

A systematic review on hybrid approach for optimizing website usability using FULE methodology and usability heuristics reflecting user's behavior and perception



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Abstract Understanding how culture, society and economy influence our thoughts and viewpoints is crucial for creating cultural interactions. Developing awareness, empathy, flexibility and sensitivity helps individuals navigate perspectives and foster better global connections. To understand how social and emotional features of a software application influence people from different backgrounds we conducted usability tests on a university website of the United States with users based in India. This paper evaluates the website using the FULE methodology (Functionality, Usability, Look and feel and Evaluation) and usability heuristics to improve website usability. FULE takes a view by considering functionality, usability, aesthetics and ongoing evaluation. Usability heuristics rely on established principles. Usability Heuristics quickly identifies common pitfalls and proposes immediate improvements. Combining both methodologies in the redesign process yields a website addressing immediate issues while providing a deeper, engaging user experience. This blended approach offers a dynamic framework for continual improvement, ensuring websites remain resilient amid evolving user expectations and technological advancements. The study is focused on offering information, for web designers and usability experts connecting concepts and user perception, with real world application. By combining these perspectives a flexible structure is introduced to evaluate and support webpage enhancements proving that websites need to adapt to changing user demands in different locations. The inquiry acts as a roadmap for web developers to balance between user centered design and enhance the efficiency of the website by guaranteeing a user friendly website application for users coming from different backgrounds, culture and geographical locations. The work aims to provide insights for website designers and usability professionals, bridging theory and practical implementation.

Keywords: website design, functionality, evaluation, user-centered design, user experience, acuity

1. Introduction

Cognition and perspective are influenced by a multitude of factors, including cultural, social, economic, and educational backgrounds. These differences shape how individuals across various countries perceive, interpret, and respond to their environments. These facts have been discussed by authors (Heine, & Norenzayan, 2006; Simon, 2001; Paz et al., 2018). Understanding these differences is crucial for fostering cross-cultural communication and collaboration (Nisbett et al., 2001; Oyserman et al., 2002). The behavioral management approach delves into the study of human behavior within organizational settings. It integrates insights from psychology, sociology, and anthropology to offer a scientific framework for comprehending user actions and interactions. Humans thrive in a wide range of environments, showing great behavioral diversity both within and between populations (Brown et al., 2011; Pendleton et al., 2019). Design acceptance by users of a specific region may or may not enhance the user experience of the global audience. A webpage may seem user friendly and easy for a group of people in a certain region. However, the same webpage may or may not be user friendly for a group of people in another region. The authors (Dormann, & Chisalita, 2002) presented the cultural value of website design. (Chao et al., 2012) provide insight into local website localization in the Chinese market. In the dynamic digital world, where websites are accessed by a global audience, the pivotal role of website usability in fostering meaningful interactions is important. A well-designed website not only showcases products or services but also ensures seamless experiences, allowing visitors to navigate, interact, and accomplish tasks with ease. Two influential methodologies, the FULE methodology (Garcia-Gonzalez et al., 2019) and usability heuristics (Elveren & Tosun, 2020; Jackson et al., 2018), have emerged as powerful tools for evaluating webpages and capturing usability issues (Liberman et al., 2021; Jakob & Rolf, 1990).



The FULE methodology, denoting functionality, usability, look-and-feel, and evaluation, represents a holistic approach that transcends mere functionality (Nantel et al., 2008). The FULE methodology is represented in Figure 1. This methodology insists on a balance between technical prowess, user-friendliness, visual aesthetics, and continuous evaluation, recognizing users as active participants in a digital journey. With its four-quadrant framework, it delves into technical aspects, user interaction, visual aesthetics, and ongoing evaluation, ensuring a nuanced understanding of a system's overall performance. While comprehensive, the FULE methodology introduces challenges in terms of resource intensiveness and potential time constraints, requiring a delicate balance between comprehensiveness and feasibility.

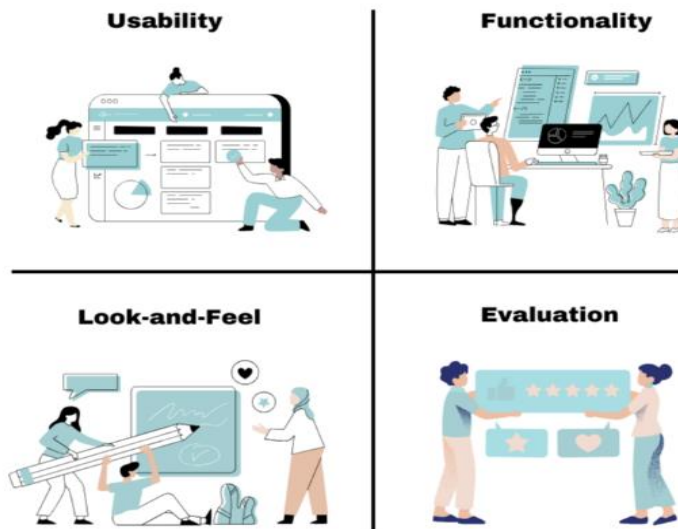


Figure 1 FULE methodology as a four-quadrant framework. Source: Open Source Canva tool.

On the other hand, usability heuristics, rooted in established usability principles, provide a set of guidelines for evaluating and enhancing the usability of digital interfaces. These heuristics, devised by the authors (Nielsen, 1994; Jakob & Rolf, 1990) cover various aspects, such as system status visibility, real-world alignment, user control, consistency, error prevention, cognitive load reduction, flexibility, aesthetic design, error recovery, and documentation. Adherence to these principles contributes to increased efficiency, reduced errors, enhanced learnability, and increased user satisfaction. The heuristics offer a standardized set of principles suitable for rapid assessments, ensuring a consistent evaluation process across interfaces (Shneiderman et al., 1987). Ten evaluation heuristics are depicted in Figure 2. (Canva tool is used to design figures 1 and 2).

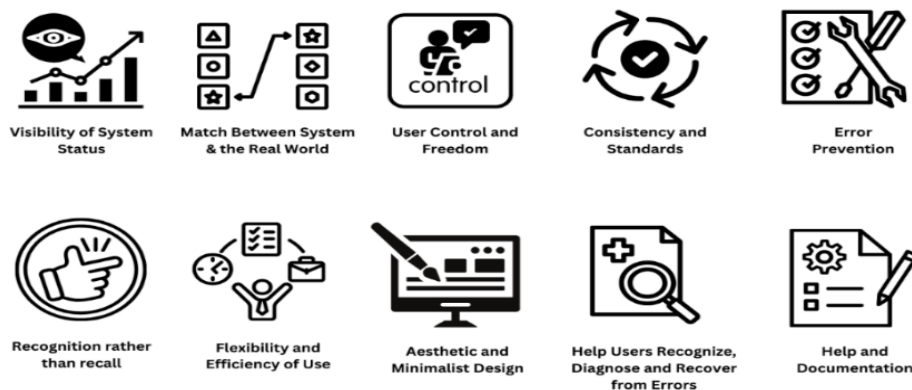


Figure 2 Ten usability heuristics. Source: Canva tool.

The experiences of users located in “India” in assessing the website of universities located in the “United States” are evaluated via these two methods. The following sections undertake a study of the FULE methodology and usability heuristics, applying both methods to optimize a website's design. The comparative analysis highlights distinct roles for the FULE methodology and usability heuristics. The FULE has emerged as robust for comprehensive evaluations that consider functionality, usability, and aesthetics. This approach is beneficial when time and resources permit in-depth techniques such



as user testing and surveys. Usability heuristics are pragmatic for quick, standardized assessments and are particularly useful in time-constrained scenarios. Combining both methodologies proves strategic, addressing diverse evaluation needs. The synthesis optimizes resources, with usability heuristics identifying high-priority issues swiftly, followed by detailed refinement through FULE. Through detailed analysis, the paper seeks to uncover insights into specific region user behaviors and perceptions of using webpage design globally, providing a nuanced understanding of their strengths and limitations in enhancing overall website usability.

