic elements as “items which cannot be worn at the same time on the same part of the body (such as hats, trousers, or shoes)”. The syntagmatic dimension is the juxtaposition of different elements in a complete ensemble from hat to shoes (Barthes, 1967).

Within a genre, the syntagmatic dimension is the textual structure, while the paradigmatic dimension can be as broad as the choice of a subject matter. In this framing, the form of a genre is a syntagmatic dimension, while the content is the paradigmatic dimension. However, while form is also subject to paradigmatic choices, content is to syntagmatic arrangement.

In the case of the film narrative, the audience’s interpretation of an individual shot depends on both paradigmatic and syntagmatic analyses. The determination of meaning in a narrative seems to be primarily dependent on the syntagmatic dimension, but some examples of films in which the paradigmatic dimension is at the foreground are *Pulp Fiction* (Quentin Tarantino, 1994), *Crash* (Paul Haggis, 2004), *Valentine’s Day* (Gary Marshall, 2010), *New Year’s Eve* (Gary Marshall, 2011), and *Mother’s Day* (Gary Marshall, 2016). These examples require the audience to make comparative inferences regarding a series of separate events, thus captivating the audience’s attention as they crave to know more. However, the syntagmatic dimension resumes its conventional dominance towards the end of the narrative.

Similarly, the convergence of the fields of visual journalism, design, creative storytelling, and programming creates interactive information graphics and narratives through the application of the paradigmatic dimension operating at the foreground and the use of the syntagmatic dimension when required. This engages the user through comparative inferences to enhance

information absorption. Therefore, this plays an important role in bridging the gap between producers and consumers of information who are often inundated with information (Ottens, Cheng, and Drewnowski, (2015:1901).

### **2.3 The South African context of online news interactive information visualisations**

When one conducts a literature search for the terms “data”, “visualisation”, “South Africa” and “journalism”, it is interesting to note that no references emerge on the Web of Science and a few relevant references on Google Scholar are outlined here. It seems information and data visualisation or interactive visual narratives for news are synonymous with digital journalism, though they do not mean exactly the same thing. In the South African context, literature related to this study refers more to the execution of information transfer through social media platforms rather than the production of information visualisation narratives for the online platform.

In the South African context, the term ‘digital’ is apparently associated with social media. In their findings, Verweij and Van Noort (2013) suggest that pluralism and openness are important characteristics of the South African Twitter network; therefore, South African journalists use Twitter as a journalistic tool for crowdsourcing, breaking news events, live blogging and balance, as well as checking and cultivating sources. One reference that deals with data journalism in the Global South offers a chapter on South Africa, focusing on investigative journalism using digital crowdsourcing to fund investigative journalism (for example, the case of AmaBhungane) (Mutsvairo, 2020).

Similarly, Bosch (2016) confirms that Twitter underpinned youth participation in the Rhodes Must Fall campaign in South Africa. The article analyses Twitter activism around the campaign and how social media discussions set the agenda for public debate. Mutsvairo (2019:1290), attests that “in the West collaborative and diverse storytelling projects are combining to communicate and showcase data’s ability to improve visual journalism”. However, just a handful of studies have begun capturing the emergence and impact of data in the Global South. Thus, the literature available on ‘interactive information visualisation’ is somewhat limited from a local perspective.

Moyo (2019), vouches that structures, resources and professional ideologies are seen as central in the tailoring of digital news cultures and practices such as data journalism because in Africa, data has become a big source of news on public affairs. However, literature on information and data visualisation for online news in South Africa is limited. Furthermore, the emphasis is on

the need to further unpack the concept ‘digital’ because at this point, in the South African context, ‘digital’ is limited to social media activity rather than the incorporation of interactive narratives within the digital realm of news storytelling. Brems et al. (2016) opines that social media are increasingly embedded in everyday communication, thus challenging journalism to anticipate the changes in the news production media. However, this understanding is still limited to social media activity and discussion. Therefore, it can be argued that data journalism has come onto the African media landscape at an opportune time because it provides newer methods of disseminating information or data, particularly through non-linear interactive visualisation (Moyo, 2019).

#### **2.4 Impact of the Fourth Industrial Revolution (4IR) on faster broadband, internet connectivity, disruption and ICT advancement**

According to Pozdnyakova et al., (2019:11), “The revolutionary transition to The Fourth Industrial Revolution (4IR) in the 21<sup>st</sup> century was formed in the conditions of past industrial revolutions, which were accompanied by rise of production powers and transformation of the system of public production”. The First Industrial Revolution used water and steam power to mechanise production. The Second Industrial Revolution used electric power to create mass production. The Third Industrial Revolution used electronics and information technology to automate production. Now, the Fourth Industrial Revolution (4IR) is building on the Third Industrial Revolution, the digital revolution that has been occurring since the middle of the last century to advance technology into a phase of the Internet of Things (IoT), Artificial Intelligence (AI) and Machine Learning (ML) that allow for advanced human computer interaction. The concept of the 4IR was introduced by Professor Klaus Schwab, the founder and executive chairman of the World Economic Forum. Kenney, Rouvinen and Zysman (2015) further indicate that abundant, ubiquitous, and cheap ICT resources have the potential to alter business dynamics in most industries that are outside the core sectors; in fact, any information intensive process is experiencing a major change, the advancement of the technology that results in a change to the norm. 4IR is characterised by a fusion of technologies, thus blurring the lines between the physical, digital, and biological spheres. In comparison with previous industrial revolutions, the Fourth Industrial Revolution is evolving at an exponential, rather than a linear<sup>2</sup> pace

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<sup>2</sup>Progressing from one stage to another in a single series of steps; sequential.

consequently disrupting<sup>3</sup> almost every industry in every country, including the creative media sector.

According to Xu et al. (2018:93), “the fourth industrial revolution is more than just technology driven change, but rather, it is powered with disruptive innovation to positively impact our core industries”. Resultantly, the disruptive nature of technological advancement has transformed people’s lives, blurring the lines between the physical and digital spheres.

A typical example of such transformation manifests when one undertakes banking transactions on a bank’s website with convenience and ease. People are exposed to online shopping, with shoppers enjoying the convenience to purchase books from e-commerce websites such as “www.takealot.co.za” in South Africa and Amazon. Individuals can also purchase flight and bus tickets online. The online shopping option is also available for groceries in South Africa, although this option is still developing within the South African market.

The Fourth Industrial Revolution is quite unique and may even change what it means to be human, as it is all about the “internet of things,” the “internet of systems”, combining cyber-physical systems, where individuals oscillate between digital domains and offline reality using connected technology to enable and manage their lives (Miller, 2015).

The digital revolution in the banking sector typifies the characteristics of the Fourth Industrial Revolution (4IR), as exemplified by the First National Bank’s (FNB) option that enables client to open bank accounts using a ‘selfie’ taken from their mobile phones. The development of such helpful innovations owes its success to the bank’s digital migration strategy with financial transactions and app usage soaring to 10% and 66%, respectively in 2017. This has allowed frictionless<sup>4</sup> onboarding<sup>5</sup> through biometric facial verification on the FNB App for both consumers and business owners. Clients can now access the bank’s platform using a ‘selfie’ and open an account within minutes, with identity verification being done through the

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<sup>3</sup>Interrupt an activity or process.

<sup>4</sup>Achieved with little difficulty

<sup>5</sup>The process of integrating a new customer with one’s services

Department of Home Affairs. Clients will also be able to order and schedule courier delivery of new bank cards, switch debit orders, and immediately setup digital banking.

According to Veneruso et al. (2020), companies such as Zara have adopted the Augmented Reality (AR) approach in their retail shops, and they have installed smart totems that can detect the physical shape of the customers to allow them to virtually try on clothing in real-time. The retailers have also removed still window displays from their stores, replacing them with moving images of women modelling the latest fashion trends in the retail shops. However, this can only be enhanced by the augmented reality app as customers simply hold their phones up to the display window. The intersection between digital and online platforms is rapidly becoming the new wave of experiential retailing.

Interestingly, the article, ‘Times Live Leads the News Online’ – from The Sunday Times, 18 April 2021, reported the Times Live website as having recorded unprecedented increases in the number of registered users from April 2021 to July 2021. The most critical contributing factor to this phenomenon could be the increase in remote working, partial lockdowns instigated by the resurgence in COVID-19 infections in South Africa and access to technological devices. Against this backdrop, similar disruptive opportunities such as those taking place in the banking sector could be considered for online news platforms as well, particularly with a focus on disrupting the regular approach of visualised data and information for the online platform.

This evidence demonstrates innovative technological advancements currently being implemented in South African society, which gradually embraces the technological revolution. According to Pavlik and Bridges (2014), the convergence of digital technologies, the Internet, and mobile media dramatically transforms the content and storytelling possibilities of journalism and other media forms. “With globalization and advances in information technology, news and information about the African continent are much sought after commodities” (Mutambara, 2017:23).

Furthermore, Van Hooijdonk (2018:19) states that “dominated by technological changes, the world of business is experiencing unprecedented disruption. But rather than fight these changes, the most forward-thinking organisations are embracing them, integrating these new practices, technologies, and approaches into their business models”. This evidently demonstrates such change management, as “Media outlets are also learning from other

industries. The videogame industry, for example, is one step ahead in terms of garnering user loyalty” (Aviles, Prieto, Robles and Gonzalez, 2018:7).

Media outlets are bent on applying mechanisms typical of gamification to journalism, adapting them to digital platforms. Therefore, for South African news publishing companies to remain at par with the rapid growth of global online platforms, they ought to be innovative, upgrading their own online platform offerings by embracing change, integrating new practices and technologies, as well as investing in forward-thinking human resources in order to embrace the Fourth Industrial Revolution.

Shaub (2016:2) reiterates that, “we are witnessing profound shifts across all industries, marked by the emergence of new business models, the disruption of incumbents and the reshaping of production, consumption, transportation and delivery systems. On the societal front, a paradigm shift is underway in how we work and communicate, as well as how we express, inform and entertain ourselves”. This evidently has a profound effect on the media industry, especially the digital and online platforms.

Innovation, disruption, and collaborative thinking for embracing the technological renaissance within media was further demonstrated at Brazil, Russia, India, China, and South Africa (BRICS) developing countries nation media forum, held under the theme ‘BRICS Media Cooperation – Fostering an Inclusive, Just World Order’, from 18-19 July 2018. Dr Iqbal Surve, the chairman of the BRICS Business Council and Independent Media, stated: “the media around the globe is undergoing unprecedented changes. BRICS media should adapt to the trend and meet new challenges and use opportunities such as this forum to engage in high level talks, and mutual visits to share experiences, and learn from each other in the internet era” (The Star, 2018:2). The opportunities to embrace technological change and innovation are therefore presenting themselves. In South Africa, the challenges are that legacy thinkers rather than disruptors are still playing key decision-making roles within media, especially from a visual perspective encapsulated in the online platforms.

Gill (2016:7) posits that:

In South Africa, the newspaper industry is facing fundamental change. The combination of new reading platforms, new market entrants in digital businesses,

a stagnant economy and weak advertising market are forcing media owners to rethink business models, to innovate and to make tough structural decisions about their business.

This confirms the urgent need for innovative and unique news delivery formats in South Africa. Interestingly, Christensen (2016) some successful companies ultimately fail due to organisational impediments (Christensen, 2016). However, organisations that embrace improvement are better suited for exploiting radical technological change.

Globally, the digital revolution has heralded a new and prolific era of information. A typical example is the Time Magazine Publishers that fired three hundred employees through lay-offs or buyouts as the publisher struggles to transform its declining print business into an online one conforming to the digital age. According to Smith (2017), the Time Magazine Publishers plans to introduce the Sports-Illustrated Online Video Service incorporating documentaries and insights from the magazine's reporters, as part of its paradigm shift towards video. Although print media have undergone a traumatic contraction due to technological development and greater news content being consumed on digital platforms rather than on print platforms, traditional media are now adapting to multiple platforms for distribution. Content is also created to complement these platforms. Therefore, this example indicates that interactive information and data visualisation must be considered for content to complement digital and online platforms in enhancing content distribution in South Africa.

According to Velarde (2017), 90% of the information transmitted to people's brains is visual. People remember eighty per cent of what they have seen; conversely, they can only recall twenty per cent of what they have read. In South Africa, information retention can be perpetuated through the implementation of information and data visualisations for the online platform, amongst other media components. Media companies face challenges as they attempt to determine and capitalise on a platform that could increase and maintain the volume of users. With the rapid advancement with which the Fourth Industrial Revolution is unfolding, it would have to be the digital platform that propels it.

Koch (2012:55) aptly sums up the transformation of traditional news content towards a digital platform by reiterating that, "you don't need print for news anymore". In the online space, a user can access a news website during work (free for the user) and from their own home.

## **2.5 Internet access in South Africa**

The Statistics South Africa (Stats SA) estimated that the South African population reached 55.9-million people in June 2016, and the country reached the 40% internet penetration mark at the end of the same year. Furthermore, in an article, published in 2018, My Broadband magazine cited the International Telecommunications Union as having reported that South Africa added two million Internet users in 2017, with the number of Internet users growing to 30.81 million from 28.81 million, and thus placing the country's Internet penetration at 54%. This is significantly higher than the recent estimates from the 2017 Internet Access survey conducted in South Africa, which indicated that South Africa's Internet penetration would be approximately 40%. Additionally, the results of Google's 2017 Connected Consumer Study found that 65% of South Africans aged 16 and above are now online. South Africa's Internet penetration is three percentage points above the Southern African average, and one percentage point above the global average. These statistics indicate that South Africa's Internet user base grew by 7% from 2017 to 2018. This places South Africa on the thirteenth position in the world in terms of relative Internet user growth. To illustrate the surge of Internet penetration in South Africa, the Price Waterhouse Coopers Southern Africa report quantified the number of Internet users in South Africa as having reached 8.9-million in 2011, which was nearly twice the total of 4.6million in 2008. This growth had principally been driven by a surge in the number of mobile broadband users, which jumped to 5.8-million in 2011 from only 600,000 in 2008. This further demonstrates that there is a stable online connectivity structure accommodating the growing need to connect citizens to the Internet.

The Internet Access in South Africa 2017 report reveals that the commonest reason for using the Internet among South African adults is communication, as reported by almost a third (31%) of the respondents, followed by social networking (24.9%), searching for information (23.7%), with entertainment being the least (22.1%). Shopping and finance had been cited by only 15% of the respondents.

Goldstuck (2017) indicated that:

The findings emphasise the potential of the internet to enhance lives when we have greater penetration across all segments and demographics. Over time, we will see higher proportions of people engaging in a wider range of activity, but the barriers to more active use will first have to come down.

In view of these statistics and compared with the increasing competitive rates and opportunities available for fibre connectivity offered by telecommunication organisations, it is estimated that a fair percentage of users will continue undertaking light work or browsing on their laptops, tablets, or smart phones from home. These users are also constantly surf the Internet whilst working on their laptops. The most likely result is the increase in the volume of users occupying digital space. According to Varian (2010), “online news reading is predominantly a labour time activity, while offline news reading is primarily a leisure time activity. One of the big challenges facing the news industry is increasing involvement with the news during leisure hours, when readers have more time to look at news”. If news and data are presented in a format that incorporates visualization and interactivity, media platforms could be a unique selling point to lure users to consume news and information as compared to other media platforms used during leisure periods. Therefore, if news content is developed accordingly, it is most likely to attract more user attention and its subsequent use.

Di Biase (2011:266) further explains that “what we need to do is requalify paper, as a very convenient form of display which needs no batteries but is also very expensive and therefore must contain valuable, exclusive information. We specifically need to view the digital technologies as a great opportunity for a new business”.

Furthermore, De Biase (2011), is also of the view that by viewing digital technology as an opportunity to investigate new business models, it also refrains publications from becoming redundant, and their online offerings from becoming repetitive and boring. South African media companies must consider adapting to the digital technology.

According to Murdoch (2006:48), “there is only one way, that is by using our skills to create and distribute dynamic, exciting content, but newspapers will have to adapt as their readers demand news and sport on a variety of platforms: websites, iPods, mobile phones or laptops”. Murdock (2006:48) further opines that, “I believe traditional newspapers have many years of life left but, equally, I think in the future that newsprint and ink will be just one of many channels to our readers”. Clearly, content ought to be repurposed to suit the needs of a contemporary audience.

An example of innovative choices in the news publishing domain manifests in the test phase, where Facebook has undertaken to test premium news models that allow users to purchase newspaper subscriptions through its instant article format. Facebook did this in partnership with news organisations in the United States of America and Europe. News publications included in the test were Germany's Bild and Spiegel, France's Le Parisien, Italy's La Repubblica, the Telegraph and the Economist of Britain and the US-based Boston Globe, Washington Post, and news groups - Hearst and Tronc, which include the Baltimore Sun, Los Angeles Times, and San Diego Union-Tribune.

The African continent is perceived as having relatively under-developed ICT strategies. In most African countries, ICT strategies are characterised by an emphasis on the need to address the lack of infrastructure and a sound regulatory environment. Some of these countries have favoured privatisation to address issues of lack of infrastructure and access to the internet. While some African countries are described as late adopters, South Africa has been among the early adopters of ICT. In South Africa, the growth of the digital economy from 2010 to 2015 has been negligible, though it was expected to accelerate by 12.1 per cent from 2016 to 2020, indicating the strong momentum with which South Africa is progressing towards the new digital era (Seedat, 2017). These statistics further show the prevalence of an emerging digital culture in South Africa. News media organisations must take advantage of these opportunities and embrace digital innovation to churn out unique products for their online platforms.

The Effective Measure (EM) released its February 2018 Internet demographics statistics for South Africa. The Effective Measure, which is an official traffic measurement partner of the IAB South Africa, provides accurate traffic and demographics statistics for South Africa's top websites. In February, the Effective Measure performed 285 000 demographics surveys on South African Internet users. The survey data showed an almost even male and female split regarding the gender of internet users in South Africa. Data also showed that most local Internet users were below the age of 35, and mainly resided in cities and large towns. Table 2.1 below provides an overview of the results of the Effective Measure February 2017 Demographics Survey:

**Table 2.1: The Effective Measure Demographics Survey-February 2017**

South Africa's Internet Population	

<b>Gender</b>	<b>Percentage</b>
Male	50.94%
Female	49.06%
<b>Age</b>	<b>Percentage</b>
15-18 years	10.06%
20-24 years	22.77%
25-34 years	32.94%
35-44 years	16.89%
45-49 years	6.37%
50-54 years	3.06%
55-64 years	4.73%
65+ years	3.18%
<b>Size of community internet users live in</b>	<b>Percentage</b>
Metro – Major city: +250 000	28.01%
City/Large town: 40 000 – 250 000	40.23%
Small town/villages (500 – 39,999)	24.53%
Settlement/Rural (under 500)	7.24%
<b>Highest level of education</b>	<b>Percentage</b>
No school or some primary school	2.22%
Some high school	14.98%
Matric	40.58%
Technikon diploma / Artisan certificate	23.27%
University degree	18.96%
<b>Work status</b>	<b>Percentage</b>
Student/scholar	10.68%
Work (full time)/self-employed	46.68%
Work (part-time)	10.31%
Retired	3.92%

Not working	11.59%
Unemployed	16.83%
<b>Provincial statistics</b>	<b>Percentage</b>
Eastern Cape	7.53%
Free State	3.97%
Gauteng	38.73%
KZN	16.68%
Limpopo	7.88%
Mpumalanga	6.42%
North West	4.27%
Northern Cape	1.57%
Western Cape	12.95%
<b>Metro statistics</b>	<b>Percentage</b>
Cape Town	12.74%
Greater Johannesburg	16.82%
East Rand	10.05%
West Rand	2.91%
Soweto	4.77%
Vaal	1.36%
Pretoria	14.43%
Port Elizabeth/Uitenhage	4.90%
East London	2.21%
Durban	10.65%
Pietermaritzburg	1.05%

Bloemfontein	2.70%
Kimberley	0.22%
eMalahleni/Witbank	1.10%
Other	14.09%
<b>Devices used to access the Internet</b>	<b>Percentage</b>
Desktop personal computer	9.37%
Work or personal laptop	16.47%
Mobile phone	62.77%
Tablet	7.46%
Other device	1.94%
Do not know	1.98%
<b>Type of connection used to access the Internet</b>	<b>Percentage</b>
Dial-up	4.97%
ADSL	36.58%
Mobile data	26.78%
Fibre	12.81%
Do not know	18.87%
<b>Purpose of regular use of Internet</b>	<b>Percentage</b>
Search	81.21%
Email	68.15%
Social networking	53.61%
Instant messaging	47.90%
Banking	41.44%
Check the weather	36.86%

Download apps	34.16%
Reading online newspaper or magazine	30.07%
Reading news online	28.85%
Music downloads	28.49%
Use maps	28.07%
Access listing sites	27.41%
Travel bookings	22.32%
Access classified advertising websites	22.11%
Stream Videos online	19.09%
Entertainment bookings	18.44%
Purchase goods or services	18.20%
Make calls on the Internet	17.74%
Play games	17.60%
Stream online TV programmes	12.93%
Other Internet activities not mentioned previously	11.77%
Listen to radio	11.40%
Subscribe to receive content or services	9.82%
Access auction websites	9.70%
Download a podcast	6.20%
Share trading	4.20%
Dating	3.94%
Gambling	2.23%

Source: INTERACTIVE ADVERTISING BUREAU OF SOUTH AFRICA

In line with the above statistics, Brynjolfsson and McAfee (2014: 9) expressed that:

The transformations brought about by digital technologies will be profoundly beneficial ones. We're heading into an era that won't just be different; it will be better, because we'll be able to increase both the variety and the volume of our consumption.

Clearly, the statistics in the table above indicate that the percentage of users using the Internet for reading the online newspaper and magazine is 30.0%, whereas the percentage of users reading online news is 28.85%. This is typical of the trending phenomenon amongst users, which gravitates towards accessing news content via the online platform. This trend sets the pace with regards to piloting the use of interactive information and data visualisation for online news platforms in South Africa.

According to Bandelli (2018), art constitutes the core of the activities that shape the Fourth Industrial Revolution. Bandelli (2018) <sup>6</sup>further explains that:

Art and design enables us to leapfrog the shortcomings of current technologies and give us the possibility to deep dive into the consequences of futuristic “what if” scenarios. Today more than ever, art is necessary to build an emotional framework to make sense of the dialogues at the core of the 4IR. Art and culture build trust, the trust we need to bridge conflicting views and interest, to overcome current barriers and obstacles with dynamic and innovative approaches, and to understand the values that are embedded in any process of technological innovation.

<https://www.weforum.org/agenda/2018/03/here-s-how-art-activates-the-fourth-industrial-revolution/>

In view of this scenario, it is imperative to be cognisant of the reality of embedding art and design into prototyping and innovating. Art and design forms the foundational phase for the development of interactive information and data visualisation. If information and data visualisation specialists are given the freedom to develop and prototype such innovations for online news platforms in South Africa, the possibilities to innovate through visualisation can become endless.

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<sup>6</sup> <https://www.weforum.org/agenda/2018/03/here-s-how-art-activates-the-fourth-industrial-revolution/>

## CHAPTER 3

### THEORETICAL FRAMEWORK

#### 3.1 Introduction

A content user is simply a reader and observer of content for the print platform; thus, the reader cannot interact with the content. Comparatively, the online experience is two-way, as it allows readers to contribute through interaction with the content (Levison, 1999). This occurs when the content is presented in an interactive and non-linear manner, with hypertext and hypermedia. Transforming online visual content into a non-linear interactive experience allows the user to become not only a reader, but also an engager with the online visual content. The user, therefore, interacts with the content; this also stimulates higher information intake and retention rates, which is beneficial to the user. However, if innovative interventions are not undertaken for online news platforms, media organisations will risk being perpetually isolated and stuck in the past in an era of rapidly evolving technological innovations, with online media content appearing redundant and stale. The experience of visual content for the online platform will remain static, boring and unappealing to users, thus reducing online user attention. Subsequently, hypertextuality has superseded linearity to such an extent that it has become one of the predominant foci in communication (Newhagen and Rafaeli, 1996).

According to Anfara and Mertz (2015), there are many theoretical frameworks available in many different fields of study. Anfara and Mertz (2015) further reiterate that it is this diversity of theoretical frameworks that allows researchers to determine in new and different ways what seems ordinary and familiar. In defining any theoretical framework, researchers understand certain aspects of the phenomenon being studied.

Mills (1993) defined a theory as an analytical and interpretive framework that helps the researcher to interpret what obtains in the social setting being studied. A study's theoretical framework affects every aspect of a study and determines how to frame the purpose and problem underpinning the study and decides what to look for in making sense of the collected data; therefore, research theory underlies all the research (Merriam, 2009).

In addition, a theory plays a substantive role in the research process. Therefore, this chapter outlines the Contextual Constructivist Theory (CCT) and the Social Media Theory as well as

Gestalt's principles of aesthetics, which form the theoretical framework underpinning the current study.

### **3.2 The Contextual Constructivist Theory (CCT)**

According to Raskin (2002), constructivist psychology theorises about and investigates how human beings create systems that foster a meaningful understanding of their world and experiences. Visualisation through visual imagery has been an effective way of communicating both abstract and concrete ideas. This is evident in the deconstruction of cave paintings and Egyptian hieroglyphics, which were regarded then as effective systems of communication. Interestingly, semiotics deals with those general principles which underlie the structure of all signs and with the character of their utilisation within messages as well as with the specifics of the various sign systems and of the diverse messages using those different kinds of signs (Jakobson, 1968). However, Mogahoa (2014:57) advanced the agenda-setting theory by stating that “contextual constructivism is concerned with social construction of knowledge and the application of the knowledge”. The world is composed of facts and the goal of knowledge is to provide a literal account of the reality that constitutes that world (Sayers, 1981). Similarly, the objective of information and data visualisation is to ensure the simplest and easiest form of transferring knowledge and information to an audience. The aesthetic design of that information does contribute towards effective user engagement with the information. Underpinning this view, Bollini (2014:589) argues that “the issue of the aesthetic dimension in design disciplines is always central and critical”. The aesthetic provides a clear and enjoyable experience. Using the basic rules of visual language creates a well-organised and pleasant interface that supports the users in building a strong mental model and cognitive comprehension of the information (Bollini, 2014).

Fusch (2016) argues for the necessity of social relations, including social production, communication, social relations of production, a certain degree of co-operation, consumption, and the social use of the means of production. Due to advancement in technologies and the digital medium, one of the current theoretical tasks for critical theory is to stress the changes of value in the digital age (Fischer and Fusch, 2015). The disruptive nature of technological advancement has contributed to the gradual change in media consumption. More citizens are accessing media content via digital devices as evidenced by the drastic decrease in newspaper sales. Ripolles and Castillo (2013) confirm that the consumption of online news has increased

substantially; however, the sector's current business model faces many challenges due to the late adoption by newspapers of the news model produced by digital convergence. Remote and online approach to work, especially during the lockdown periods induced by the COVID-19 pandemic, has also motivated more users to access news content and content in general through the digital platform. This behaviour transformation motivates online news divisions to enhance their presentation of information and data graphics through the online platform. Congruently, Ryan (2004) explains that readers ought to analyse the specific characteristics of digital language, since the intrinsic properties of a medium shape the form of the narrative and affect the narrative experience. Marie-Laure Ryan (2007) also subscribes to this point of view. Historians of technology would regard daily newspapers as a manifestation of the same medium as books, since they rely on roughly the same printing techniques; however, narratologists would defend their medium status with respect to books by pointing out that the daily press promoted a new style of reporting news, which resulted in an autonomous narrative genre (Ryan, 2004). This is fundamentally the genre that uses non-linear interactive visualisation of information and data for online news graphics.

Knight and Cross (2012) further reiterate that what is central to the CCT is that all research involves the fusion of two key elements, that is;

- 1) Context and
- 2) Cognitively driven constructs.

Equally, there is a need to determine the characteristics that inform and influence the relationship between the two. The research context borders on the conceptualisation of how the research object will be investigated (Ellis and Levy, 2008; Kerlinger and Lee, 2000). The second concept of constructs is that research, as a mode of inquiry, is constructed whereby the researcher must find ways of building abstracted constructs that are used to describe the phenomena being investigated.

Equally important is the need to describe the co-dependent nature of these two central concepts of the Contextual Constructivist Theory since constructs are seen as not existing outside of a context which, in turn, is said to have an influence on the development of the research constructs. However, the Contextual Constructivist Theory also provides over-arching scaffolding for research that requires the conceptualisation of both constructs and context, which is ideal for unpacking complex, real world problems (Knight and Cross, 2012).

Comparatively, the non-linear interactive visualisation of information and data allows for inter-dependent use of multimedia, which enhances the process of absorbing complex information and data. Since the fusion of context and cognitively driven constructs are key elements to the CCT, this theory can play a pivotal role in determining how interactive information visuals connect with online users, particularly from an interface design and user experience perspective. This is a critical element that lack within South African news web interfaces discussed in samples Figures 5.42 – 5.49, further demonstrating how the human visual system alleviates the processing of large amounts of information through visual means.

### **3.3 The Social Media Theory (SMT)**

Traditionally, information was disseminated to the public through print, radio, television and advertising in these media were the key outlets of sharing information publicly. Habermas (1991), provided the foundational ideas of a public sphere and ideal communicative acts, thus emphasising widespread public participation, sharing information with the public, reaching consensus through public dialogue rather than exercise of power, avoiding privileging experts and bureaucrats (Aygyris and Schon, 1974; Innes, 1995; Lauria and Soll, 1996; Wilson, 1997). This aligns to the objectives of media such as print, radio and television to disseminate information. Similarly, the online platform can be seen as an evolution of the traditional platforms (print, radio, television) of disseminating information.

Ayerdi et al. (2014) explain that asynchronicity and synchronicity are no longer the privileges of any particular medium; therefore, newspaper newsrooms are gradually learning how to integrate video, sound or infographics with text. Despite the evolution of the distribution method of information, the principle still aligns to Habermas' theoretical basis of sharing information with the public. The need to access news online has combined all the traditional mediums (print, radio, and television) into a single digital distribution platform. Interactive information and data visualisation can be seen as an extended element in terms of conveying that information for the public domain. However, non-linear interactivity is fused into content on many international news websites such as The New York Times, The Straits Times, to add pizzazz to the user's experience as a whole in comparison with traditional mediums which are static and linear as evidenced by South African news websites.

Interestingly, Habermas (1991:226) said, “I am of the opinion that social pathologies can be understood as forms of manifestation of systematically distorted communication”. If that is the case, then one must be able to use a theory of communication to analyse the normal patterns of undistorted communication, thus transmitting cultural knowledge in the process of achieving a mutual understanding.

Wessler (2018:7) indicated that Habermas (1991) used the term “public sphere” in a relatively specific fashion, an arena in which citizens discuss matters of common concern in such a way that the power of the better argument reigns instead of the socioeconomic position of the speaker. Comparatively, it can be argued that at present, digital mediums and digital content provide similar opportunities for citizens to access information free from their socio-economic limitations, and power status, a special and irreplaceable form of activism in a technological society. The advantages of such disruptions are that it provides the opportunity for all citizens to access information through digital means. Feenberg (2017) concurs with this opinion, reiterating that in recent years there has been public debate on technological issues that were formerly considered beyond the bounds of discussion. However, due to the expansion of the public sphere, new forms of technical agencies have emerged.

The Department of Communications and Digital Technologies bears testimony to this, as it channels such directives through its State-owned agency, the National Electronic Media Institute of South Africa (NEMISA). The NEMISA’s mandate in e-skilling the nation with digital and technological skills and knowledge, is to eradicate the notion of racial, social, and power status in terms of accessing these beneficial powers, but rather a benefit for all citizens, thus bridging the digital divide and re-orienting all citizens towards becoming e-citizens.

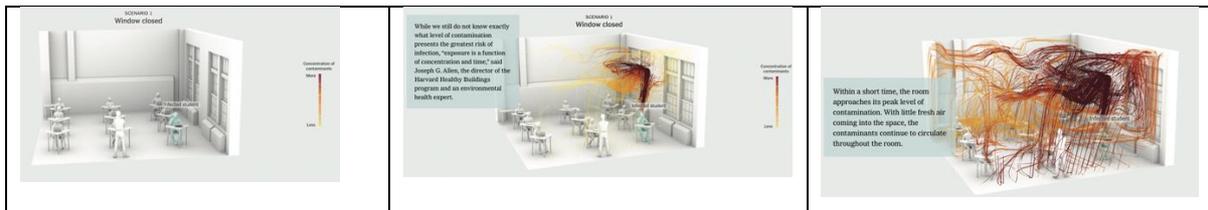
This is similar to what Habermas (1991) refers to as the ‘private realm’, referring to “private citizens” who act in it as opposed to bearers of public authority and State function. The purpose of accelerating the acquisition of digital skills by all citizens is to exploit the vast access of information and knowledge through digital mediums, a result of technological advancement. This aligns to the preparation of all e-citizens, ultimately contributing towards a more scaffolded interaction with digital content, particularly visualised information and data through digital channels and platforms.

Although Harbemas (1991) has not theorised on digital communication (internet, social media and mobile media), Fusch (2016) implied that the internet, social and mobile media cannot be ignored because new communications technologies are among many realities, and the internet's power structures are not profoundly different from those of traditional mass media. However, Castillo (2013) asserts that the reason online newspapers face increasing competition is particularly related to the increased use of social media and online websites. The online digital space also provides a wider range of interesting options with regard to access to information. The debate between Harbemas and Marcuse over technology re-emerges where the former argues that the latter was right after all to claim that technology is socially determined (Feenberg, 1996). Eltantawy and Wiest (2011) subscribe to this view, suggesting that new communication technologies, especially social media via the Internet, have become important resources for the mobilisation of collective action and the subsequent creation, organisation and implementation of social movements worldwide. Technology has proved to be historical and reflexive, like the essence of other social institutions. Comparatively, the essence of being informed, the access to information and the impact of this towards developing a knowledge economy in present times cannot be ignored. However, with particular reference to news, the challenge manifests in the information presentation format, especially within the context of the debate around the future of newspapers and the likelihood of digital media replacing print media (Meyer, 2009).

It is interesting to note that in their research, Ripolles and Castillo (2013) present on some online news websites content that is equivalent to that in the print edition and is provided in the Portable Document Format (PDF) with no multimedia and interactive resources, which demonstrates poor exploitation of the possibilities presented by the digital universe. This view dovetails with the main research problem: "The problem is that information and data visualization for online news in South Africa lacks in the use of non-linear interactivity for innovative presentation, despite the acceleration in digital development"(see pages, 10-11). Therefore, storytelling approaches that evoke human responses, spark human interest and simply communicate information with the intention of informing the audience can be shared imaginatively, evoking the desired effect of identifying the experience with the user (Feenberg, 2017). A perfect example of the possibilities in terms of addressing poor exploitation of digital technology is demonstrated in the information visualisation from the New York Times (<https://www.nytimes.com/interactive/2021/02/26/science/reopen-schools-safety-ventilation.html>) that effectively shows the benefits of opening windows as a key to the

reopening of schools in United States of America (USA) after the lockdown period during the COVID-19 pandemic. In view of this example, an opportunity could therefore have presented itself with regard to supporting the visualisation of information and data for digital news platforms within the South African context.

**Figure 3.1: The benefits of opening windows in a classroom during the COVID-19 Pandemic**



Source: <https://www.nytimes.com/interactive/2021/02/26/science/reopen-schools-safety-ventilation.html>

### 3.4 Information design and online information graphics

According to Daniyaal (2001:9), “semiosis is the biological capacity that underlies the production and comprehension of signs”. The study area is dominated by philosophers such as Ferdinand de Saussure (1959), who was the founding member of a group of structuralist philosophers who believed that all representations have value and meaning to those that understand and agree to them. Therefore, it is reasonable to consider visualisation as communications since the human mind can perceive the visual information transfer in a short time and in a more efficient and permanent way compared to written or verbal information transfer, Uyan Dur (2014:40). Although information design is associated with the age of technology, it has its historical roots in the Egyptian period, where it functioned as a way of communicating through simple visuals. As Horn (1999) noted that Egyptian scribes sat every day in the marketplace and wrote hieroglyphic<sup>7</sup> letters, reports, memos, and proposals for their clients. The pictures and symbols used in hieroglyphics were used to represent objects, concepts, or sound to inform and transfer information. Similarly, Simlinger (2007) avers that information refers to the result of manipulating, organising, and processing data in a way that adds to the knowledge of the person receiving it.

<sup>7</sup>Hieroglyphics are symbols in the form of pictures which are used in writing systems in ancient Egypt.

Contemporary information designers seek to edify more than persuade, to exchange ideas rather than foist them on users (Jacobson, 1999). Whilst advertising design is about persuading the customer to take a course of action, information design presents all the objective data required to enable the user to make decisions. Horn (1999) defines information design as the art and science of preparing information for effective and efficient use by human beings. It addresses the organisation and presentation of data, transforming it into valuable, meaningful information. According to McLuhan (1994:6), “De Tocqueville in his earlier work on the French Revolution, had explained how it was the printed word that achieved cultural saturation in the eighteenth century”. Furthermore, the typographic principles of uniformity, continuity and linearity overlaid the complexities of the ancient, feudal, and oral society, motivating the new literati and lawyers to lead the French Revolution. The title Information Design does have many egos or identities. For example, it is referred to as information graphics in newspapers and magazines, scientific visualisations in research and science projects and presentation graphics in business. However, information design, as a discipline, is ultimately the efficient communication of information as its primary task despite the many titles it is referenced to.

