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User Experience of Academic Library Websites

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Abstract— *Despite the indispensable technological shifts, the success of a website is anchored on effectiveness, perception, valuableness, satisfaction, reliability, and efficiency dimensions. In this research, heuristic evaluation enabled to assess the primary content elements on academic library websites homepages. The heuristic method's findings were compared to task-based usability tests. Usability heuristics results correlate to task-based usability testing findings by supplementing measurement of users' expectations in multifaceted magnitudes. Cultural and one's national origin determines students' assessment and usability of universities' libraries' websites to a great deal. Universities can benefit from optimized operational performance by upholding underlying principles of heuristic model to achieve exceptional outcomes. This study derives ultimate satisfactory consciousness that heuristic evaluation's principles guide to design an academic library's website that complements efficiency and satisfaction.*

Keywords— *User Experience Design, Heuristics Evaluation, Usability, Academic Library Websites, User Interface*

I. INTRODUCTION

With the advent of technology, academic libraries' services have become crucial access points to bulk information. A library is no longer a physical building stack with mass print materials (books and journals). In the modern era, databases have eased the retrieval and access of information. Library websites facilitate discovery and distribution of wider-ranging content materials. University libraries have adopted a culture that fosters excellent learning and research through innovative technology. This arrangement creates a sense of interest in organizing, acquiring, and using data. However, it necessitates service conveyance that appeals to the end-users. Conventional knowledge is that academic libraries have become a center for testing the usability of virtual spaces. Universities have strived to align their library services to positive user experience. The practice is endeavored to mitigate technological advancement complexity. Delivering sustainable goals within the sphere of content material, it obliges the realization of engagement among different stakeholders (students, staff, and web designers). This association will facilitate intellectual growth through the availability of academic literature based on quality technological platforms. Within the Kingdom of Saudi Arabia, Umm Al-Qura University, King Abdulaziz University, King Saud University, and King Khalid University have distinguished library websites. The user experience assists in determining how a person develops a connection after interacting with a system. Universities have committed to facilitating the acquisition of information and resources through library websites' spaces. This work explored the user experience of universities' libraries' websites in Saudi Arabia.

Universities' websites ought to become universal communication medium for promoting academic services through technological awareness. Educational institutions have endeavored to assemble an extensive collection of content materials and offer them through websites. With increased technological transformations and Internet use, educational entities have realized the importance of comprehensive web spaces. Universities library websites are commonplace outlets of data distribution. Scientific advancement has prompted an increase in the quest for exploiting the Internet, especially for higher learning institutions, to benefit from the opportunity of stimulating efficient knowledge acquisition and teaching practices [1]. An examination of how these systems guarantee positive interaction is essential. Regardless of technological shifts, the success of the website is anchored on various dimensions. How do its users perceive it? Is it reliable to provide the expected value? Is it easy to navigate? Does the system uphold users' satisfaction because of accessing information? These aspects influence the desire to interact with a website. They are the foundation for determining whether a user can regularly rely on a system for information retrieval. Different Saudi universities have grasped the essential requirement of websites to influence positive users' interaction. One can appraise the usability of their libraries' home web pages to determine their efficiency level. Heuristic evaluation provides a multifaceted outlook of user experience (interactions and satisfaction) for libraries' websites. Moreover, it presents a differentiated standpoint to assess university libraries' websites' user experience. This research paper focuses on the user experience of academic library websites. It compares those of Umm Al-Qura University, King Abdulaziz University, King Saud University, and King Khalid University. Therefore, this research uses the heuristic evaluation for evaluating operations of academic library websites of Saudi universities.

The research questions for this work emphasize the primary content elements of universities' libraries' websites homepages. They are outlined as follows:

1. To what extent do the results of heuristic evaluation, which are based on an evaluation checklist of a website, correlate with the results of task-based usability testing?
2. To what extent do cultural and national origins impact students' assessment of the usability of academic library websites?

II. RELATED WORKS

Different studies have developed an interest in this area of exploration regarding user experience of universities' websites. This research examined and synthesized various studies' backgrounds using distinctive themes. They included academic libraries websites, empirical studies on academic libraries websites, Saudi universities, empirical studies on user experience and usability, task-based usability testing, and the culture and usability of websites.

