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Age-Inclusive User Interface Design for an AI Mindfulness App (LugnAI)

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Abstract

Voice-based mindfulness applications are emerging as valuable tools for promoting emotional well-being in digital health. Despite the growth of mobile health (mHealth) apps, many still lack attention to inclusive design practices that consider users with varying accessibility, cognitive, and emotional needs.

This study presents a user-centered design (UCD) process aimed at developing a functional, accessible prototype for a voice-guided mindfulness application. The goal was to generate actionable design insights to support future development of digital mindfulness tools.

The project followed a five-step methodology: (1) a literature review on accessibility and usability principles; (2) interface prototyping using Figma; (3) mobile app development in Flutter; (4) participatory co-design workshops with target users; and (5) a qualitative analysis of user feedback. The process emphasized core elements such as layout clarity, personalization, interface, tone, privacy and transparency.

Findings revealed user expectations for calm, neutral voice guidance, control over personalization and reminders, high visual clarity, and support for screen-free interaction. Participants expressed a preference for ambient, emotionally safe experiences over performance-driven feedback.

By integrating direct user input into design decisions, this study advances inclusive approaches to digital mental health technologies. The results demonstrate how human-centered interaction design can improve accessibility, usability, and emotional engagement across diverse user groups.

Keywords Mindfulness, older adults, user-centered design, accessibility, mHealth, voice interface, UI/UX design.

Sammanfattning

Röstbaserade mindfulness-applikationer blir allt viktigare för att främja emotionellt välmående inom digital hälsa. Trots tillväxten av mobilbaserade hälsoappar (mHealth), saknar många fortfarande ett inkluderande designperspektiv som tar hänsyn till användare med olika behov när det gäller tillgänglighet, kognitiv förmåga och känslomässigt stöd.

Denna studie presenterar en användarcentrerad designprocess med målet att utveckla en funktionell och tillgänglig prototyp för en röststyrd mindfulness-applikation. Syftet var att generera praktiska designinsikter som kan vägleda framtida utveckling av digitala mindfulnessverktyg.

Projektet följde en metodik i fem steg: (1) en litteraturöversikt kring principer för tillgänglighet och användbarhet, (2) gränssnittsprototyping i Figma, (3) utveckling av mobilapplikationen i Flutter, (4) deltagardrivna co-design-workshops med målgruppen, och (5) kvalitativ analys av användarfeedback. Processen fokuserade särskilt på tydlig layout, personalisering, tonalitet i gränssnittet och transparens kring integritet.

Resultaten visade att användare förväntar sig lugn och neutral röstvägledning, kontroll över personalisering och påminnelser, hög visuell tydlighet och stöd för skärmfria interaktioner. Deltagare uttryckte en tydlig preferens för omgivande, känslomässigt trygga upplevelser framför prestationsbaserad återkoppling. Genom att integrera direkt användarinvolvering i designbesluten främjar denna studie ett mer inkluderande synsätt inom digital mental hälsa. Resultaten visar hur användarcentrerad interaktionsdesign kan förbättra tillgänglighet, användbarhet och emotionellt engagemang i en bredare användargrupp.

Nyckelord Mindfulness, äldre användare, användarcentrerad design, tillgänglighet, mHealth, röstgränssnitt, UI/UX-design

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CONTENTS

1 Introduction

Mindfulness, originally rooted in Buddhist meditation and clinically introduced by Jon Kabat-Zinn through Mindfulness-Based Stress Reduction (MBSR), has gained widespread recognition for its benefits in promoting emotional regulation, cognitive clarity, and stress reduction [1], [2]. Mindfulness-based interventions (MBIs) have demonstrated strong evidence in improving outcomes across mental, physical, and interpersonal domains, especially through structured programs like MBSR [2], [3]. Despite this, older adults remain underrepresented in the design of digital mindfulness tools, even though they could significantly benefit from such interventions.

This thesis investigates the intersection of mindfulness, aging, and digital health, focusing on the design of a voice-based mindfulness application tailored to older adults. With the rise of mobile health (mHealth) technologies, conversational AI and voice interfaces are increasingly used to lower usability barriers for aging populations [4], [5], [6]. The LugnAI project leverages these technologies, combining personalized voice guidance with a user-centered design process to enhance emotional well-being and social connection.

This work consists of one article examining design requirements and accessibility principles for digital mindfulness tools targeting older adults. It contributes to the field by addressing key design challenges, proposing inclusive UX solutions, and offering insights from co-design workshops.

