Designing interactive data visualisations for RTL Nederland's online news platforms: increasing visibility of the "volg" functionality and user engagement

Benedetta Cervone

s1443887

Creative Technology

University of Twente

Supervisor

Andreas Kamilaris

Critical Observer

Maurice van Keulen

RTL Nederland

Supervisor

Koen van Gestel

Date: 31.01.2020

Abstract

Since news has started spreading online, its focus on fast, visual content has increased drastically. Data visualisation practices are becoming more common in the news world to represent topics and to present the reader to new insights. RTL Nederland would like to use data visualization to present to the user not only the overview of relevant news, but also to give higher visibility to their "volg" functionality. "Volg" allows the user to subscribe to specific topics and receive a notification as soon as a new article related to that topic is posted. The functionality is at the moment fairly hidden within the site.

Through looking at the RTL case from two different perspectives – a "current" achievable scenario and an "hypothetical" scenario - a series of data visualisations are developed and tested. The "current scenario" resulted in a real implementation of a data visualisation on the RTL Boulevard site that was then tested with a large scale of real end users. The "hypothetical" scenario resulted in a data visualisation for each RTL news site that was then tested with a group of representative RTL users using a participant based evaluation.

From testing a visualisation on the RTL Boulevard site with real end users, an indication of an increase of user engagement can be deducted. From the "hypothetical" scenario test, a positive interest can be measured towards the use of simple and personalised data visualisations in the news.

Further testing and development is needed to answer the research question with more certainty, such as testing with a specific target group for each site and A/B testing on the websites with end users for a longer period of time.

"If you can't fly then run, if you can't run then walk, if you can't walk then crawl, but whatever you do you have to keep moving forward."
- Martin Luther King Jr

Acknowledgment

In no particular order I would like to thank my supervisor Andreas, for guiding me through the challenge that has been working on this thesis, providing the right feedback, getting the best out of my work and making sure I was *always* ok. Thank you my critical observer Maurice as well for the clear, constructive feedback.

Another thank you goes to Koen, my RTL supervisor, for giving me the opportunity to work in a great and stimulating environment such as RTL, providing me with all the creative space needed for this project. And thank you to the rest of the RTL team that I have been lucky enough to work with, thank you for welcoming me in the team, the many teas, the lunch break reminders, the (not so) wise words, and everything else for which I would potentially need a separate chapter for.

And last but not least a thank you goes to Stijn, for the many proof reads and for being always understanding, no matter the circumstances.

Table of Contents

Table of Figures

Benedetta Cervone
s1443887

1 Introduction

The main focus of this thesis is on developing data visualisations aimed at improving the visibility of a news website's features. These data visualisations will be developed in assignment of RTL Nederland for the three following websites: RTL Nieuws[1], RTL Boulevard[2], RTL Z[3] - from now on referred to as: "RTL news sites". This introduction chapter will firstly offer background information on the topic of online news and data visualisations, then introduce the company for which the research will be done, will define the objectives and challenges of the assignment, define the research question with relative sub-questions and lastly present an outline of the thesis.

1.1 Background

Background information about online news and the use of visuals and data visualisations in news will be outlined in this section, together with an introduction to the company for which this research is being done - RTL Nederland - and "volg" a functionality central to this project.

1.1.1 Background information

In 2019, 71.5% of the Dutch population that is 25 years or older has read online news on a daily basis. This number has grown by 20% since 2012 [1]. The way that news content has been spread has seen a continuous evolvement through the years, and, since going online, the content that is being posted online has become more visual-oriented and has been spreading faster than ever [2]. This has also affected the reader's behaviour towards the consumption of news, as first news consumption was happening on an habitual basis and was part of a routine – it is now drifting towards incidental exposure that is not based on the news provider, rather by what appears on the screen [3].

Extensive research has been done on how the human brain perceives written information compared to visual information, and it has been proven that the human brain acquires information more easily and in a faster, more impactful way through visuals or a combination of visuals and text rather than only text ([4], [5], [6]). This phenomenon was firstly introduced in the literature by Nelson et al. and is commonly referred in the literature to as the "picture superiority effect" or the "pictorial superiority effect" [7].

[1] http://www.rtlnieuws.nl
[2] http://www.rtlboulevard.nl
[3] http://www.rtlz.nl

Within use of visuals, the use of data visualisation as a mean to portray information has been growing and the availability of data has never been as large as it is now [8]. Data visualisation finds many definitions in the literature ([9] [10] [11]), however the definition can be generalised to "Interpreting information in visual terms by forming a mental picture based on data" [10]. The data that can be visualised and the purpose of a data visualisation is very broad and varied [11].

This growth in popularity of data visualisation had been predicted by Shneiderman [12], who stated in 1996: "As computer speed and display resolution increase, information visualisation and graphical interfaces are likely to have an expanding role". More about data visualisation will be discussed in section 2.1.2.

1.1.2 RTL Nederland

RTL Nederland is a media company subsidiary of RTL Group, based in Hilversum, the Netherlands. RTL Nederland owns many tv channels in the Netherlands such as RTL 4, RTL 7, RTL Z - but is also active online with platforms such as rtlnieuws.nl, Videoland, rtlboulevard.nl. This thesis will focus on the online platforms, more specifically on three specific RTL news sites – RTL Nieuws, RTL Boulevard and RTL Z. More specific information on the themes and target audience of these sites can be found in section 2.3.1 . Although these sites appear as three separate sites, the articles in these websites are all organised under one specific and defined data taxonomy. More information about the taxonomy will be given in section 2.3.2.

Although the research will be carried out for RTL Nederland, the aim is to be able to reflect these results to other online news platforms.

1.1.3 "VOLG"

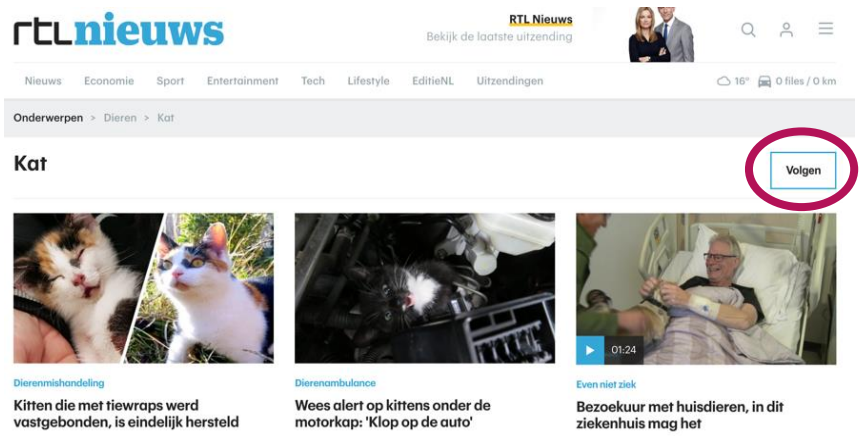


Figure 1-1: Tag page with follow function

As a news provider, it is important for RTL that the general Dutch population can receive news in a fast easy and accessible way [13]. As mentioned before, RTL keeps the

public updated through publishing their news on their respective websites and app platforms, through their social media platforms but also on TV. Outside of these standard ways to connect and spread content, RTL also sends push-notifications to the users using their apps when there is a breaking news of importance for the general public. However which push-notifications the user can receive can be altered, through the VOLG function (Dutch for "follow"). VOLG allows the reader to subscribe to different topics, people or locations that can be of their interest, by sending them notifications when a new article is posted using that specific "tag" (see Figure 1-1). This gives the option to the RTL reader of being always up to date when something that is of direct interest is posted.

1.2 Objectives and Challenges

In this section the objectives that want to be achieved with this project will be outlined, together with the challenges that will have to be taken into account. A small section is dedicated to the languages that will be used throughout this project.

1.2.1 Objectives

The aim and objective of this project is to increase the visibility of the VOLG functionality, so to increase the popularity and visibility of the RTL news sites - through the design of fitting data visualisations.

As of December 2019, only 2% of the registered users follow at least one topic, and thus actively use VOLG as a service [14]. VOLG is a function that is at the moment quite hidden within the RTL news sites on the web platform. In order for the user to be acquainted with even the option to follow a topic they need to click on an article, scroll to the bottom of the page, click on the tag and ultimately click on a button that says "volgen" (Dutch for "follow"). See Figure 1-3 for the steps.

The amount of steps or the "kinematic load" required to accomplish the task of following something is very high, including scrolling, reading and clicking. Reducing the kinematic load can improve design and usability drastically, if kinematic load is low, performance time and errors decrease and the probability of the user achieving a goal increases [5].

In the current version of the RTL Nieuws and RTL Z app the VOLG function is more accessible than the web version (see Figure 1-2). At the bottom of the article, where the tags are shown, a switch is implemented. The text on top translates to "receive a notification if there is news about:". This makes the VOLG function a little more accessible and visible to the user, however this is not implemented in the RTL Boulevard app. Furthermore, the options and categories that the reader can follow are not mentioned anywhere in the websites (both in the app or web platform) clearly.

Figure 1-3 Follow workflow

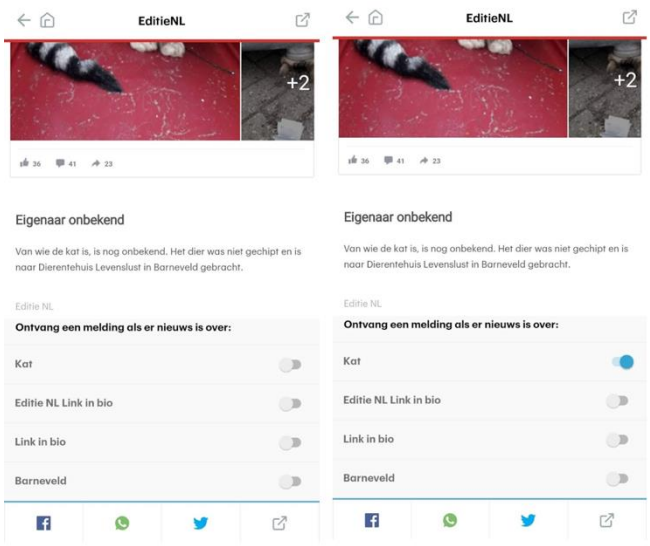


Figure 1-2 RTL Nieuws app

From 2015 until the redesign of the website in September 2018, the VOLG function was portrayed at the top of the homepage of the RTL Nieuws site, under the menu bar (Figure 1-4). The aim was to portray the most interesting articles/topics of the day that the reader would want to follow. This would additionally also aid the user into knowing what they can follow. However the criteria as to why these articles were chosen was up to the redaction, similar to the function that is common in most newspapers "redaction's top picks". Not only this was not based on factual data, the articles to portray had to be manually inputted by the

redaction themselves. These were some of the reasons why, during the re-style of the website this section was removed.

In a world where news is being published faster than ever, users want and can be updated about their interests almost instantly. They expect "rich and immersive" content, and if an "information broadcaster" fails to do so, the user can and will easily step over to a social media platform [11]. The "Fear Of Missing Out" (FOMO) is something that has a high impact in the news world, and any news organisation must understand it and be on top of it by all means possible [13]. By offering VOLG as a functionality, the chances on missing on an important news items that interest the reader are lowered – however the user also needs to know about the existence of such a functionality.

Figure 1-4 RTL Nieuws homepage May 2014

1.2.2 Challenges

The main challenge in this project is creating new, innovative visualisations for each RTL news site that allow a more pleasant and informed presentation of relevant and actual content - with as overall goal keeping the user engaged with the different platforms and lead to the use of VOLG.

The majority of the traffic on all three of the RTL sites (around 90%) is web-based [15], thus the focus of this project will only be on the web platforms and not the app platforms. However around 75% of the devices registered visiting the RTL news sites is mobile based [15], thus the design will have to be mobile-first, that is giving priority to mobile interfaces. Designing with a focus on mobile interfaces will mean that there is a smaller screen space to display the visualization, which will still need to convey all the information correctly and clearly.

Another challenge to take into account in this project is the number of stakeholders involved in the creation of the product. The design has to be approved not only by the development and design team but also by editors and journalists of the respective news sites and ultimately by users. These data visualisations have to be pleasant to the eye, do not take the attention off of news items, but need to be understood without any need of effort and encoding by the reader.

Lastly, the visualisations will have to fit the respective site's corporate style in terms of design.

1.2.3 Language

RTL Nederland is a Dutch company, based in the Netherlands. This means that the final product and content created will be in Dutch, just like the content that is now present on their websites. However, this report will be written in English. The surveys and user tests will preferably be done in English, unless the respondent prefers Dutch.

1.3 Research Question

The main research question for this thesis can be defined as follows:

How can novel data visualisation practices be designed and implemented in the RTL news sites in order to increase user engagement and visibility of the VOLG service?

In order to answer the above question, the following sub-questions will also be answered.

SQ 1: How does a user read a (news) site homepage?

SQ 2: What elements in a data visualisation can be easily decoded by the RTL news sites reader?

SQ 3: How is user engagement and satisfaction measured within RTL?

SQ 4: How can relevant data be visualised for the different audiences and themes of the different RTL news sites?

SQ 5: Can novel data visualisations bring more user engagement and satisfaction when viewing a news site homepage?

1.4 Report Outline

This thesis consists of six chapters. These chapters are going to guide through the process of this thesis and in the end will aid to answer the research question. Chapter 1 is an introduction to the context and background information of this paper, chapter 2 explores the state of the art related to the project including a literature review and a context review related to RTL Nederland. Chapter 3 will explore the methods used in this project, including the methodology of work of RTL Nederland and how the final product(s) will be evaluated. Chapter 4 will discuss the design and realisation of the final product(s). Chapter 5 will discuss the final product(s)'s evaluation and results. Lastly chapter 6 will provide conclusions answering the research question, eventual limitations that have been encountered in the research and future recommendations.

2 Theory and Background

In this section, the theory and background information needed for the completion of the thesis will be outlined. This includes a literature review, an exploration of existing work and the background information about the RTL news sites audiences needed to formulate an appropriate, user driven design choice.

2.1 Literature Review

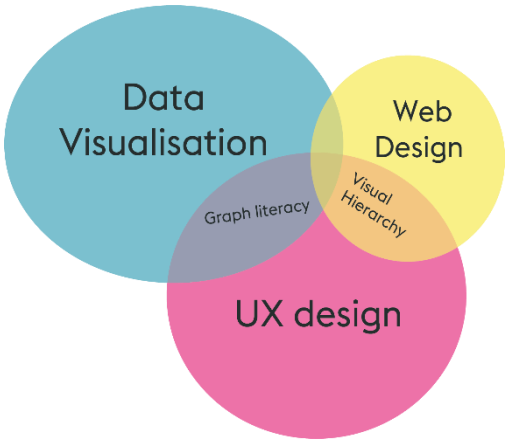


Figure 2-1: Representations of fields of research

This section covers a literature study on the themes of graph literacy, data visualisation and visual hierarchy – which are also the central themes that constitute this thesis (Figure 2-1).

2.1.1 Graph literacy

In order to create a visualization that is broadly understood, the term graph literacy must be defined. In literature the terms graph literacy and data visualization literacy are interchanged. Graph literacy is the "*ability to understand graphically presented information*" [16]. Boy et al. defines the ability to understand data visualizations more specifically as follows: "*The ability to confidently use a given data visualization to translate questions specified in the data domain into visual queries in the visual domain, as well as interpreting visual patterns in the visual domain as properties in the data domain"* [17].

There are three steps to undertake in order to understand graphs. Friel et al. [18] identify: understanding conventions of graph design, manipulating information read from a graph and generalize and predict trends. Friel et al [18] adds that in order to comprehend a graph best, understanding the context in which it is placed is the most important aspect.

A visualization is made up of elements and symbols that are meant to portray meaning and represent data [19]. Ware [19] makes a distinction between sensory and arbitrary

elements in a data visualization. Sensory elements are those that do not need an explanation and will be understood and decoded by the human brain. Arbitrary elements on the other hand need explanation and context. Sensory elements have a variety of properties, such as that they need to be understood without training, fast and need to be understood throughout cultures. On the contrary, arbitrary elements and codes are hard to learn, easy to forget and are bound to a context and culture [19] . Thus, a visualization that has to be designed for a broad audience with different levels of graph literacy must include mostly if not only sensory elements.

2.1.2 Data Visualisation

2.1.2.1 Purpose of data visualisation

The purpose of a data visualisation can be generally divided in two main categories: explanation or exploration. In an explanatory data visualisation the main aim of the visualisation is to explain or show a concept, in an exploratory visualisation the main aim of the visualisation is to discover new information and insight [20].

2.1.2.2 Data classification

Data is a very broad concept. Webster Dictionary provides different definitions for the word data, the most relevant are: "factual information (such as measurements or statistics) used as a basis for reasoning, discussion, or calculation" and "information in digital form that can be transmitted or processed" [21]. Categorisation of data can be done in different ways, however this universal schematics will be used to categorise data in this thesis (Figure 2-2).

