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Realization of intended visual hierarchy in e-commerce web design

An eye tracking case study

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ABSTRACT:

The theory of visual hierarchy has been widely used in the field of web design, with the increasingly emphasized importance of UX-design in the e-commerce industry. As eye tracking technology has become a popular research method, the visual hierarchy of web pages has been studied from various perspectives. However, the domain lacks extensive research to determine the effectiveness of specific visual hierarchies in conveying intended information.

This thesis reports a case study to investigate the design of a selected e-commerce website, with a focus on visual hierarchy and viewing patterns. The study employs an eye-tracking device to examine whether the arrangement of design elements on the website leads to the desired viewing patterns and supports the company's intended commercial objectives.

The theoretical section of this paper discusses the ways in which the structural design of a web store can influence user attention and affect the customer’s journey within the page. The empirical part of the study begins with a case interview to determine the applied design strategy and intended outcomes of the design. This is followed by an eye-tracking experiment to assess whether practice aligns with theory and whether the website's goals are achieved in real-world conditions.

The findings of this study provide valuable scientific insight for the company by suggesting improvements to the website's design. These findings may also be generalized to other websites or interfaces with similar characteristics, contributing to scientific knowledge. Additionally, the accuracy of existing scientific knowledge in applicable contexts is discussed along with the implications of the results.

KEYWORDS: Eye tracking; web design; visual hierarchy; design strategy; user experience

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TIIVISTELMÄ:

Verkkokaupan käyttäjäkokemuksen korostuneen merkityksen myötä visuaalisen hierarkian teoria on saanut laajaa suosiota verkkosivusuunnittelun viitekehyksessä. Katseenseurannan kehittyessä ja yleistyessä tutkimusmenetelmänä, on sitä hyödynnetty visuaalisen hierarkian aihepiirissä huomattavasti. Kuitenkaan kirjallisuudessa ei ole kattavasti käsitelty visuaalisten asettelutapojen tavoitteiden toteutumista käyttäjien katseessa.

Tämän tutkielman tarkoituksena on selvittää, kuinka verkkokaupan sivustosuunnittelussa käytettyjen visuaalisten elementtien asettelu toteuttaa suunnittelijan tavoitteet asiakkaiden käyttäytymisessä. Katseenseurantalaitetta hyödyntämällä toteutettu tapaustutkimus pyrkii selvittämään, miten sivustoa katsovan huomio jakautuu elementtien kesken ja tukevatko havaitut katsekuviot suunnittelijan haastattelussa esittämiä tarkoitusperiä, liittyen sivuston visuaaliseen hierarkiaan ja halutun tiedon välittymiseen.

Tutkielma koostuu kirjallisuuskatsauksesta sekä empiirisen tutkimuksen raportista. Aiemman kirjallisuuden tarkastelussa määritellään keskeiset käsitteet sekä pohditaan, millä tavoin verkkokaupan visuaalinen rakenne ja asettelu voi vaikuttaa asiakkaan käyttäytymiseen ja kokemukseen. Empiirinen osa alkaa case-sivuston suunnittelijan haastattelulla, jonka jälkeen suunnittelijan tavoitteita vertaillaan katseenseurantalaitteella kerättyyn aineistoon.

Tutkimuksen tulokset tarjoavat case-yritykselle arvokasta tietoa hyödynnettäväksi verkkokauppansa kehittämisessä. Tuloksia voi myös yleistää muille sopiville käyttöliittymille, tarjoten tieteellistä aineistoa myös laajemman yleisön hyödynnettäväksi. Tutkielman päätteeksi raportissa pohditaan havaintojen suhdetta aiempaan tieteelliseen kirjallisuuteen.

AVAINSANAT: Eye tracking; web design; visual hierarchy; design strategy; user experience

Table of contents

Figures and tables

Figures

Tables

1 Introduction

Emphasis on the internet as a platform for communication and interaction between individuals and organizations has seen an exponential increase in recent decades. The implications of this phenomenon have had subversive effects on all aspects of life, and not the least in the context of commercial activities. Digitalization and the internet have sparked fundamental change in many industries, constantly creating endless opportunities for new business models to emerge and existing ones to transform in this digital era of electronic commerce.

The online business environment is fundamentally global for most businesses, at least in the e-commerce industry. Even though companies can choose to keep their target on only national or local markets, in most cases they can still face international competition from anywhere in the world, enabled by the internet. Consequentially, markets can be saturated with competition, and with the alternative costs for customers being virtually non-existent in any online business model, the importance of a well-designed user experience and a conversion-optimized interface has become axiomatically essential. If a web page design fails to satisfy a customer in any way, there are most likely dozens of competitors only a few clicks away for the customer to browse through in no time.

Studies have shown that the design of commercial websites can have a significant influence on the users' impression of the company (Oh et al. 2008). According to Badran and Al-Haddad (2018), user experience has an immense impact on customer satisfaction. For the purposes of commercial enterprises, properly designed user experience is therefore a key element of profitable business and according to Sward (2007), essential to achieving competitive advantage. In fact, marketing experts think that recent years have seen user experience become the strongest brand differentiator, overtaking price and product as the conventional ones (Walker, 2017; Bynder & OnBrand, 2020).

User experience and user behavior can be highly affected by the ways and the order in which important information is conveyed to the user. This order of importance is created by a designed visual hierarchy of structural elements and content, including pictures, fonts, colors, and other layout decisions.

A user's journey on a web page is formed by their viewing patterns across elements and the simultaneous cognitive process that guides their attention, decisions, and actions. This part of the customer journey can be steered by a structural hierarchy design between the page elements and content. Thus, visual hierarchy has an immense impact on user experience, including the potential to guide the user towards desired decisions that support the commercial objectives of the service provider.

According to studies, eye movement can also have subconscious down-stream effects on the user's decision making (Holmqvist et al., 2021). Therefore, a visual layout designed to guide the viewer's eyesight and attention, and to convey information according to the website's objectives is of utmost importance and an essential part of a successful user experience design. As such, the importance of related research and knowledge is extremely emphasized in all web design regardless of its purpose.

1.1 Objectives

This thesis is a case study of a commercial web page, with a focus on visual hierarchy and design objectives. This study seeks to determine whether the applied web design principles regarding visual hierarchy and the positioning of information produce intended outcomes, and to find out whether the realized viewing patterns and user attention on the page are in accordance with the design strategy intended to carry out the company's commercial objectives. Thus, the research questions are:

1. How are the designer's intentions reflected in the viewing behavior of users?

2. Does the design involve any properties that may impede commercial performance?

The initial objective of this paper is to form an understanding of the state of the visual hierarchy on the case web site in relation to the company's design objectives and use eye tracking to generate suggestions to improve their website design and overcome possible problems that may have a negative influence on their commercial performance. Further on, this study aims to contribute to a wider audience concerned with both practical and academic efforts in the context of interface design, by generalizing the findings to the widest possible range of interfaces with similar characteristics and objectives.

1.2 Motivation

Despite the growing interest among researchers and the increasing use of eye tracking to conduct research in the field of interface design, the scarcity of research about the realization of design choices with commercial intentions by examining the viewing patterns of users is the fundamental motivation for conducting this experiment, as elaborated in the literature section of this paper.

A more specific motivation to this study is the case company's concern about the inefficiency of their webstore. The business owners believe that their webstore is currently not realizing its entire sales potential, possibly resulting from inadequate design choices on the page. Thus, this study aims to determine whether users' viewing behavior on the site indicates an underperforming visual structure and produce guidelines or suggestions for the company to improve their website to take full advantage of their sales potential.

In general, conducting eye-tracking research about e-commerce web design is important because it helps identify what elements of a webpage are capturing user atten-

tion and which are being overlooked. This insight allows designers to make adjustments that can help improve customer experience, increase conversions, and ultimately generate more revenue for the business. Eye tracking also offers valuable insights into user behavior such as where they look when on a page and how long they focus on certain elements, providing an understanding of user preferences in terms of layout and design.

The problems faced by the case company are most likely not unique, and spark interest to study the principles applied in web design in a more general sense. There are countless other small business websites that also benefit from such knowledge emerging, emphasizing the importance of this study and providing motivation.