A. Academic Library Websites

Academic library websites have become essential systems allowing access to an array of collections of information through the online platform. When academic libraries use such a system, they strive to develop a database. Balistreri-Daum [2] indicated that providing scholarly information to students and faculties through searchable online databases has been on the rise. This development has been as a result of the continued expansion of technologies and internet access, which, in turn, has provoked the necessity to utilize proxy servers to allow remote navigation of library services. Website functionality is the fundamental reason for achieving such a vital milestone. Ullah and Qutab define websites as a system comprising digital assets (pages, images, and videos) within an integrated uniform resource locator (URL) in a domain name, IP address, or Internet protocol across a network [3]. Academic libraries use a website because it permits the intertwining of information and resources electronically. Ullah and Qutab concluded that websites had become integral tools for libraries' operations in the contemporary world [3].

B. Empirical Studies on Academic Libraries Websites

Academic libraries become a focal point of distributing information when advanced tools permit the users to achieve excellent outcomes. A study on the associated trends of Web 2.0 applications on academic libraries across Asia resolved that these systems have become central hubs for elevating the level of users' engagement with information services. The benefits accrued to the utilization of Web 2.0 are collective intelligence and connectedness due to integrated web experience [4]. These findings were a result of an analysis that involved a multi-method approach for 75 universities in Asia. The findings were that over two-thirds of higher institutions of learning had

adopted Web 2.0 applications [4]. The future of academic libraries and their development are based innovative services revolving around web 2.0 application [4]. This study is relevant to this present research because it provides its findings from a perspective of developing economies. Saudi Arabian nations placed within this category, the findings are, thus, applicable.

In the same manner, Mierzecka, Kisilowska, and Suminas [5] reported the crucial impact of academic library websites in enabling information distribution and retrieval through online platforms. The results of this inquiry relied on a survey conducted on Polish and Lithuanian academic library websites. This quantitative analysis incorporated 460 respondents (humanities or social sciences scholars). With the help of Computer-Assisted Web Interviewing (CAWI), the findings revealed the accessibility of online materials as a vital element that influences the performance of an academic library website. The user experience of university libraries' websites necessitates an understanding of how numerous web applications motivate progressive outcomes. Thus, Mierzecka's, Kisilowska's, and Suminas' [5] work added to the comprehension of an effective technique that befits user experience when navigating academic libraries' websites.

In a distinctive method, Li, Wu, and Su [6] were concerned with the importance of various design features and their effect on promoting higher education learning. These authors explored the physical library facility as a useful place for sourcing referencing materials. However, they considered the prevailing presumption that the current millennial generation of university students have familiarized themselves with online information search. Using China as the background of their inquiry, they [6] articulated that modifying library designs to suit students' learning needs is a core effort for university libraries, mainly due to the emergence of digital age.

Academic library websites impact students' learning success. In 2017, the Association of College and Research Libraries [7] conducted as assessment project of the effect of a library on the institution's goal of promoting academic achievement. The reported findings of the importance of an academic library consisted of a positive association between the academic library and student learning success. The following were the revealed outcomes of an academic library. Students benefit from library guidelines to help complete the coursework, the presence of various collaborative academic programs that enhance student knowledge acquisition, high information literacy, and boosted library search consultations. Other advantages comprise improved student retention, positive long-term academic value, and student engagement [7].

C. Saudi Universities

Saudi Arabia has a distinctive path in its higher education and subsequent incorporation of digital tools that facilitate data distribution for academic purposes for positive user experience. Digital libraries support electronic learning techniques. Gul and Saqib [8] argued that educational websites should ease information access in a timely manner to promote increased usability level. A website application that adheres to quality measures must support various usability dimensions. Based on this description, these authors evaluated usability of educational web pages Saudi Arabia [8]. Using a quantitative approach that integrated data collection using a questionnaire administered on undergraduate students, the researchers exposed the usability problems of libraries' websites. Aldiab, Chowdhury, Kootsookos, and Alam [9] had focused on the advantages of universities in Saudi Arabia to advance digital tools incorporation in educational institutions. Whereas this arrangement limits students' cultural barriers to pursue higher education, it has become a matter of significant concern for the government to move towards the application of practical learning techniques, digital libraries.