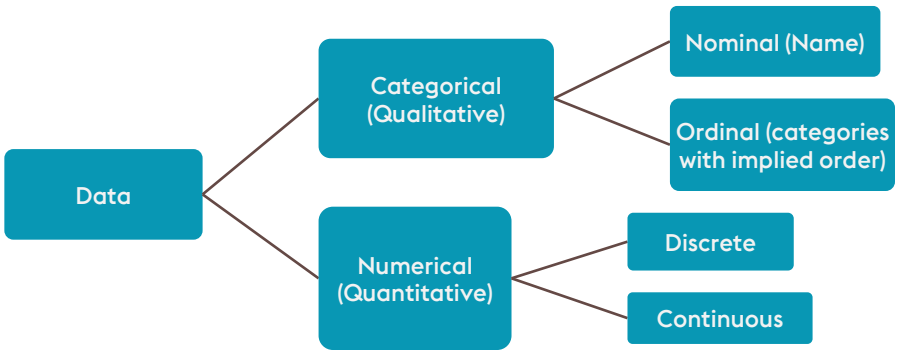


Figure 2-2: Data classification schematic

2.1.2.3 Graphical Elements

The elements that are part of a data visualisation see many definitions in the literature. They are mainly referred to as symbols or glyphs. The definition that will be used in this thesis to represent an element that portrays any value is Ware's definition of a glyph. A glyph, according to Ware [19] is defined as *"a graphical object designed to represent some entity and convey one or more numerical attributes of that entity"* [19]. An example of a glyph can be seen in Figure 2-3. The "dots" in this scatter-plot diagram represent different values, the colour represents the geographic location, the position is mapped by the x and y axis and represents income and life expectancy and lastly the size represents the size of the

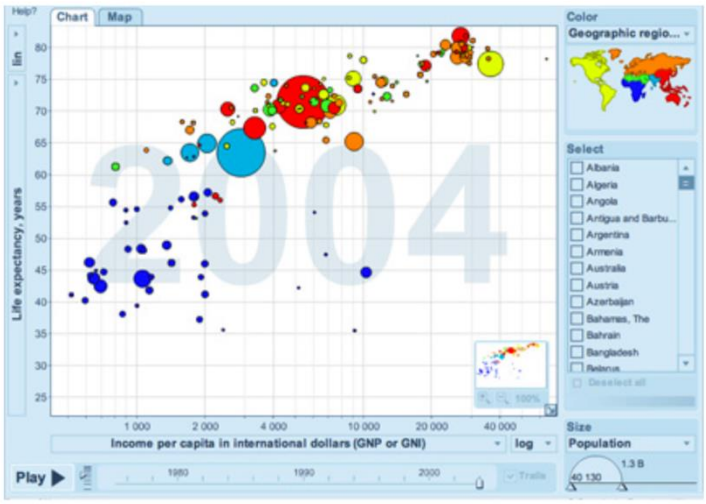


Figure 2-3 Glyphs on a graph

populations.

As seen above, these elements or "glyphs" can all have different attributes, how to use and classify these attributes can be helpful in creating an understandable visualization. Ware [19] states that there are three *"basic high-level channels"* that can be used to visually distinguish and display different aspects of data: colour, form and motion. Effects based on colour, orientation, size, contrast and motion are the strongest and easiest to perceive and when designing a set of glyphs to represent a certain quantity. [19].

Lee et al. [22] warns about the use of colour for a pure aesthetical purpose and without a clear value to the visualization, as a general viewer will try and give colour a meaning or a value. Roth [23] and Lidwell et al. [5] also warn about using colour to code data as colours can have different meanings across the population and advices to verify the meaning for the particular target audience before applying colour. Ware [19] however states that cross culturally red, green yellow and blue are the most valuable in coding data. It is proved that, in a web store, blue red and white are colours that trigger the user the most across western and eastern countries and that blue provokes trust, red arousal and white calmness [24].

Cheng et al. [24] points that, in western countries, the colour red is mostly associated with danger – he suggests that for this reason for the colour red to be used for attention points and be spared as a background colour. For an element or symbol to be seen rapidly it must have a contrasting colour; "*in a display of blue, green and grey symbols, red will stand out*" (Figure 2-4) [19]. Furthermore Roth [23] and Ware [19] state that more saturated colours should be used when coding small symbols and areas.

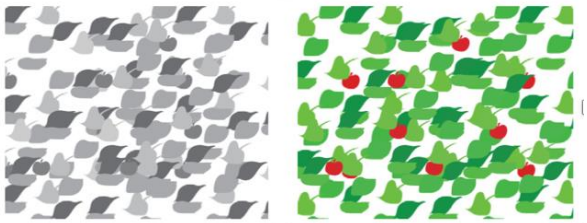


Figure 2-4: Colour Contrast [19]

Roth [23] adds that elements of contrast can help focus the reader's attention more on the key elements the designer wants to highlight. In general it is important to note that one must be careful with only using colour as the only mean to transmit information, as most of the population has limited colour vision, also known as colour blindness [5].

Figure 2-5 Visual Representation of Visual Hierarchy

When talking about motion, items that move in the same direction and at the same speed will be perceived as one unit belonging together. This is also called "Gestalt's Principle of Common Fate" [9]. Cavanagh and Alvarez [25] point out that if items move in different directions, people will struggle to follow them if there are more than five different

elements. The human eye will willingly pick a few to follow and label the other movements as noise.

2.1.3 Visual hierarchy

Visual hierarchy can be defined as *"the order in which a user processes information on a page"* [26]. Exploring how to construct a visual hierarchy is important in order to be able to naturally guide the user through a web page (Figure 2-5). Faraday [27] is the first to develop a model to create a visual hierarchy in a website. The model involves three different steps, "initialization", "search" and "scanning". The focus will be put on the second step - the search step. The search step categorizes the characteristics of elements in a webpage that define the hierarchy at first glance. These characteristics can be found in Table 2-1, ordered from the highest to the lowest in the hierarchy. Like Faraday,

Roth [23] states that what establishes a visual hierarchy is the size of an element, and adds that the placement, its shape and how often the element appears can also influence the visual hierarchy. However Still [28] argues that Faraday's model is an outdated model, as he proves that spatial position (how close elements are to each other) and distinctiveness (how different elements are from each other) is just as important to discuss when creating a visual hierarchy [28].

Dynamic Media	Moving elements and animations go above still images
Size	The bigger the element the higher the importance
Images	Images are looked at before text
Colour	Bright coloured text is looked at before dark coloured text.
Text Style	Hyperlink is looked at first, then bold, then italic and lastly underline
Position	Top and left of the screen is preferred to right and bottom of the screen

Table 2-1: Faraday's search elements

When looking into the placement of a visualization element in a website, Ware [19] states that visualization displays must be made as compactly as possible, so that the reader does not need to put too much visual effort into understanding and looking for all of the different elements that construct the visualization.

Figure 2-6 Gestalt Principle of Perception

When placing elements, Roth [23] mentions that when elements are positioned closely together, they will be perceived as being grouped perceptually (Figure 2-6). This concept is

also one of the laws in Gestalt Theory [29], also known as Gestalt Principles of Perception [5]. Ware [19] states: "*to make symbols easy to find, make them distinct from their background and from other symbols; for example, the primary spatial frequency of a symbol should be different from the spatial frequency of the background texture and from other symbols*". This concept can also be applied when adding labels to objects in a visualization. These should be placed close to the object they are representing, to emphasize the fact that they are related to each other [5].

If information is placed in a structured manner, the perceived quality of aesthetics goes up. This is also backed up by Lidwell et al. [5] that defines the "aesthetic usability effect", stating that if "*aesthetic designs are perceived as easier to use, are more readily accepted over time, and promote creative thinking and problem solving*". Lavie et al. [30] argue that aesthetics is a measurable construct in the field of human computer interaction and divides aesthetics further into two categories, classical and expressive aesthetics. The classic aesthetics emphasize clear design, expressive on the other hand is the ability to break design's conventions. Barakovic et al. [31] argue that how the information is placed on a website influences the perceived aesthetics and thus the likelihood of a user visiting a website. Thus, it can be concluded that classical aesthetics and clear design can help having a better perceived usability and can also aid creating a clearer visual hierarchy.

2.2 State of the Art

In this section products and projects related to the scope of this thesis will be presented. The state of the art will be divided into the following subsections: use of data visualisation in the news, content presentation practices in news websites and use of visualisations and interactive graphs as a mean of presenting content.

2.2.1 Data visualisations in news sites

A trend can be observed nowadays in the news in the field of data visualisation and data journalism. A growing amount of news articles and stories are being portrayed visually and news is being created from data. The use of data visualisation is usually defined to a specific topic or section in the website, as an article or supporting an article. As it can be seen on Figure 2-7, the New York Times uses a data visualisation to show political preferences results from a (public) poll. This is placed in the middle of the page, using pictures and last names to the politicians to represent them and a horizontal bar chart to show the percentages of the people who voted. These percentages are also written in the bar chart.

Figure 2-7 The New York Times homepage 1 November 2019

Using data visualisation in political articles and during election times is a recurring trend. In Figure 2-9 one of the many examples is presented. In the example from CNN (Figure 2-9) a choropleth map is being used to show in which American states which preference for which party was given. The colour in this case is representing a specific political party, the shades of blue and red are meant to represent the two main political parties of the US. Using blue for representing the democrat party and red to represent the republican party is a general convention in the US. In this case the visualisation is interactive, allowing the user to click on different states, instances, and generate more visualisations that are specific to the state.

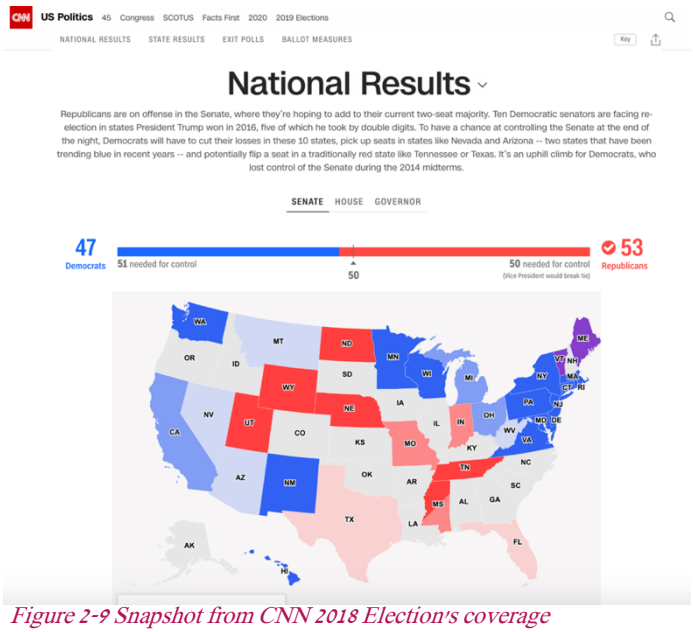


Figure 2-9 Snapshot from CNN 2018 Election's coverage

A separate example and recurring trend is the use of data visualisation to represent stock data on business news sites or business sections of news sites. For example, on the NOS[4] website (Figure 2-8), a separate business section can be found, representing all of the stocks and respective companies at the moment. This page has a lot of elements of data visualisation, however a high level of background knowledge is needed to understand these codes.

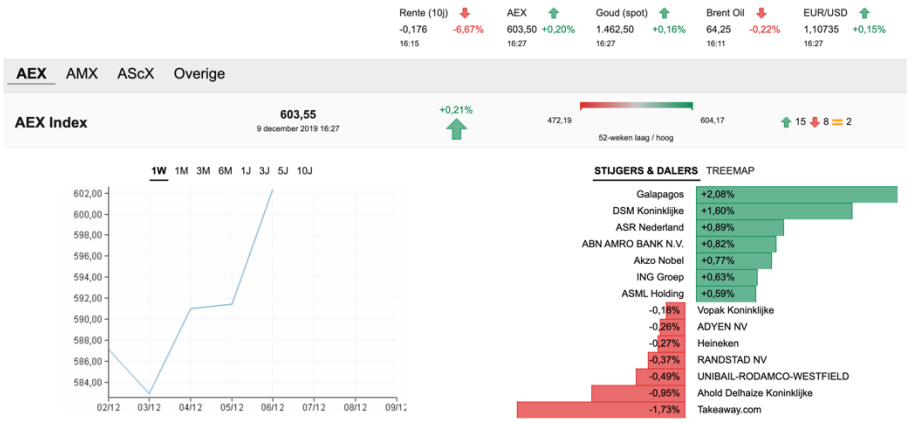


Figure 2-8 NOS business stock data visualization

[4] Nos.nl

Likewise, on the RTL z site a similar section with similar graphs can be found, which also adapts to a mobile interface (Figure 2-11).

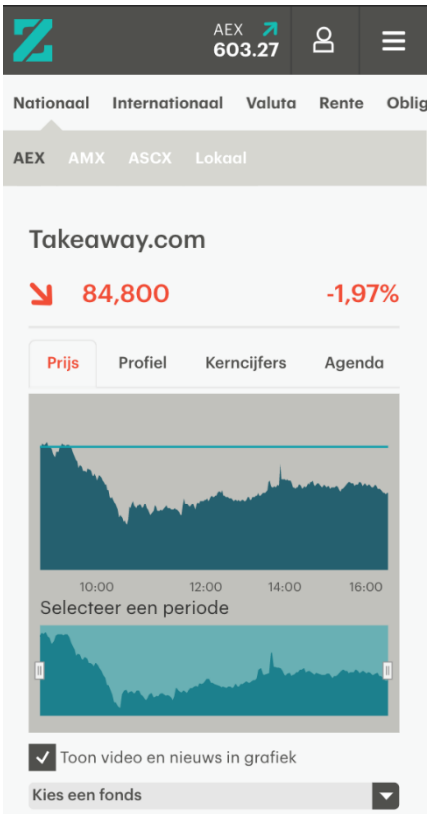


Figure 2-11 RTL Z business page

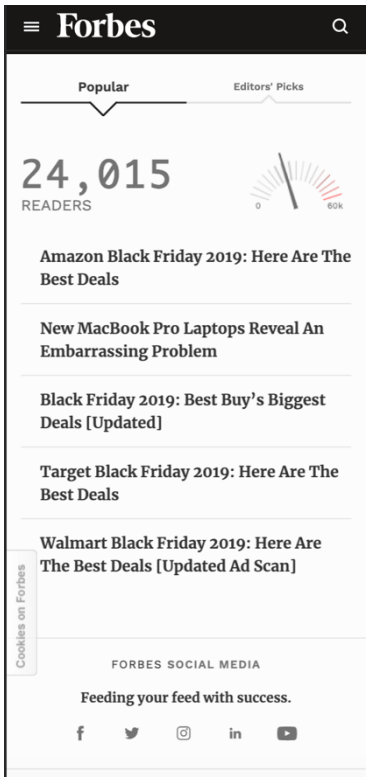


Figure 2-10 Visualization on amount of current readers Forbes

Differently, on the Forbes site[5] homepage a non-interactive, data visualisation element is present (Figure 2-10). This is to represent the amount of real time readers on the website.

2.2.2 Presentation of content to the reader in news sites

A popular way to expose the reader to a news website content that goes beyond to the articles that can be seen on the homepage, is inserting "top lists" such as "editor's picks" or "most read". Some examples can be seen in the RTL Nieuws site itself (Figure 2-12), just as well as on other popular Dutch news sites such as Nu.nl (Figure 2-13), and international news sites such as The Wall Street Journal (Figure 2-14).

[5] https://www.forbes.com/

Some, such as The Wall Street Journal, Nu.nl and The Washington post use numbers to even more emphasize on the order of most popularity or most read.