The history of information design can be traced back to the Eleventh Century. The Bayeux Tapestry is an interesting example that demonstrates the history of information design since it is laden with Latin subtitles and graphical events depicting the events of the Norman invasion of the Anglo-Saxon Kingdom of Harold. In addition, Cohen (1984:128) suggested that “Florence Nightingale is credited with inventing new types of statistical graphs and being of the first to use information design in a public policy report”. Furthermore, during the 1850s, little was understood about germs; therefore, the outbreak of cholera was a mystery. In 1854, Dr John Snow created a map depicting cholera outbreaks in London. The map displayed each death in the form of a bar, thus visualising the data. This information design enabled analysts to conclude that the cholera cases were clustered around a specific region of London, which made it easier to determine the root cause of the disease. Downs (2017:66) notes that “concepts like distance and quantity are easier to comprehend in visuals. It is more intuitive for people to see those concepts than read descriptions of them encoded in text.” Other examples of historical information design include Charles Joseph Minard’s 1861 diagram depicting Napoleon’s Russia Campaign of 1812 and Otto Neurath’s International Picture Language of the 1930s.

Information gives meaning to statistics and facts (also known as data) collected for an audience or user. According to Shedroff (1994:2), “transforming data into information is accomplished

by organizing it into a meaningful form, presenting it in meaningful and appropriate ways and communicating the context around it”. Shedroff (1994) further indicates that information can be transformed into knowledge, and therefore into wisdom. When users are exposed to information, they learn something from it. The process of gaining new knowledge from the information results in the user becoming more knowledgeable about the content that they would have been interacting with, thus enhancing the user’s wisdom. Data are worthless to most of us; they are a product of research or creation and an inadequate product for communication. For data to have informational value, they must be organised, transformed, and presented in a meaningful way (Wurman, 1989). The most important elements of communication are clarity, un-complexity, and effective presentation of information, just to name a few. Shedroff (1994:3) further indicates that “there is no reason why elegantly structured or well architected data cannot also be beautiful. Information design is not meant to replace graphic design and other visual disciplines but to provide the framework for expressing these capabilities”.

Within the entire discipline of information design, graphic design is the most omnipresent mode of design. This derives from the traditional legacy of the print platform particularly posters and business cards among others. A further analysis of graphic design (GD) shows that visualisation is often combined with textual information as well. Sometimes, the use of visuals only can also be a powerful communication tool in graphic design. Hansen (1988) acknowledges the existence of different spoken and textual languages, thus there are different graphical languages as well. She further argues that the skilful deployment of these languages can accomplish many different ends. In an era where information imposes order in a chaotic reality, visualisation of that information intensifies the restoration of order for consumption by an audience.

At global level, the volume of information is currently increasing rapidly. The dissemination of information is also becoming more complex. In the contemporary society, agility, whether physical, emotional, or technological, has resulted in information becoming more crucial than ever before. Displaying information in an easy-to-understand graphic format or data visualisations is important to communicate information efficiently in society. Wildbur and Burke (1998) describe the information designer as a transformer of information – whether in the form of raw data or a set of actions or a process – into a visual model capable of revealing

its essence in terms which audiences can easily grasp. The transformer is the expert who successfully steers the spectator's attention (Neurath, Haller and Rutte, 1981).

However, one cannot assume that written information, whether it is in the form of an explanation, figures, or data, is the most effective mode of communication. Shedroff (1994) argues that the first step towards transforming data into information is to explore its organisation. Ultimately, the visualisation of information is designed for the user or consumer of the content. The information designer must always consider this important factor before attempting the visualisation process to transforming information into an interactive consumable.

The advent of personal computers transformed the information design process from traditional techniques to the use of computer software. Further development resulted in updated and more advanced operating systems, with larger memory storage capacity for data storage. These technological changes affected the way designers worked, including the output of their work, which eventually gave birth to desktop publishing (DTP)<sup>8</sup>. Tuck (1989:29) noted, "thanks to desktop publishing, communication became easier by making the printed product more readable and presentable". Desktop publishing programmes typically allow the author of a document to specify a layout for the document prior to entering content into the document. This meant that the design process and output, especially of news content, became faster. Technological advancement created an opportunity for designers to experiment and innovate on the computer. According to Ulmanu (2017:64), "today, technology allows us to dissolve the borders between text, visuals, and other elements to offer a better, more natural way of consuming the news." The advancement in computer software allowed designers to paint, draw, and type on the computer, thus providing tools to create compelling and effective information visualisation and layout for the print format. This advancement also enabled the amalgamation of typography, graphics, moving images, sound, and music. Thus, designers could apply motion and interaction to the information visual on an interface platform which, according to Bellantoni and Woolam (2000), is an emerging discipline with four loosely related titles: Time Based Typography; Kinetic Typography; Dimensional Typography and Motion Graphics.

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<sup>8</sup>Desktop Publishing (DTP) is the production of design products designed on a computer with specific software for layout and design. Have a section with abbreviations as well.

According to Carlson (2015:8), “changes in news gathering have led journalists to integrate new, technological specific forms of work, such as photo-journalism, and later, computer assisted reporting in their news practice”. Throughout history, technological changes have influenced the work of designers and visual journalists working for the print and digital platforms. The newspaper sector has changed forever. Technology has been a transformative factor in the media sector, which is adjusting itself in the aftermath of mass circulation of newspapers. The work of designers now overlaps into the discipline of journalism, with interaction and basic software development being applied through methods such as action scripting, animation, interactive storytelling, thus empowering their visual end-products with motion and interactivity. Roels et al (2017) commented that the rise in the so-called narrative visualisations or visualisations has helped storytellers to tell stories with data.

However, during the early nineties, the approach to news production incorporating the visualisation of news data was still traditional. The Web was seen as something meant for kids, a new video game that would soon go out of fashion (Sabadin, 2007). Stassen (2010) confirms that “the consumption of news was previously limited to reading the newspaper, listening to the news on the radio, or watching news on television”. However, although the Internet changed the way people consumed news, decision-makers were not visionaries that would predict the power of the internet. They were orthodox in their thinking and methods. The print platform was still considered a prestigious product; therefore, investment in new mediums, such as the online one, was not considered a worthy endeavour in that regard. Information visualisation at that time was orthodox and boring. This influenced the reproduction of the linear look and feel of the print editions, for the online platform. In contrast to the linear reproduction of the print look and feel for the online platform, Rafeeq (2014:29) notes that “The traditional top-down model of print journalism has been made irrelevant as a result of technological advancements, empowering media users in a bottom-up model of communication”. Therefore, the technological disruption to a traditional way of thought for online news visualisation and data provides opportunities for SA media companies to explore innovative methods for their online news visualisations, particularly with the integration of nonlinear interactive multimedia in their online visual offerings.

In the meantime, online media have moved forward. According to Bly (2018:94), “infographics (IG)<sup>9</sup> are very popular right now; in fact, infographics are liked and shared on social media three times more than any other type of content.” As the circulation of the current print newspaper drops, the rates of Internet connection increase. It is estimated that over one billion people are connected to the internet globally. Technology has evolved in several different directions which all share a common element: a creative attitude on the part of the people who made it evolve, an attitude which is not limited to exploiting the potential of the Internet but somehow attempts to add to this potential, because the Internet is not just what it is: it is also what we want to be (De Biase, 2011).

According to Porter (2013), a clear and intelligible infographic could communicate as much information in an instant as a five-hundred-word story that would take several minutes to read, as the idiom implies, “a picture says a thousand words.” In the South African context, it is common for the audience to view photographs, whether they are still images within a news website serving as pivotal elements of visual communication in a newspaper. According to Nussbaun (2007), “the problem is with editors who don’t understand the discipline of design and what kind of power it has”. In some cases, though unknown to the reader or user, it is unfortunate that pictures often serve to fill space in a news setting, irrespective of whether it is for a print or an online platform.

Information graphics, on the other hand, does not “say a thousand words” in comparison with a news story. Information graphics presents all the objective data required to enable the user to make a decision (Wilbur and Burke, 1998). Information graphics is precise and detailed in the communication of the information and it is not as ambiguous as some photographs may appear.

Information Design has become more dynamic and interactive in the delivery of online news. The visualised design and storytelling approach has made the content more memorable for the viewer. According to Franchi (2014), the advent of the internet, despite all the reservation one might have about it, has clearly created new difficulties for the old newspaper business. It does not make much sense for editorial decision-makers to oppose the wave of the Web; hence, it is time for newspapers to develop strategies that would enable them to ride the wave of technology rather than fighting it. Franchi (2014) further explains that advocates of total

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<sup>9</sup>An infographic is a visual representation of information or data, for example, as a chart or diagram.

integration claim that old heads of the editorial staff are incapable of overseeing a multimedia<sup>10</sup> newsroom and they hope to see the responsibility being handed over to people knowledgeable about the online platform.

Information visualisation for online news in South Africa has somewhat lacked in interactivity, innovation, and a presentation format suitable for online platforms despite the acceleration in the development in digital technology. This study avers that online news in South Africa is a digital replica of a traditional newspaper, extensively relying on the use of still photographs to accompany text. Although text and photographs are multimedia elements, they are used in a static, linear format. The lack of interaction has led some researchers to conclude that most online newspapers are mere mirrors of their printed versions, where content from the latter is simply “lifted” into the former without substantial augmentation. Chyi, Sylvie and Riley (1998) and Schultz (1999) stated that the transferring of content from print to Web is often referred to as “shovelware” journalism, indicating little or no adaptation to the new medium. This is precisely the problem confronting online news in the South African perspective. Information graphics and data visualisations are often used in newspapers to fill space in the content layout.

Comparatively, this thinking is adopted for the online news platform as well. Simply shifting information from the print newspaper to an online platform does not demonstrate innovation. The same applies to the utilisation of information visualisations for newspaper and online news platforms. Adaptation to a new medium must be considered to embrace innovation in the current era of digital renaissance. According to Ulmanu (2017:65), “as devices gain new functionalities, they shape the way we consume content. Today, technology allows us to dissolve the borders between text, visuals, and other elements to offer a better, more natural way of consuming news.” Adaptation to the new online medium must be considered to embrace innovation in the current era of digital renaissance. Serrano (2017) reiterates that infographics is a powerful tool that has become indispensable to journalism. It showcases models, tendencies and connections that would have otherwise remained obscure. It helps people understand the world around them.

### **3.5 Data visualisation**

Large volumes of data and the ever-growing access people have to more information had been the driving force behind the wave of technological change sweeping across all industries.

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<sup>10</sup>The combination of text, graphics, video, sound and animation as a whole or part of as a means to communicate information.

However, all the available data is useless if it cannot be understood. An understanding of information design starts with the essential view that the vast volume of things that bombard our senses everyday does not represent pieces of information but mere data (Shedroff, 1994). Data visualisation is about how to present your data to the right people at the right time to enable them to gain insights into content most effectively. Fortunately, visualisation solutions are evolving as rapidly as the technological advancements. Charts, videos, information graphics and augmented reality presentations offer increasingly engaging communication options. Visualisation is a vital topic in computer literate culture, and artists and designers can play an essential role in the transformation of visualising data. According to Viegas (2007: 182),

Information visualization is traditionally viewed as a tool for data exploration and hypothesis formation. Because of its roots in scientific reasoning, visualization has traditionally been viewed as an analytical tool for sense-making. Both the mainstreaming of computer graphics and democratization of data sources on the internet have had important repercussions in the field of information visualization. With the ability to create visual representations of data on computers, artists and designers have taken matters into their own hands and expanded the conceptual horizon of data visualization as artistic practice.

In an era where Information, Communication and Technology (ICT) are merging and presenting the emergence of interestingly new possibilities and offering symbiotic relationships to each other, it is sensible that designers experiment with technology to develop novel techniques, such as visualising data.

The core purpose of visualising data is to ensure that the consumer of the content understands the data being communicated, which they may not interpret clearly in its true sense (Roels, Baeten and Signer, 2017). It is also imperative to adhere to the principles of design to increase the quality of data visualisation. Sendpoints Publishing, in their book titled *Graphic User Interface Design* (2015:8), confirms that “Graphic User Interface (GUI) is one of the first things to consider since it enables users to have efficient and rewarding access to information. A project may be superbly created but if the GUI (visualisation) is not well designed, those advantages are unlikely to be of help”. Therefore, the purpose of and output in adhering to design principles results in effective data visualisation presentation, avoiding distraction and confusion, reducing cognitive<sup>11</sup> load and adding aesthetic value. Data visualisation and

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<sup>11</sup> The mental process of perception, memory, reasoning and knowing.

infographics that are well designed in terms of visuality aim to visually present and transfer intense and sophisticated information on a certain subject in a more comprehensible manner (Uyan Dur, 2014).

Visualisation is the transformation of symbolic representation to geometric representation. The goal of visualisation is to analyse, explore, discover, illustrate, and communicate information in clearly understandable forms (Khan and Khan, 2011). Illiteracy was at its peak during medieval period in Europe. During this period, book designers created illuminated manuscripts in which the text was supplemented by elaborate decorations and visuals. The decorations and visuals enhanced literacy for the illiterate. Similarly, data visualisations fostered effective comprehension of data in the digital era. In 2014, a team of researchers from New York University conducted several experiments to measure how persuasive charts were in comparison with textual information. Interestingly, many participants’ minds were changed by the charts, particularly if they did not have a strong pre-existing opinion about the topics on the charts (Cairo, 2019).

When communicating with data, it is imperative to ensure that the data is visually appealing to users. Llinsky (2010) identifies four criteria to define the beauty of visualisation.

**Table 3.1: Criteria to define the beauty of visualisation**

<b>Information</b>	Successfully conveys information or data
<b>Efficient</b>	Simple, focused, clear and straightforward
<b>Aesthetic</b>	Uses axes, layout, shape, colours, lines and typography appropriately (Principles of design)
<b>Novel</b>	Be creative and attract readers with new design

Source: Nesbitt and Friedrich (2002)

According to Llinsky (2010), visual treatments and aesthetics can redundantly encode information, thus helping the reader differentiate, perceive, and learn information quickly and easily thus aiding understanding of content. Aesthetics for data visualisation should not be

different for the online news platform. Recent technological advances have led to more dynamic and interactive data visualisations. The data, whether text or statistical, can be transformed into an interactive visual for a higher retention rate and effective transfer of information for the user.

According to Knaflic (2015), in data visualisation – and communicating with data in general – spending time making aesthetically pleasing designs could mean audiences will have more patience with visuals, increasing the chance of success in getting the message across. Studies have shown that more aesthetic designs are not only perceived as easier to use, but are also viewed as more readily accepted and used over time by the audience. These also promote the development of creative thinking and problem-solving competences, thus fostering positive relationships and making people more tolerant of problems with designs, such as limited aesthetics of the design. Consequently, people perceive more aesthetic designs as easier to use than less aesthetic designs. Data visualisations are not about producing visual elements for their own sake, but about telling a story in the most efficient and relevant way possible for the online user.

According to Fry (2007:5), “software-based information visualization adds building blocks for interacting with and representing various kinds of abstract data, but typically these methods undervalue the aesthetic<sup>12</sup> principles of visual design rather than embrace their strength as a necessary aid to effective communication.” The principles of design underpin the aesthetic design and, the creation of data visualisations. Effective implementation of design elements such as colour, alignment, and spacing can be transparent in the design only if the data visualisation is executed effectively. If the elements in the data visualisation are not effectively aligned to one another, or the choice of colours used to visualise the data is multi-coloured, or the spacing of elements in the data visualisation is not appropriate, then the data visualisation will appear disorganised and unappealing to the viewer. Cawthon (2007) further expressed the notion that the aesthetic value seems currently under-represented in most current data visualisation evaluation methodologies. It is imperative for the visual editor to take responsibility for making final decisions with regards to aesthetics and layout of data visualisations.

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<sup>12</sup>Concerned with beauty or the appreciation of beauty. Technically and digitally, it refers to the use of colour, layout, icons, art direction for an intended context of use.

### 3.6 Gestalt Principles

The Gestalt Principles are important in identifying visual elements in information or data that needs to be communicated. They are also important in determining which data might be too much clutter as visuals. The Gestalt Theory is an important characteristic in designing and visualising data. The Gestalt Principles (GP) is a theory that describes the human brain interprets visual information. The word ‘gestalt’ is a German word which means “whole”, “form” or “shape”. According to the Gestalt Theory, the whole is other than the sum of its parts. This means that while each individual part has its own meaning, the whole body gives a complete meaning. This means that the human mind automatically tries to simplify visual input and as a result, individuals see the meaning of the whole instead of the meaning of individual parts. The “mental map” of information provided by a graph drawing is very dependent on the perceived form or structure in the overall layout.

The Gestalt Principles cover a wide range of perceptual experiences. Perception is the process of comprehending the surrounding world around. The Gestalt Principles of design can help understand how readers see images in their context, that is, in relation to a whole visual field (Kostelnick and Roberts, 1998). Although human senses may initiate the perceptual process, perception involves more than a sensory response as it also involves lots of thinking, especially when the sense of sight is involved.

Nesbitt and Friedrich (2002) describe the Gestalt Principles as elements presented together and tend to become grouped into distinct patterns. Hence, these principles strongly influence how the components of a network drawing, the nodes and links are organised and perceived as a whole.

The six Gestalt Principles to consider when visualising data are shown in Table 3.2 below:

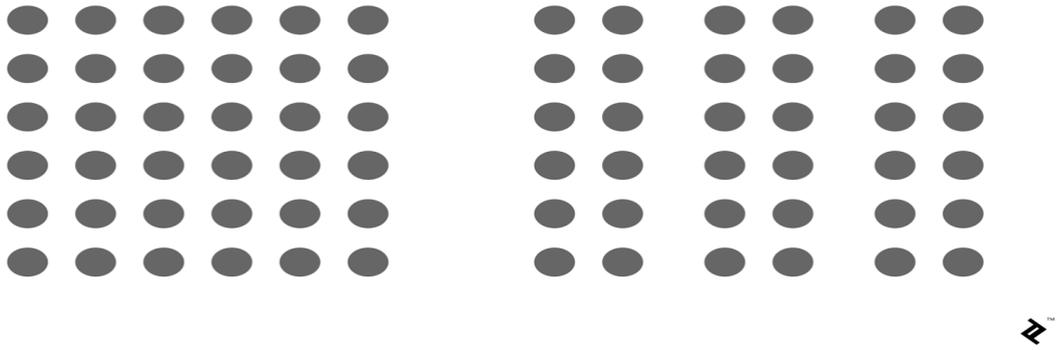
**Table 3.2: The six Gestalt Principles**

1. Proximity	Psychologically, the human brain perceives objects or visuals that are physically close to each other as belonging to a part of a group (Figure 3.2).
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2. Similarity	Objects or things that are of similar colour, shape, size or orientation are perceived as related or belonging to part of a group; for example, associating blue circles together or green squares together (Figure 3.3).
3. Enclosure	Humans perceive objects that are physically enclosed together as belonging to part of a group; for example, using a light background shading in a graph to differentiate between forecast and actual data (Figure 3.4)
4. Closure	The human brain tends to perceive a set of individual elements as a single, recognisable shape when they can, and when parts of a whole are missing, human eyes fill the gap (Figure 3.5).
5. Continuity	The principle of continuity is similar to the principle of closure. When looking at objects, human eyes seek the smoothest path and naturally create continuity in what they see even where it may not be explicitly existent (Figure 3.6).
6. Connection	Humans tend to perceive objects that are physically connected as part of a group. The connective property has a stronger associative value than similar colour, size or shape (Figure 3.7).

**Source: Nesbitt and Friedrich (2002)**

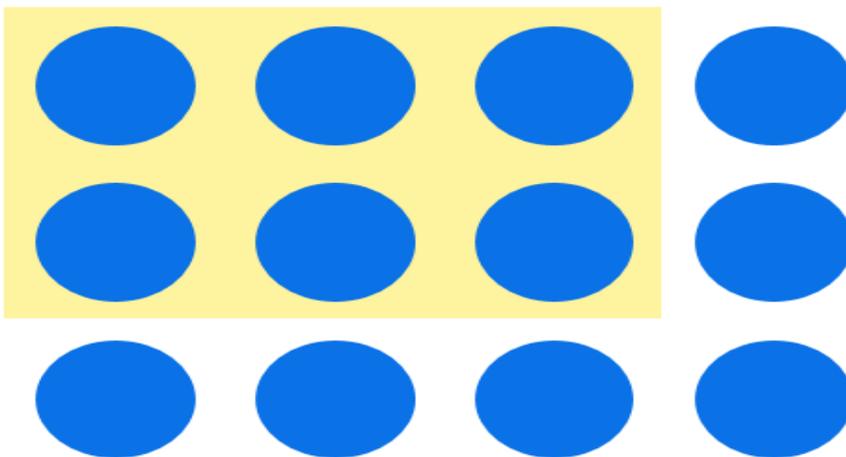
**Figure 3.2 Principle of Proximity**



**Figure 3.3 Principle of Similarity**



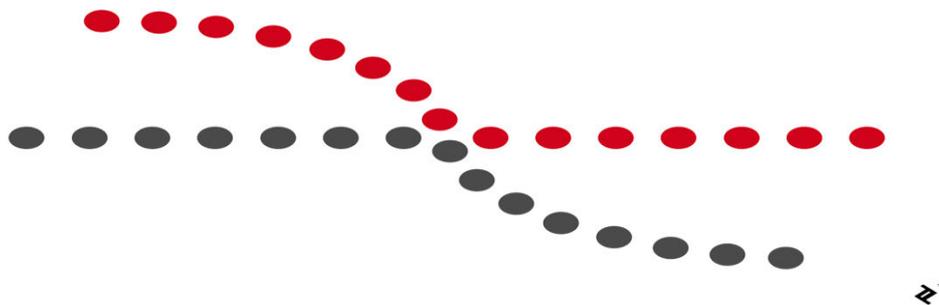
**Figure 3.4 The Principle of Enclosure**



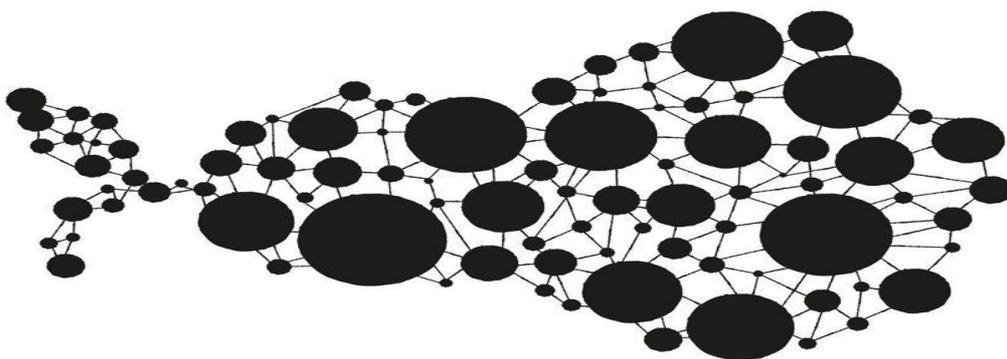
**Figure 3.5 The Principle of Closure**



**Figure 3.6 The Principle of Continuity**



**Figure 3.7 The Principle of Connection – (Particularly important for designing data)**



This examines how the Gestalt Approach to designing information and data can be used to enhance user engagement and interaction.

Gestalt is a German word that translates to ‘configuration’; therefore, the Gestalt Theory provides rational explanations why shifts in spacing, timing and configuration can have a profound effect on the meaning of presented information. Interestingly, though, Graham (2008:1) indicates that “visual artists and designers of the twentieth century adopted gestalt perceptual factors to improve their work because it provided a scientific method explaining human perception and our tendency to group things and explained pattern seeking in human behaviour”. Since the gestalt visual laws provided scientific validation of compositional structure, it was further used by design educators in the mid Twentieth Century to explain and improve visual work. Greg Berryman (2008:30) points out that “gestalt perceptual factors build a visual frame of reference which can provide the designer with a reliable psychological basis for the spatial organisation of graphic information”.

In addition to this view, Connor (2015) expresses the view that the Gestalt Theory of perception remains highly relevant to applied design and visual communication in general. O’Connor (2015) further explains that just as colour and contrast in design play important roles in human visual perception, they also have the capacity to reinforce the operation of some of the principles of the Gestalt Theory of Perception. Resultantly, colour and contrast are frequently harnessed in the design of visual communication to draw the audience’s attention to key elements such as headlines, text or images. This enhances the effectiveness of the design and layout of a design. Similarly, this principle of colour and contrast remains the same when implemented in the design of information and data, irrespective of the platform (print or digital), using the Gestalt laws or theories to enhance the overall design and draw the audience’s attention to the content. Therefore, a skilful application of the Gestalt Theory can result in the development of digital interface designs for online platforms, with stronger compositions that facilitate effective communication and interaction, particularly for online news or Web interfaces.

In 2018, The National Institute of Communicable Disease (NICD) demonstrates how the visualisation of health data played an important role in identifying the root cause of Listeriosis

in South Africa. According to Diphoko (2018:18), the NICD started gathering health-related data dating back to 01 January 2017 and used the data to construct graphs to determine the trends of the disease Listeriosis. From 2013, a year-to-year comparison was made to ascertain if 2017 deviated substantially from all the other years. A careful analysis and application of the Gestalt Theory to the data showed that the visualisation of this data accelerated the comprehension of the information, thus influencing medical experts to quickly identify the root cause of Listeriosis in South Africa. This example perfectly demonstrates how history influences the present. In 1854, John Snow implemented the same approach when he mapped the cholera cases on the map of London. Each death case on the map was represented by a bar. The outcome of visualising each death resulted in discovery of the cause of cholera, which meant that a solution could be found much faster to combat the problem.

According to Cox (2017:186), “data visualization will drive journalism more than the other way around, as has been the case previously.” Heumann (2017:93) further suggests that “Infographers”<sup>13</sup> have the power to deliver more trustworthy information by taking socially relevant data into account in their data visualisation. For example, tools such as Google Earth and Google Maps allow organisations such as the military to present intelligence in a way that is more readily understood by a wider audience comprising digital natives<sup>14</sup> and those that migrated to mobile devices and the Web later in life. The same thinking can be embraced by other organisations, particularly online news platforms.

According to Tien (2013), it is projected that about four zettabytes of digital data are being generated per year from retail, services, manufacturing, construction, agriculture, mining, security cameras to global positioning systems. Google, on the other hand, receives more than two million search queries every minute. On a larger scale, humans are currently generating an estimated two comma five quintillion bytes of data every day. Statistics indicate that ninety per cent of the world’s data has been created in the last two years alone. The multitudes of sources, from social media to the Web, are making it difficult for organisations to interpret data. When this occurs, it is almost impossible to translate the information into something actionable and capable of providing tangible returns on investment. The author expresses the view that visual data displays, or data visualisation is helping to meet this need. Therefore, the time is now for

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<sup>13</sup> Designers who specialize in producing information graphics

<sup>14</sup> A person born during the age of digital technology and is familiar with computers and the internet from an early age.

media organisations to implement new solutions for leveraging data visualisation and thus unlock their true potential to meet business goals in the era of Web 2.0 and the Fourth Industrial Revolution.

Borner (2014) emphasised five major types of data visualisation.

**Table 3.3: The Five Major Types of Data Visualisation**

1. Charts	Pie charts
2. Tables	Categorical axis that can be selected, cells can be colour-coded and might contain proportional symbols.
3. Graphs	Quantitative or qualitative (categorical) axis. Timelines, bar graphs, scatter plots.
4. Geospatial maps	Use latitude and longitude reference system, world, or city maps.
5. Network graphs	

**Source: Borner (2014)**

Many contextual, perceptive, and cognitive considerations come into play when making an effective visual. Two factors particularly play a significant role: the intended message and the context of use. Keen attention to these two factors, in addition to the data itself go far in making a data visualisation effective, successful, and beautiful (Illinsky, 2010). A visualisation should convey the unique properties of the data set it represents. The key to the success of any visual, beautiful, or not, is providing access to information so that the user may gain knowledge. A visual that has not achieved this goal has failed.

### **3.7 Non-linear interactive multimedia**

Data visualisation has been acknowledged as an important tool in decision-making support. However, Theus (2002) argues that visualisations are usually static and just used for presentation rather than exploration of content. Interactive statistical data visualisation, on the other hand, is a powerful tool that goes beyond the limits of static graphs (ibid).

Kay (2001:123) further states that “the actual dawn of user interface design first happened when computer designers finally noticed, not just that end users had functioning minds, but that a better understanding of how those minds worked would completely shift the paradigm of interaction”. The advent of the Internet required the development of effective user interface design to retain online user activity on websites. The synergy of online multimedia usage and the incorporation of interactivity to these media retained user activity. Multimedia applications for an online platform are different from multimedia programmes on television and cinema. The multimedia programmes for an online platform are both digital and interactive<sup>15</sup>. A media theorist, Torres (1995:3), defined interactivity as, “a particular medium’s ability to facilitate the properties necessary in an ideal conversation”. In his research, Torres (1995:3), argues that interactivity should be defined by “how well a medium facilitates two-way communication rather than by the technology of the medium.”

According to Kovachi and Rosenstiel (2001:163), “bosses at major media networks are always looking for what will be the next big trend for young people. If engagement and relevance will help to explain how journalists can more effectively approach their stories, especially in the age of internet infinity, who is to say?” Driscoll (2010) explains that the ability to animate graphics multiplies, by several orders of magnitude, the amount of information that can be included in a visualisation.

Berger (2001) further expands on online engagement, highlighting that hypertext information presented as a linked network of brief self-sufficient texts that the computer users may navigate in a non-linear fashion offers journalists a way of telling stories that take advantage of the unique characteristics of online media. One of the characteristics of an information visualisation in a non-linear<sup>16</sup>format means that the user can simply choose and click a button or a navigation link and gain access to any part, and in any order of the application. Clicking

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<sup>15</sup> Allowing a two-way flow of information between a computer and a computer user.

<sup>16</sup> A system that is not sequential or straightforward.

on the Internet through hypertext<sup>17</sup> and hypermedia<sup>18</sup> is the most perfect example of a non-linear interactive function of multimedia applications. In a standard printed version, a reader can stop, pause or re-read any word, line, or paragraph until they have understood the content. The reader is not forced to pay attention to multiple items at once. Glick (2004) suggested that non-linear multimedia for an online newspaper should not be different; thus, the user should have control over pace. In traditional media, demarcation lines between publishing, printing, broadcasting, and entertainment have all but disappeared owing to multimedia convergence. The same convergence of multimedia elements, text, graphics, animation, video, and sound, combined with interactivity, constitute the factors that foster the advancement of information visualisations for the online news platform.

Shroeder (2004:563) further indicated that “interactive information graphics can be referred to as ‘such added values’, because they make complex processes visible and comprehensible”. Interactive graphics are also a wonderful story-telling technique that outclasses traditional print graphics (Outing, 2004). The addition of a non-linear sequence, integrated with interactivity, enriches the user’s experience of the online platform. Non-linear interactive multimedia is a unidirectional action and is different from a one directional action that characterises linear media. The linear approach is a step-by-step approach that contrasts with the non-linear approach which allows the user to explore the data individually. The user can manipulate the graphic by filtering, selecting, and searching the data. Non-linear interactivity fosters the use of interactive navigational controls to access the desired information. Neo and Neo (1998) suggested that interactivity in the form of navigational controls is a component of the application that would enable the user to control the content they see without information overload. Therefore, the non-linear approach combines controlling the absorption of ready-made content at one's own pace and choosing content from a set of pre-defined choices.

According to Conneen (2003:3), "interactive information graphics are an important piece of storytelling and deserve to be showcased online, much like photographs are". If the information visualisation is presented in a non-linear interactive format, the user would also fully control the way they would access the information and the duration they would want to access the content.

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<sup>17</sup> Is the text displayed on a computer display or other electronic device with references to other text that the reader can immediately access, or where text can be revealed progressively at multiple levels of detail.

<sup>18</sup> Hypermedia is an extension of hypertext, is a nonlinear medium of information that includes graphics, audio, video, plain text and hyperlinks.

According to Fredin (1997), hyper-stories<sup>19</sup> make readers more actively involved. For that to occur, Fredin (1997) further suggests that they must provide readers with clearly described layers of information from which to choose, starting with a little and then a lot of information (Lowrey, 2004). Research on online news has focused on presentation of overall site format and online searching, but little research has focused on the format of individual news stories. There are few exceptions, including Fredin's (1997) proposed prototype for a hyper-story. A hyper-story is a network of interlinked computer files from which readers make choices and construct their own news meta-stories<sup>20</sup>.

Hyper-stories result in non-linear interaction between information graphics and the user. Dube (2004) indicated that "in the most common forms, these are simply interactive versions of traditional newspaper and TV graphics. This form has produced some of the most innovative online visual journalism". The users are not merely presented with information; thus, they become actively engaged with the information, and are lured to engage more intimately with the content.

According to Paulussen (2006:1), "a web survey was conducted in spring 2001 among 73 Flemish online journalists. The survey results show, among other things, that most respondents believed that the future of online journalism lies in interactivity, hypertext and multimedia". The new media storytelling model is interactive and non-linear. Interactivity has always been considered one of the key features of new media (Steuer, 1992). The storyteller conceptualises a member of the audience not as a consumer of the story engaged in a third person narrative, but rather as a participant engaged in a first-person narrative. The storyteller invites the participant to explore the story in a variety of ways, perhaps beginning in the middle, moving across time and space, or beginning by topic. Non-linear storytelling may come as a bit of a shock to some traditional journalists, but it is possible to adapt to new technology without sacrificing quality and integrity. The storytelling approach in creating non-linear interactive information graphics can also provide a somewhat "leisure" approach to the consumption of the news. Information graphics also combine the aesthetic sensitivity of artistic values with the precision of numerical data in a format that is both understandable and dramatic (Lester, 1995).

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<sup>19</sup>Hyper stories are stories that are interactive and are made up of multimedia elements.

<sup>20</sup> Metastories are one story embedded within another.

Steuer (1992) defines interactivity as the extent to which users can participate in modifying the form and content of a mediated environment in real time. The most common view of interactivity involves "cause and effect" relationships between the content and the user, the user performs an action with some sort of input device and as a result, another action occurs. The following are common examples of some cause-and-effect levels of interactivity:

- **Rollovers** - the user rolls their mouse over a certain web-based object and that object responds interactively.
- **Flash websites** - the user can "interact" with the content of the website in different ways; the user has a cause-and-effect relationship with the content on the page.
- **Video games** - the player can control an on-screen character's actions through the input of a keyboard or game control.
- **Hypertext** - the user clicks on a text and is taken to a different Web location.
- **Input devices** - (computer keyboard, mouse and so on) – this is the most obvious form of interactivity; the user's intentions gravitate towards the input objects and their actions are directly mirrored in the programme the user is using.

The researcher demonstrated the use of interactivity in disseminating information through the interactive timeline that was created on an Australian online news site<sup>21</sup> in the Harvey Weinstein sexual harassment case<sup>22</sup>.

### **Harvey Weinstein's accusers**

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<sup>21</sup>[www.news.com.au](http://www.news.com.au)



Source:

[https://cdn.knightlab.com/libs/timeline3/latest/embed/index.html?source=1qW6iOaTT7qHD700s5KBmY1a1gvcODHPXErpCsvAhwT4&font=Default&lang=en&initial\\_zoom=2&height=750](https://cdn.knightlab.com/libs/timeline3/latest/embed/index.html?source=1qW6iOaTT7qHD700s5KBmY1a1gvcODHPXErpCsvAhwT4&font=Default&lang=en&initial_zoom=2&height=750)

The interactive timeline<sup>23</sup> integrates visual, text and interactivity not only to communicate to the user the accusers of Harvey Weinstein, but also to allow the user to participate in the experience of accessing the information. Furthermore, the timeline within each accuser's segment provides more in-depth information about that particular accuser and their relationship with Harvey Weinstein; that is done in written format using creative typography and layout. To access this information, the user further participates through hyperlinks<sup>24</sup> and hypermedia<sup>25</sup>.

Another example the researcher utilised to demonstrate the information visualisation used in The Guardian's online edition was the visual communication used in the rescue operation of the Thai soccer team that was trapped in the Tham Luang cave in Thailand.

### Figure 3.8: Tham Luang Cave - Thailand

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<sup>23</sup>[https://cdn.knightlab.com/libs/timeline3/latest/embed/index.html?source=1qW6iOaTT7qHD700s5KBmY1a1gvcODHPXErpCsvAhwT4&font=Default&lang=en&initial\\_zoom=2&height=750](https://cdn.knightlab.com/libs/timeline3/latest/embed/index.html?source=1qW6iOaTT7qHD700s5KBmY1a1gvcODHPXErpCsvAhwT4&font=Default&lang=en&initial_zoom=2&height=750)

<sup>24</sup> A link from a hypertext document to another location, activated by clicking on a highlighted word or image.

<sup>25</sup> An extension to hyper-text providing multimedia facilities, such as those handling sound or video.

