EvolveUI: User Interfaces that Evolve with User Proficiency

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ABSTRACT

Recent studies have highlighted the challenges low-literacy users face with complex user interfaces, often preventing them from utilizing essential smartphone applications for an improved quality of life. This paper introduces the EvolveUI design approach that diverges from conventional interface design by evolving in complexity alongside a user's growing proficiency. Initially presenting a single navigation point to simplify interaction, EvolveUI systematically expands, introducing more features and navigation points as users become more adept at interacting with the interface. We build upon previous adaptive user interface research by uniquely focusing on expanding functionality based on user proficiency, offering a tailored experience that aligns with individual learning curves. By conceptualizing the interface as a dynamically expanding hierarchy, starting as a minimalist "tree" and unfolding into a more complex structure, EvolveUI facilitates a more accessible and engaging user experience. Our study compares this evolving interface approach with conventional designs through usability tests on a mobile health application, demonstrating EvolveUI's potential to enhance technology accessibility for low-literacy users and suggesting new directions for inclusive design practices.

CCS CONCEPTS

• **Human-centered computing → Usability testing**; *Smartphones*; Accessibility.

KEYWORDS

user experience design, mobile applications, illiteracy, adaptive user interfaces

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1 INTRODUCTION

There has been a considerable rise in smartphone ownership in emerging economies since 2015 [26]. However, a significant educational divide in smartphone ownership exists that is especially prevalent in developing economies [35]. One explanation for the slow uptake of smartphones amongst users with limited formal education is the increased complexity of a typical smartphone's interface relative to a feature phone's interface. Previous research indicates that populations with limited literacy can struggle with most modern computer and mobile applications due to the cognitive overload of navigating complex user interfaces (UI) [18]. One approach to reducing the cognitive load and resulting emotional challenges in navigating complex applications is to leverage the design of an adaptive user interface [16]. Research has shown that certain straightforward adaptive mechanisms are effective in helping people with limited literacy navigate and use digital interfaces [34]. For example, simple feedback mechanisms such as input forms being greyed out after accepting user input have been proven to help inform users with limited literacy on how they should proceed with the interface [34].

We aim to build upon this research by introducing and testing a novel design approach of a gradually evolving user interface. Our study enables a gentle learning slope for low-literate, first-time technology users. In this paper we introduce the *EvolveUI approach*, which, at a high level, merges the feature-by-feature walk-through typically embedded at the start of an application with an in-situ experience, gently onboarding a new user who may not have used a similar application before.

This paper presents a case study of implementing the EvolveUI approach, by designing a smartphone version of an Interactive Voice Response (IVR)-based platform in Pakistan that connects expectant fathers with a community of doctors and peers. The EvolveUI variant of the application starts with simply a single 'microphone' button on the screen, enabling first-time users to voice-record questions. The application incrementally adds new features once it becomes evident that the user is comfortable with the previous user interface element. The sequence in which the features are introduced in the application is based on the most common user journey of the users of the Super Abbu IVR platform. In this scenario, instead of inundating the user with several features simultaneously as they begin using the application for the first time, EvolveUI systematically exposes increasingly complex features of the interface at various points of the user journey, predicated on the user's proficiency with the existing features.

In this paper, we present comparative user test findings of (a) users interacting with the EvolveUI variant of the application, with (b) users interacting with a more conventional design that presents all features from the start. We report a quantitative comparison across key metrics, such as time spent on completing certain tasks in both versions of the application, as well as qualitative insights based on user feedback.

2 BACKGROUND AND RELATED WORK

In this section, we summarise some of the previous work related to our study, organized around two major themes.

2.1 Adaptive Interfaces

There are a multitude of strategies for tailoring the presentation of a user interface to enhance user experience. Among these, adjusting the spatial arrangement of elements such as menus or toolbars is a prevalent technique aimed at optimizing the accessibility of options for the user. Adaptive user interfaces excel in dynamically modifying elements—moving, resizing, or replicating items anticipated to be of greatest utility to the user, or conversely, concealing items deemed less frequently utilized. Moreover, these interfaces may also tweak the visual characteristics of certain components to capture the user's attention more effectively. This visual modification can be achieved through various means, such as intensifying the color of a user interface element or manipulating the sequence in which items are displayed.