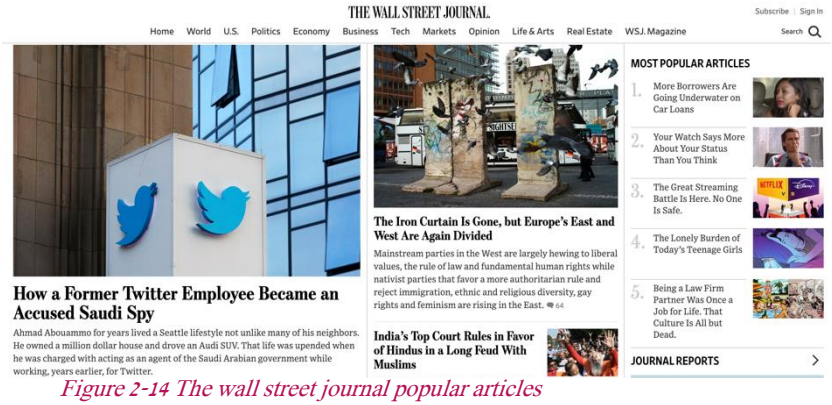


Figure 2-14 The wall street journal popular articles

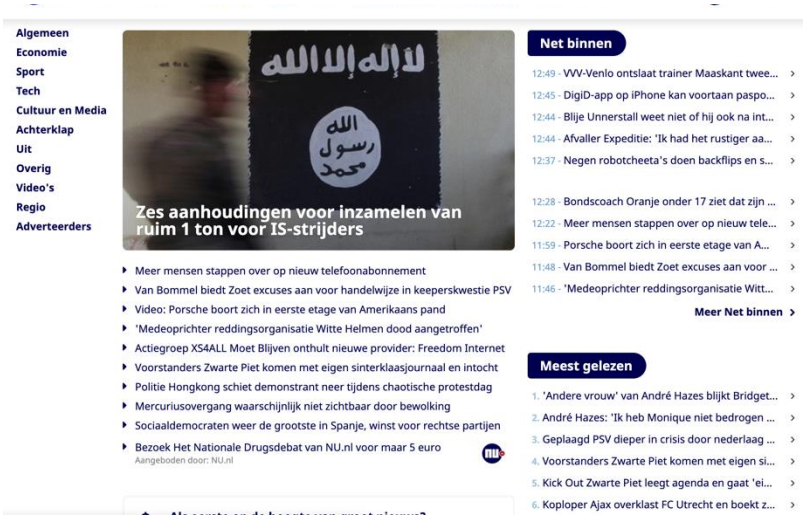


Figure 2-13 Nu.nl Just in and most read articles

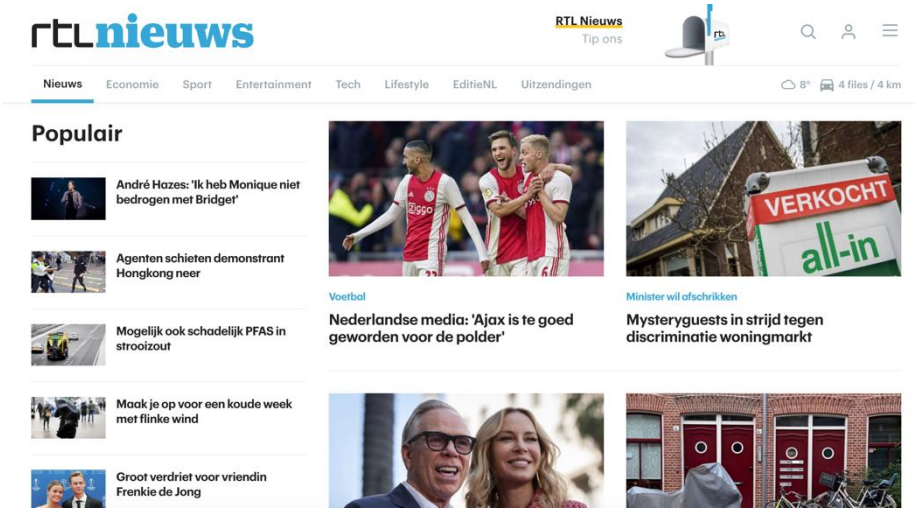


Figure 2-12 RTL Nieuws Popular articles

These examples (Figure 2-12, Figure 2-13, Figure 2-14) all include a list on the sidebar of their homepage, with a clear article title and picture, to identify the article. Although this is the most popular way to display lists of articles, this is not the only one. The Washington Post also includes a list of tags on the top of the homepage (Figure 2-15) under the "in the news" tag. This has as an end aim to get readers to click on topics rather than articles. Clicking on any of these tags will then bring to a page with articles related to those topics.

Figure 2-15 The Washington Post "In The News"

A similar approach can also be found on the Italian news site laRepubblica (Figure 2-16) right under the menu. "Si parla di" literally translates to "it is talked about" – this section presents the most discussed tags in the news. By clicking on these tags the result is the same as The Washington Post, the user will be presented with a page with articles all having the same tags.

Figure 2-16 laRepubblica "Most discussed"

Msn.com takes a different approach (Figure 2-17). At the bottom right, a poll ("peiling") is posted, asking different questions to the reader. In Figure 2-17 it asks the reader to give an answer as to whether the reader has ever experienced sleep walking and it gives 4 different options.

Figure 2-17 msn.com poll

If the user clicks on “stemmen” (vote), the user is presented with the percentages of what the rest of the readers have voted for, together with an article related to the question. In this case (Figure 2-18) it advices to read an article related to sleep walking. The reader can also click on “volgende” (next) and answer another poll, which will then result in another article being suggested and so on.

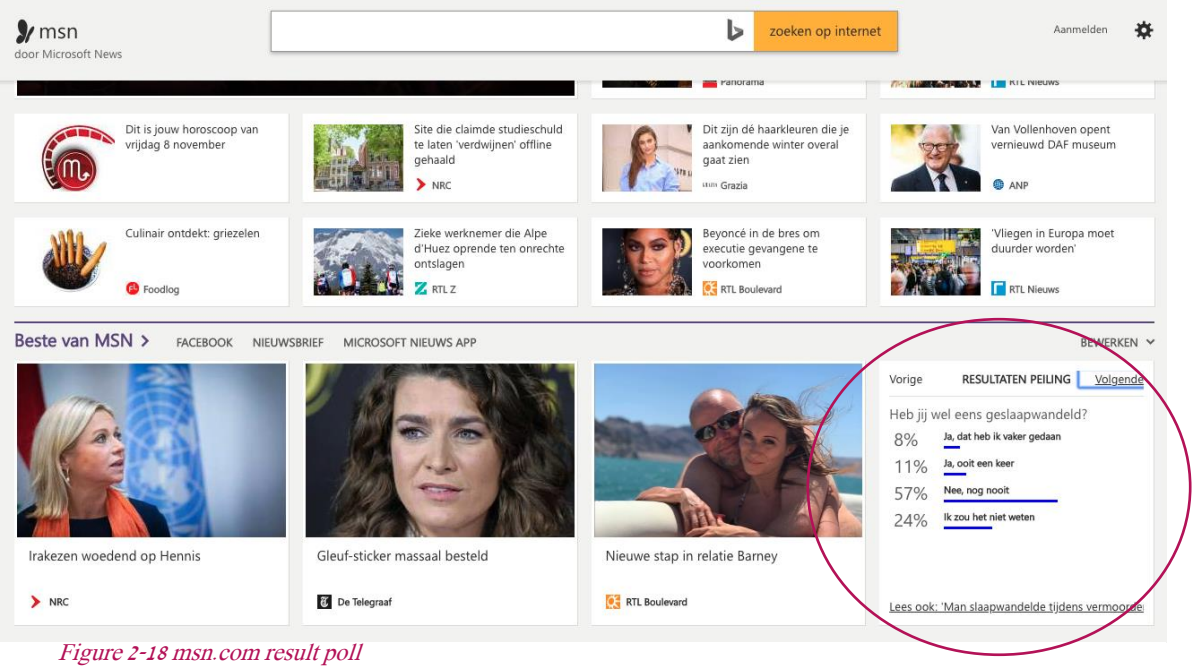


Figure 2-18 msn.com result poll

2.3 RTL Context Research

In this section of the thesis the research done to understand more about RTL Nederland, their products and resources is outlined. This research is a combination of gathering information through provided internal documents, informal interviews with different parties and attending meetings both inside and outside of the team.

2.3.1 Audience of the RTL news sites

RTL Nederland is a brand directed towards a Dutch-speaking public. All of the articles published on the different sites are written in the Dutch language. Although RTL as a brand itself has an own identity and audience, the three different sites that will be taken into consideration in this thesis, all have their own specific target group and audience. These will be discussed in detail further.

2.3.1.1 RTL Nieuws

RTL Nieuws is catered to the general Dutch public that wants to follow the news with a “human touch”. The users are equally both female and male, with a majority being between the ages of 35 and 64 [15]. RTL Nieuws aims at writing articles for the common

public with a human touch, in a simple way. The RTL Nieuws reader is interested in news close to them both geographically and personally. Furthermore, the RTL Nieuws reader wants to scan through the news in a fast way and get as much knowledge as possible in a short amount of time [32] .

2.3.1.2 RTL Boulevard

RTL Boulevard posts prevalently gossip and entertainment articles, is directed at a female public. The majority of the users is female (around 70%) and of age mainly between 25 and 44 years old [15].

2.3.1.3 RTL Z

RTL Z as a brand focuses on business and innovation and caters its content towards a young entrepreneurial audience [33]. RTL Z is for the "entrepreneur, ambitious and curious" [34]. An RTL Z reader wants to always be updated on the latest news, is curious about the world around him/her and is always looking for a chance to develop him/herself both personally and professionally [34]. In general, the RTL Z reader does not have a lot of time to read the news yet has a fear on missing out on the latest news [34]. The readers of RTL z are mainly male (75%) and for the majority between the ages of 25 and 54.

2.3.2 Taxonomy

As mentioned previously, the articles in the RTL sites is organized under a data taxonomy. The figure represented in this thesis (Figure 2-19) is only a summarized example of the true taxonomy, which is evolving every day and includes more than a thousand entries.

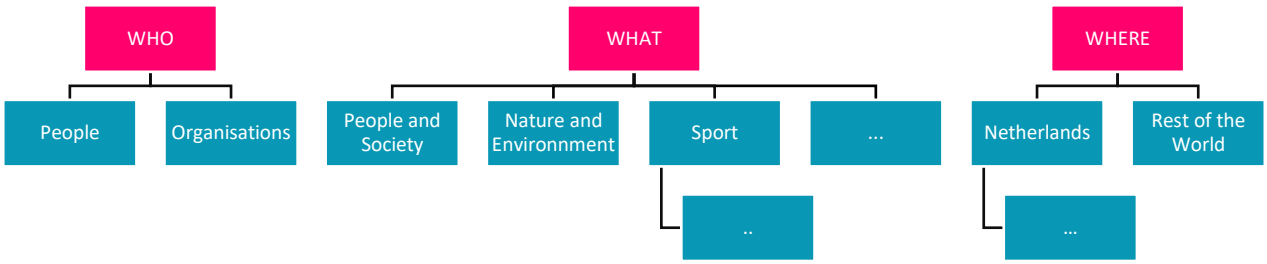


Figure 2-19: Data taxonomy for RTL Sites

Every tag in the taxonomy covers interest for each RTL news site and can be followed through the VOLG service. As mentioned in section 2.3.1 each site has their own audience and topics of interest. In Table 2-2 a matrix is presented that visualizes which tag are most

interesting to follow for which news site. This matrix has been generated connecting the focus themes from each website as given in Section 2.3.1.

RTL Nieuws's goal is to bring news closer to the heart and the RTL Nieuws reader wants to read news that is relevant for them and their surroundings, thus "what" and "where" are the two most relevant tags . RTL Boulevard's main focus is news about people and gossip, thus "who" is the most interesting tag to represent. Lastly RTL Z focuses on business and organisations, thus business in combination with their theme can be of interest for the average RTL Z reader.

	WHO (PEOPLE)	WHO (ORGANISATIONS)	WHAT	WHERE
RTL NIEUWS				
RTL BOULEVARD				
RTL Z				

Table 2-2: Matrix for interest and news site

2.3.3 Data Available

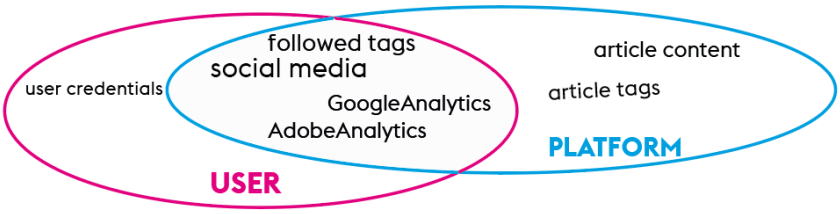


Figure 2-20 Diagram representing available data

All of the data that RTL has at its disposition goes beyond the scope of this thesis, therefore only the data that is directly connected to the RTL news sites will be listed below. The data can be divided into user data and platform data (Figure 2-20). The user data involves all of the data that has to do with the readers and registered users, the platform data is data connected to the content of the news sites. Google Analytics and Adobe Analytics are two commonly used tools to look into website performance and user actions. Furthermore the credentials of all the users that have an account on the different websites or follow something is recorded in a separate database, used to send out push-notifications. As the three RTL news sites are active on social media too, the social media data is also available.

2.3.4 Limitations of the data

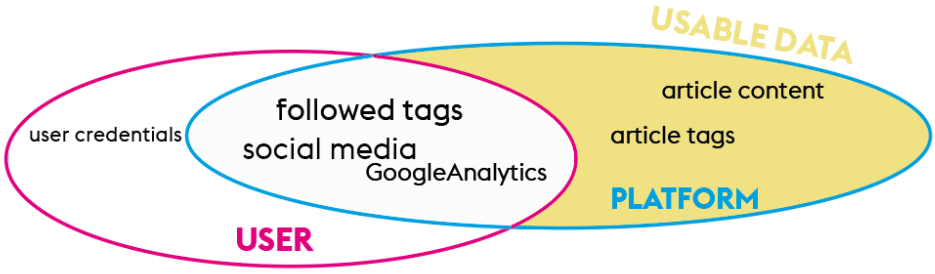


Figure 2-21 RTL Usable Data

In section 2.3.3 an introduction to the available data is done. This data has to be furtherly divided within usable and not usable data. Unfortunately, not all the data is technically ready to use, meaning that it does not momentarily output an API that can be easily accessed real-time. The user databases are outdated and serve the sole purpose of outputting the right notifications to the right accounts. Getting this data ready to use in the available timeframe is not possible. Google Analytics includes confidential information which could not be shared to the public without extra measures, that also cannot be implemented in the available timeframe. Based on Figure 2-20 a new diagram is generated, showing in yellow the data that is at this moment ready to use (Figure 2-21). Looking at the categorisation made in Figure 2-2, this data can be categorised as ordinal data, as it involves data that is qualitative (content and tags) but it can be ordered as the content and the tags can be quantified.

3 Method

This section will outline the design, the development and testing methods and techniques chosen to be implemented in this project.

3.1 Scrum

RTL works using the scrum framework. Scrum is "a process framework used to manage product development and other knowledge work" [35]. Work in the scrum framework gets planned in "sprints". A sprint is a timebox of, in the RTL case, two weeks, in which the team aims at developing concrete product improvements. Tasks within the sprints are refined, at RTL, during refinement sessions. Refinement involves assigning team members and points representing complexity to each task. The points are given in a Fibonacci series, from 1 to 13. In order to complete part of this project together with the team, when planning work in which team efforts that are beyond the scope of this thesis are needed, the scrum framework needs to be adapted in the product execution planning.

3.2 Design Workflow

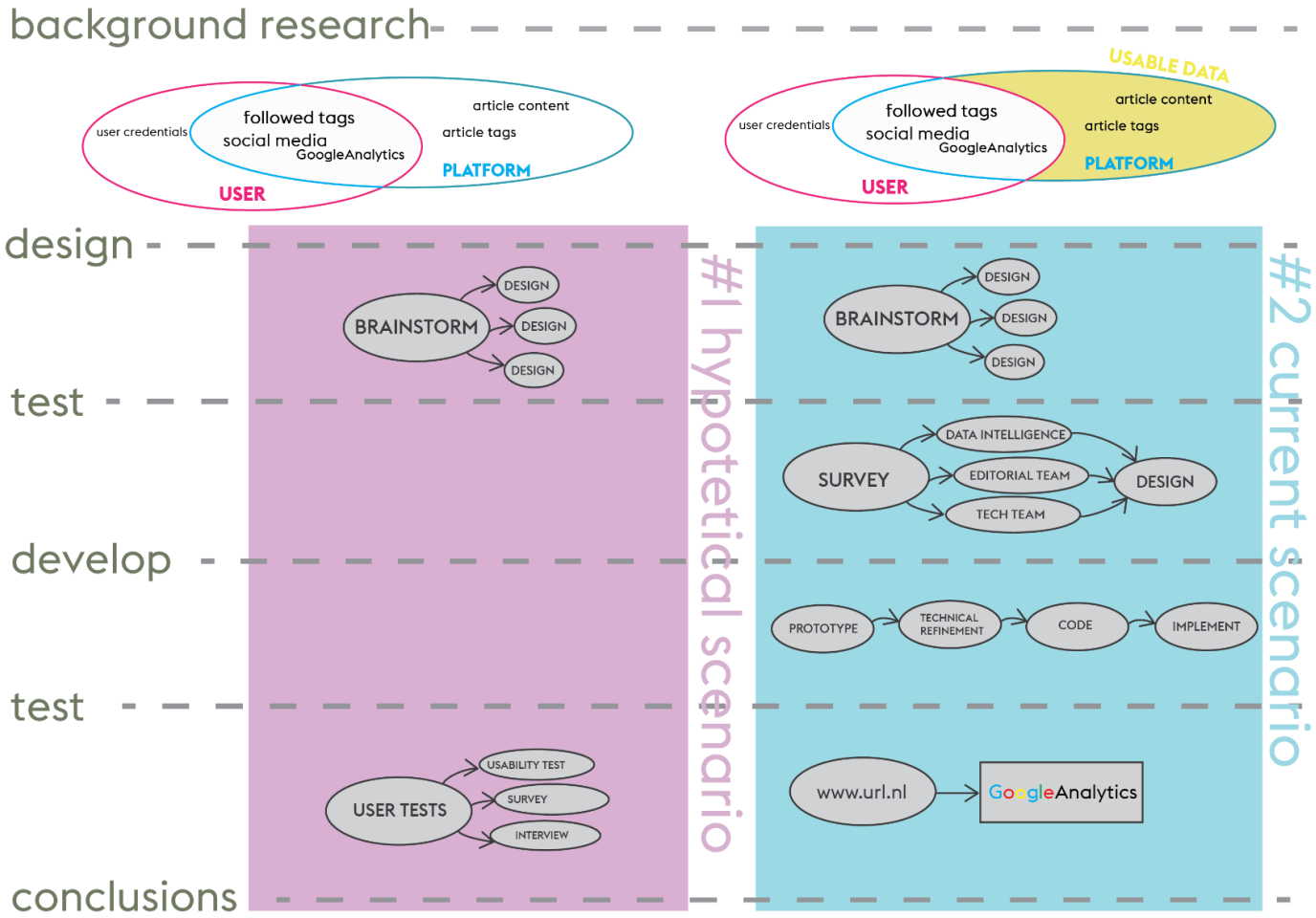


Figure 3-1 Method workflow

In Figure 3-1 an overview of the design process that will be used in this thesis can be found. In this chapter the different steps are outlined in detail.