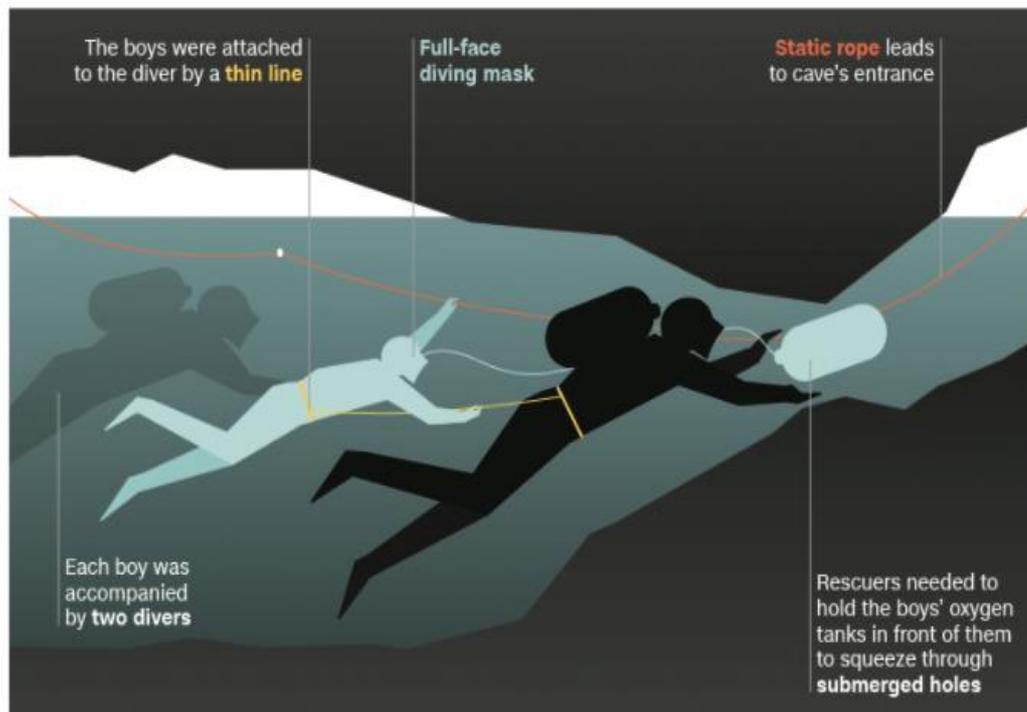


The online edition<sup>26</sup> makes expressive and detailed use of information and data visualisation to inform the user about the rescue operation and the nature of the flooded cave. However, the visualisations on the online platform of the Guardian are static and non-interactive. Although they may be regarded as effective, their effectiveness could have been more enhanced by incorporating interactivity used in the data visualisations. More so, their effectiveness could have been enhanced if the interactivity was non-linear or multi-modal<sup>27</sup>. Paulussen (2004) reiterated that the internet provides the online journalist with a vast range of new opportunities for feedback, customisation of content, instant publishing, archiving, hyperlinking, the use of audio and video, all of which can have serious implications for online media production and in particular online news presentation.

**Figure 3.9 Visualization of the rescue operation in the Tham Luang Cave-Thailand**

<sup>26</sup> <https://www.theguardian.com/world/ng-interactive/2018/jul/03/thailand-cave-rescue-where-were-the-boys-found-and-how-can-they-be-rescued>

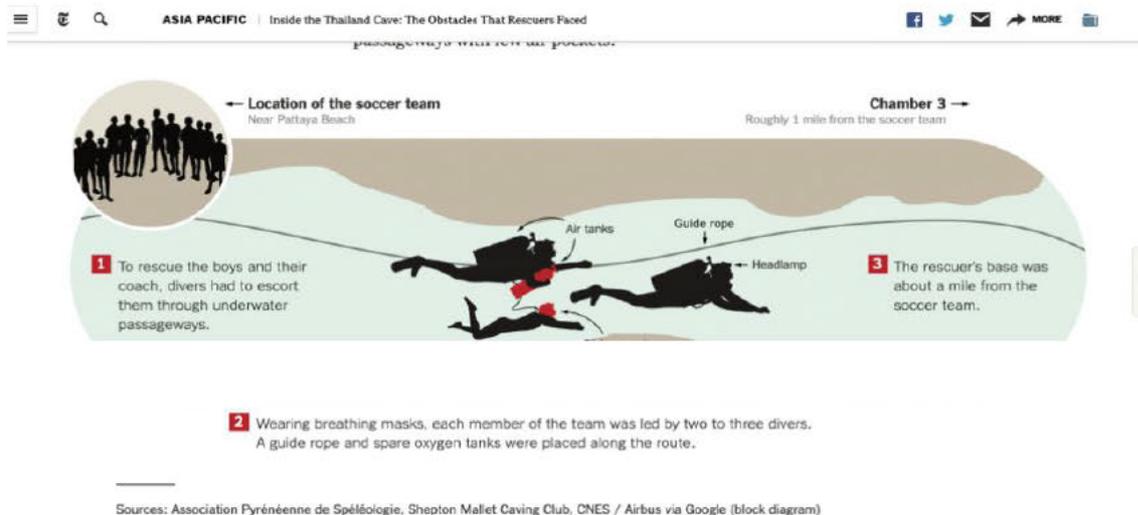
<sup>27</sup> Characterized by several different modes of activity



CNN uses the same approach as the Guardian.<sup>28</sup>

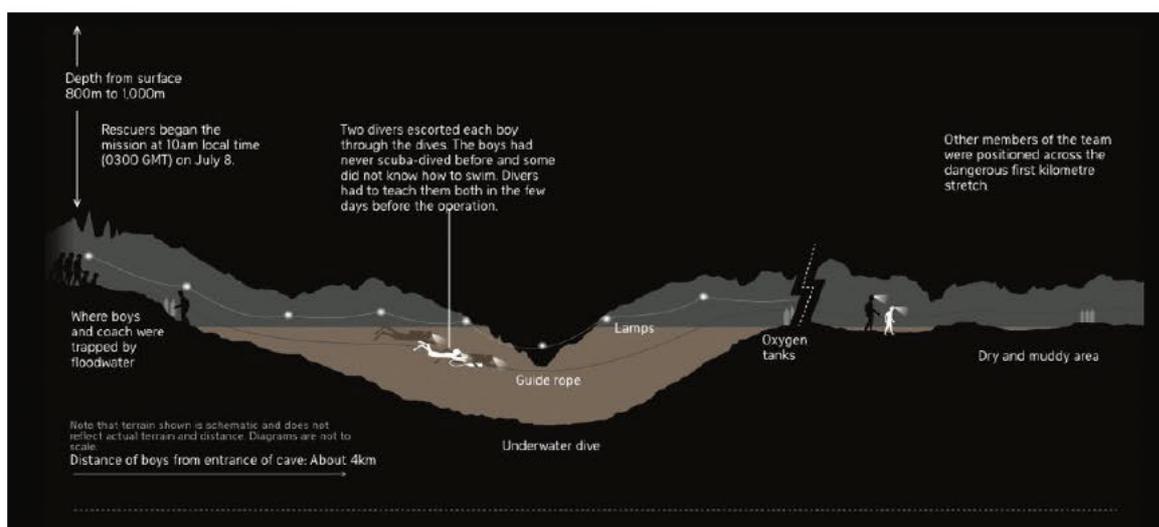
**Figure 3.10 Visualization of the rescue of the rescue operation in the Tham Luang Cave-Thailand**

<sup>28</sup> <https://edition.cnn.com/asia/live-news/thai-cave-rescue-live-intl/index.html>



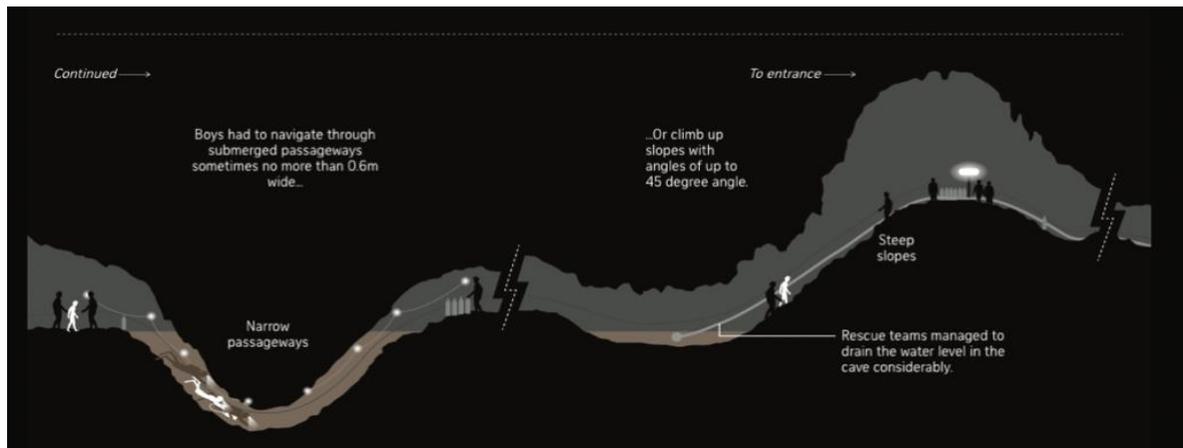
The New York Times utilises basic interactivity within their information visualisation, thus luring the user to interact with the graphic to gain more information.<sup>29</sup>

**Figure 3.11 Visualization of the rescue operation in the Tham Luang Cave - Thailand**

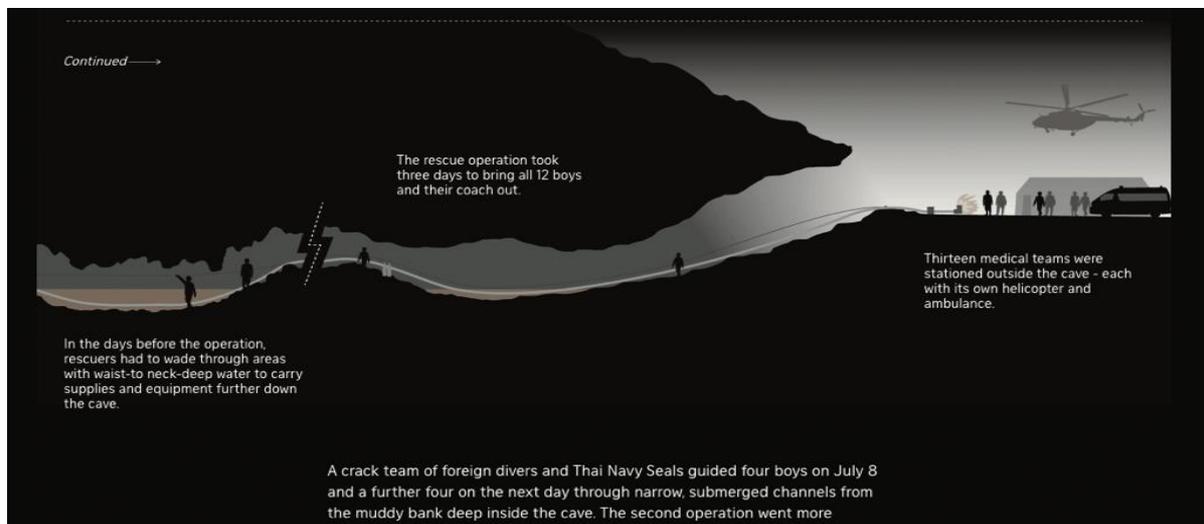


**Figure 3.12 Visualisation of the rescue the rescue operation in the Tham Luang Cave- Thailand**

<sup>29</sup> <https://www.nytimes.com/interactive/2018/07/06/world/asia/thai-cave-rescue.html>



**Figure 3.13 Visualization of the rescue operation in the Tham Luang Cave-Thailand**



The Straits Times also utilises basic interactivity within their information visualisation techniques to lure the user to interact with the graphic to acquire more information.<sup>30</sup>

A dialogue between Newhagen and Rafaeli (1996) and Dahlgren (1996) points out five primary and highly related aspects of cyber-communication which are at the core of its media logic, and which continue to shape the formats of cyber-journalism. These key qualities are multimedia, hypertextual, interactivational, archival, and figurational.

Heeter (1999) identifies dimensions of interactivity. Among these dimensions, Massey and Levy (1999) argue that four dimensions appear to fit the literature on online media production. These four dimensions are: complexity of choice available, responsiveness to the user, facilitation of interpersonal communication, and the ease of adding information.

<sup>30</sup> <https://graphics.straitstimes.com/ST/STIMEDIA/Interactives/2018/07/thai-cave-rescue/>

The 'complexity of choice available' refers to the extent to which users can choose their own trajectory through the available information. On the websites, this 'choice complexity' can be established in different ways. First, this dimension is closely related to 'textuality', and because hyperlinks, offer choices to users for them to navigate throughout the website; so, the more hyperlinks, the higher the 'choice complexity'.

Second, choice complexity, with regard to online media, can be increased by allowing consumers to choose, in accordance with their individual needs and interests, the categories of news and information they want to receive - an ability generally referred to as 'customisation of content'.

Third, the choice complexity within a news site can be measured by considering the various 'extra services' available to users; for instance, e-commerce sections, site information and support, search engines, agendas et cetera.

By 'responsiveness to the user', Heeter (1989) means the degree to which new media can react to or interact with the user, whether technologically or personally. It is important, however, to stress the difference between passive and active responsiveness; in other words, to distinguish between the "potential for responsiveness" and "actual responsiveness" (Massey and Levy, 1999:526).

The fourth dimension of interactivity, 'ease of adding information', which deals with asynchronous, one-to-many communication or the degree to which users themselves can upload information on a website. This fourth dimension of interactivity calls for further investigation into the possibilities of attaching an additional component of the user's manipulation of content, perhaps by expressing their opinion or adding viewpoints to the content to encourage dialogue within the interactive data visualisation.

McLuhan (1964) suggested that the most important thing about any communication medium is that message receipt is really message recovery. Anyone who wishes to receive a message embedded in a medium must first have internalised the medium for it to be "subtracted" out to leave the message behind. McLuhan (1964) implies that if a personal computer is a truly new medium, then it would change the thought patterns of an entire civilisation (Kay, 1989).

Similarly, the advent of the Fourth Industrial Revolution and the rapid technological advancements has resulted in the disruption of traditional norms, initiating a paradigm shift in thought patterns. Human beings may not realise this aspect, though it is a glaring reality. Therefore, media organisations must also be more proactive with technological and visual innovation to deliver online content that changes thought patterns and mind-sets so that they embrace visualised online data or online news. Once this change of mind-set has been achieved, society develops more solutions to problems and witness advancements rather than holding negative opinions on absorbing visual data for the online news platform.

One of the most important implications of multimedia is that the online journalist must learn how to apply these different media formats. In terms of writing, the journalist also needs the relevant skills to decide for each story which part(s) will consist of text and which part(s) will carry audio or visual elements that enhance interactivity. Just like a hypertext, multimedia has serious implications for (the linearity of) online news presentation (Hall and Pavlik, 2001). This implies the rise of hypermedia, whereby the actual visuals become hotspots<sup>31</sup> and links to further information, which ultimately forms the foundation of interactive data visualisation. It must also be highlighted that multimedia refers to a new media format that results from the convergence and integration of traditional print, audio and video formats with animation and interactivity.

Hypertextual and hypermedia characteristics of the Internet require new strategies for the presentation of online news. The linking of texts and the layering of news demand the development and incorporation of new ways of story-writing and visual storytelling. Media experts agree that online news stories can no longer be shoehorned into the classical, inverted pyramidal model of storytelling in print media. In contrast, Hall (2001:66) suggests that a news story on the Internet should be structured as a 'matrix' of different 'lexia' (chunks of information), all linked to one primary 'anchor text' that constitute the top level providing the essence of the story. This is a non-linear type of storytelling that combines aspects of both print and broadcast media. It is, of course, important that the online journalist should keep the reader curious enough to browse through the different chunks of information (Fredin and David, 1998). This is where the interactivity and non-linear type of storytelling becomes crucial. This

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<sup>31</sup>An area of graphics object, or a section of text, that activates a function when selected. Hot spots are particularly common in multimedia applications, where selecting a hot spot can make the application display a picture, run a video, or open a new window of information.

way of storytelling is characterised by ‘complexity of choice available’, which allows the user to wander through the content at their own pace, thus arousing the user’s curiosity to search for more information.

The problem is mainly technological; for instance, the limited bandwidth makes innovative multimedia content difficult (Deuze, 2001). However, Yoo (2010) posits that the miniaturization of hardware, use of increasingly powerful microprocessors, inexpensive and reliable memory, broadband communication, and efficient power management have fostered the digitization of key functions and capabilities of industrial-age products, including cars, phones, televisions, cameras, and books.

More complex problems affecting multimedia appear at the organisational and institutional level of online media, and not in media competition and copyright concerns. Still, much work ought to be done in terms of developing integrated multimedia newsrooms that are seen by many as a precondition for effective online news reporting (Pavlik, 2001; de Aquino et al., 2002). On the contrary, current technological advancements promote Internet-enhanced multimedia interaction. So advanced is the human race that the world is now experimenting with and implementing artificial intelligence and robotics; the use of technology provides convenience in the way people live, as this has enabled people to develop and implement smart objects, utilities, et cetera. The irony is that interactive multimedia elements (text, graphics, sound, video and animation) are actually the user interface for these technological advancements. However, the same cannot be said about such implementation of data visualisation for online news platforms. Furthermore, according to Yoo, Henfridsson and Lyytinen (2010), the digitisation of the book has fundamentally been responsible for restructured book publishing for the past 200 years by bringing together firms from previously unrelated industries, ultimately changing the way the book is perceived. This is evidenced by Apple’s production of iPad and Amazon’s production of Kindle. Both digital products demonstrate how the digitization of books has stimulated change within an era characterised by technological advancements, further stimulating new opportunities. Therefore, it is a logical transition for information and data visualisations for news digital platforms to follow a similar pattern, despite advancements in technology and internet connectivity now accommodating such perceived challenges.

Jankowski and van Selm (2000), have suggested that traditional media on the internet often follow a defensive ‘carry over’ strategy designed to maintain current audience and advertising markets as opposed to policies driven by an exploration of new terrains and possible convergence of traditional media fare into multimedia products. However, such a conservative strategy rarely encourages online journalists to experiment with and explore the potential of interactive, hypertextual and multimedia capabilities that could enhance online news presentation. Nonetheless, media experts are convinced that the use of the Internet's added values can enable online media to distinguish themselves from their traditional counterparts - and it is this distinction that might serve as the precondition for readers and advertisers to embrace online news media.

It is also imperative to determine the decision-makers’ ‘real’ experience of multimedia for these strategies within media organisation. As the cliché goes, “in order to grow, an organisation has to expand”. The organisation cannot develop growth strategies without envisioning expansionist trajectory required to cut costs. Furthermore, such growth strategies must be developed by experienced experts in the media field. In media organisations, such experts are appropriate specialists with intense knowledge of both academic and practical components, including interactive multimedia required by online news platforms. There must be specialists developing these online visual and content strategies for media organisations. Such best practices deny ‘carry over’ strategies that could inhibit visual and technological innovation required by online news platforms in South Africa. It is also important to involve academic research and integrate it with the professional environment to stimulate and encourage innovative thinking bordering on how online news can distinguish itself from its traditional counterparts. Such engagements also gradually disintegrate ‘legacy thinking’ that stimulates ‘carry over strategies’. However, in most situations, power struggles scuttle acceptance and approval of ideas amongst decision-makers. Ultimately, however, it is about the benefit of the ideation and product for the user and, the growth of the organisations’ online platforms.

Deuze (2003) identified three interactivity options for the different websites that are used over the Internet for many different purposes. These interactivity options are:

1. Navigational interactivity
2. Functional interactivity

### 3. Adaptive interactivity

Navigational interactivity refers to a situation where the user has the permission to navigate through the content accessible on the website. Functional interactivity relates to a situation where the user co-participates in the actual process of producing and designing the website or interact with other users of the website. Adaptive interactivity deals with the user's entire actions and their consequences. For this research, both navigational and adaptive interactivity are relevant to the development and implementation of interactive data visualisations for online news. However, it could be possible to also explore the way functional interactivity could provide a beneficial experience for the consumer of non-linearised interactive data visualisations. This option needs to be investigated and researched on in more depth to determine such possibilities.

It is widely acknowledged that good interfaces ought to satisfy the principle of visibility (Norman, 1988; Hutchins, Hollan and Norman, 1986); thus:

- a) Users should be able to see the actions that are open to them at every point of choice;
- b) Users should receive immediate feedback on the actions they have just taken and;
- c) Users should get timely and insightful information about the consequences of their actions.

The challenge is that effective interfaces for data visualisations often fail to provide the user with information needed to decide on what to do next. These challenges have been overcome by designers using hotspots, hypermedia, hyperlinks, hotspot buttons and menu buttons on visual elements in a data visualisation. Therefore, the interactivity (functional and adaptive) into a multimedia data visualisation must be sensitive to the goals of the users, thus helping them to direct the goals in the appropriate direction.

Interestingly, Manovich (2002) argues that hypermedia users get their own version of the complete text by selecting a particular path of it. The user can only interact with those choices a designer would have already programmed into the "interactive" object. The approach is seemingly interactive because the user is given a choice, though, the user is only following one of the designer's preconceived paths through a branching tree structure. However, the researcher partly agrees with Macmillan (2000) who reported that interactivity may lie in the user's perspective and it is not a purely functional dimension. This research study avers that

interactivity for online news data visualisations can be a dimension of functional interactivity. The user can never be a part of the development and production of the product because the user will not have the knowledge and expertise to contribute to the development of the output. Therefore, specialist interactive multimedia designers develop preconceived paths and branching tree structures of information that guide the user in interacting with the information for absorption.

According to Curtis (2002:189), “people don’t like to puzzle over how to do things. The fact that the people who built the site didn’t care enough to make things obvious and easy can erode our confidence in the site and its publishers”. Although users would not be regarded as a dimension of functional interactivity, they could on the other hand form part of a focus group for a research and development project. Data obtained from such a project can contribute towards effective user interactivity on a website, or in this case, within a data visualisation piece of work.

Ducroquet (2017:176) emphasises the power of interactivity, “by allowing users to make decisions about how and where they advance, the experience becomes more unique and more memorable”. The integration of non-linear interactivity within online data visualisation provides this unique and memorable experience. If the experience is memorable, the content will resultantly be memorable as well.

### **3.8 Saussure’s syntagmatic and paradigmatic elements of signs**

Given that data visualisation is visual and textual, semiotic analysis is the key approach to analysing how the visual relates to the text and how texts are encoded in infographics in comparison with text encoded with static images. Between 1907 and 1911, Ferdinand de Saussure wrote extensively about semiotics. Of particular interest is his description of ‘syntagmatic’ and ‘paradigmatic’ elements of signs (Chandler, 2002:83). Chandler (2002) explains Saussure’s differentiation as:

While syntagmatic relations are possibilities of combination, paradigmatic relations are functional contrasts – they involve differentiation. Temporally, syntagmatic relations refer intratextually to other signifiers co-present within the text, while paradigmatic relations refer intertextually to signifiers which are absent from the text. The ‘value’ of a sign is determined by both its paradigmatic and its syntagmatic relations. Syntagms and paradigms provide a structural context within which signs

make sense; they are the structural forms through which signs are organised into codes (ibid).

Semioticians developed the commutation test to identify signifiers and determine their level of significance. In paradigmatic transformations, substitution and transposition are used, while addition and deletion are used in syntagmatic transformations (Chandler, 2002). Saussure's syntagmatic and paradigmatic elements of signs and signifiers can mainly be applied to evaluate and compare the extent to which intratextuality and intertextuality are used in online news sites. This develops insight into whether or not a text employs referents beyond its closed set of meaning to create deeper meaning, or to alternate meanings.

Intratextuality and intertextuality are important in the context of linear and visualised texts. They allow for discerning points of differentiation between different texts. For example, an online news site may use text, bold headlines and a link to a YouTube video of the story; for instance, an interview or a recording of the incident. This analysis arguably typifies intratextuality, where the syntagmatic relations refer to other signifiers present in the same text, forming a closed loop of meaning. The researcher avers that with the use of data visualisation, paradigmatic relations refer to signifiers outside and beyond the text; hence, such relations are intertextual. Thus, an open (or less closed) loop of meaning is created through intertextuality.

Chandler (2002) argues that both syntagmatic and paradigmatic relations are key determinants of sign value. Hence, this thesis argues for and advocates the inclusion of both syntagmatic and paradigmatic relations on the South African online news platform in order to increase sign value and possibly foster audience retention.

Skeuomorphism refers to the retention of old forms and designs in new systems, even though the old design does not serve any necessary application in the new system. In the context of learning management systems, lecturers use learning management systems in a skeuomorphic way, which is storage of notes on a Learning Management System (LMS) (Blewett, 2014). The author argues that this replication of old ways in new systems rarely enhances the potentials afforded by the new systems.

Blewett's (2014) argument for education can be transposed to the context of the South African journalism. Similarly, online news sites tend to be skeuomorphic in their approach, replicating

the traditional broadsheet, print format. The static arrangement of images and texts is occasionally spliced with YouTube videos related to the story.

Taking into account the submissions made by Chandler (2002) and Blewett (2014), it becomes apparent that South African online news sites are missing the opportunity to enhance the sign value of their news broadcasts due to their use of the skeumorphic approach to online news. This perception will be elaborated in the comparative analysis of South African online news and international online news websites.

# CHAPTER 4

## METHODOLOGY

### 4.1 Introduction

This chapter discusses the study methodology encapsulated in the interpretivist paradigm. A qualitative case study technique was used to observe four online news websites. Two websites were international news organisations, namely, The New York Times and The Straits Times of Singapore. The other two websites were local news media organisations, namely, Tiso Black Star's Times Live and eNCA online. The qualitative case study research approach was observational. An observation of these websites allowed for digital video recordings of the four websites that constituted the study sample. Data from the recorded videos were comparatively analysed through a descriptive analysis.

### 4.2 Case study research approach

According to Cockburn (2016), a case study research is undertaken when a researcher intends to examine, explain and understand a specific phenomenon in its appropriate setting. The case study approach appeals to as many data sources as possible in its investigation of individuals, groups, organisations or events. This research study adopted a descriptive case study approach which used recorded videos to document the possibility for user interaction stimulated by interactive infographics and data visualisation with the content on selected international and local news websites. Cockburn (2016) further reiterates that some of the advantages of the case study approach are:

- a) It is capable of eliciting rich data.
- b) It can solicit descriptive and explanatory data.
- c) It provides lots of data sources across the research spectrum.

According to Rowley (2002:16), "case studies are widely used because they may offer insights that might not be achieved with other approaches". The case study method may gather data through observations, audio-recordings, descriptions, or interviewing (Johnson and Christensen, 2008; Silverman, 2011). These advantages further justify the appropriateness of the case study research approach for this research study. However, it can be challenging to explain a highly interactive visualisation of content with the written text only. Therefore, the

digital video-recording of the actual examples of websites is a sampling method that sufficiently supplements written descriptions; thus, the readers can read and see the content simultaneously.

Furthermore, the New York Times Digital and the Straits Times Digital effectively exemplify an innovative presentation of information and data visualisation in an interactive and multimedia format.

### **4.3 Research approach**

This study applied a qualitative research approach to solicit data. This approach involved the use of non-statistical research methods, such as in-depth interviews, written documents, and direct observation (Given, 2008). The video recording of the researcher's interactive engagement with the selected websites in this research study can be regarded as direct observation. Furthermore, Drew, Hardman and Hosp (2007:26) perceive qualitative research as a kind of research "that involves collecting data in the form of words, or a narrative that describes the topic under study and emphasizes collecting data in a natural setting". Creswell (2013) and Lichtman (2006) confirm that the qualitative research approach explores and understands individuals or groups associated with a social or human problem; this often involves the use of in-depth interviews, observation or documentation to study phenomena in their natural and social settings. De Vos, Strydom and Delpont (2011) further state that a qualitative paradigm requires that the research design be more than a set of worked out formulas, and that the researcher be concerned with understanding rather than explaining phenomena under study.

Researchers concur on the notion that the topical application of qualitative research involves identifying, collecting, extracting relevance to relationships, definitions, associated examples, and the use of contexts from literature being reviewed (Huang, 2013; Huang, 2009; Kaslow et al., 2007; Lauckner, Paterson and Krupa, 2012). Furthermore, topical relevance involves the researcher comparing the relationships identified from different domains, integrating them into a unified typology of relationships (Huang, 2013; Huang, 2009; Kaslow et al., 2007; Lauckner et al., 2012).

Draucker et al (2007:1138) indicate that theory based samples are similar to selective sampling in that it acts as a tentative jumping off point to develop theory. This means that samples are sought out to discover "manifestations of a theoretical construct so as to elaborate and examine the construct and its variations" Palinkas et al (2015:18). In this case, the international sample emerges from across five years (2016 - 2020) in order to illustrate the best practices of data visualisation. This is due to the observation that international online news sites have incorporated data visualisation for some time. In the South African sample, a recent (2021) one month sample was used, due to the observation that data visualisation has not been incorporated by online news sites. Palinkas et al (2015:18) state that a theory-based sample draws on "potential manifestation or representation of important theoretical constructs. Sampling [is] on the basis of emerging concepts with the aim being to explore the dimensional range or varied conditions along which the properties of concepts vary."

In this study, therefore, the researcher narrowed the scope of the investigation by ensuring that observation through digital video-recording was done on specific news websites. This study further compares examples of interactive non-linear information visualisations available on the international news websites with those available on local news websites. Data were collected through mobile phone-based video recording. A qualitative research design was ideal for this study because it enabled the researcher to gain an in depth understanding of non-linear information and data visualisations obtained through video recordings.

#### **4.4 Target samples**

The target sample news websites were:

- a) Times Live ([www.timeslive.co.za](http://www.timeslive.co.za)) – South Africa
- b) eNCA ([www.enca.com](http://www.enca.com)) – South Africa
- c) The New York Times ([www.nytimes.com](http://www.nytimes.com)) – United States of America (USA)
- d) The Straits Times ([www.straitstimes.com/global](http://www.straitstimes.com/global)) – Singapore

##### **4.4.1 Reasons for the selected samples**

The two South African samples were selected due to the fact that the Times Live is a popular digital daily of the Sunday Times weekly newspaper; the same can be said about the eNCA online, the digital division of eNCA broadcast news channel.

The eNCA website reported that as of February 2017, the unique browsers (UBs) for the eNCA.com amounted to 2.4 million and of this figure, 2 million were domestic UBs.

As of March 2019, statistics<sup>32</sup> indicated that the pages viewed for Times Live Online reached 29.43%, compared to the 24.12% representing the Independent Media Online page views. The Independent Media and Times Live parent company, Tiso Blackstar, are the most popular and competing news brands in South Africa and, since its inception and implementation of its online strategy, it leads trends online (Mavhungu & Mabweazara, 2014). The statistics obtained via a desktop research by the researcher indicate that there is room for increasing user viewership for both of the online publications. Since Times Live Online did have a higher user percentage rate in comparison with the Independent Media Online, the researcher chose the former as the second local sample.

The New York Times Digital and the Straits Times Digital were selected for their innovative execution of information and data visualisations on their online platforms. In 2019, The New York Times reportedly generated more than \$709 million in digital revenue in 2018 and aimed to reach \$800 million in digital sales by the end of 2020. The New York Times also managed to enlist 265 000 new digital subscribers in the fourth quarter of 2019. About 172 000 subscribers signed up for the core news product whilst about 93 000 were drawn by digital-only products.<sup>33</sup>

According to the Straits Times in 2018, the Singapore Press Holding, the holding company of the Straits Times, saw its digital-only readership growing from about 413 000 to 597 000 in 2018. However, its print base declined from 713 000 to 600 000<sup>34</sup> in 2018. Furthermore, since August 2020, the daily average circulation of the Straits Times on print and digital platforms was 458 200, an overall increase from 386 100 since 2020. Digital circulation, which was close to 300 000, exceeded that of print (Sin, 2021).<sup>35</sup>

These statistics clearly demonstrate a gradual paradigm shift from print distribution towards the digital platform as a way of accessing information because consumers in Singapore are

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<sup>33</sup> <https://www.nytimes.com/2019/02/06/business/media/new-york-times-earnings-digital-subscriptions.html>

<sup>34</sup> <https://www.straitstimes.com/singapore/more-reading-news-online-with-the-strait-times-remaining-most-read-local-english-title>

<sup>35</sup> <https://www.straitstimes.com/singapore/challenge-faced-by-sph-news-platforms-stems-from-inability-to-monetise-digital-readership>

increasingly viewing local newspapers online, with digital readership registering growth (Moon, 2018). The strengthening of investments in producing high quality digital content by media owners is catering to the evolving media habits of tech-savvy consumers.

#### **4.5 Data collection instruments – Video recordings**

Schensul and LeCompte (1999) stated that data collection tools may include questionnaire, interview, observation and reading. In addition, Mackey and Gass (2015) emphasised that the researcher is responsible for ensuring that the instrument chosen for the study is valid and reliable. The authors further maintained that the validity and reliability of any research project depends to a large extent on the appropriateness of the data collection tools. Thus, whatever data collection procedure the researcher uses, it must be critically examined to ascertain its ability to yield the expected results.

According to Creswell (2014), the qualitative research enabled the researcher to purposefully select participants or sites that best help the researcher understand the problem and the research question. In this study, the researcher adopted a comparative case study approach to the exploration of The New York Times and The Straits Times news websites that successfully and innovatively utilise non-linear interactive information and data visualisations on the websites and Times Live and eNCA news websites that can overhaul their visual part of the website.

In this study, data were obtained through observation and digital video recordings. Data from the recorded videos were descriptively and comparatively analysed to demonstrate the differences in the implementation of interactive information and data visualisation for online news websites.

#### **4.6 Data analysis**

Yin (1994) recommends that researchers produce an analysis of the highest quality through employing four principles outlined below. Thus, the researcher should:

1. Show that the analysis relied on all the relevant evidence
2. Include all major rival interpretations in the analysis
3. Address the most significant aspect of the case study

#### 4. Use their prior expert knowledge to enhance the analysis

Churchill and Lacobucci (2005), on the other hand, suggested that data collection is an essential part of a problem-solving process. This part of research constitutes the empirical research component, where case study observations would provide an insightful input. For this study, the data collected for analysis consisted of digital video recordings elicited from the sampled news websites, both South African and international. Data were obtained through observation and an analysis of samples of video recordings of the interactive information and data visualisation obtained from the chosen news websites.

#### **4.7 Trustworthiness**

According to Cook (1983), the question of quality in qualitative research differs from the way it applies to quantitative research. In a qualitative study, thematic content analysis is a popular method of analysing written material. However, Elo et al. (2014) argue that pictures may convey results more clearly than words and this should be borne in mind when reporting content analysis findings. Therefore, the comparative analysis of digital visualisations formed the basis of discussion for this study.

Inferably, in a qualitative research, researchers often engage with flexible realities where the subjective views of respondents may shape the research frame and the whole process of the inquiry (Creswell, 1994). Similarly, rigour in research implies the use of appropriate methodology, approach or data collection tools to meet the specified research objectives (Ryan, 2005). Therefore, the observation of the two real online samples fostered the comparative analysis that constituted the discussion in this study.

Lincoln and Guba (1985) argue that ensuring credibility is one of the most important factors that guarantee trustworthiness in qualitative research (Shenton, 2004). In support of this view, Roberts and Priest (2006) aver that trustworthiness depends on a number of research features, such as the initial research question, how data are collected, when and from whom data are collected, how data are analysed and the nature of conclusions that are drawn.

Precisely, qualitative research is concerned with the extent to which the results of a study or a measure could be replicated in different circumstances (Bryman, 2001). Furthermore, Roberts, Priest and Traynor (2006) maintain that in a qualitative study, the thematic content analysis is a particularly reliable approach to data handling. The data were recorded, and the results were interpreted and analysed using thematic content analysis and against the backdrop of existing literature.

All websites were observed to ascertain evidence of non-linear information and data visualisation in their online news presentations. These examples formed the descriptive samples exhibited in the study's analysis section. Due to the visual and interactive nature of the graphics short videos of the sample were presented in a separate file due to size limitations of the recorded video files.

Validity refers to the balance between the utility value of a measurement as used in the study and its true or objective value. Objectivity may be defined as the relationship between the researcher and the researched; it is precisely the researcher's ability to report subjects' responses without bias (Denzin and Lincoln, 1994). External validity implies the applicability of the findings of the study to other people and situations, ensuring that the conditions under which the study is carried out are representative of the situations and time to which the results apply. Internal validity relates to the reasons underpinning the outcomes of the study and helps to reduce other, often unanticipated, reasons for these outcomes.

The three approaches to the assessment of internal validity are content validity, criterion-related validity, and construct validity (Eby, 1993). Content validity is ensured by the literature review and intends to measure the relevance and representativeness of items in the current study. Criterion-related validity can be used to establish if a tool, such as a questionnaire, can be compared to similar validated measures of the same concept or phenomenon. Construct validity clarifies the relationship between the concepts under study and the theoretical construct relevant to them.

In this study, content validity ensured that the recorded video sampling focused on concepts and constructs that emerged from the literature review and the theoretical framework used to determine the effectiveness of interactive information and data visualisation for online news in South Africa and on the international scene.