2. Literature Discussion

The initial emotional responses of web users, such as pleasantness and arousal, triggered by the visual complexity and order of a webpage's design when first encountered, have carry-over effects on subsequent approach behavior toward the website. These facts are presented in the paper by the author (Deng et al., 2010). Furthermore, the design of a webpage significantly influences its usability, often surpassing the impact of users' past experiences (Țichindelean et al., 2021). Additionally, findings in the paper by the authors (Anindita et al., 2022) indicate that the aesthetic appeal of a webpage enhances the relationship between perceived e-service quality and e-customer satisfaction. Another study by Sapronov (Sapronov et al., 2022) supports this by demonstrating an important application of load theory to the real-world behavior of internet users.

The FULE method was previously used to evaluate both website design and product design. The author (Simon, S. J., 2001) inscribes that the use of the FULE technique has been essential in achieving major improvements in the creation of autonomous medical devices. The analysis of data obtained from test cases demonstrates that the device's design and development, guided by the FULE methodology, have resulted in the creation of a functional, reliable, safe, and user-friendly product compared with the original device. This achievement highlights the important contributions of the FULE methodology to the field of medical device development. The FULE methodology has been identified as a potential strategy that improves the general performance and credibility of autonomous medical devices. Its application is a critical factor in the development process, emphasizing the methodology's potential for wider adoption and further research in the realm of medical device engineering (Interaction Design Foundation, 2019). The authors (Marcus, & Gould, 2000) discuss various methodologies, including FULE, for evaluating usability in web design. The authors (Cyr & Trevor-Smith, 2004) presented a detailed multicriteria analysis of the FULE methodology, examining its effectiveness in evaluating web usability. The article by the author (Nantel, 2008) focuses on the development and validation of a comprehensive web usability evaluation tool. This tool aims to systematically assess the usability of websites, ensuring that they meet user needs and preferences.

Authors (Ghraham et al., 2004) have increasingly turned to heuristic evaluation methodologies to assess and refine not only infusion pump designs but also various other medical devices. The potential of this method to increase patient safety and streamline healthcare processes has sparked considerable interest within the academic and clinical communities. By leveraging this methodology, researchers have not only gained valuable insights into the optimization of future infusion pump designs but also shed light on the critical insights required to increase the usability of equipment currently in use in critical care environments. The authors (Allen et al., 2005) outlined a thorough methodology used to develop a streamlined heuristic evaluation approach designed exclusively for the evaluation of web page screenshots. The results from the study of the authors (Paz et al., 2018) demonstrate that conducting heuristic evaluations is a time-efficient, cost-effective, and straightforward process, offering a valuable substitute for more resource-intensive usability testing methods. However, usability is not limited to web development; it is crucial for any interactive software system involving human users, as described by the author (Ferre et al., 2005).

The authors (Hayat et al., 2020) presented a usability evaluation for mobile banking applications; the purpose of this study was to conduct a comparative analysis of the effectiveness of two distinct evaluation methods: the FULE methodology and usability heuristics. The study's objective was to ascertain which approach proved more adept at uncovering usability issues within these applications. The research findings show that both the FULE methodology and usability heuristics have been effective at spotting usability issues that are common in mobile banking applications. However, it became evident that the FULE methodology offered a more comprehensive evaluation, yielding detailed feedback. This emphasizes the importance of selecting the most appropriate evaluation methodology for assessing the usability of mobile applications and highlights the possible benefits of the FULE methodology for in-depth evaluations. These findings contribute to the current debate on usability evaluation methodologies in the context of mobile banking, potentially influencing future research and practical applications in this field.

Layla Hasan's (Hasan et al., 2012) study evaluated the usability of e-commerce websites through a comparative analysis of user testing and heuristic evaluation methods. The research highlights the unique strengths of each approach, demonstrating that user testing excels in identifying major and minor problems in specific areas through real user interactions, whereas heuristic evaluation demonstrates proficiency in pinpointing issues on the basis of established usability principles. The literature emphasizes the importance of considering both methods, detailing common problems identified, unique strengths, and areas where each method missed usability issues. Additionally, the study addresses the cost implications of employing these evaluation methods, providing a comprehensive overview for practitioners seeking effective and economical approaches

to assess e-commerce website usability. Hence, both heuristic evaluation and the FULE method are used for evaluating the selected web page. The complete process of evaluating the selected university website via FULE and heuristic evaluation is explained in the next section.

3. Methodology

The website evaluation was conducted on the “Yale School of Art” website, employing both FULE methodology and usability heuristics. Two user groups, aged 18–30 years and with diverse backgrounds, participated in the study. FULE involves interviews and surveys that explore functionality, usability, and user satisfaction. The usability heuristics involve ten established principles for assessment. The FULE reveals comprehensive insights into the website's functionality, usability, and user experience, drawing from diverse perspectives. Usability heuristics quickly identify common pitfalls and propose immediate improvements. Combining both methodologies in the redesign process yields a website addressing immediate issues while providing a deeper, engaging user experience. Unexpected outcomes underscore the importance of a balanced redesign strategy. These references offer a comprehensive overview of how cultural practices and social contexts influence the perception and design of webpages, providing valuable insights for designing globally effective websites.

Embarking on a captivating case study, we chose to dissect the Yale School of Art website (<https://www.art.yale.edu/>) to unravel the intricacies of usability enhancement and user acceptance. Our objective is to evaluate the website for its effectiveness via the FULE methodology and usability heuristics to improve an already functional website for global users, specifically Indian students. This study aims to target specific usability issues and evaluate the site comprehensively. Subsequent to the comparative analysis of both methodologies, we plan to initiate a redesign based on the insights gained. This iterative process aims to provide practical recommendations and assess the tangible impact of these approaches on the usability of the Yale School of Art website. A comprehensive strategy is used to assess the targeted website. Following an in-depth analysis of the website's features, we crafted questionnaires aligned with the FULE methodology. Simultaneously, we identified relevant heuristics to guide our evaluation process. The testing phase involved two distinct user groups, each comprising five participants, for a total of ten individuals.

The FULE study is a methodical approach ensuring a detailed examination of the website's performance and user experience from the perspective of functionality, usability, and overall user satisfaction. For the FULE methodology analysis, a structured approach involving interviews and surveys to comprehensively understand the user experience on the website is adopted. Through careful consideration, we formulate ten pivotal questions that encapsulate key aspects of functionality, usability, and user interaction. These inquiries serve as a foundation for insightful interviews and surveys aimed at extracting valuable user feedback from targeted users. The targeted users selected in the study were Indian university students. This sample of users is selected to understand the behavior and acceptance of the application by users from global locations who aspire to use the website to pursue postgraduate studies at Yale School. The demographic profile of the assessors in the research study includes a broad population between the ages of 18 and 30, with a mix of genders and jobs. Evaluator 1, a 22-year-old female artist, contributes a unique perspective from the artistic domain. Evaluator 2, a male student, and Evaluator 3, a female student, represent the academic community. Evaluator 4, a male designer, provides insights from the field of design, whereas Evaluator 5, a male artist, further enriches the artistic dimension of the study. The inclusion of individuals from different backgrounds and professions enhances the comprehensiveness of the research findings. Notably, all the evaluators are based in India, giving the study's findings a broader context of user behavior and perspectives. The ten constructs and the user feedback are explained in section 4.