Due to the limitations in the data that can be used to develop working visualisations and time restrictions, the decision has been made to -in order to be able to fully answer the research question - develop the product according to two different scenarios: a current scenario and a hypothetical scenario. The steps are presented in a linear form, however going back a step is always allowed, in order to re-evaluate what has been done and change anything accordingly.

3.2.1 Hypothetical scenario

In the hypothetical scenario the design will only be developed up and until working hi-fi prototypes. The hypothetical scenario will be developed for all three the above mentioned websites. In this scenario, the brainstorm for the data visualisation will be done taking into account all of the data that is possible to collect and of possible interest, no matter if it is

ready to use. The end product of the hypothetical scenario will be a fully testable hi-fi prototype. The results of this test will aid to draw conclusions answering the main research question. The designs will be developed for RTL however, as this scenario allows for a broader perspective, the aim is to generalise the conclusions to all news sites, through the RTL case. By creating two scenarios it is possible to balance contributions that are most relevant for RTL with contributions that are more general and scientifically relevant.

3.2.2 Current scenario

The current scenario takes into consideration the design possibilities within the requirements with all of the usable data that RTL has at its disposition. The current scenario will have as an end product an actual data visualisation that is implemented in the RTL news sites. As this design will be implemented in the website, the results from the testing will be based on real user data. This result will aid to draw conclusions answering the main research question as well and providing a more concrete feedback to RTL.

3.3 Tools

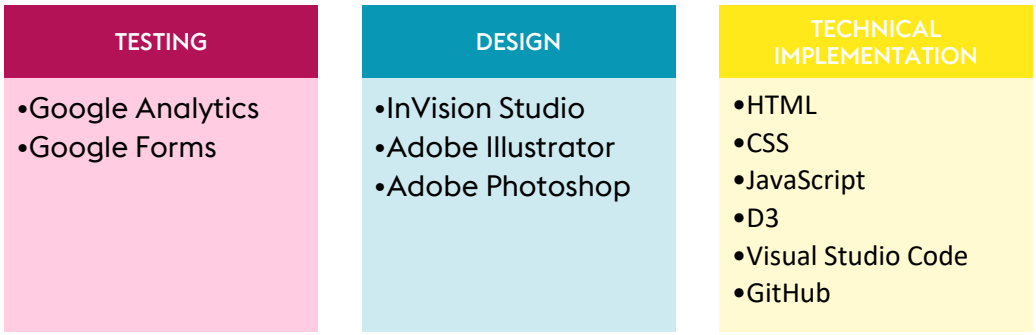


Figure 3-2: Overview of tools

In order to execute this project different technical and non-technical tools will be used. These are listed in **Error! Reference source not found.**. Under testing all the tools are listed that will be used in aiding with the testing of both the current and the hypothetical scenario. Google Analytics will be used to analyse website traffic and actions. Google Forms will be used in order to create surveys and as an aid to guide the user through the user testing.

In order to brainstorm and to design prototypes three main software tools will be used: InVision Studio, Adobe Illustrastor and Adobe Photoshop. InVision studio is the user interface prototyping tool preferred by RTL. Adobe Illustrator is a vector graphics editor, helping in making more advanced graphics to be added to InVision studio. Adobe Photoshop will mainly be used in the brainstorm phase, as it is a great tool to visualise ideas digitally through the help of a graphical tablet.

Under the technical implementation fall the languages, libraries and tools that will be used to create the visualisations that are then implemented in the RTL sites. D3 is a data

visualisation JavaScript library which will be used as an aid to create the visualisations. GitHub will be used so that the rest of the development team can review the code and eventually add their own so to make the implementation as smooth as possible.

3.4 Design

The design method consists of a brainstorm for each scenario and website. Firstly the brainstorm will be diverging, then converging as shown in Figure 3-3. This implies that looking at the design requirements and design resources many ideas will be generated, going into different directions. Afterwards, these ideas are then combined, some may be left out, coming together to one final idea.

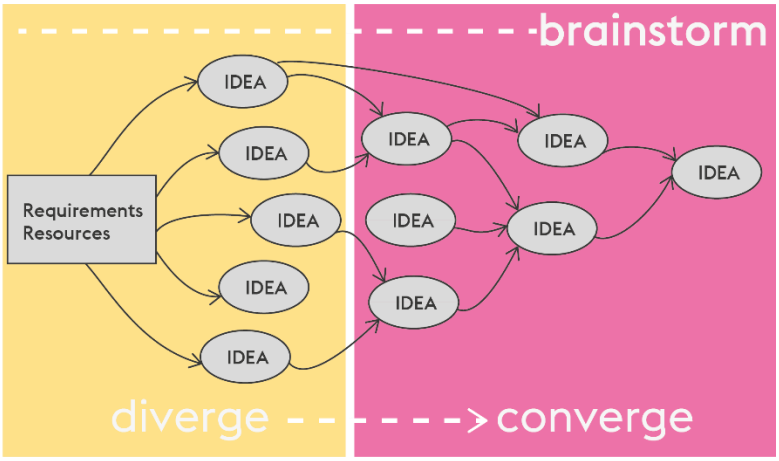


Figure 3-3: Brainstorm Methodology

Looking at the results of the converging brainstorm and the literature research, at most three designs are worked out in illustrator. These are then further refined with the team and turned into testable hi-fi prototypes. For the current scenario these hi-fi prototypes are then submitted to survey with stakeholders in order to further refine the design that then will be built. In the hypothetical scenario the hi-fi prototypes are then tested with a panel.

3.5 Development

This step is only needed in the current scenario design, as the visualisation has to be built and set online. The development will be done with aid from the team at RTL, to ensure that the quality of the product and the code is sufficient to be on the respective website. This means that this step will be done with the scrum framework in mind, as it needs to be done in cooperation. First of all a refinement has to be done, where the user story is presented, including the design. During the refinement, tasks that can be achieved within the 2 week sprint are defined, assigned points representing level of difficulty and are then divided amongst the team members if the task is outside of the scope of the visualisation itself.

After the refining session, the visualisations are developed in a local developer environment. Once they are ready, they are reviewed by other members of the team until they are ready to go into the acceptance environment. That's where everything is implemented within the website. After it is on acceptance and everything works it can go into production and then it is ready to go live.

3.6 Test Methods

A variety of test methods will be used throughout the execution of the assignment. These will be outlined below.

3.6.1 Survey

A survey will be distributed within RTL workers and stakeholders. The survey will be aimed at narrowing down the design for the final data visualization that will be posted on the respective website. The survey will include a combination of closed questions to be answered following a 5 point Likert scale and short open questions. The aim of the open questions is to give the chance to add personalized feedback and comments to the designs, as well as to justify answers given, providing more insight.

3.6.2 User Test (Participant Based Evaluation)

A user test will be executed in order to test the final designs for the "hypothetical" scenario. This user test will be a "cooperative evaluation" which is a type of participant-based-evaluation [36]. The aim of a cooperative evaluation is to use testers not as passive subjects but as co-evaluators. The cooperative evaluation executed in this project includes a combination of a usability test, a short semi structured interview, 5 point Likert scale closed questions and short open questions. The choice to execute such an evaluation is because this test is aimed not only at testing if the visualisation is well accepted, but also discovering what (creative) input and opinions the user might have, furthermore this test maximizes data gathered from one single testing session [36].

3.6.3 Google Analytics

Lastly Google Analytics will be used as a testing tool when the visualisation from the "current scenario" will actually go online. Google Analytics offers great insight into user behaviour, and analysing this can provide insight into how the visualisation has influenced the reader's behaviour. With the google analytics tool the user engagement and satisfaction will be measured using the following metrics:

- Follow actions measured on the visualisation button
- New accounts made compared to last week
- Length of page visit
- Page views per session

These metrics have been indicated by RTL as the best measures to take into consideration when evaluating user engagement and satisfaction [33].

4 Execution

In this chapter the execution of the method will be discussed in detail, and the eventual adjustments thereof. The RTL news sites that will be taken into scope for each scenario will differ. In the hypothetical scenario all will be taken into scope, in the current scenario only the RTL boulevard site will be taken into scope as shown in Table 3. The choice to only take the RTL boulevard site into scope was made together with the supervisor at RTL and with the product owner. The choice was made because of time limitations and because RTL Boulevard was the only site with only one variable to present, and thus would make the visualisation easier and faster to develop.

Table 3: RTL sites per scenario

4.1 Current Scenario

The current scenario takes into consideration the data that is "ready-to-use" and has as an end product a data visualisation that can actually be built and implemented within the time and resources available. In this section the execution of this data visualisation will be discussed in detail.

4.1.1 Brainstorm

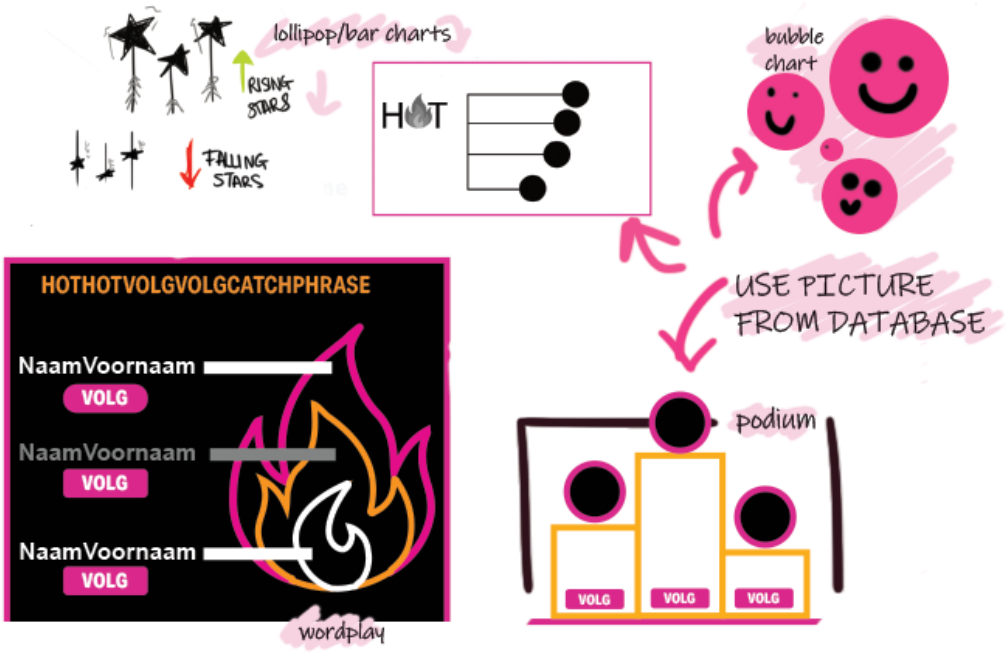


Figure 4-1: Final outcome of Brainstorm RTL Boulevard Current

Brainstorming is the first step in this creative process. The brainstorm has been done following the method discussed in detail in section 3.4. The final step of the brainstorm can be seen in Figure 4-1. The integral version of the brainstorm can be found in Appendix 1– Brainstorm RTL Boulevard. From Figure 4-1 different elements stand out, such as the metaphor for the stars rising showing popularity, using pictures representing the people who are the most popular instead of only text, and placing multiple follow buttons.

4.1.2 Choice of designs

Out of the previously discussed brainstorm three final designs were developed and worked out in inVision, a tool discussed in section 3.3. InVision can offer a closer imitation of the user experience, simulating animations and navigation. These designs (Figure 4-2) were chosen because they provided a variety of visualization of the same concept, which can offer a good base to test which one actually fit the criteria at best.

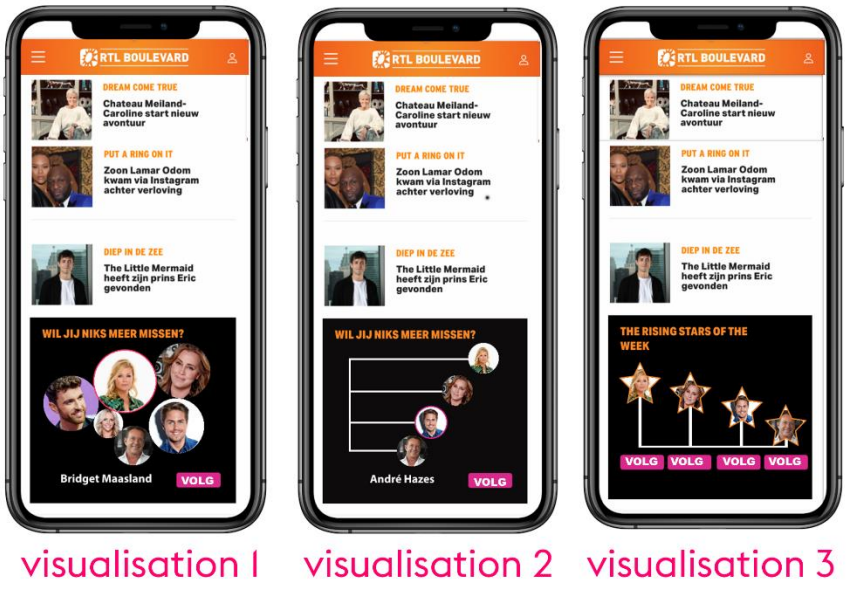


Figure 4-2: Three final designs tested with RTL

These hi-fi prototypes all provide interaction. The first visualisation is a bubble chart. The size of the bubble is how often the person has been tagged in articles on the RTL Boulevard sites. By clicking on different people their respective name will appear and the user is able to follow them.

The second visualisation is a lollipop chart, where the longest "lollipop" indicates the most tagged person in the news the past week. Again, by clicking on the pictures the respective name will appear at the bottom and the user is able to follow them.

The last visualisation is a bar chart using stars to represent the picture of the most tagged person. This visualisation offers the option to follow all of them initially but does not show any names. Only after clicking on any face the name will appear and the follow button will become one, just like with visualisation 1 and 2.

4.1.3 Testing and results

The three designs have been tested through a survey as discussed in section 3.6.1. The survey can be found in Appendix 2[6]. This survey has been spread around different RTL stakeholders using a google form. The stakeholders include the RTL Boulevard editorial team, the RTL data intelligence team and lastly the team I am working with in this project: the publishing tech team.

Table 4: Result of internal RTL Survey

Visualisation	Purpose	Where to look first	Knowing where to click	Aesthetics	Corporate look	Intuition
1	2.5	3.28	3.57	2.64	3.86	3.43
2	2.78	3.07	3.21	3.5	2.57	3.07
3	3.87	2.12	2.12	2.75	3.75	2.5

Looking at the numerical results (1 to 5) taken from the survey (Table 4), the preferred visualization was visualization number 3. The results have been colour coded; a best score being green and a worst score being red. Furthermore the statements that were negative have been inverted while doing the colour coding to prevent confusion.