1.3 Scope

Websites can serve various purposes. The scope of this study is limited to the commercial ones designed by business enterprises with the purpose of selling products or services and making profit. More specifically, this study focuses on one selected case website.

However, the findings of this study are also generalized to cover a wider range of websites with similar objectives and characteristics. Thus, the perspective of this paper emphasizes economic gain, as justified by the business administration degree acquired with this thesis study. Other perspectives to web design are beyond the scope of this paper.

The empirical side of this study is conducted using an eye-tracking device, as justified in the methods section of this paper. Consequentially, focus within the concepts of design is limited to phenomena that can be studied and measured using an eye tracking device. As such, other forms of data or phenomena cannot be properly addressed within the confines of this case experiment.

1.4 Structure

This thesis constructs between a combination of theory and empiricism as shown in Figure 1. The remainder of this paper is structured as follows: First, a literature review is conducted, analyzing the existing scientific knowledge to form a basis for further analysis. The theoretical part focuses on defining central concepts and seeks to find out how visual hierarchy affects users' viewing patterns on a web page and how design elements can affect the user's perception of websites according to current knowledge.

In order to fully understand the design and functionality of the target webpage, it is necessary to conduct a thorough analysis from both a theoretical and practical perspective. From a theoretical standpoint, this involves examining the principles of visual hierarchy and the ways in which they can be applied to create a cohesive and effective web design. Additionally, it is important to consider the specific goals and objectives of the business in relation to the design of the webpage, as these will influence the overall strategy and layout of the page.

To gather more detailed insights about the design of the target webpage, it is also useful to conduct a case interview with the designer of the page. Through this interview, we can gain a deeper understanding of the intended outcomes of the design strategy, as well as the specific elements and techniques that were applied to create the website. This will allow us to better understand the thought process and reasoning behind the design choices made, and how these choices align with the scope of the business.

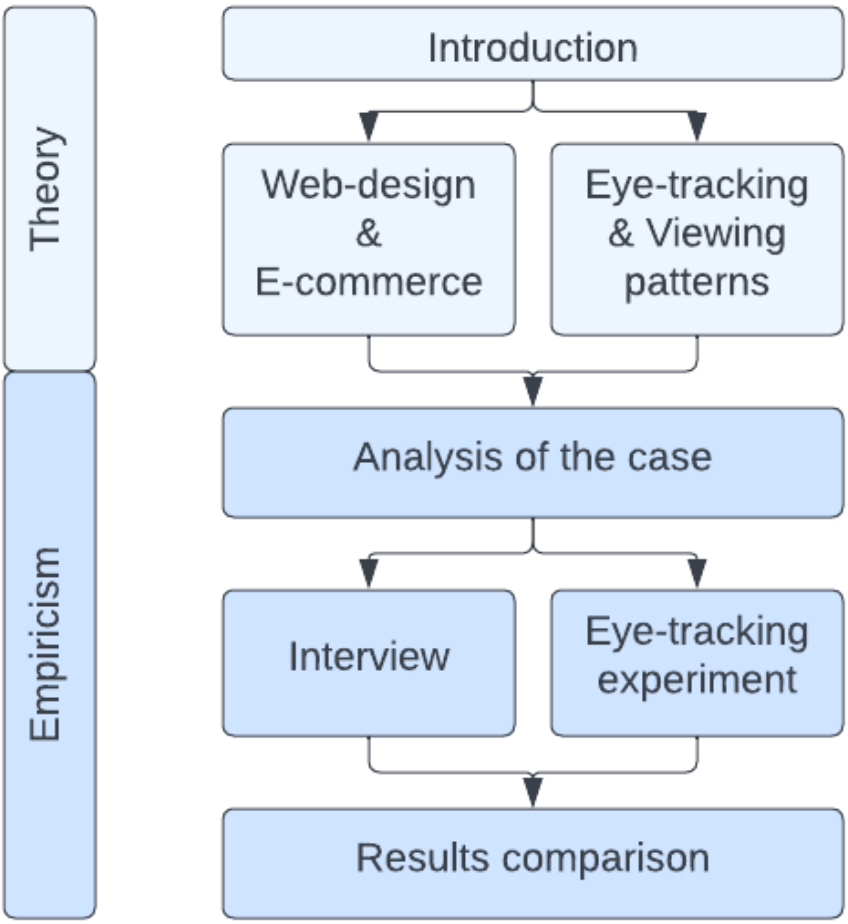

Figure 1. Thesis structure

The empirical part of this study aims to compare the results of the case interview with data from an eye tracking experiment, which is designed to test whether the intended objectives of the webpage design are realized in the viewing patterns of actual users. This experiment allows us to observe how users interact with the webpage and to identify areas of the design that are effective in achieving the intended outcomes, as well as areas that may require further attention or improvement.

The results chapter of this study presents a synthesis of the findings from these sources to provide an answer to the research question. This is followed by a discussion of the

implications of these findings for the company, including recommendations for how they might improve the design of their webpage.

In order to contribute to the broader field of web design, the findings of this study are generalized to a larger context, allowing us to draw conclusions that are applicable beyond the specific case being examined. Finally, the paper concludes with a summary of the key answers to the research questions and an evaluation of its contributions to scientific knowledge in the field of web design.

2 Theoretical framework

This chapter presents an overview of previous literature to form a basis for the empirical study presented later. To this end, the literature review focuses on discussing and defining central concepts, such as common design objectives and strategies, terminology, visual hierarchy, as well as how design choices affect user experience and behavior. Secondly, the latter section of this chapter dives into the literature about eye tracking and how this method can be useful in conducting research about web design and visual hierarchy.

2.1 Literature

The importance of web site design and a positive user experience has become rather axiomatic as a result of the constantly accelerating emergence of online commerce. As the magnitude and significance of the e-commerce industry has exponentially increased, so has the demand for reliable scientific knowledge. With a growing emphasis on the significance of understanding user behavior in relation to design choices, recent years have seen an increase in research using eye-tracking, as well as a growing body of literature focusing on the various topics related to web design.

Research in web design has focused on the use of eye-tracking to analyze user behavior, identify usability issues, and improve interface design (see e.g. Vasseur et al., 2023; Still et al., 2020; Hernandez, 2013; Djamasbi, 2014). However, eye tracking has yet to be utilized in case studies about the effectiveness and performance of specified design strategies and visual hierarchies, where research in general has been dearth. This study aims to fill this gap by examining how a particular case of visual hierarchy design performs as an implementation of commercial objectives.

Another popular domain of scientific literature among researchers on this topic is the abundance of theories about cognitive behavior and bias, the findings of which have

been applied in web-design, as well as other means of visual presentation (e.g. serial position effect or the information processing theory). In addition to research, there are many books, articles, and blog posts related to the topic. These resources provide insights into current trends and best practices, as well as guidance for implementing eye-tracking in related studies.

2.2 Terminology

The prevalent terminology in both practical and academic discussion within the domain of interactive systems design can often seem replete with interrelated concepts and versatile definitions technically aloof from each other, yet ambiguous in their apparent redundance. This ambiguity, attested by frequent remarks by researchers (Berni & Borgianni, 2021; Quaresma et al., 2022), insists on the unequivocal explanation of concepts being discussed.

A website that aims to facilitate or promote commercial transactions is essentially a virtual interface acting in support or in place of a physical store location. The ISO standard defines the term user interface (UI) as “all components of an interactive system (software or hardware) that provide information and controls for the user to accomplish specific tasks with the interactive system” (ISO 9241-210, 2019). To this end, UI-design can be interpreted as the process of determining the quality, quantity, function, content and positioning of components on an interface.

Usability is defined as the “extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” (ISO 9241-210, 2019). Despite being used indistinctively by some, usability is more often seen as a confined component of a more comprehensive concept, called user experience (UX) (Rusu et al., 2015).

