Usability analysis of graphical interfaces of travel websites according to the universal design principles

Analiza użyteczności graficznych interfejsów serwisów turystycznych z uwzględnieniem zasad projektowania uniwersalnego

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Abstract

The article examines the usability of tourism website interfaces based on universal design principles, focusing on the growing need for accessibility. The hypothesis defines that altering the layout and increasing the contrast of interface elements will improve the speed at which users find and comprehend information. The research methodology includes an analysis of two tourism interfaces. They were tested by study participant using an eye tracker and the LUT survey. The WAVE tool was used to assess accessibility. The results, presented through heat maps, fixation paths, graphs and surveys, demonstrate that component positioning and increased contrast significantly enhance users' ability to quickly locate elements in the tourism application.

Keywords: universal design; eye tracking; accessibility; usability

Streszczenie

Artykuł analizuje użyteczność interfejsów turystycznych stron internetowych w oparciu o zasady projektowania uniwersalnego, koncentrując się na rosnącej potrzebie dostępności. Hipoteza badawcza określa, że zmiana układu i zwiększenie kontrastu elementów interfejsu poprawi szybkość, z jaką użytkownicy znajdują i rozumieją informacje. Zakres badań obejmuje analizę dwóch interfejsów turystycznych. Zostały one przetestowane przez uczestników badania przy użyciu eye trackera i ankiety LUT. Do oceny dostępności użyto narzędzia WAVE. Wyniki przedstawione za pomocą map cieplnych, ścieżek fiksacji, wykresów, ankiet, pokazują, że pozycjonowanie elementów i zwiększony kontrast znacznie poprawiają zdolność użytkowników do szybkiego lokalizowania informacji w aplikacji turystycznej.

Słowa kluczowe: projektowanie uniwersalne; eyetracking; dostępność; użyteczność

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1. Introduction

Today's society, intensified by the dynamic development of information and communication technologies, is increasingly using online services to plan travel and book accommodation. The significant increase in the popularity of travel portals and booking platforms is prompting a deeper reflection on the quality of the graphical interfaces of these services. In the context of travel, the development of digital technologies has significantly influenced the way users search for, compare and book travel-related services. Interactions with travel websites are a key aspect of this process, and their intuitiveness and adaptation to diverse audiences are fundamental to user satisfaction.

Universal design, in the context of tourism service interfaces, focuses on ensuring accessibility and usability for all users, regardless of their individual skills or limitations [1]. This study focuses on aspects of universal design, with the understanding that interface interactions should be accessible and understandable to all, regardless of any individual limitations or differences. The study focuses on two key principles of universal design: clear information and simple and intuitive use.

The research methodology will include the use of an eye tracker, a modern tool that makes it possible to monitor users' eye movements while using interfaces [2]. The use of the eye tracker will make it possible to precisely record the areas of attention and the time spent on individual elements of the interface. The research carried out with the eye tracker will cover a variety of scenarios for the use of tourism service interfaces.

The analysis of the eye tracking data will be carried out in the context of three key variables: readability of information, intuitiveness of use and visual parameters such as font size and contrast of the interface.

The study hypothesis defines that altering the layout and increasing the contrast of interface elements will improve the speed at which users find and comprehend information. The results of the study will provide a basis for the evaluation of the research hypothesis. It will also provide practical guidance on the design of tourism website interfaces taking into account the principles of universal design. The analysis of these results will allow to deduce the effectiveness of the application of specific design practices and their impact on the user experience, which will consequently contribute to enrich the discussion in the field of interface design from the perspective of universal accessibility and usability.

2. Related works

The literature review aims to familiarise oneself with the current state of knowledge concerning the research topic. It enables you to understand what theories, models, research methods and research results already exist in the field. It influences the quality of the study, providing more relevant conclusions.

2.1. Universal design concepts

The article "*A Universal Design Resource for Rich Internet Applications based on Design Patterns*" [3] presents research into the creation of a design pattern language for web accessibility design, especially Rich Internet Applications (RIAs). The researchers hypothesize that such a language could be useful to designers of varying experience. A phased study was conducted, assessing the tool's accessibility, its effectiveness for designers, and its practical application in scenarios. The result showed that the language has positive features, being well-organised and useful to participants. The study found that more patterns and technical details are needed, especially for interactive elements of web applications. The article also stressed that the WCAG 2.0 guidelines are important, but their quantity may discourage designers from addressing accessibility.