Saudi Arabia has strived to take advantage of a knowledge-based economy through a significant emphasis on technological application. According to Salem [10], universities have become a hub for stimulating the establishment of knowledge-based economies. It is now a norm in Saudi Arabia to propel the performance of its high education sector to enhance economic growth. Salem examined the fundamental impact of universities on constructing a knowledge-based economy within the spheres of technological advancements (research commercialization, innovation, and technology transfer). Eventually, this study affirmed that Saudi universities had become central avenues of exciting sustainable economic development [10]. On the other hand, Saudi Arabia has not profited from an efficient digital technology in its learning system. Quadri, Muhammed, Sanober, Qureshi, and Shah [11] analysis revealed that infrastructure and technology dimensions fundamentally influence the performances of higher education centers. An evaluation of various barriers documented in different works of literature enabled these researchers to make this verdict.

Saudi Arabia has a renowned approach to promoting the success of higher education. Alhabeeb and Rowley [12] examined the circumstances for sustaining university education's efficiency in Saudi Arabia. Their work showed that the Saudi government had channeled a substantial amount of resources to support and advance digital tools use. The authors found out that manipulation of technology for educational purposes delivers academic opportunities and resource utilization within and out of campus [12]. This investigation guides the evaluation of how electronic media devices facilitate the implementation of a system to motivate the distribution of knowledge in universities resulting from the use of advanced digital arrangement.

D. User Experience and Usability

Within the realm of university libraries, researchers have developed a great interest in user experience and usability to suit the desires of the end-users. Wiles, Roberts, and Abdelnour-Nocera [13] identified the university library's central impact and considered it the heart of the higher institutions of learning. With particular emphasis on how libraries can become virtually usable, they performed an exploratory study to investigate user experience and usability within the UK's universities library. The analysis depended on a survey questionnaire distributed to three university libraries. The participants were required to express their opinions based on indicated usability properties. The findings indicated significant concerns about inadequacy information transmission among users. It required addressing user experience to improve the expectations of those accessing information in the university libraries.

The academic library interface influences the expectation of accessing information. Alazemi [14] addressed libraries' web interfaces as a vital gateway to retrieving information using the information-seeking behavior (ISK) framework and the human-computer interaction (HCI) model. After integrating a qualitative analysis to explore users' information needs and experiences with academic libraries' websites, the author designated complexity in information search and content structuring issues to interfere with efficient operational academic libraries' websites. He concluded that supporting users' needs and expectations provide the flexibility of promoting information search [14].

Access to information for online library users exhibits various barriers and experiences. Balistreri-Daum explored the limitation of using proxy servers remotely and the approaches for overcoming such hindrances. The study's participants were students from the midwestern university that accessed the library remotely. The research reported barriers in information search and access strategies as the essential factors that need addressing to stimulate enhanced library systems [2]. Sauro [15] utilized normative and multidimensional and evaluative instruments to identify user experience that warranted enhancement. The examined factors were usability, trust, appearance, and loyalty. The conclusion was that the quality experience of a website differentiates the organization's performance level in terms of whether customers are likely to use their website or refer others to enjoy a similar experience.

E. Task-Based Usability Testing

Task-based usability testing signifies the effectiveness of a conventional interface in academic libraries. In their work, Zhang, Niu, and Promann [16] assessed a test-usability of interacting with e-books. The work adopted a methodology involving the analysis of usage data and behavior observation. The expectation was that these variables could provide the framework for designing a task-based usability test. This assessment measured the participants' reactions to reveal the user's perception and interaction as well as the usability issues to e-book. The exploration noted that the e-book interface influences the reading experience by facilitating effective navigation and access to information [16].

In another research that analyzed academic e-book usability, Tovstiadi, Tingle, and Wiersma [17] utilized task-based usability testing to assess how users were satisfied with academic e-books services. The participants of this search were the students associated with the University of Colorado Boulder. They were required to engage in typical tasks related to test usability on e-book platforms. The inquiry results identified various benefits and limitations accrued to the e-book platforms concerning the student's experiences and preferences. The final finding specified students' necessity to access educational materials using e-books compared to EBSCO. Consequently, Tovstiadi, Tingle, and Wiersma [17] determined that e-book's features and functionality impact students' aspirations to conduct their search with a particular platform.