According to Morville's (2004) UX Honeycomb model, user experience extends beyond usability by including six additional measures: accessibility, desirability, value, credibility, findability, and usefulness. As defined by the ISO standard, user experience consists of "a person's perceptions and responses that result from the use and/or anticipated use of a product, system or service" (ISO 9241-210, 2019). Thus, user experience, as the name describes, is the entire experience of interacting with a system, including all possible effects that the user perceives from using the interface.

As such, the concepts of user experience, user interface and usability are all equally concerned with and shaped by the overall functionality, structure and content of a system. Despite the segregating nuances within definitions, UX/UI-design is frequently conceived as a single hypernym for interface design related terminology, and the context of this study speaks to the plausibility of condoning such an abstracted aggregation of definitions.

To this end, UX/UI-design is closely related to the term web design widely used in this report. Conceptually, web design can refer to either the process of creating a web site or the outcome of said process, with some inconsistency in definitions connoting varying attributes of the site's technical implementation often considered separately as web development. (Romano, 2023; Christenson, 2013).

The Interaction Design Foundation defines web design as a process, acceding to a somewhat circular definition: "Web design refers to the design of websites", with the apprehension that it affiliates with the perusal of user experience rather than software engineering, substantiating the conceptual distinction between design and development (Interaction Design Foundation, 2016).

For the purposes of this study, web design can be discussed as being both the process and the outcome of actions taken to research, determine, and construct the visual aspects of applicable components and content to be deployed as part of an interactive

online presentation with the aim of commercial functionality. Hence, the success of web design, as discussed in this thesis, embodies success in user experience, user interface, usability, and other relevant factors, although limited to the visual appearance of the site.

2.3 Commercial web design

The fundamental objective that guides the management of a web store is to maximize sales and profit generated for the company. While there are various means of improving commercial performance, developing the website's design related aspects is recognized as an effective one.

The relationship between web design and store performance has been well established in research (Guo et al., 2023; Palmer, 2002), as design quality has been shown to have direct positive effects on customers' perception and purchase decisions (Faisal et al., 2017; Liang & Lai, 2002; Song & Zahedi, 2001). Web design also affects usability (Lee & Koubek, 2010; Pengnate & Sarathy, 2017) as well as the overall user experience (Caldiroli et al., 2017), which have been identified as some of the most important indicators of success for online commerce. (Badran & Al-Haddad, 2018; Sward, 2007; Walker, 2017; Bynder & OnBrand, 2020.)

A key aspect in successful web design is to form a well-defined strategy to meet the specified objectives and achieve desired outcomes (Ghandour & Benwell, 2007). While the most appropriate or effective measures to improve a web site's design depend on the store's previous performance with respect to its current state of design, some of the common primary objectives of web design in the context of e-commerce are maximizing conversion rates and improving user engagement, while enhancing brand perception and trust.

The findings of Gabir and Karrar (2018) identified usability, system quality and information quality having a direct effect on websites' conversion rates, whereas Hernández et al., (2009) recognized ease of navigation as an important factor affecting conversion. The use of images has been linked to improved user engagement on digital interfaces (Li & Xie, 2020), while Oh et al., (2008) explored the possible effects of design choices on web store image and expectations of quality, finding a positive relationship to both.

Case-specifically, the objectives of web design can be more detailed and unique to reflect the context, however, researchers have underlined the importance of goals that are clearly defined, relevant and measurable (Schaupp et al., 2006). Common measures employed by web designers to achieve their objectives include improvements in layout design, navigation structure, and content presentation. The context of this study justifies the reasonability of considering these measures from the perspective of visual hierarchy.

2.4 The experience of visual hierarchy

The theory of visual hierarchy, introduced by Faraday (2000), suggests that web pages are viewed and processed in a hierarchical sequence of perception, in which elements have differing priorities. The theory builds upon the suggestion that the process of reading a web site consists of two phases: the search phase and the scanning phase, referring to the user's initial efforts to find an entry point, and the subsequent extracting of information around this point.

As further explained by Faraday, the first phase of this process, search, is influenced by the characteristics of the following attributes: motion, size, images, color, text style, and position. The following phase of scanning can be affected by the relationships between elements by altering their grouping, proximity and reading order. Thus, visual hierarchy in its essence is an ensemble of elements comprised of varying combinations of text, images, sizes, colors and formats. Together with these characteristics the rela-

tive positioning of elements forms patterns and groupings appearing on the page to achieve a strategic sequence of conveyed information. (Faraday, 2000).

Although Faraday's model has been widely used as a guideline for web design, Still (2018) demonstrated justified criticism of it for being incompetent in predicting entry points, and advised against its use. However, this criticism does not erode the validity of Faradays description of a perceived sequence of priorities within a web page, besides the fact that details of elements and attributes are always to be considered in context when applying models such as Faraday's.

The Interaction Design Foundation describes the visual arrangement of elements as a way of controlling the delivery of user experience (Interaction Design Foundation, 2016), as well as Djamasbi et al. (2011) regard visual hierarchy as an important aspect of the experience perceived by users on websites. By creating a distinct visual hierarchy, designers can guide the viewer's attention (Faraday, 2000) and help them to navigate their way to desired content (Djamasbi & Hall-Phillips, 2014).

Overall, the literature suggests that the use of a well-designed visual hierarchy is a critical component of web design, as it can amplify the effectiveness of the design and promote the extent of desired properties in a web site. However, regardless of design efforts, visual hierarchy is subjective by definition and as such, ultimately defined individually by every viewer. Hence, it is the scrutiny of users' viewing behavior that reveals the extent to which a visual hierarchy succeeds to realize the intentions behind it.

2.5 Eye tracking in web design research

2.5.1 Background

The utility of eye tracking technology is to gather data to examine the details of human ocular behavior. As such, it can be used for several different purposes and fields of re-

search from medicine to advertising and, of course, all forms and purposes of visual design. The repertoire of available equipment is wide which, as well as the technical functioning of these devices is further examined in the methods chapter of this paper. (Cummins, 2017).

Eye-tracking has been used to study web design since the early 2000's and has become an important tool for understanding how users interact with websites. By measuring the movements of the eye and analyzing patterns of gaze, eye tracking enables researchers to identify the areas of an interface that are most likely to attract the user's attention and to determine the effectiveness of different design elements in guiding user behavior.

Eye tracking has gained increasing popularity as a research method in the field of information systems design (Riedl et al., 2020; Vasseur et al., 2019), and is an invaluable source of insight as it allows researchers to understand how users actually view and interact with interfaces, as opposed to what they may think or report doing. As noted by Djamasbi (2014), conducting eye tracking tests without asking the viewer to say anything or comment about their behavior during the test, allows for a less distracted user experience and results in more reliable data. (Djamasbi, 2014).

The findings of Vasseur et al. (2019) pointed out that a large amount of the research on information systems using eye tracking has been focused on visual design. In their extensive literature review into eye tracking research in information systems development, Vasseur et al. (2019) groaned about the concentration of used methods despite broad research themes, concluding that almost all eye tracking research in the field is quantitative. Inspired by their call for more comprehensive use of different analysis methods, the case experiment presented in this paper is a qualitative study aiming to produce explanatory results.

Eye tracking has been used in research specifically about web design and visual hierarchy by authors like Djamasbi et al. (2011) and Pan et al. (2004). However, this field also seems to suffer from the same lack of imagination regarding different methods of analysis, as the research is predominantly quantitative and frequently uses the same metrics, limiting the research field to its basics, as described by Vasseur et al. (2019).

A prominent theory that is widely used in web design and visual hierarchy is the F-Pattern theory, a concept developed by the Nielsen Norman Group using eye tracking. This theory claims that users tend to scan web pages in an “F” shape, initially focusing on the top left corner of the page and then looking downward at a slight angle before moving back up towards the right side of the page. The end result is an “F” shaped pattern of navigation as users try to identify important information quickly. (Nielsen, 2006).

The F-pattern theory has been approved by later studies (e.g. Shrestha et al., 2007; Chaparro et al., 2007), and It has been widely used as a basis for website design since its introduction (Steane, 2023), with developers looking to emphasize key content within this area so that it is more likely to be seen and to receive perceived importance by visitors when navigating the site.

