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Universal Design of ICT

Soccer Highlight Website Design: Improving Current Interface and Proposing Universal Design and Accessibility Principles

Ernest Pranoto

Department of Computer Science

Faculty of Technology, Art and Design

OSLOMET

Abstract

In today's increasingly technological world, all of the information we have are presented digitally through the internet, with a website as the main vehicle to deliver digital activities (Derong Lin et al, 2009). As the internet has become a channel for providing and finding information (Plaza, 2010), more and more people are depending on the internet to acquire what they are expected to get. As technology mature, especially in the last two decades, a term which is known as “User Experience (UX)” has become central aspect of Human-Computer Interaction (Hassenzahl & Tractinsky, 2006). Many types of research, studies, and surveys have proved that user experience is capable of giving value to web users when they are consuming information through the internet (Hassenzahl et al, 2008).

The thesis aims to improve the web design of a highlights website of a Norwegian Soccer League. This thesis focuses on the understanding and the application of user experience to optimize the improvement of the website. Through the tenure of this thesis, evaluation, and design efforts have been made to produce a better user experience. The evaluation found that the highlights website still has many contents that lack elements that motivate user experience, while the design effort managed to fix the flaws and the weaknesses. Through the new design, a higher level of user experience has been presented to the audiences. An assessment by conducting user testing was used to determine whether or not the design can produce a higher level of user experience. As the result shows that there is a higher rating in user experience, this research has completed its main mission.

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1. Introduction

1.1. Background and Motivation

Businesses in all sectors around the world are continuously using the internet as the media to communicate with their customers to market their products and services (Fenech and O'cass, 2001). Organizations in sport industries are included among these organizations that exploiting the use of the internet. According to several authors (Caskey and Deeply, 1999; Kahle & Mekee, 1999; Auty, 2002), the internet is also used as marketing tool by sport organizations and sport professional teams. Using the internet as the tool and website as the mediator, are believed to give them a close, loyal relationship and committed fan base (Judson and Carpenter, 2005).

Football (known as soccer in several countries), has been considered the most popular sport across the world (Tomlinson, 1994). As the internet has grown rapidly and soccer has a very high popularity, soccer websites are found all across the digital world. Soccer websites are an important element in building communication with soccer fans (Seo and Green et al, 2007). When close communication with the fans is built, it can create a fanship. When the organization has fanship, it will lead to higher attendance and viewership, and increase loyalty and audience retention (Seo and Green et al, 2007). Optimizing the website is a powerful medium to enhance the fan's community, and fanship.

There are many efforts have been made by organizations to approach their customers, build closer relationships, attract more potential consumers. For example, e-commerce businesses depend greatly on the website to achieve success (Kriemadis et al, 2009). They enhance their interfaces to gain the customers' trust, provide comfortability, increase satisfaction, etc. As well as them, the same effort and motivation must present to enhance our soccer website to reach the fans and audiences.

As mentioned, "User Experience" will be optimized throughout this thesis. The choice of applying UX was motivated by the fact that researches and attention toward user experience are highly relevant, even the idea of designing a product/service that considers the involvement of user experience has a scientific foundation (Hassenzahl et al, 2008). More and more researchers put very much attention on user experience (Hassenzahl, 2008; Kuniavsky, 2003). Several examples of the researches are emotional

design (Norman, 2004), design for pleasure (Jordan, 2000), affective design (Helander & Khalid, 2006).

Having a full awareness of the popularity of both internet and soccer, the tailoring of a good website, which provides a service that provides experience when obtaining the information, can be seen as a powerful media to reach the soccer fans, starting from domestic and then across other parts of the globe. Developing a higher level of user experience through the interaction with our web design will give us a huge potential in gathering our fans and even attract new fans.

1.2. Problem Statement and Research Question

Based on the importance of providing information and experience mentioned in the previous section, we found that there is very high potential in enhancing a soccer website to have better information and experience. We decided to enhance the design of the web interface in the attempt to gain a higher level of user experience, which led this thesis to the following research questions:

How has a good design affected user experience in a soccer website?

To answer this research question, we set four objectives that we will be focusing on to complete and lead us to solve the research question. The four objectives are as follows:

Objective 1: a better design to give an impression.

Objective 2: a better design to increase usability.

Objective 3: a better design to deliver better content quality.

Objective 4: a better design to provide mobile robustness.

With the research question and the objectives that have been formed, we started our research that will pursue the completion of the objectives to answer the research question.

1.3. Limitations

In Understanding User Experience (UX), some challenges limited us. UX is filled with many dynamic concepts, such as emotion, user affection, sensation, experiential, etc. All of those dynamic concepts will keep growing and changing over time. In motion with them, UX will keep adjusting from time to time, and challenges will be embraced

anytime when UX needs to be defined. Although UX has many diverse useful ideas gained from many researchers, they are scattered widely in different forms (Hassenzahl et al, 2008), it is difficult to choose which user experience definition to adapt and develop. Even after the theory has been formed, it has some potential that the theory might be outdated and irrelevant in the future.

With the limitations in building the theory, the design of the interfaces built based on the theory are very limited to cover the needs of each single user individual, especially with the fact that every individual is unique. User experience is something personal, it is "within" an individual (Law et al, 2009). There are many different approaches, interaction styles, expectations of end-users to be fulfilled. Not everyone can be fully satisfied using the interfaces that built using the guidance from the theory.

Regarding the interfaces, we limit ourselves to only evaluate and design three pages. The design effort and the number of pages and interfaces were adjusted as it is to finish the project in the tenure of one semester. There are still several design ideas, features, and accessibility fulfillments that have not been developed. We also limit ourselves in the way we present the videos to the audiences. As we were building the interfaces, we did not include the design of the video player or video page. All the links on the new interfaces that contain video will be directed to eliteserien's website.

1.4. Research Method

1.4.1. Theory

To apply user experience (UX) in our design, a decent understanding of UX is important. To reach this understanding, gathering UX definitions and form them into a UX theory is the method we used. UX theory is scattered widely in different forms and definitions, even some researchers argued that UX is still a "loose knowledge" (Hassenzahl et al, 2008). A study that gathered the views of UX from 275 researchers and practitioners suggested that most researchers who have investigated the scope of UX agreed that UX is dynamic, context-dependent, and subjective (Law et al, 2009). In respect to this fact, the study suggested that UX has to be an individual scope towards a system, or service, or product (Law et al, 2009).

To build a UX theory, the approach used in this thesis consists of 4 steps, which are

described as follows; (i) Gather the user experience literature, (ii) Studying the target website, which is www.highlights-eliteserien.no, and studying several major soccer league websites, (iii) Assembling all the set of existing definitions and establish a link between the UX and the target website interface, (iv) Build the theory as an individual UX theory.

1.4.2. Design

The design procedure started by evaluating the current interface. The theory was used to evaluate which part or element that can be improved. As supporting elements, several major soccer websites such as EPL, Bundesliga, SerieA, LaLiga were visited to compare with the higlights.eliteserien.no to enrich the evaluation process.

When the evaluation phase is completed, all the possible improvements found from the evaluation were gathered to begin the design. The design of the interfaces was built using the formed UX theory as guidance to achieve a better UX improvement. Universal Design Principles and WCAG were used as guidance to achieve universal design and accessibility. To conclude the design process, the design will be conducted using three guidance. They are UX theory, UD and WCAG, current interfaces, and other soccer websites.

To solve the problem and answer the research questions, the effort in designing the interface will focus specifically on five elements that can increase user experience. The better design will take place to increase (i) first impression, (ii) usability, (iii) content quality, (iv) mobile robustness. By increasing these four elements, a higher level of user experience is aimed to be achieved at the end of this project.

1.4.3. Assessment

The method for data collection for this thesis was user testing and questionnaire survey. The data collection was conducted by having the testing participants interact with both designs, the current interfaces, and the new ones. Tasks were given as the media to have the participants interact with both interfaces. The testing of the two designs was done separately to have separate result to determine how great is the improvement from the current interfaces with the new ones. For finding additional supporting data, a short interview was also conducted after the participants completed the user testing.

1.5. Main Contributions

Throughout the course of this thesis, we researched and developed a design that capable of providing a better user experience to the fans. As mentioned in the research questions (section 1.2), we set 4 objectives that the design should achieve to increase the user experience and answer the research questions. Following describes the objectives and the outcome after completing the objectives:

Objective 1 *A better design to give an impression.*

The completion of this objective creates the degree to which the users believe that the interfaces are attractive and pleasing. The perceived attractiveness will motivate the intention of using the functions of the interfaces. Through impression, the first intense moment can be created and lead the users to the next steps of web interaction.

Objective 2 *A better design to increase usability.*

The completion of this objective creates the degree to which the users believe that interacting with the interfaces requires only low effort. The improved usability can also enhance the performance of the users in completing their tasks. When the users have perceived better usability, it can positively influence the frequency of use.

Objective 3 *A better design to deliver better content quality.*

The completion of this objective creates the degree to which the users believe that they have perceived all the pieces of information they need, accurately and valuable. As well as usability, better content quality also opens door to the possibility that the users will access other information more frequently.

Objective 4 *A better design to provide mobile robustness.*

Mobile robustness opens access to the users to have the same experience when accessing the interfaces via mobile devices.

Through the performed assessment, we learned that impression, usability, content quality, and mobile robustness are increased after the new design has been developed.

With all of them are increased, they lead to a better user experience. The result of the assessment shows that the new interfaces have managed to answer the research questions by proving that (1) a better design can contribute well to a better user experience, and (2) impression, usability, content quality, and mobile robustness have contributed to better design improvements.

1.6. Thesis Outline

This thesis consists of five chapters. The first two chapters are introductory to present the background that shaped this master thesis and provides the readers the necessary understanding of the thesis. Chapters 3 and 4 present the work done in this thesis, accompanied by the artifact located in the appendix. The fifth chapter, which is the last, will present the summary of the thesis and propose future work. Following is the summary of all the chapters (excluding chapter 1).

Chapter 2: Literature Review: The literature used as the base of this thesis will be presented here, both scientific and non-scientific literature. This chapter will consist of the works related to this thesis, guidelines, law & regulations. These several sections will be followed by a section that contains a theory of User Experience. The user experience section is dedicated to addressing in detail the UX definition that was built from gathered literature and many sources by following under with the relevancy of the target, which is the soccer highlights website.

Chapter 3: Evaluation and Design: This chapter will deliver in-depth evaluations of the chosen interfaces using guidance from literature and the built user experience theory. Alongside the evaluation, a new design will be presented with improvements and details of comparison.

Chapter 4: Assessment and Result: This chapter will present the procedure, result, and other additional findings received from the assessment. A discussion section is also present to provide better insights into the assessment outcome. The last part of this chapter will address how great is the improvement from the current interface to the new interface according to the gathered results.

Chapter 5: Conclusion: This chapter will address the summary of this thesis, contributions made through this thesis, and the insights of possible tasks and objectives that are potential to be conducted in the future.

2. Literature Review, Website Review, and Theory

2.1. Related Works

Satisfier and Dissatisfiers: A Two-Factor Model for Website Design and Evaluation

There are 2 factors that can guide the evaluation of web design, they are hygiene and motivator (Zhang and von Dran, 2000). The two-factor idea was motivated by Herzberg's motivation-hygiene theory about factors of satisfaction and dissatisfaction in the workplace, and apply them to the web environment. Hygiene is the factor that provides service and functionality to users. The absence of these 2 attributes will cause dissatisfiers. This factor was also suggested before by Jakob Nielsen in 2019, he suggested that poor interface functionality has the potential to cause usability meltdown. The second factor is a motivator, which creates satisfaction by providing better website values to users. To summarize those two, hygiene must present to prevent dissatisfiers and motivators must present to provide satisfiers.

The Study of these design factors is to investigate how these design factors have an impact from a theoretical perspective, and develop them so the two factors can:

- Make a website usable and serviceable, to avoid dissatisfaction
- Create better stimulation, better visualization, more comprehensive and more commercial website
- Increase website attraction and maintain user’s interest

Highlighs.eliteserien.no is a website that provides videos of Norwegian soccer matches. The hygiene factor which focuses on serviceability and functionality will be optimized to minimalize dissatisfiers. The attempts will be upgrading the service and function qualities when the audiences access the video content by helping them fulfill their tasks. The attempt to create values, which can increase the satisfiers factor, is by creating sharp and meaningful contents.

Factor Influencing the Usage of Websites: the Case of a Generic Portal in The Netherlands

Many companies and enterprises today give high effort in increasing the popularity of their websites. Website popularity is determined by the number of traffic. A website that has high traffic is believed to create positive outcomes, in any kind of industry. For e-

commerce companies, high traffic on their website will motivate their sales numbers. For non-sales websites, with having high numbers of visitors, they can acquire additional revenue by putting advertisements on their webpage.

The issue about why the audience wants to, does not want to, or will revisit a particular website is still being questioned and researched all the time. To investigate the acceptance level of a website, Davis et al suggested a model called TAM (Technology Acceptance Model). The model can be seen in figure 2.1.

Van der Heijden, H. (2003). Factors influencing the usage of websites: the case of a generic portal in The Netherlands.

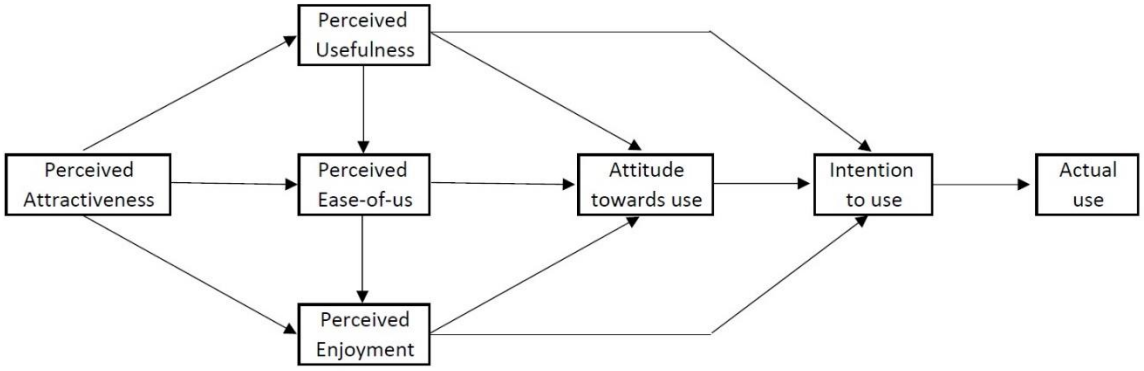

Figure 2. 1. Technology Acceptance Model (TAM). Revised version by Van der Heijden, H. The figure explains the step from perceived attractiveness until the actual use.

Through the research and study, the authors defined that visual attractiveness plays a high role in the decision of using a website. When visual attractiveness “caught” the audiences, the next three elements (usefulness, ease of use, enjoyment) can be promoted. When these three elements are successfully delivered to users, they will lead to attitude, intention, and actual usage.

Research conducted was a survey of a dutch web portal with results received from 827 respondents. There are 4 findings from the survey using the TAM model. The first one is actual usage is dominantly dictated by the intention of use. second, the intention of use is dominantly influenced by attitude while usefulness and enjoyment are slightly less dominant, which made intention is the strongest mediator to motivate the intention of use. The third finding is usefulness, ease of use, and enjoyment shared almost the same impact on attitude. The last finding, visual attractiveness gives higher feelings of usefulness, explains enjoyment better, and also explains the ease-of-use better.

Using the TAM model suggested by this research, attractiveness will be optimized as

the “frontline agent” in designing the webpage in highlights.eliteserien.no to attract audiences to interact with the website. When they have perceived the attractiveness well, audiences will step into the second stage. The second stage will consist of usefulness and easy navigation. These 2 elements will be provided to them when watching the highlight videos or other non-video information, and at the same time, audiences can perceive the enjoyment by creating additional functions. These several elements are hoped to create positive users’ attitude and add higher users’ intention to surf in our website.

Website design: Viewing the web as cognitive landscape

Effective web design requires the right strategy in making web content. A well-designed web is believed to add users' visits and revisit. As we understand that web contents have many elements such as text, layout, images, videos, colors, sound, motion, putting the right strategy is very important in achieving effectiveness in the design. However, the understanding of making effective web design to have repeat visitors is still low (Rosen and Purinton, 2004). In this research, Rosen and Purinton used the perspective of cognitive to examine the web to develop more effective websites.

Through research by environmental psychologists, Stephen and Rachel Kaplan suggested that there is a strong relationship between cognitive psychology and physical landscape because people want to get involved in the landscapes around them. Since accessing web content requires human cognition, it is mandatory to let the users experience the digital landscape.

Based on the study of the physical landscapes by the Kaplans, Rosen and Purinton developed a website effectiveness scale tool, the website Preference Scale (WSPS). The WSPS program was developed to identify web content elements that can be improved to create a better and more effective web design.

Based on the fact that highlights.eliteserien.no is a website containing videos and non-video content, the required effort to create simplicity and minimalize design might be higher. Even though it is higher, making the website have the simplicity and minimalistic way of design is very essential, because they have high contributions in the effectiveness of web content. They can prevent the design from creating information overload. The simplicity of the design can also make sure that the content is faster to

load despite our website contains many types of attributes. As the study from this paper gave the result that humans favor the minimalized environment more, we would like to adapt the idea to create this kind of environment simplicity into our highlights website.

The Influence of E-commerce Website Colors on Usability

This research focused on consumers' behavior in order to reach a better understanding of website usability. Jen-Eric Pelet, the writer of this paper believed that the rise of e-commerce business is contributed significantly by one factor referred to as "usability of the site". Identifiable links, useful buttons, a strategic position of the search engine are several of the factors. All these factors are supported by characteristics such as hue, saturation, and brightness, and other color-related characteristics.

Although color variable is widely researched by many researchers, there are very few studies focusing on the effects of colors in websites. To be more specific, the color variation like hue, saturation, and brightness has not been addressed much in any researches. To fill this gap, this research will investigate how colors can help users in perceiving the usability of a website.

Colors have consisted of three principal elements (Trouve, 1999).

- Hue (chromatic tonality), The visual sensation defined according to color denominations such as red, green, blue (or RGB)
- Saturation, The proportion of chromatically pure color container in the total sensation
- Brightness, The degree to which an illuminated surface seems to emit more or less light.

The study was conducted using qualitative and quantitative analysis types. Both types of analysis contained the participants who are chosen widely from different backgrounds, ages, sex, and different expertise in using the website. There are several elements that were planned to be measured. They are memorization, emotion, mood, and buying intention.

Both qualitative and quantitative results showed that colors are proved as an integral part of the e-commerce atmosphere, even the role of colors is more important than we have ever anticipated. And the final result suggested that colors are part of colors that have a very important role in consumer's perception. Colors can shape consumers'

emotional states when shopping online. This will create smoothness in usability, which reaches to consumer retention of information and increase their buying intentions.

Despite the fact that highlights.eliteserien.no is not an e-commerce website which focuses on purchase number, the relevancy with this paper is very close. As the result showed that colors can make customers experience a state of mind, this means that colors can provide a positive experience and leads to sales. The main aspect that can be implemented from this research is achieving the positive experience of shaping users' state of mind in interacting with soccer highlights service.

Universal Design and the Library Website

The origin of applying universal design is making a better product and better service for all. The service built with UD principles is relevant both physically and digitally. A library offers the facilities of providing space for everyone who wishes to be in the library to read books, or some people would prefer to have the book they want to be delivered to them, and another service is the library offers digital access of all the books from their website.

As well as a library that offers inclusive physical access for visitors, it should also provide inclusive digital access for online visitors. Online visitors are not only the "average user", there are also people with visual impairments, hearing issues/loss, cognitive disabilities, etc. Since it is important to provide equal access to the library website, universal design is the essential achievement a website must-have. With universal design principles implemented in the digital contents, both normal people and people with impairments can access the online library.

A statistic from Wordlatlas shows that soccer is the most favored sport in the world, ranked number one. And in Norway, soccer is the largest and most popular sport, according to NFF (Norges Fotball Forbund). This means that we have many soccer audiences in Norway. The audiences here are most likely ranged from young to old people, and also ranged from normal to people with special conditions. Building a universally designed highlights website means that we can provide videos of soccer games to both normal audiences and audiences who have disabilities.

2.2. Guidelines

2.2.1. 7 Principles of Universal Design

Universal Design (UD) is a design of products, services, environments, systems that are usable to the greatest extent possible by all people regardless of their ages, abilities (Horton and Leventhal, 2008). Because UD is the practice of designing for all people, it is also can be defined as barrier-free access (Guder, 2014).