The article "*Eye Tracking and Usability Testing in Form Layout Evaluation*" [4] discusses the use of eye tracking technology and usability testing in form layout evaluation. The authors present two main research tools: eye tracking, which helps to understand how users scan and interpret visual information, and usability testing, which evaluates the ease of use of products. The study compared five different forms of layouts, varying in the placement of labels and input fields. The paper highlights that although there were no apparent differences in completion times and error rates, eye movement analysis revealed significant differences in scanning performance and cognitive load for different form layouts.

The article, entitled "*Using Eye Tracking to Compare Web Page Designs: A Case Study*" [5], is a study using eye tracking to evaluate and compare two different American Society of Clinical Oncology website designs. The aim of the study was to see which design made it easier for users to find information quickly and efficiently on the website. This study included a group of 12 participants. The paper presents detailed analyses of several key tasks that users were asked to perform on the websites. The results showed that eye tracking provides additional valuable data to better understand why one project may be more successful than another. The author discusses the advantages and limitations of using this method in usability research, highlighting its usefulness in diagnosing visual search problems and in making decisions about optimising website designs.

2.2. Universal design principles

The article [6] by Sheryl Burgstahler explores the application of universal design principles to the teaching of computer science. The research is based on an analysis of the literature and teaching practices, exploring the potential benefits of this approach. The results indicate that universal design can create a more accessible and inclusive learning environment, and teacher practices, such as the creation of accessible online portals, illustrate the effectiveness of the approach. The article highlights the importance of taking into account the diversity of students, particularly those with disabilities, and encourages further research into the effectiveness of specific universal design practices in the context of computer-based instruction.

The article, entitled "*A Comparative Eye Tracking Study of Usability – Towards Sustainable Web Design*" [7], focuses on evaluating the usability of different websites using eye tracking technology. The study aims to identify elements, structures and designs that enhance usability. The research involved 22 participants using 5 different bank websites, each of which presented information in different formats such as text, images and symbols. Participants performed specific scenarios while their eye movements were tracked to analyse where and how long they focused their attention. The results indicate that elements such as images of people, specific page positions and structured content are more likely to capture users' attention and improve usability.

The study [8], authored by Jyh-Rong Chou, focuses on developing an effective evaluation method for universal product design. An innovative linguistic rating scale was introduced, and a similarity matrix and property algorithms were used to determine criteria weights. Usability tests were conducted with 20 users, including 2 with disabilities. The results confirmed the effectiveness of the method, eliminating the difficulties associated with the traditional analytical hierarchy process (AHP) approach. However, the authors noted some limitations related to the linguistic scale. The study provides a valuable tool to support decisions in the universal design process.

2.3. Eye tracker and research methodology

The article [9], authored by Joseph Goldberg and Anna Wichansky, is about a study of eye tracking in web search tasks to evaluate specific design features of a prototype web portal application. The study involved 7 participants who navigated through multiple web pages while performing 6 specific tasks. The authors examined whether parameters resulting from eye tracking were related to page order, user actions prior to visiting pages, and horizontal or vertical browsing preferences. The study found that when navigating a web portal, users tend to visit portlets placed on the left side and at the top of the page, which may suggest a more intuitive placement of key content in these locations.

The study, entitled "*Using Eye Tracking to Measure Overall Usability of Online Grocery Shopping Websites*" [10], examines the use of eye tracking technology to evaluate the usability of online grocery shopping platforms. The authors analyse how metrics such as number of fixations, scan path length, pupil size and task time can correlate with traditional methods of self-

assessment of usability, such as the SUS and WAMMI scales. The study involved 30 people who performed shopping tasks on 3 different websites, and their eye movements were monitored to better understand how users interact with various elements of the site. The results showed that users with more online shopping experience and males exhibited fewer fixations and shorter task times.