## **CHAPTER 5**

### **DATA ANALYSIS AND DISCUSSION**

#### **5.1 Introduction**

This chapter presents the findings elicited from the collected data. It reports and discusses the findings within the context of the digitally recorded comparative case studies. The data were analysed in relation to the key objective of this study, which is:

- (1) To identify the extent to which information visualisation, non-linear interactivity and multimedia elements are used in;
  - a. Two international online news sites (The New York Times and The Straits Times)
  - b. Two South African online news sites (Times Live and eNCA Online)

#### **5.2 Comparative case studies**

According to Kaarbo and Beasley (1999:373), the first type of case study is what Lijphart (1971) referred to as “atheoretical” and what Eckstein (1975) called “configurative-idiographic”. In this case study, the analyst is principally interested in the case itself and typically attempts to gain a gestalt or a holistic picture of the event or phenomenon. However, Dion (1998: 127-145) indicates that “comparative case studies often rely on a practice known as selecting on the dependent variable”. This research technique involves the researcher choosing some phenomenon of interest, gathering data on occurrences relating to the phenomenon, and then determining common characteristics in those occurrences. This methodology has been numerously applied in Political Science, including the study of economic growth, social revolutions, and international conflict. However, the perspective is not limited to such situations, as Dion (1998) further conveyed that selecting on the dependent variable has provided an important method for gathering information when there are relatively few data. Stake (2008) adds that case studies are a common way of executing a qualitative inquiry, further emphasising the view that whatever methods researchers have decided upon, they still have to choose to study the case, analytically, holistically, hermeneutically, organically, culturally or by mixed methods, though the researcher has to concentrate on the case.

The researcher therefore chose the comparative case study design for this research study to gain an international understanding, and use this influence to set the benchmark for interactive information and data visualization use in a South African perspective for online news. The two chosen South African samples were the Times Live, and the eNCA websites, and two international samples were the New York Times and the Straits Times of the United States of America and Singapore websites, respectively. The International samples were taken from a five-year period (2016-2020). The South African samples were taken over a period of two months, between December 2019 and January 2020. The sampling was undertaken at least twice a week, which included a day within a week and a day during weekends for the South African cases.

### **5.3 Data presentation and descriptive analysis**

The presentation and description of the following examples provides a visual and explanatory overview of the trends that emerged at an international level in comparison with the trends that emerged at a local level. This section also addresses the key objective of this study, which is, to demonstrate how information visualisation, non-linear interactivity and multimedia elements are used together in international online news websites for effective transfer of that information to users or readers, an approach that has not been adopted by the local online news websites.

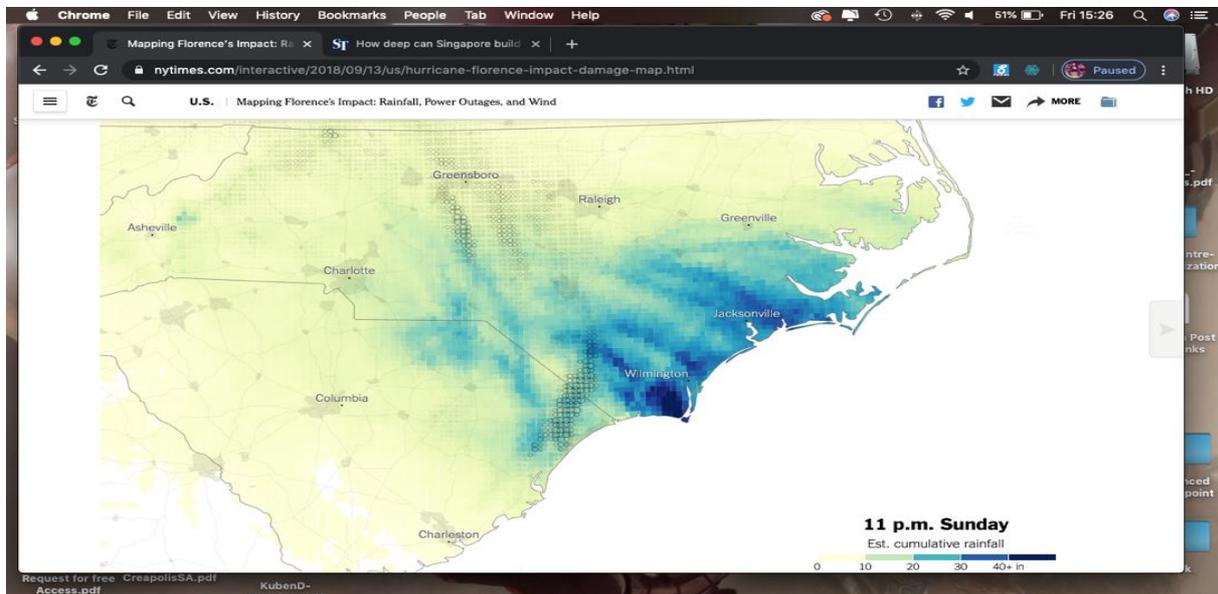
#### **5.3.1 International examples of online interactive information visualisation**

##### **5.3.1.1 Natural disasters**

The selected sample from the New York Times' online site is titled Mapping Florence's Impact: Rainfall, Power Outage and Wind. The interactive visualisation depicts the route, impact, force and strength of Hurricane Florence. The following screen shots from the New York Times depict, both virtually and interactively, the information about the storm (Video 1).

URL: <https://www.nytimes.com/interactive/2018/09/13/us/hurricane-florence-impact-damage-map.html>

**Figure 5.1 - Hurricane Florence – The first page**



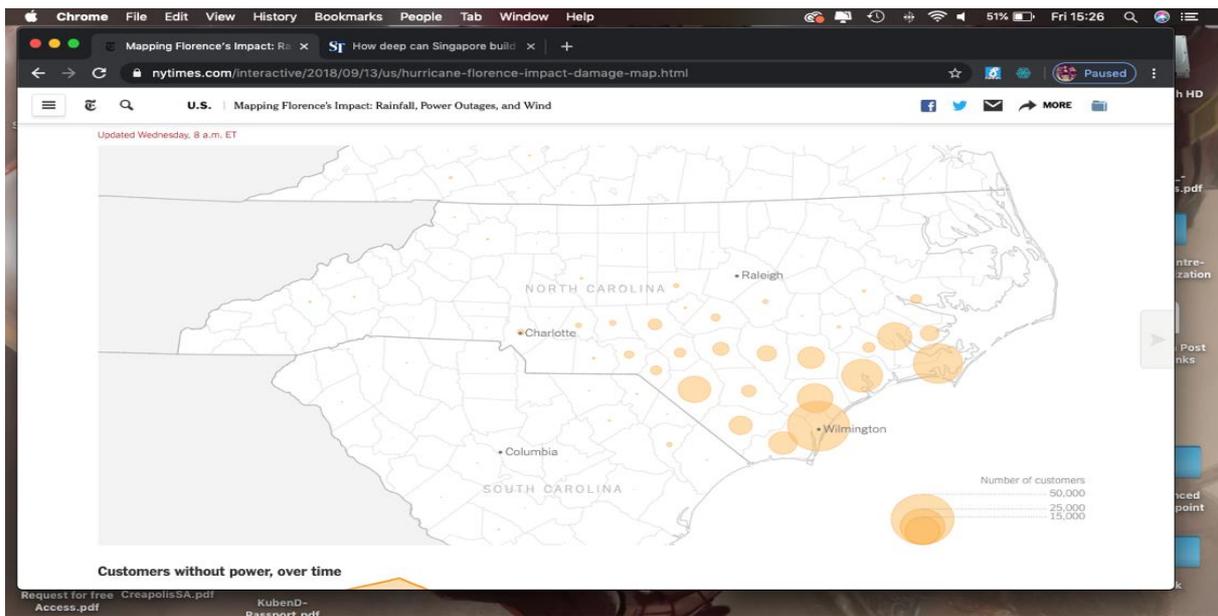
**Source: [www.nytimes.com](http://www.nytimes.com)**

Figure 5.1 depicts information and data on Hurricane Florence in a highly visual and interactive manner. When the user scrolls down, they see the visualisation being depicted in Figure 5.1. The hurricane is in the form of a motion graphic; it is animated in a circular motion, moving towards a north-westerly direction on the map. As the motion of the hurricane drifts across the map, the key on the bottom left corner of the page displays the time and day of the movement of the hurricane across specific regions on the map. The colour key displays a tonal range of colour, ranging from light blue to dark blue. The variation in the tonal range symbolises the varied intensity of the rainfall on the map, syncing with the movement of the hurricane. The cities displayed on the map become hotspots, displaying more information and data in the form of text and small bar graphs as the user rolls the mouse over specific cities.

This example typifies navigational and adaptive interactivity. Rollovers, that is, the movement of the mouse over Web-based objects creates responses from the interactive graphic. This feature creates navigational interactivity, where the user can construct their news pathway, though in a limited way. The Gestalt principles of similarity and continuity are noticeable especially with regards the graphic user interface and the positioning of the mouse rollovers to access the information.

Here, one observes the use of syntagmatic elements as signifiers in the text and these are mostly intratextual and do not refer to any information or data outside the text. Although this first interactive image is just syntagmatic, there is an attempt to layer information on the anchor story. An extra detail is temporal animation of the hurricane on a map, which successfully increases the value of the story.

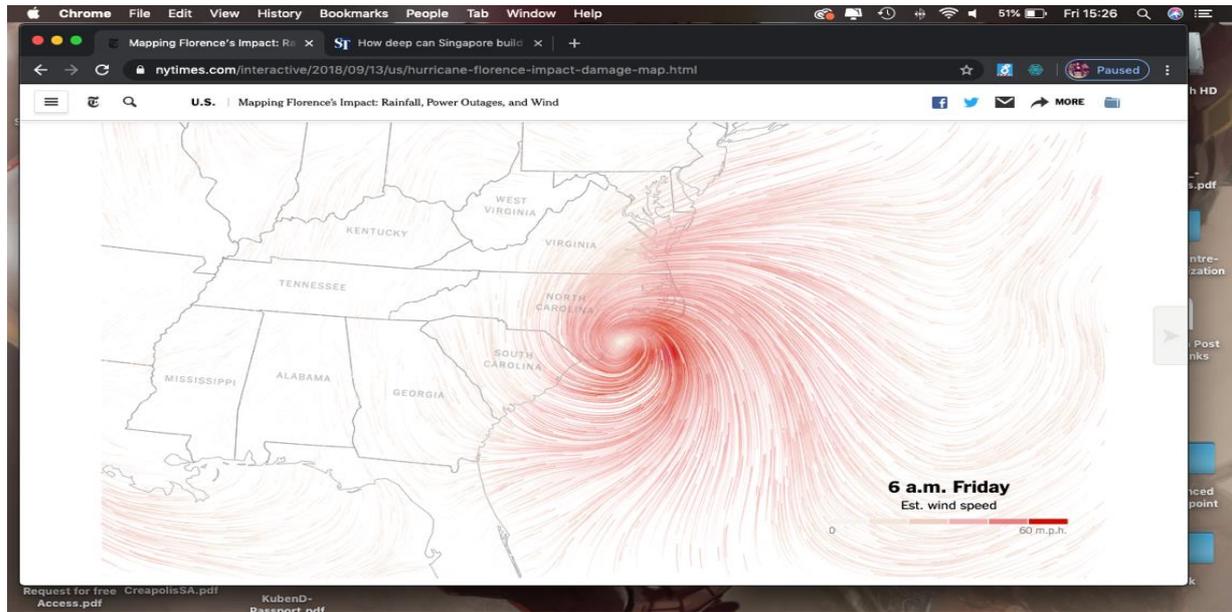
**Figure 5.2 - Hurricane Florence – Interactive transition from Figure 5.1**



Source: [www.nytimes.com](http://www.nytimes.com)

Figure 5.2 expands on the colour key and tonal range model to indicate the impact of Hurricane Florence. The circles on the map represent people without electric power in the indicated regions. The bigger and lighter the circle in the tone of orange, the larger the number of people without power. The smaller and darker the circle in the tone of orange implies a smaller number of people without electricity. This version of the map is supplemented by a line graph (Video 1) to visualise the same data.

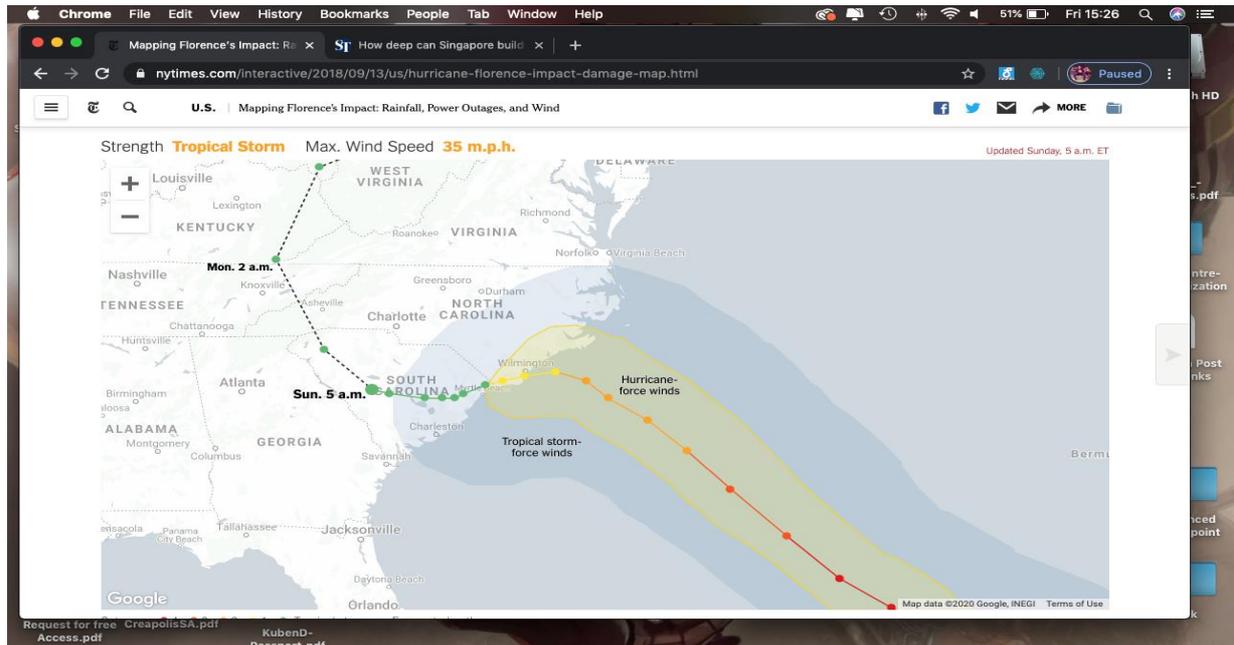
**Figure 5.3 - Hurricane Florence – Interactive transition from Figure 5.2**



Source: [www.nytimes.com](http://www.nytimes.com)

Figure 5.3 depicts the intensity and speed of the wind. As seen in Figure 5.1, there is a key at the bottom right corner of the page. The tonal range of the colour red indicates the intensity of the wind speed within the twister. The darker tone of the colour red implies higher wind velocity within the twister. The lighter the tone of the red colour, the slower the intensity of the wind. The twister is visualised with lines that are animated in order to create a simulation of the twister. This interactive graphic is further supplemented by data visualised on a line graph, positioned below the graphic on the website.

**Figure 5.4 - Hurricane Florence – Interactive transition from Figure 5.3**



Source: [www.nytimes.com](http://www.nytimes.com)

Figure 5.4 depicts the route of Hurricane Florence as represented by a line that contains points. These points are transformed into mouse rollovers in order to show more information about the hurricane. For instance, when a user clicks on the points, a pop-up text box appears, showing more information about the day, time and strength of the hurricane at that particular point on the map.

Figure 5.1 through Figure 5.4 demonstrate the animation of a story using rollovers, navigational interactivity and hotspots. Interactive elements increase the complexity of choice from the perspective of the user. These elements shift a potentially static story to a non-linear, interactive one.

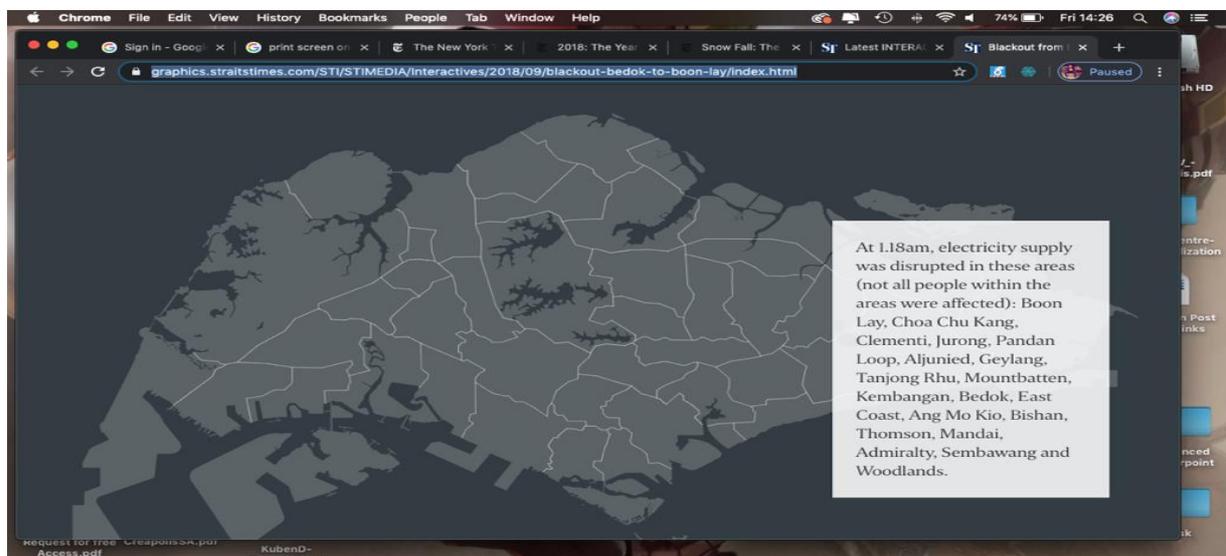
According to Palilonis et al. (2013:135), “it is clear that when the rich multimedia potential of the web is used properly, a number of positive outcomes, from student engagement to improved learning outcomes are possible”. Comparatively, using interactive non-linearity in multimedia content to inform the user is more likely to result in the user absorbing that information, which is also a positive outcome in comparison with engaging with linear content that is not rich in interactivity and non-linear multimedia application. The examples in Figures 5.1 – 5.4,

demonstrate that had the visualisation been linear, it would have been difficult for a user to really understand the severity and strength of the hurricane. By visualising the content through rich non-linear interactivity, user experience is heightened in displaying the impact of a powerful storm. Many studies corroborate the view that interactivity positively influences learning outcomes, information transfer and ultimately user satisfaction (Brady, 2004).

### 5.3.1.2 Power outage – City blackout from the Bedok to the Boonlay region - Singapore

The following sample was selected from the Straits Times in Singapore<sup>36</sup>. The story aptly replicates the load-shedding challenges that South Africa is currently experiencing. It is interesting to compare and note how the blackout information was visualised, ensuring that the information is easily comprehended by the viewer. The researcher has not identified a similar approach on all South African news websites. The following screen shots from the sample depict, both virtually and interactively, the information about the blackout from Bedok to Boonlay in Singapore.

**Figure 5.5 – Blackout from Bedok to Boonlay region-The first Page**

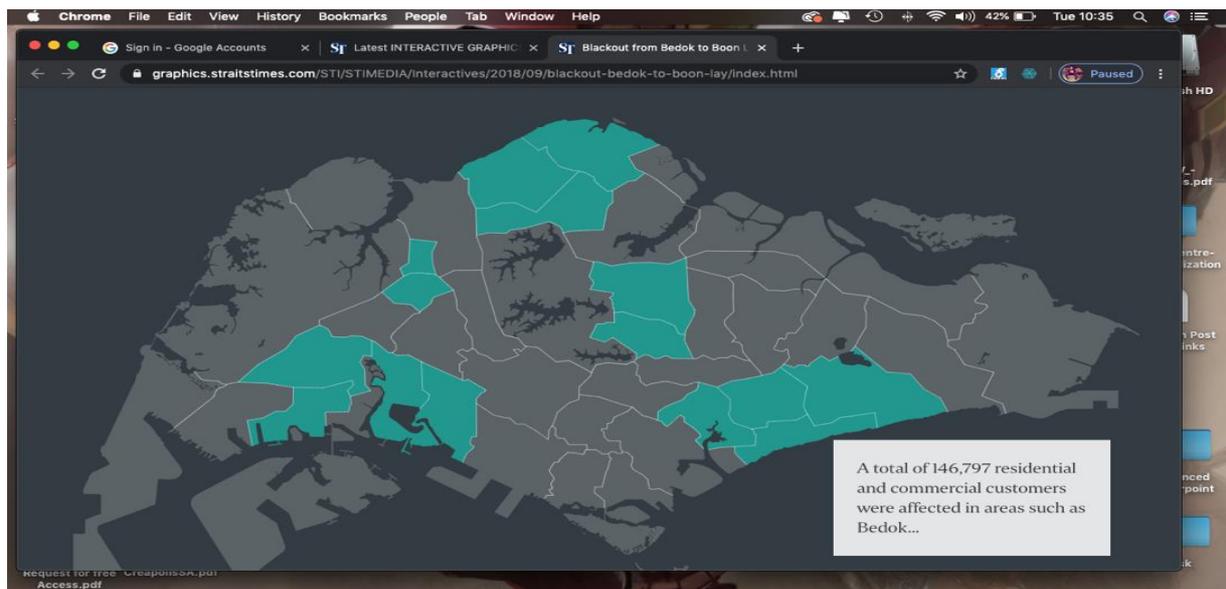


Source: [www.straitstimes.com](http://www.straitstimes.com)

<sup>36</sup> <https://graphics.straitstimes.com/STI/STIMEDIA/Interactives/2018/09/blackout-bedok-to-boon-lay/index.html>

Figure 5.5 demonstrates a graphic map of the specific regions that were affected by a power outage from the Bedok to the Boonlay regions. The colours and the tonal range of the colours extend an emotional connection to the viewer, who feels literally present during the blackout. As the user scrolls the mouse downwards, the text box on the right of the screen floats from bottom to the top; thus, concise information about the blackout and the specific regions that were affected appears in the text box.

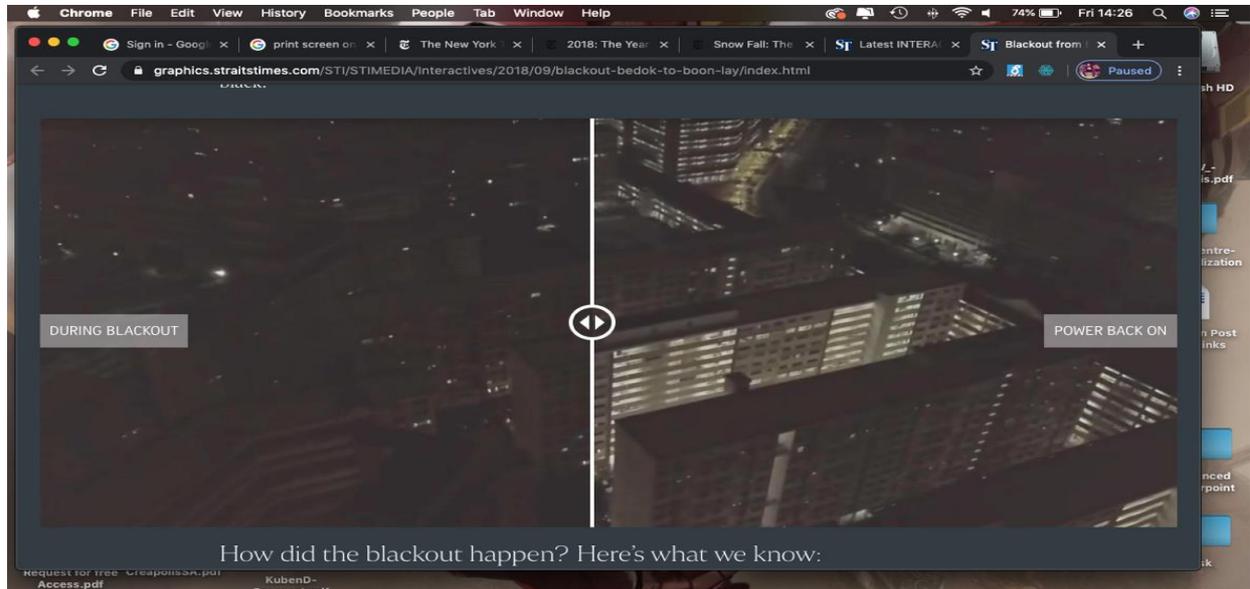
**Figure 5.6– Blackout from Bedok to Boonlay Region -Transition from Figure 5.5**



Source: [www.straitstimes.com](http://www.straitstimes.com)

When the user applies a downward mouse scroll, Figure 5.6 is smoothly transitioned into Figure 5.6. This explanation is demonstrated in Video 7.2 or through the footnote link 35 above. Interestingly, specific areas on the map are highlighted in a lighter tone of turquoise. The tone of turquoise representing the regions shown on the map contrasts with the darker background tones, and that accentuates the selected regions. The information in the text box is aligned with the highlighted visuals; hence, the highlighted turquoise regions on the map visualise the written information in the text box.

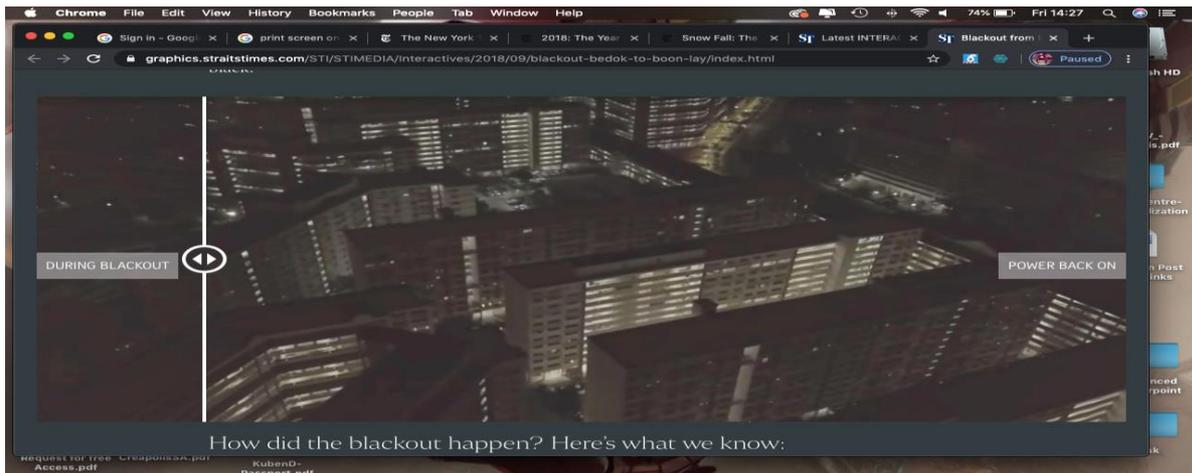
**Figure 5.7– Blackout from Bedok to Boonlay Region-Transition Figure 5.6**



Source: [www.straitstimes.com](http://www.straitstimes.com)

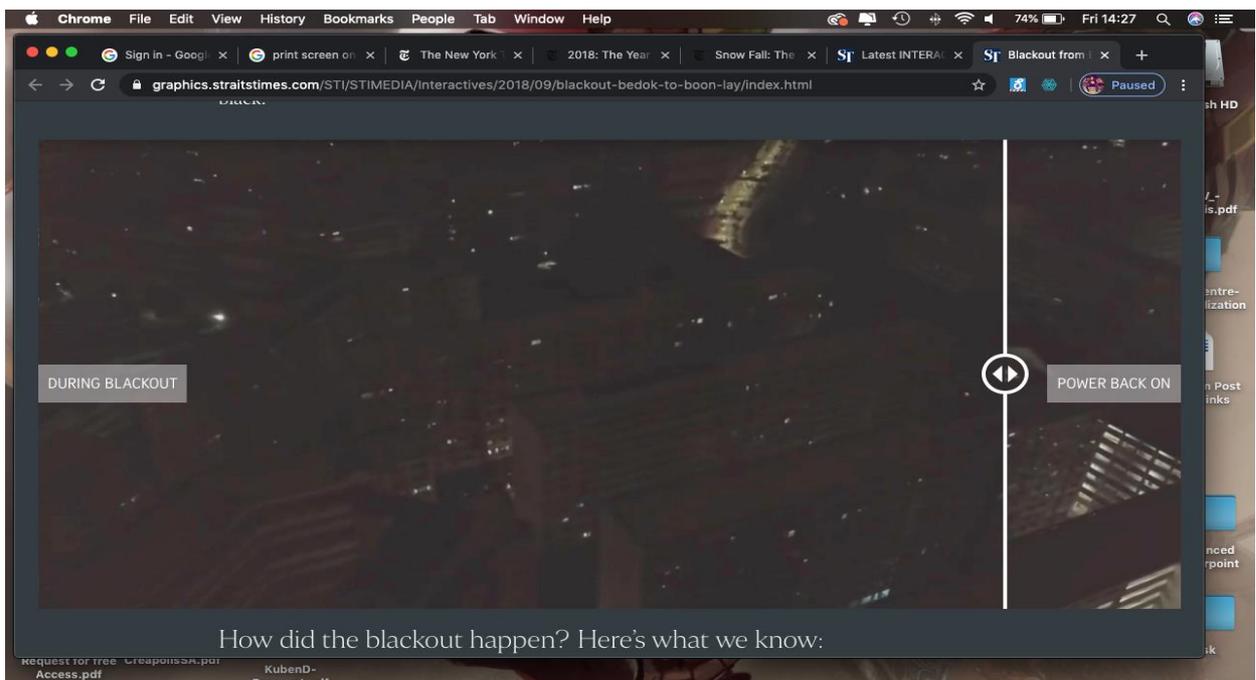
Figure 5.7 depicts an effective interactive slider, which allows the user to click on the circular button with two arrows pointing in the opposite directions. Whilst holding down the mouse, the user can then drag the slider to their left or right at their own pace. Sliding the arrow to the left-hand side shows the user a building with electricity at night. Sliding the arrow to the right-hand side shows the user the same building without electricity during the blackout. Further visual samples of this blackout are shown in Figure 5.8 and Figure 5.9 below.

**Figure 5.8– Blackout from Bedok to Boonlay Region-Transition from Figure 5.7**



Source: [www.straitstimes.com](http://www.straitstimes.com)

**Figure 5.9– Blackout from Bedok to Boonlay Region-Transition from Figure 5.8**



Source: [www.straitstimes.com](http://www.straitstimes.com)

As seen in Figure 5.8 and Figure 5.9, the interactive slider demonstrates an effective user experience, comparing a region with power and that without power.

In this example, the use of rollovers creates navigational interactivity, with the user being able to construct their news pathway in the story. Again, there are syntagmatic elements as signifiers in the text. In addition, paradigmatic elements are added, where information about the blackout

is visually substituted to increase its accessibility. Also, a lot of relevant information is layered on the anchor story. This increases the value of the visualisation as it invites interaction, and a large amount of information is layered in a highly visualised way. This allows the user to navigate through the story at their pace, without being overwhelmed with too much information.

According to Dick (2014), some news stories are considered better suited to be rendered in the interactive form than others. The examples of news stories titled Power Outage – City Blackout extracted from the Straits Times, demonstrate why some news stories are better suited to be rendered as interactive graphics as opposed to the use of non-linear graphics such as YouTube videos and static photographic visuals.

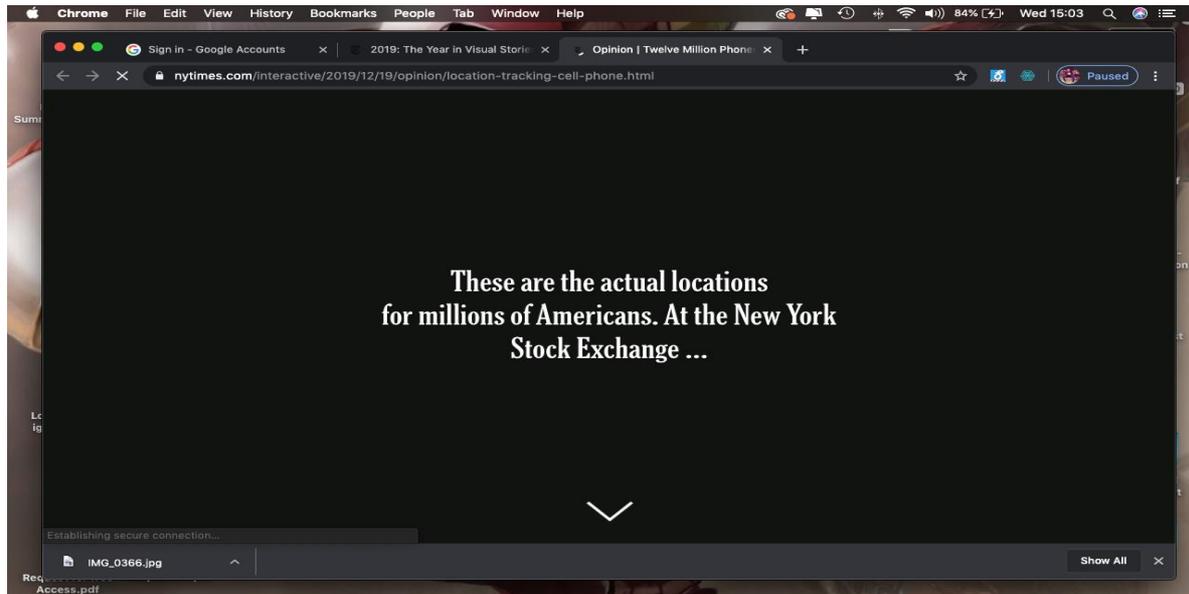
Figures 5.5 and 5.6 effectively allow the user to visualise the regions that were affected by the blackout on the map. Through effective use of non-linear interactivity and colour theory for the colour change on the mouse rollover, the graphics highlight the affected regions on the map. Similarly, the use of the Gestalt Principle of Enclosure enables the viewer to perceive objects that are physically enclosed together as belonging to part of a group. For example, by using a light background shading in a graph to differentiate between forecast and actual data, the user does not only gain better experience with regard to accessing information, but also engages with the non-linearity of the graphics thus fostering users' retention of the information.

Figures 5.7 – 5.9 use non-linear interactivity, thus allowing the user to further gain an experience of the blackout through the use of an interactive slider. Furthermore, an effective comparison is showcased when buildings are shown during a blackout and when power had been restored and that is done through the interactive slider. This experience would be impossible through the implementation of linear graphics or still images to visually communicate the story, as these methods hardly present the same user experience. Apart from that, this example indicates that the benefit of using non-linear interactivity, particularly with the interactive comparison, is embedded in the creation of visual scenarios and experiences to relay information about the possible risks encountered during load-shedding at night from a South African perspective.

### **5.3.1.3 Cyber security – Visualisation of cell phone tracking data**

The following sample on cyber security was selected from the New York Times<sup>37</sup>:

**Figure 5.10 – Cybersecurity monitoring –First Page**



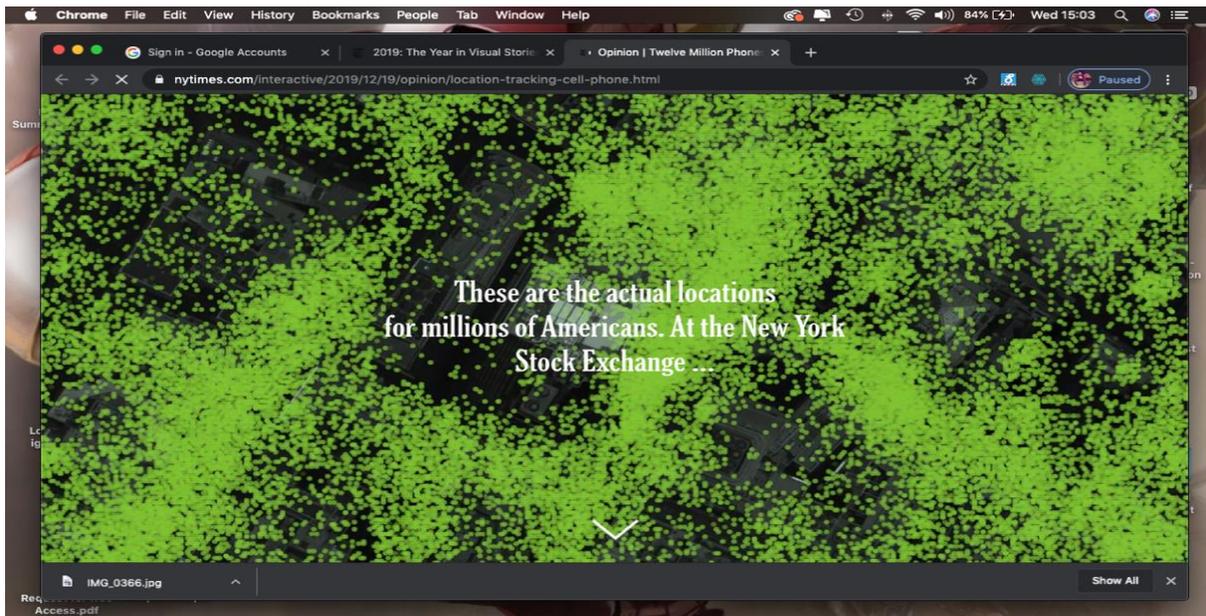
Source: [www.nytimes.com](http://www.nytimes.com)

Figure 5.10 enables the user to recognise the confirmation that actual locations data were used to graphically visualise the information on cyber security issues.