Beyond these common alterations, some advanced adaptive interfaces incorporate user behavior and preferences over time to further refine their predictions and adjustments. They might introduce context-sensitive help or tooltips based on the user's interaction history, or employ machine learning algorithms to predict and present the most relevant options. This sophisticated level of adaptation not only improves the user's efficiency but also creates a more personalized and engaging interface experience. By understanding and anticipating the needs of the user, adaptive interfaces aim to create a more intuitive and seamless interaction between the user and the technology.

Each distinct type of adaptation comes with its merits and weaknesses. Spatial adaptation can help reduce the time to navigate a menu [14], or support the motor abilities of individual users [12]. However, this method can introduce spatial instability into the interface, where users cannot find items where they are used to finding them. This can, in turn, adversely impact the efficiency of their visual search and performance [5]. On the other hand, changing the visual appearance of items maintains spatial stability. In this space, color highlighting is perhaps the most researched technique, but research evaluations have shown that it does not provide a performance benefit over a nonadaptive interface [11]. On the other hand, ephemeral adaptations, such as the order in which menu items appear, have been shown to reduce visual search time and improve performance [9].

Another important consideration for adaptive interfaces is if adaptation is mandatory or elective for the user. In a mandatory adaptation interface [30], since the users cannot ignore the changes made by the system, frequent adaptations may prevent a user from developing spatial memory of the menu layout. These user interfaces have been shown to negatively impact the performance and satisfaction of users [8]. On the other hand, elective adaptations do not replace the original user interface, and instead use an additional menu with adaptive changes, which the user can ignore. The elective adaptive interfaces are faster and typically preferred by users than a mandatory adaptive design [11]. This is even though users are burdened with the additional cognitive effort to discover the adaptive interface. This cognitive burden is often resolved by carefully aligning the locality of the additional adaptive menu with the user's current focus. Otherwise, users may ignore helpful adaptations [11].

Our approach draws on lessons from previous work but also sets itself apart by focusing on a demographic often overlooked in technology design: low-literacy users. Most adaptive user interface methods prioritize enhancing the efficiency of expert users or improving accessibility for visually or motor-impaired users. However, our work is specifically designed for individuals with minimal prior exposure to computer interfaces. Instead of relying on standard adaptations such as the ability to move, resize, replicate, or copy items within a menu, our approach adopts a more personalized strategy. We systematically introduce new options to a user based on their growing proficiency, ensuring that once an option is presented, the interface's layout remains consistent. This stability is crucial for minimizing cognitive overload and potential confusion among low-literacy users. Our methodology prioritizes a gradual, evolutionary enhancement of the user interface that aligns with the learning curve of a novice user. By doing so, we create an experience that resembles an in-situ, step-by-step tutorial rather than a conventional adaptive interface, which often places efficiency above ease of understanding.

2.2 Designing for Low-literate Users

Text-based interfaces often present significant usability challenges for users with limited literacy skills [20, 21]. Therefore, several approaches have been proposed that use voice, graphics, and video [4, 25]. Previous work has focused on using non-textual graphical interfaces [21], speech-based and audio-based interfaces [32], replacing keyboards with pen-style input [27], and embedding instructional video [23] and audio based instructional content in the application [20].

Voice-based interfaces naturally minimize the requirement for literacy. Even when users can read and write basic words, they can often only do it in their native language, whereas localization keyboard input across ligature-based languages and many fonts and scripts pose challenges [15]. At the same time, making general-purpose automatic speech recognition (ASR) systems work across multiple languages is often not practical due to a lack of training data [24] in different dialects and accents [25]. Therefore, approaches that use limited vocabulary models for specific applications have shown more success [32].