2 Background

Mindfulness can be practiced through a variety of techniques that accommodate different levels of experience, cognitive states, and contextual needs. These include focused attention on the breath, body scan exercises to enhance somatic awareness, loving-kindness meditation to cultivate compassion, and movement-based practices like mindful walking [1], [7], [8], [9], [10], [11], [12], [13]. The adaptability of mindfulness practices has made them suitable for digital delivery, where users can personalize aspects such as session length, guidance voice, and auditory environment to match their preferences or limitations. Research suggests that such customization enhances user engagement and long-term adherence, particularly among older adults who may benefit from gentler, shorter sessions and calming formats like ambient sound or silence [7], [12], [14], [15], [16]. This diversity in formats underlines the importance of designing flexible and inclusive mindfulness tools that support a wide range of user needs.

Digital mindfulness and mobile health (mHealth) applications have emerged as effective tools for increasing access to mindfulness-based interventions. Apps such as *Calm* and *Headspace* offer guided meditation and breathing exercises, helping users manage stress and improve well-being [4], [5], [17]. Their popularity surged during the COVID-19 pandemic, highlighting the demand for flexible and accessible self-care technologies [17]. Studies have shown that digital mindfulness interventions can yield similar benefits to in-person training, reducing anxiety, depression, and stress levels [4]. However, engagement is often limited by usability issues and a lack of personalization [5].

Older adults, defined as individuals aged 65 and over, represent a growing but underserved demographic in this field [18]. Despite increasing smartphone

ownership—42% of older adults now own smartphones [5]—many face challenges when using digital health apps. Barriers include complex navigation, small interface elements, low contrast, and fears of making errors [6], [19], [20]. Privacy concerns and digital insecurity further reduce adoption rates [6], [20]. Voice-based interfaces have been identified as a promising solution, offering intuitive and accessible interactions that align better with the sensory and cognitive needs of older adults [6], [21].

To address these barriers, human-centered design (HCD) and co-design approaches involving older users have been recommended [19], [22]. These methods improve alignment with user preferences, increase satisfaction, and promote sustained engagement. However, many mHealth applications fail to include older adults meaningfully beyond early development stages, resulting in designs that often reflect technical priorities rather than user needs [23]. Research also suggests that older adults prefer integrated tools that combine mindfulness with other well-being features like health tracking and caregiver communication [23].

Designing effective digital mindfulness tools for older adults requires attention to visual clarity [24], cognitive effort [25], interaction simplicity [26], and trust in privacy settings [25]. Overlooking these factors contributes to low adoption and disengagement. Although mHealth apps have progressed, few have undergone rigorous usability testing with older users or address their unique needs directly [27]. Future work must integrate accessibility, personalization, and emotional engagement to develop truly inclusive mindfulness technologies [19], [22].

3 Research Methodology

3.1 Design of Research Questions

The research process began with a broad interest in the intersection of artificial intelligence (AI) and digital well-being, particularly within mobile health (mHealth) applications. The initial curiosity centered on how AI-driven tools could be used to support mindfulness practices. Given the expansive nature of the field, an early refinement was necessary. A literature review was conducted to understand existing approaches in digital mindfulness, revealing a noticeable lack of tailored design for older adults—a demographic often overlooked in mainstream app development despite being at higher risk for loneliness, cognitive decline, and digital exclusion.

The review showed that while numerous mindfulness apps exist, few incorporate accessibility standards or follow user-centered design practices tailored to the cognitive and sensory needs of older users. Moreover, older adults are rarely involved beyond early-stage feedback, leaving critical usability and emotional factors underexplored. These insights directly shaped the formulation of the study's research questions, which were developed to address both theoretical gaps and applied challenges. The final research questions are:

- **RQ1.** What design principles and accessibility guidelines are most effective in supporting older adults' engagement with mobile mindfulness applications?
- **RQ2.** How can accessibility and cognitive usability insights be translated into a functional mobile prototype for older adults, and what tools best support this design-to-development process?

- **RQ3.** What design needs, preferences and usability concerns for voice-based mindfulness applications emerge from qualitative data collected in co-design workshops with older adults?

Each question maps onto a specific stage of the methodology (Section 3). RQ1 was addressed through the literature review (Section 3.1), which provided the theoretical foundation and informed the accessibility features included in the design. RQ2 was tackled through the visual design in Figma and technical implementation in Flutter (Section 3.2 and 3.3), ensuring that accessibility guidelines were effectively operationalized. RQ3 was answered through co-design workshops and user feedback analysis (Sections 3.4 and 3.5), where direct input from older adults revealed key usability and emotional design considerations.