The study "*Eye Tracking and Web Experience*" [11], examines the use of eye tracking technology in studying user experience on websites. The article discusses methods for visualizing this data, such as heat maps and area-of-interest maps, which show how users navigate through websites. The author predicted that eye tracking technologies could become a standard in web design, helping to create more engaging and effective user experiences. In the future, it will be possible to conduct large-scale surveys, as is currently the case with online surveys, opening up new opportunities for reexamining human-computer interaction. The author emphasized that investing in a positive user experience is critical to success in today's business environment, and eye tracking technology can play a key role in achieving this goal.

2.4. Application of universal design and eye tracking technology

The article, entitled "*Studying the User Experience in Online Banking Services: An Eye-Tracking Application*" [12], analyses the user experience of online banking services using eye tracking technology. The study focuses on analysing how the structure and presentation of information on bank websites affects their usability and consumer understanding. The authors used a two-stage research model that combines traditional research methods, such as surveys, with neuromarketing. The results of the study show that elements such as promotional images, colors and the layout of information on a page have a significant impact on grabbing users' attention. The study also found that users' previous experiences with banking services can affect their ability to remember certain information, suggesting that web designers should consider both visual and structural aspects when creating user-friendly banking sites.

The article published in Applied Computer Science [13] investigates the impact of applying universal design principles on the usability of accommodation booking websites. The study compares two websites: one designed according to universal design principles and one that does not follow these principles. It used eye tracking technology and user surveys to measure usability-related outcomes. The researchers tested three hypotheses, all related to whether a site following universal design principles provides better usability compared to a traditional site. The experiment involved participants performing tasks on both sites, and their eye movements were tracked to measure how quickly they found key elements on the page. The results showed a significant improvement in usability for a site designed according to universal design principles. Users located

elements more quickly and easily, indicating higher efficiency.

The article, entitled "*Analysis of the usability and accessibility of websites in view of their universal design principles*" [14], focuses on the analysis of both usability and accessibility in the context of universal design. The study covers four websites: two designed according to universal design principles and two that do not follow these principles. Eye tracking technology was used to measure users' ability to find key elements, and an automated validation tool (WAVE) was used to identify accessibility issues. The results show that pages complying with universal design principles are more intuitive and accessible. Users were able to navigate and find information faster on these pages, leading to better usability scores. The article highlights the importance of adhering to universal design and accessibility guidelines, not only for people with disabilities, but also to improve overall user satisfaction and website performance.

3. Material and methods

This chapter will discuss issues related to the research methods to prove the hypothesis. As part of the research into the usability of tourism website interfaces, three experiments were performed on two web applications. Firstly, a study was conducted using an eye tracker device to track the gaze of the research participants. Then, each participant was given a LUT survey to completed, the results of which will help to compare the quality of the two interfaces. The final experiment is the use of the WAVE tool, which is used to assess the accessibility of the interface.

3.1. Study objects

The application that was evaluated is a travel agency's tourism website called Agatbus (https://agatbus.pl/). For the purposes of the study, a completely new version of this travel service was created, in which the principles of universal design were applied. A number of aspects that are important to the usability of the interfaces have been included in the new application. First and foremost, the contrast of individual elements has been improved. An example of such a change in contrast is shown in Figures 1 and 2. In the designed web application, the color scheme and layout have been completely changed. The reason for this change is that yellow and black have a lower contrast than white and dark blue. Such a change can have a positive impact on the readability of information.

Figure 1: Subpage of the Agatbus tourist service presenting the tourist offer.

Figure 2: Subpage of a web application designed according to the principles of universal design presenting a tourist offer.

3.2. Participants

The study included 15 participants (male and female), a number that allows for a variety of perspectives and data while maintaining a controlled environment. The group included students majoring in Computer Science with an age range of 23-24 years. Each had different levels of experience in using travel applications. All participants performed the given tasks under the same conditions. Prior to each study session, each individual was given detailed information about the aims and conduct of the study, as well as the potential benefits and possible risks of participating.

3.3. Eye tracker study

3.3.1. Research stand

The tests were conducted in the laboratory of the Department of Computer Science at the Lublin University of Technology, where artificial lighting was used. During the tests, each participant sat on an adjustable chair to ensure comfort.