The practical challenge of building ASR systems can be addressed by building user interfaces that combine graphics and touch for a better experience. For instance, VideoKheti is a multimodal interface that combines an ASR with graphics and touches on a smartphone to search videos for agriculture [6]. Touch input has also been shown to improve the performance of low-literate users on a search task between a hierarchical user interface and a multipage list design [19]. Results show that participants using the multi-page list perform better than a hierarchical user interface, without experience using touch-screen phones.

Approaches that leverage natural interaction, such as using a pen-style input device, have also been shown to work well for low-literate users. Projects such as Milpa [27] and PartoPen [36] use a pen–based interaction and use that for input to a digital tablet.

Extensive use of graphics in user interfaces, in place of text, has been shown to help overcome the inability to read text [15, 21]. Text-free user interfaces have broadly explored five different representational styles: local language text, static hand-drawn graphics, photographs, video, and animation [23]. Usability studies have shown that static, hand-drawn representations are better understood than photographs or icons by low-literate users, even though graphics can have more photorealism as the specificity of the information increases [23]. Several recent projects have built on earlier work on graphical icons and pictures for low-literate users. Platforms such as 'Easy- Texting' [10], 'Karaoke" [7] and 'Parichaya' [31] extensively use graphical icons to improve the performance of low-literate users.

In addition to using speech and graphical interfaces for input, audio, and video output have also been used to guide and assist low-literate users in using an application [10]. Video and audio output to guide and assist the user also helps overcome fear and mistrust of the technology and lack of comprehension for low-literate, first-time technology users.

EvolveUI is tailored toward general-purpose applications designed as hierarchical information architectures (or IAs) [19]. Hierarchical IAs naturally enable structured navigation of general-purpose information systems by displaying a few options at a time. Since hierarchical IAs economize the space needed for navigation by nesting, they are especially suitable for mobile devices with limited space for displaying options. However, previous research has shown that low-literate users find hierarchies difficult to use [33].

Complex hierarchical interfaces, which concentrate several options at every navigation point, increase intimidation for low-literate technology users [20]. EvolveUI specifically addresses this by enabling a gentle evolution of the hierarchy of options shown to the user, based on their familiarity and proficiency of previous options.

3 METHODOLOGY

In this section, we describe our methodology for designing the smartphone application based on EvolveUI, as well as the design of the user study.

3.1 Application Design

The application we are designing is a mobile app variant of an existing IVR platform in Pakistan called *Super Abbu*, or Super Dad. Super Abbu is a voice-based platform that users can access at no cost through a simple phone call. Super Abbu uses IVR technology to allow users to record questions for doctors, listen to doctors' answers to their own questions or other people's questions, and lastly, share and listen to stories from the community. As access to mobile broadband connectivity continues to expand to remote areas in Pakistan, it is worth contemplating whether the platform can be redesigned as a smartphone application that is easier to distribute and maintain than an IVR platform. The core functionality of the platform encompasses three distinct types of content: questions from users, answers from doctors, and stories shared between community members.

Based on these features, we created a simplified version (depicted in Figure 1) of the navigation tree of the Super Abbu IVR platform as the basis for its corresponding smartphone application. Therefore, first-time users would have to understand and navigate up to sixteen distinct user interface components if the Super Abbu application was designed using the conventional approach.

In comparison, the EvolveUI approach for the same smartphone application would only feature a single navigation point representing the most essential functionality for first-time users. In this case, that would be the "Record Your Question" button present in the top-most branch of the diagram in Figure 1). Thus this design simplifies the user experience and decreases cognitive load for first-time users by significantly constraining the number of distinct user interface components on the landing page.

As the users gain more proficiency in interacting with the application, the interface would evolve alongside them and reveal new features. There exist a multitude of approaches that inform when a particular feature should be revealed in an adaptive user interface [11]. Our specific aim is to only evolve the interface when the user is comfortable interacting with the current state of the application. Based on this goal, we decided that the key metric that would inform whether the interface evolves is the number of times the user successfully completes the main task introduced in the current interface.