Together, these questions support the study's overarching aim: to create actionable design recommendations for inclusive, AI-supported mindfulness technologies. By combining design theory, participatory practice, and technical prototyping, the study ensures its outcomes are both conceptually grounded and practically relevant.

Alternative directions—such as examining AI model performance, behavioral outcomes, or biometric integration—were considered but excluded. These approaches, while valuable, would have shifted the project's emphasis away from immediate design challenges and user experience, which were prioritized in line with the goal of building not just with AI, but for users often marginalized in digital innovation.

3.2 Background Framework

To construct the Background chapter of this study, a systematic literature review was undertaken, guided by recommendations from the KTH Library workshop on academic search strategies. The goal was to identify peer-reviewed literature and relevant design guidelines that could inform the development of an inclusive mindfulness app for older adults. The search was oriented toward uncovering both theoretical foundations (e.g., digital mindfulness, aging and technology, accessibility in UI/UX) and practical design frameworks (e.g., human-centered design, co-design methodologies).

Searches were conducted across a range of academic databases including **Scopus**, **PubMed**, **IEEE Xplore**, **ACM Digital Library**, and **Google Scholar**, to capture both health-oriented and design-oriented perspectives. The search strategy evolved iteratively, becoming more refined as preliminary themes emerged. Initial keyword combinations included:

- ("mindfulness app" OR "digital mindfulness") AND ("older adults" OR "aging population")

- ("user-centered design" OR "inclusive design") AND ("mHealth" OR "mobile health apps")
- ("voice interface" OR "conversational agent") AND ("accessibility" OR "cognitive load" OR "usability")
- ("AI in healthcare") AND ("user trust" OR "design ethics" OR "personalization")

The inclusion criteria were:

- Peer-reviewed journal articles or conference papers.
- Published from **2012** to ensure current relevance.
- Studies involving design or evaluation of digital health tools, with a focus on older adult users.
- Research addressing voice-based or accessibility-enhanced interfaces.

Exclusion criteria included:

- Studies centered solely on algorithmic performance or technical backend development.
- Applications unrelated to health or mindfulness.
- Design guidelines not evaluated through empirical or user-based methods.

This strategy initially yielded over **400 articles**. After abstract screening, approximately **70 papers** were selected for full-text review. Ultimately, **35 sources** were integrated into the background chapter based on their methodological rigor and direct relevance to the research questions.

As the review progressed, it became evident that many existing mindfulness applications failed to include older adults throughout the design process. Moreover, few studies examined the intersection of voice interfaces, personalization, and emotional safety in this demographic. These gaps significantly shaped the direction of the study: instead of merely proposing a novel app, the research centered on **user-centered design**, **emotional accessibility**, and **co-design participation**—especially crucial for ensuring that older adults feel seen, heard, and supported in their digital well-being journey.

Thus, the literature review not only informed the technical and aesthetic design decisions but also provided a conceptual foundation for formulating the final research questions and workshop methodology.

3.3 Methodology Approach

This study followed a **five-step user-centered design (UCD) methodology**, selected for its ability to integrate user needs into each phase of development. UCD is particularly relevant in the context of digital health

tools for older adults, as it emphasizes participatory design, accessibility, and iterative feedback—all crucial when designing for populations with diverse cognitive and physical capabilities.

Rather than focusing solely on technical innovation, this approach prioritizes the creation of a meaningful and accessible user experience. The five steps—**literature review, visual design, application prototyping, co-design workshops, and user feedback analysis**—were intentionally selected to align with the research questions and ensure that both theoretical and practical considerations were addressed throughout.

3.3.1 Literature Review

The first step involved a literature review to identify age-specific accessibility and usability principles applicable to mobile interfaces. This review grounded the design decisions in evidence and ensured relevance to the older adult population. This method was selected because it allowed the study to draw from peer-reviewed insights and validated guidelines without the resource intensity of primary research in the initial stages.

Key findings included the prioritization of:

- High-contrast visuals (7:1 ratio for text readability).
- Large sans-serif fonts (minimum 16px, scalable).
- Text-labeled icons and oversized buttons.
- Low cognitive load and intuitive privacy controls.
- Personalization features like voice selection, background sounds, and meditation techniques.

These insights directly informed the research design by shaping both the visual prototype and the app's functional requirements.

3.3.2 Visual Design Development

In the second phase, an **interactive Figma prototype** was created based on the literature findings. This step translated theoretical guidelines into a tangible UI/UX prototype tailored for older adults.