**Figure 5.11 – Cybersecurity monitoring –Transition from Figure 5.10**

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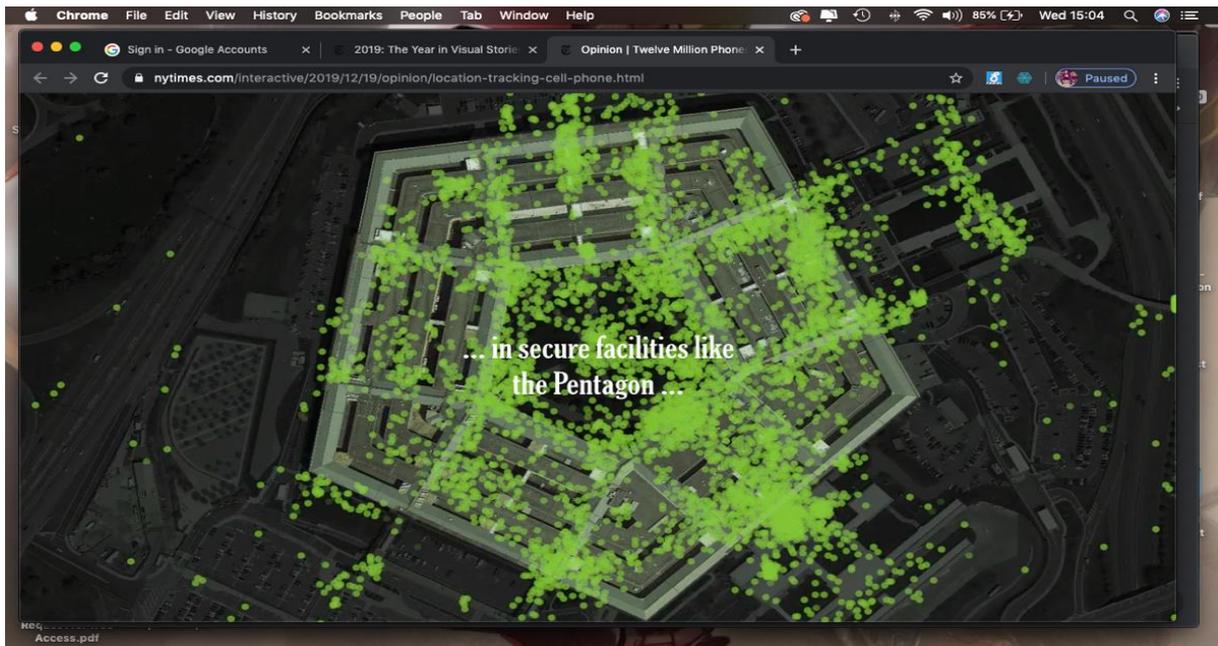
<sup>37</sup> <https://www.nytimes.com/interactive/2019/12/19/opinion/location-tracking-cell-phone.html>



Source: [www.nytimes.com](http://www.nytimes.com)

As the user applies a mouse scroll-down, the screen transitions into a transparent map showing a top view of the vicinity of the New York Stock Exchange. The visualisation begins with sparsely dispersed green dots that gradually fill the screen. The green dots are visualised representations of smart phone owners within the vicinity of the New York Stock Exchange. If one were to read a chunk of textual information, whether statistical or otherwise, it would become mentally overloading or too confusing for the user to grasp the information. However, as Figure 5.11 confirms, a visual interpretation of the volume of smart phone owners is unequivocally effective. As seen in other samples related to this visualisation, brief yet concise textual information is regarded as complementing the visualisation.

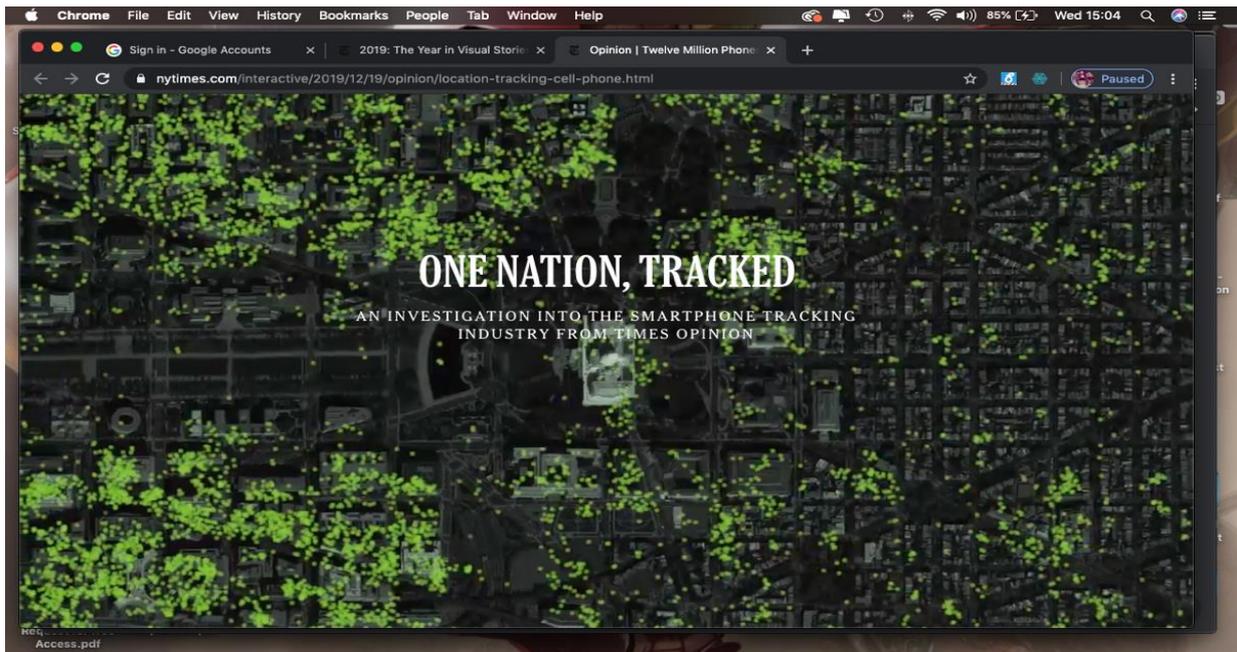
**Figure 5.12 – Cybersecurity monitoring –Transition from Figure 5.11**



Source: [www.nytimes.com](http://www.nytimes.com)

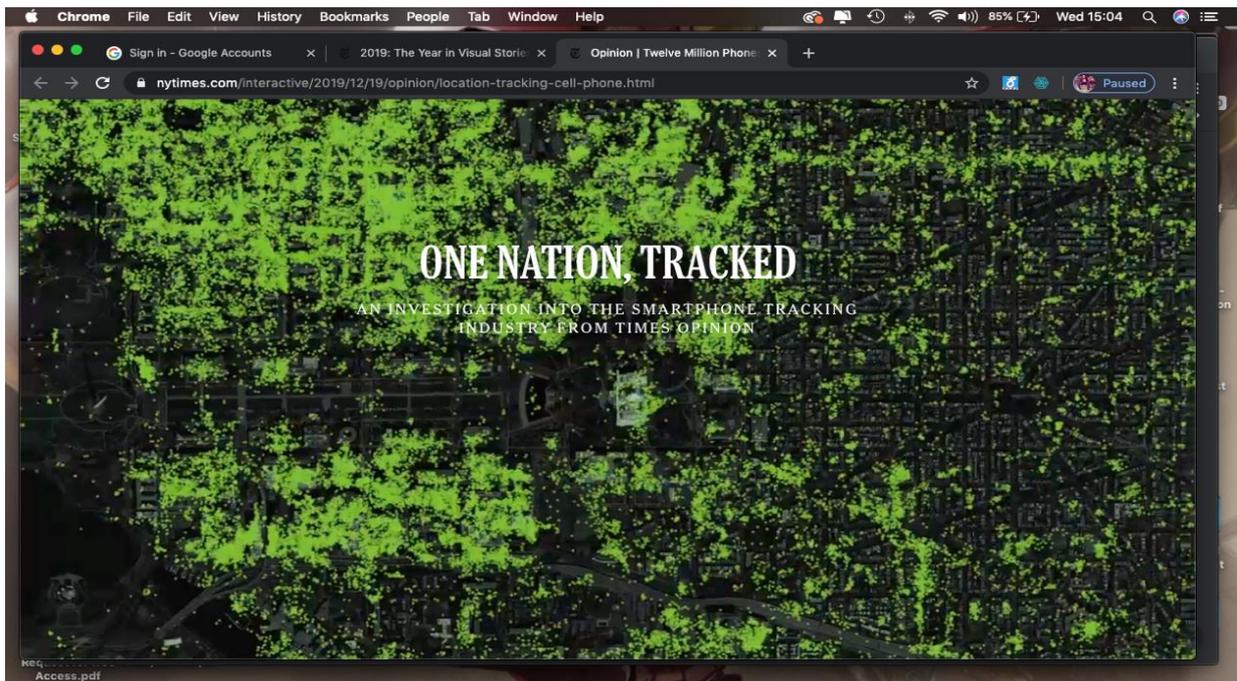
Figure 5.12 is the top view visualisation of the Pentagon in Washington DC. Although the Pentagon is a highly secure facility, the visualisation represented by the green dot shows the volume of smart phone users inside and outside the perimeter of the Pentagon premises. This shows individuals' ability to track their mobile phones. The visualisations are more dramatic to view than only reading the data presented in a statistical format. The visualisation becomes more effective especially when the green dots are animated over time and as they appear on the Web page.

**Figure 5.13 – Cybersecurity monitoring –Transition from Figure 5.12**



Source: [www.nytimes.com](http://www.nytimes.com)

Figure 5.14– Cybersecurity monitoring – Transition from Figure 5.13

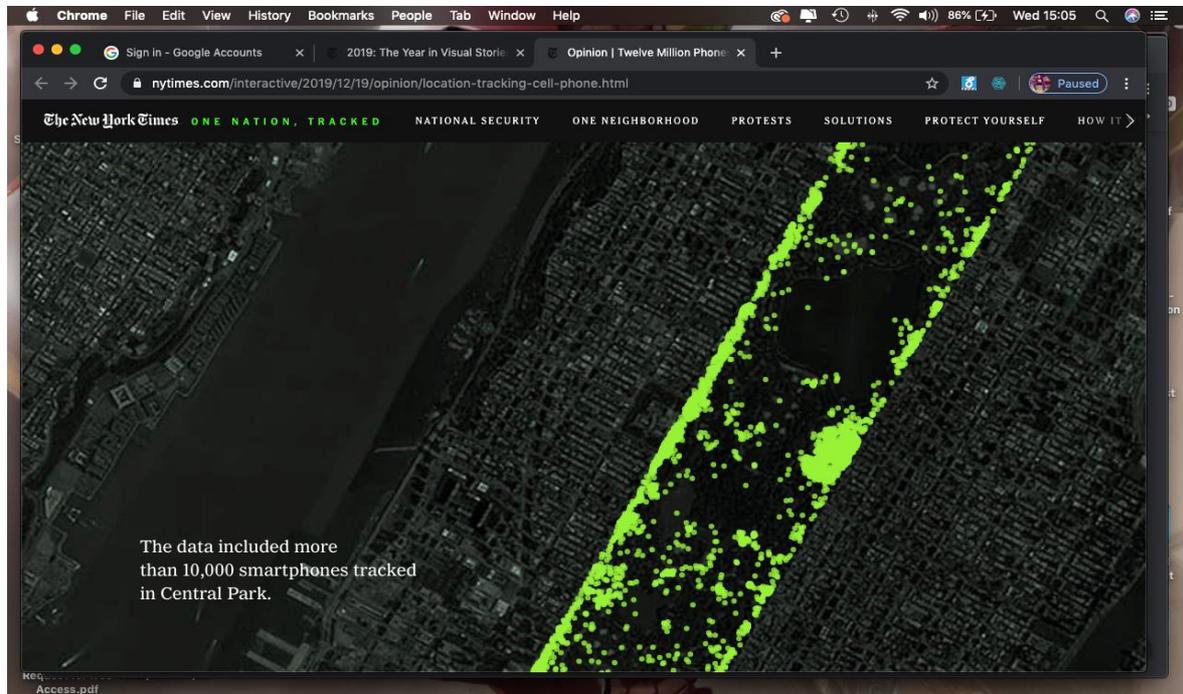


Source: [www.nytimes.com](http://www.nytimes.com)

Figure 5.13 and Figure 5.14 are visual representations of the same region. However, the difference between the two visuals is reflected in the intensity of smart phone users during a particular day’s off-peak (Figure 5.13) and peak hours (Figure 5.14). A visualised representation of this comparative data has more impact as compared to reading figures and

statistics expressing the same comparison. Precisely, when the information is viewed visually, it is better retained by the observer as compared to statistical figures.

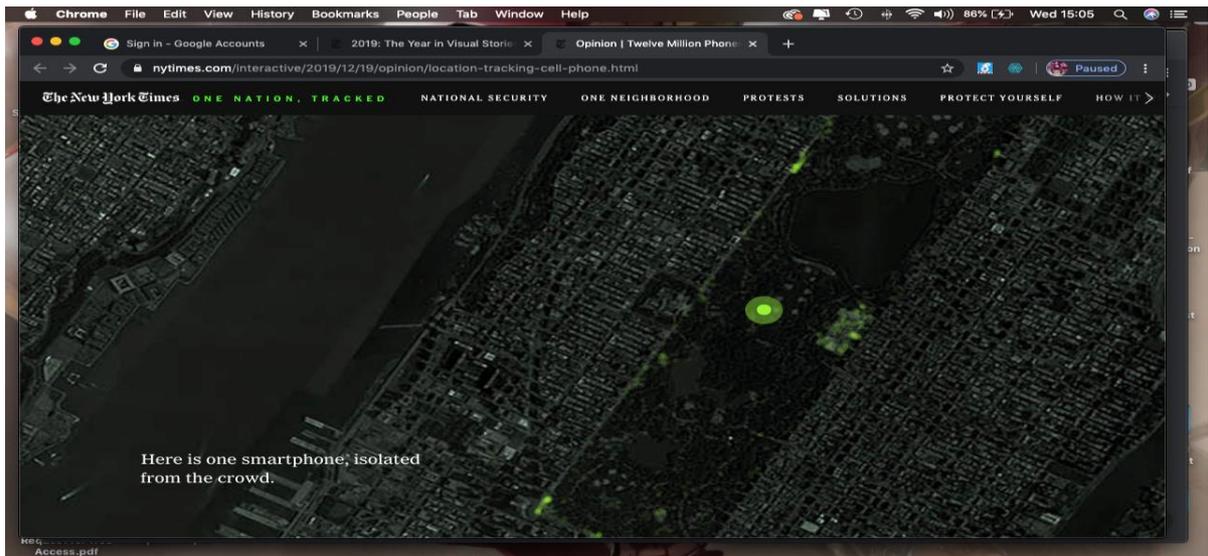
**Figure 5.15– Cybersecurity monitoring – Transition from Figure 5.14**



Source: [www.nytimes.com](http://www.nytimes.com)

Figure 5.15 visualises more than 10 000 tracked smart phones in Central Park, New York City. The visualisation is effective because a viewer can literally ‘see’ the volume of smart phones and their location in Central Park. When the user applies a mouse scroll-down, Figure 5.15 is transitioned into Figure 5.16.

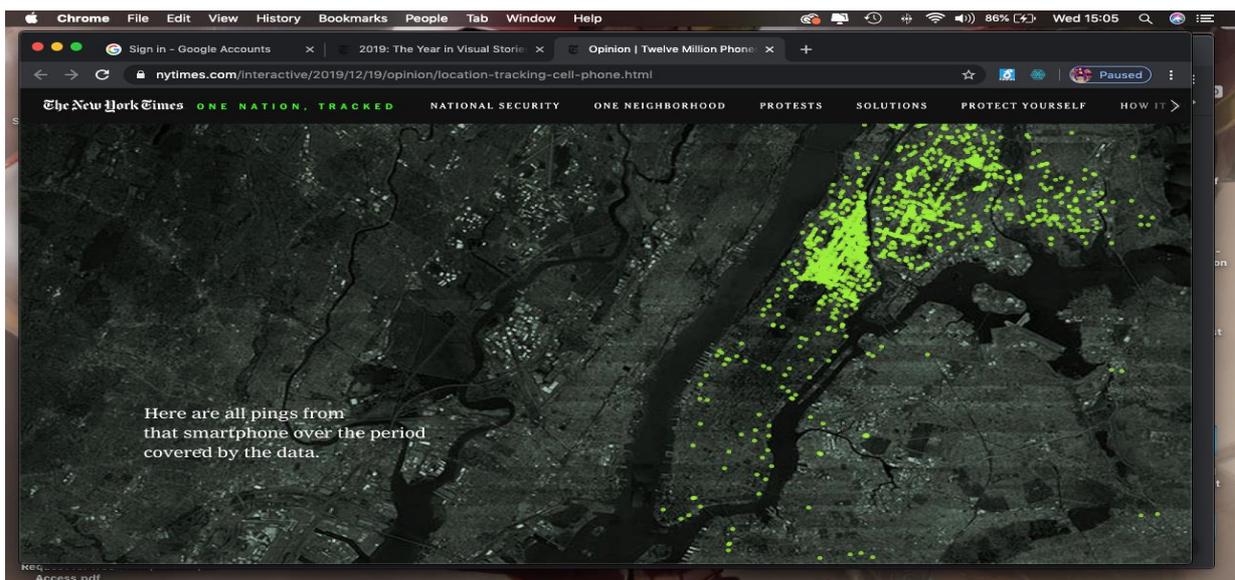
**Figure 5.16– Cybersecurity monitoring – Transition from Figure 5.15**



Source: [www.nytimes.com](http://www.nytimes.com)

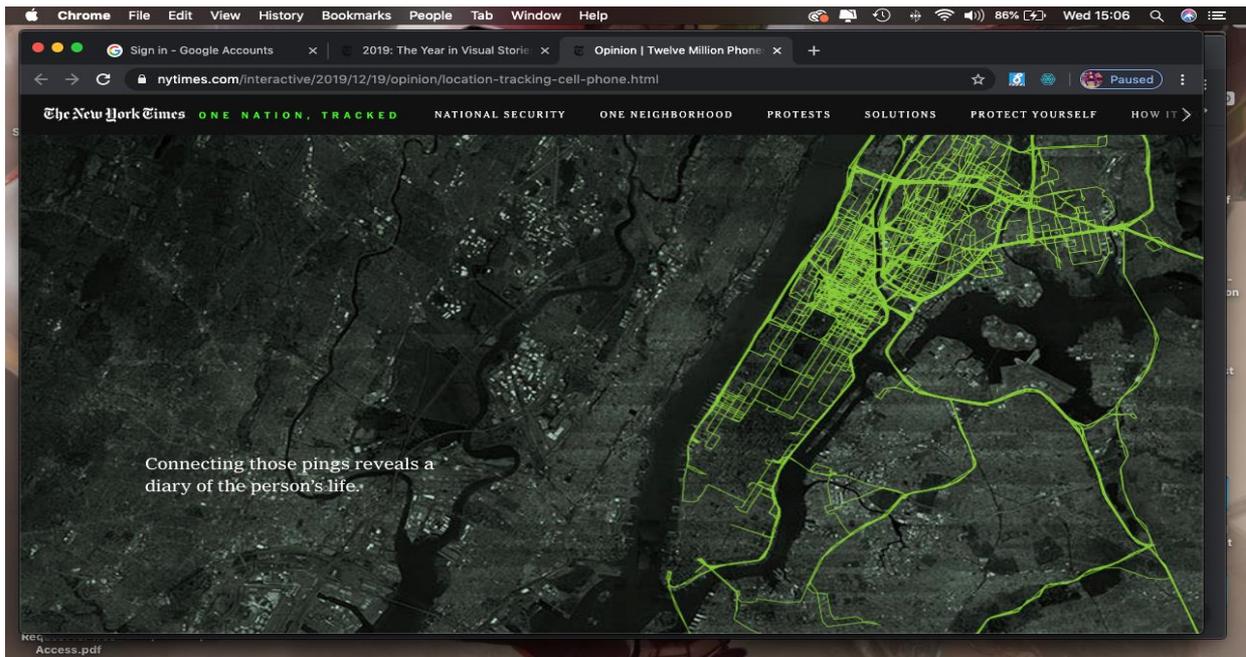
Figure 5.16 depicts one smart phone user who is isolated from the crowd of smart phone users in Central Park New York City as seen in Figure 5.15. The isolated user is visualised by a blinking circular icon. The smart phone icon (blinking circle) also tracks the movement of the phone user. This effect is evident in the graphic on the website. Without visualising this data, understanding this phenomenon through written text and statistical data would not have been equally effective.

**Figure 5.17– Cybersecurity monitoring –Transition from Figure 5.16**



Source: [www.nytimes.com](http://www.nytimes.com)

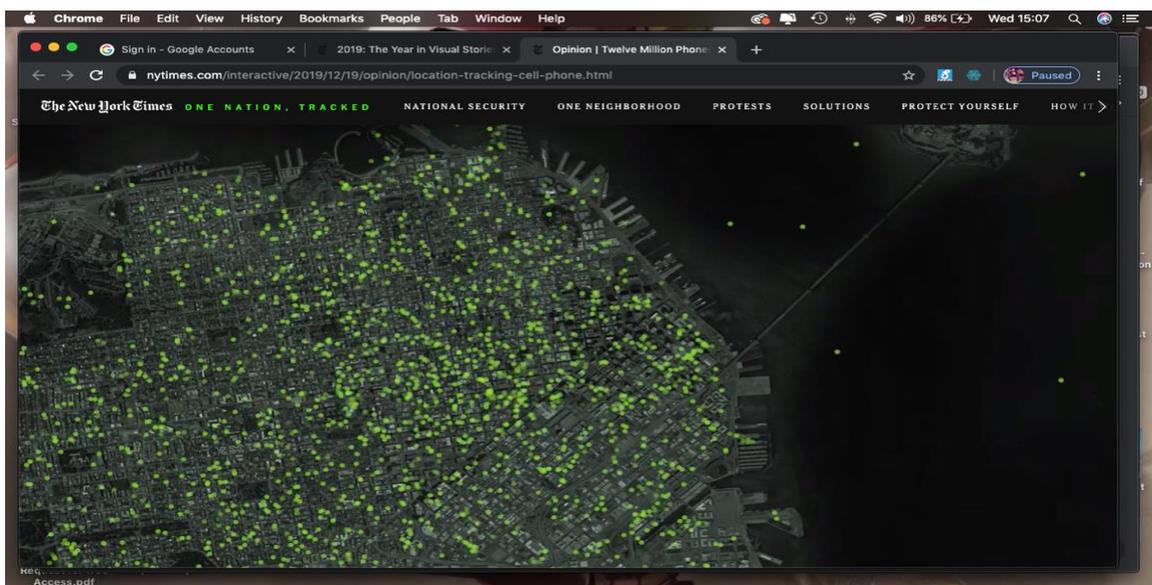
**Figure 5.18– Cybersecurity monitoring – Transition from Figure 5.17**



Source: [www.nytimes.com](http://www.nytimes.com)

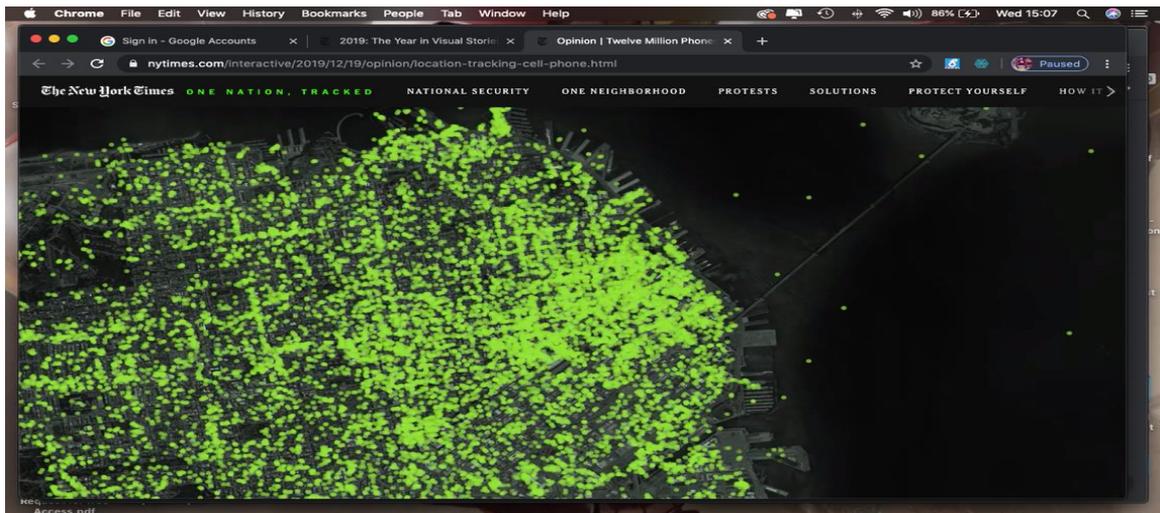
Figures 5.17 and 5.18 are interesting visualisations. The visualisation in Figure 5.17 depicts pings from chat messages exchanged by smart phone users in the visualised region shown on the map. Figure 5.18 shows the location of the receiving user within New York City. With this data visualisation, it becomes easier to monitor the interaction of smart phones.

**Figure 5.19– Cybersecurity monitoring – Transition from Figure 5.18**



Source: [www.nytimes.com](http://www.nytimes.com)

**Figure 5.20– Cybersecurity monitoring – Transition from Figure 5.19**



Source: [www.nytimes.com](http://www.nytimes.com)

Figures 5.19 and 5.20 visualise the volume of smart phone users in the San Francisco Bay area. Figure 5.19 is gradually populated by animation of green icons which transition into a densely populated animation as shown in Figure 5.20. Vindicating the example presented in Section 5.3.3: Cyber Security – Visualisation of Cell Phone tracking Data, Theus (2002) affirms that data visualisation has been acknowledged as an important tool in decision-making. However, visualisations are usually static and just used for presentation rather than exploration purposes. Interactive statistical data visualisation is a powerful tool that transcends the limits of static graphics.

With reference to the example in Section 5.3.3: Cyber Security – Visualisation of Cell Phone tracking Data, the non-linearity of the interactivity ‘shows’ and communicates the information rather than ‘explaining’ as a way of communicating the information. For instance, in Figure 16, the icon becomes a non-linear hotspot showing the user’s movement from one spot to another.

The visual simply translates the main idea of the story into pictographic elements. Additionally, the implementation of non-linear interactivity has a more altitudinous impact on the user engagement with the visual. It enhances user experience during the process of absorbing and retaining information. Ward et al. (2010) weigh in, averring that a single picture can contain wealthy information that can be processed much more quickly than a page of words. This is so because image interpretation is performed quickly and in parallel with other operations within the human perceptual system; comparatively, the speed of text analysis is slowed down by the

sequential process of reading. Humans are visual beings; hence, they use sight as one of their key senses that enhance acquisition of information.

Furthermore, modern visualisations harness digital media and non-linear interactivity. Johnson (2009:5) quotes Cooper (1993) as maintaining that the next paradigm in computer-based instruction will be the placement of the computing element of the personal computer close to its source of data, thus using the network to deliver instruction to the user. Precisely, the interface design would need to be more user-friendly and adaptive in order to encourage user interface engagement.

Comparatively, Lustria (2007) alludes to an experiment conducted to examine the effects of Web interactivity on comprehension and to determine whether or not individual differences might moderate such effects. Two websites on skin cancer were designed with different levels of interactivity. The findings of the study suggested that interactivity can significantly affect comprehension and attitudes towards health websites with regards to accessing information. Resultantly, digital visualisation production, particularly for information design, must be designed accordingly to accentuate the visual sense in comprehending information.

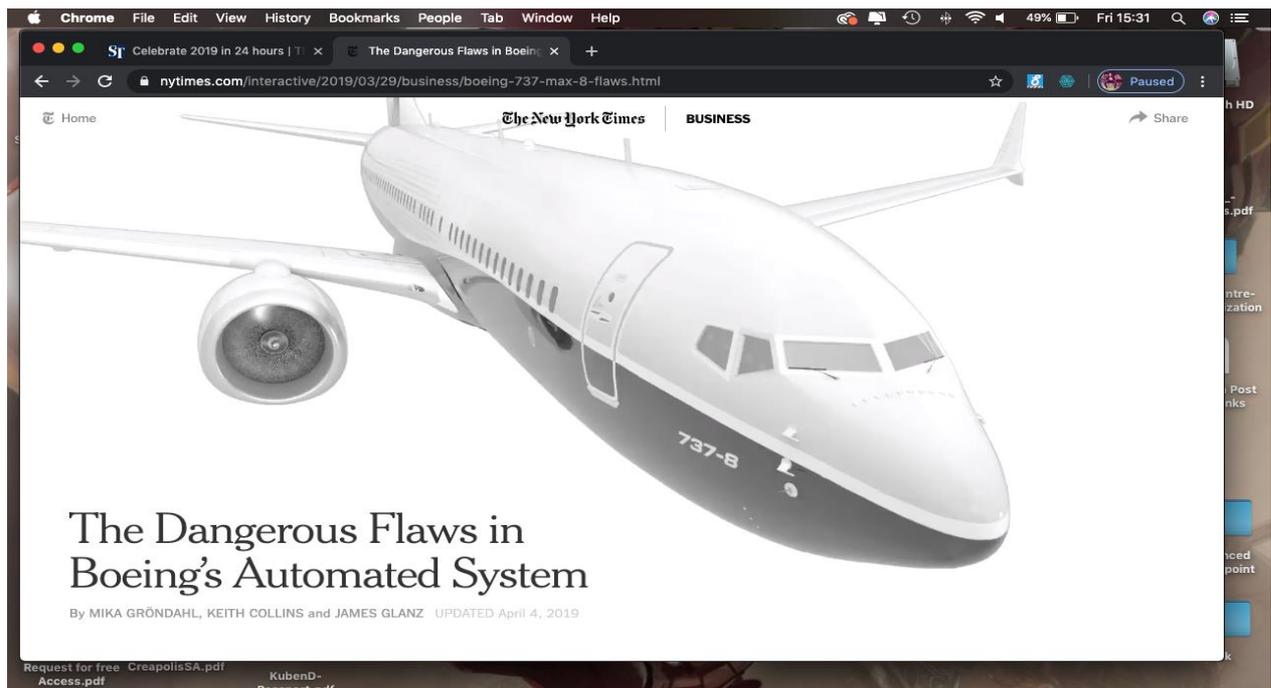
#### **5.3.1.4 Aeronautical technical failures**

The following sample was selected from the New York Times<sup>38</sup>. It depicts the dangerous flaws in Boeing's automated system.

#### **Figure 5.21 - Dangerous flaws in Boeing's automated system-First page**

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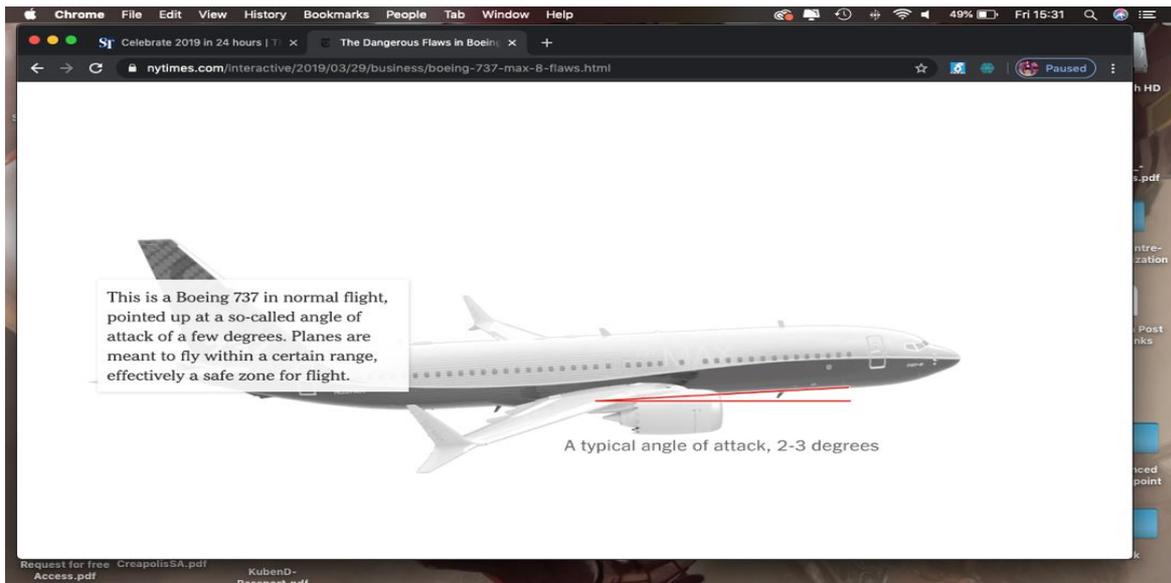
<sup>38</sup><https://www.nytimes.com/interactive/2019/03/29/business/boeing-737-max-8-flaws.html>



Source: [www.nytimes.com](http://www.nytimes.com)

This sample demonstrates interactive information design, as the user can interact with the information. The researcher sampled the process, which fairly details an aeronautical engineering failure, a subject the researcher is not familiar with. However, the visual presentation impacts the user experience as it simply resulted in the transfer of information on this complex subject matter. The visualisation fostered a clear understanding of the flaws occurring in the aeronautical engineering design (both technical and physical), particularly regarding the Boeing airplane. An application of a mouse scroll-down results in the image being simulated into motion three dimensions into Figure 5.22.

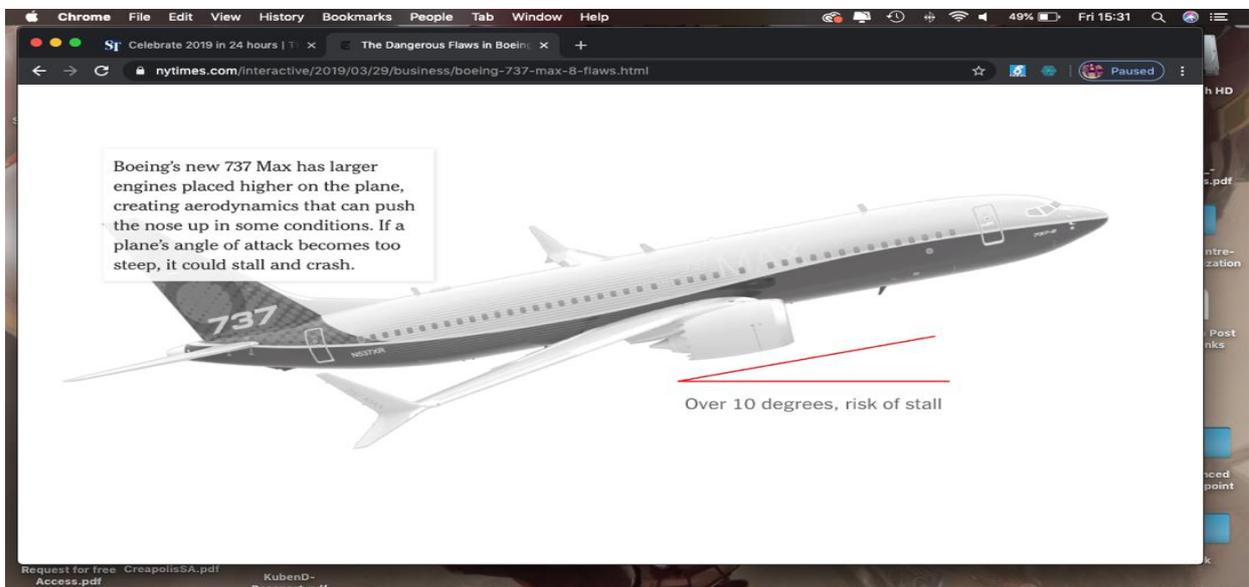
**Figure 5.22- Dangerous flaws in Boeing's automated system-Transition Figure 5.21**



Source: [www.nytimes.com](http://www.nytimes.com)

Figure 5.22 visually depicts the normal angle of an airplane's flight. This visual description is supplemented textually and diagrammatically through a floating text box and two red lines on the illustration of the Boeing aircraft.

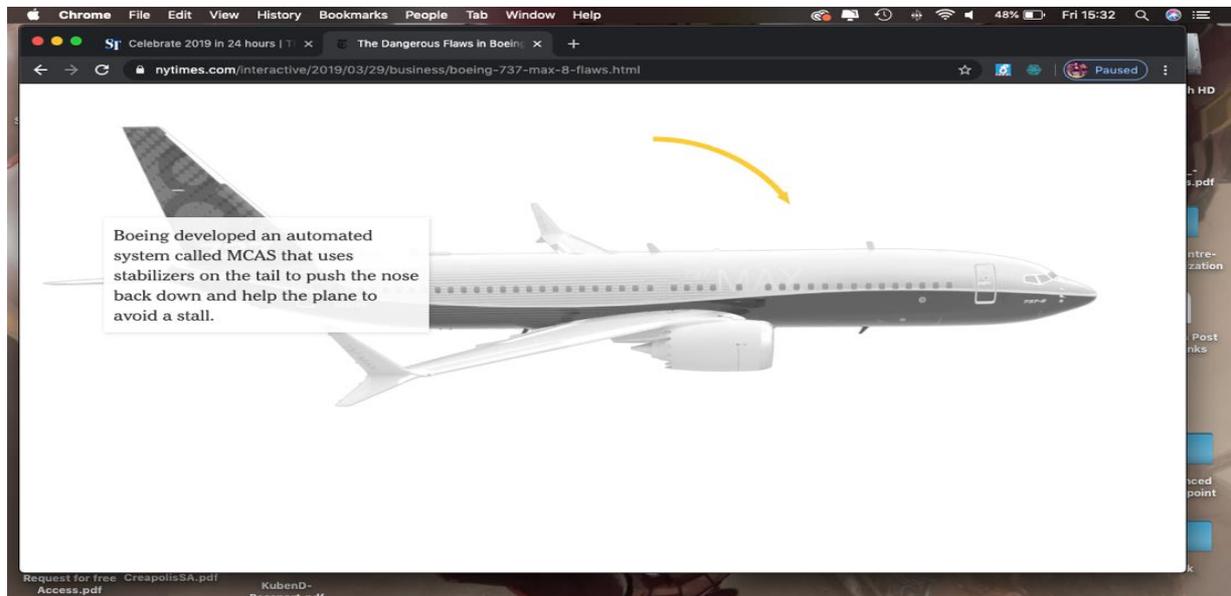
**Figure 5.23- Dangerous flaws in Boeing's automated system-Transition from Figure 5.22**



Source: [www.nytimes.com](http://www.nytimes.com)

A mouse scroll-down results in the illustration in Figure 5.23 moving in an upward direction, thus corresponding with the written content in the text box.<sup>39</sup>The red diagram with lines also gets into an upward motion.