F. Culture and Usability of Websites

Culture affects the usability of websites. A study to advance cross-cultural concerning human-computer interaction using the usability model appreciated the fundamental role of culture in accessing a website. Alexander [18] examined the design characteristics of three cultures (Australian, Chinese, and Saudi Arabia). He adopted a usability measurement instrument to evaluate the web page serviceability of these cultures. The finding of the empirical evaluation of the archetype was human-computer interaction and cultural factors facilitate website usage [18]. Comparatively, Barón, Luse, and Townsend [19] analyzed how usability has manifested itself in cultural dimensions. Quantitative evaluation and measurement of website usability informed their findings. The examination concluded that universal site design elevates the ability to create positive users' experiences. The presented studies account the need of user's interaction with a system. User testing is the prevailing evaluation of a website to spot the level of users' association with it. Nevertheless, administering an assessment that allows predetermining usability to afford the much-anticipated approach to interacting with a structure.

G. Saudi Digital Library

Saudi Arabian countries have realized the need for adequate transformation in the educational institutions, especially their approach to the provision of quality learning that aligns with notable technological advancements. These nations have undertaken the importance to execute library digitalization to benefit from quality academic in addition to research data [20]. Saudi Arabia's efforts towards allowing access to mass information is evident in the number of educational centers that have realized this benefit. Alasem (2013) reported that with approximately 21 and 11 government sponsored and private-managed universities respectively, Arabian countries need to implement digital library services to serve the increasing student population became paramount. From 2000, Saudi Digital Library became a reality [21]. Alasem affirms this notion and articulated that digital library services can be traced back to 2000. For instance, in 2000, digital library was established to offer Arab and Islamic heritage to deliver electronic resources to different populations (Arab leaders and academic field) [21]. Therefore, as a result of realizing the relevance of quality data and collection of content material, optimizing libraries' websites was critical. The associated benefited that followed these practices were reported.

Saudi Digital Library has different positive impacts. The study [20] reported the positive impacts of Saudi Arabia promoting informative digital references, aligning Saudi towards elevated internet connectivity status, sustained economic progress through skilled human resource to match with the dynamic global settings, and strengthened intellectual property, and increase number of internet users through digital platform. Towards the essential of maintaining a knowledge-based environment, it obliges a workable solution. It is for this reason that Taala [20] concluded that Saudi Digital Library must uphold user-data management to align with the shifting educational requirements (digitalization). Evaluating Saudi Digital Library, important findings can be reported. According to Alasem [21], the problems associated with Internet use in the country affect the level of digital libraries' development. This declaration was after this author examined the usability of Saudi Digital interface using questionnaire-based approach. After evaluating effectiveness, aesthetic, learnability, and efficiency dimensions, the noted finding was that Saudi educational institutions had not fully integrated the interface. Thus, to bridge the digital knowledge gap, exploiting the Internet tool was crucial to motivate an excellent life [22].

The critical analysis literature review has helped bridge the literature gap in user experience design. Most of the analyzed studies identified usability testing as critical in determining the user-friendliness of a website. Heuristic evaluation, a comprehensive evaluation checklist of a website, provides a new outlook on the user experience of universities' libraries' websites. Besides, identifying how cultural and national origins impact students' assessment of the usability of university libraries' websites is a literature gap that needs bridging.

III. FINDINGS

Based on qualitative analysis, the current research utilized heuristic evaluation as the research approaches. Heuristics evaluation usually assesses the nature of the website's friendliness to determine its usability. Its checklist comprises "visibility of system status, match between system and the real world, user control and freedom, consistency and standards, error prevention, recognition rather than recall, flexibility and efficiency of use, aesthetics and minimalist design, help users recognize, diagnose and recover from errors, help, and documentation" [23]. The utilization of these research methodology helped record the findings concerning the users' experiences, preferences, and expectations of the four universities' libraries. Thus, this approach enabled the research to distinguish how heuristic evaluation correlates with task-based usability testing.

A. Heuristic Findings

1) Visibility of System Status

The homepages of the universities' libraries inform the users about the recent news. They communicate critical news regarding what is happening promptly (figure 1).

Fig 1. Visibility of System Status

2) Match Between System and the Real World

The websites incorporate either Arabic, English, or both English and Arabic languages (Figure 2).

Fig 2. Match Between System and the Real World

3) User Control and Freedom

This checklist scale indicates explicit user actions. The findings are indicated in figure 3.