The prototype simulated core flows—like launching a session, customizing settings, and accessing statistics—allowing early feedback on structure and logic. To ensure usability, **structured use cases** were defined, covering tasks such as:

- Profile creation
- Starting and resuming sessions
- Accessing statistics
- Managing personalization and settings

This step was critical in validating the app's alignment with user expectations before entering development. Figma was selected over manual sketching as it allowed for the rapid creation of interactive, mid-fidelity prototypes that could simulate user flows and be shared digitally for remote feedback. While hand-drawn sketches are useful in early ideation, they lack the precision, scalability, and interactivity needed to evaluate accessibility features such as button size, font legibility, and navigation logic. Figma also enabled alignment with design system standards (e.g., Apple HIG [28]) and supported collaboration with stakeholders, which would not have been feasible with static paper sketches. Given the target group's specific cognitive and visual needs, a digital prototype was essential to accurately test and validate usability principles before development.

3.3.3 Application Prototyping

In the third step, the Figma prototype was converted into a **working mobile application** using Flutter and developed in Visual Studio Code. Flutter was chosen for its cross-platform capabilities and native accessibility support.

Key decisions included:

- Focusing on iOS and following Apple's Human Interface Guidelines (HIG) [28].
- Ensuring consistent design-to-code translation of all accessibility features (scalable text, color contrast, touch targets).
- Implementing the core navigation and personalization elements in code to allow real interaction testing.

Alternative frameworks like React Native were considered but discarded due to less optimal support for iOS-specific accessibility and voice interaction features.

3.3.4 Co-design Workshops

To explore how older adults perceive and interact with the app, two **co-design workshops** were held. Participants were guided through the Figma prototype rather than the fully coded version, to focus feedback on interface design rather than backend functionality.

The workshops included:

- Introductory mindfulness exercises and AI concepts.
- Guided walkthroughs of the app interface.
- Focus group discussions on visual style, avatar selection, emotional tone, and interaction modality.

Audio recordings were collected to ensure accurate qualitative analysis. This phase was selected over surveys or standard usability testing to foster open-ended, exploratory discussions better suited to uncovering emotional, cognitive, and design expectations. This method was chosen over large-scale surveys or usability testing because it supports open-ended dialogue, emotional expression, and collaborative ideation—aspects often critical for uncovering deep-seated needs and expectations.

3.3.5 User Feedback & Design Recommendations

The final step consisted of analyzing qualitative data from the workshops. Patterns were identified across the group discussions, revealing user preferences regarding:

- Calm and neutral voice tone.
- Transparent privacy controls.
- Emotional comfort over performance metrics.
- Screen-free or ambient interaction possibilities (e.g., lighting, sound cues).

This analysis resulted in a comprehensive set of **design recommendations**, ensuring that the final product is not only functionally accessible but also emotionally attuned to the needs of older users. This approach was favored over quantitative metrics (e.g. task completion time or error rates) because it prioritized emotional safety and subjective usability, which are essential when designing for older adults' mental well-being. The resulting recommendations ensure that the final product responds not only to practical usability needs but also to emotional and cognitive comfort.

3.3.6 Alignment with Research Questions

The entire methodology was structured to align with the project's research questions:

- **RQ1** was addressed through the literature review and its translation into design guidelines.
- **RQ2** was tackled through the Figma and Flutter prototyping phases.
- **RQ3** was directly informed by the co-design workshops and feedback analysis.

Despite its strengths, the chosen methodology presents limitations:

- Workshops were limited to two sessions, potentially narrowing the diversity of user input.
- Feedback was collected using a static prototype, meaning interaction behavior in the actual app was not observed.

- No long-term testing or clinical trials were conducted to assess sustained engagement or psychological impact.
- Participants in the focus groups were all healthy older adults from a specific demographic, limiting generalizability of

Future studies could incorporate extended co-design phases, longitudinal usage testing, and integrations with ambient or tangible devices to further validate the design principles established here.

4 Summary of Article

4.1 Results

The co-design workshops revealed that older adults consistently valued calm, neutral voice tones, clear and uncluttered visual layouts, and intuitive navigation. A strong preference emerged for personalization features that remain optional and fully user-controlled, such as background sounds, coach voice, and reminders. Participants also expressed concerns about data privacy and favored transparent, easy-to-understand settings with the option for anonymous or session-only modes. (See Section 4.1 for the Interface Design and Section 4.2 for the User Feedback)

Notably, many participants preferred off-screen or ambient interactions—such as sound cues or tactile elements—over traditional screen-based engagement, associating these with greater emotional comfort and accessibility. The desire for flexible, non-intrusive feedback mechanisms also emerged, with users rejecting gamified progress tracking in favor of symbolic or reflective tools.