Similarly, ten heuristics are selected to evaluate the website's usability. The user evaluators were provided with clear explanations of each heuristic, fostering a shared understanding of the criteria for assessment. Subsequently, the user participants were presented with the website to examine and apply these heuristics in practice. This methodical approach ensures a structured evaluation process, allowing us to gather insights into the website's compliance with established usability principles and identify areas for enhancement on the basis of these heuristic guidelines. The demographic mix of the evaluators in this research study reflects a diverse group of evaluators, aged 18–30 years, emphasizing gender and professional diversity. Evaluator 1, a 27-year-old male artist, provides artistic insights, whereas evaluators 2 and 4, both students, contribute from an academic perspective. Evaluator 3, a female designer, adds a design-oriented viewpoint, and evaluator 5, a female artist, enriches the artistic dimension. All the user evaluators are based in India, offering a geographical context. This ensures comprehensive analysis, capturing varied opinions influenced by age, gender, and professional background, enhancing the study's applicability and richness.

4. Analysis and Evaluation of Existing Design

The original website of the Yale School is chosen to analyze usability issues, with a focus on revealing the user experience through a comparative study of the FULE methodology and usability heuristics. This section aims to provide a foundational understanding of the website's current state, employing both methodologies to assess functionality, usability, and overall user experience. Through this analysis, we aim to identify key strengths and areas for improvement, setting the stage for subsequent

discussions on the impact of these methodologies on website usability. Figure 3 , Figure 4, Figure 5, Figure 6 and Figure 7 represent a series of original website snapshots, offering a visual representation of the interface that users examine during the evaluation. These screenshots serve as a tangible reference point, providing evaluators with a first-hand view of the website's design and layout. Through this visual exploration, we aim to capture the initial impressions and visual aesthetics that users encounter, setting the stage for a detailed analysis of the website's look-and-feel. Below, we include screenshots that were showcased to users as part of our comprehensive evaluation via both the FULE methodology and usability heuristics. These screenshots, carefully selected to represent critical aspects of the website, were instrumental in generating data that form the foundation of our user research analysis, shedding light on the strengths and weaknesses of the website from the user's perspective.

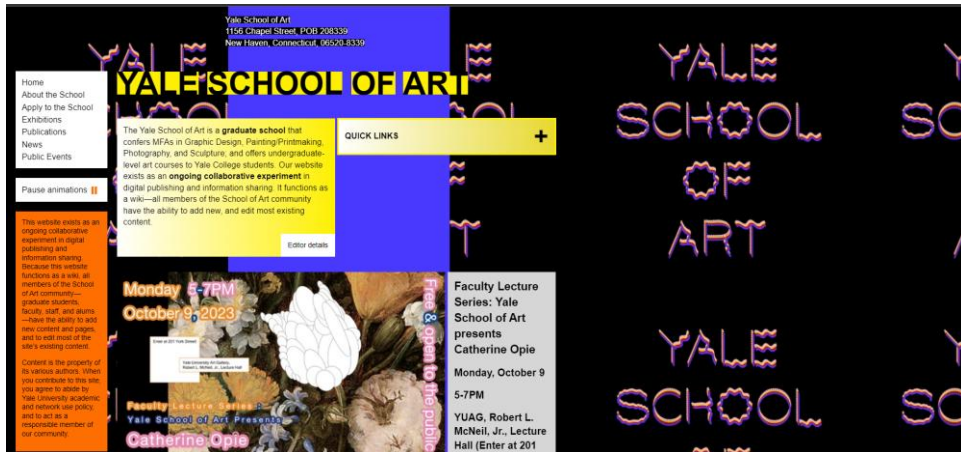


Figure 3 Represents homepage snapshot.

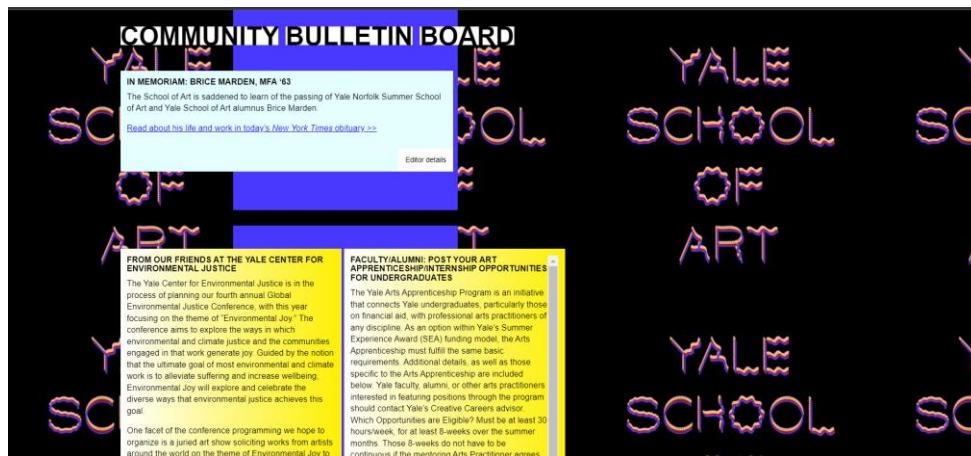


Figure 4 Represents content presentation snapshot.

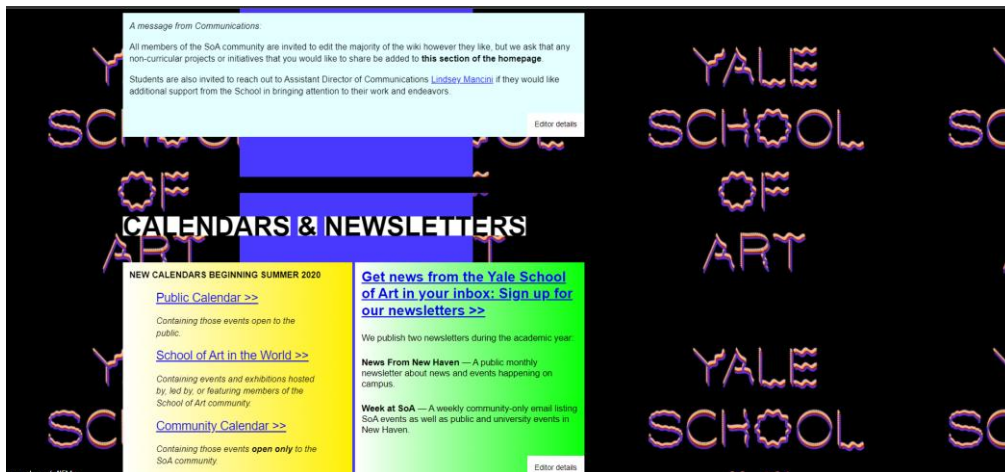


Figure 5 Represents calendar events page snapshot.

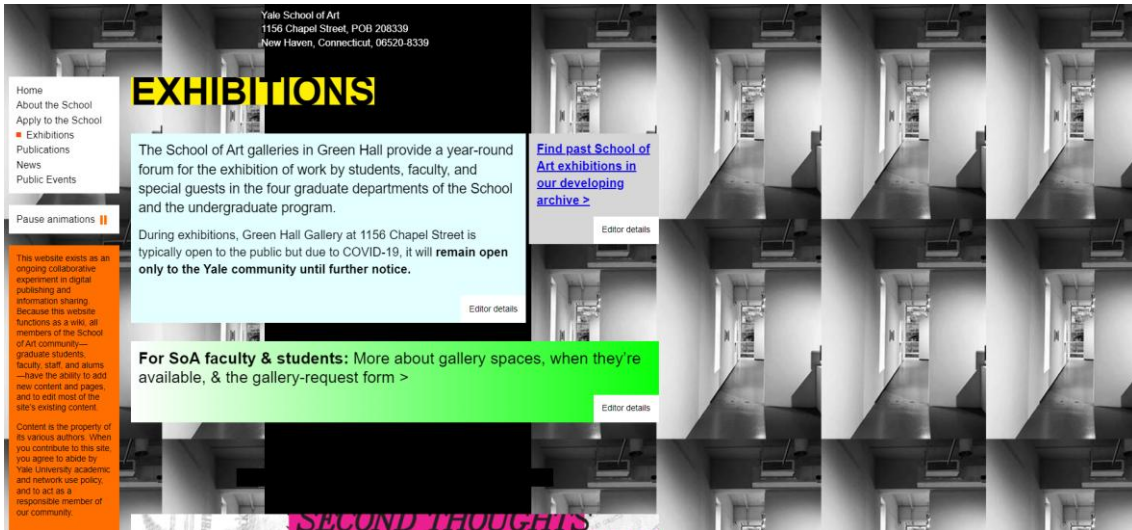


Figure 6 Represents exhibition page snapshot.