Figure 2 illustrates how the main menu of the Super Abbu application evolves when designed with the EvolveUI approach. For our study, both the first navigation point and the order in which the evolving interface unfolds were predefined, based on the most common user journeys for Super Abbu. However, it is important to note that the EvolveUI approach does not necessarily aim to predefine the initial feature or the evolution of the interface. Instead, both the starting point and the way the interface evolves can be adapted based on different learning strategies to suit diverse user needs. It is crucial that designers adopting the EvolveUI approach carefully consider the user journeys of their target audience to achieve a balance between a gentle learning curve and enabling each user to easily access their desired functionality in the application. In the EvolveUI approach, the initial interface of the application contains the most basic functionality of the application where a user is presented with one simple use case: ask a question from a doctor. As the user receives the first response to the question, another button appears on the user interface enabling them to hear the response. After multiple successful interactions of asking a question and receiving a response, the user is given an option to review previous questions and answers. As the user becomes more familiar with the app's functionality and how they can interact with doctors, EvolveUI

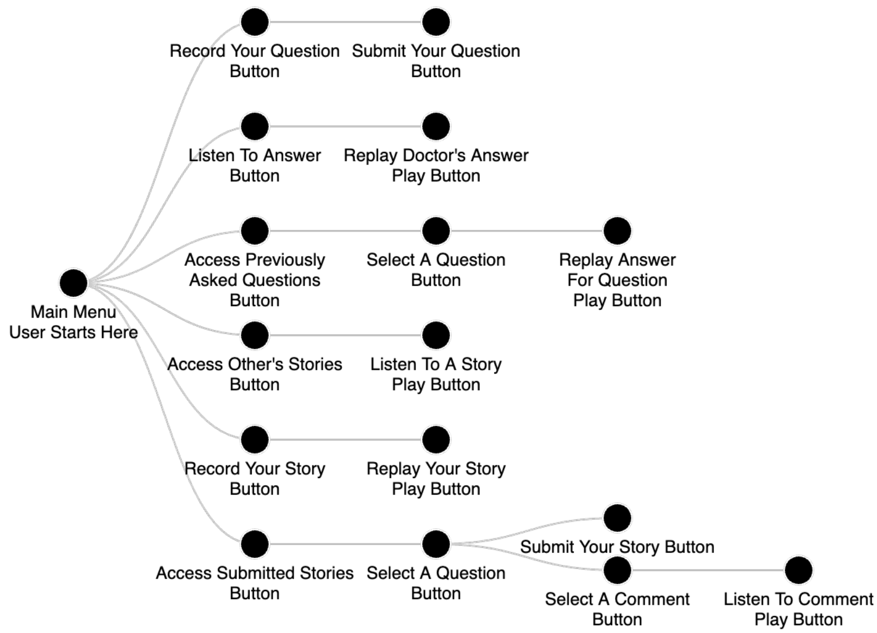

Figure 1: Tree diagram for the navigation options in the landing page for the conventionally designed Super Abbu application.

adds the option to hear contributions (stories/experiences) from other users, thereby providing an opportunity to engage within the Super Abbu user community.

As the user becomes familiar with hearing other users' experiences, an option is added for the user to record their own stories. Finally, as the user builds proficiency in recording stories, they can listen to their past stories and the comments they received on them. At this point, the initially compressed navigation tree has unfolded and we are presented with a user interface that would be the default main menu in terms of conventional application design.

Drawing on findings of previous studies on adaptive interfaces, we use a variation of color highlighting [11] to attract the attention of the user to a newly added option. In our design, a newly added icon appears with an animation with a new color, which defaults to the regular color theme once it's clicked for the first time by the user.