These findings align with previous studies on inclusive design in mHealth, supporting the view that emotional safety, simplicity, and autonomy are critical factors for adoption among older adults. They suggest that mindfulness applications aiming to serve this demographic must go beyond usability, incorporating ethical and affective dimensions to ensure long-term engagement and trust.

4.2 Discussion

The co-design workshops revealed three key design priorities for voice-based mindfulness tools aimed at older adults: voice interaction, off-screen

engagement, and feedback design. Participants preferred calm, slow-paced, and neutral voice tones, with control over tone and pacing viewed as essential for comfort and autonomy. Overly expressive or directive voices were often perceived as condescending—consistent with research on older adults' sensitivity to "elderspeak" and directive interaction styles [29]. Emotional tone and perceived companionship also play a key role in acceptance of voice assistants [30].

Participants strongly favored screen-free formats, such as dimmable lights or sound cues, which were seen as calming and less cognitively demanding. These ambient formats support mindful presence and are especially valuable for users with screen fatigue or visual limitations. Research shows that hybrid systems combining voice with visual or tactile elements increase accessibility and comfort over time [31].

Opinions on progress tracking varied. Many rejected gamified metrics like streaks, preferring optional, reflective tools that avoid judgment. This aligns with broader concerns about the stress-inducing nature of goal-based wellness systems [32]. Participants also emphasized the need for transparency and control over what the system remembers—reinforcing the importance of ethical personalization and data privacy [29].

These findings highlight that inclusive design for older adults must go beyond usability to prioritize emotional safety, user autonomy, and respectful interaction across both voice and ambient modalities.

4.3 Limitations

This study focused on a small sample of older adults in two co-design workshops (4 and 3 participants), which limits the generalizability of the findings. At the time of evaluation, the fully interactive Flutter prototype was still under development and lacked the stability and consistency needed for a controlled user test; for this reason, we relied on static Figma screens to ensure that all participants saw the same interface elements. As a result, some interaction-related feedback may not fully reflect real-world use, and certain gestures or voice-enabled behaviors inherent to the final app could not be observed.

4.3.1 Ethical Considerations

The integration of AI into mental health support raises profound ethical concerns. These tools depend on access to highly sensitive personal and health-related data, and without rigorous encryption, secure storage protocols and fully informed consent procedures, users' risk having their confidential information exposed or misused. Moreover, the predictive algorithms at the heart of AI mental health applications are not infallible: they can generate false positives—flagging normal emotional fluctuations as clinical symptoms—or

false negatives, overlooking genuine indicators of distress. Such errors can delay appropriate intervention or provoke unnecessary anxiety, compromising the very care these systems are intended to facilitate.

Compounding these risks is the potential for algorithmic bias. If training datasets under-represent certain populations—such as ethnic minorities, non-native language speakers or people with atypical symptom profiles—the resulting recommendations may systematically disadvantage those users, reinforcing existing health disparities rather than alleviating them. At the same time, an over-reliance on AI feedback can diminish opportunities for genuine human connection; while algorithms can analyze patterns in language and behavior, they cannot replicate the empathy, nuanced judgment and contextual sensitivity provided by trained clinicians, potentially leaving users' deeper emotional needs unmet.

Finally, the rapid pace of AI innovation has outstripped the development of comprehensive regulatory frameworks in many jurisdictions. This regulatory gap creates ambiguity around legal and ethical accountability when an AI system causes harm—whether through data breaches, inaccurate assessments or biased guidance—leaving unclear which party (developers, overseeing clinicians or deploying organizations) bears ultimate responsibility.

4.4 Future Research

Future studies should involve larger and more diverse participant groups to validate findings across cultural and linguistic contexts. Usability testing with a fully functional voice-based prototype will be essential to assess real-time interaction and engagement. Further research could also explore integration with ambient devices and evaluate long-term impacts of AI-guided mindfulness on emotional well-being, particularly in older populations with varying levels of digital literacy. Also, the mindfulness assistant should be embedded to the Flutter prototype.

5 Fulfillment of Learning Outcomes

5.1 Scientific Knowledge and Methodology

A comprehensive literature review was conducted to ground the research in established scientific knowledge related to digital mindfulness, aging, and human-centered design. The study draws on current research in mobile health (mHealth), accessibility, and conversational interfaces, with particular emphasis on inclusive design for older adults. Key frameworks such as User-Centered Design (UCD) and cognitive accessibility principles guided the methodological approach.