Universal Design was first introduced by Ronald Mace. His idea and commitment to providing accessible service to the greatest extent possible by all people created the term Universal Design. The project started in 1989, he founded the Center for Universal Design, which was stationed at North Carolina State University. Then in the year 1997, Ron Mace led a project, gathering a group of designers, engineers, researchers, architects and they developed the 7 universal design principles (universaldesign.ie). Since the development, the principles are being implemented in the present day.

Following are the principles according to the Center for Universal Design (1997). Every single principle has its own guidelines, recommending the important elements that are required to be present in designing a product or service. This set of 7 universal design principles can be used to guide the design in two realms: physical and digital, thus these principles are relevant for the website development process, evaluate and integrate current website design intelligently, and reaching the needs of diverse potential users.

Table 2. 1. Universal Design Principles, Descriptions, and Guidelines

Principles	Descriptions and Guidelines
1. Equitable Use	The design is useful and marketable to people with diverse abilities. a. Provide the same means of use for all users: identical whenever possible; equivalent when not. b. Avoid segregating or stigmatizing any users. c. Make provisions for privacy, security, and safety equally available to all users. d. Make the design appealing to all users.
2. Flexibility in Use	The design accommodates a wide range of individual preferences and abilities. a. Provide choice in methods of use.

Principles	Descriptions and Guidelines
	b. Accommodate right- or left-handed access and use. c. Facilitate the user's accuracy and precision. d. Provide adaptability to the user's pace.
3. Simple and Intuitive Use	The use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level. a. Eliminate unnecessary complexity. b. Be consistent with user expectations and intuition. c. Accommodate a wide range of literacy and language skills. d. Arrange information consistent with its importance. e. Provide effective prompting and feedback during and after task completion
4. Perceptible Information	The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities. a. Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information. b. Maximize the "legibility" of essential information. c. Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions). d. Provide compatibility with a variety of techniques or devices used by people with sensory limitations.
5. Tolerance for Error	The design minimizes hazards and the adverse consequences of accidental or unintended actions. a. Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded. b. Provide warnings of hazards and errors. c. Provide fail-safe features. d. Discourage unconscious action in tasks that require vigilance
6. Low Physical Effort	The design can be used efficiently and comfortably and with a minimum of fatigue. a. Allow users to maintain a neutral body position.

Principles	Descriptions and Guidelines
	b. Use reasonable operating forces. c. Minimize repetitive actions. d. Minimize sustained physical effort
7. Size and Space for Approach and Use	Appropriate size and space are provided for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility. a. Provide a clear line of sight to important elements for any seated or standing user. b. Make reach to all components comfortable for any seated or standing user. c. Accommodate variations in hand and grip size. d. Provide adequate space for the use of assistive devices or personal assistance.

2.2.2. Web Content Accessibility Guidelines 2.0 (WCAG 2.0).

To have the full picture of WCAG, the details of guidelines below are retrieved from WCAG official guidelines from its website. WCAG was created and published by WAI (Web Accessibility Initiative). WAI is the part of World Wide Web Consortium (W3C), an organization for the international standard of the internet. WCAG contains a set of recommendations to help web content developers achieve more accessible web content for the widest range of people. Following the recommendations from WCAG, the web content can be accessed by users in general and users with disabilities.

WCAG has 4 main principles, which can be simplified in four words “POUR” are Perceivable, Operable, Understandable, Robust. Under the 4 principles, there are 12-13 guidelines.

1. Perceivable

1.1 Text alternatives for non-text content so that it can be changed into other forms people need, such as large print, braille, speech, symbols, or simpler language.

1.2 Provide alternatives for time-based media.

1.3 Create content that can be presented in different ways (for example simpler layout) without losing information or structure.

1.4 Make it easier for users to see and hear content including separating foreground from background.

2. Operable

2.1 Make functionality is available from a keyboard.

2.2 Provide users enough time to read and use the content.

2.3 Do not design content in a way that is known to cause seizures.

2.4 Provide ways to help the user navigate, find content and determine where they are.

3. Understandable

3.1 Make text content readable and understandable.

3.2 Make web pages appear and operate in predictable ways.

3.3 Help user avoid and correct mistakes

4. Robust content and reliable interpretation

4.1 maximize compatibility with current and future user agents, including assistive technologies

Each guideline has success criteria with 3 levels of conformance: A, AA, and AAA. The level of conformance can be seen in table 2 (W3C, Wikipedia).

Table 2. 2. WCAG 2.0 Conformance Level

Conformance Level	Priority Level
A	Web developers **must** satisfy this requirement
AA	Web developers **should** satisfy this requirement
AAA	Web developers **may** satisfy this requirement

The existing standard of WCAG we have today is WCAG 2.0 and 2.1 (published on 5 June 2018 and 11 December 2018 respectively). updated from WCAG 2.0, the 2.1 contains exactly the same success criteria, plus the additional success criteria focus on low vision, cognitive, and mobile disabilities. The next update, WCAG 2.2 is scheduled to be published in 2021. All requirements, wording, guidelines, and success criteria will be

exactly the same as the previous versions.

According to W3C, WCAG is intended for:

- Web content developers
- Web authoring tool developers
- Web accessibility evaluation tool developers
- Other parties who need accessibility guidelines and standard (web and mobile)

2.2.3. WAI-ARIA

Also published by W3C, WAI-ARIA (Accessible Rich Internet Applications) is a set guideline for increasing accessibility of rich web content such as dynamic web content, and user interfaces developed using JavaScript, HTML, and other related software. ARIA consists of a pack of HTML attributes that can be applied when native HTML cannot fix accessibility issues.

When we provide an accessible website to users, it is also important to ensure the accessible website can support assistive technologies (AT). The attributes can help the web owner or webmaster in fulfilling the duty of making the website more accessible and compatible with assistive technologies.

There 3 main components of ARIA:

1. Roles – these define what an element is or does. The roles are to describe the page structure. Examples : role=”navigation”, role=”banner”, role=”search”, role=”tab”, etc.
2. Properties – properties can be used to add extra meaning to an element. The properties can refer to or specify any information that supports the element.
3. States – a special property that defines the current condition of an element. For instance, if the property is aria-disabled=”true” or aria-checked=”false”, the screen readers will specify that element is disabled.

Despite ARIA is also an accessibility guideline, is not the main guideline as WCAG. ARIA is only used to provide additional semantic and present whenever and wherever accessibility is lacking. Even though ARIA is highly recommended in designing rich website content, there are still rules that must be complied with by webmasters (adapted from W3C and WebAIM):

1. Prioritize semantic HTML over the use of ARIA.

   Native HTML elements have the foundation of web accessibility. Using semantic

HTML is recommended as the top choice if ARIA is not needed. Adding the ARIA role to re-purpose an element is only used when a particular feature does not have accessibility support available in HTML. When ARIA is used incorrectly, it will give a setback to accessibility instead.

2. Do not change native semantics.

   Most HTML elements, especially HTML5 have built-in semantics that is recognized by screen readers. For example, <button> will be recognized by screen readers as a button element, while <nav> will be recognized as a navigation bar.

3. Interactive ARIA controls must be accessible using a keyboard.

   Using an example of button elements, the third rule here is to provide multiple capabilities a button should have, such as clickable by the mouse cursor, enter key, and space bar. Adding the role of an element and the capabilities have to be implemented together.

4. A focusable element must not be hidden.

   We need to aware of what kind of elements we are applying in the HTML, do they visibility or interactive states. For example, the use of role=”presentation” or aria-hidden=”true” is not recommended to be used in focusable elements. Applying those will result in the element being hidden. Only use those attributes when there is an element that does not require interaction or focus.

5. All interactive elements must have an accessible name.

   Accessible name is the name of a user interface element. The accessible name is to provide descriptive text to screen reader users. This will help the users to have the visual information even though they do not have the ability to look at the page.

   There are 3 ways of delivering descriptive text to screen readers:

   1. aria-labeledby - This attribute will specify the name or label of an element by referring it to the element that contains the label using ID. This attribute is only used if the labeling is visible on the screen.
   2. aria-label - Also used to specify the name or label of an element, an accessible name can be generated by putting the text directly alongside the HTML element. This attribute is used when labeling is not visible on the screen.
   3. aria-describedby - Using this attribute, we can provide a whole sentence or even a paragraph to describe the element. Similar to aria-labelledby, this attribute is

also using ID to deliver the description.

The latest version of WAI-ARIA is 1.1, which was updated from version 1.0 and published on 14 December 2017. Full guidelines are available in W3C.

2.3. Disability

Disability today is not seen as an unfortunate issue in the human body anymore today. With the efforts made by human rights societies and organizations, the perception of viewing disabilities has changed. Instead of seeing disability as an attribute, disability now is recognized as a stage of life of a human (UNCRPD, UN). And further, disability has been human rights concern today. The inclusion of people with disabilities in society has been mandatory in creating and providing service to the people, both digital or non-digital service.

2.3.1. Disability Gap Models

Fuglerud, K. S. (2014). Inclusive design of ICT: The challenge of diversity.

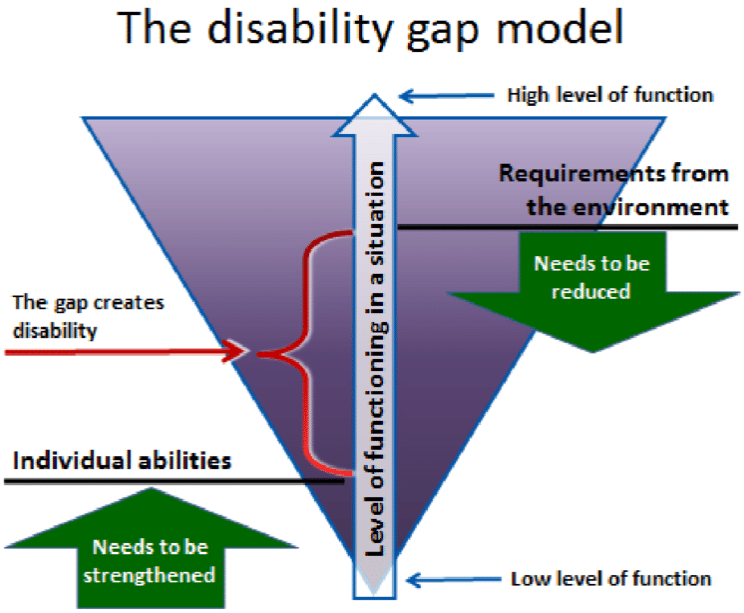

Figure 2. 2. Disability gap models. The model was designed to visualize the gap that creates disability between individual abilities and environment.

The model on figure 2.2 was created by Ivar Lie in 1989, the model is to illustrate how individual abilities and environment can create disability (Fuglerud, 2014). The arrow in the middle is the level of function a product or a design has. The higher the function, the higher individual abilities are required. When the requirement is too high and individual abilities are too low, the individuals are unable to fulfill the demand set by the

environment, which creates the disability gap (marked with a red arrow in the figure above).

There are two efforts that can suppress this gap. The first is by strengthening individual abilities which can place the individual higher on the function arrow. Here, assistive technologies are commonly used to support the users' abilities to use the design. Second, reduce the high function requirement. In this part, implementing universal design and web accessibility is one of the solutions to provide more inclusive design to more users to reach the functionality.

2.3.2. Types of disabilities and barriers

Every single individual is unique and special. People have diversities of skills and abilities in using the web. The abilities an individual has will give a good impact on how they operate web content. As well as that, people have diverse disabilities when accessing a website, and in this case, the disabilities will limit individuals in using the website.

There are 4 major types of disabilities that have limitations when accessing the website. All 4 disabilities will experience web accessibility barriers if a website is inaccessible. (Adapted from W3C: Diversity in Web Use)

1. auditory

Auditory impairment includes the impairment between one or both ears. One ear hearing loss or both ears have low functionalities can be defined as “hard of hearing” and total loss of hearing is “deafness”

Potential barriers:

- Video with audio content, without captions or subtitles
- Poor text size and caption color management in the video
- Audio content without volume adjustment

To prevent the barriers, web developers have to consider providing captions in every audio content whether it is audio-only or video-based audio. After providing the captions, text size and color selection are also important. And volume adjustment is for users who have poor hearing abilities.

2. Physical

Physical impairment or can be defined as motor disabilities are the limitation of muscular movement control. The types of this disability are also very variant, for

examples:

- Amputation, permanently missing one or more parts of the human body.
- Paralysis, loss of control over one or more parts of the human body.
- Cerebral palsy caused by brain injury
- Parkinson's disease due to older age

Potential barriers:

- The web browsers do not support keyboard operation.
- Lack of text alternatives in images, links, buttons, controls.
- Webpage functions are unpredictable, inconsistent, and complicated.

Due to lack of physical ability, the users often require specialized assistive hardware or software to use a website. Several of these assistive technologies are ergonomic mouse and keyboard, head pointer, mouth stick, foot controller navigation, eye tracker, and voice recognition.

3. Visual

As well as auditory, visual impairments also have 2 types of loss, partial loss (low vision) or complete loss (blindness). Besides those 2, there are several other types of visual impairments such as color blindness (red and green, or blue and yellow), blurry/cloudy vision, individual who is under-eye treatment.

Visual Impairments have the same potential barriers as physical impairments, with additions of poor foreground and background color management (in text and images), text, and images that are un-resizeable.

Several solutions that recommended to be built on web design for audiences with visual impairments are:

- Contents on the web can be magnified (text, image, icon, etc).
- Well-designed color, spacing between attributes, font selection.
- Text can be converted to speech with screen reader features
- Compatible for users with braille.
- Web contents are operable using only a keyboard or without both mouse and keyboard.

Apart from the above solutions, web developers are also required to design the web content to be navigable and usable without using mouse and screen visualization. The

solution recommended for providing accessibility to physically impaired audiences is also very suitable for visually impaired audiences.

4. Cognitive (Neurological)

Cognitive disabilities are very broad. The disorders in this area are intelligence, behavior, learning ability, and other mental health-related disorders. Several impairments that most people suffer nowadays are autism, dementia, short-term memory, attention deficit hyperactivity disorder (ADHD), seizures (WebAIM, 2013b).

People with cognitive disabilities will most likely find difficulties in receiving information, reading contents, understanding the mechanism of the website, lack of descent ability to perceive video, audio, motion. Several potential barriers they might find are:

- Page layouts are too complex to understand and use
- Bad wording and sentencing techniques
- Too many moving or blinking elements in the web content
- Too many plain texts without the presence of supporting attributes

To provide a good interface to web users with cognitive impairments, developers must commit to maintain consistency, simplicity, predictability in any elements presented in the web content and avoid unnecessary distractions. This commitment is not only relevant for users with cognitive disabilities, but it is also relevant and useful for users without disabilities.

5. Other types

Besides giving benefit to people with disabilities, web accessibility also benefits the people who have other types of disabilities or other types of limitations, for examples:

- Age-related impairments: Older people who have reduced ability levels due to aging might have slight or significant differences in the use of the web in both computer or mobile devices.
- Health conditions: People who have health conditions may affect their way of using the website. For instance, a person in the middle of eye medication will have a lower ability to see web content and need a longer duration to take action.
- Temporary disabilities: People who are temporarily disabled for a short term or long term due to accident, healthcare, medication. for example, a broken arm or

leg.

- environmental limitations: People in an unfriendly environment such as sunlight brightness level, lost eyeglasses, noisy area.
- Internet users in developing countries or rural areas who have low internet speed
- Internet users who have small device screen

2.3.3. Assistive technologies

According to ATiA (Assistive Technology Industry Association), Assistive technology is any item, equipment, software, system, product that capable to increase, improve, and maintain the functional capabilities of people with disabilities. With the advanced technology today, there are many types of Assistive Technologies (AT) that can fulfill users' needs in any approach or field. Low-tech or high-tech, light-weight or heavy-weight, digital or non-digital are some of the many examples. In the case of interacting with a website, the used assistive technology will be computer hardware and software.

The purpose of using assistive technology is to bridge the gap between the low ability of individuals and the environmental demand. To ensure the AT can assist website users, developers must build an accessible website. Without the website accessible, assistive technology has no function in assisting web users (Rosmaita, 2006).

As an example, a website that provides alternative text of images, proper menu, navigation bar, heading elements, can be accessed by blind website users using screen reader software. However, if the website is not built accessible, the screen reader will be unable to assist the blind users.

2.4. Law and Regulations

2.4.1. United Nations

United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) is a human rights treaty of the United Nations, the convention is to protect the rights, dignity, and equality of people with disabilities under the law (adopted on 13 December 2006). One of the articles of the convention is Article 9: Accessibility.

“To enable persons with disabilities to live independently and participate fully in all aspects of life, States Parties shall take appropriate measures to ensure to persons with disabilities access, on an equal basis with others, to the physical environment, to transportation, to information and communications, including information and

communications technologies and systems."

The accessibility is not only about adding additional features, but it is also required by law. The laws regarding accessibility are published by both national and international organizations, such as the UN for international, APA in America, AAD in Norway. This means the countries that implemented this law dictate that the inclusion of people with disabilities is mandatory.

2.4.2. Norway's Anti-Discrimination and Accessibility Act (AAD)

The law was introduced in 2008, making Norway one of the few countries in Europe that actively promote anti-discrimination and universal design. Information and communication technology (ICT) is one of the focuses in the establishment.

AAD Chapter 3. Section 13. (Retrieved from English-translated version of "*Lov om forbud mot diskriminering pa grunn av nedsatt funksjonsevne"*).

"Universal design" shall mean designing or accommodating the main solution with respect to the physical conditions, including information and communications technology (ICT), such that the general function of the undertaking can be used by as many people as possible."

Norway has the regulation of fulfilling the requirements for the regulation on information and communication technology (ICT) to have the success criteria of WCAG at levels A and AA. Several criteria around video are excluded (1.2.3, 1.2.5m 1.2.6). Not only accessibility is recommended in Norway, but there are also consequences if a website does not fulfill the required criteria. An organization called DIFI (Direktoratet for forvaltning og ikt), is a government agency that controls the fulfillment of web accessibility in Norway. DIFI can impose a fine if a certain website does not fix the accessibility issue within the given deadline.

2.5. Soccer Leagues' Websites

To enrich the idea that can be used in the design effort, websites from various major soccer leagues were visited. English Premier League, Spanish Laliga, and German Bundesliga were selected to be studied. The purpose of studying other soccer sites is to gain an understanding of today's most relevant design for soccer websites.

Figures 2.3 and 2.4 present the homepage of EPL and Bundesliga respectively. Both pages present the latest match/result on the front page of the interfaces. EPL presents

the latest match alongside the headline (Figure 2.3), while Bundesliga present it in a section before the headline (Figure 2.4). Presenting the scores above the page is a very good practice to provide the users the easiness of finding important information.