3.2 Study Design

We developed high-fidelity prototypes for the evolving and conventional version of the Super Abbu application using Figma. A comparative usability assessment between the different versions of the application was completed using a translated version of the System Usability Scale (SUS) [3]. The SUS is a recognized instrument known for delivering fast and reliable results on the usability of applications even across limited sample sizes [17]. We utilized a purposive sampling approach to recruit thirty-six participants residing in a rural Pakistan community with minimal to no smartphone application exposure.

Table 1 illustrates the demographic details of the participants in the study. The participants were randomly sorted into two groups of eighteen and tasked with assessing one of the versions of the Super Abbu application. All research activities were approved by the Institutional Review Board of the authors' affiliated institution.

Table 1: Demographic Details of Study Participants

Characteristic	Number of Participants
Total Participants	36
Gender	
Male	32
Female	4
Age Range	
17-25	6
26-35	8
36-45	14
46-60	8
Level of Education	
No Formal Education	17
Primary School	4
Middle School	9
High School	6

The usability tests were conducted as follows: First, participants were given a detailed explanation of the nature of the study and the application. Next, informed consent was obtained from each participant. This process involved both verbal confirmation and written consent from the participants after they had been informed about the voluntary nature of their participation and the confidentiality of their responses which ensured that each participant was well informed and had agreed to their involvement in the study.

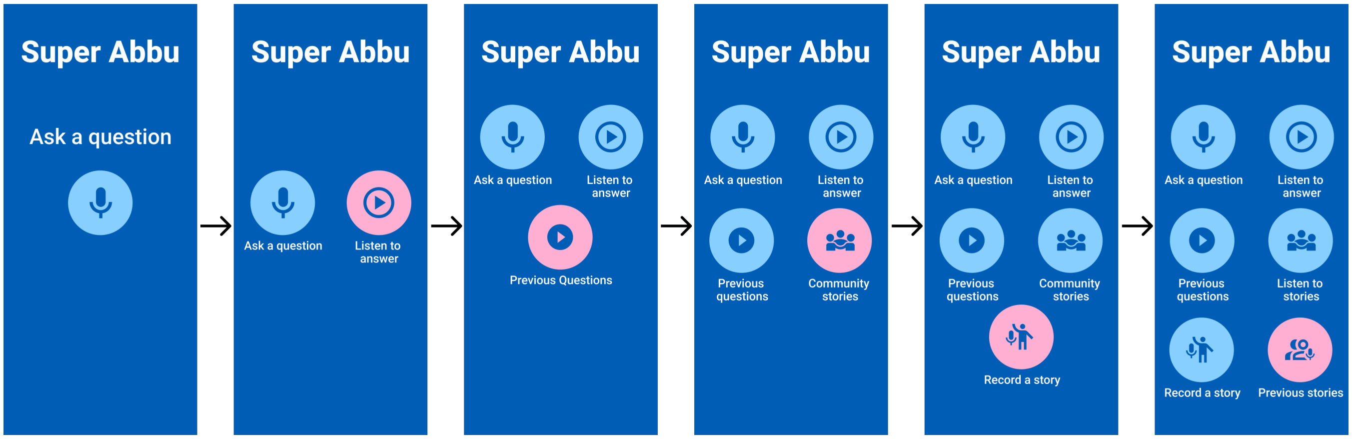

Figure 2: The evolution of the main menu for Super Abbu designed with EvolveUI. The last screen is where the evolving interface and the conventional interface coincide.

The researchers then asked the participants for demographic information related to age, sex, level of education, occupation, location of workplace, and experience with smartphone applications. The high-fidelity prototypes were set up on an Android phone and presented to the participants alongside a list of tasks they would try and accomplish using the application. These tasks were based on common use cases for Super Abbu and included recording a question, listening to the answer to that question, listening to a previously received answer, listening to stories from the community, recording and sharing their own story, and listening to comments of a story. In the case of the evolving interface, we had set up the prototype to evolve whenever the user completed their task successfully as our goal was to evolve the interface as soon as the user expressed their understanding of the current state of the system. Users were asked if they understood the tasks after each one was completed which differentiated false positives from actual cases. We utilized a Wizard of Oz methodology to simulate system responses, a popular approach to facilitate the rapid development and testing of user interface prototypes [13]. As the user navigated through the screens on the application, the researcher would speak out loud the doctor's answers or the community stories as the user interacted with mechanisms for these actions.