The methodology (Section 3) outlines a five-step process that includes literature analysis, interface prototyping, app development using Flutter, co-design workshops, and qualitative data analysis. These methods were selected based on their relevance and suitability for engaging older adults in participatory design. The use of structured use cases and adherence to Human Interface Guidelines (HIG) [28] further demonstrates methodological rigor and alignment with best practices in digital health interface design.

This multi-method approach ensures both scientific validity and practical relevance, reflecting a strong understanding of current developments and challenges in designing AI-supported mindfulness tools for aging populations.

5.2 Systematic Information Gathering

The research adopted a systematic and critical approach to gathering and integrating information. A structured literature review was carried out using academic databases such as PubMed, ACM Digital Library, and Google Scholar, focusing on key terms including “digital mindfulness,” “older adults,” “accessibility,” and “voice user interfaces.” This process enabled the

identification of relevant studies and theoretical frameworks that informed both the design criteria and methodological choices.

Knowledge gaps—particularly regarding the emotional and ethical dimensions of voice-based mindfulness for older users—were identified early in the review. To address these, the study incorporated two co-design workshops that provided qualitative insights directly from the target demographic. This iterative process of gathering, evaluating, and integrating information is documented in the literature and methods sections (Sections 2 and 3), ensuring that the research remained grounded in evidence while responsive to real-world user needs.

5.3 Handling Complex Questions

The research addresses the complex challenge of designing a digital mindfulness application that meets the diverse cognitive, emotional, and accessibility needs of older adults. This required balancing multiple dimensions—technical feasibility, usability, ethical considerations, and emotional safety—within the constraints of a prototype development process. One key complexity was integrating personalization (see Section 3.1.5. Personalization and User Preferences and Figures 5-7) without compromising user autonomy or trust, particularly given participants' concerns about data handling and AI behavior.

In light of the limited prior work on voice-enabled mindfulness tools for older adults, we combined insights from the literature with qualitative findings from co-design workshops to inform our user-centered prototype. This allowed the project to identify and navigate nuanced user expectations, such as the rejection of gamified progress tracking or the need for ambient, screen-free interactions. These multifaceted challenges are discussed in Sections 3.5 and 5 of the article, where design trade-offs and user feedback are critically assessed to guide future development.

5.4 Planning and Execution

The project proceeded along a structured timeline with successive phases for literature review, visual design, prototyping, user engagement and analysis. Guided by the original thesis proposal, we used Figma for UI mock-ups, Flutter for a working prototype and facilitated co-design workshops to collect qualitative feedback. Where participant schedules or emerging insights required it, the plan was flexibly adjusted in consultation with the supervisor and recorded in our documentation. Section 3 of the article outlines this process in detail, showing how we balanced rigorous planning with adaptive changes to meet both academic and practical needs.

5.5 Clear Communication and Argumentation

The research was communicated through a clearly structured academic article, guiding the reader logically from background and methodology to results, discussion, and conclusion. The arguments presented were grounded in both literature and user data, ensuring that conclusions were well-supported and transparent. Findings were discussed with peers and faculty during a research seminar, where critical feedback was addressed constructively, demonstrating the ability to engage in academic dialogue across disciplines.

Section 5 of the article synthesizes the insights from the co-design workshops and frames them within the broader context of inclusive design for digital mental health, illustrating the ability to articulate complex ideas clearly and persuasively.

5.5.1 Use of AI tools

ChatGPT was used to refine grammar and improve the overall clarity of the text without modifying the content. Specific prompts included requests such as *"Improve grammar and flow of the thesis introduction"* and *"Generate alternative formulations of the opening paragraph to highlight the relevance of AI in mindfulness design for older adults."* Only human-curated content was used in the analysis and conclusions.

5.6 Scientific, Social, and Ethical Assessments

This study critically examines the ethical landscape of conversational AI in mental health, going beyond familiar concerns of data privacy and emotional autonomy to address the risk of AI-generated inaccuracies. When an AI system offers guidance that is incomplete or misleading—whether through misinterpretation of user input or flawed inference—participants may experience confusion or misplaced confidence rather than genuine support. Equally troubling is the potential for these tools to supplant real-world clinical engagement: organizations under pressure to cut costs might deploy automated interactions in place of qualified professionals, diminishing opportunities for empathic dialogue and accountability.

From an environmental perspective, the computational demands of large-scale AI models carry a significant carbon footprint. Although a single inference on a user's device may seem negligible, the aggregate impact of continuous background processing and cloud-based computations across a broad user base can contribute substantially to greenhouse-gas emissions, challenging ambitions for sustainable digital health solutions.