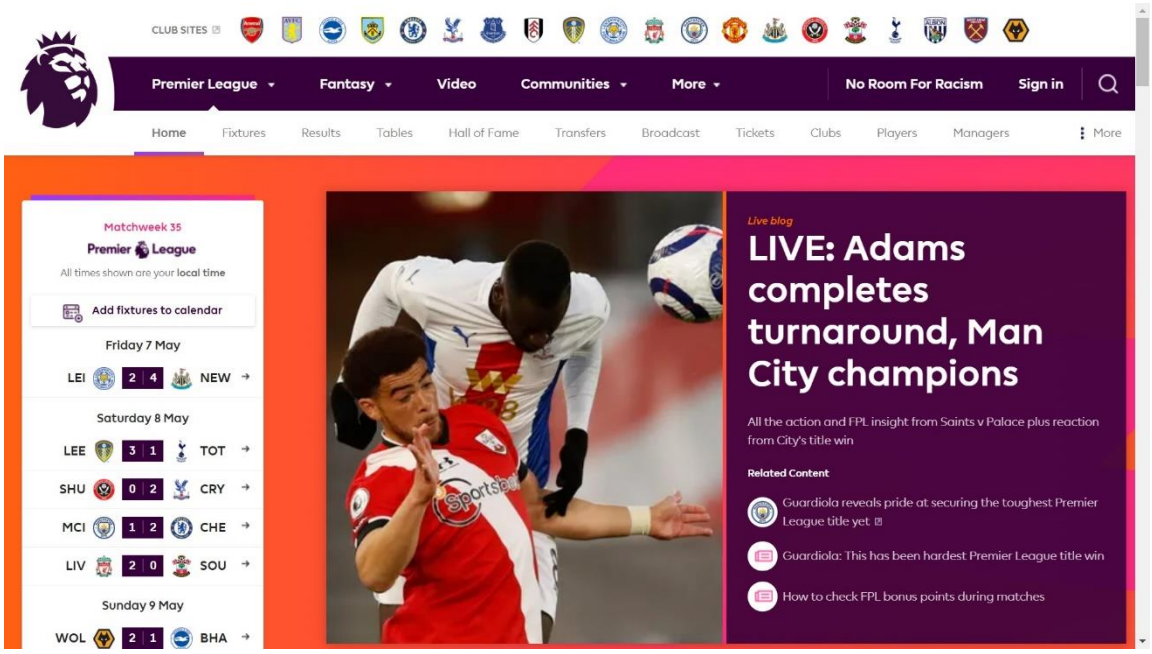

Figure 2. 3. Screen capture of EPL's homepage

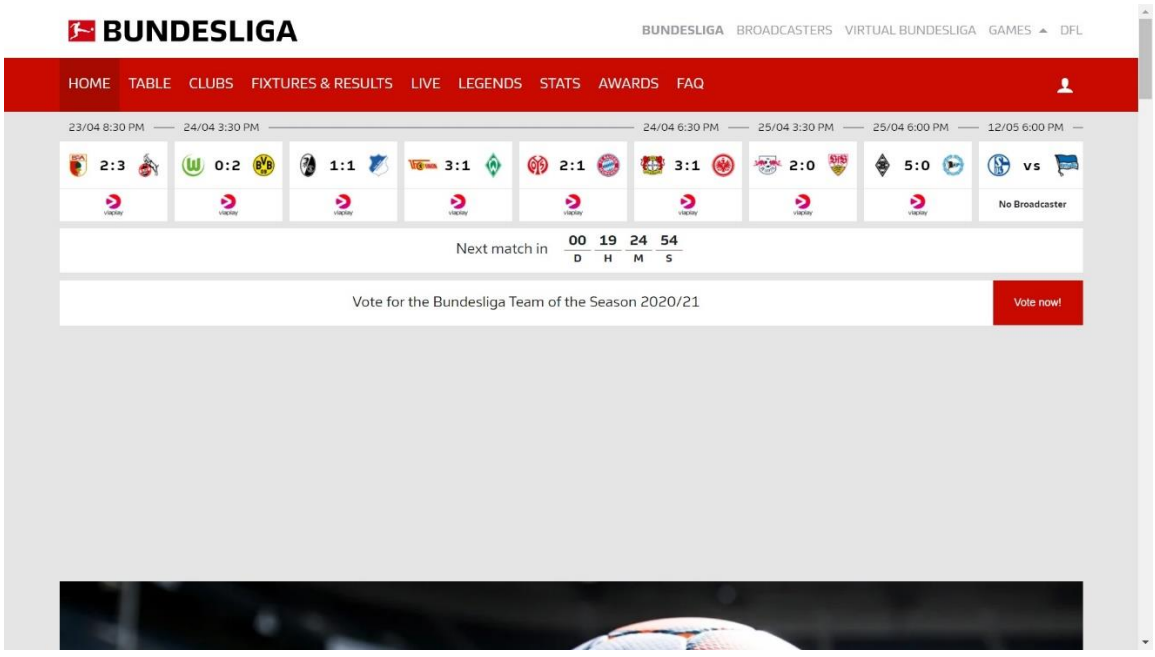

Figure 2. 4. Screen capture of Bundesliga's homepage

Match page was the next page that was studied. The optimization of a graphic element such as the club logo was optimized very well on both interfaces. Special attributes were also carried by the score to provide them a “spotlight”. For instance, the score on the EPL’s match list carries a box with color and a different color for the font

(Figure 2.5), while the score on Bundesliga has a unique size of font different from other fonts (Figure 2.6). Dynamic feature was also found on both pages. A small effect was shown when the mouse is hovering on one particular content (Figure 2.5 and Figure 2.6).

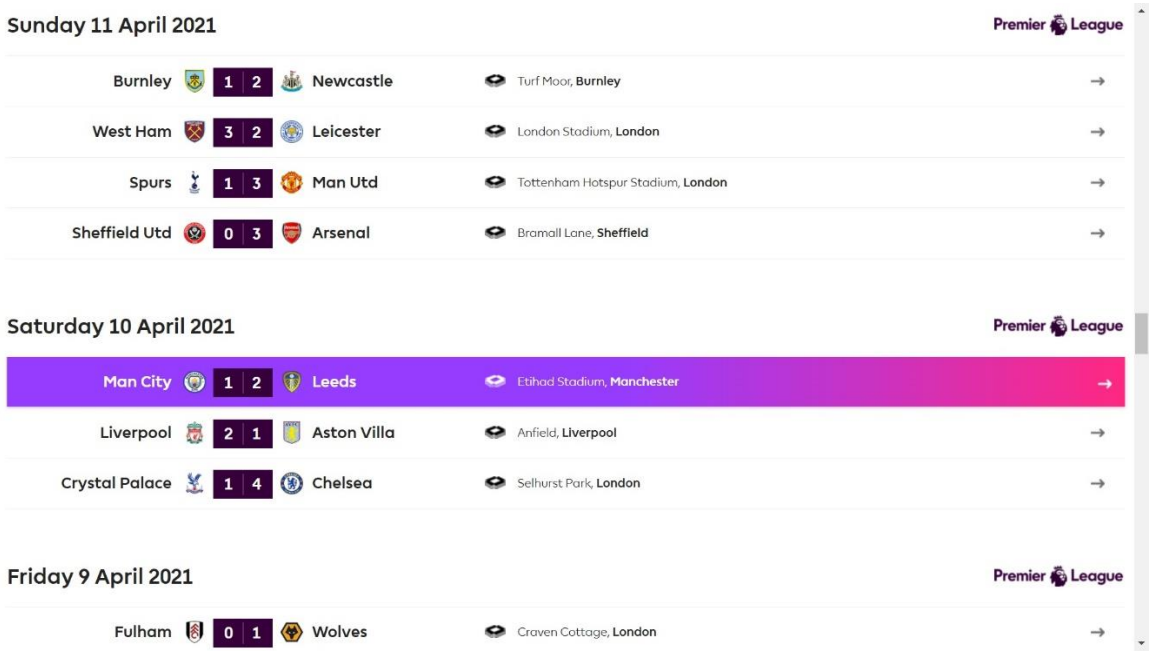

Figure 2. 5. Screen capture of EPL's match list page. A hover effect on a match between Manchester City against Leeds united.

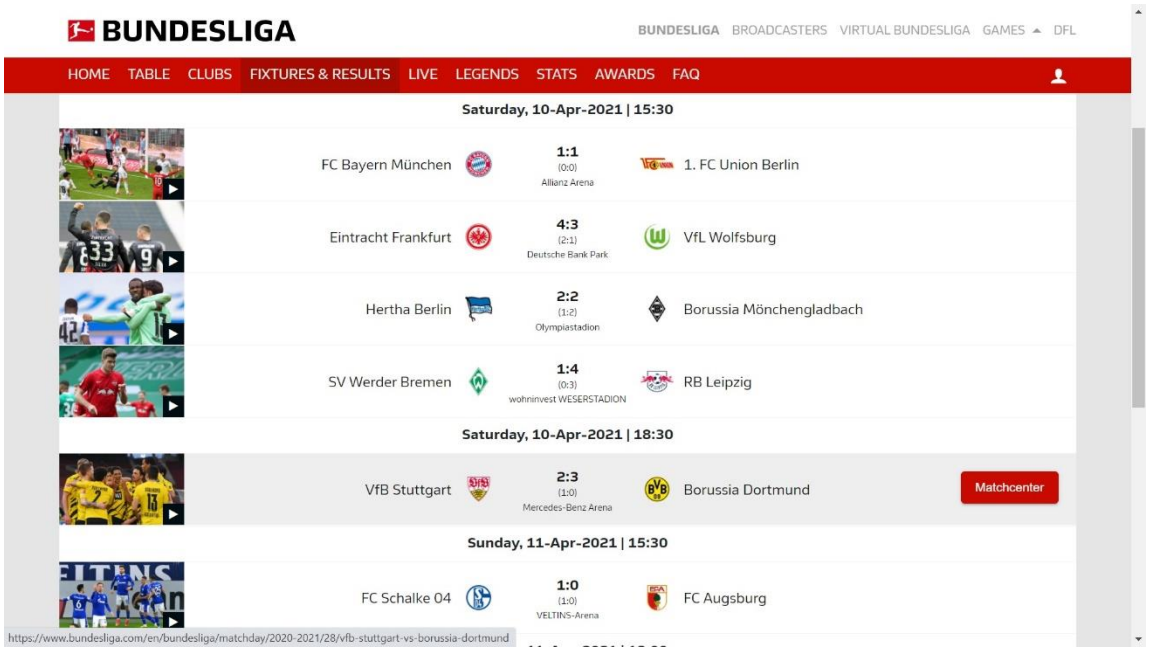

Figure 2. 6. Screen capture of Bundesliga's match list. A hover effect on the match between Stuttgart against Borussia Dortmund.

Another important page of a soccer site is the result page. This page contains much information that the fans are looking for. As it is difficult to decide what kind of information that relevant to be presented, studying the page from other league sites is

very useful. In Figure 2.7, 2.8, and 2.9, again, the club logo, as an important element in soccer information presents to support the content. Half-time score and goal-scorers as part of the final score present alongside and close to the final score. Additional information such as venue, date, time, referee is also present on the result page (Figure 2.7, 2.8, and 2.9). Optimization of images is shown to provide a very positive environment to Bundesliga's result page (Figure 2.9). The stadium image can give the "feel" of the atmosphere of the place where the match took place.

Figure 2. 7. Screen capture of SerieA's result page from a match between Parma against AC Milan

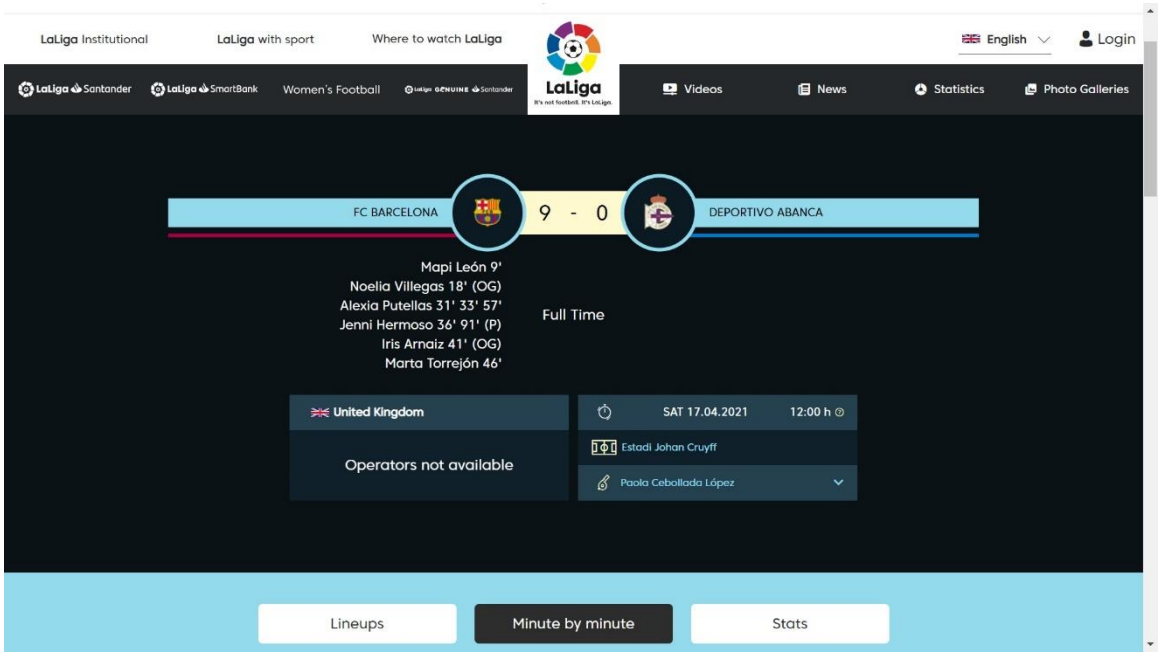

Figure 2. 8. Screen capture of Laliga's result page from a match between FC Barcelona against Deportivo Abanca

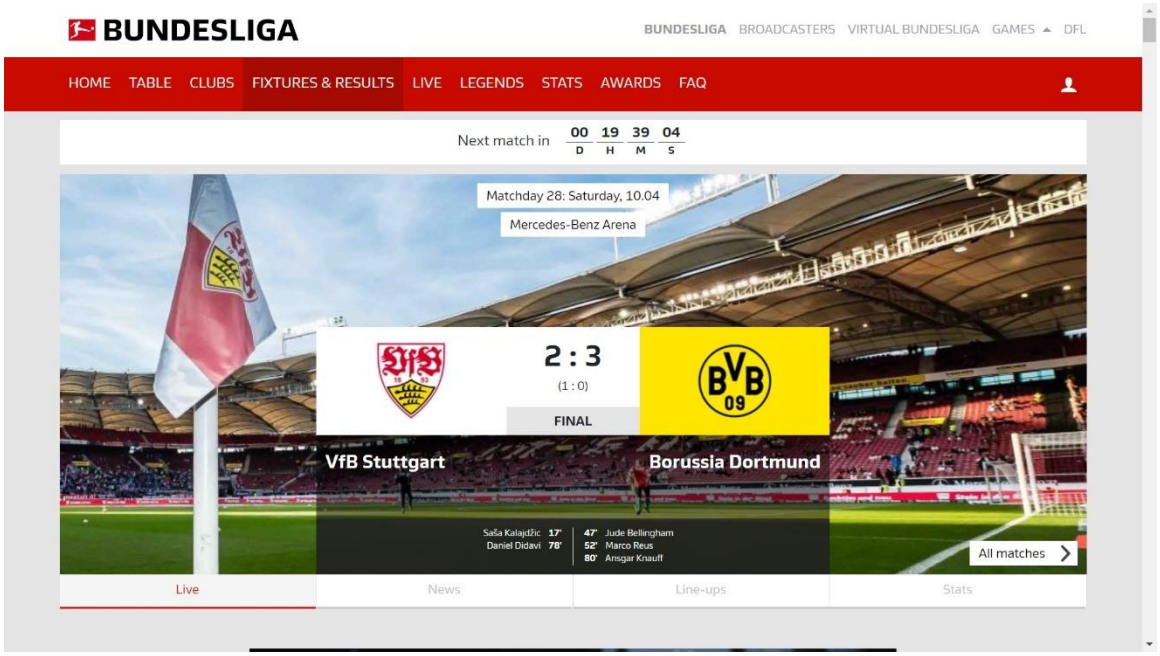

Figure 2. 9. Screen capture of Bundesliga's result page from a match between VfB Stuttgart against Borussia Dortmund

2.6. User Experience

There are many definitions of User Experience (UX). All of them are defined through integrated and fully-committed research activities conducted by many researchers. Table 2.3. contains several examples of existing UX definitions. The definitions in the table were listed by choosing the definitions that have the closest relevancies in assisting the improvement of the soccer highlight website.

Table 2. 3. User Experience definitions gathered from literature and other sources from the web.

Writer(s)	Year	UX Definitions
Don Norman	1995	User experience encompasses all aspects of the end-user's interaction with the company, its services, and its products.
L Alben	1996	All the aspects of how people use an interactive product: the way it feels in their hands, how well they understand how it works, how they feel about it while they're using it, how well it serves their purposes, and how well it fits into the entire context in which they are using it.
Hassenzahl, M., Tractinsky, N.	2006	A consequence of a user's internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g. complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs (e.g. organisational/social setting, meaningfulness of the activity, voluntariness of use, etc.).
McNamara, Kirakowski	2006	The user experience considers the wider relationship between the product and the user in order to investigate the individual's personal experience of using it.
Nielsen-Norman Group,	2007	All aspects of the end-user's interaction with the company, its services, and its products.
W3C	-	A set of material rendered by a user agent which may be perceived by a user and with which interaction may be possible.
Wikipedia	-	how a user interacts with and experiences a product, system or service. It includes a person's perceptions of utility, ease of use, and efficiency.

The term user experience is still lacks of proper theoretical definition. Even the use of the theory is in many different ways and some are in contradictory ways (Battarbee & Koskinen, 2004). Until today, although there are much concern regarding the relationship between human and technology, there are not many well-developed assessment methods in evaluating user experience (McNamara, 2006).

As it is clear that there are no universal definitions of UX, the theory was built into an individual theory based on the gathering of different views. Different definitions of UX from different researches, both scientific and non-scientific were gathered as a ground to understand, scope, and build the stand-alone theory. Following are the UX elements that have been assembled:

2.6.1. Impression

A study from Google showed a result that website visitors will form their first impressions of a website in only 0.05 seconds (Alexander N. Tuch at, 2012). This 0.05 second is the time that we have to provide a first impression to the audiences and create an attractive visual interface to convince them to stay longer or access other pages.

The argument about the importance of website impression is also suggested by a study by Babara S. Chaparro, 2009. The research indicates that visual appeal can highly influence first impressions. Results from the research showed that users gave higher ratings to the interface with higher visual appeals. Users also gave low ratings to lower visual appeal despite the usability is higher than the better visual appeal.

Creating an impression is not only about creating only the first one. Impressions have to be maintained or presented again even after users have perceived the first impression. A psychologist and a noble-prize winner, Daniel Kahneman, introduced a rule known as the "Peak-End Rule". This rule states that people only remember the most intense moment and the ending, the moment in between will not be remembered.

When users landed on the website, the first intense moment we can create for them is the first impression when they visualize the content. Next, users can experience another intense moment from the features we created when they interacting with the content. Then the ending is when they completed the tasks. Maximizing these 3 steps can create a highly intense moment and a memorable experience. And memorable experience is very close to a long-lasting impression, thus audiences are willing to stay and revisit the website.

2.6.2. Usability

In building a website, usability is one of the vital properties in ensuring the quality of a web application. The better the usability functionality, the higher the quality of the web applications (Kaur, 2016). Usability is about how easy to use a product (or website)

and how the features meet users' needs without formal training. According to ISO 9241-11, it can be defined as "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use".

Usability is about everything that human interact with, must be usable. This means everything such as machine, tool, software, process, and of course website (Kaur, 2016). Usability is an important element web developers want to build and website users want to have. A design has a big impact on providing the ease of using a website. A good design can help the contents and functions easier to find. When everything is easy to find, the usability will most likely be higher and users may find the website has frustration-free experiences.

A bad design will make the product harder for users to use, or in other words, the usability level is very low. The same issue in website design, the bad design of a web may cause the users to find more difficulties when using the website and completing the tasks. As an example, figure 3 below shows the difference between the 2 interfaces.

Figure 2. 10. a) calculator interface with minimum design, only white color throughout the page and without borderlines. b) interface with the design supported by colors and lines (foreground and background, borderlines).

The first interface on the left (figure 2.10.a) shows that the calculator interface does not have any border between the numbers, no significant difference between fonts, no color management. The first interface will create difficulty of use because there is very minimum design effort, only neat font positioning is provided. Users may find it difficult to click on the number buttons, operation buttons, and frustrated when seeing the operand.

The better-designed interface on the right picture (figure 2.10.b) will provide more

usability because there is more effort in applying design in the interface. Space between buttons, bigger font size and size variant, better color management will provide easiness of use to the users. And apart from the usability level, a well-designed calculator is also most likely more preferable to be chosen by the users rather than choosing to use the un-designed calculator.

2.6.3. Content

2.6.3.1 Color

By simply taking a glance at what is around us, we can see that colors fill our world. The clothes we wear, the colors of walls we have inside and outside our house, advertisement boards on the road we pass, the food served in restaurants, jerseys worn by soccer players, the colors subconsciously drive our emotions and decisions. In today's modern era, as well as in the non-digital world, the artform of color is used widely across the digital world. The fact that we live in a world full of colors, we can improve the skill of color management and refine color usage endlessly.

Colors have the ability to create attractiveness and attention. Among many variables that support a positive experience to users, colors play a very important role (Pelet, J.E., 2010). when visitors are attracted, they are encouraged to continue and experience the usability, usefulness, and enjoyment we would like them to have. Colors also have the ability to stir users' emotions (Ferris & Zhang, 2016). When the right colors are applied, our website will have the right mood and positive atmosphere. Imagine if a website is only filled with black and white colors, the capability of stirring visitors' emotions might be very low (Pelet, J.E., 2013). Web conversion level is also affected by colors because colors can guide users to respond to call-to-action on our website (Varela, M. et al, 2013). For these several reasons, color is one of the most powerful tools to achieve success in designing a website.

Color choices and management require careful planning. Color management is about preventing both too few colors and too many colors. Too few colors will decrease the satisfiers and too many colors can cause users to get eye fatigue and overwhelmed. Within these two strategies, there are many variables that need to take into account when designing a website, and sometimes even it takes time to plan the colors. Below are several elements of color fundamentals.