While the participants completed their tasks, the researchers observed and made notes of any issues they faced with using the prototype or in understanding the tasks, as well as any actions they took outside of directly interacting with the user interface. The researchers also measured how long it took each participant to understand each task, how long it took them to complete individual tasks, and the overall time spent interacting with the application. If the users indicated that they did not understand a task or felt they could not complete it, the researchers would give a quick tutorial about specific user interface components, such as the buttons that would help the participant complete their task. The researchers also noted the specific tasks where the participants would ask for help. After the participants had completed their tasks, the researchers introduced them to the SUS [3] and asked them to assess the application's usability. The SUS featured 10 statements translated into Urdu, each with a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Participants who had experience using smartphone applications that assessed the EvolveUI version of the application were also asked for feedback on the gradual introduction of features in the user interface. Finally, participants from both groups were asked for feedback on the overall process and their experience interacting with this smartphone application.

The interviews were conducted in Urdu, the native language of the participants of this study. The first two authors, researchers with relevant cultural competencies, carried out the interviews in person. Data was recorded solely through observational notes and the prototypes recorded no identifiable participant information.

4 FINDINGS

We report the descriptive statistics and qualitative insights from the usability testing conducted across both versions of the Super Abbu application. A total of thirty six usability tests were conducted, with eighteen participants evaluating the evolving interface while the other eighteen participants evaluated the conventional interface. Of the participants who evaluated the evolveUI variant, eleven had no formal education, two had received a primary school education, three had received up to a middle school education, and two had received up to a high school education. Of the participants who evaluated the conventional interface, six had no formal education, two had received a primary school education, six had received up to a middle school education, and four had received up to a high school education. Eight participants who used the evolving interface had never used a smartphone application before, while the other eight had minimally interacted with social media, video playing applications, and video game applications. Eleven of the participants who used the conventional interface had never used a smartphone application before, while the remaining seven had minimal exposure to social media and video-playing applications.

Table 2 summarizes the descriptive statistics for our measured metrics in the usability tests. These metrics include time taken to complete all tasks on average, as well as the SUS scores for both user interfaces.

Table 2: User Interface Comparison

Metric	Conventional UI	Evolving UI
Average Time Spent (secs)	131	123
Median SUS Score	57.5	63.75
Mean SUS Score	52.5	54.2
Standard Deviation SUS	17.5	25.5
Maximum SUS Score	82.5	87.5
Minimum SUS Score	20.0	10.0

Table 3: Interface Scores by Participant Education Level

Education	Median SUS	Mean SUS	Std. dev.
Evolving Interface			
No Formal Education (n=11)	35.0	44.1	25.2
Primary School (n=2)	47.5	47.5	17.7
Middle School (n=3)	75.8	75.8	2.9
High School (n=2)	83.8	83.8	5.3
Conventional Interface			
No Formal Education (n=6)	38.8	40.8	15.4
Primary School (n=2)	53.8	53.8	23.0
Middle School (n=6)	58.8	57.5	20.7
High School (n=4)	62.5	61.9	3.8

Figure 3 visualizes the SUS scores of the conventional and evolving interfaces, respectively, alongside the participant's level of education. Table 3 summarizes descriptive statistics for the participant's SUS scores across the different levels of education.

4.1 Acceptable SUS Scores Among Novice Users with Limited Literacy.

Most of the participants in our study had never received a formal education and had not interacted with a smartphone prior to the study. Despite this inexperience, the usability tests resulted in mean SUS scores 54.2 for the evolving interface and 52.5 for the conventional interface. Thus, based on the work of Bangor, Kortum, and Miller in interpreting SUS scores [1, 2], both versions of the application would meet an acceptability range of 'Low Marginal Acceptability' and an adjective rating of 'OK' overall. Given that the majority of participants in our sample had no exposure to smartphone applications before the study, the fact that the overall SUS scores fall into an acceptable bracket highlights the applications's accessibility for first-time users.