**Figure 5.24- Dangerous flaws in Boeing’s automated system-Transition from Figure 5.23**



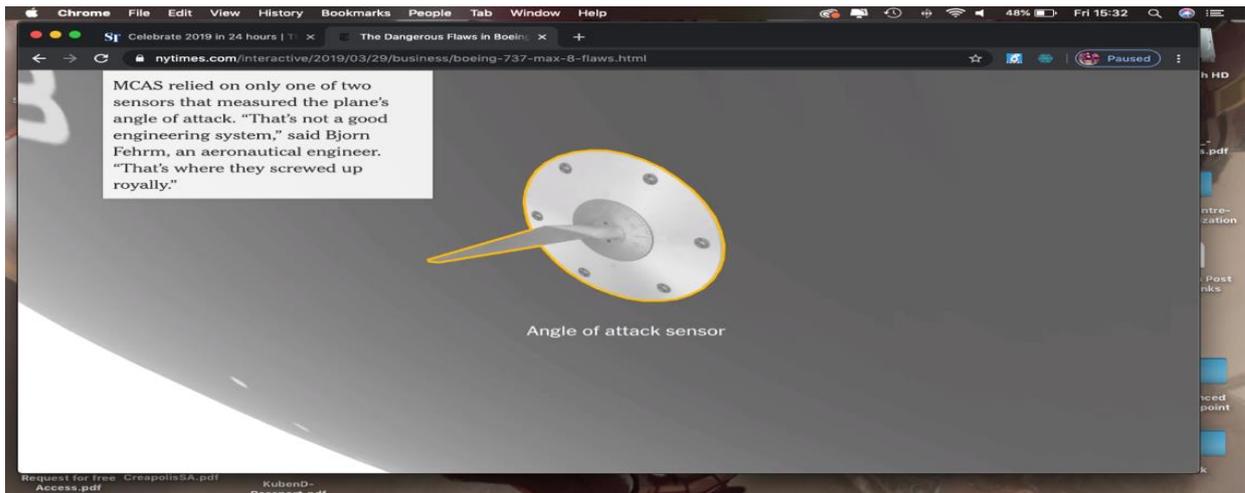
Source: [www.nytimes.com](http://www.nytimes.com)

A mouse scroll-down instructs the illustration in Figure 5.24 to move downward, corresponding with the written information about the automated system in the plane in the text box. The motion of the airplane is supplemented by directional yellow arrows on the top of the illustration of the airplane to further indicate its direction.

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<sup>39</sup> <https://www.nytimes.com/interactive/2019/03/29/business/boeing-737-max-8-flaws.html>

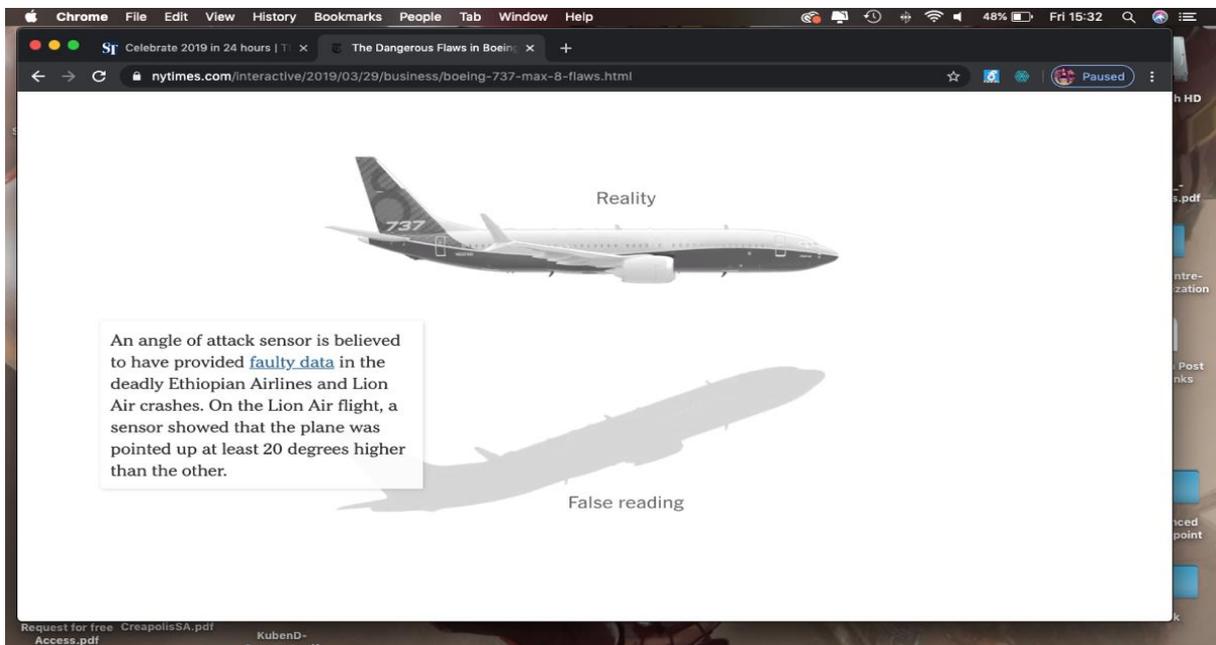
**Figure 5.25- Dangerous flaws in Boeing’s automated system-Transition from Figure 5.24**



Source: [www.nytimes.com](http://www.nytimes.com)

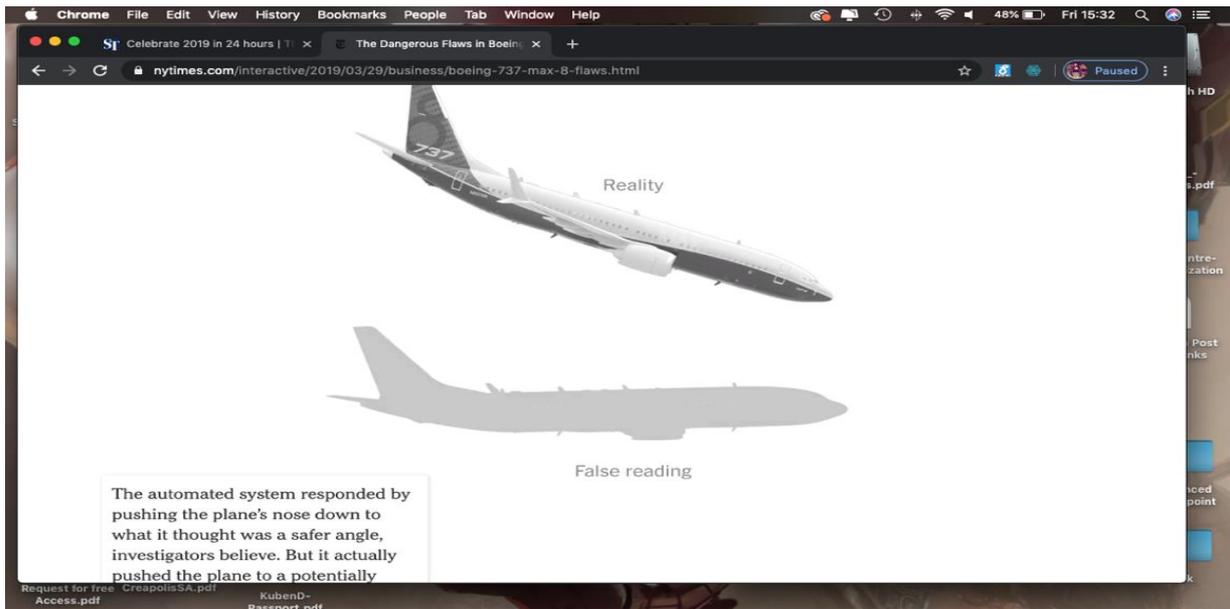
On applying a mouse scroll-down, the image is transitionally simulated in three dimensions into Figure 5.25, an extreme close-up view of a sensor fitted to the aircraft. Textual information supplements the visuals in describing the purpose of the device in an extreme close-up view.

**Figure 5.26- Dangerous flaws in Boeing’s automated system-Transition from Figure 5.25**



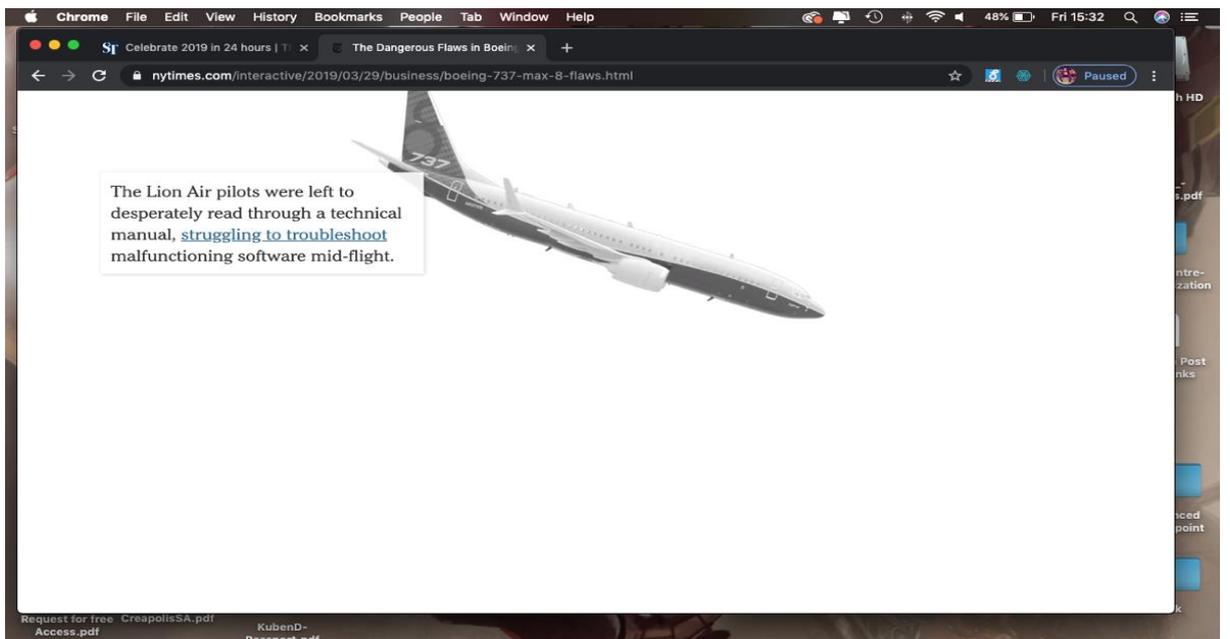
Source: [www.nytimes.com](http://www.nytimes.com)

**Figure 5.26- Dangerous flaws in Boeing’s automated system-Transition from Figure 5.25**



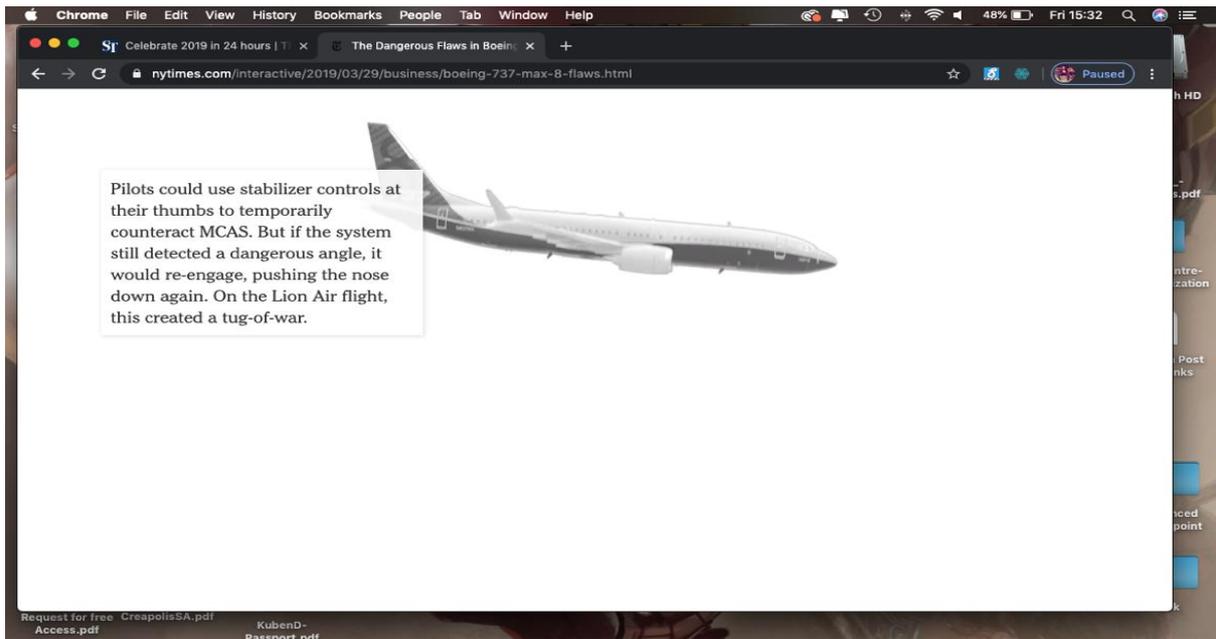
Source: [www.nytimes.com](http://www.nytimes.com)

**Figure 5.27- Dangerous flaws in Boeing’s automated system-Transition from Figure 5.26**



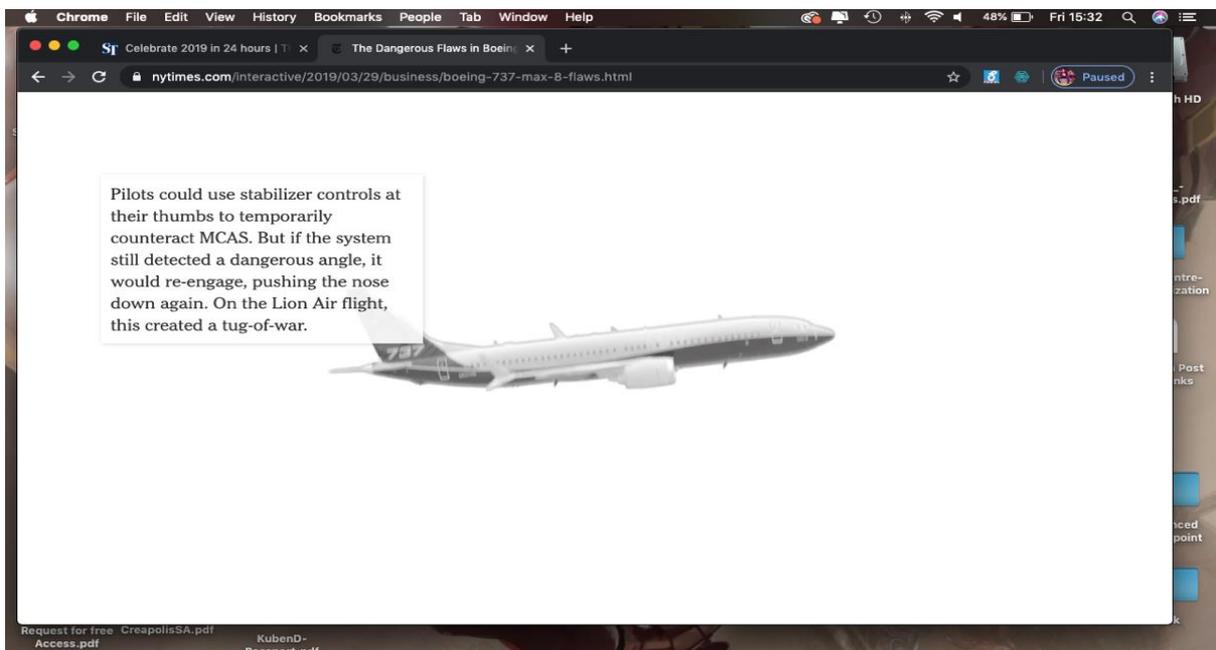
Source: [www.nytimes.com](http://www.nytimes.com)

**Figure 5.28- Dangerous flaws in Boeing’s automated system-Transition from Figure 5.27**



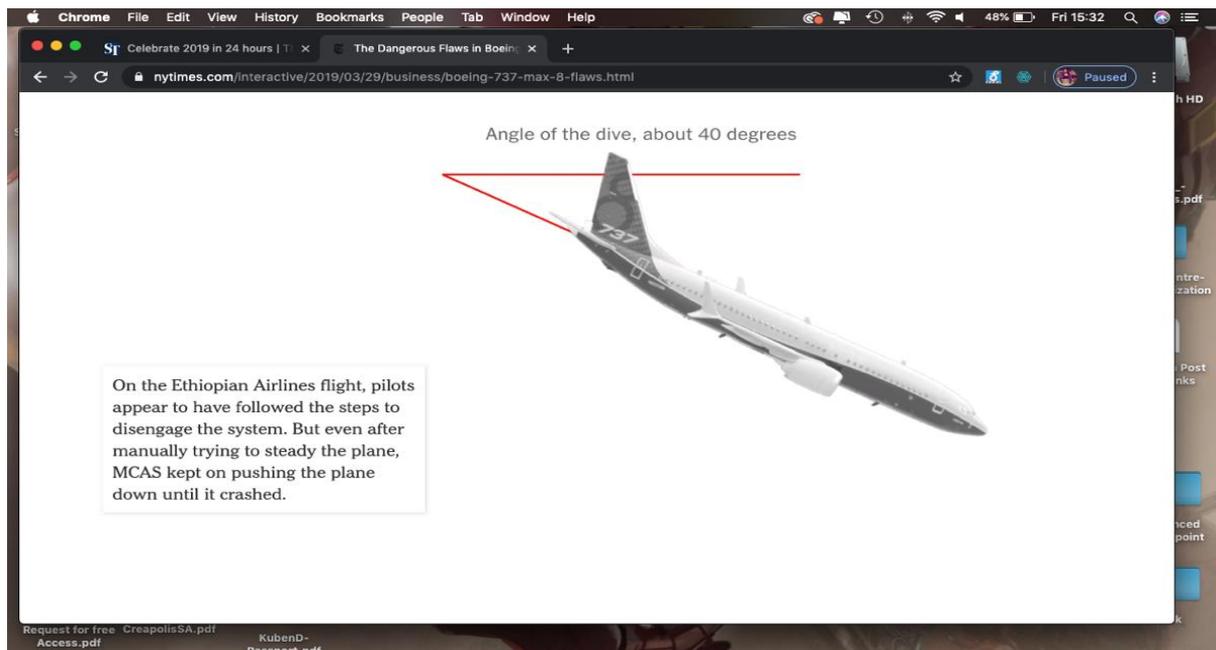
Source: [www.nytimes.com](http://www.nytimes.com)

**Figure 5.29- Dangerous flaws in Boeing’s automated System-Transition from Figure 5.28**



Source: [www.nytimes.com](http://www.nytimes.com)

**Figure 5.30- Dangerous flaws in Boeing’s automated system-Transition from Figure 5.29**



Source: [www.nytimes.com](http://www.nytimes.com)

As the user applies a mouse scroll-down, the screen shots from Figure 5.26 to Figure 5.30 are set in motion, explaining both visually and textually (written information in the text box) the details about what could have possibly transpired during the two air crashes involving the same model of the Boeing aircraft in question. This further exemplifies a hyper-story, where rollovers, hypertexts and hotspots create a network of interlinked files that the users can navigate at their own pace. The information is layered in a dominantly visualised format, with some text boxes popping up when the user hovers over or clicks a hotspot.

From the researcher’s experience interacting with this information graphic, it would have been more confusing to understand this aviation fault process, particularly if the researcher were to read this information in its mere text format. However, a combination of selected interactive multimedia elements (text, graphics, sound, animation and video) did not only make the transfer of information easier, but also made it even easier to understand and retain. Furthermore, from the researcher’s experience, the interactive and visual demonstration of the problem makes sense with regard to what could have caused the crash of both aircrafts. The conclusions this study arrived at could not have been deciphered had the researcher only read the written article or watched and listened to a television and radio broadcast. Ayerdi et al. (2014) explains that when media began to appear online, the main characteristics of the digital

language were hypertext, multimedia and interactivity, and most trends of the online world led to interaction. Figures 5.26 – 5.30 are testimony to this notion of interactivity. The use of a non-linear multimedia narrative in this example gives the user the freedom and choice to engage with the graphical content at their pace while engaging with the content. A linear narrative structure offers few possibilities for the user to choose amongst different trajectories (Noci, 2014).

### **5.3.1.5 Travel and Tourism**

The following samples were obtained from The Straits Times Online – Singapore<sup>40</sup>.

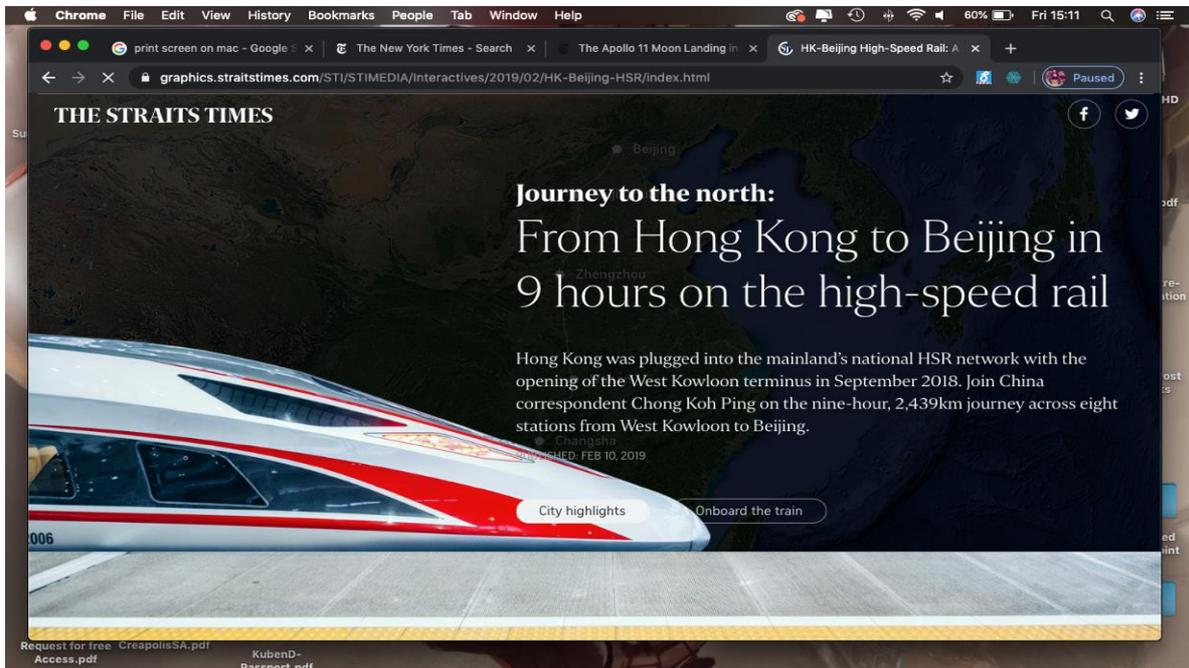
A Chinese correspondent, Chong Koh Ping, travelled on the newly opened high-speed rail connecting Hong Kong to Beijing. This interactive piece of information allows readers to literally join her on the nine-hour, 2 439-kilometre journey across eight stations from West Kowloon to Beijing. The use of videos, photos and the text brought to life the highlights of each of the eight stops.

This sample was developed in two versions. The first version of the sample demonstrates a virtual experience, allowing the user to become a virtual co-passenger on the train. However, the researcher could not access the virtual version due to not having subscribed to the Straits Times Online. Some of the interactive virtual graphic options could only be accessed via the subscription model. The researcher could only access the CITY HIGHLIGHTS button, a non-linear interactive version of this visualisation, which did not require the subscription option. The CITY HIGHLIGHTS option is a virtual interactive top view visualisation that depicts the journey whilst stopping at each of the six cities in-between Hong King and Beijing. This version also serves as a tourist bulletin. Information about the stop-over cities, particularly interesting sights, a brief history, and interesting restaurants and hotels, is accessible as the highlighted icon representing the train on the graphic approaches the cities. The researcher has not identified a similar approach to online graphics on local news websites. The following screen shots demonstrate the interactivity of the sample.

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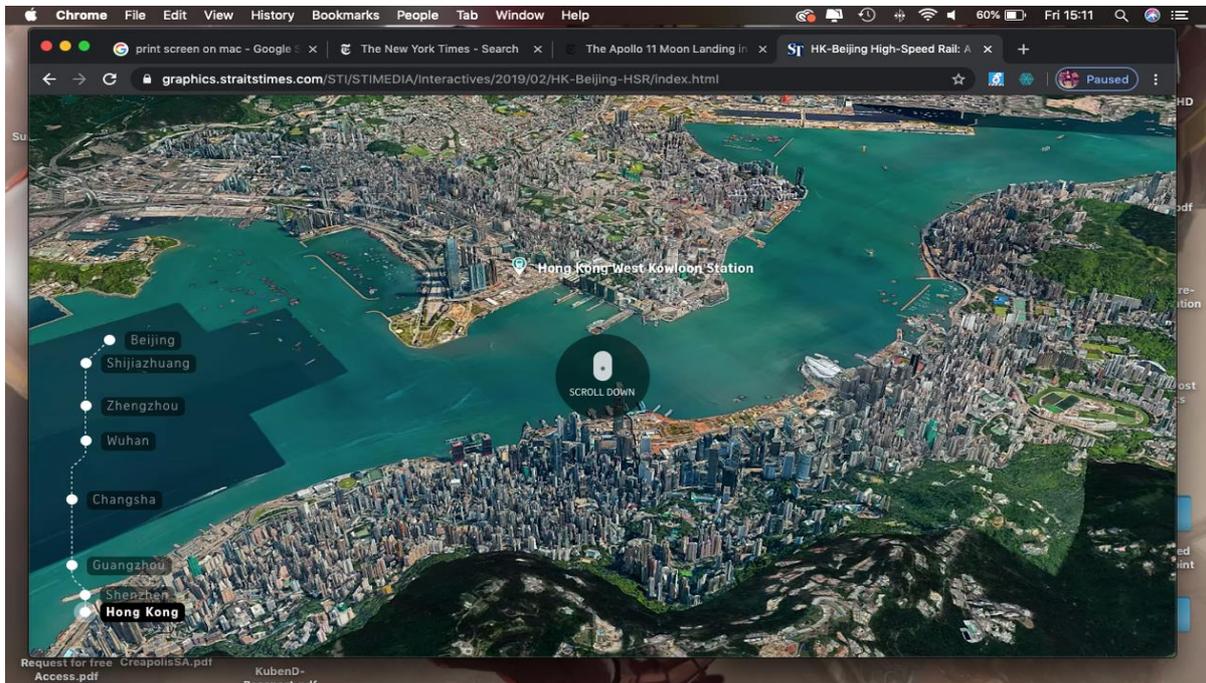
<sup>40</sup><https://graphics.straitstimes.com/STI/STIMEDIA/Interactives/2019/02/HK-Beijing-HSR/index.html>

**Figure 5.31- A train journey from Hong Kong to Beijing in nine hours aboard a high-speed train-First page**



Source: [www.straitstimes.com](http://www.straitstimes.com)

**Figure 5.32- A train journey from Hong Kong to Beijing in nine hours aboard a high-speed train – A transition from 5.31**

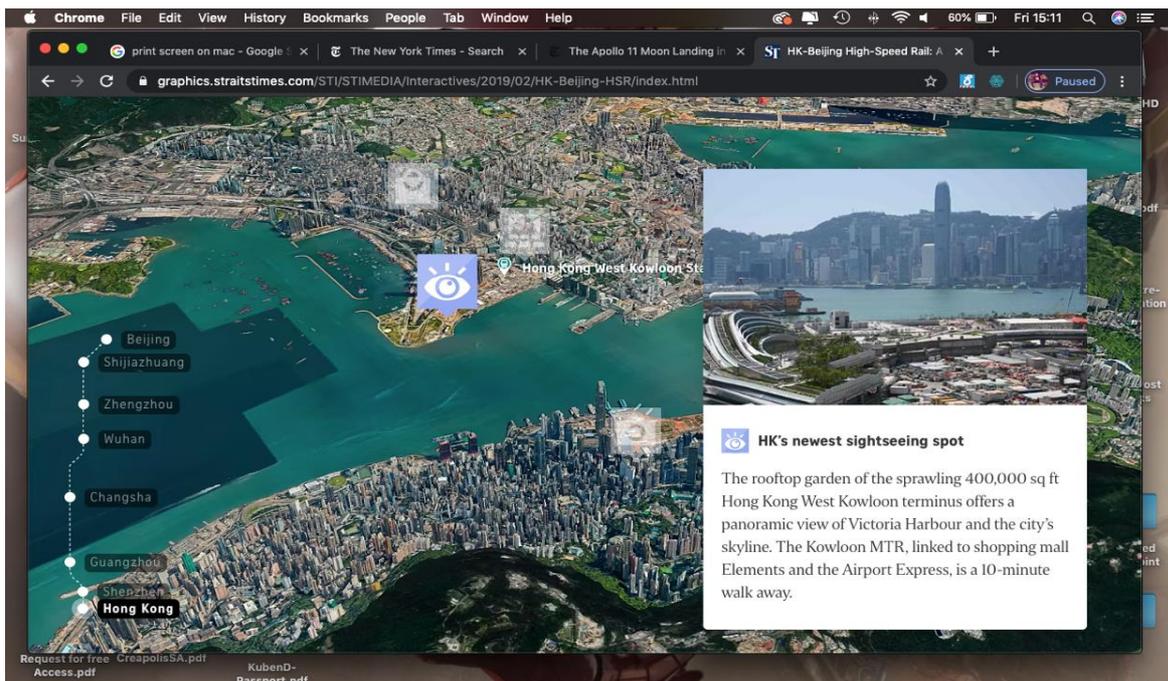


Source: [www.straitstimes.com](http://www.straitstimes.com)

From Hong Kong (HK), the visual begins as a simulated aerial view of the city. Highlighted on the left of the screen are the cities through which the train would pass en-route to Beijing. The cities are:

1. Hong Kong (HK)
2. Shenzhen
3. Guangzhou
4. Changsha
5. Wuhan
6. Zhengzhou
7. Shijiazhuang
8. Beijing

**Figure 5.33- A train journey from Hong Kong to Beijing in nine hours aboard a high speed train – A transition from 5.32**

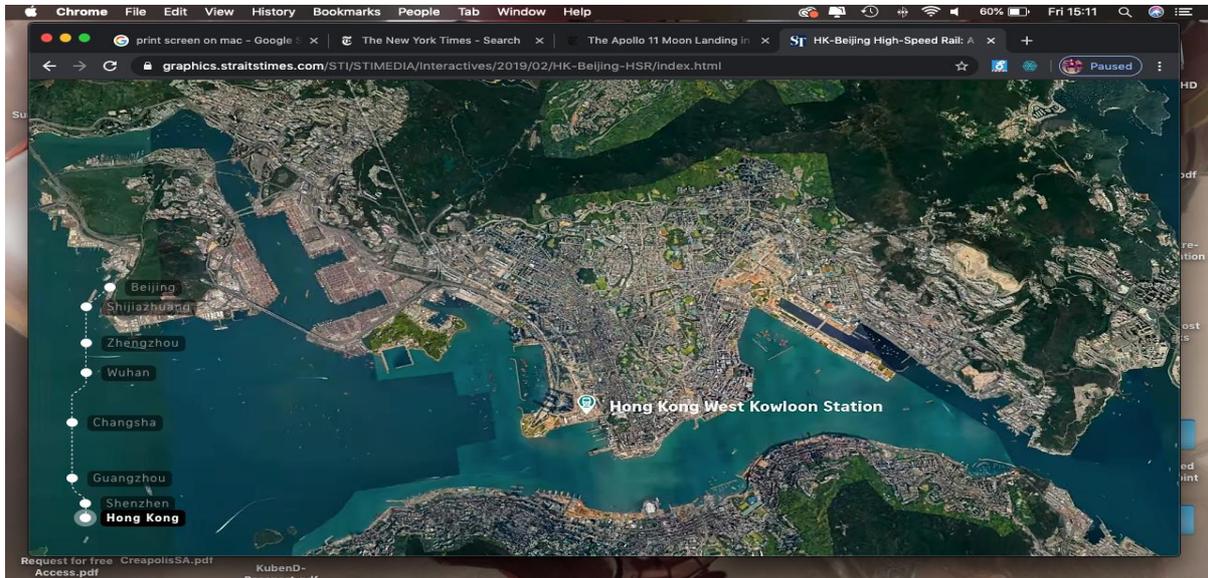


Source: [www.straitstimes.com](http://www.straitstimes.com)

Figure 5.33 depicts Hong Kong (HK) as highlighted in the timeline on the bottom left corner of the screen, with other key sights also being highlighted to communicate important information about the city. Hong Kong's newest sightseeing spot is highlighted with an 'eye icon' indicating the exact positioning of the spot on the virtual map. Furthermore, a highlight text box appears with a photograph of the view and a brief textual description of the sightseeing

spot. The same approach is used to indicate key information on other cities on the train route to Beijing (Figures 5.37 and 5.38).

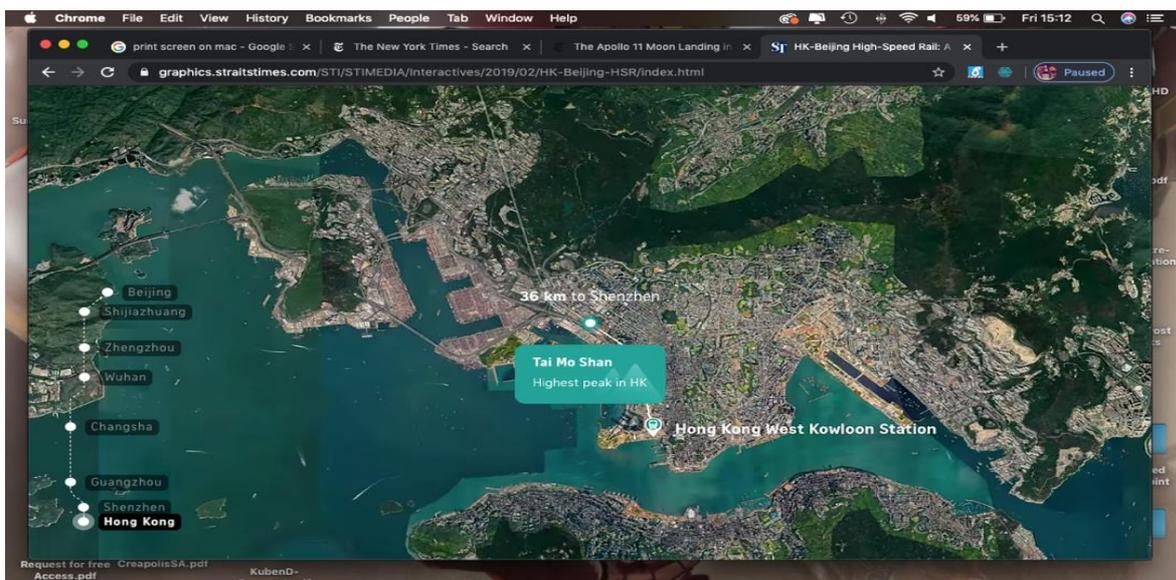
**Figure 5.34- A train journey from Hong Kong to Beijing in nine Hours aboard a high-speed train- A transition from Figure 5.33**



Source: [www.straitstimes.com](http://www.straitstimes.com)

Figure 5.34 shows the Hong Kong West Kowloon Station, indicated by an anchor pin on the map. This is the departure point for the high-speed train.