- Contrast

The purpose of creating contrast is so that colors differ from one to another. When two colors are in a very near position of color scheme, the contrast level is low. When they are in a far position from each other, the colors have high contrast. The importance of contrast comes when we want to present key information on our web content. Accessibility in color aspect is within this contrast element. According to the guidelines by WCAG 2.0, it is required to have a contrast ratio of 4.5:1 to achieve the success criteria level AA (WebAIM).

- Complementation

  Complementation is the opposite of contrast. Not all colors are at odds with each other, some colors are complementing each other. A complementary color will bring out the best of its target color. This element is focusing more on visual attractiveness.

- Vibrancy

  This element has the most implications of emotions and has there is a very close link with human psychology. A brighter color such as red will motivate audiences to give more attention and alert, while darker colors such as dark blue or gray provide a bold and relaxing atmosphere. For example, CNN and BBC as news channels, use red color as their main banner. The choice of red color motivates the alertness of their readers.

- White space

  This element is very crucial in color management. White space is the element that provides us visual breathing room for our eyes when interacting with a website. A more detailed section about white space is presented in the following section.

Not only about the visual garnish, but color management is very important in creating motivator, which is the element that creates satisfiers. When the colors are badly-planned, no proper motivator will be experienced by the audiences. But when the colors are carefully-planned and done correctly, it can give a game-changing effect thus the website can gain positive reactions from the audiences.

Besides enriching the visual garnish of a website interface, colors play a crucial role in accessibility also (WebAIM). For instance, the placement of correct background color and foreground color with a higher value of contrast can make sure the web visitors who

have some forms of color blindness can read the content. Colors can help web developers in creating better interfaces and experiences while maintaining the standard and the success criteria of accessibility guidelines.

2.6.3.2. white space

Oftenly, white space is seen as empty space in web layout or considered as empty "real estate" of web content. However, the true fact about whitespace is it is one of the most valuable elements alongside color and graphic management (Zhong, S. et al, 2008). Different presentation of whitespace will produce different psychological feelings (Zhong, S. et al, 2008). Which means that the whitespace must be considered in creating design that can enhance user experience. When whitespace present, it can improve the readability and scanability of a website (Jakob Nielsen, 1997). Without whitespace, other colors, images, and graphics will not be complimented. Whitespace does not mean that space must be filled with white color. It means there is blank space or empty space between elements (text, images, graphics, etc).

Since it is very important to deliver clear information to the audiences, web developers must deliver a page that readable, understandable, and enjoyable (Jakob Nielsen, 1997). The effort to increase the attractiveness of a webpage by adding images, graphics, colors, or other elements too much might cause some "pollutions" in the webpage and users will feel uncomfortable (YC Liu, 2017). The existence of whitespace in the web design will keep the balance of all those elements we placed in it without causing users to feel uncomfortable (Roslyn Raward, 2013).

Even though whitespace is very important and useful, web developers need to use it wisely. Using whitespace too little or too much will cause dissatisfaction (S Zhong et al, 2008). When we have enough white space on the interface, it gives us more freedom in adding different colors. White space is not a stand alone element. The importance of white space is it can make other element become important. The more white space surrounding the text, images or other elements, the more important the elements become (S Zhong et al, 2008). The portion of white space can complement the effort we made to drive users' attention, guide their eyes to key information or call-to-action elements.

Instead of being a role as an empty space, whitespace has an important role in improving everything we try to achieve in this project, such as attractiveness, usability,

ease-of-use, comfortability, and others which are mentioned above. A good placement of whitespace which can manage the position of the elements that let users' eyes breathe will increase user experience.

2.6.3.3. Text

The main reason people visit a website is to find information. And the information they can receive is from the text that a website provides (Kaur, 2016). To successfully deliver the information, the text has to be managed correctly. This is one aspect that is recognized as readability (Jakob Nielsen, 1999). Readable text can highly affect how users can process the information provided to them. Poor readability content will discourage readers and fail to get the information they want. On the other hand, when it is done correctly, good readability lets the users get all the information efficiently and accurately (Ozok & Salvendy, 2010).

Since it is already well-understood that text is very important in delivering information, developers must be very wise in providing text (Ozok & Salvendy, 2010). It has been a longstanding debate about the amount of text that should be provided on a webpage. Some developers believe that a long and big block of text has the ability to address people's concerns and lead to conversion, so a webpage needs a lot of text in order to let the search engine find and index the site. While the other believe that audiences can be put off by a massive amount of text and the text has to be kept short in order to draw the audiences' attention to the main point.

A study (Jakob Nielsen, 2008) indicates that users only read 28% of words in a webpage, at most. Surprisingly, the average is only 20%. The result of the study shows that web users do not favor too much text when landing and viewing a webpage. And also according to the research about colors in an e-commerce site (Jean-Eric Pelet, 2010), people are not giving their time to read all the contents if the contents are not appealing enough. The study showed there are quite some issues when there is too much text or poor-managed text on a site. In order to make the text count, it is important to present the text in a way that audiences can perceive it easily, frustration-free, and quick to digest. The quality of the presentation can help the quality of a block of text as information.

2.6.3.4. Image and Graphics

Most web users today are visually driven, even they perceive images faster and better

than text (Yalanska, 2015). So image is most probably the first website element that is seen by the audiences. Especially with many demands on graphical interface by web users, and also with many dedicated designers today, images used in the internet are very informative and able to drive the users emotionally.

Images and graphics are believed to be an ultimate addition to any website layout. they can break up the text and at the same time give visual attractiveness to the content thus we can really engage our audiences. Because images are used to enhance the experience on our website and provide visual aids for all the elements on the pages, it is very important to carefully select what kind of image that is the most effective one to enhance user experience. There are many types of image that have been used in the website, one of the most popular ones is icon.

As one of the types of images, icon can break up text on our website and help us engage the audiences. Especially today there are many icons that have symbolic meanings, audiences will easily understand the purpose of placing the icon on the page. For instance, house icon as the homepage, magnifier icon as a search engine, arrow icon as back or forward, etc. Since the sizes of icons are small, using icons is a great way to increase visual representations of web content while keeping the webpage clean and organized. Icons were chosen as the element that will be well used on the part of optimizing graphical elements. The 3 chosen interfaces from highlights. Eliteserien.no will optimize the use of icons to integrate the web content.

2.6.4. Mobile Robustness

Advanced but affordable mobile devices, with faster networks contributed the increase of mobile usage globally (Cazanas & Parra, 2017). More people are using the convenience of mobile device to access information. With the increase of users who are relying on mobile to access information, numerous startegies are researched and developed to answer this trend. Most current strategy in designing mobile interface is using multi-device design approach. This design is building a single web interface that adaptable to different screen-sizes, resolutions, device types, and browsers (Cazanas & Parra, 2017). This design is defined as Responsive Web Design (RWD).

RWD can provide custom layout to according to the type of the device users prefer. Achieving RWD can make a webpage look good equally regardless of the the screen-size (Kim, 2017). With this capability, RWD also can be defined as multi-device design

(Cazanas & Parra, 2017). RWD has been widely used in almost every web design today (Kim, 2017). The efficiency of applying RWD is with only one single design, many devices can access it with the same attractive layout.

Building mobile friendly design or ignoring it will have positive and negative outcome respectively. As mentioned, more people are using mobile device, when they have the positive experience when interacting with the web content, it can motivate them to visit the site again using their PC in the future. When the mobile friendly design is ignored, it will discourage the users to visit the desktop version and even the users might totally abandon the website. The optimization of all the elements on the theory mentioned above must be integrated in the mobile version.

2.7. Summary

The literature review involved the study of several sub-sections. First, related works that have close relation with this thesis, research that focus on improving websites, creating a positive online environment, applying universal design. Second is guidelines to achieve universal design, accessibility, and a brief overview of law and regulations. Third, the study of different types of disabilities and barriers toward the use of the website.

Four European soccer leagues, English Premier League, Bundesliga, SerieA, and Laliga were chosen and visited to conduct websites review. The study of those websites helped to provide the most updated design that can be adopted in this thesis.

A theory was formed from the gathering of multiple UX definitions. All the selected UX definitions were chosen based on the close relevance with developing a website, in particular, a soccer website. An individual theory was formed and contains elements describes as follows; (i) First impression, (ii) Usability, (iii) Content, (iv) Mobile Robustness. Based on the literature, website study, and the theory, evaluation and design were done as the next step of this research to answer the research questions.

3. Evaluation and Design

As the new round of the new 2021 season of the Norwegian soccer league has not taken place yet when this thesis was written, the fewer information of the matches might limit the evaluation and design. As the solution, the interfaces that were chosen to be evaluated and designed were the ones that contain the full match information, which is the 30th round of season 2020. The interfaces are home, match list, and match result pages.

The match result page has 2 main elements, scoreboard and timeline. To present a better evaluation and design, this interface will be divided into 2 parts, first the scoreboard, then the timeline.

Both evaluation and design of the chosen interfaces are divided into 4 sub-sections, which are content management, color management, dynamic feature, and mobile compatibility.

3.1. Evaluation

The web design improvement started from evaluating the chosen three interfaces. Using the UX theory and the study from several European leagues' websites, the evaluation will present several weak points the current interfaces have, and the elements that are potential to be improved.

3.1.1. Home Page

The current interface in Figure 3.1 has the headline of the latest goal, with the goal details and the thumbnails of the video as the image. The next section is the most popular videos section and followed by the latest match (The latest match still empty due to delay) (Figure 3.1).

https://highlights.eliteserien.no/

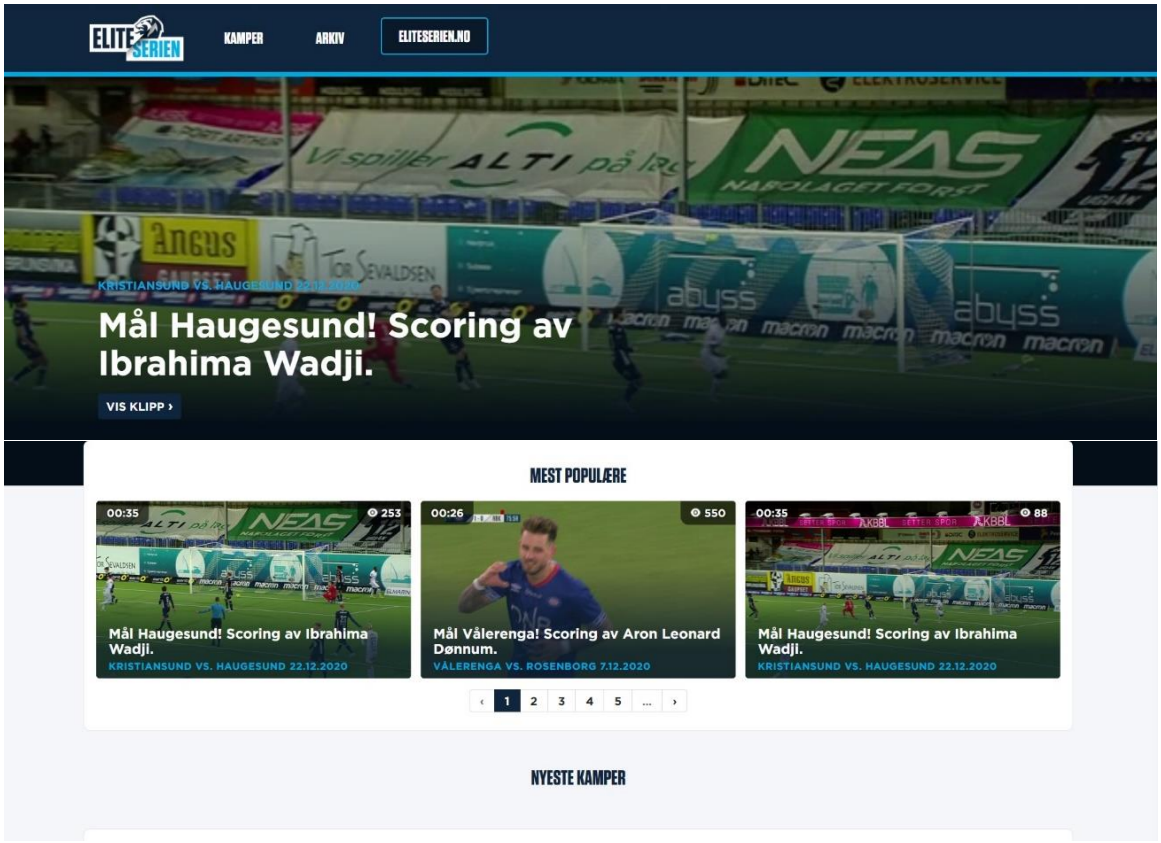

Figure 3. 1. Screen capture of current homepage interface. The figure shows the latest video, most popular video section, and latest match section.

As the thumbnail of the video depends on the content of the video, the image presented on the latest goal section is random. The interface has a lower capability to present a good image that can increase visual attractiveness and experience. Next is the latest match, which is an important part of soccer does not present on the headline of the webpage. The latest match is one of the most important pieces of information that the audiences would like to find when they land on the highlights website.

3.1.2. Match List

The match list chosen to be evaluated is the 30th round of the 2020 season of the Norwegian league, as it is the latest match fixture when this thesis was written.

As seen in figure 3.2, The team names are aligned on the left side while the score is aligned to the right side of the match list container. Despite there is still many available spaces on the match container box, the two teams are shown designed in block display (top and bottom), this creates a wide gap between the teams and their scores (figure 3.2). The audiences must go from the left side of the screen to perceive the teams and then to the right to perceive the score.

The fonts of the team name and the score also carry the same format and size. The sharpness of the information from this layout is quite low. This content layout is not effective in providing a good information deliverance and good experience because the audiences must give extra effort to get all these pieces of information.

https://highlights.eliteserien.no/games?startDate=2020-01-01&endDate=2020-12-31

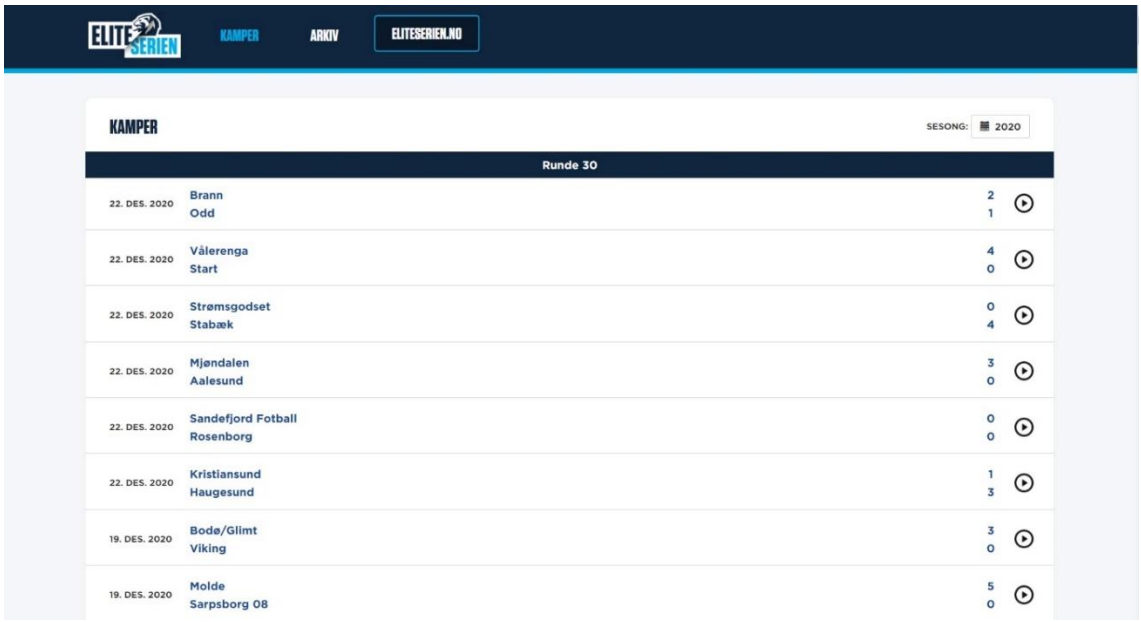

Figure 3. 2. Screen capture of the current interface of a match list. The match is the 30th round of season 2020.

Regarding the colors, the interface has minimum colors which create cleanliness and does not create any pollution (Figure 3.2), but there are several side effects, which are less visual garnish and less experience. As mentioned that there is still much white space, the interface does not use this advantage to add supporting elements. The integration of color boxes, fonts, or colors from club logos can be optimized here.

The mobile interface of the current design in Figure 3.3 shows that there is no more wide gap between the teams and their scores. The mobile interface with a smaller screen has fixed the gap. But still, the presentation has less experience because of the absence of better content and color management. There is still one or two efforts that can be done to provide a better interface.

https://highlights.eliteserien.no/games?startDate=2020-01-01&endDate=2020-12-31

Figure 3. 3. Screen capture of the current mobile interface of a match list. The match list is the 30th round of season 2020.

One other flaw is found in the match between Sandefjord Fotball and Rosenborg (Figure 3.3). As Sandefjord Fotball has a long team name, it requires more space to fill the box. With the current design, the box is unable to contain Sandefjord Fotball and Rosenborg. The score in the box also does not show in the correct position, both numbers are seen right on side of Sandefjord Fotball (Figure 3.3). This created an inconsistency in the proposition of the layout.

3.1.3. Scoreboard

The interface used in evaluating and designing the result page is from the match between Bodø against Viking, on 19th December 2020, which took place in Aspmyra Stadion. (Retrieved from https://highlights.eliteserien.no/game/1293). Using this page, 2 interfaces, which are the scoreboard and the timeline will be evaluated and designed.

The scoreboard as shown in Figure 3.4 shows a very nice and clean interface that the audiences will perceive. Club logos sizes and positions are placed neatly. Text elements

which are club names, score, date, and time are managed very well with score has a bigger size to sharpen the important information. Several pieces of information that are missing on the scoreboard, they are the goal scorer and half-time score. As this is a result page and contains a scoreboard, the information of the goal scorer and half-time score is very essential to present.

https://highlights.eliteserien.no/game/1293

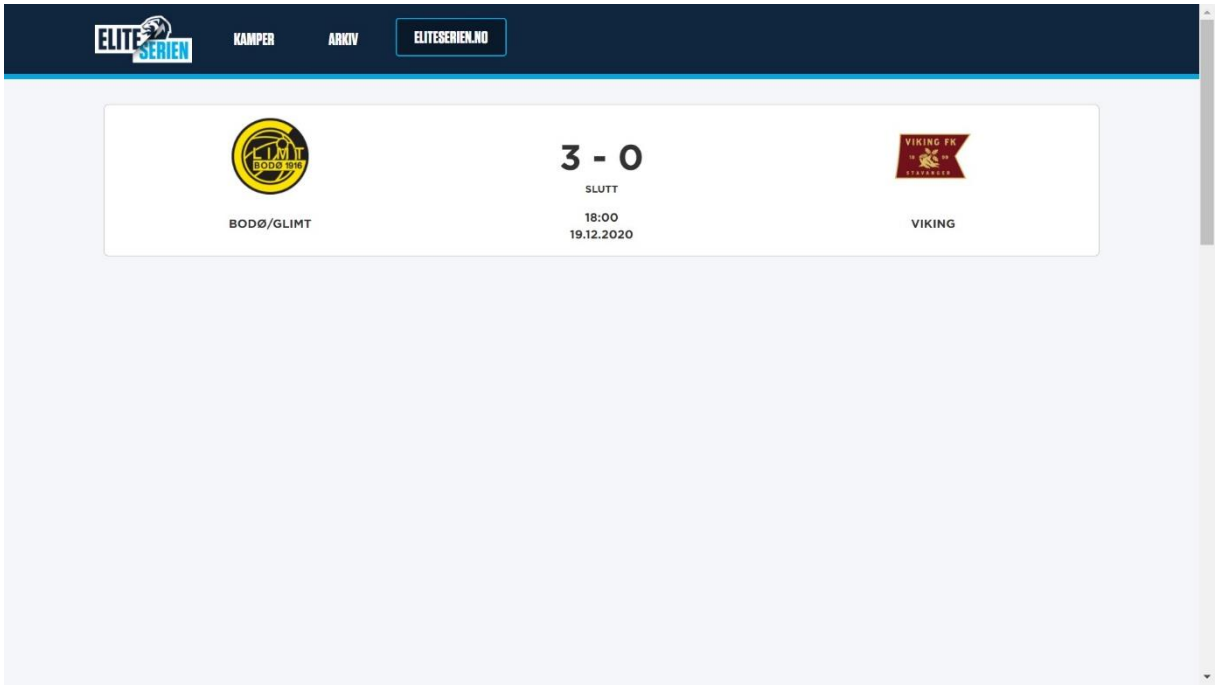

Figure 3. 4. Screen capture of current timeline interface from the match between Bodø/Glimt and Viking on 19th of December 2020. The interface shows the scoreboard without the match timeline interface.