Visualisation 3 scored above visualization number 1 in all points, except on the aesthetics criteria. When looking into the general comments given on the visualisations most respondents seem to agree that visualization is not perceived as aesthetically pleasing because of the many call to actions and is not fitting within the RTL Boulevard corporate style. Furthermore the title that was not perceived as appealing enough and that the number of follow buttons were too many.

However, the majority of the answers (50%) to the question "*which visualization would you like to see on the RTL Boulevard website*" was visualization 1. When asked why, the main reason given was because of its clear and simple design.

[6] https://forms.gle/B1BnxSBezbPRb1xC8

4.1.4 Design Refinement

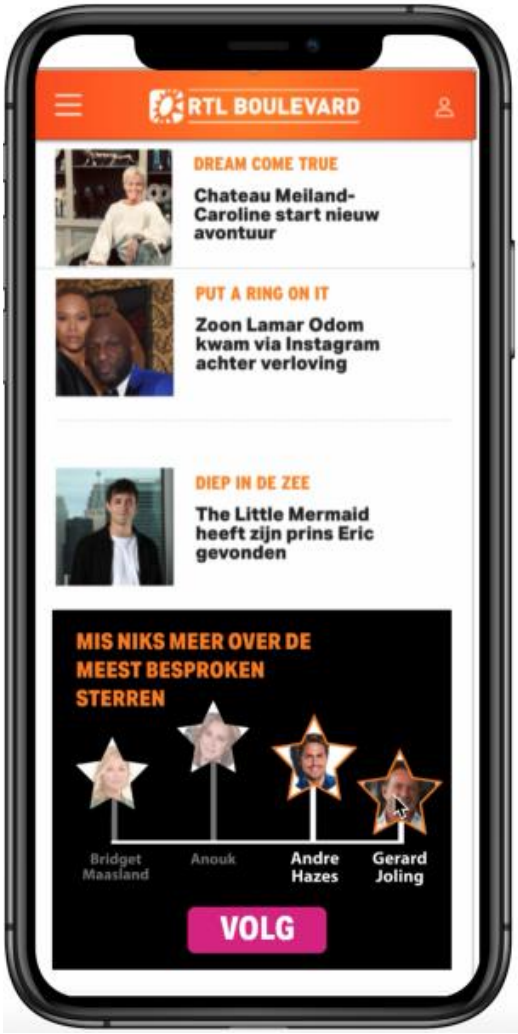


Figure 4-3: Mobile mode hi fi prototype

After having analysed the results of the survey, it was clear that a combination of the simple elements of visualization 1 and the build of visualization 3 had to be combined to come up with a final design. The first choice made was to reduce the "volg" buttons from four to one, reducing the call to actions thus giving the user one element to focus on instead of four. By making the volg button bigger instead of four smaller ones, the reader will know better where to put their attention – establishing a more defined visual hierarchy. An animation element is also added to the visualization, making the bars rise as the user scrolls down, grabbing the attention of the user through movement. It is important to also emphasize which element is selected, as taken from literature through means of colour and saturation. The final design has been executed in inVision can be found in Figure 4-3.

As the design is mobile first but has to be also viewed in desktop mode, together with the team designer, an optimal solution has been found and can be seen Figure 4-4 .

Figure 4-4: Desktop mode hi-fi prototype

4.1.5 Technical Refinement

With the aid of the inVision hi-fi prototype, together with the development team a technical refinement took place. The visualisation will be made using JavaScript and the d3 data visualisation library. D3 is chosen as a library because it is already installed within the Drupal environment that the RTL Website. A JavaScript code will be delivered to the development team which will then be reviewed, improved, and implemented within the website.

Because of time limitations for the coding and implementation of the design, a MoSCoW analysis of the functional and non-functional requirements has been made (Figure

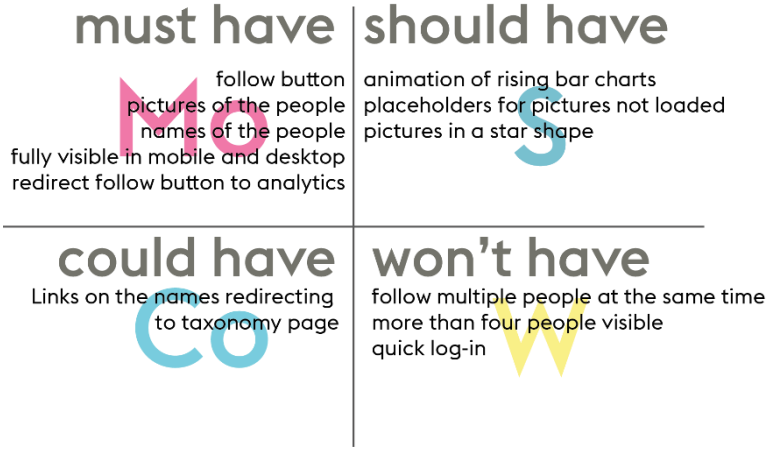


Figure 4-5 MoSCoW analysis RTL Boulevard Data Visualization

4-5), based on the inVision design that has been previously delivered, defining and prioritizing technical and design properties that will appear in the final product. The MoSCow analysis is based on the priorities and limitations given by the team and by setting as a priority a functioning, understandable visualisation.

Screenshots of the final product can be found in Figure 4-6 and Figure 4-7.

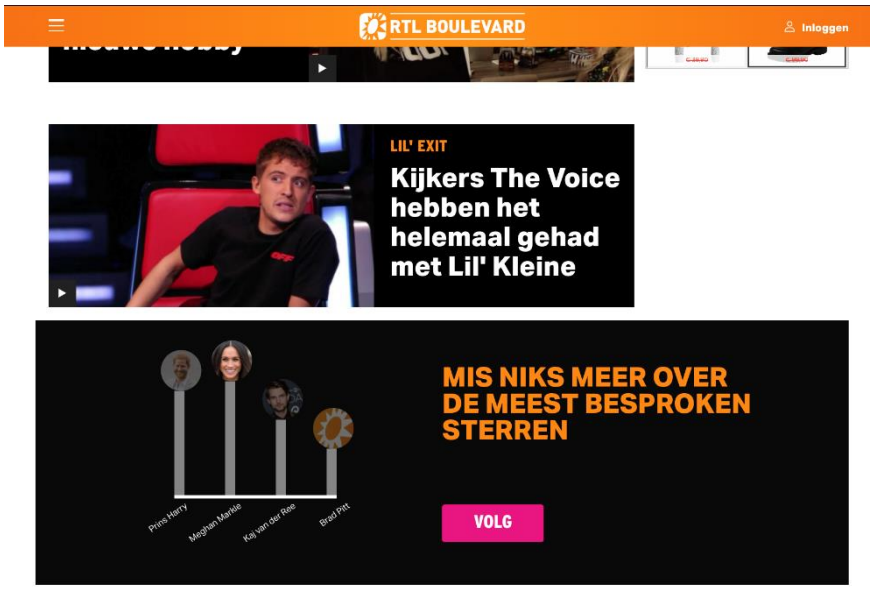


Figure 4-7: Final visualisation RTL Boulevard desktop

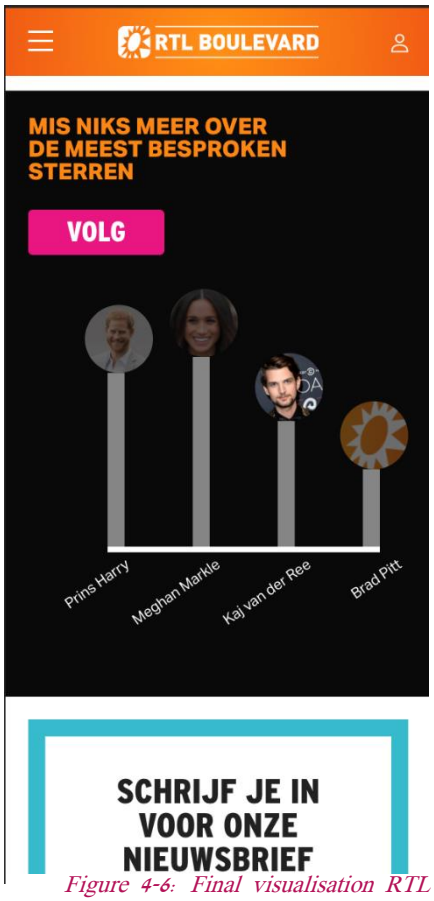


Figure 4-6: Final visualisation RTL Boulevard mobile

4.1.6 Real end users testing

The visualization went online on the 17th of January 2020, and the measurements took place in a week time, thus between 17th of January 2020 and 23rd of January 2020. The parameters that are tested are discussed in section 3.6.3.

Initially the testing included comparing the tested parameters to a week time frame of a year before and a week before the visualisation has gone live. As RTL Boulevard has seen a significant growth in the past year due to the introduction of sharing articles on social media, testing to the parameters for a year before will show an increase nonetheless – and is thus not a significant result (See " Appendix 6– RTL Boulevard Traffic 2019" for an overview of RTL Boulevard growth and incoming traffic for the past year). Testing a week before is also not reliable, as the traffic on the RTL Boulevard site is unpredictable due to

the traffic being highly influenced by the content, thus other external variables are likely to influence the metrics [37].

4.2 Hypothetical Scenario

As the previous scenario included many limitations in the data that was available, a scenario is sketched out where the data that can be represented was not limited, giving room to create hi-fi prototypes to user test that will not necessarily be worked out within the time and resource limits characterizing this project. Within the hypothetical scenario all of the three RTL websites that are in the scope of this project were taken into account.

4.2.1 Brainstorm

The procedure followed for the brainstorm is the same as the one described in section 3.4. The brainstorm has been executed separately for RTL Z, RTL Boulevard and RTL Nieuws. The data that has been taken into consideration while brainstorming is the data represented in Figure 2-20. The final brainstorms can be found in Appendix 2, 3 and 4.

4.2.2 Choice of Designs

For each of the websites two final designs were chosen (Figure 4-8). This means that in total six designs were worked out in the inVision tool. These designs show a variety of data that can be visualised using different dimensions. These designs will then be tested with a group of users randomly, to see if one design is preferred to the other and for what reason.

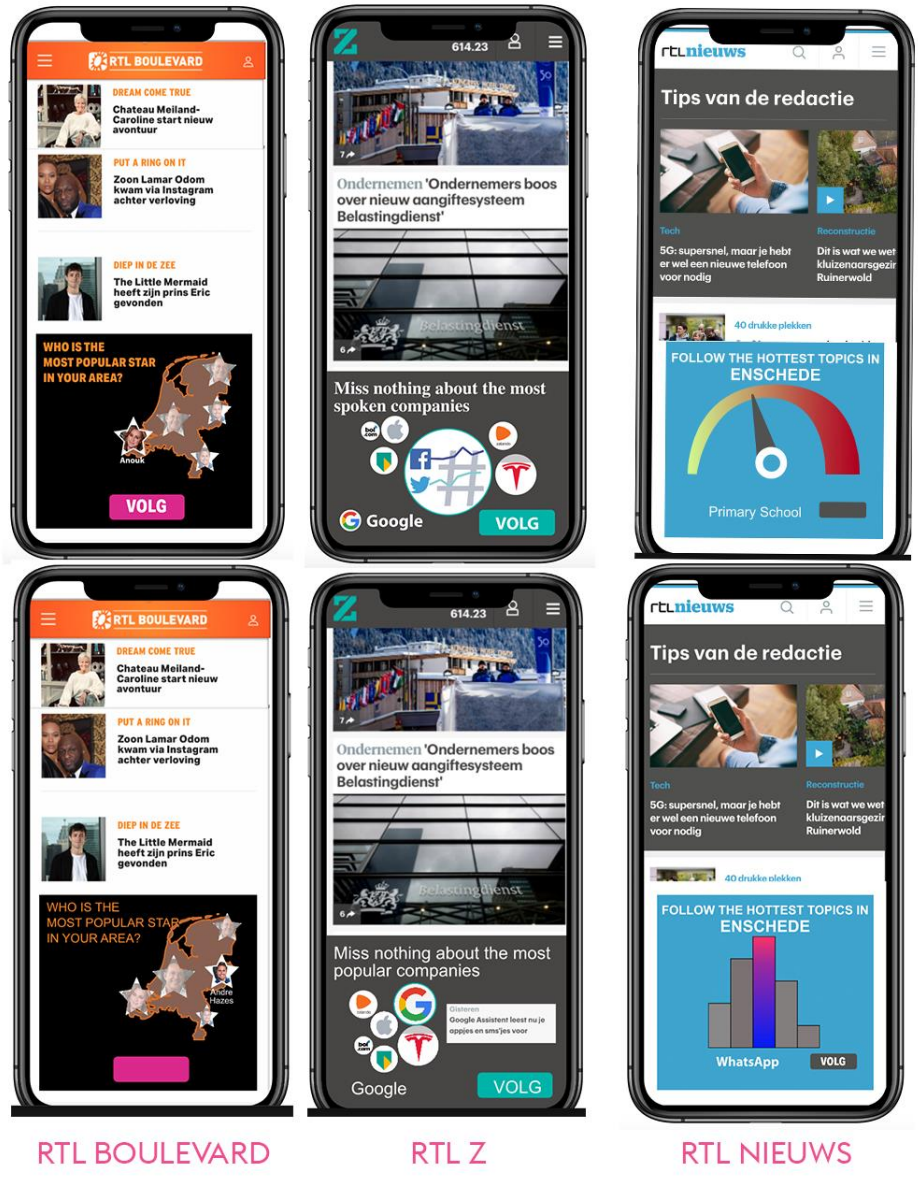


Figure 4-8: Six final testable hi-fi prototypes

For the RTL Boulevard site the most followed stars in a specific area are visualised through the use of a map. In the second visualisation the only difference is that the size of the stars also represents how often they have been tagged on the site in the past week.

For the RTL Z site the first visualisation shows the most tagged companies in the past week in a bubble chart. When clicking, a line graph will show the respective company's social media presence in the past week. In the second visualisation the bubble chart element is still present, however when clicking, the latest articles will appear on the side.

For the RTL Nieuws site the most followed topic in your location will be given. The location will be automatically determined by the GPS coordinates of the user, in the example the location is Enschede. In the first example an indicator will show the least "hot" to the "hottest topic", in the second example presents the same data in a bar chart ordered in a podium mode with an extra variable introduced. The variable is in this case gender, but it can be any other demographics. This is shown by the percentage of the blue (male) or pink (female) colour.

4.2.3 Pilot Study

A pilot study can be used in different testing situations to evaluate different aspects of a test. In this paper the definition that will be followed for a pilot study is: " ..the specific pre-testing of a particular instrument such as a questionnaire or interview schedule" [38]. In this case, before the user tests can be done, a pilot test is executed to test if the test runs smoothly as planned and adapt the final test accordingly. A pilot study can help in this case to understand if the test setup is feasible and if all of the questions are understandable. Because of time restraints only one pilot test has been executed, with a user that had no knowledge about the project.

The pilot study showed that the planned test would take double the amount planned, meaning that the number of tests that could be done in the time frame planned would then be less. Testing two visualisation per website in a different order was too much and would not present valuable results if done with a smaller sample size, so the choice has been made to test one visualisation per website, however always in a random order (Figure 4-9). Moreover, during the pilot study, all of the movements of the interaction of the user with the visualisation were hand noted by the tester, this turned out to be time consuming, therefore the test will be tracked by screen and cursor recording.

Lastly, first showing all three of the visualisations and then presenting the questionnaire caused the user to forget what the visualisations looked like, making the test less reliable. The choice is thus made to fill in the questionnaire after each visualisation. Since knowing which questions are being asked should not influence the bias of the test for the following visualisations this was possible.