The most common alternative theories with similar application are the Z-shaped pattern and the Gutenberg pattern. The Z-pattern is very similar to the F-pattern theory explained above, only being in the shape of the letter Z, whereas the Gutenberg approach portrays more distinct characteristics as displayed in Figure 2. The Gutenberg diagram assumes a viewing path along the reading gravity which is drawn diagonally, strarting from the top left corner from where the view of the user moves in sweeps on the axis of orientation, and gradually declines towards the bottom right corner. (Eldesouky, 2013).

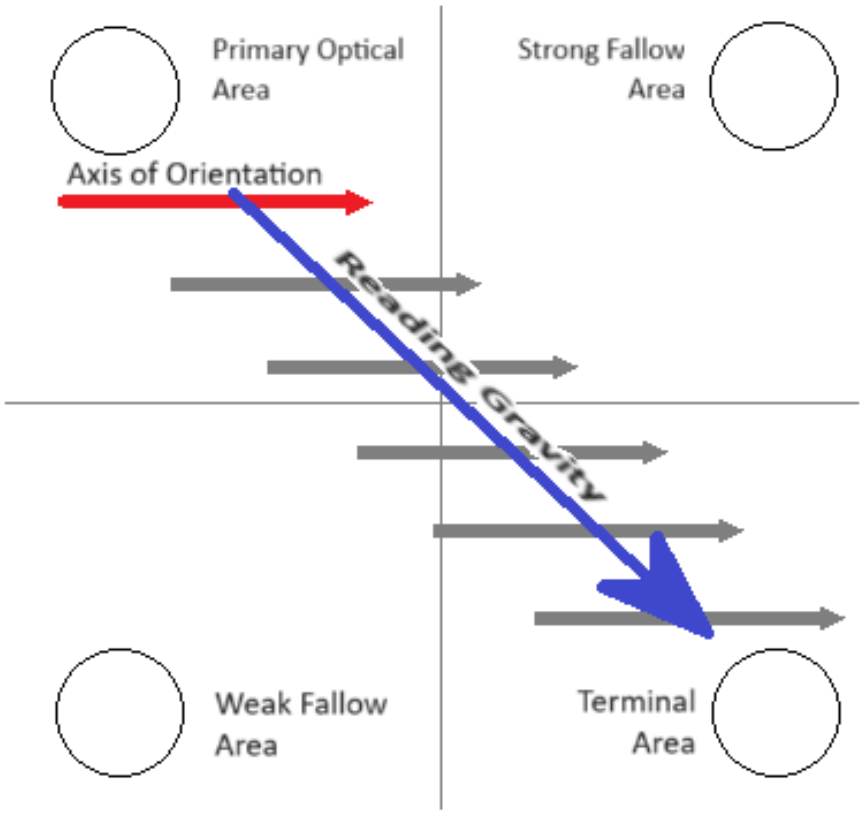

Figure 2. Gutenberg diagram (Eldesouky, 2013).

The use of a Z-shaped hierarchy is proposed to be successful for pages with low information density (e.g. a company homepage meant to act as an advertisement), as the F-pattern is said to be more suitable for text-heavy pages (Hernandez, 2013). The Gutenberg pattern has been suggested to be the most effective for landing pages in online commerce, as Hernandez (2013) also found an association between use of the Gutenberg pattern and an enhanced conversion rate.

Eldesouky (2013) argues that an effective implementation of the Gutenberg diagram on a web store layout can be achieved by positioning the logo of the company in the primary optical area, having relatively important content along the reading gravity, and a call to action on the terminal area. According to the diagram, the strong and weak

fallow areas are easily overlooked, advising against positioning important information on them.

In fact, both the F and Z-shapes also embrace the conception of users viewing patterns starting from the top left corner of the page, being natural for the western reading orientation (Eldesouky, 2013). Therefore, it is safe to assume that the top left corner of the page is a good position for something that embodies the page identity, regardless of the rest of the page design.

The visual complexity of web site layout has been proposed to affect the shape of viewing patterns, as Djamasbi et al. (2011) argued that the F-shape is often witnessed on simple layout structures but described its occurrence having negative correlation with increased complexity. This notion could imply that the effective use of the F-pattern to design visual hierarchy requires certain degree of simplicity in the structure.

A frequent finding in eye tracking research is that there is variation in the scatteredness of viewing patterns across different levels of complexity in the visual hierarchy of a webpage. Djamasbi et al. (2011) found, that complex visual hierarchy resulted in more scattered data of viewing patterns as opposed to previous studies examining less complex designs of visual hierarchy. Likewise, Pan et al. (2004) discovered variations of scatteredness depending on complexity of the website in their scanpath analysis, rationalizing the argument that the simplicity of design leaves less room for variation, increasing the consistency and predictability of user behavior and thus making it easier to create a well-functioning visual hierarchy, regardless of the intended pattern.

In addition to pictures in general having a notable influence on users' attention and the visual hierarchy, the findings of Tullis et al. (2009) presented strong evidence for people being drawn to faces on websites. In an extensive study, they concluded that even small images of faces received substantial numbers of gaze points in eye tracking tests,

reasoning the phenomenon with the biological priority of face recognition among subconscious cognitive processes.

Research by Djamasbi et al. (2012) came to a similar conclusion about faces on websites, and as Tullis et al. (2009) state, this calls for extreme caution in the selection of the image content, as faces are likely to distract the viewer from its surroundings. Thus, image content, especially ones with people and faces in them, should always be relevant considering the interest of the intended visual hierarchy.

In conclusion, the key findings from studies that have utilized eye tracking technology to analyze user interaction with webpages constantly seem to promote simplicity of structure, careful use of images, and the correct use of established viewing patterns that users tend to follow as effective design practices to create compelling visual hierarchies in web content.

2.5.2 Metrics

Eye-tracking devices can be used to study various different metrics to determine different kinds of things. The basis of most metrics studied in eye-tracking are fixations and saccades. These fundamental elements of eye movement form the basis of further analysis methods, like scanpaths, heatmaps or areas of interest (Hauser et al., 2018).

A fixation is the event where the eye stops and stays still for a relatively long time as a person is viewing a specific point and processing it (Holmqvist & Andersson, 2017). Hauser et al. (2018) argue that fixations are good predictors of attention, however, a fixation does not necessarily guarantee cognitive processing of information in the point in question. Shojaeizadeh et al. (2016) found that the length of fixations reflects the amount of cognitive effort and workload, and as explained by Cummins (2017), the anatomy and mechanics of the eyes reason the conception that fixations can be interpreted as attention, or at least correlate positively to it with their quantity and length.

With common sense, it is clear to assume that a fixation is at the very least a prerequisite of attention. Thus, fixation length and dwell time are important measures to consider, however, Cummins (2017) emphasizes the importance of considering the context of data in the interpretation of these metrics. In the context of web sites, the lengths of fixations are logically decent approximate measures of the viewer's attention and the complexity of the viewed information. The longer one must focus their vision on something, the more likely that something is either complicated to process or interesting in some way. From the same reasoning, the number of fixations on a certain point or area can be similarly regarded as an important measure of attention, interest, and complexity of the content.

Saccades are the moments in between fixations, when the eye moves rapidly, shifting the focus of the view from one point to another (Purves et al., 2001). These movements of the eye are extremely fast, even to the extent that it is believed that the viewer is completely incapable of detecting or receiving any visual information during them (Holmqvist & Andersson, 2017). This means, that in the context of web design, placing information or elements in between the areas that grab more fixations, could possibly lead to the viewer being blind to that information. Thus, saccades are an important metric in determining the relationships between design elements and their relative positioning.

The combination of fixations and saccades together form a route of the eye movement conducted to view something, also referred to as a scanpath (Holmqvist & Andersson, 2017). Scanpaths, involving both fixations, saccades and their relation to each other, are extremely useful in web design research, because they can be used for analyzing the interestingness and complexity of elements, the order in which the viewer perceives information on a page, and which elements or content draws attention and interest in relation to its surroundings.

Another form of visualizing eye-tracking data is a heat map, which can be very useful in analyzing user behavior. A heat map is a graphical representation of the distribution of gaze points, using different color gradients (green, yellow and red) laid over the presented image or web page. This map can effectively visualize the distribution of users' attention between elements. (Djamasbi, 2014).