As well as the match list interface, the page is lacking color optimization and it does not use the advantage of the available white space (Figure 3.4).

3.1.4. Timeline of Match Events

When there is too much text presented to audiences, the chance of getting the audiences to become overwhelmed is higher, especially if the pieces of information are inside a small space. This is what the current timeline has, there is too much text inside a narrow column (figure 3.5). The information of every event might provide difficulties to the audiences to read them all.

The minimalization of text has to be considered because the timeline has more than 20 narrow columns with text inside every one of the columns. The only non-text element that supporting the content is the shoot icon (Figure 3.5).

https://highlights.eliteserien.no/game/1293

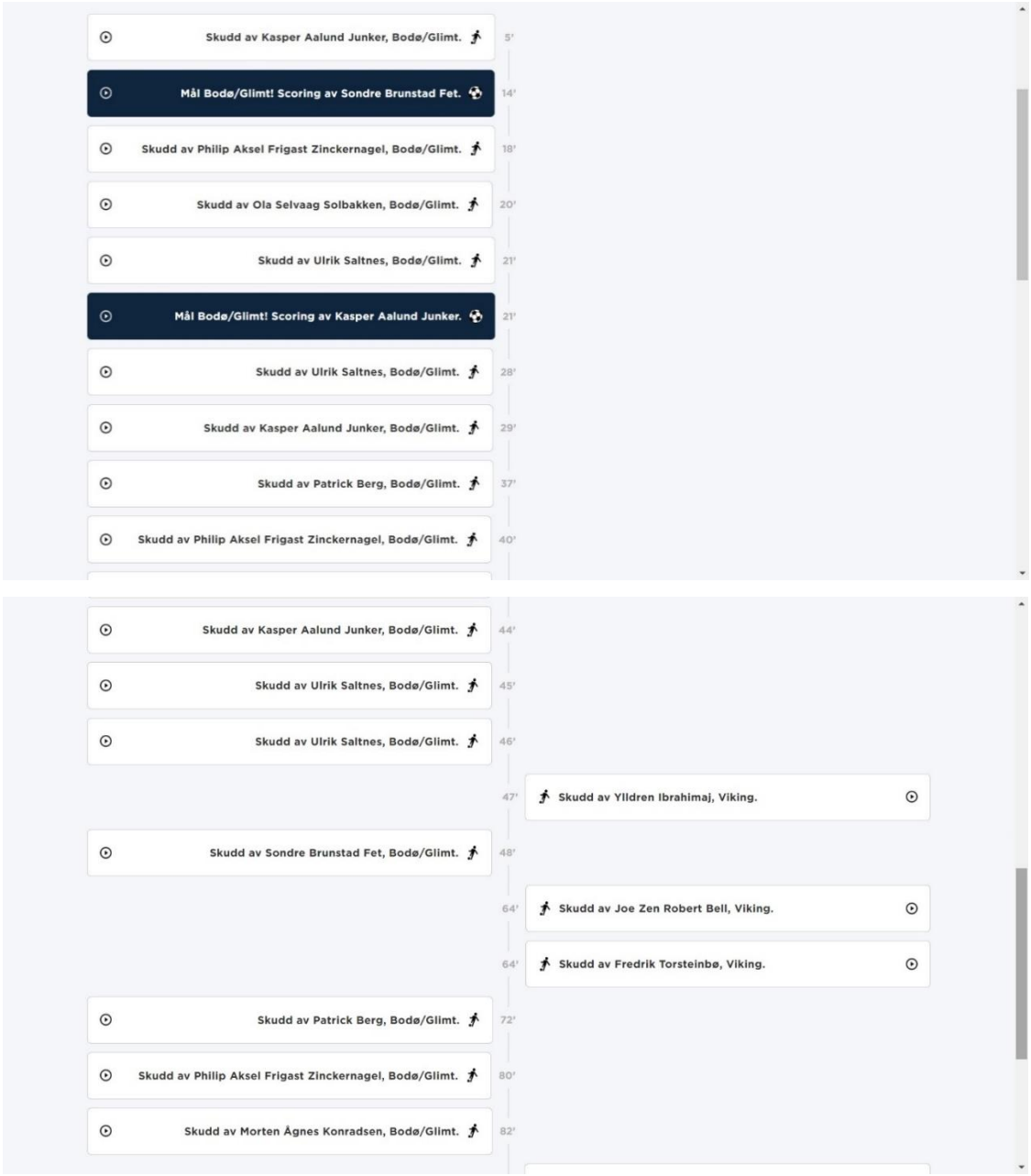

Figure 3. 5. Screen capture of current timeline interface from the match between Bodø/Glimt and Viking. The timeline contains the events from the 5th to 82nd minute.

The current interface in figure 3.5 above shows that all 4 information (time, event name, player name, and club) in one single event are in text format and the same text style. This composition will make the content full of text for the whole timeline considering there are more than 20 events per match. Text, text, and text will put off the audiences from staying there longer (Weinreich et al, 2008). A webpage cluttered with text, inside a similar box, and multiple numbers of boxes might give them higher frustration. When the pieces of information increase and also require more audience

effort to process the information, it will create lower satisfaction and lower confidence in using the services offered by a website (Thongpapanl and Ashraf, 2011). This will make visitors simply scroll down as fast as they can until they have found what they are looking for and leave immediately afterward.

In figure 3.6, the font color of the event name as seen in the current interface is the same as the color of the player's name and club's name. with addition to the too much text amount, the design is not strong enough to provide experience to the users.

https://highlights.eliteserien.no/game/1293

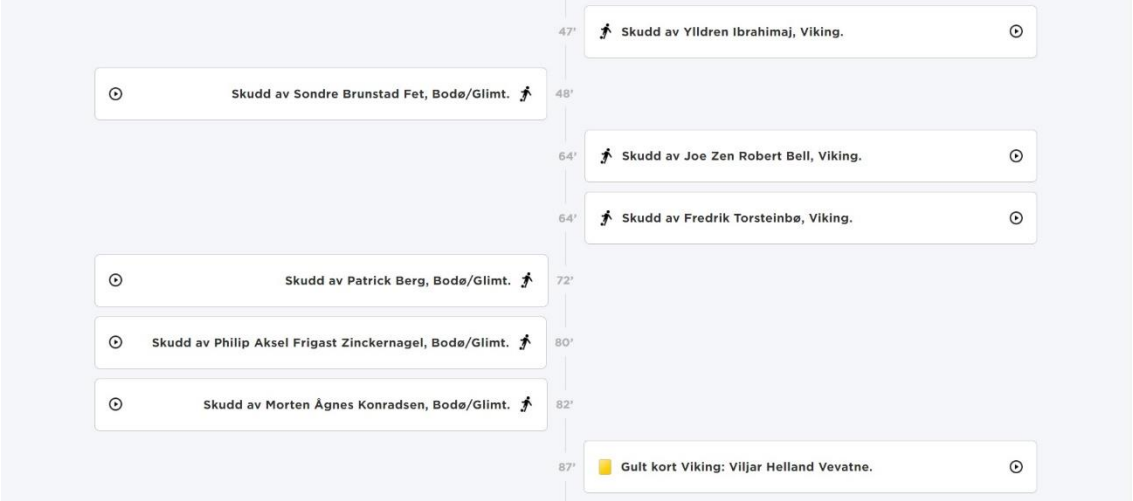

Figure 3. 6. Screen capture of current timeline interface from the match between Bodø/Glimt and Viking. The events on the timeline between the 47th to 87th minute.

On the event box with goal event, the current interface which carries different colors has a very good effort in delivering key information (figure 3.7). The dark blue color, which is different from any other event shows that this event is special, a scored goal. With this design, audiences can notice that this is where the goal event. But despite that fact, the whole timeline has the same color of goal event.

https://highlights.eliteserien.no/game/1293

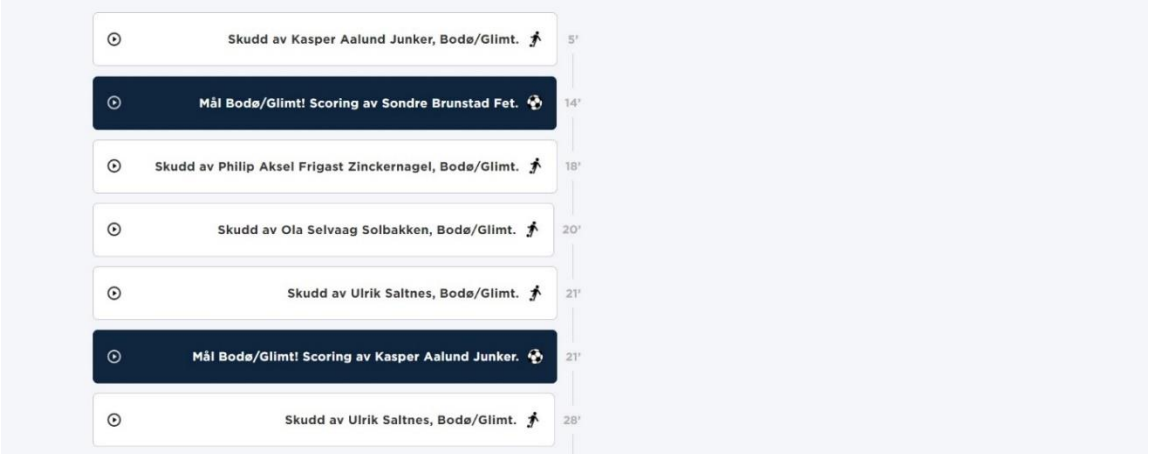

Figure 3. 7. Part of the current timeline interface that presents goal events. 14th and 21st minutes with the color of dark blue are the goal events.

A small dynamic effect was found on the current interface. As shown in figure 3.8, the interface has a hover effect when the mouse cursor is hovering the event, which is underline as the text-decoration. This feature is very helpful in helping users in knowing where they are, but there is still more to be optimized to produce more user experience.

https://highlights.eliteserien.no/game/1293

Figure 3. 8. Part of current timeline interface with mouse hovering effect. A hovering effect is on Bodø/Glimt's event box on the 72nd minute with underlined text decoration.

In the layout for the mobile interface (figure 3.9), there are 2 double words presented, event name and club name. "Skudd" and "Bodø/Glimt" exist twice in every single event, which created too much text and information in one single box. With this layout, the information will be too overwhelming to read. Another negative outcome is, with too much information, there will be fewer events that can be shown on the mobile screen. The way the text is presented will not represent the simplicity of a mobile interface.

https://highlights.eliteserien.no/game/1293

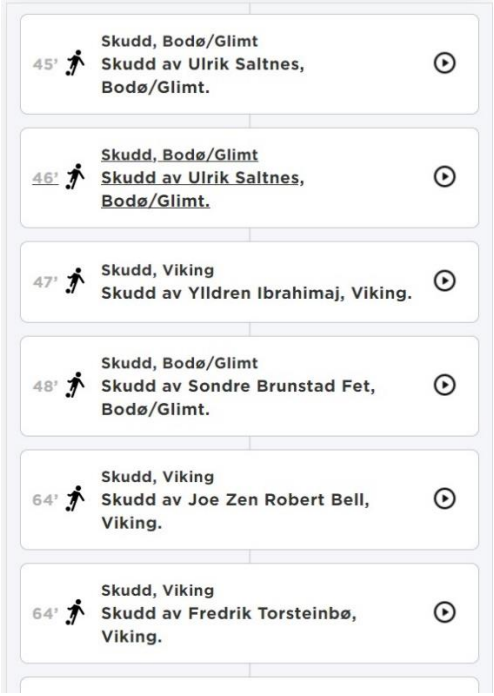

Figure 3. 9. Screen capture of the mobile version of the current timeline interface.

3.2. Design

The design of the interfaces will be divided into 4 sections to present better insight into the design, which are described as follows; (i) content management, (ii) color management, (iii) dynamic feature, (iv) mobile interface. The design development was using ReactJS as the programming language, and CSS to style the interfaces. All the built interfaces were assembled in a mini-website containing all the designed interfaces. For assessment and for convenience of accessing the website, it was launched and hosted using Netlify and available to be accessed using the internet browser.

3.2.1. Home Page

From the original homepage of eliteserien.no, several main sections were developed. They are the latest match, latest video, and 3 sections of video playlists. These sections are the main elements that the audiences will perceive when the first time they land on the page. Since the development of the video playlists involves a big database, there were only 4 videos presented on each video playlist, to fill the playlist of the section.

3.2.1.1. Content Management

Latest match

The first design effort on new interface is by placing the latest match section on the top page of the webpage after the header (Figure 3.10). Presenting the latest match (latest result or next fixtures) on the top of the webpage is inspired by the concept used in the newspaper, “Above the fold”. This concept is placing the important text in the space above the newspaper fold. In the website content case, the above-the-fold concept can be defined as “above-the-scroll”. this will refer to the top page of the website that appears in the browser. A study about website visitors’ behavior showed that 77% of website visitors do not scroll when they visit a website (Jakob Nielsen, 2006). According to this study, most web designs are encouraged to place the important information at the top of the web. With the minimum size of the latest match, it can fill the top page without “stealing” the space needed by the latest goal as the headline.

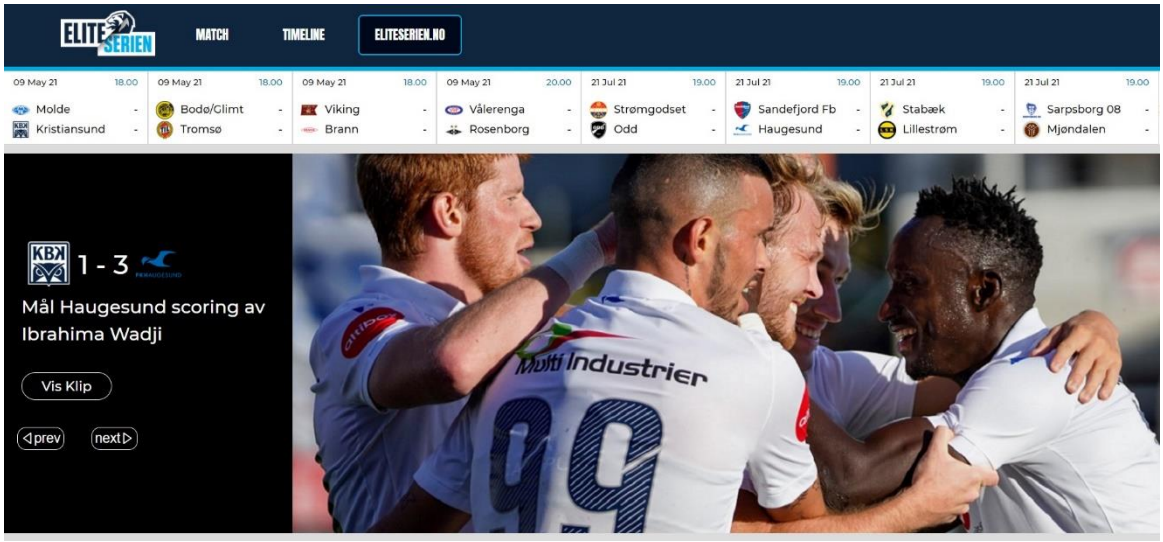

Figure 3. 10. Screen capture of new homepage interface. Latest match section presents after the header and followed by the latest goal section.

Latest Goal

instead of using video thumbnails as the presentation of the latest goal, the new interface is using an image of the moment when the players were scoring (or after they scored) a goal. Using the captured moment (images) of the goal event is to provide the audiences the feel of what was going on when the goal has happened. As the latest goal is one of the front-line “soldiers” of the homepage, a better visual appearance must be achieved. Another advantage is we can control the content we want to provide to increase the presentation that can give emotional encouragement to the audiences to

access the presented headline. On the video clip information, club logos were used to minimize the risk of too much text element presented on the layout.

Video Playlists

On the video playlists, the most popular, latest goal, and latest card have change on the video details. The current interface that has the details overlap on the video thumbnails (Figure 3.1). On the new interface, the details are presented under the image of the video to present a clearer image and information (Figure 3.11).

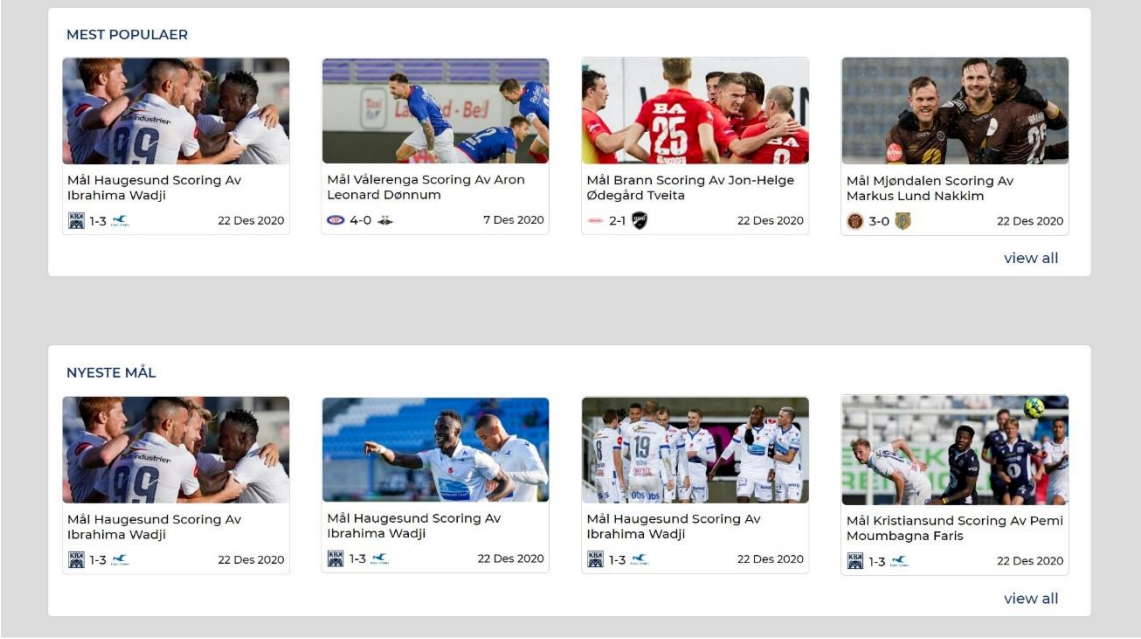

Figure 3. 11. Screen capture of new homepage interface showing the video playlists of most popular and latest goal.

3.2.1.2. Color Management

With the use of images and club logos, they contain very much color composition and variation. Those graphics also have already taken the most portion of the webpage. To carefully add colors without polluting the interface, only two major colors were used, black and white. The latest match section carries white color as the background and black color as the fonts, with a small portion of light blue to fill small variation (Figure 3.10). The same black and white colors formula was also used on all three video playlists (Figure 3.11). The latest goal clip section carries black as background and white fonts (Figure 3.10).

3.2.1.3. Dynamic Feature

The latest goal section also has one additional feature. The feature is a dynamic movement of several other goal clips in this section. Different match images and match

details were added to this section and they can change dynamically every 5 seconds from one goal clip image to another. For additional convenience to the users, next and previous buttons were added to access the clips easier.

To assist the users to access the buttons easier, a small hover effect were added on “Vis Klip” button, and “Prev” and “Next” buttons. Also, to add additional experience and, hover effects can be seen in figure 3.12. The hover effects only use black and white colors to keep the minimum pollution on the interface.

Figure 3. 12. Screen capture of hover effect on vis klip button.

3.2.1.4. Mobile Interface

The latest match section design is kept as the desktop design, only with size adjustment for mobile simplicity (Figure 3.13). The main adjustment for this section is there is an overflow function on the mobile version. The users can simply scroll horizontally across the latest match section. The latest clip section was built with a responsive design. The image can automatically adjust following to the size of the device. The images of the goal moment can still present with the match details and buttons are overlapped on top of the image (Figure 3.5).