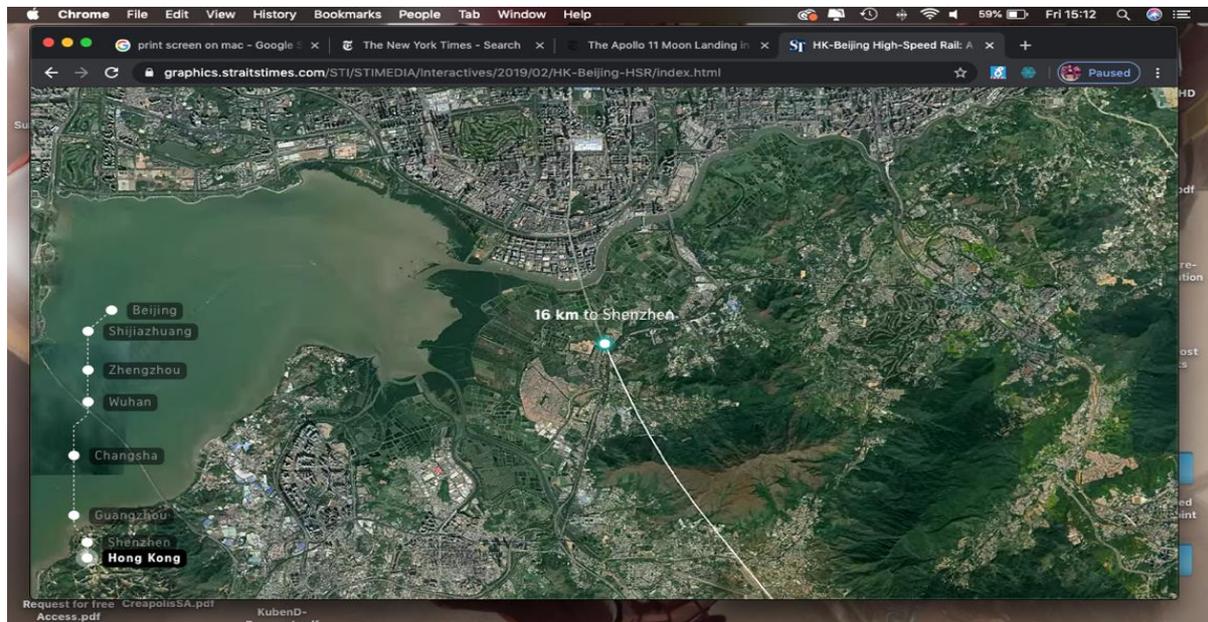
**Figure 5.35- A train journey from Hong Kong to Beijing in nine hours aboard a high-speed train – A transition from Figure 5.34**



Source: [www.straitstimes.com](http://www.straitstimes.com)

Figure 5.35 shows the highlighted circular icon representing the train. This icon moves on the map as the user applies a downward mouse scroll.

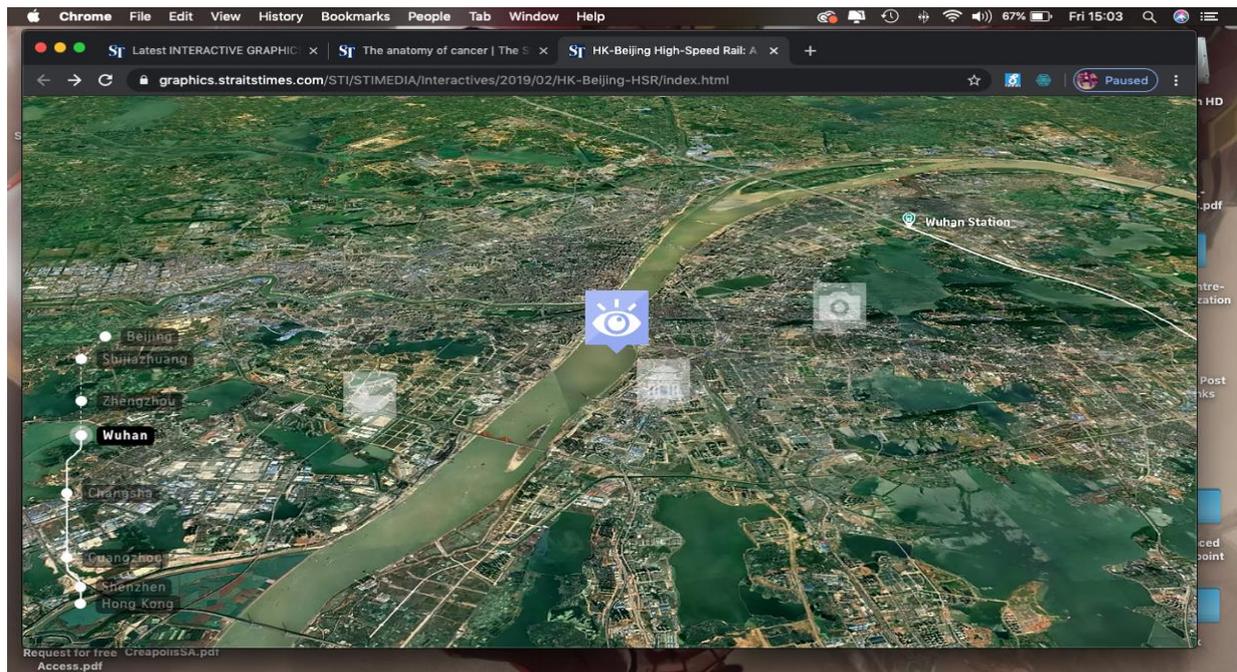
**Figure 5.36- A train journey from Hong Kong to Beijing in nine hours aboard a high-speed train – A transition from Figure 5.35**



Source: [www.straitstimes.com](http://www.straitstimes.com)

Figure 5.36 depicts the start of the journey. The motion is applied and visualised with a mouse scroll-down. The distance the train has covered is highlighted in a yellow line over the railway line. Information on the distance is given in kilometres until the next city is indicated in intervals as the user applies a mouse scroll-down.

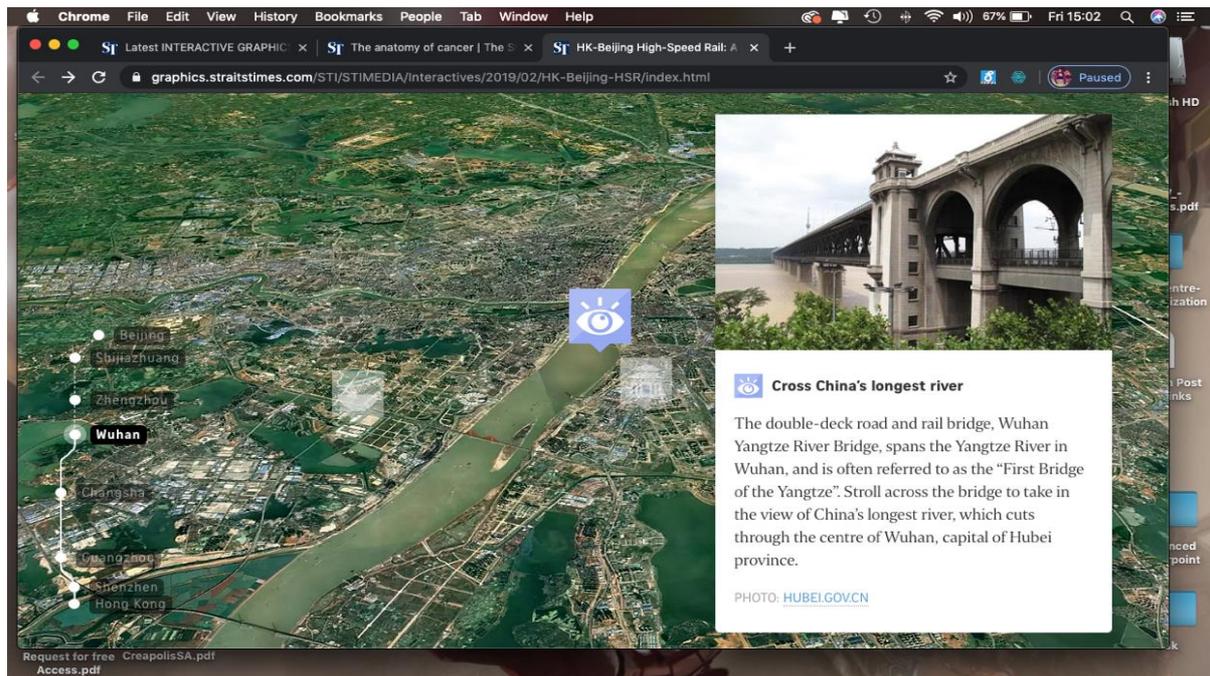
**Figure 5.37- A train journey from Hong Kong to Beijing in nine hours aboard a high-speed train – A transition from 5.36**



Source: [www.straitstimes.com](http://www.straitstimes.com)

As described in Figure 5.37, the top view transitions into a three-dimension bird's-eye-view when the train approaches a city stop. This view shows the city's activities and highlights by using icons that indicate these descriptions.

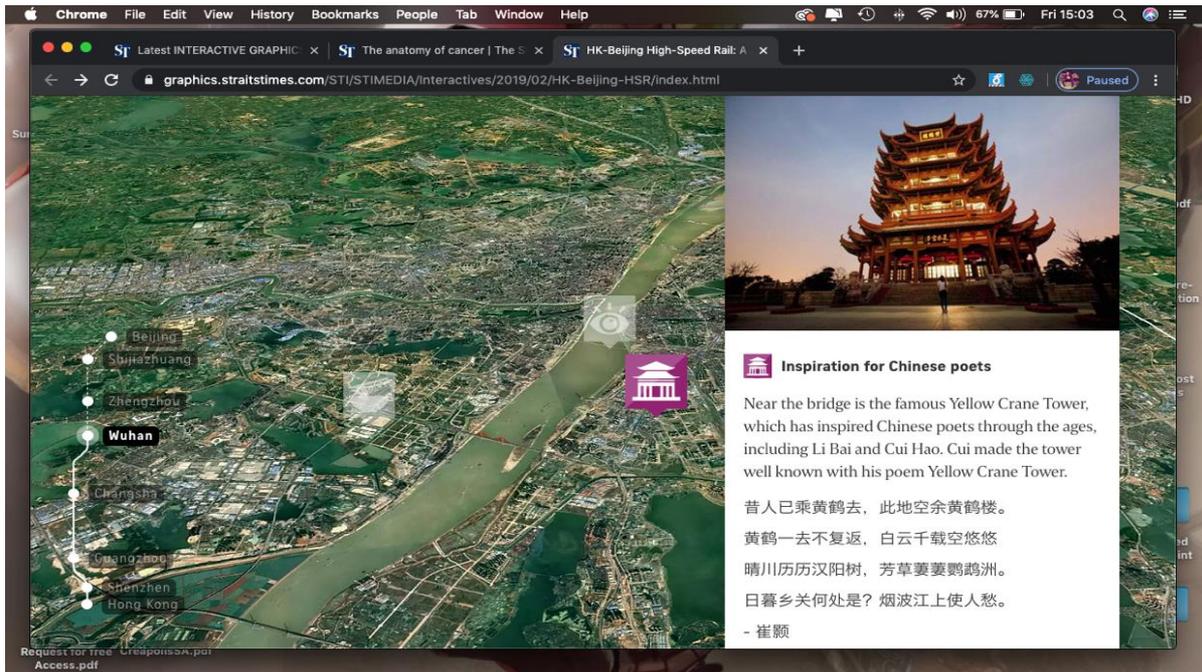
**Figure 5.38- A train journey from Hong Kong to Beijing in nine hours aboard a high-speed train – A transition from Figure 5.37**



Source: [www.straitstimes.com](http://www.straitstimes.com)

As described in Figure 5.33, historic and interesting information about the stop-over city is indicated by an information box displayed to the right of the screen. The real picture of the sight highlighted on the map (the eye icon) accompanies the text box information. The user can also notice that WUHAN is highlighted in the timeline on the left of the screen to further indicate the name of the city the train would have stopped.

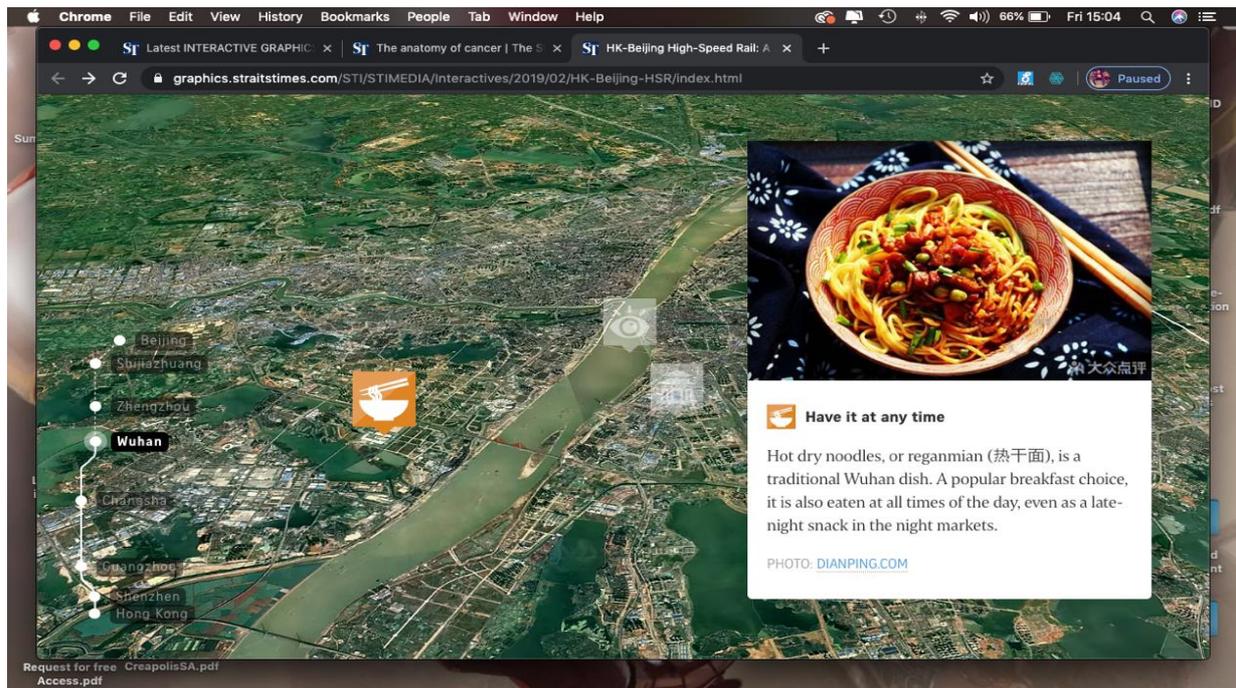
**Figure 5.39- A train journey from Hong Kong to Beijing in nine hours aboard a high-speed train – A transition from Figure 5.38**



Source: [www.straitstimes.com](http://www.straitstimes.com)

Figure 5.39 depicts Wuhan's historic buildings and sights worth visiting; for example, the Yellow Crane Tower (YCT). The proximity of the YCT is indicated by the purple icon on the map. The icon also displays a stylized graphic symbol of the YCT, reinforcing knowledge of the precise location of the building. A mouse scroll-down enables the user to migrate to the following screen shot, Figure 5.40.

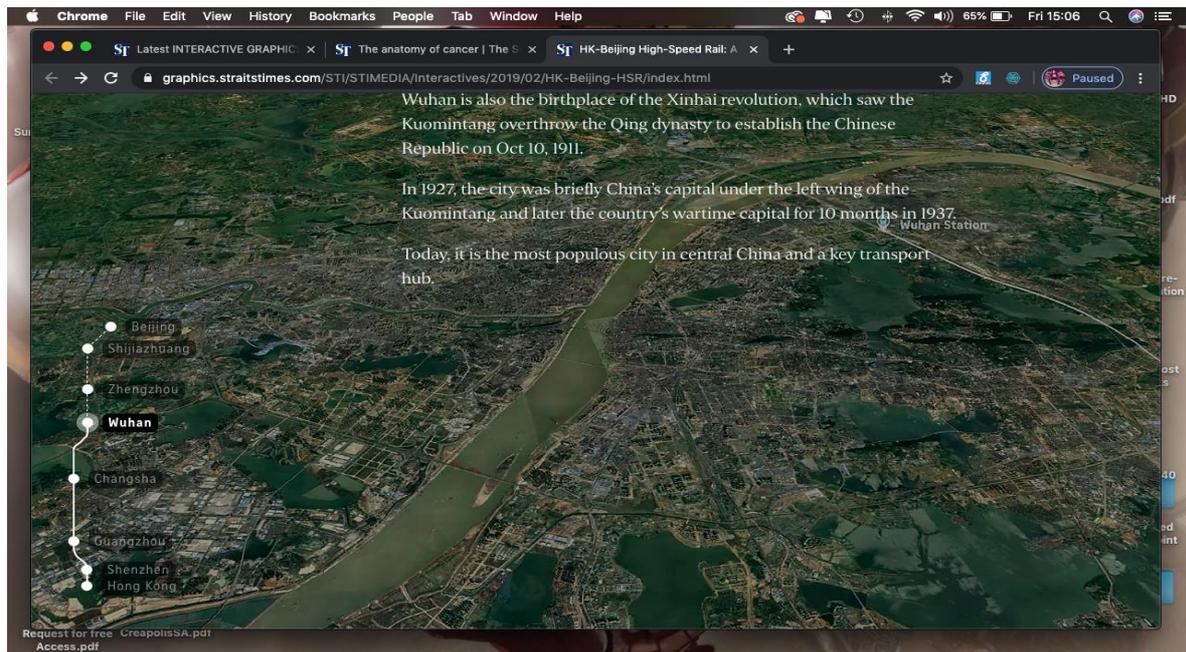
**Figure 5.40 - A train journey from Hong Kong to Beijing in nine hours aboard a high-speed train – A transition from Figure 5.39**



Source: [www.straitstimes.com](http://www.straitstimes.com)

Figure 5.40 shows the user experiencing a gastronomic feast in the City of Wuhan. This example demonstrates the place where a traveller can experience a traditional Wuhan noodles dish. The location of this restaurant is indicated by the orange pin on the map and it is highlighted with a stylized graphic symbol of noodles in a dish.

**Figure 5.41 - A train journey from Hong Kong to Beijing in nine hours aboard a high-speed train – A transition from 5.40**



Source: [www.straitstimes.com](http://www.straitstimes.com)

A mouse scroll-down transitions into Figure 5.41. This is the last bit of information displayed about Wuhan. Thereafter, with a mouse scroll-down, the visualisation becomes interactive as it gets into motion, depicting the train journey to the City of Zhengzhou.

This example depicts the fullest use of hyper-stories. There are rollovers, where the movement of the mouse over Web-based objects, thus creating navigational interactivity. The rollovers, videos, hypertext and hotspots increase the complexity of the choice, from a user perspective. Also, there is tremendous layering of information, which is temporally available as the user interacts with the graphic. This is referred to as the matrix of lexia, where information is linked to the anchor text.

This example aptly demonstrates application of both syntagmatic and paradigmatic elements in a news story. The syntagmatic elements highlight information in a temporal way, literally taking the user through the journey from Hong Kong to Beijing. While this presentation is intratextual, paradigmatic elements also emerge, with the user being alerted to significant information around each city stop. These bits of information capture China's historical sites, famous restaurants, and modern architecture. Apart from just pop-up graphics highlighting this kind of information, the text boxes also contain a lot of complementary historical detail.

However, this is temporally animated to avoid instantly overwhelming the user with too much information, thus allowing the user to literally travel through the story at their pace. The incorporation of both syntagmatic and paradigmatic elements into the same story greatly increases its sign value, making a compelling case for interactive information visualisation.

### **5.3.2 South African examples of online information visualisation**

This section addresses the second objective of this study, which sought to determine the extent to which information visualisation, non-linear interactivity and multimedia elements are used in South African online news sites.

According to Palilonis and Spillman (2011), there is considerable scholarship defining the unique features of digital storytelling and detailing interactive content for online newspapers. Multimedia technology has been used in online journalism from its very beginning (Neuberger et al., 1998; Schultz, 1999). However, this presence largely remained linear in the South African context. Infographics, which aroused great expectations in the first years of the new millennium, was used sparingly in South African online sites. Infographics styles were not dynamic; rather, they consisted of static shapes, static line graphs and charts as well as still images. However, on an international platform, the decade that ends in 2010 saw media companies such as the New York Times, and the Straits Times offering good examples of the creative use of graphics and interactive multimedia narratives (Figures 38 – 48). The journey by train from Hong Kong to Beijing is an interactive and non-linear narrative. The user is immersed in the journey, literally as a passenger.

The non-linearity and interactivity of the story accentuates the immersion of the user by allowing the user to interact with various points of interest at every city the train stops and that occurs throughout the journey. This engagement could never be achieved with linear interactivity. Linearity would only allow the user to explore the journey from the beginning to the end. It would not allow the user to divert at any point in time between the beginning and the end of the journey. The hypertextual information about each city, through stops during the journey, provides useful information about each particular city, such as the geographical locations of hotels, restaurants, and entertainment areas. This approach is beneficial to the user, who literally undertakes the same journey via train; it would be difficult for the user to get lost if they stopped over at certain cities, since the information presented through non-linear

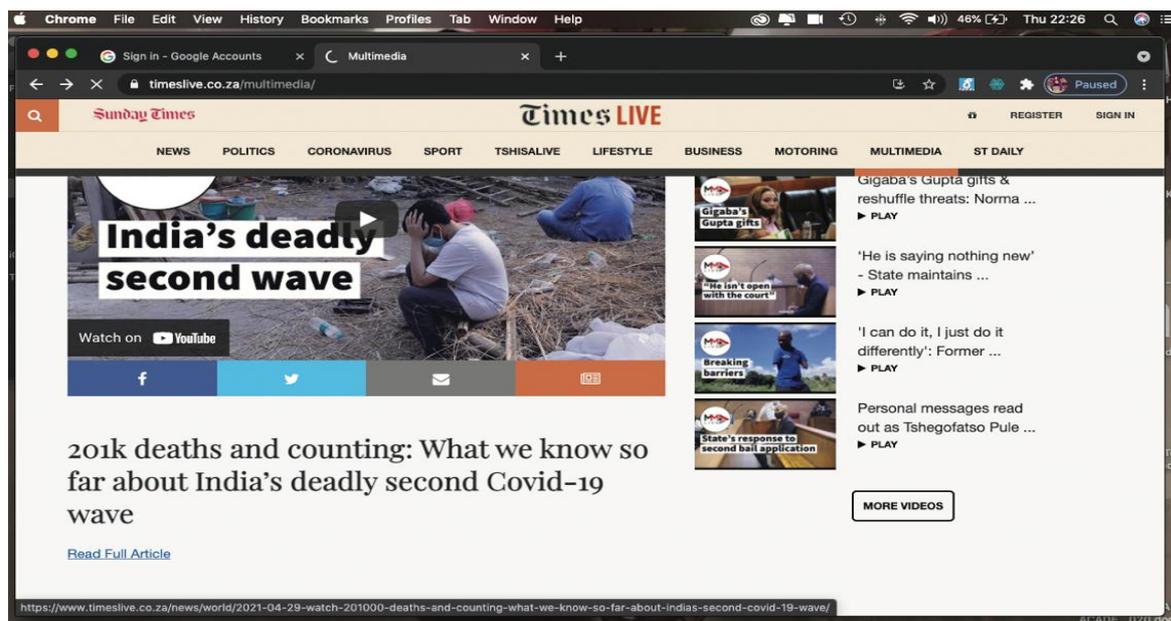
interactivity in the information graphic narrative is effective for the user to retain the information.

Therefore, it would be a benefit for the mainstream online media to use multimedia language, which is interactive and hypertextual, thus fostering an online distribution, particularly from a South Africa perspective (Lopez et al., 2005).

### 5.3.2.2 eNCA and Times Live

This section evaluates local online news sites in order to determine the extent to which interactive data visualisations are being used. The two online news sites used are eNCA and Times Live.

**Figure 5.42 - The corona virus second wave-First Page**

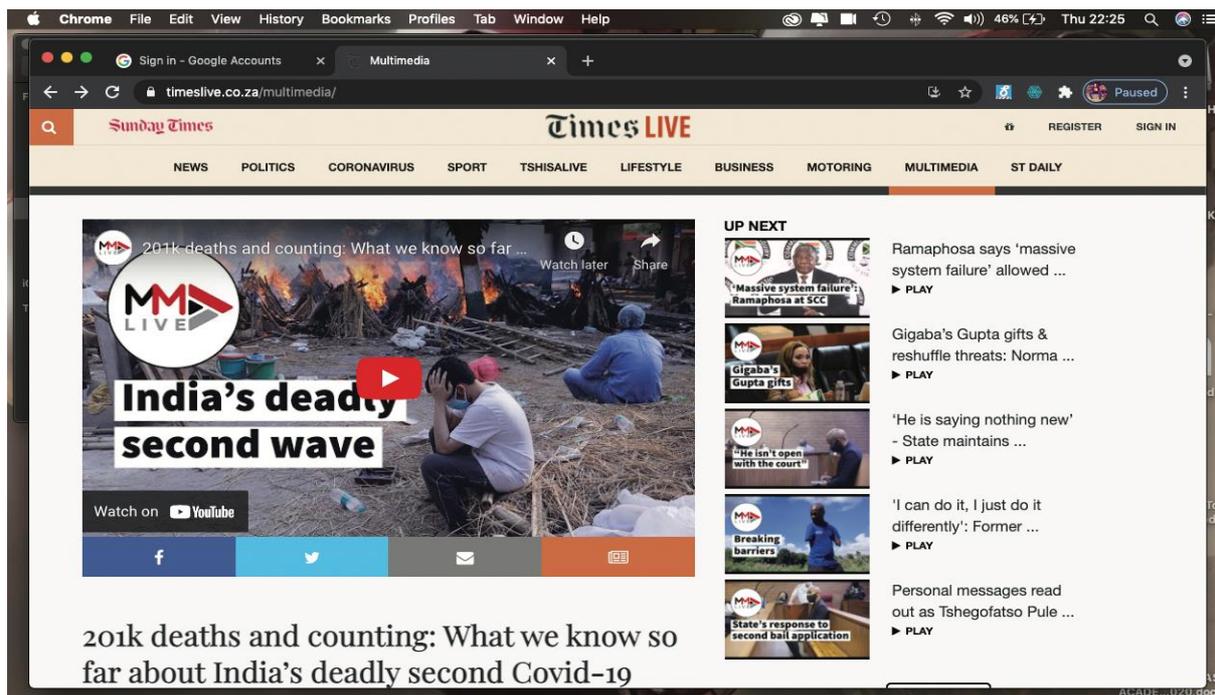


Source: [www.timeslive.com](http://www.timeslive.com)

Figure 5.42 displays the multimedia section of the Times Live website. This manifests in the highlighted orange strip below the MULTIMEDIA hypertext in the screen shot. The other grey strips indicate that those hyperlinks are not selected or activated. However, since the MULTIMEDIA menu link is selected, this therefore manifests as an orange strip below the text.

The home page in the MULTIMEDIA section of the Times Live website displays a YouTube video link. YouTube video links depicting other stories are also present on the right side of the web page. All this is displayed on the video in a black box titled “Watch on YouTube”. Thus, the PLAY VIDEO icon is the identity of YouTube products. Further, evidence of this display is captured in the following screen shots.

**Figure 5.43 - The corona virus second wave-You Tube link to linear video file**



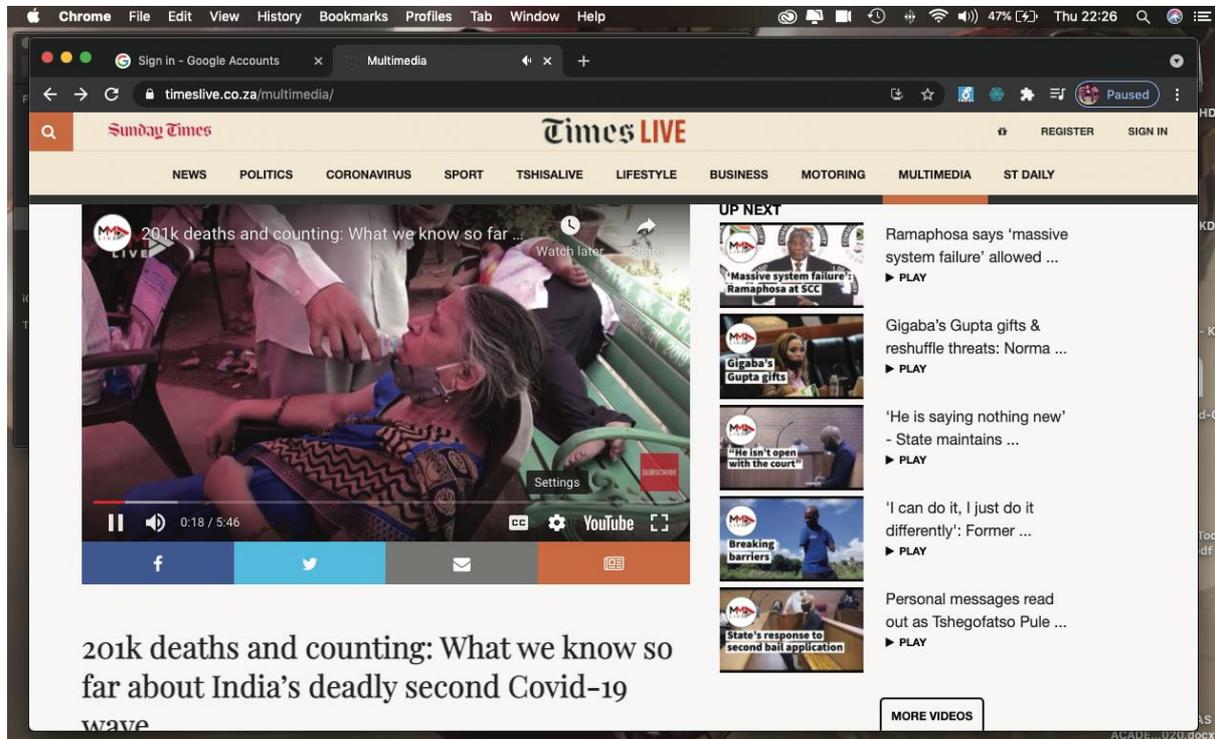
Source: [www.timeslive.com](http://www.timeslive.com)

The design for the PLAY button icon is clearly a product of YouTube as depicted in Figure 5.42. Below the video display are hyperlinks to Facebook, Twitter and email. These hyperlinks allow users to share this story as a URL hyperlink to their respective social media platforms.

In this context, the story is told through text and video. The multimedia element is the link to the YouTube feed of the story. Despite the use of multimedia (video), this typifies a linear construction, which is one mode of reaching out to the audience. The layering of information is also limited; hence, it remains intratextual, with all the signifiers within the story. There is no evidence of navigational interactivity, save the PLAY button, thus limiting the user's capacity to navigate through the story and create their individual news pathways. The lack of layers of information linked to the anchor story also contributes to its linearity and the state of

being fairly static. The other examples replicate the same linear fashion, with text and video being favoured in spite of offering little navigational interactivity.

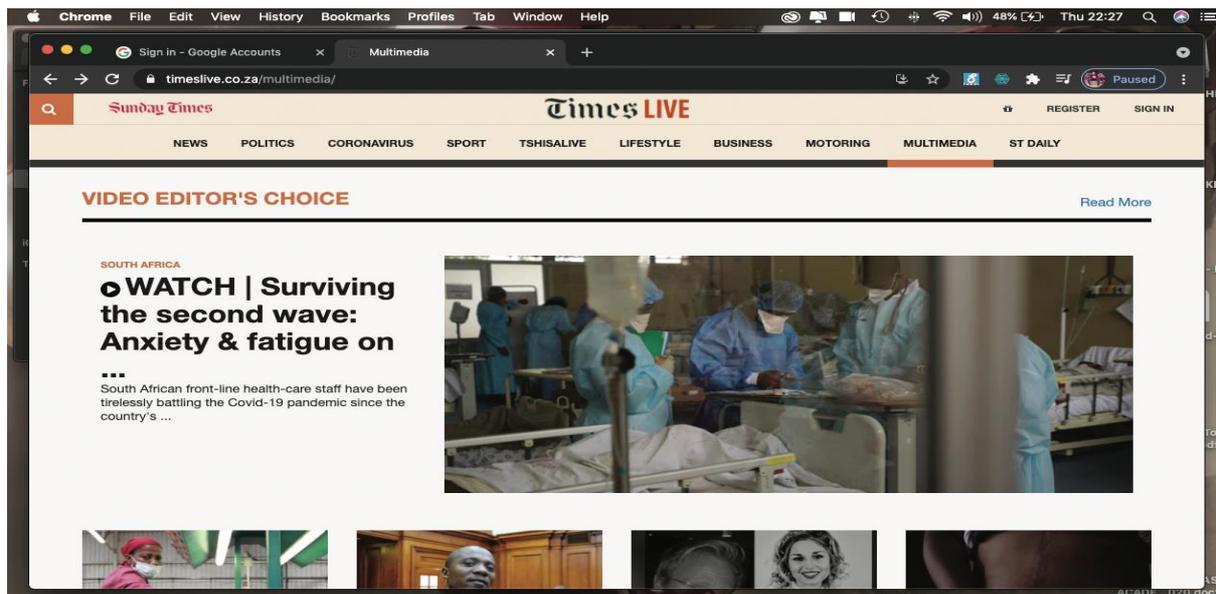
**Figure 5.44 - The corona virus second wave-You Tube link to linear video file**



Source: [www.timeslive.com](http://www.timeslive.com)

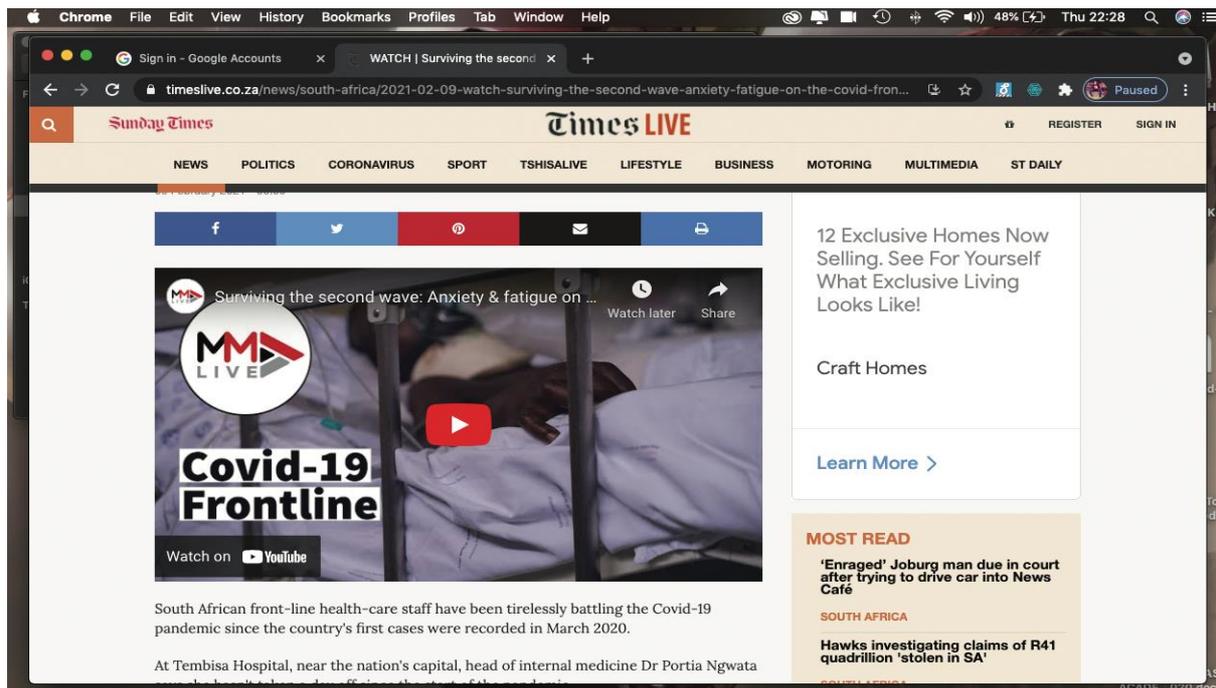
This is a linear video after clicking on the PLAY icon on the video. The video is actually a YouTube link that shows the challenges Indian citizens experienced at hospitals. This video replicates what one would view on any news broadcast channel via television. There is no evidence of non-linear interactivity or non-linear hypermedia that manifest in international examples. There is purely linear user interaction, which is enabled by a YouTube video link embedded in the backend coding of the website to be displayed on the front-end web page. Despite having been selected as an EDITOR'S CHOICE, the following examples display the same characteristics as in Figures 5.43 and 5.44.