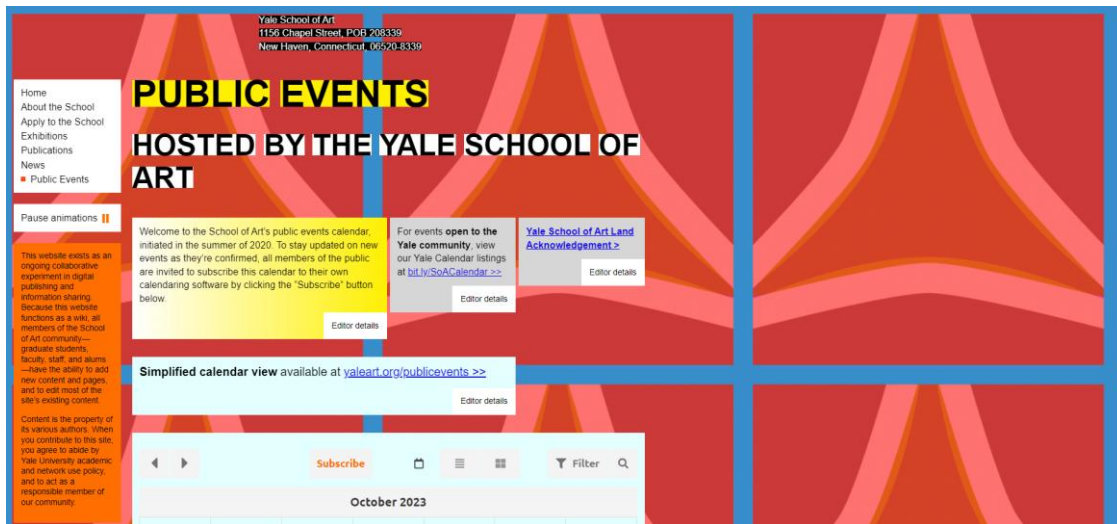


Figure 7 Example of a public event page.

4.1. FULE methodology analysis

To conduct the usability testing study of the “Yale School of Art” website, five independent evaluators were rigorously instructed to assess the website objectively, without any form of bias, and to express their genuine opinions regarding its usability. The evaluators were closely observed throughout the process, allowing us to identify key pain points and areas where improvements could be made to enhance the website’s functionality, usability, and overall look-and-feel. The usability testing questions for the Yale School of Art website, which use the FULE methodology, are as follows:

- QN01. Can you find the information you are looking for quickly and easily?
- QN02. Is the website easy to navigate?
- QN03. Are the links easy to find and click on?
- QN04. Is the website visually appealing?
- QN05. Is the layout of the website easy to understand?
- QN06. Are the fonts and colors easy to read and understand?
- QN07. Are the images and videos relevant and high-quality?
- QN08. Does the system minimize the user's need to remember information?
- QN09. Is the system consistent in its use of icons, symbols, and other graphical elements?
- QN010. Would you recommend the Yale School of Art website to others?

A five-point Likert scale is used as a measurement tool. The five-point scale is chosen because it is relatively easy for respondents to understand and use, minimizing potential confusion. The five-point scale used to measure the degree of agreement with the research questions was as follows: 5- strongly agree, 4- agree, 3-neutral, 2- disagree, and 1- strongly disagree. Each user was asked to provide ratings from 0 to 5, with 0 being the lowest and 5 indicating the highest level of satisfaction, for a set of ten predefined questions. Additionally, participants were encouraged to provide suggestions for



improving the website. The findings reveal strengths, weaknesses, and user-friendly aspects, serving as benchmarks for usability enhancement. Unanimous responses highlight clear insights into the website's overall performance and user satisfaction. The user experience results are tabulated in Table 1. The corresponding graph for the user convenience ratings for the FULE methodology questions is represented in Figure 8.

Table 1 Likert scale for user experience with the FULE questions.

FULE Questionnaire	User 1	User 2	User 3	User 4	User 5
QN01	4	2	1	2	3
QN02	3	1	2	3	1
QN03	4	2	3	2	3
QN04	3	2	1	1	2
QN05	2	1	2	2	1
QN06	1	1	1	1	1
QN07	3	4	2	1	2
QN08	1	1	1	2	1
QN09	1	2	0	1	1
QN10	1	1	1	1	1

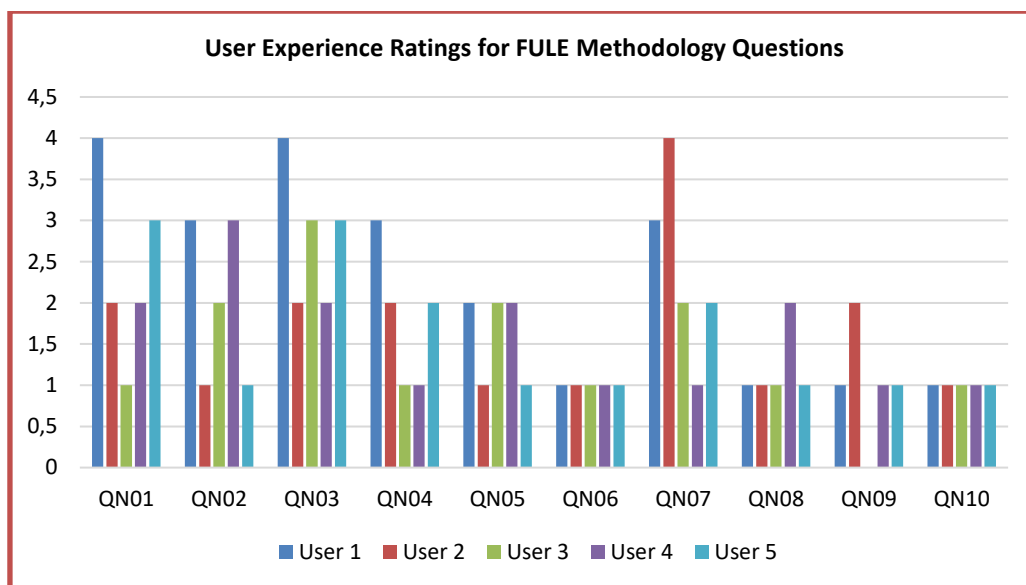


Figure 8 User experience ratings for the FULE methodology questions.

In the impartial evaluation, diverse insights from evaluators highlight website strengths and areas for enhancement at the Yale School of Art. Ratings provide a solid foundation for analysis and recommendations. The observer notes help us identify pain points, which helps us achieve our goal of optimizing the user experience. Unbiased feedback is invaluable for website improvements.

The following paragraphs offer a comprehensive summary of evaluator suggestions and critical user testing observations for the Yale School of Art website. They serve as a repository of valuable insights, forming a roadmap for improving functionality, usability, visual design, and overall efficiency. The combination of recommendations and observations creates a holistic view, guiding prioritized changes for optimized user experience. The Yale School of Art website faces functionality and usability issues: a lack of a search function causes frustration, no option to save event dates, and vital resources are not easily accessible. Accessibility features are lacking: images lack text, videos lack captions, and keyboard navigation is needed. Usability concerns include a cluttered navigation structure, challenging text readability, and the need for cues to enhance the user experience. Excessive use of color creates a visually taxing and unpleasant user experience.