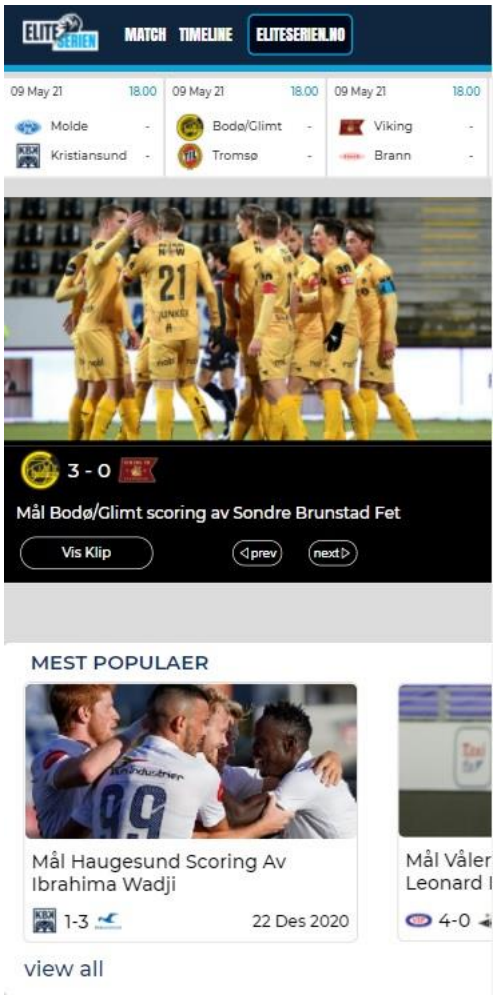

Figure 3. 13. Screen capture of the new mobile interface of the homepage.

3.2.2. Match List

3.2.2.1. Content Management

With the available space that we can optimize, 2 additional elements were added to the match container box, they are club logo and venue. The use of club logos is to enhance the visual attractiveness and also they can represent the soccer team better on the webpage. Another supporting argument for using club logos on the match/fixtures page is from the survey from the 4 major soccer leagues' websites, EPL, SerieA, LaLiga, and Bundesliga. All four websites have club logos present in their match/fixtures pages. The second addition is the venue. The venue name was added to deliver the information of where the match takes place.

After the two additional elements, the formula used to present all the elements on the web content is structured as below:

Date|Time|Home team|Home logo|SCORE|Away logo|Away team|Venue|Icon

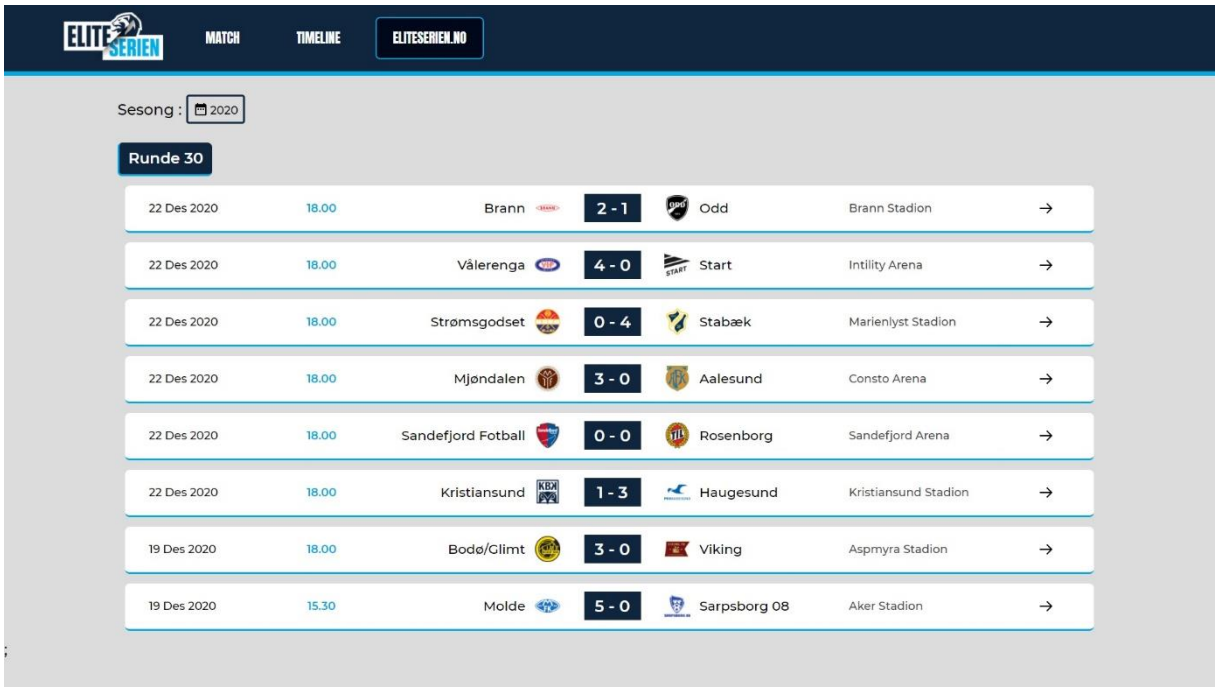

Figure 3. 14. Screen capture of new interface design of match list.

A fully built interface can be seen in Figure 3.14. As information of date and time are relevant to each other, they filled the left-end of the box while the stadium and icon filled the right-end. This format is to have the main elements of the scoreboard can be presented in the middle. The club logos are now placed alongside both team names, and finally, the score is in the middle.

From the current interface, there is a play icon placed on the right end (Figure 3.2). As each single of the match list does not contain a playable video yet, the new interface replaces the play button with an arrow button instead (Figure 3.14).

3.2.2.2. Colors management

With the colorful club logos, the match list interface did not add new colors. This new interface only optimized the use of white color and the eliteserien authentic dark blue and light blue colors. Adopted from the current interface (figure 3.2), the new design also uses white color as the match background color. With the background carries white color, the score box uses the dark blue color as the background to represent the spotlight “shooting” toward the score of the match, which the font carries white color (Figure 3.14). This way, the match container has sharper information thus higher user experience can be delivered to the visiting users.

2 more small color improvements are on the time and the bottom border-line of the

match container. Both of them have a light blue color to add visual attractiveness when users see between matches (Figure 3.14). As the time element only has a very small portion inside the box and the border-line is only at the bottom, they will not create “pollution”.

3.2.2.3. Dynamic Feature

The hovering effect is present to create additional interaction between the web and the users when they navigate the page. When the users hover the mouse on one particular match, the box changes color to light blue, font and arrow icons change color to white, and the arrow has the motion effect 20 pixels to the right (Figure 3.15).

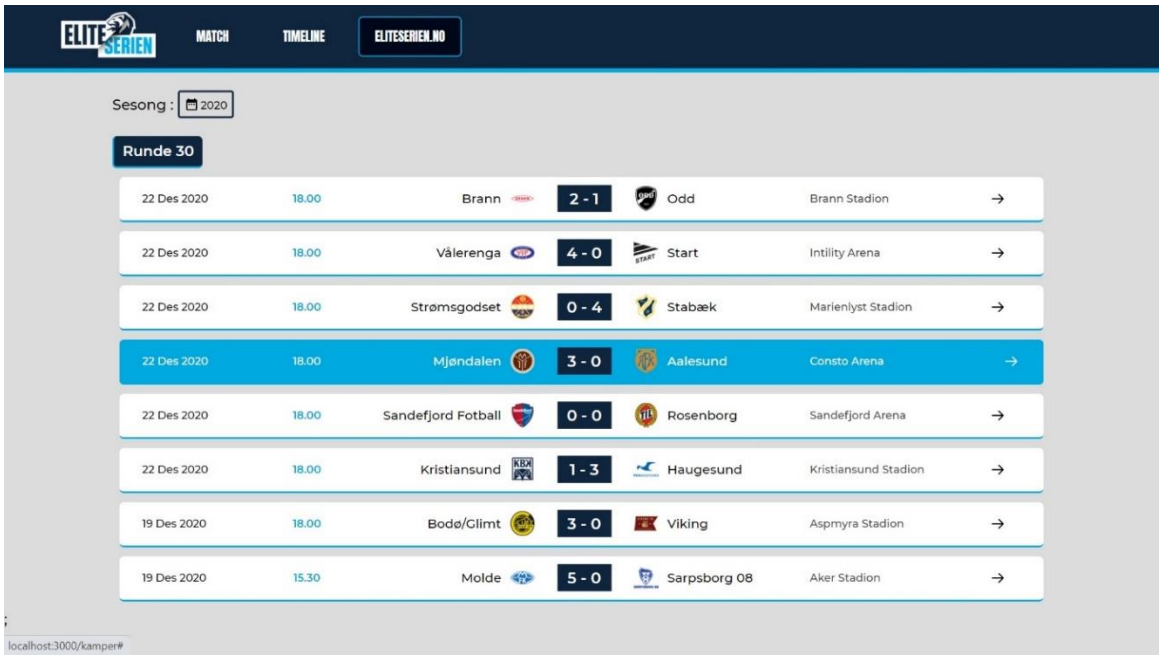

Figure 3. 15. Screen capture of new interface design of match list with mouse hovering effect. The hovering effect with light blue color can be seen in the match between Mjondalen versus Aalesund.

With the consistent color formula, hover color can present without “dragging down” the design of the interface. From the 8 matches listed in figure 3.15, only 1 match has a color change, and it is only when the user moves their cursor to the particular match.

As mentioned above in the user experience section, about the advantage of creating an intense moment, colors change when hovering is to create the intense moment when users' cursor touching the event area. Besides providing better visual presentation, the hovering effect also can help the users to know where they are and which match they want to access. With the visual garnish and usability are increased, a higher user experience can be perceived by the audiences.

3.2.2.4. Mobile Interface

Figure 3. 16. Screen capture of the new mobile interface of match list.

On the mobile interface in figure 3.16, the venue and icon were removed so that the mobile interface has a simpler presentation with more important information were chosen to be presented. Club logos keep their existence here alongside the team name and the score as the main information on the page.

Regarding the match between Sandefjord Fotball and Rosenborg, the design does not cause any change in the box size. That particular box is seen the same as other boxes (Figure 3.16).

3.2.3. Scoreboard

As the result page on the website contains both scoreboard and timeline, to present a better and more detailed evaluation and design, the scoreboard and the timeline will be presented into 2 separated sections. The scoreboard on the result page will be presented below while the timeline will be on the next following section.

3.2.3.1. Content Management

To increase user experience from this current interface, the efforts that were taken to improve this interface were by optimizing Image to fill the plain background and icons to enrich the content of the scoreboard. For providing more relevant and valuable information, additional elements such as goal-scorers, half-time result, and venue were presented along with other information.

The major difference between the current and new interface is the image of the stadium. Placing an image of the stadium on the scoreboard is to give the audience the feel of the stadium atmosphere when they are “standing” on the result page (figure 3.17). The addition of stadium image has a better user experience than presenting plain color as scoreboard background (Figure 3.4).

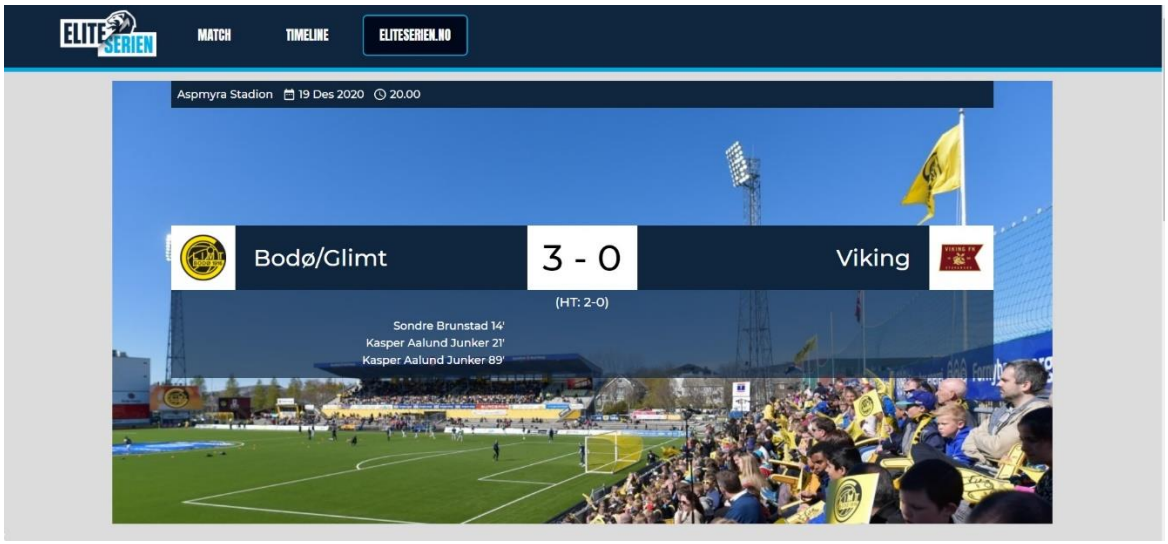

Figure 3. 17. Screen capture of new timeline interface from the match between Bodø/Glimt and Viking on 19th of December 2020. The interface shows the scoreboard without the match timeline interface. The image of the stadium was retrieved from Bodø official website.

As well as adopting the “above-the-fold” concept on the homepage design, the scoreboard design will also use this concept. Important information was presented on the top of the webpage with the addition of presenting the goal scorer on the scoreboard. The goal scorers, which is the important part of a soccer match need to be presented along with the result of the match. All important information is presented to the audiences the first second they land on this page. The goalscorers can be seen in figure 3.17. The goal scorer information and details can also assist the users when viewing the timeline. It can provide information of which minutes of play a goal was scored, thus can guide the user to the particular part of the event on the timeline.

The half-time score is placed along with the score, as it is relevant to be provided to the audiences (figure 3.17). As there is still space for placing more supporting elements, icons are used to complement the information. Small icons of date and time are placed alongside the time and the date of the match (figure 3.17).

By using an image of a stadium and multiple icons on the result and timeline page, there is a possibility that reduces the page performance. To prevent this, the image optimization is carefully planned to provide decent image quality and at the same time maintain the page performance. As the webpage was designed using Reactjs, all the icons are imported from Reactjs icons library thus will provide lightweight icons.

3.2.3.2. Colors Management

With one image presents on the interface and the image has a rich amount of colors, no new colors were added in the design, only the use of eliteserien's authentic colors of dark blue was added to the scoreboard, and a small portion of white color.

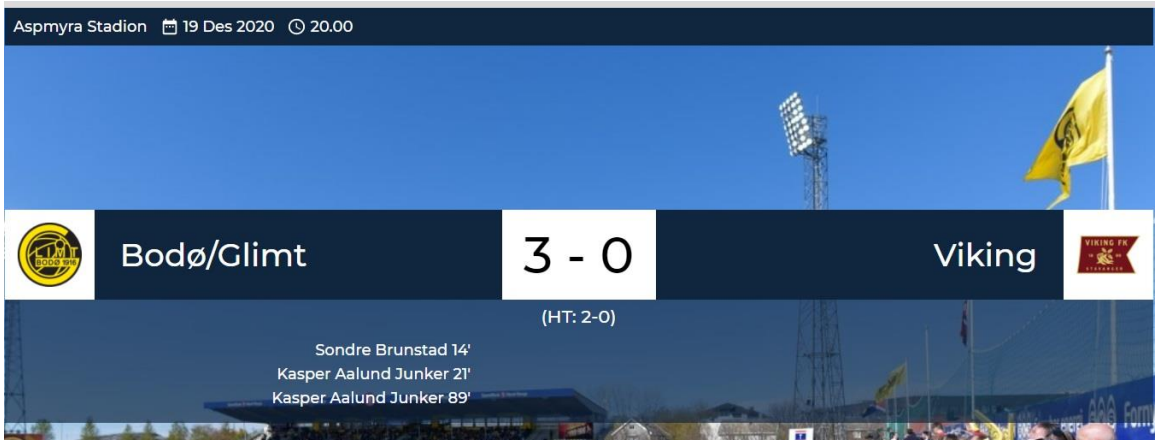

Figure 3. 18. Screen capture of zoomed-in new timeline interface. The zoom is focusing on the content of the stadium, date, time, clubs, scores, and scorers.

The score is the only element that carries the white color after the club logo background. This is to provide a sharper information deliverance as the score is the most important information on the scoreboard (figure 3.18). Venue, date, time, club names carry the dark blue color, while the goal-scorer section also carries the same color with a transparent effect to add more variation and visual attractiveness (figure 3.18). Font color with dark blue as the background color was kept white and black fonts for white background.

3.2.2.3. Mobile Interface

With the interface was built with responsive design, it can adjust the size to the

mobile screen. Figure 3.20 shows that Images, club logos, box sizes, fonts on the new interface are adjusted to the mobile interface. For additional reference, the comparison between the current mobile interface and the new one can be seen in figures 3.19 and 3.20. The space below the scoreboard will present the timeline in the next section.

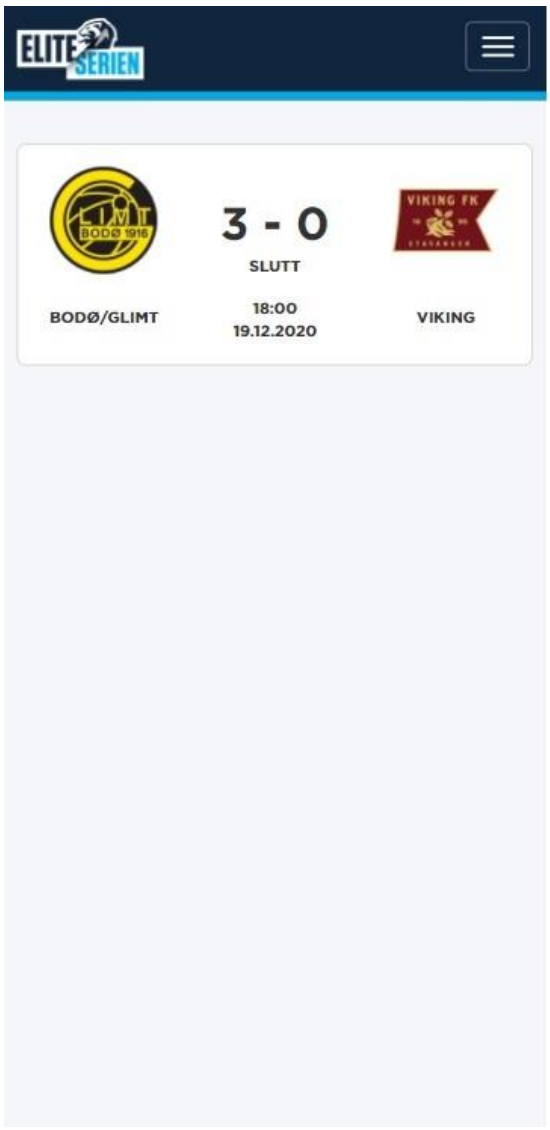

Figure 3. 19. (Left) Screencapture of the mobile version of the current scoreboard design without timeline interface presents.

Figure 3. 20. (Right) The new design for the mobile version without timeline interface presents.

3.2.4. Timeline of Match Events

3.2.4.1. Content Management

The continuation of designing the result page is the timeline interface which is right after the scoreboard of the match between Bodø/Glimt and Viking. The use of images, graphics, and icons will be optimized to provide more non-text elements that can support the information.