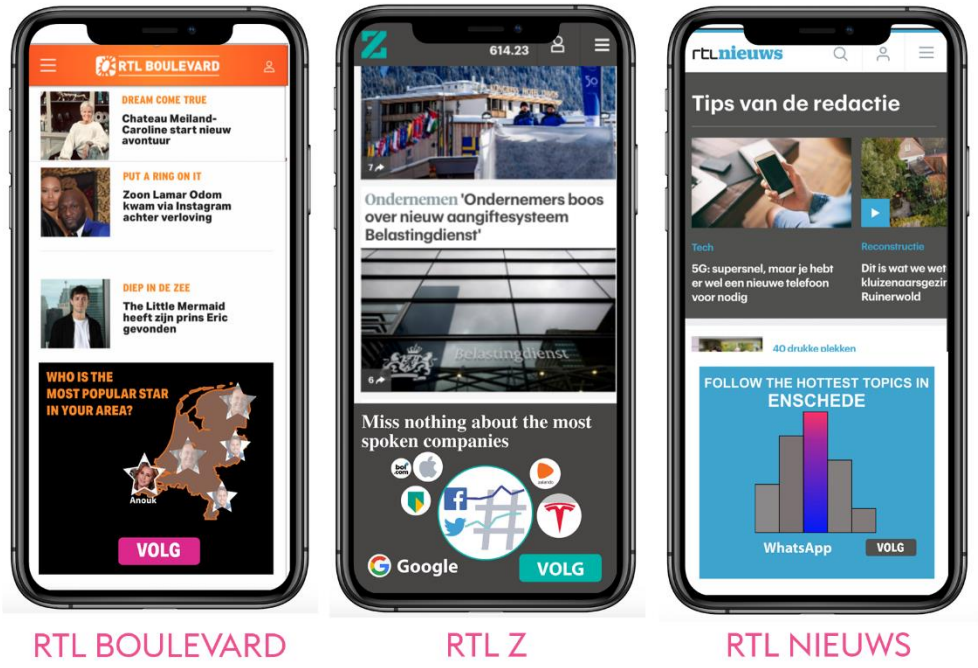


Figure 4-9: Three tested interfaces

4.2.4 User Test

In total seven tests were taken. The test was taken with visitors of the canteen of a Sport Centre in Enschede, this was so to gather enough users of a varied enough background to fit the broad RTL public. In order to gather respondents, the option to enter a raffle for a bol.com voucher was offered.

The google form[7] used to aid the testing - including the consent form - can be found on Appendix 7 – User Test.

The questions that were used as a guideline during the semi structured interview have been partially taken from the methodology explained by Benyon [36]. The questions are as follows

- What do you see?
- What variables can you recognize?
- What do you wish you could do?
- What do you think VOLG does?
- Do you read the news?
- Would you use this functionality on your favourite news application?
- What data would interest you personally?

[7] https://forms.gle/9WpKPM92nMCpNeQH9

5 Results and Evaluation

In this section the results from the testing will be outlined and evaluated.

5.1 Current Scenario

In Table 4 the collected data of the testing period is shown. The metrics that have been tested show a positive effect throughout, indicating that – on the metrics tested – user engagement has increased.

Table 5: Google Analytics Results

	Avg. time on page	Avg. session duration	Pages/Session
Clicked "VOLG"	1m26s	9m24s	4.766
Visited Homepage	1m13s	3m52s	2.346
VOLG influence	+0m13s	+5m32s	+2.42
Growth (%)	13%	143%	103%

When looking at the metric for accounts made these have been extracted from the local volg database. In this database it is not possible to make a difference between accounts made on the website or made on the app and thus on which platform something has been followed. Looking globally, comparing the testing week (17 January-23 January) to the week before, a 37% decrease in new accounts made can be seen. However, when looking at the new accounts made that are also following a topic there is a 200% increase in "volg" actions. This can indicate that the introduction of the visualisation has had an effect on making new accounts in order to follow a topic, however this cannot be proven with certainty. As mentioned in section 3.6.3 testing data against a different period is not the most accurate methodology.

The volg button has registered a total of 249 unique follow events and 8 unique unfollow events. The unfollow events have been registered in a short period after the follow events, indicating that viewers might have clicked on the follow button just to see what its function was. As the volg button also registered the events of people that were not registered, this is not a clear indication of actual new follows. Due to the limitations of the local volg database, it is not possible to cross reference how many people have actually followed, however comparing the most followed people on the RTL Boulevard before the visualisation has gone live and after a week it has to be noted that only the people that were present in the visualisations have shown a growth in number of follows. This can be connected to the fact that they were most in the news but the action could also have been triggered by the volg button.

It is important to note one specific example; the who tag "Kaj van der Ree" had no followers before the data visualisation went online, however he was one of the people that appeared on the visualisation during the measurement time. He has gained six follows, which brings him to the top seventeen most followed people in the system at the moment. Although this is a small number, the most followed person in the RTL Boulevard site has 22 follows, meaning that a growth of six follows in a week can be considered a significant result.

Concluding, the introduction of a data visualisation element can possibly have had a positive influence on the number of "volg" actions and in user engagement, however not on the amount of new accounts made.

5.2 Hypothetical Scenario

In this section of the report the results of the user test done with the three designs from the hypothetical scenario will be discussed in detail. In total seven respondents took part in the user test, all of age between 18 and 35 out of which three females and four males. The user test has been done following the guidelines laid out in 4.2.4. The user test results will be divided into three different categories: a usability test, a semi-structured questionnaire and a survey consisting of open and closed questions.

5.2.1 Usability test

The main aim of the usability test was to get the user to perform a simple task. The list of tasks per visualisation is as follows:

- **RTL Boulevard:** "Follow the most popular star in Overijssel".
- **RTL Z: "**follow the most/least popular organisation"
- **RTL Nieuws:** "follow Primary School".

In this usability test the variable that was tested was time of execution. The results can be found in Table 6.

Table 6 Time of Task Execution in seconds

RTL Boulevard	RTL Z	RTL Nieuws
0:36	0:25	0:26
0:13	0:13	0:16
0:08	0:08	0:13
0:16	0:17	0:18
0:14	0:15	0:28
0:18	0:11	0:16
0:17	0:39	0:11
AVERAGE	**AVERAGE**	**AVERAGE**
0:17	0:18	0:18
IDEAL	**IDEAL**	**IDEAL**
0:10	0:11	0:12

As it can be seen from the result, all three visualisations show an average close to 18 seconds per task executed. Within the data some longer task executions can be found, such as for the first user who generally took longer to execute tasks and the last taking the longest to execute the RTL z task. The time is compared to the time taken to execute the task by someone who is known with the visualisations and a difference can be found, indicating need for improvement in intuition of the visualisations.

5.2.2 Semi-Structured Interviews

After that the participant has executed the task given, a short semi-structured interview took place. When the participants have been asked what they see with the RTL Boulevard visualisation in general they seemed to understand that the location was related as to how popular they were, however the concept of "popular" was not clear. Some thought it meant that their articles were read a lot in that region, others thought that it was where they were seen the most. It is important to mention that participant 3 mentioned that at first glance they thought that the people lived in that area and that's why they were in the map.

For the RTL Z visualisation everyone except participant 7 seemed to understand that the size of the logos was related to the popularity of the organisation. When clicking, a

different visualisation appeared, showing Facebook and Twitter popularity over the time frame of a week. Participant 6 thought at first that it was a bug and did not realise that it was a line graph. In general the point of the second step was not understood straight away.

For the RTL Nieuws visualisation it was clear that who saw another visualisation beforehand knew that they were supposed to click, however the people who saw it first struggled to see that it was clickable and just guessed. The presented data was understood correctly, except the colour coding. The bars' colour were meant to show how many males and how many females follow the subject, however it was perceived by everyone as how "hot" a topic was. This means that the colour coding was seen as strengthening in the length coding and thus not indicating a new variable.

When asked at the end of the session what the participants thought that VOLG meant everyone seemed to understand that it would send you a notification if something new about that topic was published online. It has to be noted that 2/7 participants were known with the VOLG function and were familiar with the RTL app and products. Participant 1 added that he would expect all of those topics to also appear first in his news feed.

Another question that was asked was whether the participant would use such a functionality if it was presented to them in the context of their own preferred news source – meaning if their daily used news app would offer a data visualisation with an overview of topics you can follow. All seemed positive about the idea yet would like to see improvements. Participant 5 mentioned that presenting more in depth visualisations in a separate section might offer more space for insight and does not distract from scrolling down the news.

Participant 4 mentioned that she does not follow the news very often because the items that are not of interest seem to always be on the top of the news, so if she could only receive news on topics that are of her interest then she would consider following the news more often. Participant 5 mentioned that he has all of the notifications turned off on his phone except Whatsapp. This is because "I only read the news when I decide so and I do not need to know if Max Verstappen got a new car". When asked whether he would consider turning the notifications back on if the notifications he received are only of the things he follows he replied that he would consider it.

5.2.3 Survey

Lastly after each visualisation the participant had to fill in the survey. The responses for the survey showed overall positive results, with the RTL Boulevard visualisation scoring the highest except in the functionality criteria. The RTL Nieuws on the other hand scored lowest except on the functionality criteria. The full results can be found in Table 7. The results are colour coded, the closest to green, the more positive the answer. The coding has been inverted for the answers with a "negative statement" such as "the purpose was not clear", to provide a clearer overview.

Table 7: results of the user test survey

	Easy to understand	Purpose not clear	aesthetics	intuitiveness	No functionality added	simple
RTL Boulevard	4.14	2.43	4.14	4.14	2.14	1
RTL Z	4	2.14	3.71	4	2.28	1.42
RTL Nieuws	3.42	2.14	3.42	3.14	2.14	1.57

6 Conclusions and recommendations

In this section the research question will be answered and recommendations and limitations of this thesis will be outlined

6.1 Conclusions

In order to fully answer the research question and thus to design novel data visualisations for the purpose of this project, design principles have been researched in the literature in the themes of UX design, data visualisation and web design (SQ1), (SQ2). Then a context analysis - in this case – of the client RTL has been done (SQ2). Furthermore, in order to understand exactly what can be visualised, a data and platform analysis has been carried out (SQ3) (SQ4). From researching the available data at RTL the decision has been made to split the project in two – one developing a data visualisation with what is available at the moment, and one developing a data visualisation with all of the possible data. This is so to give a fuller perspective on the topic and to still be able to test with real end users.

With this knowledge in mind, converging brainstorms have been carried out with different purposes. From the brainstorms designs, hi-fi prototypes and a fully working data visualisation have been developed and tested using fitting methodologies within the time and resource limit (SQ4). Looking at the results from the tests that have been carried out in this project, it can be concluded that there is an indication that an element of data visualisation can possibly increase user engagement with news sites and improve the overall user experience (SQ5). Further research, testing and designing is needed to conclude this with certainty.

6.2 Limitations and Recommendations

In this section the limitations of the paper will be outlined, together with recommendation for future research and for future implementations of these data visualisations at RTL.

6.2.1 Test limitations and recommendations

6.2.1.1 Current scenario testing

The test that has been carried out on the RTL Boulevard website did have some limitations. The volg action that was registered on the analytics did not check whether the user was actually logged in, thus the amount of volg actions also included people that were not logged in and were redirected to a log in page. The volg manager database has no way of showing with certainty whether what was registered as a volg action by a user is the same volg action carried out in the visualisation.

Furthermore the volg notification system was only working on the app at the time of the testing. Before then, volg actions carried out on the website gave you two options, the option to receive email notifications at a preferred time and the option to receive an app notifications (if this was installed). Since September, this is not the case anymore. This means that in order to get notifications, you as a user would need to have an app installed on your phone and perform the volg action on the visualisation on your laptop or on your mobile browser. This is why testing data of returning traffic from a received notification was not possible, as the percentage of people that would have the app installed and use the website on their laptop is very small.

As of right now, RTL still has limited resources in terms of data that is ready to use to further test a visualization with real end-users. The available data is strictly related to content, however looking into the user tests a trend in interest in personalized news can be found. The database tracking the follow actions is outdated and is solely used for sending out the notifications to the right e-mail. If this database were to be improved this would not only provide more meaningful data to potentially show, but also aid RTL with more user insight and their follow-behaviour.

Due to time limitations the real user test has been only done through the period of a week. To get more significant data this would be preferably done over a longer period of time. As mentioned in section 4.1.6, the traffic visiting RTL Boulevard is very unstable, thus a longer period of time would potentially provide a more insightful result. Lastly performing an AB test with a visualisation versus no visualisation was not possible due to time restrictions, this would be a better solution for future research in order to get a better data comparison for user engagement.

6.2.1.2 Hypothetical scenario testing

Although a pilot test did help filter out the first problems with the test, there were still some points that could be improved. First of all the voice recording and screen recording could have been done at the same time to map action to words in an easier way. Secondly for a more accurate test, the interface should have been tested on a mobile rather than on a computer.

Lastly, to achieve best results separate tests would have to be carried out, each catered to the target group of each RTL news site, with a bigger test panel.

6.2.2 Recommendations for RTL.nl

In the near future, RTL's plan is to move to a one-brand-strategy, meaning that there will be one rtl.nl site for all that RTL has to offer. The RTL user will thus only need to go to one website to see missed episodes of their favourite show as well as to read the latest news. Offering a data visualisation that can show interesting topics catered to the user can help the reader engage with RTL and discover content.

A big problem with the visualisation that has been posted on the RTL Boulevard site is that the priority has been given to the "volg" call to action, when in reality the first call to action must be to log in. When a reader is not logged in, when they click on the "volg" button they are redirected to a login/register page. Although the steps to take are not many, this can throw off the reader and let them leave the website. RTL wants to allow users to follow topics without logging in, however by persuading users to log in, as a company, RTL can not only create a stronger bond with their users, but (with permission) also have access to a wider variety of user-based data, allowing them to monitor the user's behaviour and improve their product accordingly.

A call to action to log-in can be easily applied in the visualisation that is online for RTL Boulevard. The call to action can be achieved by offering a sneak peak of the visualisation, for instance hiding the top three most spoken people in the news and only showing the fourth. Then the reader will read that if they want to see the full visualisation they would need to log in, hereby creating a new call to action - create an account (Figure 6-1). The user might have a higher motivation to create an account to discover content that has been hidden from him/her, rather than to use a functionality – this would have to be ultimately tested. Then, after having created an account and having logged in, it is then easier for the user to follow any topics they are interested into.

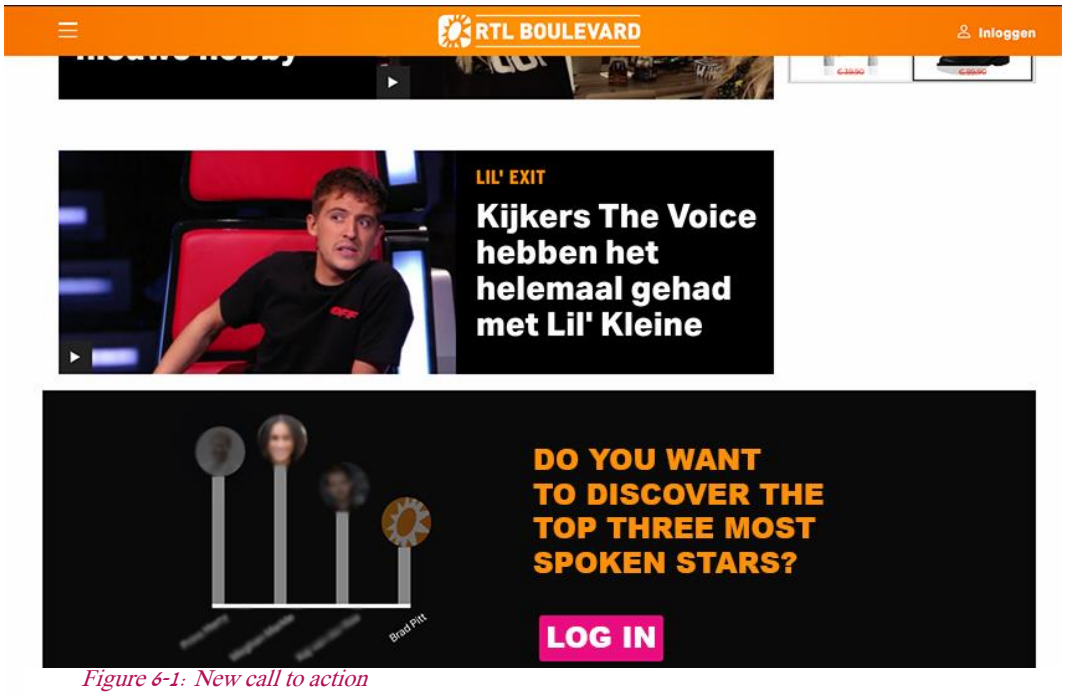
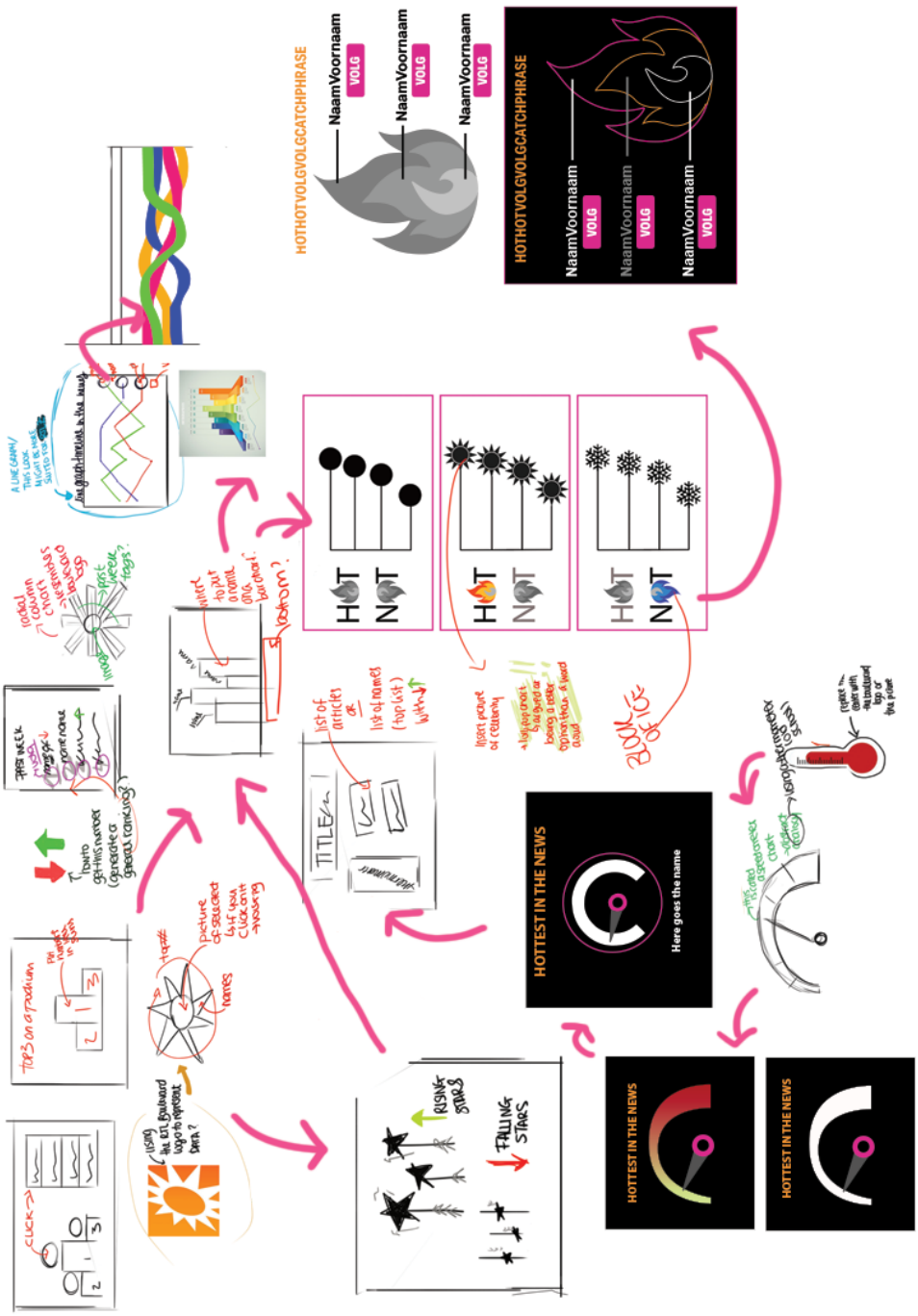