The test stand consisted of a Gazepoint GP3 HD eye tracker [15], which was connected to the laptop. The laptop ran Gazepoint Control software and iMotion 9.0 [16]. The eye tracker needs to be placed directly under the screen. Data is recorded with a 150 Hz infrared camera. There is a 9-point calibration of the equipment, which guarantees a true reflection of eye movement during the examination.

The eye tracker was connected to a ThinkPad T540p laptop equipped with an Intel Core i7-4710MQ processor (2.50 GHz), NVIDIA GeForce N14M-GS 730M graphics card, 16 GB RAM, 512 GB SSD and a 15.6" screen with a resolution of 1920x1080. Windows 10 is the operating system on which the Gazepoint Control software was installed. For proper operation of the eye tracker, the software must be run in the background. The iMotion version 9.0 platform was used to design the study, perform calibration, record user sessions and download the data needed for analysis. This software allows visualization of the results in the form of heat maps, fixation paths and data on how fast users manage to locate areas of interest (AOI).

3.3.2. Scenarios

Fifteen scenarios for each web service were created to carry out the research. Each study was divided into two parts. The first one involved the participant running the scenarios for the actual Agatbus travel service only.

The second part, on the other hand, involved running the scenarios for a universal tourism service designed according to design principles, which mirrors the original application. The list of scenarios is as follows:

1. Locate the price before discount for the offer "Gloria Golf Resort".
2. Locate the discount percentage for the all-inclusive offer in Greece.
3. Locate the "Add feedback" tab in the footer.
4. Locate company address information.
5. Locate the Hungarian currency name.
6. Locate information on the number of regions for the country China.
7. Locate information on the type of transport provided.
8. Locate information on whether a passport is required for travel.
9. Locate text box for quick search of offers.
10. Locate the graphic element that will switch the displayed image to the right-hand side.
11. Locate the button to confirm your selection in the filter list.
12. Locate the button to change the sorting of offers.
13. Locate the icon that tells you about facilities for people with disabilities.
14. Locate information about what the bid price was on July 29.
15. Locate the graphic element that redirects to the home page.

3.3.3. Conducting eye tracking study

An eye tracker is a device that monitors eye movement, allowing precise tracking of the user's line of gaze when interacting with different types of visual content, such as websites or application interfaces [17]. The basic principle of an eye tracker is to record infrared radiation reflected from the eye's cornea and pupil. Cameras and sensors enable these reflections to be tracked in real time, allowing the exact point at which the subject is looking to be determined.

Each study involved a moderator who managed the entire process. Prior to each research session, an individual calibration was carried out for each participant to adapt the eye tracker to the unique anatomical features of their eyes. Then, after successful calibration, each participant had the research scenarios to complete. Each study was recorded, allowing the results to be obtained in the form of heatmaps, fixation paths and various statistics that helped to understand the differences between the interfaces analysed and to prove the research hypothesis. The number of views examined by participants in the eye tracker study was 7 and for some scenarios they were repeated.

3.4. Survey study

The application's interface can be verified by users evaluating it according to a LUT (Lublin University of Technology) survey [18]. The list consists of areas (navigation and structure, messages, feedback, user assistance, application interface, sub-page text, providing

data) that have been divided into sub-areas and questions in each sub-area. Each question is rated on a 5-point scale, which can be seen in Table 1. The number of views examined by respondents was 7.

Table 1: LUT survey rating scale [18]

Rating	Description
1	There were critical usability issues that prevented or discouraged use of the application/website
2	Serious usability issues have been encountered that may prevent most users from completing tasks
3	There have been minor usability issues that individually do not pose a hindrance to most users, but their accumulation can affect the user experience
4	Identified individual minor usability issues that may reduce the quality of working with the application
5	No usability issues identified or affecting quality of work

The WUP (Web Usability Points) metric is used to assess the quality of the application on a scale of 1 to 5 points. A higher value indicates a better designed interface. The formula for counting this metric is as follows [18]:

$$WUP = \frac{1}{n_a} \sum_{i=1}^{n_a} \frac{1}{s_i} \sum_{j=1}^{s_i} \frac{1}{q_{ij}} \sum_{k}^{q_{ij}} p_{ijk}$$

n_a - number of areas

s_i - number of sub-areas in area i

q_{ij} - number of questions in area i and sub-area j

p_{ijk} - evaluation of question number k in area i and sub-area j

3.5. Accessibility evaluation study

Interface accessibility testing is a key part of the web application design and development process. It is a particularly important activity that helps create an interface that is accessible to every user, regardless of their individual skills, needs or limitations [19]. It's about ensuring equality of opportunity in access to information, services and opportunities offered by technology. Through accessibility testing, designers and developers have the opportunity to make interfaces easier to use for people with different abilities, including those with limited visual, auditory, motor or cognitive abilities [20].