According to research, viewers often scan a web page to find entry points, allowing them to receive information around them (Faraday, 2000). Djamasbi and Hall-Phillips (2014) argue that a clear visual hierarchy makes entry points easier to identify, making webpage navigation less complicated for the user. A heat map can be a useful tool for determining how these entry points are being found by users and if the design promotes thorough inspection of the website. (Djamasbi, 2014).

Eye tracking studies can be conducted using areas of interest (AOI) (Hauser et al., 2018). Using this method means that certain elements or areas are determined to be the focus of the analysis. Assigning specific areas as AOI's allows to study the number and length of fixations and saccades that happened in and between those areas.

Thus, the AOI technique is very useful in studying visual aspects of web content and the importance and positioning of different elements. This technique can also be done with points of interest (POI) or data of interest (DOI). In the context of web design, the AOI method is the most suitable one considering the graphical representation and visual hierarchy of the page structure. As utilized in the experiment presented in the latter sections of this paper, the AOI method and the following five metrics related to it are of significance: time to first fixation (TTFF), first fixation duration, dwell time, revisit count, and the number of saccades.

Time to first fixation means the time that it takes for the viewer to gaze at an element from the stimulus onset. This metric can be interpreted to determine whether an element or area is effective in drawing attention or not. Thus, if the TTFF value is small

(short time from stimulus onset to fixation on target) it means that the target area has something that catches the attention of the viewer quickly. On the other hand, a high TTFF value would mean the area does not exhibit attention grabbing properties. (Byrne et al., 1999).

The first fixation duration metric tells how long the first fixation on an area lasted, providing important information about the first impressions made by different AOI's and how much attention a particular spot initially received. As longer fixation durations have been associated with higher cognitive effort and workload (Shojaeizadeh et al., 2016), together with a low TTFF value, a long first fixation duration on an AOI can be an indicator of very attention-grabbing content.

Dwell time indicates the time that the user spent looking at a particular area of interest. A relatively long time spent on a particular area can indicate strong interest and focus on its content, whereas a short dwell time might mean that there are other interesting elements in the proximity that might distract the viewers' attention. (Joseph & Murugesh, 2020).

Revisit count is an important metric to consider, however, it offers different interpretations. The number of revisits tells how many times the user returned their gaze on a particular area of interest (Holmqvist & Andersson, 2017). On one hand, frequent revisits on an element might indicate pleasant or interesting content, but it may as well result from the information being confusing or complicated in some way. A lower number of revisits, on the other hand, might mean that either the content was not interesting enough to be viewed again, or that it was simple enough to be understood on the first gaze. Despite this ambiguity, revisit count can still be a useful metric, when interpreted considering the characteristics of the content in the target area.

Saccades are rapid movements in between fixations, which can occur either voluntarily or involuntarily (Joseph & Murugesh, 2020). The number of saccades within an area of

interest is naturally affected by the size of the area and the amount and positioning of its content. A large area with different elements in it will likely record more saccades than a small one with fewer elements. The number, length and amplitude of saccades within the area can be interpreted to determine the nature of users' viewing behavior, as a high number of long and fast saccades may indicate skimming. Skimming in this context means that the user is not focusing on details, but rather looking around to get an overview and to find something worth more scrutiny. This, combined with a low dwell time could mean that the user did not find anything interesting enough to focus on.

3 Methodology

This thesis study is conducted as a qualitative empirical case experiment, using an eye-tracking device to gather data about the user behavior of five participants. Eye tracking was chosen as the main research method for its advantages in providing data on how the users interact with websites, instead of what they may think or report.

This chapter describes the methods used to conduct this thesis study. The main focus is on clarifying the details of the eye-tracking experiment applying the reporting guidelines gathered by Holmqvist et al. (2021). To form a basis for the study, the business owner who designed the website was interviewed to determine the design choices and objectives of the case website. The findings were then compared to the insights obtained by analyzing the eye tracking data to see whether the current design supports the objectives and how it could be improved.

3.1 Interview

The analysis of the case website was conducted by interviewing the business owner, asking open-ended questions that allow the respondent to elaborate on their design choices and the objectives of the website as part of the company's business. The interview was conducted as an unstructured conversation via a video call over the duration of around 40 minutes. A possible limitation of the interview method in this context is that the data quality is dependent on the interviewee's design-related knowledge and expertise, as well as their ability to disclose and present the company's objectives and their applied web design strategy. In this case, the interviewed business owner had a comprehensive understanding of the business, but was not an expert in design principles, which was considered in the process.

3.2 Eye tracking experiment

Eye-tracking data can be used to determine different characteristics of the participant or the target of their view. This study focuses on the characteristics of the webpage that the user is viewing, constituting a framework of metrics and methods, within which the study should be conducted. There are numerous different methods that can be used in eye-tracking studies, and researchers constantly emphasize the need to determine the suitable ones for the case in question before conducting any experiment. (Hauser et al., 2018; Holmqvist & Andersson, 2017).

This study is conducted by assigning areas of interest (AOI) to compare different elements, considering whether the element is receiving the desired attention regarding its information content's priority in the objectives of the page. The AOI's were analyzed using multiple metrics based on fixations and saccades. A heatmap presentation of the data provides additional information on how much attention these elements received compared to the rest of the page. A scanpath analysis was not used in this study because of an insufficient sample size (Eraslan et al., 2016).

3.2.1 Participants

Five male participants between the age of 20-30 were recruited in accordance with the target demographic of the website. Three of the participants were active skateboarders, and two had little or no experience in the sport. Two of the participants had glasses, which did not constitute a problem with tracking their eye-movements. None of the participants had participated in an eye-tracking study before and did not have any expertise in human computer interaction. All participants reported having experience in online shopping and being familiar with the common functionalities of webstores. However, none of them had visited the case website before.

3.2.2 Instructions

Due to the nature of the study, it was important to obtain an understanding of the natural user behavior considering how the elements on the page carried out the objectives of the store. Thus, the experience was made as realistic as possible, as if participants were browsing at home. The experiment was started by describing that the participant had searched for a skateboarding store online and had ended up on the case website.

The participants were instructed to imagine themselves as either wanting to start skateboarding or needing to buy new gear, depending on whether they were already skateboarders or not. After the test, the participants were asked questions, including what the store was like, where it was located and what the product selection was like, to gain an understanding of how different information was conveyed to the user in a realistic browsing experience. These answers were then compared to the data of their eye movements.

3.2.3 Apparatus and setup

The experiment was intended to be as close to a real-life scenario as possible, thus using the same kind of hardware that the participants would use at home. The test was conducted in a classroom-like environment with a desk and an office chair, but the room had a more relaxed and comfortable atmosphere with some decorative furniture, a sofa and some gaming consoles. The environment was familiar to all the participants, and one where they could imagine casually browsing online stores.

The experiment was conducted using a Tobii Pro/Nano single camera eye tracking device which tracks both eyes with a sampling frequency of 60 Hz. Other hardware included were a desktop computer, a 22” computer screen with a resolution of 1366 x

768 and standard settings, a keyboard and a mouse. The data collected with the eye tracker was analyzed using the iMotions Lab -software.

The Tobii Pro/Nano is a remote eye-tracking device, as opposed to a head mounted one. A remote eye-tracker is practically a camera device mounted to a computer screen, which casts an infrared light onto the viewer's eye, and then calculates data from the infrared reflection to track their eye movements and other parameters. The remote device was chosen over a head mounted one for its advantages in studies related to using computers and digital interfaces (Hauser et al., 2018). The remote eye tracker is simply a camera device on the bottom of the screen, allowing the test user to use the computer normally without having to wear or apply any distracting gear. This allows for the situation to be as comfortable as possible, and the environment closer to a real use-case scenario, minimizing errors and increasing the reliability of the collected data.

The remote eye tracking device requires precise calibration. As the test user can move freely without any physical connection to the device, the calibration may be very sensitive to distractions such as head movement. Hauser et al. (2018) warn that movements of the participant may cause a drift resulting in noisy or even useless data. Another problem may be constituted by the test users' varying personal characteristics regarding their eyes and eyelids.