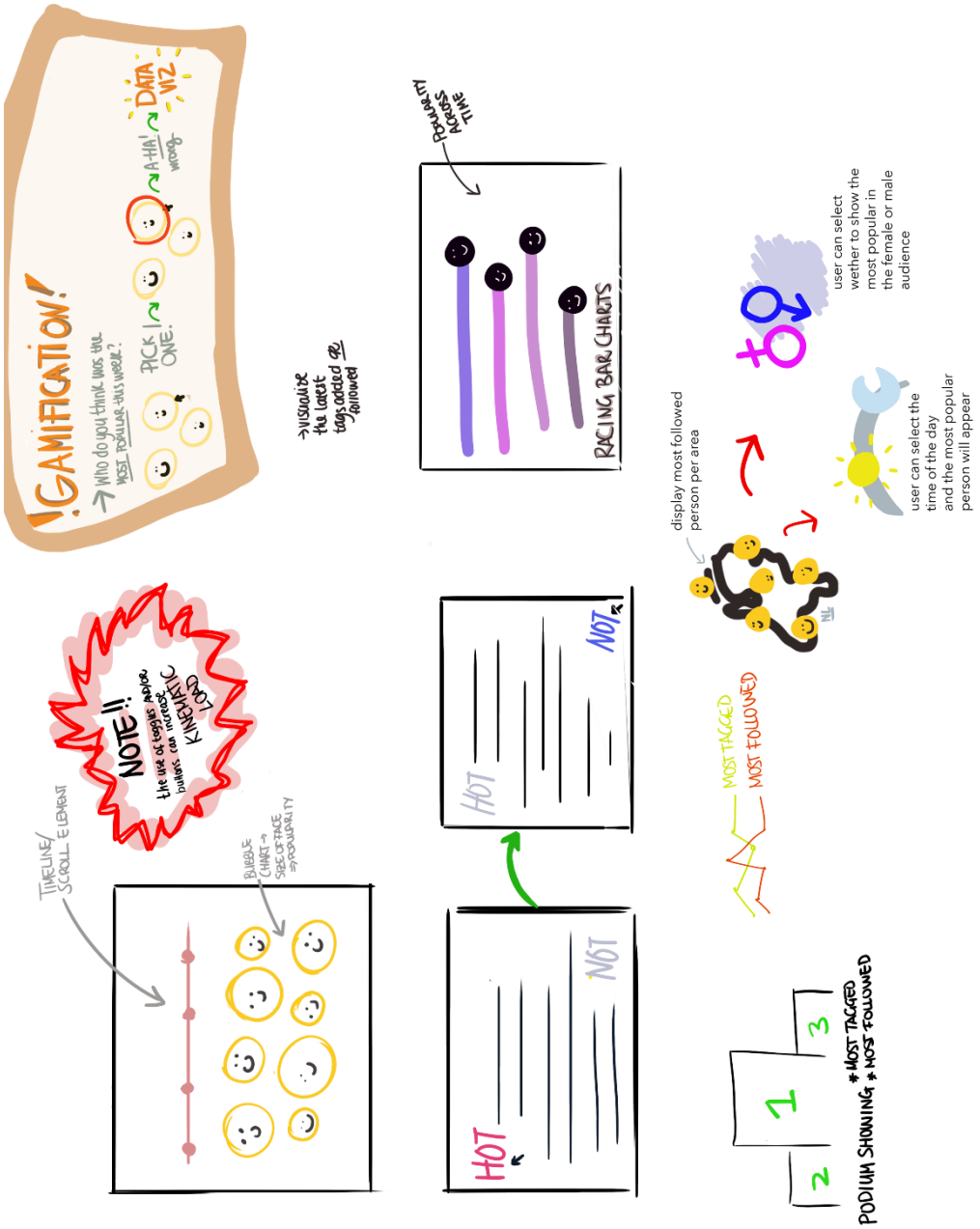
Figure 6-1: New call to action

7 Appendix I– Brainstorm RTL Boulevard "current"

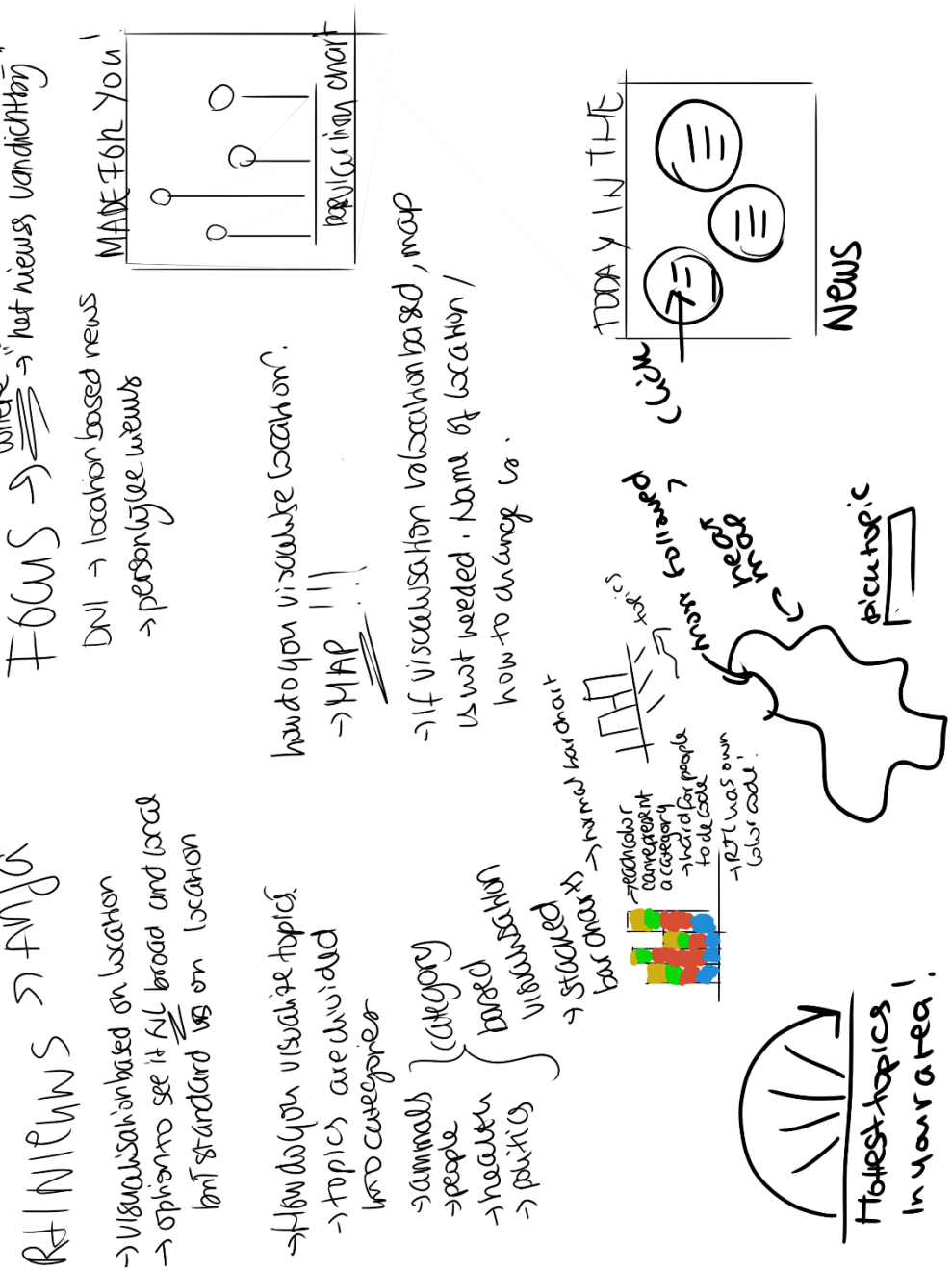


Benedetta Cervone
s1443887

8 Appendix 2 Brainstorm RTL Boulevard “Hypothetical"

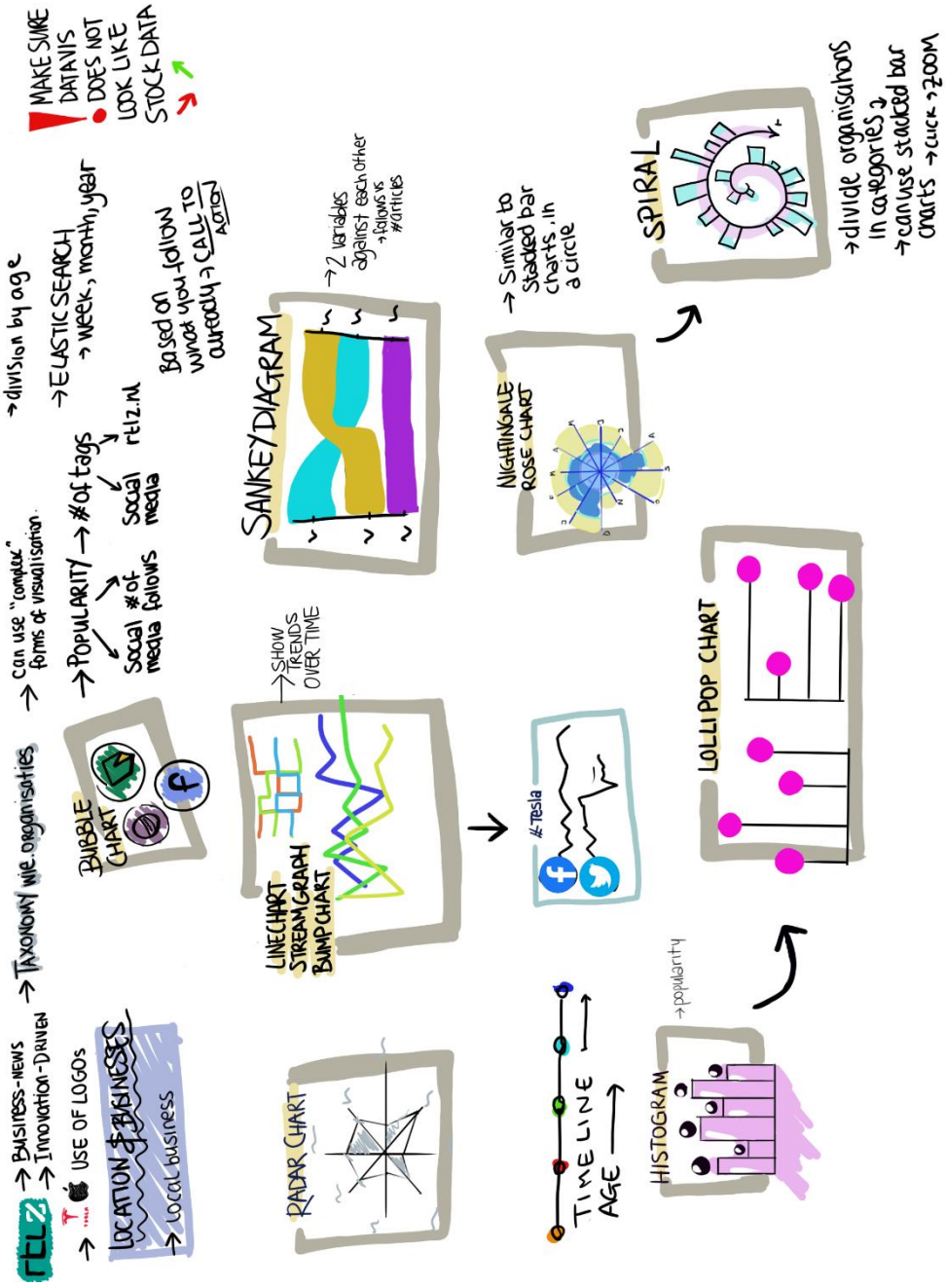


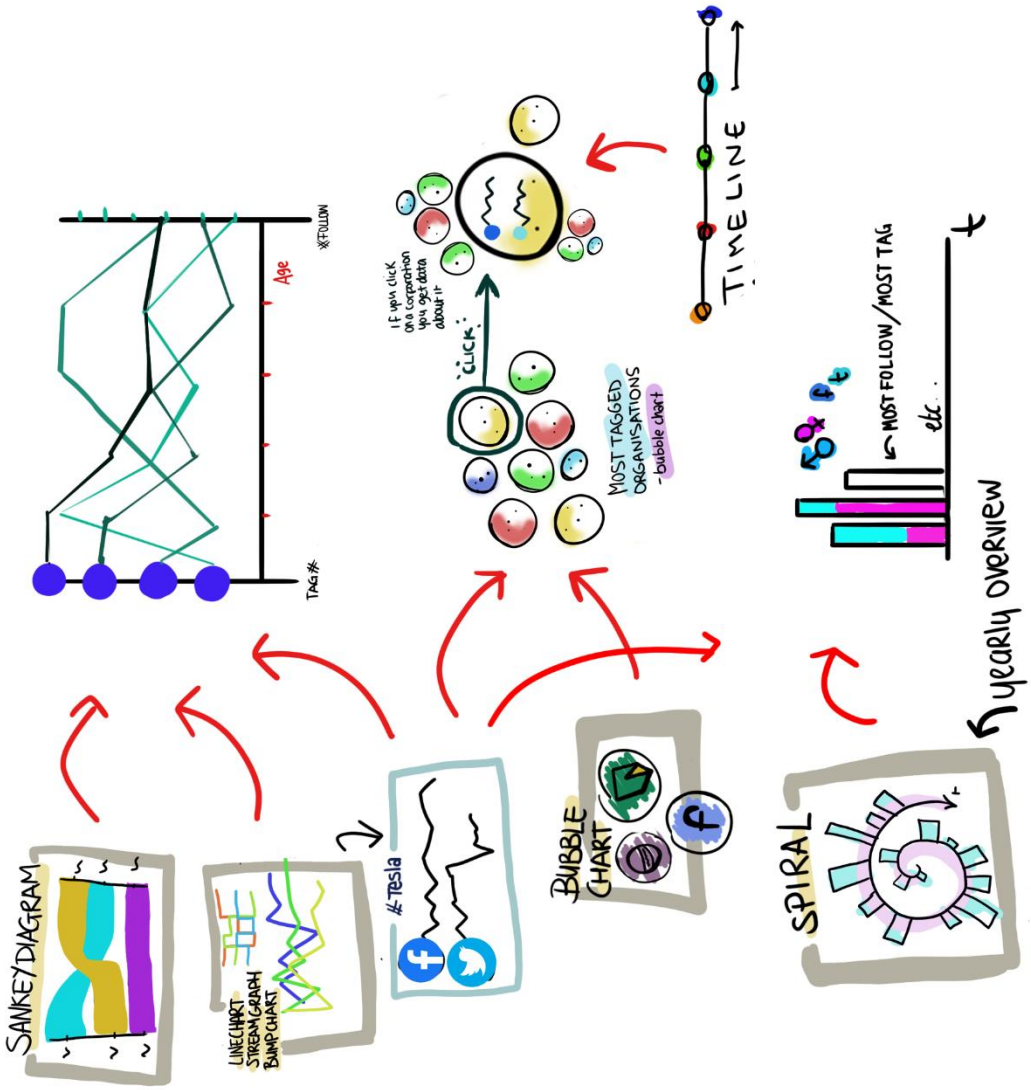
9 Appendix 3 - Brainstorm RTL Nieuws "hypothetical"



Benedetta Cervone
s1443887

10 Appendix 4 - Brainstorm RTL Z "hypothetical"




SANKEY DIAGRAM
LINECHART
STREAMGRAPH
BUMPCHART
#Tesla
BUBBLE CHART
SPIRAL
yearly overview
MOST FOLLOW/MOST TAG
etc.
TIMELINE
CLICK:
MOST TAGGED ORGANISATIONS
-bubble chart
Age
#FOLLOW
TAG #

11 Appendix 5– RTL Boulevard Survey

Data Visualisations Survey RTL Boulevard

Hi! My name is Benedetta Cervone and I am, at the moment, working on my graduation project at RTL.