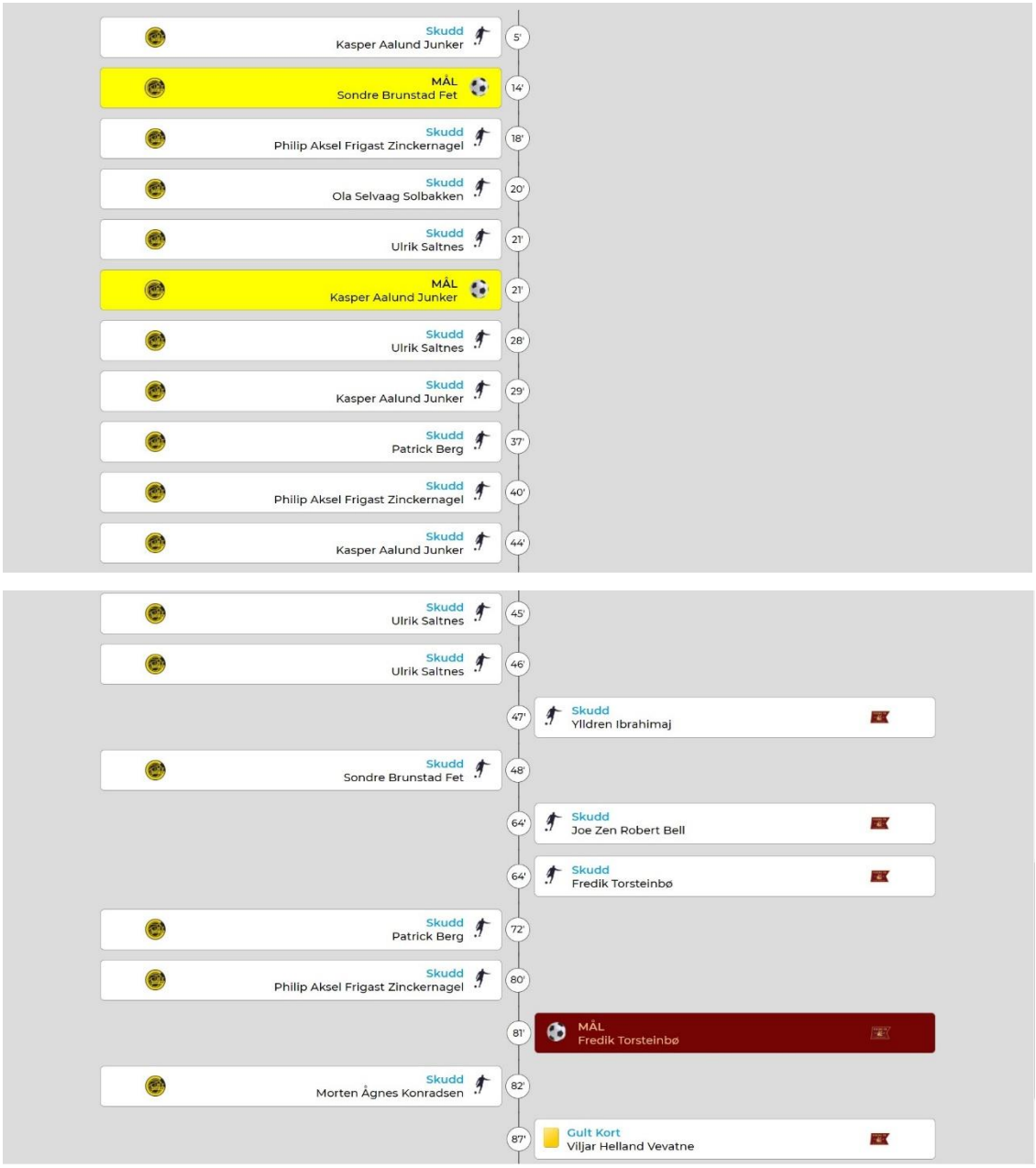

Figure 3. 21. Screen capture of new timeline interface. Taken between the 5th to 82nd minute of play.

Comparing figures number 3.5 (current interface) and 3.21, the latter has a higher chance of providing proper information to the audiences. With the new composition of text and images, we do not need to worry about presenting too much text despite we need to present multiple pieces of information in our timeline.

The use of images and graphics, which are club logo, event logo, a play button will minimalize the risk of presenting too much text and at the same time, they can emphasize the content of the event we present. After all the text, images, and graphics, the new design managed to maintain the white space that important for users to let their eyes breathe.

3.2.4.2. Colors Management

A color formula was planned on the new design to increase better and more perceivable information. The colors optimization is within the event name, player name, and the whole box of goal events. The applied colors are:

- Event box: white
- Event name (font): light blue
- Player name (font): black

This formula is applied as the default event boxes. All the events besides the goal event will carry these colors to keep the consistent use of colors across the timeline (figure 3.22).

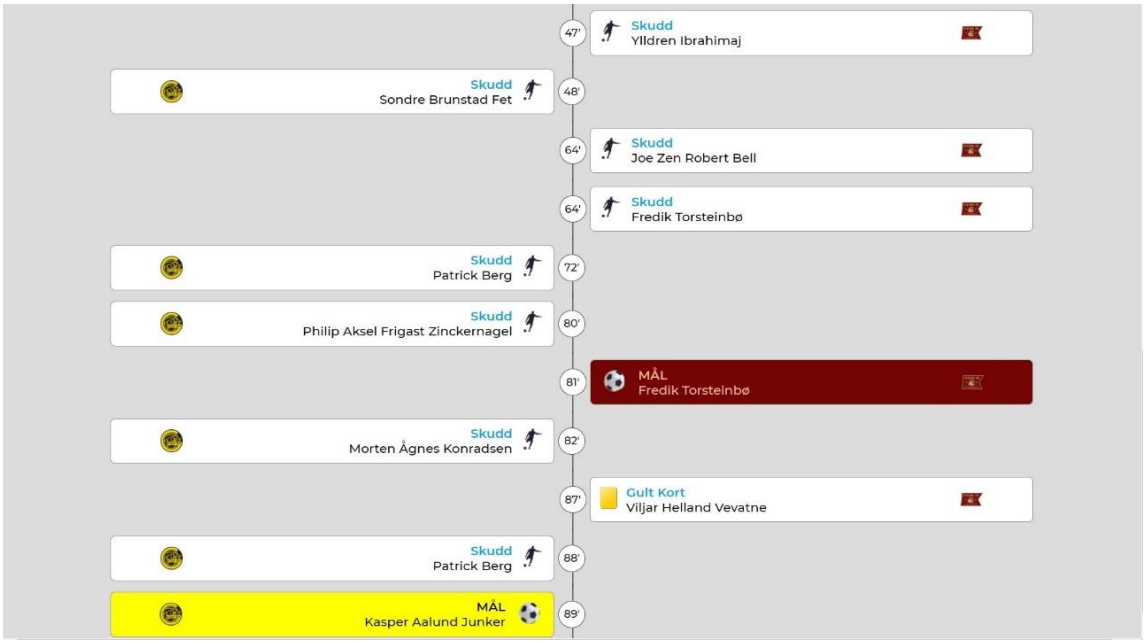

Figure 3. 22. Screen capture of new timeline interface from the same match between 47th to 87th minute.

On the text of event name and player name, both have different colors, thus provide better types of key information. Managing the keyword of the event by presented in different colors is to guide the audience on what they are seeing or guide them to where they want to be (shoot, goal, card, etc). Break up the text in different but simple colors to highlight the important information or phrase, will provide both sharper information and a better experience.

For further improvement with the color presentation, two unique colors are used in the event box that has a special event, which is a goal event. One unique color for the home team and the other for the away team. The unique colors are the colors that

represent the clubs, for instance, Bodø/Glimt has the authentic color of yellow as the main color and black as the secondary color. On the goal event scored by Bodø/Glimt, the event box will carry a yellow color and black color as complementary. The new colors will give sharp information of that particular goal event is scored by Bodø/Glimt (figure 3.23).

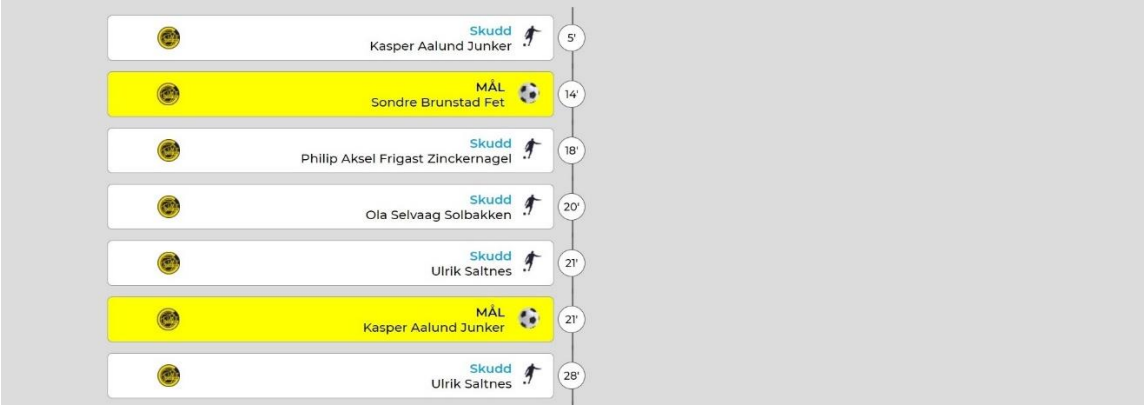

Figure 3. 23. Part of the new timeline interface that presents goal events. The yellow color used in the boxes, represent Bodø/Glimt as the club that scored the goals.

As there was no goal scored by Viking on the match against Bodø/Glimt, no goal event on Viking's side present on the actual timeline. for showcase, an additional fictional goal event was made and placed on Viking's side (figure 3.24). A player name was selected randomly and the event was placed at the best spot in between the timeline to provide a better showcase.

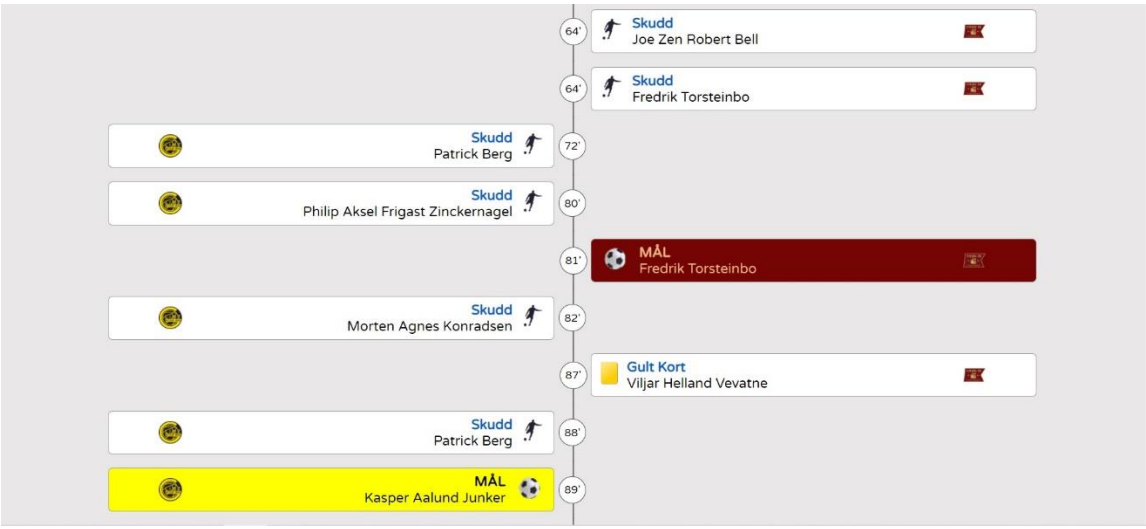

Figure 3. 24. Modified new timeline design with a goal event added on Viking's (away team) side. Viking's goal event was placed on the 81st minute.

One other purpose of using the event box formula mentioned above is to prepare the timeline for the goal event that will carry different colors. With the default formula

applied consistently to all events, putting different colors on goal events can be made possible. As the number of goal events is much fewer than the other events, the color difference will not break the timeline's major colors. When the color for the goal event is applied, the timeline will have sharper information about non-goal and goal events. The new design now has a higher potential in giving a better user experience.

3.2.4.3. Dynamic Feature

To optimize the mouse hover feature from the current interface (Figure 3.8), the effort made was by adding colors in the event box in accordance with the hover motion of the mouse cursor.

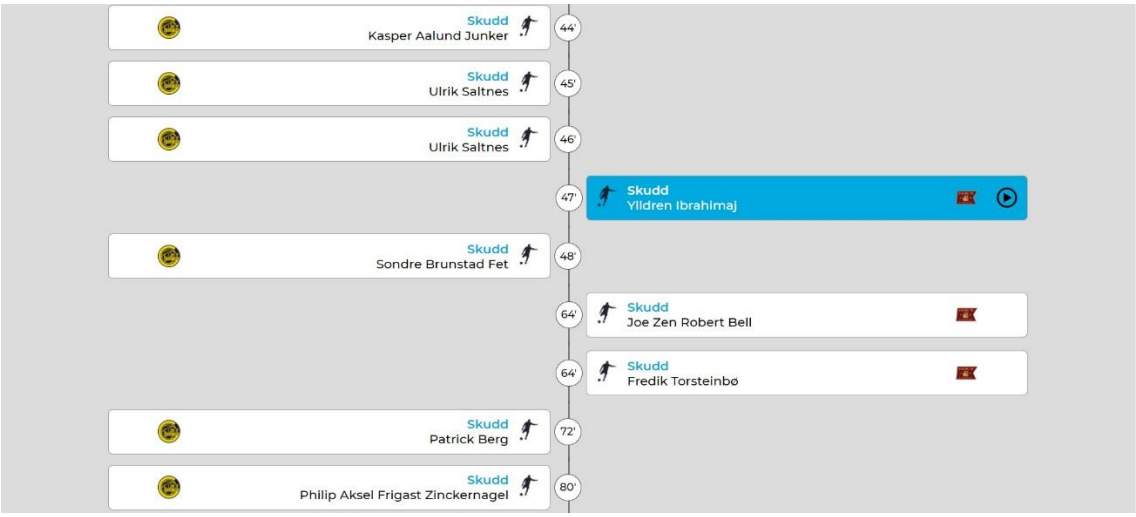

Figure 3. 25. Part of new timeline interface with mouse hovering effect. A hovering effect is on the Viking's event box on the 64th minute with the color of light gray and a play button icon is shown.

The dynamic color in the box can make the propositions more attractive when users reading and hovering the content one by one despite there are more than 20 events presented in front of their eyes. As shown in figure 3.25, when users hover to one particular event, the event box has color changing to light blue, and a play button is visible at the very end of the event box. The play button, which exists in every event, is only visible when the mouse hovering the event box as a sign that the box contains an available video to be played. The same hovering effect is applied to the goal event as well.

The moment that happens when hovering will provide additional experience when they approach the event and help the users to access the event they want to watch. Thanks to the well-provided whitespace in the timeline, adding colors in text, presenting club logo with different colors, and the hovering effects which have color change are also

can be made possible. Because there is enough whitespace all across the page, having more colors and effects are acceptable without creating “pollution”.

3.2.4.4. Mobile interface

Since mobile has a smaller portion of screen than PC, the interface should be very minimalized and simple as best in accordance to the device size, while maintaining the key information. As well as the new design for the desktop version, the club logo can replace the club name text and the text amount is minimalized to 35-40%. Even though the timeline in the mobile version is not on the left side (home team) and the right side (away team), the club logo will provide clear information about which event belongs to which club. the completed design for mobile is shown in figure 3.26.

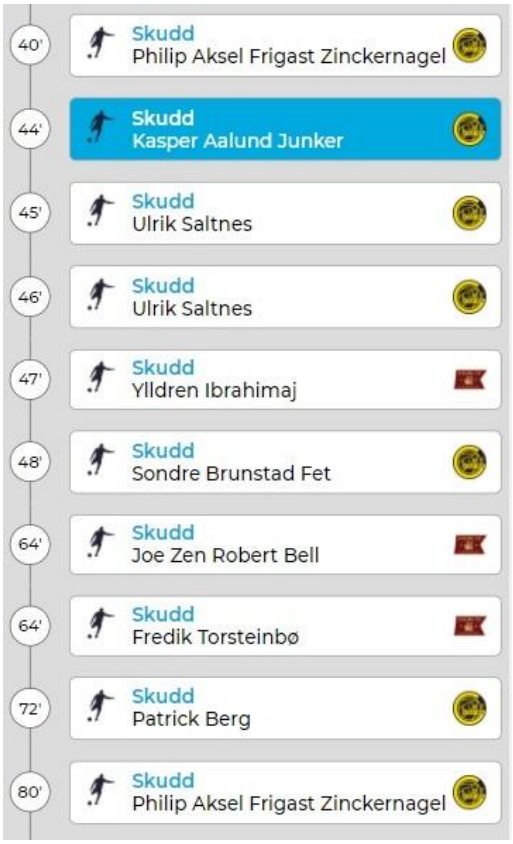

Figure 3. 26. Screen capture of the mobile version of the new timeline interface. The events are between the 40th to 80th minutes of play

The play button is not present anymore to provide enough space to contain more important information on the mobile interface. The hovering effect still presents when the users touch any particular event. The mobile interface now has minimalized information deliverance and more attractive to users, while maintaining sharp and clear information.

3.3. Accessibility

For simplicity, only several major accessibility fulfillments are presented in this Thesis. Presenting all the accessibility fulfillments will be irrelevant for the purpose of the project. The accessibility attributes are aria-label, alternate-text, and color contrast.

There are 2 pages that contain links without the proper text in the link attributes, they are match list and timeline pages. To provide an accessible link, an aria-label is placed in the link anchor to provide its accessible name. it will be read by screen reader software for users who require it. One of the code lines for the link in reactjs file is shown in figure 3.27. The link will be read by a screen reader as “lenke åpnes i ny fane Bodø/Glimt skudd av Kasper Aalund Junker i minutter 20”. Every single timeline event can be accessible with complete information using assistive technology. On the match list page, every single match that has a link with no proper text format also has this aria-label attribute to provide an accessible link.

```
return (
    <div className='timeline'>
        <div className={homeAway}>
            <a href={videosource} target="_blank" aria-label={`lenke åpnes i ny fane ${team} ${action} av ${
            player} ${time} minutter`}>
                <div className="center-line"></div>
                <p className="timeline-time">{time}'</p>
                <GrCirclePlay className="far"/>
                <img src={clublogo} class="timeline-club-logo" alt={`${clublogo} logo`}/>
                <div className="timeline-content">
                    <p className={eventname}>{action}</p>
                    <p className="event-player-name">{player}</p>
                </div>
                <div className="action">
                    <img src={actionIcon} alt="player icon"/>
                </div>
            </a>
        </div>
    </div>
);
```

Figure 3. 27. Screen capture of ReactJs code. The whole block of code seen above is the code for displaying one single event on the timeline. A line of code in the blue highlight is the link anchor that contains aria-label details.

As there are many team logos and images, all these graphical elements have been added alternated-text for accessibility purposes (Figure 3.28). Several icons like date, time, calendar icons are kept without alternate text as they are only for decoration purposes.

```
<div className="center-line"></div>
<p className="timeline-time">{time}'</p>
<GrCirclePlay className="far"/>
<img src={clublogo} class="timeline-club-logo" alt={`${clublogo} logo`}/>
<div className="timeline-content">
    <p className={eventname}>{action}</p>
    <p className="event-player-name">{player}</p>
```

Figure 3. 28. Screen capture of ReactJs code. A line of code in the blue highlight is the code that contains alternate-text details.

For color contrast, the ratio is checked using a contrast checker by WebAIM. By submitting the hex colors, WebAIM measures them and returns the result. The contrast ratio requirement from WCAG 2.0 to achieve the success criteria of AA is 4.5:1, Table 3.1 shows the result of all the colors used in the design of every interface checked using WebAIM contract checker.

Table 3.1. Color contrast ration result checked with WebAIM contrast checker.

No.	Background	Foreground	Ratio
1	#FFFFFF	#0080A7	4.5 : 1
2	#10253E	#FFFFFF	15 : 1
3	#7450505	#E6B78C	6.4 : 1
4	#000000	#000000	17 : 1
5	#00A1C6	#FFFFFF	3 : 1

The fifth result in Table 4.1 shows that the ratio between #00A1C6 and #FFFFFF is 3:1. These 2 colors are the color of background and foreground of the hover effect. When designing an interactive element, the minimum color contrast is 3:1. With the main element (non-interactive element) has maintained a 4.5:1 ratio, the secondary elements such as focusing, hovering, active element, can be built at a 3:1 ratio (Success Criterion 2.4.11. Focus Visible (Enhanced)).

3.4. Summary

In this chapter, three pages from eliteserien's highlights were evaluated. Evaluating the design by using the theory and the study from other soccer leagues' website, many layouts, contents, elements that were found to be potential to be improved. Graphical elements such as soccer club logos, images were found to be less optimized on the

current interfaces. Content and colors were also still lacking proper management.

According to the gathered evaluation, the design effort was to fix all the weak points and focus on the elements that were found potential to be optimized. As well as the evaluation, the design was developed using the theory and other website study. Four main categories that used to divide the details of the design, they are content management, color management, dynamic feature, and mobile robustness.

UD, WCAG, and WAI-ARIA guidelines are to maintain universal design and accessibility. Accessibility features and fulfillment were performed since the life-cycle of the design. As the new design involved more color organization, all the color contrasts were checked to fulfill the AA success criteria. Accessibility for the rich features on the carousel and non-text links have also been implemented.

To determine the effectiveness of improving user experience, an assessment of user testing was performed. The user testing involved the interaction of both current and new interfaces. The result presented in the next chapter will give a better overview and details about the outcome of the improvement.

4. Assessment and Result

A qualitative study was conducted as an assessment to determine how close is the relationship between the design and user experience. The qualitative study used in this project is user testing. The objective of the user testing was to determine whether or not the newly designed interfaces can provide a better user experience. Divided into 2 sections, we present how the assessment was planned and happened, then follow by the result.