A notable shortcoming of the Yale School of Art website is the absence of a usability and satisfaction evaluation process. This makes it difficult to gain critical insights into visitor engagement, navigation, and overall satisfaction. Without assessments, pinpointing and addressing problem areas becomes challenging, emphasizing the importance of including assessment metrics in the website creation and maintenance process for improved functionality and user experience. The evaluation of the Yale School of Art website, which is based on the FULE methodology and user ratings, yielded valuable insights that could be effectively categorized into four key domains. These four key domains of the FULE methodology are represented in Figure 9, which encapsulates the evaluators' candid assessments and reflects their impressions and experiences while navigating the website.



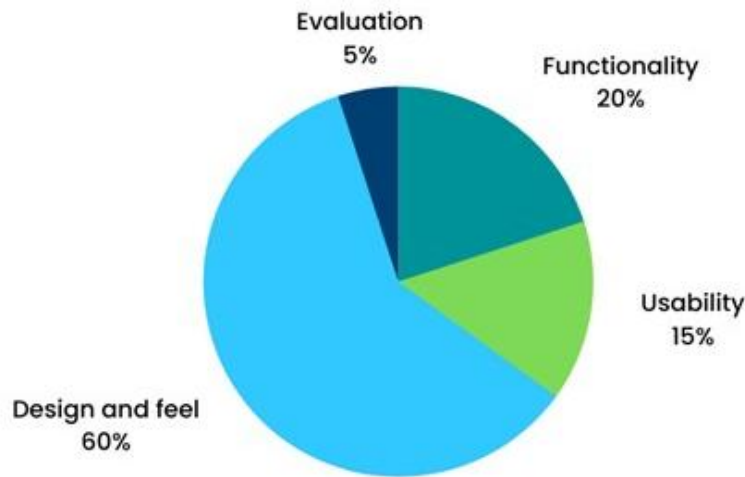


Figure 9 Usability impact distribution in the FUEL methodology.

As demonstrated in the pie chart, the majority of the issues and suggested improvements fall under the category of "Design and Feel," constituting a substantial 60% of the identified concerns. Additionally, "functionality" emerged as another significant area, representing 20% of the concerns. "Usability" accounts for 15% of the issues. Finally, "evaluation" constituted 5% of the identified concerns. This compilation of insights, anchored in real user interactions, constitutes a foundational resource for guiding the future development and refinement of the Yale School of Art website, ensuring that it aligns seamlessly with the expectations and needs of its diverse user base.

4.2. Evaluation via usability heuristics

The five selected participants performed the usability heuristics evaluation process. A detailed explanation of the 10 usability heuristics to the evaluators was briefed, ensuring a clear understanding of each heuristic's significance in evaluating the website's usability. The evaluators were subsequently given the task of rating these heuristics, reflecting the level of usability according to the five-point Likert scale. Careful observations during the evaluation captured user interactions, enriching our understanding of their experiences. The set of heuristics for usability testing for the Yale School of Art website via usability heuristics is tabulated in Table 2. Each heuristic contributes to optimizing website usability by adhering to established design principles. Likert scale values of user experience with the ten usability heuristics questions is tabulated in table 3.

Table 2 Set of usability heuristics.

ID	Heuristic Name	Features of the Heuristic for a Website
UH01	Visibility of System Status	Ensure users always know what's happening on the website; provide feedback and loading indicators.
UH02	Match between System and Real World	Make website content and language align with users' expectations and real-world terminology.
UH03	User Control and Freedom	Allow users to navigate, undo actions, and recover from errors easily with clear options.
UH04	Consistency and Standards	Maintain uniformity in design, layout, and interactions following established conventions.
UH05	Error Prevention	Implement safeguards to prevent errors, guide users, and minimize the need for correction.
UH06	Recognition rather than Recall	Reduce the need for users to remember information; make options and actions visible and intuitive.
UH07	Flexibility and Efficiency of Use	Cater to both novice and experienced users with efficient shortcuts and flexible interfaces.
UH08	Aesthetic and Minimalist Design	Strive for an attractive and uncluttered design that enhances user engagement and comprehension.
UH09	Help Users Recognize, Diagnose, and Recover from Errors	Offer clear error messages, explanations, and guidance for users to correct their mistakes.
UH010	Help and Documentation	Provide accessible and comprehensive help resources for users who require additional information or assistance.



Table 3 User experience Likert scale values for the ten usability heuristics.

Usability Heuristics	User 1	User 2	User 3	User 4	User 5
UH01	1	1	1	1	1
UH02	3	1	2	3	2
UH03	3	2	1	1	3
UH04	1	2	1	1	1
UH05	3	2	3	2	1
UH06	1	1	2	1	1
UH07	2	3	1	1	1
UH08	1	1	1	1	1
UH09	3	2	3	2	2
UH10	1	1	1	1	1

Viewed through usability criteria, the Yale School of Art website reveals issues, notably with "Visibility of System Status" and "Match between System and the Real World", which poses a usability issue. The website often deviates from users' real-world expectations due to poor navigation, uneven design elements, and a lack of hierarchical content arrangement, causing confusion. Enhancements in "user control and freedom" are warranted. The absence of a easily recognizable search tool restricts efficient information retrieval. Inconsistencies in color schemes and content layouts contribute to user confusion, lowering overall usability. Enhancements in "Error Prevention" are needed. The user experience graph of usability heuristics is depicted in figure 10.

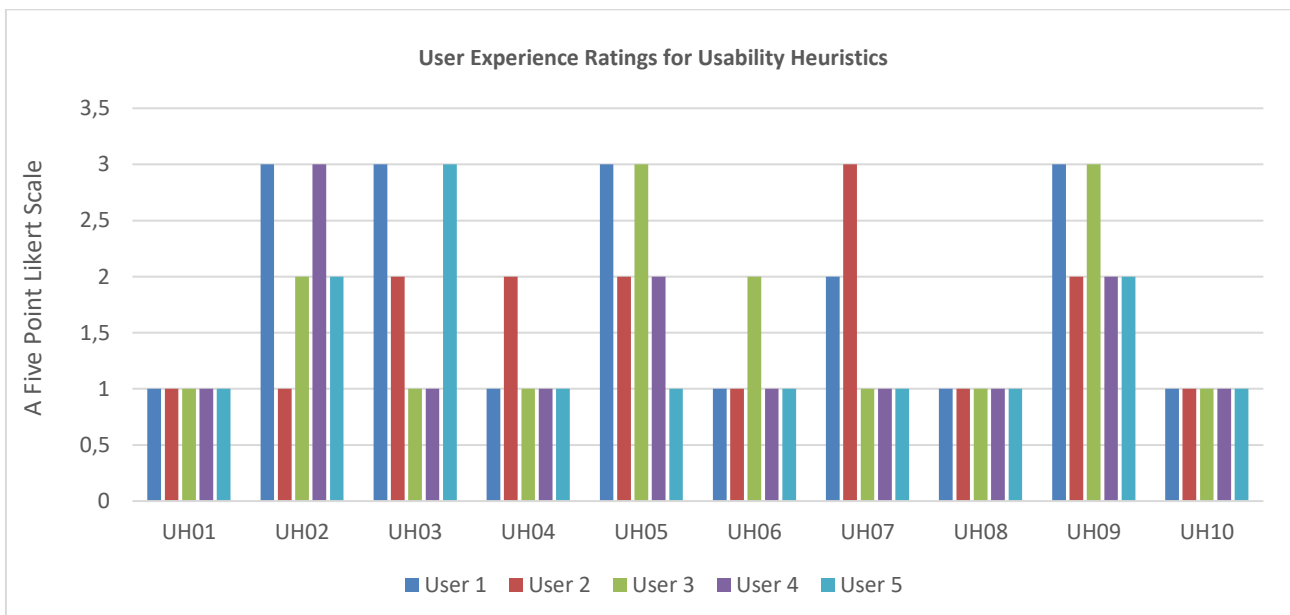


Figure 10 User experience ratings for usability heuristics.