According to the Tobii Pro/Nano user manual, the device takes these problems into consideration, however, in the experiment the participants were instructed to try to keep still and move as little as possible. Hauser et al. (2018) suggests re-calibration in longer eye-tracking sessions to prevent this problem. To keep the browsing process continuous with no interruptions, the tasks and tests were decided to be kept short enough to not have to re-calibrate mid-session, which did not contradict with the objectives of this study.

3.2.4 Test process

Each test session began by introducing the session and asking the participants a series of questions about their background regarding topics relevant to the experiment. The eye tracking equipment was then calibrated, the use-scenario was explained, and the participant was asked to browse the website as they normally would.

The task was not time consuming, and all participants completed the test as anticipated. The participants were not asked to give any think-aloud comments on their behavior in real time, as this might have affected the resulting metrics, such as the duration of fixations. The respondents were also not asked for retrospective analysis of their viewing results, but instead they were asked questions about the page without showing the results to determine what information they had received.

4 Results

This chapter presents the data of this study consisting of two sections, the case interview and the eye tracking experiment. The first section begins by introducing the case company and its business, providing context for the subsequent analysis of the interview data. The second section provides an analysis of the data obtained by the eye tracking experiment and compares it to the interview results.

4.1 Interview

The case company chosen for this study is Tile Square skate shop, a small retail store specialized in skateboarding equipment, accessories, and clothing. Operating in central Turku, Finland, the store was founded in 2021 by two local skateboarding enthusiasts, Jasse Toivonen and Eetu Hakulinen. Tile Square was chosen for this study, because they represent a large part of e-commerce businesses, especially in the smaller end of the range, and they had expressed a desire to develop their website (www.tilesquare.fi) in hopes of increased sales.

The main vision of Tile Square is to be an authentic skater-owned local store and an ambassador of the true skateboarding culture, as opposed to larger corporations in the industry that are not run by skateboarders. This authenticity and legitimacy are the most significant competitive advantages that Tile Square has, along with basic advantages of a small store, like atmosphere, service excellence and agility.

According to the owners, the target market of Tile Square is skateboarders and the so called “urban people” in general. Demographically, the largest customer group is young men, with the second being teenagers or children (and their parents). Girls and women have also become more interested in skateboarding, but they still remain a very marginal customer group, the owners describe.

At the moment, the majority of sales are generated by the brick-and-mortar store, which obviously has certain geographical limitations. The store has attempted to broaden its market area by selling their products online, but the web store has not generated as much sales as hoped. They have been considering ways to improve their website to scale their business and broaden their market, says Toivonen.

4.1.1 Goals and objectives

The purpose of the website has two aspects to it. As the business model of Tile Square has its foundation on the brick-and-mortar store, the strategic purpose of the web store is partly to be a support function for the actual store by providing information and serving as an online product catalog. The other purpose of the store is to enable easy shopping and access to the products regardless of location, geographically targeting the widest possible range of customers.

The owners recognize three most important categories of information on the website as product information, location of the store and brand identity. Perhaps the most important message that the store wants to convey is the legitimacy of their brand, that they are an authentic skater-owned store. However, the owners think that the brand identity does not get emphasized enough in the current web design and that this requires improvement.

Conveying these pieces of information is the main objective of the web site, along with making their products accessible for a larger audience, says Toivonen. Thus, in order of importance, the goals of the page are:

1. Brand identity: emphasizing the store's status as an authentic skate shop run by actual skaters.
2. Product selection: giving a good understanding of the product selection and represented brands.

3. Store location: letting the viewer know where the store is and making them feel welcome to visit.

4.1.2 Case design

The Tile Square webstore is designed and made completely by the owners themselves. Toivonen narrates, that they did not have any prior knowledge or experience in creating web sites, so they started by searching for information online, looking for easy ways to make one. After reviewing available options, they chose to use a service called Shopify because it seemed to be an easy and affordable platform to make an online store. It was also among the most popular ones in the industry and had plenty of good reviews online, says Toivonen. Shopify offers design templates and a low-code environment for editing the design, which made it a good choice for a small business with limited knowledge and resources.

According to Toivonen, the design choices for the webpage were largely based on personal aesthetic preferences and did not draw upon any theoretical principles. To inform their design decisions, the designers primarily used a benchmarking approach, reviewing other webstores for inspiration and best practices. The owners desired a simple, minimalistic page with a calm theme, with the intention of highlighting selected elements using bold colors and images. The focus was on the products themselves, with the aim of minimizing distractions. These design choices reflect a desire to create a clean, uncluttered user experience that emphasizes the products.

The overall structure of the page is a simple and generic web store layout, with the store logo on the top left corner, and product search, shopping bag, and language selection on the top right. Under the logo is a navigation bar with product categories, which is intended to be one the first things a customer notices on the page. According to Toivonen, this allows the viewer to get a quick understanding of the site structure and where different products can be found on the page.

On the bottom of the page, there is a banner with some information and links to social media. The top and bottom banners are shared with all pages of the site. The site consists of the front page, product categories and single product pages. This study is mainly focused on the front page because it is the most important one regarding the information and messages conveyed to the user.

The actual content of the front page consists of five elements, first of which is an image carousel, that shows selected products and brands, and has a link to the related product category. Next elements are static brand advertisements, with a similar purpose as the carousel, and serve as display windows to highlight certain brands.

Below them, there is a picture from inside the store, with the store location and contact information on it. Thereafter is a list of all the brands that the store represents. Finally, on the bottom of the content, there is a form to subscribe to a newsletter, which Toivonen says has not been actively used for the lack of subscribers.

4.1.3 Analysis of the case design

The goals of the page are partly reflected in the design choices. Navigation on the page is made very simple with only the product categories listed as a horizontal navigation bar, which should make it very easy to find products, at least if one knows what they are looking for. The front page is mostly used to show products and represented brands, which gives a general idea of the product selection, and creates an opportunity to emphasize chosen brands.

The location and contact information of the store are not specifically highlighted, even though they are visible and easy to find. This section might be a little low in the hierarchic order of visual elements, compared to its priority in the objectives of the page. The image on the background is not an attention grabbing one and has nothing particularly

interesting in it. This may cause people to not notice or pay attention to the element, however, it is found easily if the user is looking for it.

4.2 Eye tracking experiment

The second stage of analysis was to examine the data obtained using an eye tracker and participant interviews to find out whether the objectives of the company are reflected in the actual user behavior. The eye-tracking data provides insight into the viewing patterns of users during the experiment, while the participant interviews contribute to understanding the implications of the data.

4.2.1 Eye tracking data

Figure 3. displays the selected areas of interest, as explained in the methods section of this paper. The AOI method was used to be able to compare different visual elements and the information content that they represent on the page, by analyzing different metrics of viewing behavior shown in Table 1. A heatmap analysis (Figure 4.) of the same data was used for additional insight and further analysis.

The AOI's were selected based on the five main elements appearing on the page, considering their weight in carrying out the page objectives. These elements can be considered in two categories: brand identity or product selection, depending on what information they represent. The heatmap allows for some analysis of elements outside of these AOI's.