Fig 3. User Control and Freedom

4) Consistency and Standards

This scale specifies guidance and platform conventions (Figure 4).

Fig 4. Consistency and Standards

5) Error Prevention

This metrics is a prompt for error identification. None of the homepages of the universities had error protection specifications.

6) Recognition Rather Than Recall

The criterion for this checklist is the provision of guidance to navigate a system easily through recognition and recall attributes (figure 5).

Fig 5. Recognition Rather Than Recall

7) Flexibility and Efficiency of Use

This system of measurement indicates the customization of the interface to select an action. It involves the presence of dialogue to help execute a task. Universities libraries' effectiveness is shown in figure 6.

Fig 6. Flexibility and Efficiency of Use

8) Aesthetics and Minimalist Design

The criteria for this checklist are minimal actions and information density. The universities have different aesthetic designs (figure 7).

Fig 7. Aesthetics and Minimalist Design

9) Help Users Recognize, Diagnose, and Recover from Errors

This principle of evaluation relates to error management. It entails the provision of means to identify and avoid errors, usually a pop-up message to recover from an unintentional fault. None of the home pages of the universities' libraries had this action.

10) Help and Documentation

This plan involves the availability of external assistance to enable a user to search for information quickly. It is the overall appearance of a system. The universities have distinguished help and documentation features (figure 8).

Fig 8. Help and Documentation

IV. DISCUSSION OF FINDINGS

The present study's context was based on the primary content elements on university library websites homepages. Accordingly, this current section of the research discusses the findings from heuristic evaluation to determine whether they answered the research questions.

A. *Correlation Between the Results of Heuristic Evaluation and Task-Based Usability Testing*

The heuristic evaluation results correlate to task-based usability testing distinctively. As this research has indicated in the findings, the former assessment model has ten principles, whereas the latter entails three dimensions. Heuristic assessment manifests itself as an adequate scale to pinpoint the usability settings conforming to positive user's expectations and experience. Inbuilt features of a system influence the likelihood to rely on it to acquire vital information. Therefore, a website should reflect many dimensions that support a positive user experience.

The heuristic method provides the most practical elements that elevate a system's presentation and usability. According to the self-efficacy theory, effectiveness is the degree to which a potential user anticipates that a system requires minimal effort to navigate, eventually increasing the likelihood of acceptance [24]. This assertion aligns with the findings of the current research that many students felt that Saudi Universities' libraries' websites failed to sustain the user's confidence in using them continually. One of the usability principles of heuristic theory considered that a system should allow tailoring of actions, the flexibility of use.

Perception concerning the ability to locate information through academic libraries influences students' readiness and familiarity to utilize libraries' resources [25]. One can, therefore, examine awareness of usability from a mental perspective. Individuals shape their thought depending on the functionality of the system, which is based on experience and intuitive insights. In that sense, they shape their actions on the foundation of how effective they can solve an issue [26]. Interacting with a system has a psychological effect. To reach such a conclusion, Hutchison, Hunt, and Johnson [25] had used mixed-method approach to assess graduate student's perceptions towards the utilization of university library. The results were based on Likert-scale survey analyzed through one-way ANOVA. There was a statistically significant difference of graduate's satisfaction level and their perception on library services' use. Hutchison, Hunt, and Johnson, thus, recommended the importance of libraries to offer orientation among graduates in their respective programs [25]. This finding denotes the relevance of considering various dimensions when designing a website platform. The heuristic model enables a website designer to bridge the usability dilemma gap of accessing a web page [26]. To a greater extent, this theory is practical compared to task-based usability assessment when determining user experience.