The WAVE (Web Accessibility Evaluation Tool) isa web-based application for evaluating the accessibility and compliance of web interfaces with universal design principles [21]. It evaluates various aspects of accessibility, such as the correctness of HTML document structure, alternative descriptions of images for the visually impaired, color contrast for people with visual impairments, keyboard transitions between elements for

people using screen readers, and appropriate labels for forms. The accessibility study using WAVE consisted of comparing these statistics against the two tested applications.

4. Results

4.1. Heatmaps

Heatmaps serve as graphical representations of data, utilising varying colors to denote the intensity ofattention on specific areas within a given interface. Typically, red hues indicate a high level of focus, suggesting significant attention directed towards particular interface elements. On the other hand, green shades imply a level of awareness or observation without significant focus.

Upon analysis, a striking contrast in color distribution emerges between the two applications. Even within identical scenarios, distinct variations in heatmap colors become evident. Notably, heatmaps generated for scenarios within the non-universal design application exhibit a notably dispersed distribution of focus areas compared to its counterpart. This dispersion implies that respondents were compelled to inspect a broader array of elements to navigate to the scenario-indicated areas visually. Such a difference is visible with the heatmaps generated for scenarii number 6 for both applications. They can be seen in Figures 3 and 4. This outcome can be attributed to several factors, including interface element rearrangement, heightened contrast levels and increased font size.

Figure 3: Heatmap for scenario number 6 for an application that does not comply with universal design principles.

Figure 4: Heatmap for scenario number 6 for an application that complies with universal design principles.

4.2. Fixation paths

A fixation path, often referred to simply as a scanning path, is a series of related fixation points established during a specific task or observation. It serves as a visu-

al representation illustrating the trajectory of a user's gaze as they traverse an interface. Following the eye tracker study, these scanning paths were meticulously generated for each individual subject involved in the research endeavor.

It is noteworthy that a clear dissonance in the distribution of fixations becomes palpable when comparing the two apps. Even in identical scenarios, the distribution of fixations shows noticeable discrepancies, indicating differences in user interaction with the interface. Such a difference is visible with the fixation paths generated for scenario number 12 for both applications. They can be seen in Figures 5 and 6.

Figure 5: Fixation path for scenario number 12 for an application that does not comply with universal design principles.
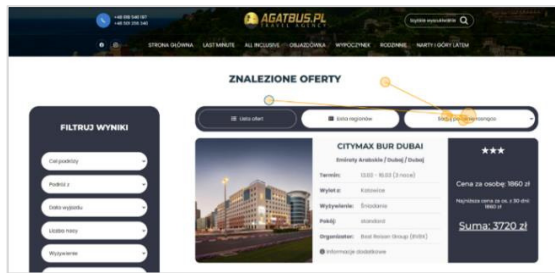

Figure 6: Fixation path for scenario number 12 for an application that complies with universal design principles.

Further analysis reveals differences in the number of fixations between the applications, with the universal design compliant application showing fewer fixations compared to its counterpart. This efficiency can be attributed to several factors, including changes in the placement of interface elements, increased contrast levels and enlarged font sizes, all of which collectively contribute to an improved user experience. Thus, the observed discrepancies in fixation path characteristics not only underscore the tangible impact of design choices on user engagement, but also offer invaluable insights into optimising interface design to enhance usability and task performance.