The website lacks tools for actively guiding users to prevent mistakes, potentially causing a less seamless and stressful experience. Additionally, the absence of "recognition rather than recall" is problematic, as the lack of a breadcrumb trail places a cognitive strain on users, who rely on memory for navigation. "Flexibility and efficiency of use" on the website requires improvement, as users find it overwhelming and challenging to use effectively. The color scheme is visually unpleasant, potentially discouraging prolonged participation. A more appealing and simple design can provide a relaxing visual experience. The assessment of the Yale School of Art website, which uses usability heuristics and user ratings, provided valuable insights that is classified into distinct categories and evaluation results are summarized in Figure 11. This method offers a comprehensive assessment of the website's adherence to established usability heuristics and provide a clear picture of its strengths and areas requiring improvement.

A significant portion of the identified issues, comprising 22% of the impact, pertain to "visual design". The categories of "user control and freedom" and "consistency and standards" each account for 17% of the impact. "Visibility of System Status," "Match Between System and the Real World " and "Recognition Rather Than Recall" each constitute 11% of the impact, further stressing the need for improvements in these critical areas. "Flexibility and efficiency of use" account for 5% and and 6 % pertain to "help and documentation". This highlights the aspects that require attention. This categorization of issues allows for

a targeted and systematic approach to address the distinct facets of the website, ultimately aiming to enhance its overall usability and user experience.

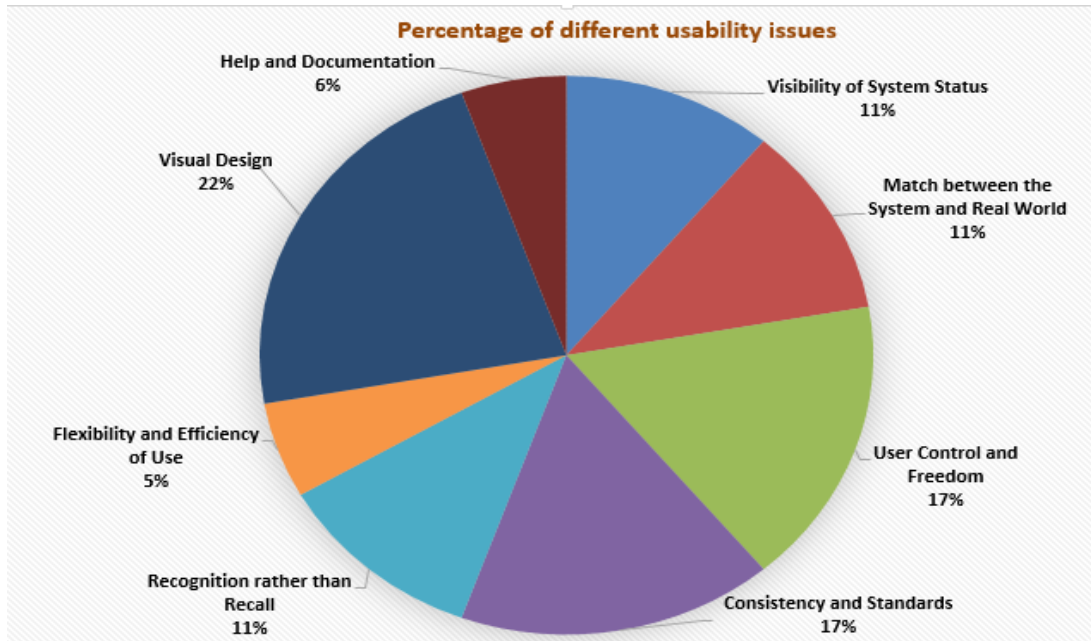


Figure 11 Usability impact distribution in terms of usability heuristics.

5. Redesign and Evaluation Results

In our quest for a user-centric design, we focused on redesigning a user-centric website to overcome the identified usability issues and to enhance the user experience of users in a particular region. The approach followed to redesign the website was to work on the user feedback received from both the usability heuristic method and the more comprehensive FULE method. This dual strategy aims to balance immediate user satisfaction with the refinement of the website's overall usability. The subsequent sections explain the redesign improvements.

5.1. Redesign case

The website was redesigned using a Canva tool to showcase the visual manifestation of our redesign efforts. Leveraging the versatile design capabilities of the Canva tool, we meticulously reimagined the website with an emphasis on user centricity. This redesigned interface is presented to the user evaluators, providing them with a tangible and visually engaging representation of the proposed improvements. The showcase not only highlights the aesthetic transformations but also underscores the strategic decisions and design principles guiding our efforts to create a more user-friendly and impactful online experience. Figure 12 and Figure 13 present the high-fidelity prototype of the user interface, which depicts the redesign of the website home page and content organization which was designed using the Canva tool.

5.2. Evaluation of the redesigned website

The evaluation of the redesigned website marks a pivotal juncture in our research, where we rigorously scrutinize the outcomes of crafting a user-centric redesign. In this phase, our evaluative lens extends beyond superficial visual enhancements, delving into the core of user centricity through the application of both the FULE methodology and usability heuristics. To ensure a thorough evaluation of the redesigned website, users were guided with clear and detailed instructions through both the FULE methodology and usability heuristics. Ten questions for FULE and ten principles for usability heuristics help assess functionality, ease of use, aesthetics, and potential improvements. This approach provides a comprehensive understanding of how well the redesign aligns with user-centric design principles, facilitating a detailed examination in subsequent sections.

We conducted another round of data collection with the same user participants after the redesign of our website. This process was undertaken to gauge the success of the redesign and understand whether the implemented changes positively influenced the user experience. Through this data collection effort, we sought to gather insights that would validate the effectiveness of the redesign and provide a clear understanding of its impact on various aspects of usability. By comparing the collected data before and after the redesign, we aimed to ascertain the extent to which the redesign contributed to the overall improvement of the website in terms of user satisfaction and functionality.





Figure 12 Enhanced website design via the Canva tool.

POPULAR ITEMS



The Yale School of Art is a graduate school that confers MEAs in Graphic Design, Painting/Printmaking, Photography, and Sculpture; and offers undergraduate-level art courses to Yale College students. Our website exists as an ongoing collaborative experiment in digital publishing and information sharing. Subscribe to the Newsletter for latest updates.

Figure 13 Redesigning the content organization on the website.

5.3. Redesign and evaluation via the FULE method

The FULE methodology provides an aligned strategy to address “Yale School of Art” website usability issues. Implementing an efficient search function with better filters, utilizing natural language processing for user queries, enhancing search result presentation, and streamlining navigation for an improved user experience are all key redesigned improvements. For enhanced usability, a straightforward navigation system is essential. The interface is improved by grouping relevant options and labeling them clearly to ensure user comprehension. Text readability is improved, especially for those with visual impairments, by enlarging the text and using high-contrast colors. Integrating visual cues such as icons and labels facilitates easier engagement with various website sections. Reviving the "Look-and-feel" element involves modernizing the website's design language, adopting contemporary aesthetics, and incorporating high-quality photographs and videos. Brand consistency is critical for aesthetic appeal, particularly in art presentations that rely on high-quality images. Usability testing and user input gathering are essential for evaluation, providing valuable insights into user interactions, needs, preferences, and past experiences. Therefore, we continued with the user evaluation process on the redesigned webpage using both the FULE and UH methods. Table 4 tabulates the user experience values of FULE method.

The results show that the usability issues identified through the FULE methodology are addressed and that the users experience more user-friendly and enjoyable website involvement. The visual data graph of the evaluation is represented in Figure 14, indicating an enhanced user experience of the redesigned website.