Usability heuristics results correlate to task-based usability testing findings through complementing users' expectations in all-encompassing dimensions. The ultimate effect of both models is to direct what peculiar features that provide constructive outcomes. The heuristic approach tends to integrate the checklists of error management and documentation as unique measurement scales of a structure. However, none of the home pages of the universities' libraries consider this action. A navigation system design should be a customized way that enables users to access information without stress. Information architecture is the core component of a website and, thus, it should help interweave a web page and not get frustrated [27]. Universities' libraries are outlets of bulk materials. Information architecture determines the satisfaction level with library websites. This supposition was based on an exploration of national library websites to convey that the overall planning of a website determines products' information is connected to designate hierarchy [28]. Saudi Digital Library results revealed that this arrangement has promoted awareness of academic literature, which, in turn, has contributed to the realization of increased learning opportunities [20]. Navigation systems should enhance the users' capacity to identify particular data without necessarily taking a substantial amount of time to locate them [27]. The criterion for recognition rather than recall is the provision of guidance to navigate a system easily through recognition and recall attributes. In this case three of the universities require usernames and passwords to navigate easily in the system except for King Abdul Aziz University library. The immediate outcome of a website with such characteristics is continued need to access its content. Website designers would discover valuableness in utilizing the principles of heuristic usability to develop a web system to prompt excellent services. The findings for this study regarding the heuristic prototype designated various approaches to realize the degree of users' experience.

A task-based usability testing approach may be an inadequate scale of assessing user experience because it does not rely on a variety of broad dimensions. Effectiveness, ease of use, and personal contentment gauge usability, but the functionality of a web page demands meeting diversified attributes related to users' desires, thus the worth of heuristic archetype. The major criticism regarding method is the presumption that is fault-finding rather than the strain to execute a task [20]. However, there are essential reasons for upholding its utilization to help measure user experience. The heuristic evaluation scheme is expansive in identifying other severe issues compared to user testing [29]. The previously documented findings match the results of the present research. Based on the two evaluation

procedures, it was possible to comprehend how universities have libraries' website pages facilitate the distribution of academic or social communication content. Results of the heuristic technique were, however, extensive.

B. Impact of Cultural and National Origins of Students' Assessment on the Usability of Academic Library Websites

Cultural and national origins are critical determinants of students' assessment and usability of universities' libraries' websites. The home pages of four universities' libraries incorporated both English and Arabic languages. Digital online has emerged as a crucial framework to attract audience at the global front to share in the cultural heritage sector. A particular scenario is the British Museum, which digitalized its collections to meet users' needs through a satisfactory interface that allows the delivery of heritage content [28]. Similarly, Saudi Arabia's universities' desire to incorporate the Arabic language on their website is to promote the country's culture. The language barrier becomes a problem for graduates who wish to interact with these web pages but are not conversant with the dialect. Taala [20] asserted that cognizant perception of Arabic language as the primary mode of communication in Saudi Arabia is a potential barrier to digital library. It compromises the intention to reengineer innovativeness in the digital platform. Consequently, Taala [20] concluded that positive outcome of a digital platform is the association of different stakeholder for sustainability. The inexperience in using a variety of website features and inappropriate labeling complicates the situation. Complexity in design, difficulties in navigating search engines, and inadequate support limit the use of digital services to access the desired material content [30]. Positively, the library sites have an option for allowing its users to shift to the English language. Nonetheless, users from other nations of origin may find it challenging to manipulate online library services from Saudi Arabian universities.

V. CONCLUSION

The findings have answered the focus of the research questions using the adopted methodologies of heuristic evaluation and task-based usability testing, and they correlate. The former method provides wide-ranging guidelines to influence library web pages' visualization design to impact the users' experience positively. The conclusions designate that Saudi universities libraries have not unified their web pages pertaining to the desired users' behavior to obtain content materials. Saudi universities ought to design library websites that demonstrate optimized operational performance. The heuristic model provides the underpinning principles and framework for sustained excellent outcomes. Effective digital library propels information retrieval as well as build a relationship with its users. People's memory is a powerful dimension to help build action-oriented awareness of browsing experience [31]. Furthermore, aesthetic design, which incorporates first impression creation, is a prospect to boost user experience [31]. Thus, universities would need an appealing inbuilt library web portfolio to boost the user's interaction with the content material. Orientation to library's website among the graduate is also crucial to allow adequate understanding of its working. This arrangement will promote redeveloping of information infrastructure with significant emphasis of users' needs [32]. Moreover, the Saudi Digital Library would provide standards for Saudi university libraries' websites that provide an easy user experience based on the Heuristic evaluation checklist. Finally, Saudi universities could take advantage of systematic designing, testing, and redesigning their information distribution spaces to suit their target users [33]. The implication of this research is providing adequate awareness that heuristic evaluation model guides the designing of e-library spaces to sustain multifaceted users' demands to reap the benefits of valuable usability of libraries' websites.

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