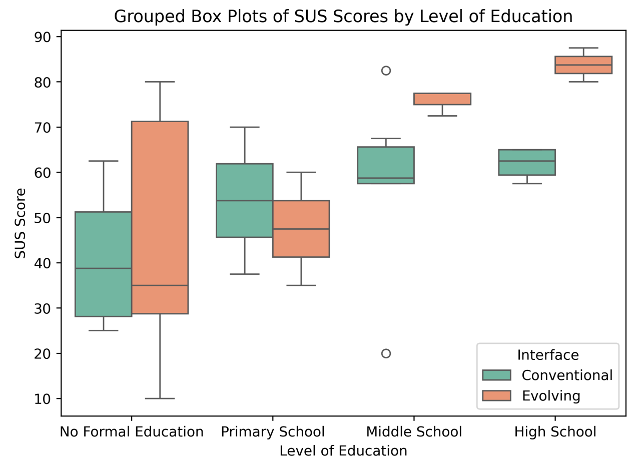

Figure 3: System Usability Scale Scores for both versions of the interface.

4.2 Evolving Interface Improves Usability for Semi-Literate Users

While the SUS scores for both interfaces were largely similar across "No Formal Education" and "Primary School" education, we observed that participants with at least a "Middle School" education rated the usability for the evolving interface significantly higher than the conventional interface. As illustrated in Table 3 and Figure 3 the evolving interface achieved mean SUS scores of 75.8 and 83.8 for this user group. Such scores correspond to an adjective rating of 'Good' in terms of usability [1]. This finding may indicate that the step-wise unfolding of the evolving interface can significantly improve usability outcomes for users with relatively higher literary skills regardless of their prior experience using smartphone applications.

4.3 Significance of Age in Perceived Usability for Users with Limited Literacy

As detailed in Table 3 the median SUS score for the evolving interface for participants with "No Formal Education" (n = 11) was 35.0, while the mean score was 44.1 with a standard deviation of 25.2. Participants with higher scores (75-80, which correspond to an adjective rating of 'Good' [1]) in this education group belonged to the 17-25 age range, which may indicate that age is an important factor in learning how to successfully interact with a user interface for this level of education.

Feedback from users primarily centered around suggestions for adding more illustrative graphics in the user interface to help recognize what each interactive component would do and a request for voice-based navigation options. Such feedback is consistent with earlier studies on designing interfaces for populations with limited literacy [22]. One user suggested the incorporation of pictures of a hospital to better define the identity of the application. One user suggested that the design may be easier to follow by assigning numbers to each UI component in order of when they need to be clicked to complete common tasks. One participant, who had prior experience with smartphone applications, including social media, initially perceived the evolving interface as slow or "lagging". It may be worthwhile to investigate the ideal balance between slowly introducing components on the screen to avoid overwhelming users cognitively while ensuring users don't become frustrated by the time it takes to access certain features.

5 LIMITATIONS

The study's small sample size (n = 36) prevents us from reporting statistically significant conclusions. Furthermore, the limited number of participants may have amplified the observed variances in the SUS scores. For instance, the variance for participants with "No Formal Education", especially those who used the evolving interface (n = 11) is relatively high as observed in Figure 3. Further study with a greater sample size and more in-depth user research is required to identify what other factors may cause this variance. However, previous research on usability studies reports that even studies with smaller sample sizes of around five users are useful in identifying usability issues with applications [38]. A more in-depth qualitative study may reveal richer insights into the user experience for the evolving interface. However, the SUS is a useful instrument for the initial usability tests of the evolving interface. Furthermore, users could not interact with the applications for extended periods due to time constraints and the limited availability of participants. This restriction may have limited the learning benefits of the evolving interface approach. Lastly, the findings from this study may not be generalizable. It would be beneficial to conduct similar studies across different socio-cultural contexts to provide more definitive conclusions about the usability of evolving interfaces for users with limited literacy.