Socially, while voice-based mindfulness apps have the potential to reduce barriers for older adults who struggle with small screens or complex menus, our reliance on a narrow cohort of healthy older adults risks overlooking those with cognitive impairments, sensory limitations, or diverse cultural attitudes toward technology. Furthermore, although co-design workshops help center user voices, brief sessions with a limited demographic can slip into "tokenism" if they fail to engage a truly representative cross-section of the intended population.

Scientifically, by surfacing these multifaceted risks—data misinterpretation, care substitution, environmental impact, participant diversity and tokenism—this work advances the field of inclusive mHealth. Sections 3.5 and 5 detail how these concerns informed concrete design decisions: prioritizing minimal data retention, enabling on-device processing where feasible, and establishing rigorous recruitment strategies to ensure broader representation and meaningful user participation.

5.7 Research and Development Readiness

The project was carried out with a strong research orientation, demonstrating the ability to approach complex design and usability challenges through systematic investigation, and critical evaluation. The combination of literature-based insights, user-centered design methodology, and qualitative analysis reflects a readiness to contribute to both academic research and practical development in the field of digital health technologies.

The iterative development of the LugnAI prototype—from conceptual design to functional implementation using Flutter—showcases technical proficiency and adaptability. Furthermore, the incorporation of real user feedback through co-design workshops illustrates the capacity to refine and evolve a solution based on empirical findings.

These competencies are evident throughout Sections 3 and 4 of the article, which document the planning, execution, and evaluation phases of the project. The final design recommendations point toward future development directions, confirming the student's preparedness to engage in further R&D activities in the intersection of AI, accessibility, and mental health support.

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Age-Inclusive User Interface Design for an AI Mindfulness App (LugnAI)

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Abstract

Voice-based mindfulness applications have emerged as promising tools for promoting well-being, particularly among older adults, who face unique barriers when engaging with digital technologies. Despite the growth of mobile health (mHealth) apps, most are not tailored to the cognitive, emotional, and accessibility needs of this demographic.

This study addresses this gap by designing the user interface for LugnAI, a voice-guided mindfulness application developed specifically for older adults. The objective of the study was to create a functional, age-inclusive prototype using a user-centered design (UCD) process, and to derive actionable design recommendations for future development.

The research followed a five-step methodology: (1) a literature review to identify accessibility principles; (2) interface prototyping in Figma; (3) application development in Flutter for iOS; (4) two co-design workshop sessions with older adults; and (5) a qualitative analysis of user feedback. The workshops focused on interface preferences such as layout, voice tone, personalization, and visual clarity.

The findings revealed several key user expectations: calm and neutral voice guidance, opt-in personalization, high-contrast visuals, and control over reminders and data. Participants expressed preferences for ambient and non-screen interactions, such as soft lighting and sound cues, and emphasized the importance of emotional safety over performance tracking.

By grounding interface decisions in direct user input, this project advances inclusive design practices for digital mental health tools. The results highlight how compassionate, age-aware interaction design can improve accessibility, usability, and emotional resonance in mindfulness technologies aimed at older adults.

Keywords

Mindfulness, older adults, user-centered design, accessibility, mHealth, voice interface, UI/UX design.

1 Introduction

Mindfulness, introduced by Jon Kabat-Zinn, is defined as "paying attention in a particular way, on purpose, in the present moment, and non-judgmentally" [1]. This concept has its roots in Buddhist meditation practices and was adapted for modern therapeutic purposes through Mindfulness-Based Stress Reduction (MBSR). MBSR and other mindfulness-based interventions (MBIs) aim to cultivate a state of awareness that fosters emotional regulation, cognitive clarity, and stress reduction [2].

Mindfulness practices have shown significant benefits in managing chronic pain, reducing anxiety, and enhancing overall well-being. Randomized controlled trials have demonstrated the efficacy of MBIs in improving outcomes for mental health, physical health, and interpersonal functioning [2, 3]. However, older adults are recognized as an important user group for mindfulness-based interventions, yet very few studies have explored or designed digital mindfulness apps tailored to this age group.

In recent years, the digital adaptation of mindfulness practices has surged, particularly through mobile health (mHealth) applications. These apps provide users with accessible tools for guided meditation, breathing exercises, and mindfulness techniques, enabling individuals to integrate mindfulness into their daily lives conveniently [4, 5]. Voice-based interactions, in particular, offer an intuitive and conversational interface, reducing barriers for older adults unfamiliar with technology [6]. This approach fosters engagement by addressing common usability challenges associated with aging, such as cognitive and sensory limitations [6].