5.4. Redesign and evaluation via usability heuristics

To implement suggestions in line with the usability heuristics and to enhance the Yale School of Art website, the focus was on usability, accessibility, and aesthetic appeal. Augmenting user autonomy and freedom involves incorporating a user-friendly search function, granting users more control and efficient tools for information retrieval. This addition not only enhances usability but also aligns the website more closely with user expectations. The introduction of features that enable users to expedite their interactions with the website would improve "Flexibility and efficiency of usage," which can be accomplished. For example, providing the option for customers to easily add event dates to their calendars increases efficiency and meets their needs for convenience. The website requires aesthetic improvements. This is accomplished by including excellent photos and videos and upholding a constant visual aesthetic. These updates not only make the site look better but also give it a more polished appearance. The website is designed to support the users by including an extensive help center under "Help and documentation". Users who are looking for support or information can use these resources as helpful tools, which improves the overall user experience. Implementing these ideas has enhanced the Yale School of Art website's user-friendliness, accessibility, and aesthetics. Leveraging collaborative discussions and usability evaluations, a new landing page was developed for the Yale School of Art website. By utilizing user-centered insights and best practices with the Canva design tool, the revamped landing page aims to provide a more user-friendly, visually appealing, and efficient gateway. This aligns with the website's goals and meets the expectations of its diverse user base. The user experience of the redesigned webpage via usability heuristics is tabulated in Table 5. The corresponding user experience graph using the usability heuristics method is represented in Figure 15.

Table 4 Likert scale values for the FULE evaluation questionnaire.

FULE Questionnaire	User 1	User 2	User 3	User 4	User 5
QN01	5	4	4	4	5
QN02	4	3	4	5	4
QN03	5	4	5	4	5
QN04	4	4	4	4	4
QN05	4	4	4	4	5
QN06	4	3	4	4	5
QN07	4	5	4	3	4
QN08	3	4	4	4	3
QN09	4	4	3	5	5
QN10	4	3	4	5	4

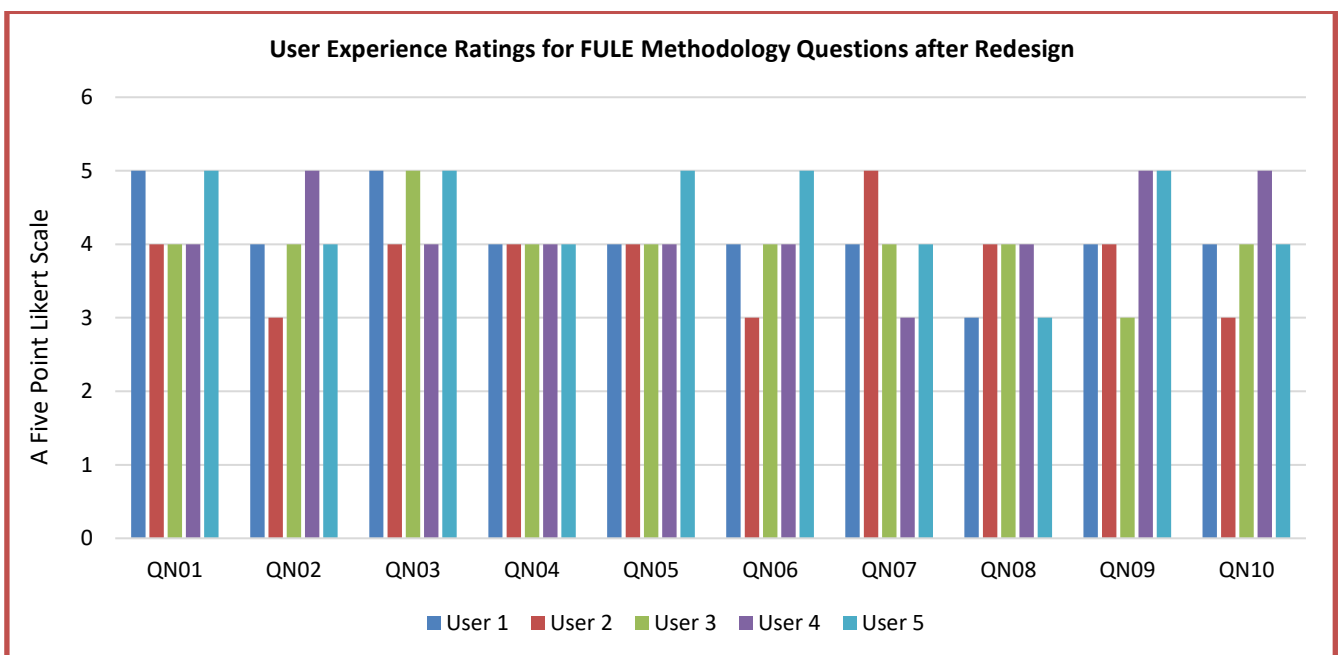


Figure 14 User experience rating for FULE methodology questions.



Table 5 User experience Likert scale values for usability heuristics.

Usability Heuristics	User 1	User 2	User 3	User 4	User 5
UH01	4	4	4	4	4
UH02	3	3	5	4	5
UH03	4	4	5	4	3
UH04	5	3	4	5	5
UH05	4	4	4	5	5
UH06	5	4	4	5	5
UH07	3	5	4	5	4
UH08	4	4	5	4	5
UH09	4	4	4	4	4
UH10	3	4	5	5	4

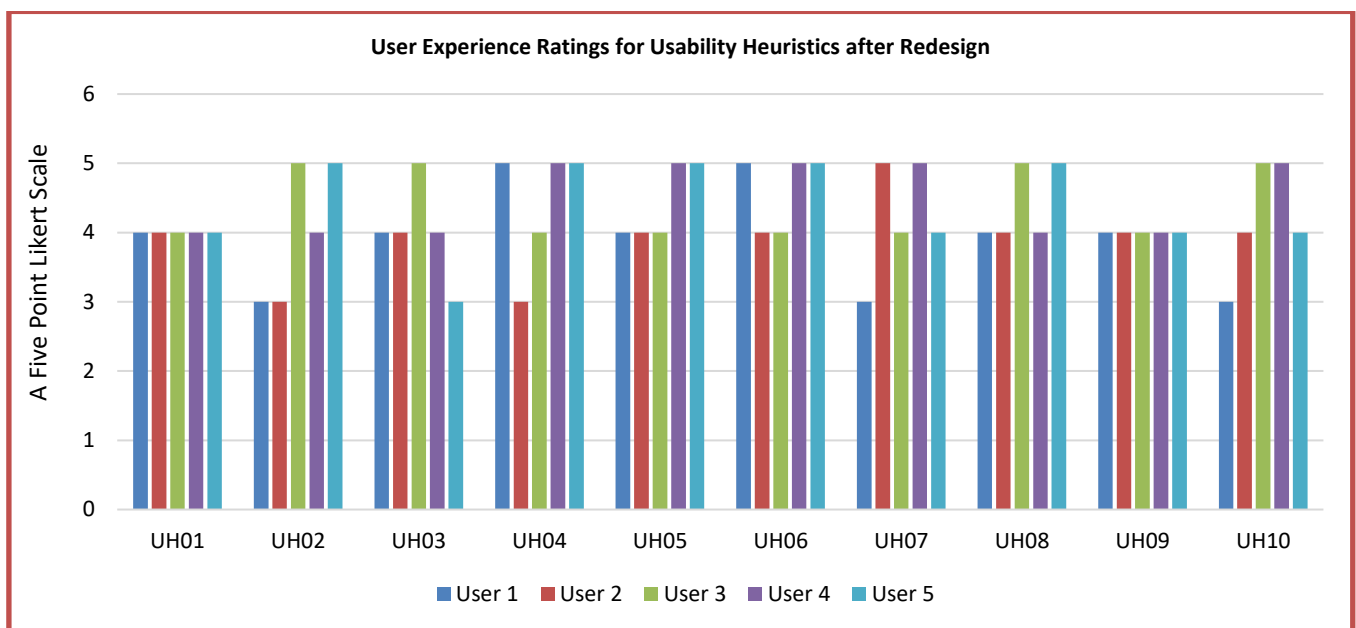


Figure 15 User experience rating for usability heuristics.