4.3. Time to first fixation

Time to first fixation (TTFF) is a key measure in the field of eye tracking research, defining the duration between the initiation of a subject's gaze towards an interface and their subsequent fixation on the anticipated area of interest (AOI). This metric is profoundly important as it provides key information on the rate at which users perceive and focus their attention on specific elements of the interface. Figure 7 provides a graph-

ical representation showing the averaged TTFF times across all scenarios for the two applications studied. This graphical representation serves as a comprehensive visual narrative to explain the comparative TTFF tendencies between the two applications.
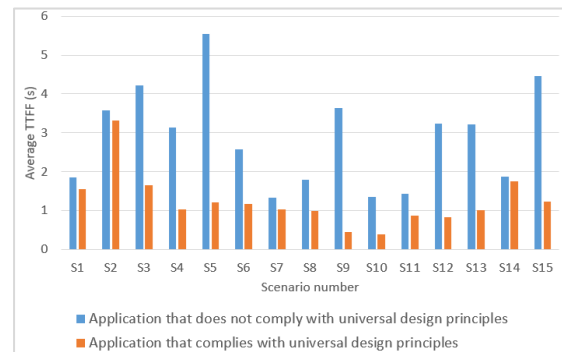

Figure 7: Averaged TTFF times of respondents for all research scenarios.

When analysed, the study produced convincing results, indicating that in 15 of the 15 scenarios, TTFF was significantly faster for the application created according to universal design principles. There were no cases where any of scenarios lasted longer for the alternative application. This noticeable trend underlines the effectiveness of following universal design principles in significantly reducing the time required to locate specific elements in the application interface.

4.4. Fixation count

The number of fixations, a key indicator in assessing subjects' engagement, provides valuable insight into how often people focus their attention on specific areas. By tracking these fixations, we gain a deeper understanding of which elements of the test subject attracted the most attention from participants.

The graph shown in Figure 8 illustrates the aggregate number of fixations for all subjects and scenarios for both tested interfaces. A compelling fact emerges from the analysis: in 15 of the 15 scenarios, the application designed according to universal design principles recorded a lower number of fixations. This significant observation indicates a clear advantage associated with adopting universal design principles, as it clearly reduces the number of fixations needed to locate elements in the application interface.
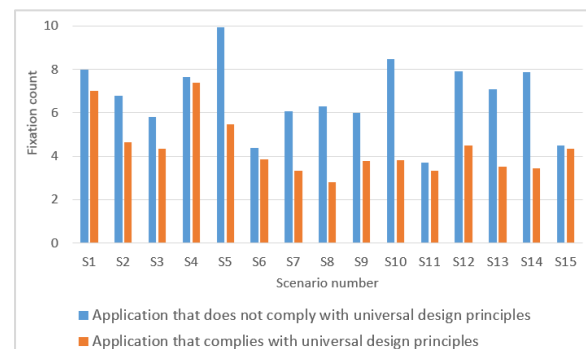

Figure 8: Average number of fixations of subjects for all research scenarios.

Such empirical data not only confirm the initial research hypothesis, but also highlight the practical advantages of prioritizing universal design in interface development. By minimizing the cognitive load required for users to navigate interfaces, universal design principles contribute to a more efficient and user-friendly experience, ultimately increasing overall usability and user satisfaction.

4.5. LUT survey

Survey participants rated the Agatbus tourism website with an average score of 2.56±0.79. It is worth noting that the layout and color selection aspect, which includes contrast, received the lowest rating. Navigation and interface structure received the highest rating, although still below the satisfactory threshold (below 3.0).

In contrast, the second application, according to the WUP index [19], showed much higher usability. Respondents rated the usability of the interface at an 4.5±0.48. However, the aspect related to messages, feedback and user assistance received the weakest rating, although still at a relatively high level. Conversely, the area related to data entry, such as filling in forms, received the highest rating. Nevertheless, the discrepancies in scores between these areas are minimal.

The significant discrepancies in WUP metric values between interfaces can be attributed to differences in design quality and usability. Participants evaluated the interface designed according to universal design principles significantly higher, influenced by various factors such as element positioning, font size and contrast value. These results underscore the importance of incorporating universal design principles into interface development to increase usability and user satisfaction.