4.1. Assessment

4.1.1. Participants

A total of 25 subjects participated in the user testing. The majority of the participants were regular internet users. There are 4 subjects among all the participants who are soccer fans while the rest are not soccer fans. Both non-soccer and soccer fans participants were asked to visit other soccer websites. The purpose is we wanted the participants to feel several user experiences from their visits to other websites before testing our interfaces. Also, the experiences they had from the “outer world” can be gathered and can be made useful for future study. To provide several preferences to participants who are non-soccer-fans, we gave several soccer websites suggestions to them such as EPL, Bundesliga, SerieA, and LaLiga.

4.1.2. Procedure

The testing was conducted by presenting 3 interfaces to the participants (home page, match list, and result), both current interfaces and new interfaces. The testing will be performed by having the participants interact with the interfaces by doing the given tasks. All the 3 interfaces have their specific unique tasks. The tasks were given in accordance with the type of the particular interface (Table 4.1).

The first interaction is with the current interface. After interacting and completing the tasks of the current interface, a questionnaire will be given to be filled (Table 4.2). Next, the participants will interact with the new interface with the same tasks. After completing them, the same questionnaire will be given.

2 outcomes were expected to be found from this user testing. First is we would like to find which interface is capable of providing a better user experience. Second, we would like to find if the objectives we set are effective in the design effort.

No.	Page	Tasks
1	Home	1. Without scrolling or clicking, look around the webpage for 5 seconds.
		2. Scroll down until the bottom and scroll back to the top.
		3. Watch any video.
		4. Watch any video. (Mobile).
2	Match (Runde 30)	1. Name all the teams that have 0 (zero) as the final score.
		2. What is the final score between Kristiansund and Haugesund?
		3. Name all the teams that have 3 as the final score (Mobile).
3	Timeline	1. Read the final score of the match.
		2. Read all goal scorers of the match and when was the goals were scored.
		3. Read the half-time score.
		4. Watch all the goal events on the timeline.
		5. Watch all “skudd” events by Kasper Aalund Junker (Mobile).

Table 4. 1. The list of tasks for user testing

To weigh the success rates of both interfaces, the questionnaire will track the responses from the participants using the scale number from 1 to 5 (Table 4.2). The scale to track the responses is as follow:

- 1: disagree
- 2: somewhat disagree
- 3: neither disagree nor agree
- 4: somewhat agree
- 5: agree

The scale of 1-5 will determine how the users agree or disagree with the statements listed on the user testing questionnaire. The questionnaire will be presented as an online questionnaire.

No.	**Questionnaire for New Interface**	**Responses**
	Visual presentation	1 2 3 4 5
1	I think the interfaces have good first impression.	◯◯◯◯◯
2	I think the interfaces have attractive visual garnishes.	◯◯◯◯◯
3	I was interested to look more the first time I landed on the page.	◯◯◯◯◯
	Usability	
4	The organization of the content on the interfaces are clear.	◯◯◯◯◯
5	I think the interfaces were easy to use.	◯◯◯◯◯
6	It was simple to interact with the interfaces.	◯◯◯◯◯
7	I felt comfortable when interacting with the interfaces.	◯◯◯◯◯
8	It was easy to find the information I needed.	◯◯◯◯◯

No.	Questionnaire for New Interface	Responses
9	The website layout is effective in helping me complete the tasks.	○○○○○
Emotion driving ability		
10	The design of the interfaces are emotionally pleasant.	○○○○○
11	I was enjoying my time when interacting with the interfaces.	○○○○○
12	I feel that the interfaces are sport interfaces.	○○○○○
13	I wanted to get out of these webpages immediately.	○○○○○
Page performance and Cleanliness		
14	I did not need to wait long to access the pages.	○○○○○
15	My eyes could breathe well when interacting with the interfaces.	○○○○○
16	I thought there are too much pollution on the webpages.	○○○○○
Overall user experience		
17	Overall, I had a good experience interacting with the interfaces.	○○○○○

Table 4. 2. Questionnaire Sample

4.2. Result

The results are presented in two parts. The result from both the current interface and new interface are presented in Table 4.3. The result shows the mean score of the 1-5 scale from the gathered answers from the user testing and the questionnaire. “Current” is defined as the current interfaces, while “New” is defined as the new interfaces.

No.	Questions	Result	
Visual presentation		**Current**	**New**
1	I thought the interfaces have good first impression.	3.12	4.44
2	I thought the interfaces have good visual garnish.	2.96	4.28
3	I was interested to look more the first time I landed on the page.	2.40	3.96
Usability			
4	The organization of the content on the interfaces were clear.	3.20	4.40
5	I thought the interfaces were easy to use.	3.64	4.12
6	It was simple to interact with the interfaces.	3.60	4.24
7	I felt comfortable interacting with the interfaces.	3.24	4.12
8	It was easy to find the information I needed.	2.92	4.28
9	The website layout was effective in helping me complete the tasks.	2.60	4.20
Emotion driving ability			
10	The design of the interface was emotionally pleasant.	2.68	3.92
11	I was enjoying my time when interacting with the interfaces.	2.80	3.88
12	I felt like the interface is a sport interface.	3.44	4.40
13	I wanted to get out of this webpage immediately.	2.56	1.68
Page performance and Cleanliness			
14	I did not need to wait long to access the pages.	4.60	4.80
15	My eyes could breathe well when interacting with the interfaces.	3.80	4.40
16	I thought there was too much pollution on the webpage.	2.36	1.84
Overall user experience			
17	Overall, I had a good experience interacting with the interface.	2.96	4.12

Table 4. 3. Result from current interfaces questionnaire.

For more detailed user experience results, table 4.4 presents the detailed result of the overall user experience, both current and new interfaces. The table shows the numbers of participants who scored the 1-5 scale. To present the result better, a discussion section presents in the next section to present a better insight.

	Current Interface					New Interface				
Overall User Experience	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
	0	8	11	5	1	0	1	1	17	6

Table 4. 4. Result specifically in User Experience.

4.3. Discussion

Positive outcomes were collected from the assessment. From the 17 statements on the questionnaire, all 17 are increased compare from both the current interfaces to the new ones (Table 4.3). Starting from the first two statements, all the participants found that the new design has a better first impression and better visual. These two categories can help to “invite” the intentions of the users to use the functions. In the usability, the participants agreed that the new interfaces are better, especially on statements number 8 and 9 on the questionnaire (Table 4.3). They agreed that the information is easy to find (number 8: current = 2.92 and new = 4.28) and the design helped them to complete their tasks (number 9: current = 2.60 and new = 4.20). Participants also found that the new design is more capable of giving better emotions to them, statements number 10 to 12 are increased by 1 point on all three statements (Table 4.3).

Both interfaces also shared close results on several categories. Participants agreed that they do not need to wait long to access from one page to another and their eyes could breathe well when having the interaction. They also found that there is not much pollution on both designs and they were not encouraged to leave the websites immediately (Table 4.3).

According to the result, statements number 1 to 16 on the questionnaire led to the final statement of overall user experience. Scores similarity were found from the result. Most of the scores on the questionnaire for the current interfaces are at 3 (range from 2.60 and 3.44) (Table 4.3), which is defined as “neither disagree nor agree”. On the new interfaces, the score on the questionnaire is dominated by 4 (from 3.88 to 4.44) (Table 4.3), which is defined as “agree”. This finding shows that survey statements from 1 to 16 have direct proportional to statement number 17 (overall user experience).

Besides the questionnaire, many data were also gathered through a short interview after the testing. Wide space on the match list page on the current desktop design was mentioned by 19 participants (almost 80% of 25 participants). On the mobile version of the timeline layout, more than half of the participants (15 participants) mentioned that there is too much text on the interface. The same case was also found on the scoreboard, 14 participants mentioned that they have difficulties in getting half-time and goal-scorers information when interacting with the current interface. According to these short interviews, wide space on match list, too much text on the timeline on mobile

interface, half-time, and goal-scores are the top three main issues that were mentioned the most. To gain additional data from the interview, we asked the participants which one of the interfaces (home, match list, scoreboard, and timeline) had the most improvement. 3 participants answered the homepage, 9 participants answered the scoreboard, and 13 answered the match list.

Several setbacks were found regarding the new interfaces. The color of the goal event might be an issue if the match is between Bodø/Glimt against Lillestrøm, which are both of them are carrying yellow as their club colors. When these both teams compete and score goals, the timeline will contain the same goal event colors on home and away teams. Four participants noticed that the buttons on the carousel on the homepage were a bit too “old-fashioned”. Placing arrow buttons on the very left and right side of the carousel was suggested by one of the participants. For several participants who have a device with 4K screen, the half-time and goal-scorer fonts are found to be quite small.

4.4. Summary

With most of the survey participants are not familiar with the Norwegian soccer league, there are several advantages that we could use. Because most of the participants are not familiar with soccer websites, they depended totally on the interface to complete the given tasks. This helped the assessment a lot in investigating if the design can assist users in using the functions and provide them the user experience.

Conducting user testing as the assessment was found to be very effective in assessing a website interface. Using numbers, we can investigate how big is the difference of the interfaces after the design effort. The numbers also helped us to determine if the objectives have been completed and finally give the answer to the research question.

The final result shows that the approaches of interaction carry the same score with user experience, the current interfaces at 3, and the new interfaces at 4. With the result suggested that there are direct proportional between the many approaches of interaction and user experience, the objectives set for this thesis have been reached, which led to the better web design. Thus solve the question that a better design can produce a higher level of user experience.

5. Conclusion

5.1. Summary

In this present day, the application of UX is highly recommended when designing a system, or product, or service. The research on this thesis is improving a design that can provide a better user experience. However, UX is a dynamic concept with a wide range of definitions, thus it is still far for us to achieve a complete understanding. With these challenges, we researched and developed an individual theory. The formed theory focuses on the elements which are impression, usability, content quality, and mobile robustness. By optimizing these elements, a better user experience can be achieved and presented to the audience. Although the built UX theory is far from perfect and way narrower than the published UX definitions, we managed to build one that is capable to help us in improving better interfaces.

An evaluation was conducted to find the flaws, weaknesses, potential elements that can be developed before the design phase. The design phase was conducted by building a design that will complete 4 design objectives, better impression, better design to increase usability, deliver better content quality, and provide mobile compatibility. The design of the interfaces was planned and done by placing them into 4 main categories, they are content management, color management, dynamic feature, and mobile robustness. This plan was aimed to create a design that improves first impression, usability, content quality, and mobile robustness. With all the elements were improved, a better user experience has been increased.

Building an accessible website was performed from the very beginning of the interface design. This practice helped us to determine what kind of accessibility feature we must apply when designing the interface. Better interface and accessibility fulfillment have been achieved at the same time when the design phase is completed.

To determine if the research has succeeded, we performed user testing as an assessment to determine if a better user experience has been provided to the audiences. The gathered result shows that the initial research questions have been answered through this thesis. the new interfaces are better in providing higher quality in impression, usability, content quality, and mobile robustness, which led to a higher level of user experience.

5.2. Contributions

As presented in the problem statement, we set 4 objectives to answer the research question we tried to solve throughout the tenure of this thesis period.

Objective 1: *a better design to give an impression.*

The completion of this objective has provided the users an attractive element that "invited" them to use the functionality we built for them. Impression can motivate the users' intentions to use our website.

Objective 2: *a better design to increase usability.*

The completion of this objective has provided ease of use to the users. The users have found it easy to use the function that is supported by a good design. Improved usability will motivate the users to use our built functions again in the future.

Objective 3: *a better design to deliver better content quality.*

The completion of this objective has provided sharp information deliverance to the users. Accurate and meaningful information are well presented to them. High-quality content will motivate the users to find information via our website in the future.

Objective 4: *a better design to provide mobile robustness.*

The completion of this objective has provided the same good design the users will have when using mobile devices.

Through the work done in this thesis, we learned that by improving to a better design, we can provide the interfaces that provide a better experience to our soccer fans. Specifically, we improved the web design using the objectives mentioned above. These objectives contributed to the improved web design and solved the research question we set at the beginning of this project.

5.3. Future Work

Updating a better understanding of user experience is very essential in designing a website. As mentioned, the UX theory in this thesis is still very narrow, the next project will integrate the building of user experience theory by adding UX knowledge from the latest conferences, forums, workshops, or similar activities that aim for the most updated definitions of UX. Although the unified view of UX is still lacking today, using the latest guidance can help us in updating the most current UX definitions. The most updated UX definitions are hoped to help us in building a better user experience.

In addition to forming the most updated UX, we would like to perform user testing before building the interfaces. User testing can continuously be used in the life-cycle of web development (Maguire & Isherwood, 2018). The importance of conducting user testing is because we must aware if our audiences are satisfied with our service (Tan et al, 2009). From the users, we can assemble all the gathered information to detect if our website is outdated, less experience, less attractive, low usability level, etc. Thus it can help us to decide what we need to improve or update. Using the most updated theory and feedback from the user testing can increase the possibilities of creating better designs.

The next design will also present a more specific design element about web performance. With the growth of technology, which provides us fast and advanced devices, the expectation of having fast information is also demanded. A fast-loading website most likely is more reliable and dependable considering the deliverance of information is faster (Kaur et al, 2016). One more possibility is using an evaluation engine named “Page Experience” by Google. Page experience is a set of signals that measure how users perceive the experience of interacting with a web page beyond its pure information value (Google). The engine will help us in designing and determining how good our web performance.

Specifically, in Reactjs, the next project will optimize an accessibility feature that has a function to announce page changes. Using the feature specially built for Reactjs, DOM elements like “CreateRef”, “Focus” method, “TabIndex”, and “aria-labelledby” are optimized to create the page announcement feature. When this feature present, when the user access a link and the new page reloads, a screen reader will provide the information that a certain page is active or has changed.

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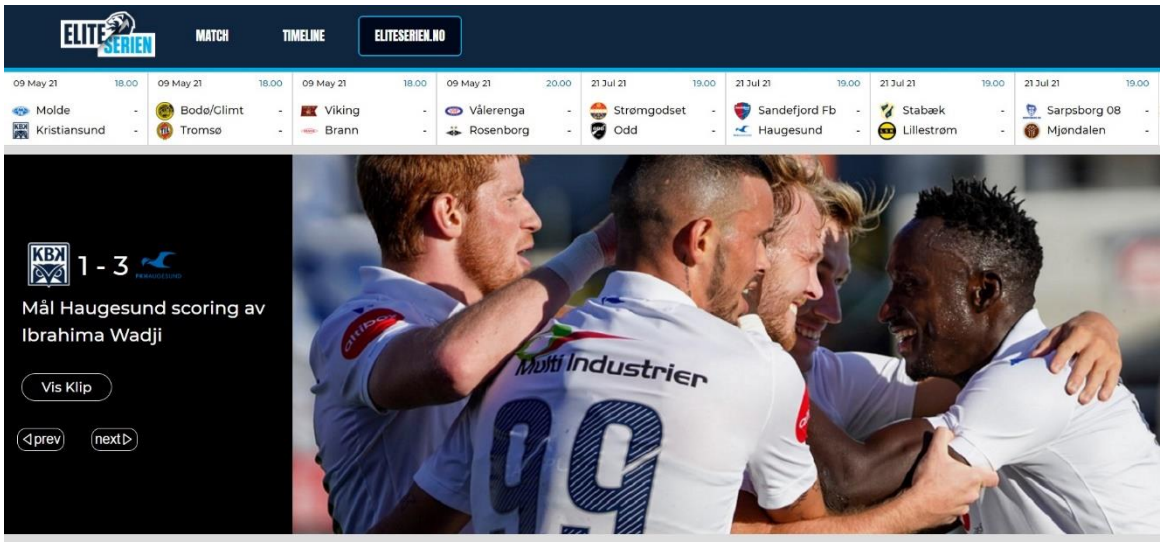
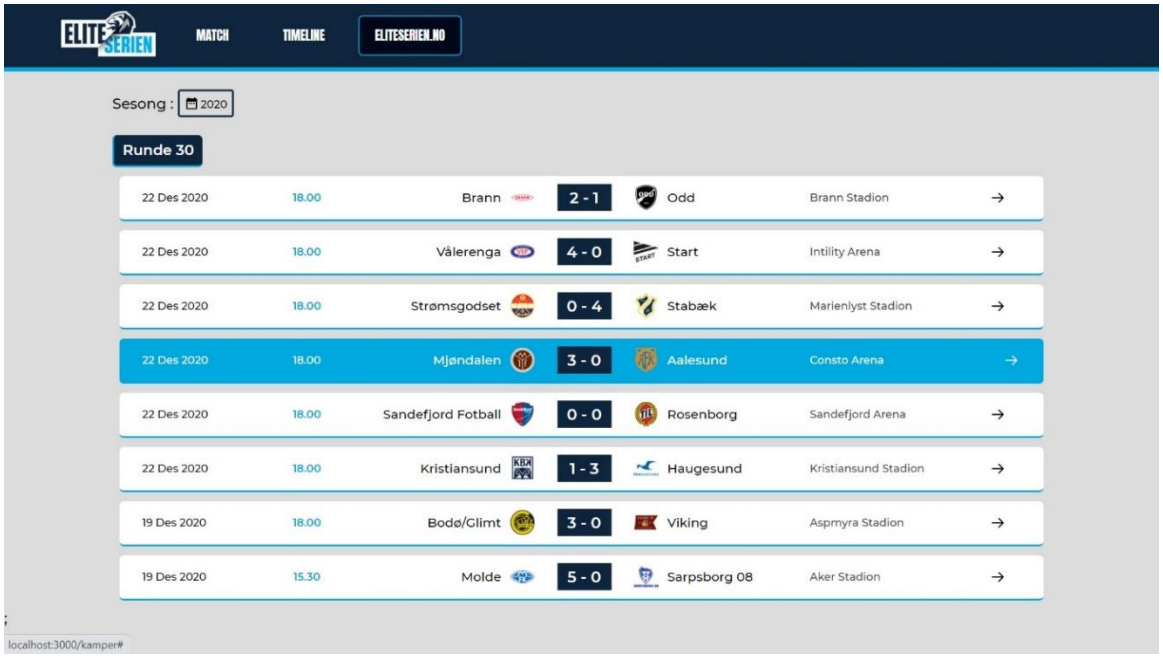
B. Appendices

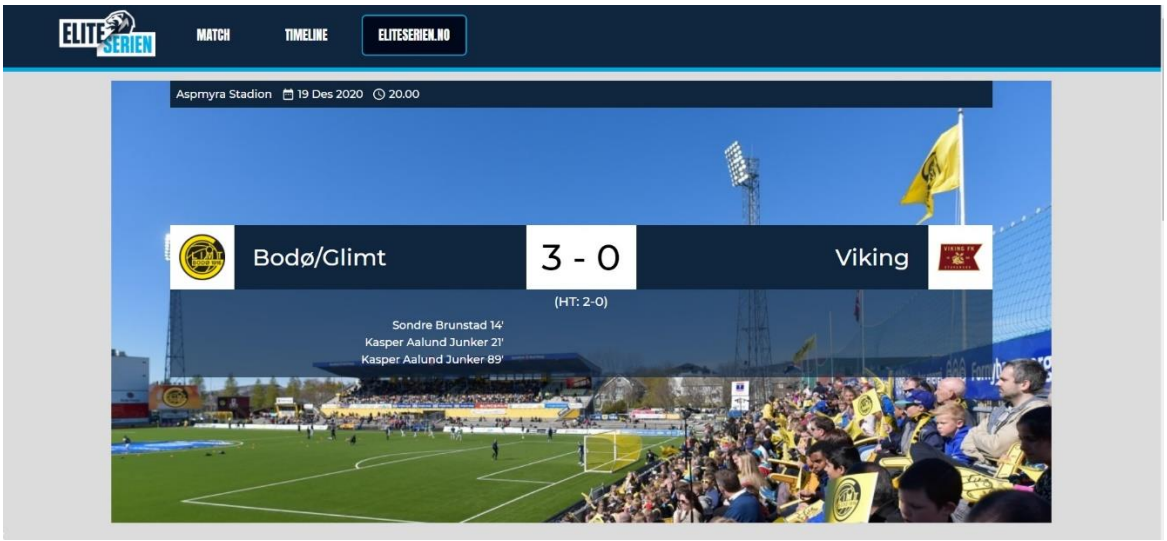
B1. Website Application

The web application is an artefact for this thesis. The artefact contains three pages, homepage, match, and timeline. The web application can be access by accessing this link [Eliteserien-thesis web application]

Screen capture of the pages:







The source code for the launched website application is located at github.com/ernest-pranoto/eliteserien-thesis

B2. Assessment Result

Current interfaces result is located at [Questionnaire result for the current interfaces]

New interfaces result is located at [Questionnaire result for the new interfaces]