The culmination of collaborative efforts and the strategic implementation of recommendations and redesign has yielded transformative results for the Yale School of Art website. The careful application of usability heuristics and the FULE methodology has significantly improved functionality, usability, visual design, and overall user experience. This success highlights the importance of ongoing evaluation and user-driven enhancements to ensure the acceptance of the webpage from a global audience located in a specific region.

6. Discussion

Usability heuristics are important in identifying the usability issues and are most widely used in the emerging metaverse design (Omar et al., 2024), wearable virtual reality educational application (othman et al., 2025), elderly centered usability heuristics for augmented reality (Nishchik et al., 2024). Many authors have conducted the usability study for mobile application to identify the usability issues (Kazdaloglu et al., 2024). The usability testing has also found its importance in human robot collaborative workspace (Schraick et al., 2024). Testing the accesibility of educational institution webpages have also been conducted using machine learning approaches to identify the key areas of usability issues (Sik-Lányi et al., 2024). The work by authors (Alhadreti et al., 2024) have used heusability heuristics and cognitive walk through method to assess the usability of an application. In our study, we have used usability heuristics and FULE method to assess the usability of the university webpage design.

The evaluation of the "Yale School of Art" website was conducted using both the FULE methodology and usability heuristics. The original website and the redesigned website is evaluated using the five point likert scale values by the identified user participants. User experience (UX) values for the FULE methodology (Lieberman-Pincu et al., 2020) questions for before and after website redesign are compared in the figure 16. In the resulting comparision graph, the user experience values have improved evidently after the website was redesigned. The improvement in the UX values for the redesigned website is shown



in figure 16. The UX values of redesigned website, on the right hand side of the figure shows that the users are more satisfied with the redesigned website.

User experience values for the usability heuristics questions designed by authors (Jakob Nielsen & Rolf Molich, 1990) and (Nielsen, 1994) before and after redesign of the website are compared in the figure 17. In the resulting comparison graph, the user experience values have improved evidently after the website was redesigned. The UX values for the redesigned website is shown in figure 17. The improvement in the UX values of redesigned website, on the right hand side of the figure shows that the users are more satisfied with the redesigned website.

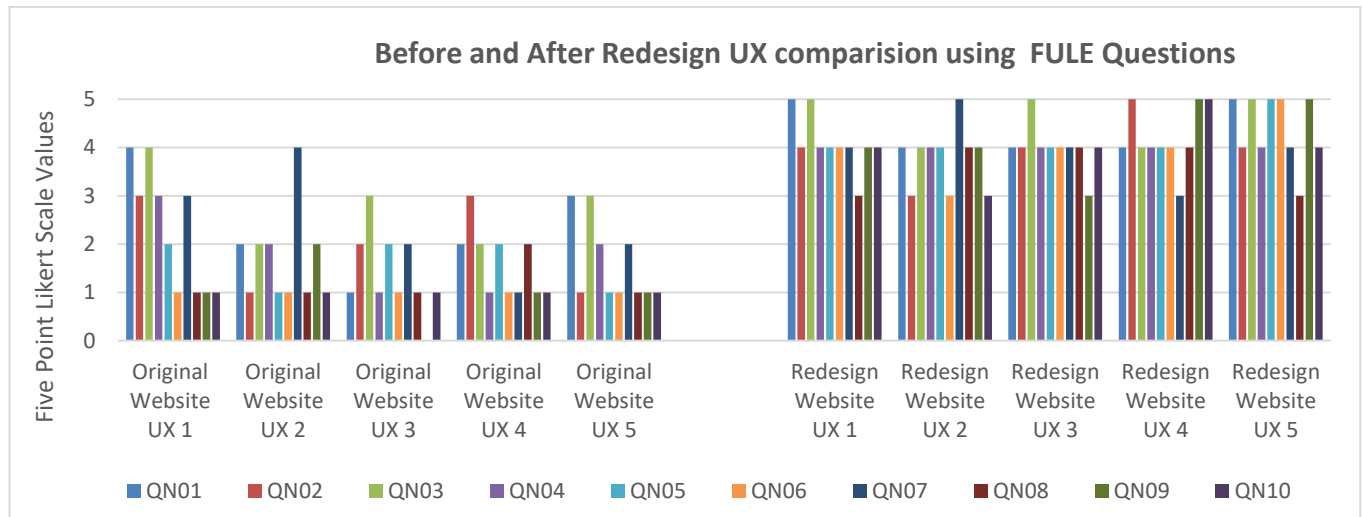


Figure 16 User experience values for original and the redesigned website using FULE questions.

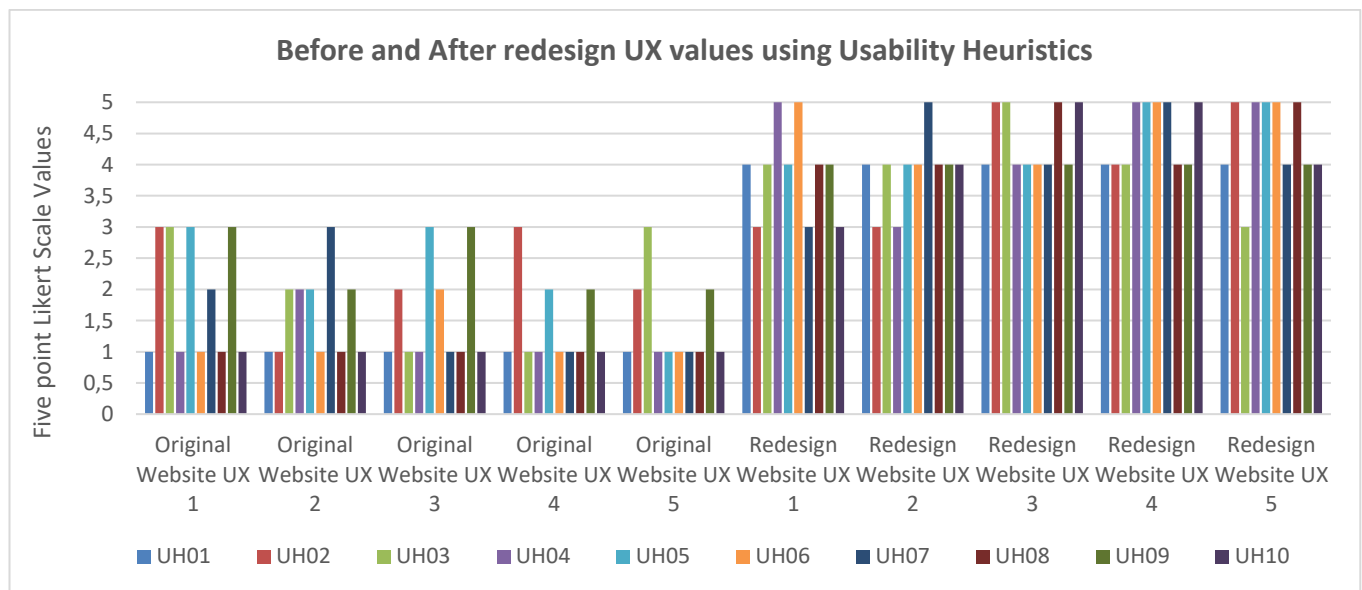


Figure 17 User experience values for original and the redesigned website using Usability Heuristics.

7. Conclusion

In conclusion, this usecase serves as a valuable resource for web designers and usability experts by bridging theoretical concepts with real-world global user perception. By integrating these perspectives, website design can be improved, emphasizing the need for websites to adapt to evolving user demands across different locations on the globe. Acting as a roadmap for web developers, the study highlights the balance between user-centered design and website efficiency, ensuring a user-friendly experience for diverse users across cultures and geographical regions.

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Ethical Considerations

The participants have provided their consent for the use of feedback information provided during the research.

Conflict of Interest

The authors declare no conflicts of interest.

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