4.6. WAVE

The WAVE tool assesses the availability of applications using six basic statistics [21]:

– Errors - issues that will impact certain users, failures to meet WCAG
– Contrast Errors - text that does not meet WCAG contrast requirements
– Alerts - elements that may cause issues; an evaluator must decide the impact
– Features - elements that improve accessibility when implemented correctly
– ARIA - presents accessibility information; reduces accessibility when used incorrectly
– Structure - shows HTML & ARIA pages regions; shows the heading structure; identifies hidden elements; lists regions and headings in order; indicates any nesting of elements

Figure 9 shows a graph that compares the sub-page statistics. The main aspect that differs between the two applications is the level of errors and contrast errors. The most common errors are missing alternative text, missing form label or very low contrast. The universal design compliant application does not have these but has more ARIA and Structural Elements.
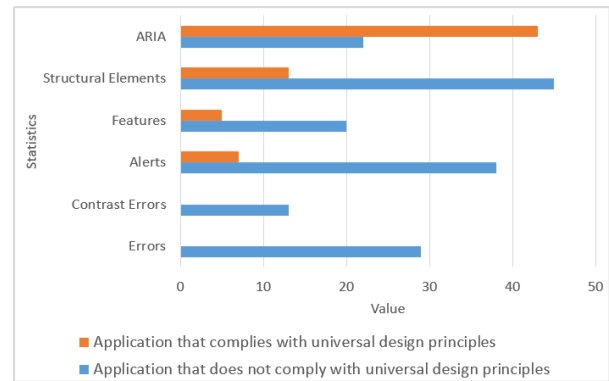

Figure 9: Comparison of the sub-pages of the interfaces studied using WAVE tool statistics.

5. Discussion

The purpose of this work was to study the usability of the graphical interfaces of tourist websites according to the principles of universal design. The work focused on analysing the impact of rearranging elements and increasing contrast on the speed and precision of finding and processing information by users. Techniques such as eye tracking and the WAVE tool for evaluating page accessibility were used to assess usability. The research was conducted on two versions of travel agency websites, one of which was designed according to universal design principles.

The research showed that interfaces designed according to universal design principles, featuring higher contrast and optimised placement of elements, significantly improve users' efficiency in finding and processing information. Analysis of collected data using an eye tracker indicated that applications following universal design principles required fewer fixations and shorter time to first fixation, suggesting a more intuitive and efficient user interface. Users rated such interfaces higher in terms of usability, as confirmed by the LUT survey results.

The research hypothesis stated that changing the layout and increasing the contrast of interface elements would improve the speed at which users find and understand information. The research results unequivocally confirmed this hypothesis. Interfaces designed according to universal design principles showed higher performance in both speed and accuracy of locating elements. In particular, these applications scored higher on the LUT survey, confirming that improvements in contrast and layout enhance the usability of websites. Comparing the results with the related works show similar trends in research on the usability of web interfaces.

Studies that have focused on analysing web form layouts confirm that appropriate placement of interface elements can improve user efficiency. In particular, form layouts with labels placed over data entry fields were found to be more effective in terms of the number of fixations, suggesting better scannability and lower cognitive load. These results are consistent with the findings of this paper, which indicate that changes in interface layout, consistent with universal design princi-

ples, can significantly improve the quality of user inter-action.

Research on online banking, focusing on the structure and presentation of information, has also shown that appropriate placement of elements and visual presentation are key to improving the user experience [12]. Strategic placement of key elements in easily accessible locations on bank websites was found to improve user efficiency and satisfaction. These results are consistent with the findings of this paper, which show that optimising the layout and contrast of tourist interfaces of websites contributes to improving overall usability and user satisfaction.

The results of the research conducted in this study and a comparison with the related works clearly show the crucial importance of appropriate visual design for improving the usability of web interfaces. The application of universal design principles, such as optimising the layout of elements, increasing contrast, not only improves the speed and efficiency with which users locate information, but also increases overall satisfaction with websites. These findings underscore the importance of continuously improving and optimising user interfaces to meet the growing demands of users and improve the quality of their experience.

Study confirms that regardless of the context, whether in tourism, online banking or e-commerce, universal design principles and an understanding of users' visual preferences are key to creating interfaces that are intuitive, accessible and effective. Implementing these principles can significantly contribute to improving the usability and efficiency of websites, which is important for ensuring a positive user experience and meeting users' diverse needs and expectations.

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