My research revolves around designing data visualisations for the different platforms of RTL with a specific aim (I won't tell which aim for the purpose of this survey ;-)) - This survey is focused on the RTL Boulevard implementation

I would really appreciate it if you could answer my short survey (±5 minutes)!

*Required

Disclaimer

I understand that the results of this survey will be treated anonymously and will be only used within this research for RTL Nederland and University of Twente. * *Mark only one oval.*

◯	Ok, continue	Skip to question 2.
◯	End survey	Skip to "You have ended the survey."

Visualisation #1

Click on the link below to see a demo for the visualisation

https://projects.invisionapp.com/prototype/DataVis1-ck3o7yeal00st3a01lv4j318g/play/fba6c2d0

I thought that the visualisation was easy to understand * *Mark only one oval*

totally ◯ ◯ ◯ ◯ ◯ totally

I did not understand the purpose of the visualisation * *Mark only one oval*

totally ◯ ◯ ◯ ◯ ◯ totally

I knew where to look first * *Mark only one oval.*

totally ◯ ◯ ◯ ◯ ◯ totally

I knew what I was supposed to click * *Mark only one oval.*

totally ◯ ◯ ◯ ◯ ◯ totally

I thought that the visualization was aesthetically pleasing * *Mark only one oval.*

totally ◯ ◯ ◯ ◯ ◯ totally

I thought that the visualisation did not fit RTL Boulevard's corporate look * *Mark only one oval.*

totally ◯ ◯ ◯ ◯ ◯ totally

I felt like the interaction was intuitive * *Mark only one oval.*

totally ◯ ◯ ◯ ◯ ◯ totally

What did you think was the purpose of the visualisation? *

Extra comments?

Benedetta Cervone
s1443887

Visualisation #2

Click on the link below to see a demo for the visualisation

https://projects.invisionapp.com/prototype/DataVis2-ck3o81sf30091dp018unslflg/play/ba69a1c2

I thought that the visualisation was easy to understand * *Mark only one oval*

totally	◯	◯	◯	◯	◯	totally

I did not understand the purpose of the visualisation * *Mark only one oval*

totally	◯	◯	◯	◯	◯	totally

I knew where to look first * *Mark only one oval.*

totally	◯	◯	◯	◯	◯	totally

I knew what I was supposed to click * *Mark only one oval.*

totally	◯	◯	◯	◯	◯	totally

I thought that the visualization was aesthetically pleasing * *Mark only one oval.*

totally	◯	◯	◯	◯	◯	totally

I thought that the visualisation did not fit RTL Boulevard's corporate look * *Mark only one oval.*

totally	◯	◯	◯	◯	◯	totally

I felt like the interaction was intuitive * *Mark only one oval.*

totally	◯	◯	◯	◯	◯	totally

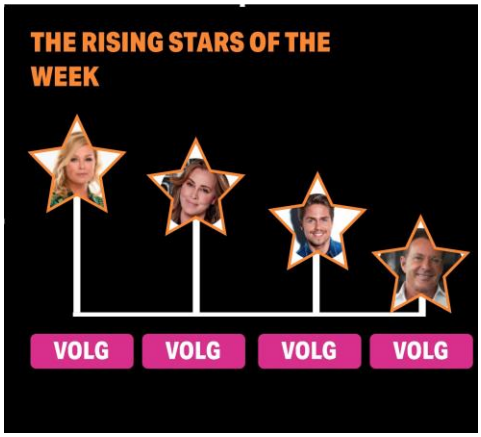
What did you think was the purpose of the visualisation? *

Extra comments?

Visualisation #3

Click on the link below to see a demo for the visualisation

https://projects.invisionapp.com/prototype/DataVis3-ck3o82o3h00xfik016g5p30nx/play/c5c69faf



I thought that the visualisation was easy to understand * *Mark only one oval*

totally	◯	◯	◯	◯	◯	totally

I did not understand the purpose of the visualisation * *Mark only one oval*

totally	◯	◯	◯	◯	◯	totally

I knew where to look first * *Mark only one oval.*

totally	◯	◯	◯	◯	◯	totally

I knew what I was supposed to click * *Mark only one oval.*

totally	◯	◯	◯	◯	◯	totally

I thought that the visualization was aesthetically pleasing * *Mark only one oval.*

totally	◯	◯	◯	◯	◯	totally

I thought that the visualisation did not fit RTL Boulevard's corporate look * *Mark only one oval.*

totally	◯	◯	◯	◯	◯	totally

I felt like the interaction was intuitive * *Mark only one oval.*

totally	◯	◯	◯	◯	◯	totally

What did you think was the purpose of the visualisation? *

Extra comments?

..last questions, I promise ; -)

Which visualisation would you like to see on the RTL Boulevard website? * *Mark only one oval*

visuali

visuali

visuali

Another

Why did you like the chosen visualisation? Do you have any improvement points? *

Any additional comments?

Demographical data

Age *

18-24

25-34

35-44

45-54

55-64

65+

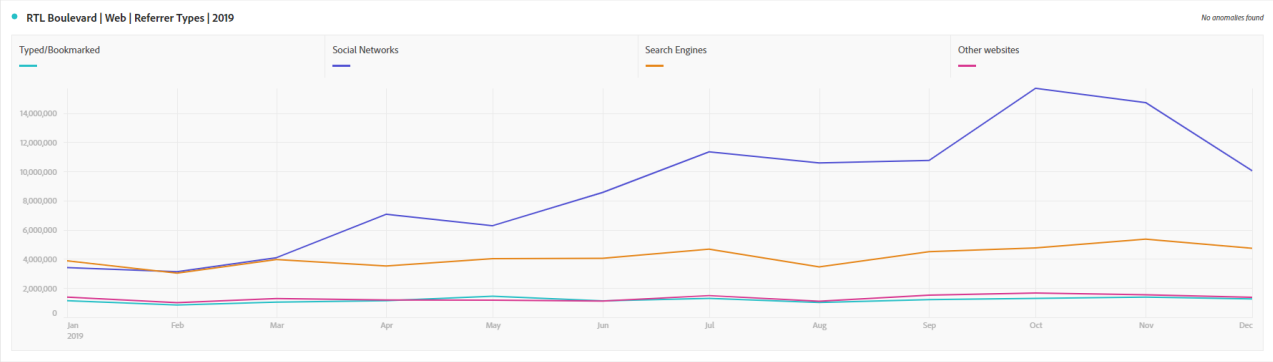
Gender * Mark only one oval.

- ⬭ Man
- ⬭ Woman
- ⬭ Other:

Thank you for your input!

If you have any questions about my research or what I am doing, if you have any other input or are just curious to know the outcome of this survey- you can reach me on slack or at benedetta.cervone@rtl.nl

12 Appendix 6– RTL Boulevard Traffic 2019



This graph indicates the incoming RTL traffic for the year 2019. A clear increase can be seen in the amount of views between January and December. In the year 2019 was also the year that RTL Boulevard decided to start to share their posts through social media as well. The blue line shows social network referrals.

13 Appendix 7 – User Test

User Test Data Visualisation

Hi! My name is Benedetta Cervone, I am a Creative Technology student at the University of Twente and I am, at the moment, working on my graduation project at RTL.

My research revolves around designing data visualisations for the different platforms of RTL. This test will last 10 to 15 minutes.

Thank you for helping me graduate! :D

Agreeing to take part in this user test

I understand that my actions will be screen and audio recorded and I understand that the results and conclusions of this user test will be treated anonymously and will be only used within this research for RTL Nederland and University of Twente.

Mark only one oval.

- Ok, Continue
- End Survey

Demographics

Age *

Mark only one oval.

- 18-24
- 24-34
- 35-44
- 45-54
- 55-64
- 65+

Sex *

Mark only one oval.

- Man
- Woman
- Other:

Living Situation *

Mark only one oval.

- Living Alone
- Living in a shared appartment (student house)
- Living with my parents
- Living with a partner Living with a partner + kids
- Other:

Click the products that you are familiar with

Check all that apply.

- ☐ RTL Boulevard
- ☐ RTL Nieuws
- ☐ RTL Z

I am familiar with the RTL VOLG function

- ◯ No
- ◯ Yes

Visualization 1[8]

Fill in the name of the website first visualisation you saw *

I thought that the visualisation was easy to understand *

◯ ◯ ◯ ◯ ◯

I did NOT understand the purpose of the visualisation *

◯ ◯ ◯ ◯ ◯

I thought that the visualisation was pretty *

I felt like that the interaction was intuitive *

◯ ◯ ◯ ◯ ◯

◯ ◯ ◯ ◯ ◯

I did not think that the visualisation added functionality *

◯ ◯ ◯ ◯ ◯

I think that there were too many things to click *

◯ ◯ ◯ ◯ ◯

What did you think was the purpose of the visualisation? *

Did you wish you could click somewhere else? If yes, where? *

Did you miss functionality? If yes, what? *

Any other comments?

I would like to enter the 15 euro voucher bol.com raffle and/or know more about the outcome of this research by e-mail

[8] This section is repeated 2 times for visualisation 2 and 3

Yes

No

14 Bibliography

[1] "CBS," CBS, [Online]. Available: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83429ned/table?fromstatweb.

[2] L. Cooke, "A visual convergence of print, television, and the internet: charting 40 years of design change in news presentation," *New Media And Society,* vol. 7, no. 1, pp. 22-46, 2005.

[3] B. Yadamsuren and S. Erdelez, "Online news reading behavior: From habitual reading to stumbling upon news," *Proceedings of the American Society for Information Science and Technology,* vol. 48, no. 1, pp. 1-10, 2011.

[4] A. M. Glenberg and W. E. Langston, "Comprehension of Illustrated Text: Pictures Help to Build Mental Models," *Journal of memory and language,* vol. 31, no. 2, pp. 129-151, 1992.

[5] W. Lidwell, K. Holden and J. Butler, Universal Principles of Design, 2010.

[6] A. A. Joan Gay Snodgrass, "The pictorial superiority effect in recognition memory," *Bulletin of the Psychonomic Society,* vol. 10, no. 1, pp. 1-4, 1977.

[7] D. L. Nelson, V. S. Reed and J. R. Walling, "Pictorial superiority effect," *Journal of Experimental Psychology: Human Learning and Memory,* vol. 2, no. 5, pp. 523-528, 1976.

[8] T. Rahlf, Data Visualisation with R, Bonn, Germany: Springer International Publishing, 2017.

[9] J. Steele and N. Iliinsky, Beautiful Visualization - Looking at Data Through the Eyyes of Experts, O'Reilly, 2010.

[10] H. Hinterberger, "Data Visualization," Springer, Boston, MA, 2009.

[11] A. Smith, "Data visualisation and beyond: A multi- disciplinary approach to promote user engagement with official statistics," *Statistical Journal of the IAOS,* vol. 29, no. 3, pp. 173-185, 2013.

[12] B. Shneiderman, "The eyes have it: a task by data type taxonomy for information visualizations," in *Proceedings 1996 IEEE Symposium on Visual Languages*, Boulder, CO, USA, 1996.

[13] M. Schreuder, Interviewee, *Interview with deputy editor in chief RTL Nieuws.* [Interview]. October 2019.

[14] *Internal RTL Database,* 2019.

[15] "Google Analytics RTL," 2019.

[16] M. Galesic and R. Garcia-Retamero, "Graph Literacy: A Cross-Cultural Comparison," *Medical Decision Making,* vol. 31, no. 3, 2010.

[17] J. Boy, R. A. Rensink, E. Bertini and J. D. Fekete, A Principled Way of Assessing Visualization Literacy, vol. 20, 2014, pp. 1963 - 1972.

[18] S. N. Friel, F. R. Curcio and G. W. Bright, "Making Sense of Graphs: Critical Factors Influencing Comprehension and Instructional Implications," *Journal for Research in Mathematics Education,* vol. 32, no. 2, pp. 124-158, 2001.

[19] C. Ware, Information Visualization: Perception for Design, Morgan Kaufman, 2013.

[20] C. N. Knaflic, Storytelling with Data: A Data Visualisation Guide for Business Professionals, Hoboken, New Jersey: John Wiley & Sons, Inc., 2015.

[21] Merriam-Webster, "Data," Merriam Webster, November 2019. [Online]. Available: https://www.merriam-webster.com/dictionary/data. [Accessed 2019].

[22] S. Lee, S.-H. Kim, Y.-H. Hung, H. Lam, Y.-a. Kang and J. S. Yi, "How do people make sense of unfamiliar visualisations? : A grounded model of novice's information visualisation sensemaking," *IEEE transactions on visualisation and computer graphics,* vol. 22, no. 1, pp. 499-508, 2016.

[23] S. Roth, "Visual Literacy and The Design of Digital Media," *ACM SIGGRAPH Computer Graphics,* vol. 29, no. 4, pp. 45-47, 1995.

[24] F. F. Cheng, C. S. Wu and B. Leiner, "The influence of user interface design on consumer perceptions: A cross-cultural comparison," *Computers in Human Behaviour,* vol. 101, pp. 394-401, 2019.

[25] P. Cavanagh and G. A. Alvarez, "Tracking Multiple Targets with Multifocal Attention," *TRENDS in Cognitive Sciences,* vol. 9, no. 7, pp. 349-354, 2005.

[26] Interaction Design Foundation, "Visual Hierarchy," [Online]. Available: https://www.interaction-design.org/literature/topics/visual-hierarchy.

[27] P. Faraday, "Visually Critiquing Web Pages," *Multimedia '99,* pp. 155-166, 2000.

[28] J. D. Still, "Web page visual hierarchy: Examining Faraday's guidelines for entry points," *Computers in Human Behaviour,* vol. 84, pp. 352-359, 2018.

[29] L. Graham, "Gestalt Theory in Interactive Media Design," *Journal of Humanities and Social Science,* vol. 2, no. 1, 2008.

[30] T. Lavie and N. Tractinsky, "Assessing dimensions of perceived visual aesthetics of web sites," *International Journal of Human-Computer Studies,* vol. 60, no. 3, pp. 269-298, 2004.

[31] S. Barakovic and L. Skorin-Kapov, "Modelling the relationship between design/performance factors and perceptual features contributing to Quality of Experience for mobile Web browsing," *Computers in Human Behaviour,* vol. 74, pp. 311-329, 2007.

[32] RTL Nieuws, "Anja - RTL Nieuws reader persona (Internal marketing document)".

[33] K. v. Gestel, Interviewee, *Interview with my supervisor at RTL.* [Interview]. 2019.

[34] RTL Z, *Internal presentation RTL Z brand definition,* Hilversum, 2019.

[35] Agile Alliance, "Scrum," [Online]. Available: https://www.agilealliance.org/glossary/scrum. [Accessed January 2020].

[36] D. Benyon, Designing Interactive Systems, Person Education Limited, 2014.

[37] S. T. (. A. RTL), Interviewee, *Informal interview with Stathis Tseflidis.* [Interview]. January 2020.

[38] E. v. Teijlingen and V. Hundley, "The importance of pilot studies," *Social Research Update,* no. 35, 2001.