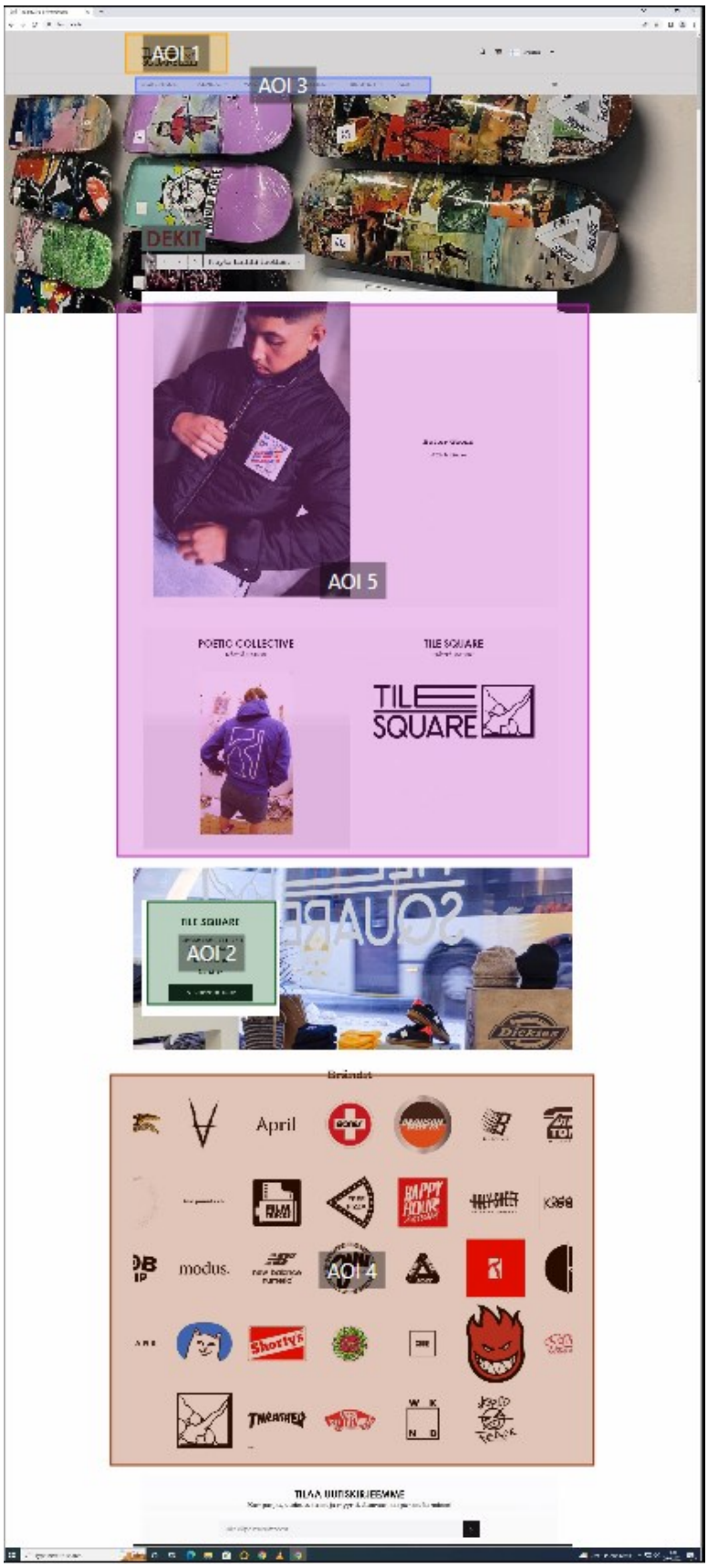

Figure 3. Areas of interest.

The first area (AOI 1) is the company logo on the upper left corner of the page, which is a key element of the company's brand identity. Not surprisingly, the logo was the first of the elements that the viewers looked at (TTFF: 1,4 ms), serving as an entry point to the page. The area and the amount of information it contains is small and not complex, explaining the low revisit count of 0,4.

However, the first fixation duration on this area was 363,1 ms on average, being substantially longer than on any other AOI, as well as dwell time being the highest on the page at 43 763,4 ms. Thus, this area receives quite a large amount of attention considering its content.

Perhaps the abundance of gaze points on this area could be affected by the proximity of the navigation bar, which expectedly receives a lot of viewing traffic as seen in the heatmap and the AOI metrics. This would mean the viewers went back and forth between these areas, however, the low revisit count on AOI 1 depicts a strong implication against this reasoning.

The second area (AOI 2) is the location information of the store. This element consists of the background picture and the text box, however, the area of interest was limited to only the text box containing all the information. The background image does not contain much of anything specific, which is supported by the scarcity of gaze points showing on the heatmap. The image is literally a background, with nothing specific or attention grabbing, which guides the gaze of the viewer on the text box where the actual content is.

AOI 2 recorded a TTFF value of 4,2 ms, indicating that it was relatively attention grabbing compared to other elements. The heat map also clearly indicates some intense fixating on the area, however, the revisit count was very low at 0,4, meaning that the element was seen but then moved on from. The area also had a low count of short saccades, perhaps due to its small size. Dwell time being below average length (11

656,5 ms) concludes that the element is not overlooked, but its received attention is likely not in accordance with the design objectives of the page.

The third area of interest (AOI 3) is the navigation bar on the top of the page, representing both product selection and site structure. As expected, this area recorded a lot of action in both fixations and saccades, with the highest revisit count (4,4) and an abundance of saccades (10,8) considering its small size. The TTFF value of 15,4 ms on AOI 3 does not imply attention grabbing content, while the low dwell time of 1750,3 ms suggests low focus on this area. Thus, the viewers were actively looking at the element, as also clearly seen in the heatmap. However, they were most likely not focusing on its content, but rather scanning through it.

AOI metrics	AOI 1	AOI 2	AOI 3	AOI 4	AOI 5
Information					
AOI duration (ms)	70833	70833	70833	70833	70833
AOI duration (%)	100	100	100	100	100
Size (cm2)	20,7	69,6	23,6	999,5	1378,6
Size (%)	1,4	4,8	1,6	68,5	94,5
Respondent base	5	5	5	5	5
Fixation based metrics					
Respondent ratio (%)	100	100	100	100	100
Revisit count	0,4	0,4	4,4	3,8	3,2
TTFF AOI (ms)	1,4	4,2	15,4	14,6	23,4
Dwell time (ms)	43763,4	11656,5	1750,3	37587,8	6969,8
Dwell time (%)	556,3	1842	4836,5	3580,8	5272,8
First fixation duration (ms)	363,1	229,8	239,8	293,1	196,5
Saccade based metrics					
Respondent ratio (%)	0	100	100	100	100
Saccade count	N/A	3,2	10,8	12,4	32
Amplitude (deg)	N/A	2	2,8	9,3	6,3
Peak velocity (deg/s)	N/A	42,9	79	160,5	134,3

Table 1. AOI metrics.

The remaining areas of interest (AOI 4 and AOI 5) are both presentations of product selection. The identities of the represented brands, and how they are presented on the page also contributes to the brand identity of the store itself, emphasizing the importance of these elements along with the substantially large area occupied by them on the page.

AOI 4 is a list of all the brands that the store represents at the bottom of the page, while AOI 5 highlights selected ones in the center of the page content. Both areas recorded a high amount of long and fast saccades which indicates scanning behavior, supported by the heatmap visualization as well as being aligned with the purpose and nature of the elements. Both elements got similar revisits, 3,8 and 3,2, indicating a high interest as the viewer returned to the element multiple times. However, both areas had a high TTFF value (14,6 and 23,4 ms), meaning that they were initially less attention grabbing than other elements of the page.

The heatmap presents that gaze points in both AOI's are scattered across the area, which is expected considering their content. The fixations on AOI 5 seem to be similarly drawn to details of both pictures and text, notably the face in the upper picture. AOI 4 received rather symmetrical attention in terms of gaze distribution.

AOI 4 recorded a long dwell time of 37 587,8 ms, meaning that the viewers spent a lot of time on this area. AOI 5 underperformed its potential considering the elements size and central location on the page with a low dwell time of 6969,8 ms. This might result from the elements' location on the page; AOI 4 being on the bottom of the page, is viewed by the user knowing that they have seen the whole page. Thus, there is nothing drawing the attention forward, as opposed to AOI 5 being in the center of the page with unseen elements below it that the viewer is intrigued to move on to.

Figure 4. Heatmap.

4.2.2 Participant interviews

After viewing the website, participants were asked to report on the nature of the shop, its location, and the types of items sold. The responses were largely consistent, with participants accurately identifying the shop as a skate shop similar to the well-known Ponkes in Helsinki, acknowledging its authenticity.

However, the precise location of the shop was not retained in memory by the participants, who instead believed it to be in Helsinki. This finding suggests that the website should place greater emphasis on the store's location as an important piece of information intended to be communicated to visitors.