Figure 5.45 - The corona virus second wave- You Tube link to linear video file



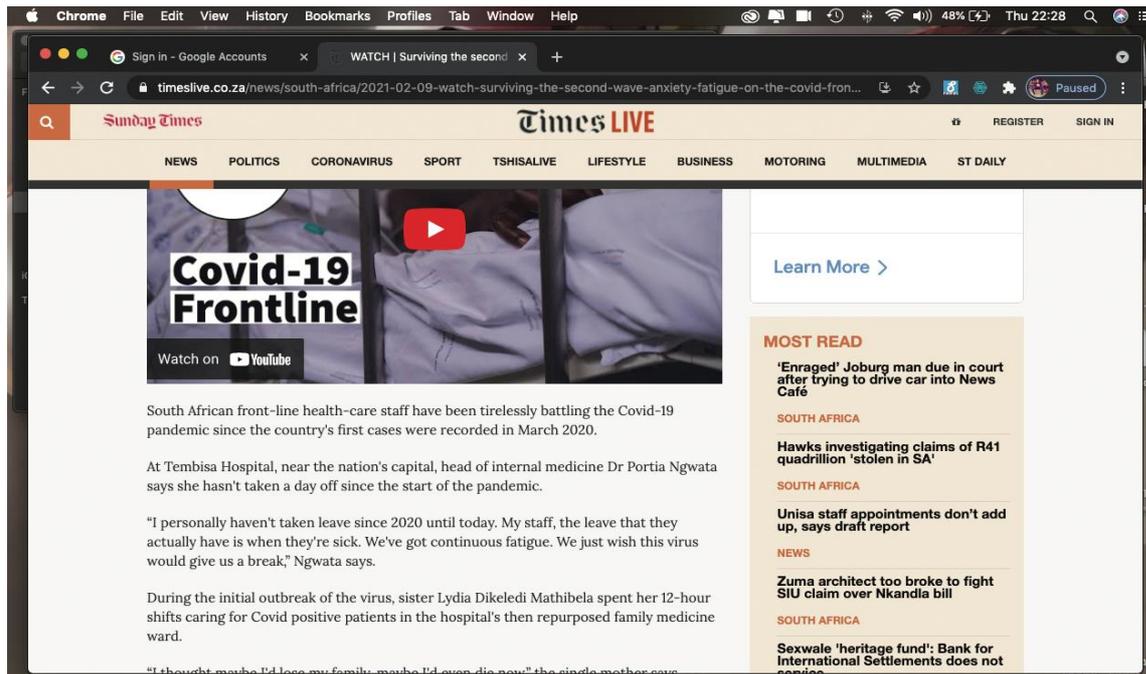
Source: [www.timeslive.com](http://www.timeslive.com)

Figure 5.46 - The corona virus second wave- You Tube link to linear video file



Source: [www.timeslive.com](http://www.timeslive.com)

**Figure 5.47- The corona virus second wave- You Tube link to linear video file**

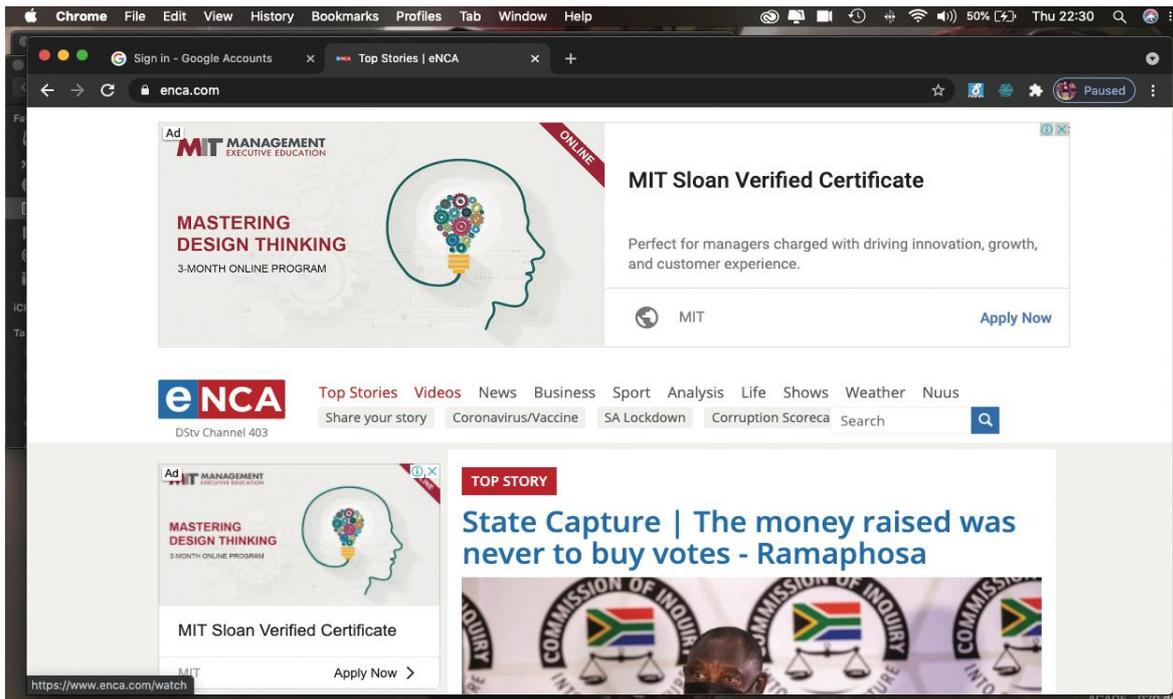


Source: [www.timeslive.com](http://www.timeslive.com)

Figures 5.45, Figure 5.46 and Figure 5.47 display still images depicting the progression of events when a user clicks on the PLAY icon on the video in Figure 5.47. Again, the video manifests as a YouTube video link that is embedded in the Times Live Web page. Although textual information accompanies the video, the presentation of both the text and the video is not visually appealing and pleasing to the user. From a professional perspective, one would argue that this presentation is not designed or created by a visual designer or visual specialist. This is part of the problem that needs to be addressed. Media companies ought to invest in specialised creative multimedia human resources, particularly Graphic Designers, User Experience and User Interface Designers, Coders, Art Directors and Creative Directors, who have the expertise and professionalism required to produce visually attractive and appealing outputs. The user interface and user experience designs, for example, are also extremely weak in the South African context in comparison with the international online news organisations included in the sample.

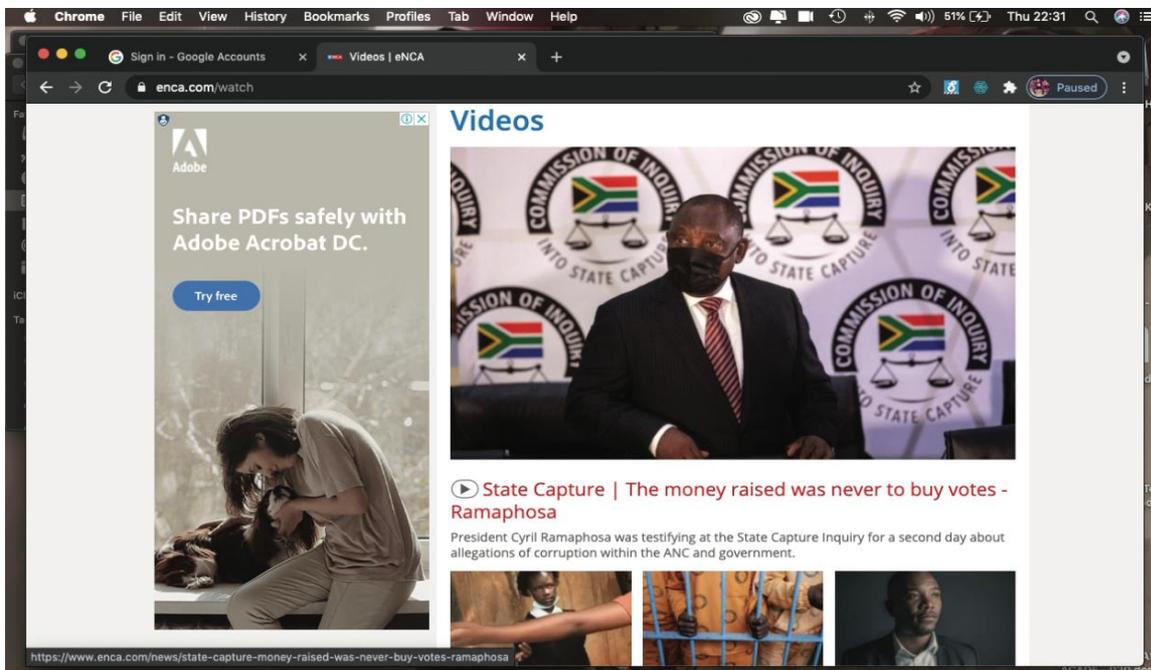
The following are still examples from the South African scenario. The examples were extracted from the eNews Channel Africa (eNCA) websites (eNCA Online).

Figure 5.48- State capture – You Tube link to linear video file



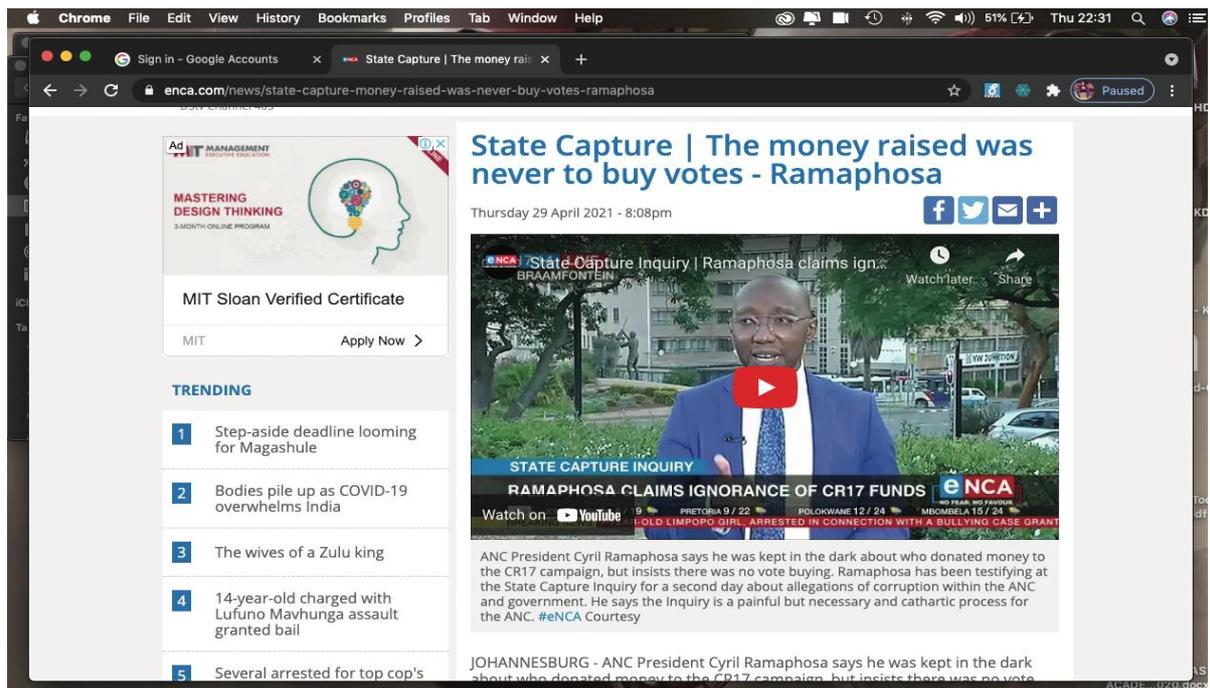
Source: [www.enca.com](http://www.enca.com)

Figure 5.48- State capture – You Tube link to linear video file



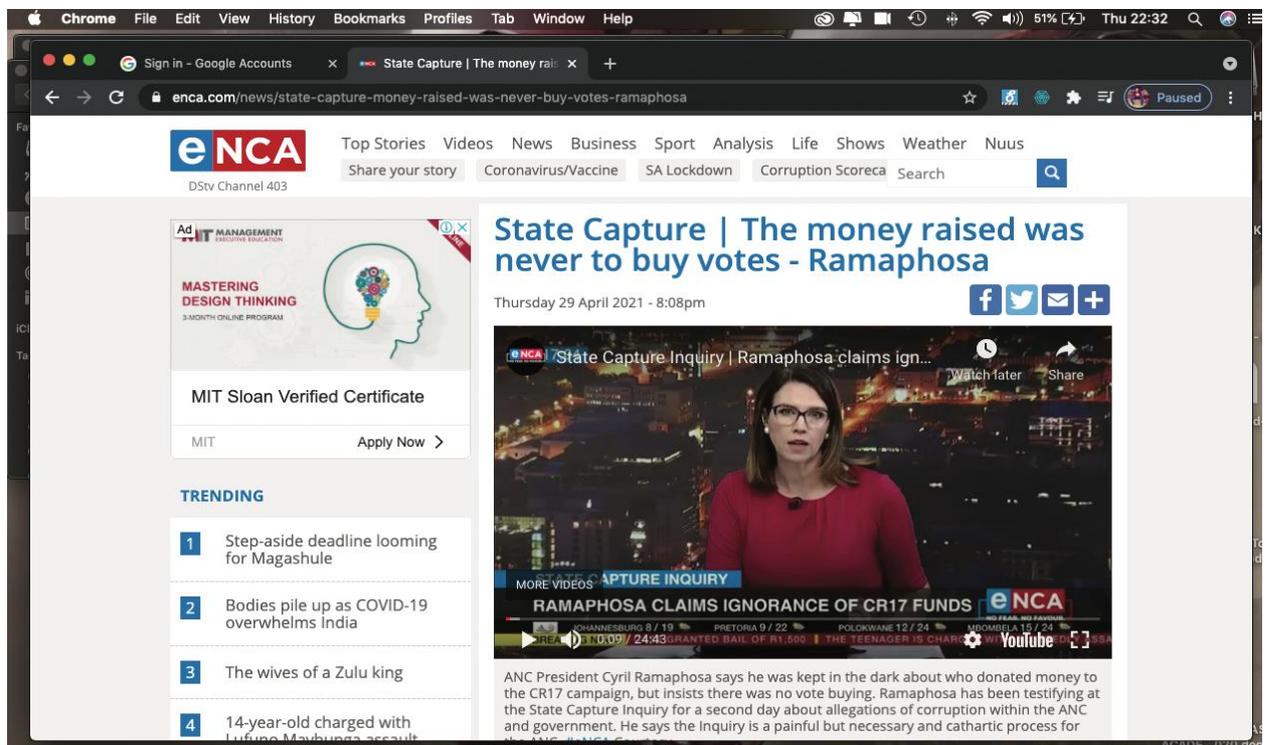
Source: [www.enca.com](http://www.enca.com)

Figure 5.49- State capture – You Tube link to linear video file



Source: [www.enca.com](http://www.enca.com)

Figure 5.50- State capture – You Tube link to video file



Source: [www.enca.com](http://www.enca.com)

Figure 5.48 displays eNCA's website home page. The Interface Design (UI Design) and layout of the website are extremely weak, resulting in a weak User Experience Design (UX Design) which impacts on usability. This is displayed by the cluttered text as one of the menus that can be found on the top of the page. The text is the actual hyperlink enabling users to obtain further links. The important menu for this study is the VIDEOS menu. In comparison with other menus, it was evident that MULTIMEDIA was the menu label on the Times Live website. However, on the eNCA website, VIDEO is labelled a menu. Thus, the title of the menu shows that a user can expect to access VIDEO upon clicking on that link.

Figure 5.49 depicts what can be accessed upon selecting the VIDEO menu. Evidence shows a poorly cropped still photograph, a poorly designed PLAY button or icon, a title and brief textual content on that particular story that supports the headline. Figure 5.50 depicts what can be accessed when a user clicks on the PLAY icon on Figure 5.49. Evidence demonstrates that the YouTube video link is embedded on the Webpage to be displayed for the viewer. Interestingly however, this YouTube video is the Video Grab Snippet of a live broadcast screened on an earlier television news bulletin. The same characteristics apply to Figure 5.51, which depicts still images that clearly demonstrate the implementation of linear content that affords linear interactivity for the online user experience in comparison with the non-linear interactive content displayed on the international news website samples.

With regard to the still samples on the Times Live website, media companies have to invest in specialised creative multimedia human resources that include graphic designers, user experience and user interface designers, coders, art directors and creative directors, who have the expertise to create professional outputs that are visually attractive and appealing to users. The user interface and user experience design for these examples are also extremely weak in comparison with the sampled international examples. The Contemporary Narrative Lab ([contemporarynarratives.org](http://contemporarynarratives.org)) initiative is a perfect example depicting an exploration of fertile ground for the intersection of art, design and journalism. This initiative creates new approaches to storytelling, bringing together artists, designers, journalists, researchers and coders for them to learn from each other's practice and thus invent innovative ways of telling stories, thereby creating unique experiences simultaneously disseminating information for the online user. It is this innovative collaborative approach with the appropriate specialists that lacks within South African media newsrooms. It is for this reason that the samples from the Times Live and eNCA websites appear still.

### 5.3.3 Results of the descriptive analysis

This section reports the findings of the descriptive analysis.

#### 5.3.3.1 Information visualisations on South African News Sites

Information is visualised in the form of embedded YouTube video links depicting a particular story; for instance, the eNCA<sup>41</sup> uploads videos of their television news broadcasts, which are then sampled, selecting specific portions which are then embedded in the web page as a YouTube video link. Times Live<sup>42</sup>, on the other hand, employs short video clips as a storytelling approach. Similarly, in the eNCA sample, these videos also present as YouTube links embedded in the web page. This is the only form of visualisation that a user can view on the sampled South African news websites. Many industries have shifted from traditional media, including industries that are not typically associated with digital media, such as health, government and education. Digital media industries are unique in that they are the intersection of art, design, business and engineering. Therefore, this aspect resonates with the digital era with its the innovative disruption that has impacted media organisation and news consumption in South Africa.

The South African samples focused on the multimedia category on its website. The researcher could access the textual article that was available below the embedded video clips. The article was heavy with information in textual format about the story , which was supported by linear YouTube links to videos related to the story (Refer to video 2). Although the linearity of the text and video in the SA samples are elements of multimedia, they were not rich in interactivity and effective design elements and principles, which are important contributing factors towards a more pleasing visual user experience and engagement.

The sampled South African websites used still pictures, though not in the multimedia section of the websites. In both samples, pictures were identified on the home page and other pages of the website. The pictures were static and did not contain any hotspot links to access further

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<sup>41</sup>[www.enca.com](http://www.enca.com)

<sup>42</sup>[www.timeslive.co.za](http://www.timeslive.co.za)

information. The visible videos were also linear; thus, they lacked any non-linear interactivity (Refer to video 2).

### **5.3.3.2 Information visualisations on international news sites**

Information is visualised to create a user experience. Although Figure 5.1 until Figure 5.48 depict still images that represent the interactive versions on the actual website, the quality of the designed graphics is superior to what is available on the local news websites (particularly the local samples). It is not a matter of pressing the PLAY button and simply watching the videos, but rather, the information graphics are designed to allow for user interaction in order to access in-depth information.

In the surveyed international samples, textual information is not evidently dominant. Thus, textual information complemented and supplemented the visualised information. This helps the user to comprehend complex information more easily and quickly.

The pictures were used in a fascinating approach. The interactive graphic story depicted in Sample 4.3.1.5 allowed readers to join the reporter on her nine-hour, 2 439-kilometre journey across eight stations from West Kowloon to Beijing. The videos, photos and text enlivened the highlights of each of the eight stops. Apparently, this interactive graphic used a typical non-linear interactive multimedia approach.

Examples of visualisations were used to depict the Hong Kong protest<sup>43</sup>. Although still images were composed close to each other in a non-regular creative layout, and when the user scrolls downward, the effect created is a virtual top view of the scene of the protest for the user. Still pictures, combined with audio and video, were used to enable the user to interact with the content. There were left and light arrows as menu buttons on either side of the pictures and video. A sound button was also available to activate the sound attached to certain pictures and video footage. All these elements were positioned on the actual picture. Therefore, the pictures

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<sup>43</sup><https://www.nytimes.com/interactive/2019/06/20/world/asia/hong-kong-protest-size.html>

<https://graphics.straitstimes.com/STI/STIMEDIA/Interactives/2019/10/hongkong-protests/index.html?shell>

used in the international samples clearly demonstrated non-linear multimedia capabilities. Below are links to some of the examples of interactive content with informative subject matters from The New York Times and The Straits Times:

<https://www.nytimes.com/interactive/2019/12/22/us/los-angeles-homeless-black-residents.html>

<https://graphics.straitstimes.com/STI/STIMEDIA/Interactives/2018/11/rising-seas/index.html>

### **5.3.3.3 Effects of information visualisation in South Africa**

From a South African perspective, it is difficult to gauge the effect of data visualisation on online news consumption, as data is not visualised for the local online platform as compared to the international samples. It is rare to find data being presented in a visually effective way. The multimedia sections of the websites are populated with YouTube video links of news stories rather than interactively designed multimedia data and information graphics. Furthermore, these examples (Figures 5.42 – 5.49) lack in the implementation of basic design principles as a starting point. The reason for this is because these examples have an interface design that is developed as a means to access content, as a shell, without effective considerations of design principles to stimulate a better user experience. Information can be better presented in terms of interactivity and data visualisation if the web interface is designed to become a part of the content as opposed to being a shell, with the means to simply access the content. Early and Zender, (2008:24), reinforce that “interface design should be designed in a way that the interactivity is as direct with the content as possible, because the interface design serves the content and not the other way around, therefore avoiding interface designs that lack in design principles and separate the content from the user”. This provides an opportunity for designers to exploit the implement of design principles and principles of interface design for the application of non-linear, interactive information and data visualisation for local news websites.

A section on Media Landscape in the Establishment Survey conducted by the Broadcast Research Council of South Africa in September 2019 shows that various data visualisations in the report communicate an upward trend in online media consumption.

**Figure 5.51 - Online media consumption in South Africa**



Source: [www.brcsa.org.za](http://www.brcsa.org.za)

Figure 5.51 depicts a line graph indicating an upward trend in terms of access to the Internet as indicated by the orange line on the axis. This rise means more users are accessing information online.

**Figure 5.52 - Online media consumption in South Africa**



Source: [www.brcsa.org.za](http://www.brcsa.org.za)

**Figure 5.53 - Online media consumption in South Africa**



Source: [www.brcsa.org.za](http://www.brcsa.org.za)

**Figure 5.54 - Online media consumption in South Africa**



Source: [www.brcsa.org.za](http://www.brcsa.org.za)

In the section titled “Snapshots by Media Type’ in the Establishment Survey, Figure 5.52 up to Figure 5.54, from pages 150 until 151, depict bar graphs that demonstrate a steady upward trend in access to the online media platform from 2017 to 2019 in South Africa. Figure 5.54 further presents a breakdown of age groupings in terms of accessing media via the Internet. The result also attests to an upward trend in the use of the Internet to access media in all age groups.

**Figure 5.55 - Online media consumption in South Africa**



Source: [www.brinsa.org.za](http://www.brinsa.org.za)

Figure 5.55 communicates data visualisation in the form of a bar chart. The data visualisation depicts a variety of websites that accessed in the percentage form, from 2018 to 2019. Although there has been a one per cent (1%) drop in the access of news websites from twenty-nine per cent (29%) in 2018 to twenty eight percent (28%) in 2019, it is imperative to determine the result of this one per cent drop in terms of accessing news websites and general interest. This aspect has not been specified in the survey. Perhaps the local news websites do not effectively employ innovative skills in content presentation, thus repelling viewership rather than attracting it. Therefore, it is more compelling to further investigate whether non-linear interactive information and data visualisation for news Web interfaces can significantly contribute towards increasing the viewership percentage for this category.

#### **5.3.3.4 Policy and industrial challenges in relation to integrating interactive information and data visualisation**

According to a World Economic Forum Report titled ‘Three tips for leadership in uncertain times’, by Kelly Grier (2019), it no longer makes sense to focus on a long-term strategy just in annual board meetings. Instead, strategy should be built into the way every development that arises is evaluated. It is equally important to get insights from third party experts because they can help identify blind spots, challenge assumptions and get a clearer picture of what might not be known.

Aziz (2018) further argues that boards have historically assumed that valuable experience is only gained with age. However, this assumption no longer holds since digitalisation is transforming many aspects of every-day lives, and how people organise their economy and

society, and how the two function. It was estimated that by 2020, half the global workforce would be millennials (born between 1981 and 2000, with a large majority of them being purpose-driven digital natives). According to the 2018 US Spencer Stuart Board Index, seventeen per cent (17%) of the incoming board members are fifty years older or younger. This increasingly 'young' representation is based on the need for more tech-savvy board members to manage the market disruption. Unfortunately, from the South African perspective, this is not the case. Perhaps the 'young' tech-savvy representation at a decision-making level in organisations explains why more organisations in the United States of America are successfully innovative.

Therefore, in South Africa, the challenges hampering policy-making processes remain with the policy makers. Generally, specialists in the creative field and the multidisciplinary innovative visionaries are not involved in the policy-making processes. The disruptive nature of the Fourth Industrial Revolution has also disrupted the role and output of the executives in policy decision-making processes. In the South African landscape, policy crafting is determined by non-visionaries who have been in senior executive and managerial positions for far too long. They continue to implement outdated approaches to policy making and decision making, thus impacting negatively on the progress of innovation in South Africa. From the perspective of creative media, if this were not the case, then non-linear interactive information and data visualisation would have been evident and presented on local news websites more innovatively.

#### **5.3.3.5 Impact of exclusion or inclusion of information visualisation on South African online news**

Holmes (2017:16) commented on an icon of contemporary information graphics, thus:

I believe in the power of pictograms, their humour and their enjoyable clarity. Pictograms are more than just pure geometric forms. They help readers comprehend abstract numbers and highly complex concepts.

In the past, the print platform executed data that communicated the size of the economy or the demographics of a nation; this information was conceived and consumed in manageable chunks. However, technological advancements have seen the print platform gradually diminishing. Testimony to this reality is when The Times Newspaper daily edition decided to

discontinue its daily print edition and invest in a digital-only option. Resultantly, technology has generated a huge magnitude of data and information. The more information and data become available, the greater the need for them to be visualised to help users to interpret it more effectively. Holmes (2017:17) reiterates the need to “move away from complexity and remove irrelevant detail until only what is essential remains. It is at this moment that what is relevant becomes visible, not before”.

According to Kovachi and Rosenstiel (2001, 9), “people have an intrinsic need to know what is occurring beyond their direct experiences. Being aware of events we cannot see for ourselves engenders a sense of security, control and confidence”. Against the backdrop of an immense amount of information and data becoming increasingly available through constant technological innovation and advancement, society instinctively deciphers this information with ease. A progressive increase in online usage and information consumption clearly implies that the larger percentage of news consumption in the future will be disseminated via the digital platform because future generations are digital natives who form a part of this ‘larger percentage’ grouping. Failure to incorporate effective information and data visualisation solutions for this platform could also repel many a digital native. However, since digital natives form a larger percentage of users accessing video games via their mobile phones and computers, it makes a logical sense for media houses to steer news consumption towards an interactive visualised approach as well.

## **CHAPTER 6**

### **RECOMMENDATIONS**

#### **6.1 Introduction**

This chapter reflects on the entire study as reported in this dissertation. It summarises the findings of the study, highlighting the research gaps. It further explains the unique contributions this study makes to the body of knowledge. The chapter highlights the conclusions this research arrived at and presents the recommendations for consideration by stakeholders in the media industry. It further elaborates possibilities for future work on non-linear interactive information and data visualisation for online news in South Africa.

#### **6.2 Summary**

This study examined the quality and effectiveness of non-linear interactive information and data visualisation for online news in South Africa. A comparative case study method was adopted to depict the application of non-linear interactive information and data visualisation by South African and international online news organisations. Data were collected using video recordings and screen shots of two selected South African news websites (Times Live and eNCA) and two selected international news websites (The New York Times and The Straits Times). This chapter concludes the study and proffers recommendations for the enhancement of non-linear interactive information and data visualisations in South African media organisations and proposes avenues for future research.

#### **6.3 Recommendations**

The study makes the following recommendations based on the findings:

6.2.1 It is recommended that South African media organisations incorporate more in-depth non-linear multimedia components to enrich their online news platforms.

6.2.2 In order to ensure a more in-depth non-linear multimedia output, it is recommended that executive positions be created within media organisations; for instance, the Multimedia Executive Officer, Chief Creative Officer or Visual Editor. The creation of these posts within media organisations could develop and enhance efficiency and interactivity in this area of specialisation.

6.2.3 It is recommended that a specialised business unit be initiated within media organisations in order to deal with all aspects of digital and visual innovation, which include the production of non-linear interactive information and data visualisation for digital platforms.

6.2.4 It is also recommended that a multi-stakeholder collaboration approach be adopted within the specialised innovation business unit, and that undertaking must include designers (graphic and information designers), researchers, programmers, design thinkers, animators, and motion graphic artists, thus amalgamating all skills needed to deliver innovative solutions into online production outputs.

6.2.5 It is further recommended that awareness be disseminated within creative art departments at universities and colleges in order to intersect the disciplines of creative design and technology. Furthermore, art departments should focus solely on enhancing traditional graphic design (from an advertising perspective) in their teaching and learning outputs. In view of the ongoing technological advancements and the availability of an enormous volume of data, universities and colleges should seize opportunities to channel the teaching and learning of creative design into a different specialisation rather than a traditional advertising design.

### **6.3 Future research**

The study explores a number of opportunities for further research.

#### **6.3.1 Research should consider the use of augmented and virtual reality (AVR) for the dissemination of visualised information and data.**

Research should embrace the opportunity to use AVR to design information and data to enhance a more informative and effective user experience. This fosters a more impactful user experience, which may yield more significant results in the effective deciphering and understanding of information and data. Furthermore, there are no limitations regarding the subject matter that can be transformed into a virtual and augmented user experience. The subject matter may range from news, Medical Science, big data analytics, Mathematics, History, Chemistry, Engineering, Education (through an advancement of e-learning), linguistics, trade skills development, and so on.

### **6.3.2 Computer Vision (CV)**

Computer vision (CV) and the interpretation of its intention could be flagged as an important aspect of future research work, especially in the wake of the gradual development of such areas as facial recognition technology. Although there is a growing concern over the use of facial recognition technology in the United Kingdom, some resistant groups believe that the technology is used for rampant surveillance, though crime intelligence and police services in London confirm that the technology is critical in maintaining public safety. For example, police in London arrested a woman accused of assault after the facial recognition technology picked her out on a street on a busy shopping day.

Furthermore, the development of Mixed Reality (XR) smart spectacles by Google, Apple, A Facebook and Ray Ban Collaboration, as well as Samsung, uses holographic displays built into the lenses of the spectacles. Volumes of information and data available on the inside lenses also need to be arranged and displayed in a manner that is comfortable to the users for them to absorb and retain the information. Therefore, an effective user interface (UI) design and smoother user experience (UX) for the user need to be treated as an important consideration.

## **CHAPTER 7**

### **CONCLUSION**

#### **7.1 Introduction**

This study sought to determine whether or not South African media companies are creative, disruptive and innovative with information and data visualisation within their online news platforms. This study also investigated the effectiveness of interactive information visualisation for Web news interfaces. A comparative case study was undertaken to juxtapose international and South African news websites to determine the extent to which these online news websites incorporate non-linear interactive information visualisations.

#### **7.2 Conclusion**

International literature confirmed that including non-linear and interactive information and data visualisations is paramount in retaining news audiences. Easier access to technology and resources as well as the availability of skilled media professionals have prompted online media companies across the developed world to transform their online operations, with text and images increasingly being augmented by a more kinetic mix of media (Thurman and Lupton, 2008). For example, The Guardian news website used data visualisations, videos, media integration, documents and animation to simplify a complex story (too much information in the physical files) about the United States of America (USA), National Security Agency files. Similarly, The Houston Chronicle.com launched a special section named the Virtual Voyager, “a multimedia magazine with storytelling, that combines text, still images, audio, video, 360-degree photography and computer animation” (Bockzkowski, 2004:201).

The South African context exuded scanty literature on the topic. The available literature strongly focuses on the use of social media platforms to distribute news content through linear text and video uploads as well as links. South African news websites also provided more linear YouTube online videos and links specifically related to a particular story.

South African authors (Verweij and Van Noort, 2013; Bosch, 2016; Mutsvairo, 2020), argued for the benefit of linear social media usage as a form of journalism communication and the

decolonisation of journalism in the Global South from precepts of the Western model of journalism; otherwise the profession will fail to serve its purpose of contributing to the development and dissemination of new knowledge (Donsbach, 2014). There is no evidence of literature articulating the intersection of journalism, creative art direction, interactive design and technological innovation, which enhance the user's experience of online journalism.

The key theories underpinning this study were drawn from informational design and the Gestalt principles. Lin et al. (2007) argue that in any interaction, gestalt theory applied interactively is experience by a user and evokes the user's subjective experience of the quality of the interaction. Therefore, interaction gestalt effectively invites designers to more concretely and explicitly explore the interaction design space to create sustainable aesthetic interactions.

The researcher also used Saussure's syntagmatic and paradigmatic elements of signs to analyse the data set. The importance of beauty or "aesthetics" has been recognised since ancient times. Bloch (1995:16) reinforces this ideology, concluding that "the physical form or design aesthetic of a product is an unquestioned determinant of its marketplace success". Therefore, one of the major themes regarding aesthetics in human-computer interaction (HCI) has been on how, from a psychological perspective, humans perceive aesthetics and how an individual's perception of aesthetics is related to usability-perception.

From a South African perspective, designers have not concretely explored a design space for possible aesthetic interactions for online news graphics. Lim et al. (2007) assert that designers should have the knowledge, freedom and flexibility to shape aesthetic interactions in a more visible, explicit and creative way. This knowledge is currently unavailable in human-computer interaction, which forms part of non-linear interactive graphics.

This research fell within the precincts of the interpretivist paradigm, where the researcher used the qualitative case study design to observe the four selected online news sites over a period of one month. These sites were:

**South African:**

E-News Channel Africa (eNCA) – [www.enca.com](http://www.enca.com)

Times Live – [www.timeslive.co.za](http://www.timeslive.co.za)

**International:**

The New York Times – [www.nytimes.com](http://www.nytimes.com)

The key finding was that non-linear interactive information and data visualisation is a neglected area of specialisation notwithstanding the fact that it can enhance the multimedia narrative output for South African news websites if implemented appropriately. It can be used to combat the digital and technological challenges that news media organisations currently experience as a result of the Fourth Industrial Revolution.

Digital media constitute content stored in digital formats and usually distributed online. In relation to the research problem, however, the implementation of interactive information visualisations is non-existent on the sampled local news websites (Times Live and eNCA). However, information is visualised in the form of YouTube videos covering a particular story. The eNCA ([www.enca.com](http://www.enca.com)) employs sampled videos from their television news broadcast and specific portions are selected from the television broadcast before being embedded in the Web page as a YouTube video link. Times Live ([www.timeslive.co.za](http://www.timeslive.co.za)), on the other hand, employs short video clips depicting a particular story. Those videos are also YouTube links that are embedded into the Web page. These constitute the only form of visualisation that can be viewed on the sampled South African news websites. The shift from traditional to online media has been pervasive, with other industries that are not typically associated with digital media, such as health, government and education having experienced the paradigm shift. The digital media industry is unique in that it is where art, design, business and engineering intersect. Therefore, this question resonates with the innovative disruption that impacts media organisations and news consumption in South Africa within the digital era that coincides with the Fourth Industrial Revolution.

Xu et al. (2018: 91), declared that “people have no control over either technology or the disruption that comes with the fourth industrial revolution, but we can certainly predict the opportunities that come with it”. Similarly, Rafeeq (2014:43) avers that “as the internet provides a rich media environment, opportunities for growth in serious online journalism are great”. Therefore, in order to make their online storytelling more interactive and engaging, South African online news divisions have to harness the primary elements and opportunities that technological innovation and disruption present. Digital media industries uniquely form an intersection where art, design, business and engineering meet. Therefore, it can be concluded that in order to stimulate and enhance a disruptive and innovative thinking approach,

it is also imperative for future studies to take into consideration a multidisciplinary approach to design practice and education. It should also become common knowledge that professionals and students should collaborate, though they form different departments and areas of specialisation (Olivo, 2015).

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## Addendum 1: Letter of Consent



Mr Kubenthran David (9260382)  
School Of Arts  
Howard College

Dear Mr Kubenthran David,

**Protocol reference number:** 00004566

**Project title:** Exploring the effectiveness of interactive information and data visualization for news web interfaces in the advent of the Fourth Industrial Revolution.

### Exemption from Ethics Review

In response to your application received on 18 November 2019, your school has indicated that the protocol has been granted **EXEMPTION FROM ETHICS REVIEW**.

Any alteration/s to the exempted research protocol, e.g., Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through an amendment/modification prior to its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited.

In case you have further queries, please quote the above reference number.

#### PLEASE NOTE:

Research data should be securely stored in the discipline/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours sincerely,

**Prof Chatradari Devroop**  
Academic Leader Research  
School Of Arts

**UKZN Research Ethics Office**  
Westville Campus, Govan Mbeki Building  
Postal Address Private Bag X54001, Durban 4000  
Website <http://research.ukzn.ac.za/Research-Ethics/>

Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

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## Addendum 2: Letter of Editing



**Mufasa Research Consultancy**

**SERVING WITH DISTINCTION**

10 August 2021

To Whom It May Concern

**RE: EXPLORING THE EFFECTIVENESS OF INTERACTIVE INFORMATION AND DATA VISUALIZATION FOR NEWS WEB INTERFACES IN THE ADVENT OF THE FOURTH INDUSTRIAL REVOLUTION**

I write to confirm that global editing and professional proofreading was performed on the above MS.

Advice on content, formatting, structure, and referencing was provided and the necessary revisions were made.

Should you require further information, please do not hesitate to contact me on the provided contact details.

Sincerely,

**Kemist Shumba (PhD)**

---

**Cell:** +27 78 315 6186 **Email:** info@mufasarc.co.za **Web:** www.mufasarc.co.za  
**Address:** 7 Chartham House, 180 Brand Road Glenwood 4001, Durban, South Africa

## Addendum 3: Turnitin Report

Turnitin Originality Report  
EXPLORING THE EFFECTIVENESS OF INTERACTIVE INFORMATION AND DATA  
VISUALISATION FOR NEWS WEB INTERFACES IN THE ADVENT OF THE FOURTH  
INDUSTRIAL REVOLUTION by Kubenthran David (9260382)  
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