6 DISCUSSION AND FUTURE WORK

Our initial experiment with the EvolveUI approach indicates that evolving interfaces may improve usability outcomes for populations with limited literacy relative to conventional user interfaces. Despite the participants having limited time with the evolving user interface, which constrained its full potential to acclimate users gradually, the evolving interface still outscored the conventional interface in several important metrics, including the overall average SUS scores and task completion times. This insight suggests that even with limited exposure, the EvolveUI approach shows promise in enhancing usability and efficiency. .

While designing user interfaces for low-literate users was an active area of research within Information and Communication Technologies for Development (ICTD) community in the early 2000's [18, 20, 22, 23], very limited research has been conducted in improving the user interface design for low-literate users in the past decade. This is largely due to ICTD researchers preferring speech-based applications powered by Interactive Voice Response (IVR) systems [28, 29, 37]. However, with low-cost Android phones available in the second hand market, and data plan costs decreasing, it is imperative researchers explore the design of accessible user interfaces that can help train its users to interact with mobile applications. This will lead to making serious health applications such as Super Abbu accessible to much larger audiences.

6.1 Evolutionary Steps

An important consideration in adaptive interfaces is the mechanism that triggers the adaption. Traditionally, adaptive interfaces introduce a new adaptation based on the frequency of the usage of a certain option by the user. This is done with the underlying assumption that the user's future behavior will be similar to what they have used most often in the past.

Our work with EvolveUI aims to design interfaces that can help users increase proficiency with any conventionally designed application, by limiting the complexity until the users can interact comfortably interact with common interface components. We aim to design the back end of EvolveUI to observe the user's behavior and trigger the next evolution accordingly. A simple implementation could introduce a new option after a user has used the previously introduced option a fixed number of times. A more advanced implementation could use a dynamically calibrated model based on previous user learning; a new option is introduced based on analysis of historical data to determine when a user can be deemed to have acquired proficiency with a given option. This threshold could vary based on the specific option to be evaluated and the type of user. Currently, we are working on a simple machine learning model that classifies users based on their level of "tech savviness" by analyzing the user's behavior. For example, if a user can quickly begin using new options, they may find themselves in a different class than more novice users and will begin seeing newer options faster than novice users. Therefore, the threshold of when a new option is introduced is a function of both the complexity of the previously introduced option and the user's proficiency with the application. In a more generic implementation, it may be best to let the machine learning model determine these thresholds rather than fixing them for all the users.

6.2 Generic Toolkit

In the future, we aim to build a framework based on the EvolveUI approach. Our goal is to apply this framework in a practical context by developing a smartphone application designed to meet the needs of users from populations with limited literacy. We intend to test this application in real-world scenarios to assess its effectiveness and reach across a wide user base. To that end, we are exploring the design and development of the key components outlined below.

We also aim to design a generic toolkit that enables any interface designer to design their application using the EvolveUI framework. We envision that in our toolkit, the user interface is visualized as a tree of navigation options and menus, and that designers would be able to attach evolutionary triggers at various nodes of the tree. The triggers can either include a simple calculation of the frequency of usage or successful interactions before a specific branch of the tree, with its new options, is unfolded or use pretrained machine learning models with dynamically adjusted triggers.

7 CONCLUSION

We present the usability testing results for two different designs of the same application to evaluate how an evolving user interface compares to a more conventional design for populations with limited literacy. Our results indicate that the evolving user interface falls into a 'Low Marginal Acceptability' bracket, even for first-time smartphone users. Furthermore, the analysis of System Usability Scale scores from our study revealed that the EvolveUI approach may significantly improve usability for users from semi-literate populations when compared to conventionally designed applications. Further long-term research with a larger sample size can help us validate our initial findings and provide insights into other variables affecting a participant's perceived usability for smartphone applications.

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