Participants demonstrated a good understanding of the range of items available at the shop, noting that it offered clothing, shoes, and skateboarding gear. Familiarity with skateboarding brands seemed to influence the ability of participants to recognize and recall specific brands in the shop's selection, with those who regularly engage in skateboarding exhibiting better recognition and recall compared to those who do not. Overall, the brand selection was perceived as being comprehensive by all participants.

The participants reported the overall experience as pleasant, with the page structure being predictable and easy to use. They did not recognize any usability issues, which was expected as the task was only to view and browse through the front page, focusing on design without considering technical functionalities.

4.3 Comparative analysis

The top left corner of the page was expectedly the starting point of the participants' ocular journey, thus introducing the viewer to the store logo. The absence of bias towards initial central fixation in the data reflects the notion that there was nothing extremely attention grabbing in the center of the page. The logo gained considerable at-

tention in light of the metrics despite its low information content and seemed to catch the users' attention effectively, serving the objectives of the site.

The navigation bar below the logo is similar to most web stores, making it very likely to be a well-functioning presentation of the site structure and its products. The participants were scanning around within the navigation area and frequently looking at it, but most likely not extensively focusing on it.

The main purpose of the navigation is to give a clear understanding of the page structure and product selection, which it succeeds in doing as far as the eye tracking data is concerned. Participant interviews also resulted in reports of having a good understanding of the product and brand selection, along with the structure of the page being perceived as uncluttered and clean, aligning well with the design objectives.

As suspected, the location of the store does not get enough emphasis on the page considering its importance regarding the objectives. The eye-tracking experiment showed that the store location element does get a fair amount of attention by viewers but is not necessarily focused on. The participant interviews also revealed that it somehow does not seem to convey its information to the intended extent.

This indicates that the visual hierarchy within the element is not effective and thus its content not properly conveyed, even though the element as a whole does get attention. Despite the elements central location on the page, it might be left in the middle of attention spans, being surrounded by other interesting elements. This means that viewers certainly gaze at the element, but with a limited focus on its content.

The page design successfully prioritizes the brand image and product selection with most of its area designated to show represented brands and products. As the participants reported positively about questions regarding product selection and brand image of the store, this objective is met to a good extent.

However, the brand and product exhibition window in the center (AOI 5) did not seem to be that interesting to viewers, with below average dwell time and clear signs of non-focused skimming. Being a rather large area in the very center of the page, the effectiveness of this element requires further examination.

The design intends to highlight specific brands with this window, which it might succeed in doing to some extent. However, one could argue for a more concise presentation of these elements, as they currently occupy nearly half of the entire page length. The space could be used to bring more attention to the location of the store, which, as a crucial part of the store's identity, insists on more emphasis to receive the amount of attention required to meet the objectives.

Either the location element is not remembered for its internal design flaws, or it is lost between the elements exhibiting product selection, distracting the attention of the viewer elsewhere. Most likely the case in question involves both of these reasonings, which should be considered and further examined by the designers.

5 Synthesis

The website's design strategy is characterized by the three main objectives recognized in the interview: emphasizing authenticity of the store, giving a good understanding of the brands and products, and conveying the store location and contact information. Participants in this study accurately identified the website as an authentic skateboard shop similar to Ponkes, although did not remember its location. They had a comprehensive understanding of the items available at the shop and even recalled specific brands in the selection, depending on experience in the sport. The overall brand selection was perceived as comprehensive by all participants.

Thus, the case website successfully fulfills the set of design objectives to a reasonable degree, however, the distribution of priority between information relative to the objectives is not entirely as intended. The findings of this experiment clearly highlight the need to find a better balance between prioritizing brand identity, product selection and the location of the store.

In the tests, brand identity received appropriate recognition, and product selection was emphasized abundantly, whereas the store location was overlooked. This means that the hierarchical positioning of visual elements on the page favors product selection over the store location by a substantial margin, the correction of which might have a positive effect on the outcome.

Therefore, to improve the realization of the objectives in the site's visual hierarchy, the case company should consider more effective use of the central area of the page (AOI 5, as well as a more emphasized appearance of store location. As a suggestion, the layout might benefit from adhering to the principles of the Gutenberg diagram, for example, by placing the location information with a description of the store in the upper center of the page and integrating call to action elements, such as an email subscription form or links to products, in the lower right section.

Overall, the website seems to meet the objectives of the design strategy rather well, implicating that the lack of online sales experienced by the company is most likely not a result of poor visual hierarchy although some flaws may contribute. No major problems were identified in this study regarding its web design principles, as far as the competency and effectiveness of applied objectives and the strategies chosen to meet them are not questioned. Being made with Shopify, the technical implementation of the website is also unlikely to contain any issues.

6 Discussion

While eye tracking data cannot tell you what the participants were feeling while viewing something, it can effectively point out things that need to be examined in more detail. By combining the eye-tracking data with the participant interviews and comparing the results to the objectives of the design, the findings of this study can provide valuable insight for the case company to improve upon.

The implications of these results may be applicable with limited integrity, as the effectiveness of the objectives and strategy chosen by the company cannot be assumed. The further analysis of a business model is beyond the confines of this study, and thus the results are limited to determining the realization of the objectives, excluding the consideration of their adequacy.

From a more commercial perspective with regards to e-commerce, the perceived underperformance of the case website could also possibly result from a poor utilization of search engine optimization methods or ineffective digital marketing efforts. Perhaps it could simply be a matter of market saturation, where the small market size hampers the scalability of business with current conditions of competition.

Additionally, the participants of this study noted the stores resemblance to the well-known Ponkes, which, although indicates a perceived legitimacy among established actors in the industry, could exemplify the possibility of excessive benchmarking. This finding emphasizes the importance of differentiating from competitors in some ways to gain advantage.

As concluded, the web store's visual implementation of components does not seem to entail major issues hindering its sales performance, although some aspects of the design may be worth reconsidering. In order to reach more definitive conclusions to this speculation, the website should be examined considering the induced user experience more thoroughly to identify possible problems in the customer journey.

In a general sense, this study confirms the functionality of some fundamental web design practices. The eye tracking results support positioning the store logo in the top left corner of the page as a theoretical recommendation (Faraday, 2000), as it was the starting point of users' views. The logo positioning is also in favor of the case company's objectives regarding their emphasis on conveying brand identity.

This notion, along with the heatmap displaying subtle resemblance to the F-shape (Nielsen, 2006), conforms with the results of previous studies arguing for a likely occurrence of the F-shape with simple visual hierarchies (Djamasbi et al., 2011). The face being present in one of the pictures seemed to attract a convergence of fixations, as researchers have found to be a common phenomenon (Djamasbi et al. 2012; Tullis et al., 2009), however, it did not seem to gain substantial attention compared to other forms of details.

A clean and simple layout with minimal distractions and emphasis on the selected elements seems to work well as a strategy to convey desired information. This case study exemplifies the possibility of accidentally prioritizing some information more than intended, disbalancing the visual hierarchy of the site. Thus, web designers should conduct a careful analysis of the prioritization of information to align the page design with the objectives.

The data used in this study was gathered and analyzed following the principles and practices recommended by previous literature, making the results internally valid. However, in order to observe the performance of chosen design attributes in an interface more productively, one should analyze the effects of updated features compared to the ones previously used and determine their influence on metrics that indicate the success of the web site, such as conversion rate or user engagement. As such, the preconditions of this experiment are inclined to account for its somewhat limited potential to produce substantial results. This observation offers both counsel and inspiration for future research.

External validation of the results can be questioned for their limited potential for generalization. However, the results of this study can be used, referenced to and further examined by not only the case company itself, but rather all similar websites where these findings can be applied. After all, the company represents a substantial segment of websites.

Furthermore, a wider audience of academia undoubtedly benefits from contributing to the discourse with a perspective of a small case company, the likes of which arguably lack the resources to have such research conducted for themselves. This thesis also demonstrates how eye tracking can be used by researchers or companies to determine the reality of their websites' effectiveness regarding design choices. Additionally, this study contributes to verify some of the current state of applicable domains of scientific knowledge.

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