LugnAI is a mindfulness application designed specifically for older adults, leveraging Large Language Models (LLMs) to provide personalized, voice-guided mindfulness exercises. The LugnAI project aims to address existing gaps by developing a user experience (UX) framework tailored to this demographic. A distinctive feature of LugnAI is its integration of social dialogue elements, fostering engagement and addressing the isolation commonly experienced by older adults. By employing a user-centered design (UCD) approach, the application ensures that its features, from interface design to personalization, reflect the real needs and preferences of its target users.

The **central objective** of this study is to conduct a user-centered design of the UX for LugnAI and get some design recommendations, focusing on design choices and its impact on the emotional and physical well-being of older adults. Instead of focusing on the technical advancements of LLMs, this research prioritizes optimizing the interface, interactions, and overall user experience to ensure accessibility and engagement for older users. The research addresses three key questions:

RQ1. What design principles and accessibility guidelines are most effective in supporting older adults' engagement with mobile mindfulness applications?

RQ2. How can accessibility and cognitive usability insights be translated into a functional mobile prototype for older adults, and what tools best support this design-to-development process?

RQ3. What design needs, preferences and usability concerns for voice-based mindfulness applications emerge from qualitative data collected in co-design workshops with older adults?

This study not only contributes to the advancement of digital mindfulness and conversational AI, but also establishes best practices for inclusive, user-centered digital health technologies. By addressing the unique needs of older adults, the LugnAI project exemplifies how cutting-edge technology can be combined with compassionate design to enhance well-being, setting a benchmark for future innovations in this field.

This article is organized as follows: The background section introduces the relationship between digital well-being, mindfulness, and older adults, serving as a conceptual framework to explore the optimal design of a mindfulness app tailored to this user group. This is followed by a synthesis of previous research on digital health mobile apps and mindfulness interventions for older adults. Methods section outlines the design process starting with the Literature Review, then the Visual Design Development, Application Prototyping in Flutter. After the design steps, the Co-Design workshops were conducted and, hence, analyzed to extract the final Design Recommendations. The results section present the Interface Design on Figma, as well as the User Feedback and the Design Recommendations.

2 Background

2.1 Digital Mindfulness as a Self-Care Technology

Digital mindfulness and mobile health (mHealth) applications have emerged as effective tools for increasing accessibility to mindfulness-based interventions. These digital solutions enable users to engage in mindfulness exercises such as guided meditation and breathing techniques, potentially reducing barriers associated with location, scheduling, and costs [4, 5]. Mindfulness apps such as Calm and Headspace have gained widespread popularity, demonstrating the increasing demand for digital mindfulness resources [7]. The COVID-19 pandemic further accelerated this trend, with meditation apps experiencing a surge in downloads as individuals sought digital tools to manage stress and uncertainty [7].

Studies indicate that digital mindfulness interventions provide similar benefits to traditional in-person mindfulness training, including reductions in anxiety, depression, and stress levels [4]. However, the effectiveness of these interventions is influenced by user engagement, which is often hindered by usability challenges and a lack of personalization [5].

2.2 Barriers to Engagement Among Older Adults

Older adults, typically defined as individuals aged 65 years and above, represent a diverse demographic with varying health conditions, cognitive abilities, and levels of digital literacy [8]. Despite the increasing rate of smartphone ownership—42% of adults aged 65 and older now own smartphones [5]—the adoption of digital health applications among older users remains limited. Research highlights several barriers that hinder engagement with mHealth applications, including poor usability, complex navigation, and insufficient adaptation to the specific needs of older adults [9]. Additional concerns such as privacy, security, and fears of making errors further complicate technology adoption [6, 10].

To improve accessibility and usability for older adults, human-centered design (HCD) principles have been proposed to guide the development of digital health applications. These principles emphasize the importance of high-contrast, large-text interfaces, simplified navigation, and step-by-step instructions tailored to the needs of older users [9]. Voice-based interactions have been identified as a promising solution, offering a more intuitive and user-friendly alternative to touchscreen interfaces [6]. Studies suggest that conversational user interfaces (CUIs) are easier for older adults to adopt, even for those who are infrequent technology users, enhancing engagement and long-term adoption of digital tools [11]. By integrating conversational AI and personalization features, digital mindfulness applications can enhance engagement and long-term adoption [10].

2.3 Toward Age-Inclusive Design in mHealth

UCD approaches, which involve older adults in the development process, have been recognized as an effective strategy for improving the usability and accessibility of digital health solutions [12]. Studies have shown that co-designing with older users ensures that applications align with their unique preferences, ultimately enhancing satisfaction and engagement [10, 12]. However, research indicates that many mHealth applications fail to fully integrate older adults' input beyond early development phases. While initial consultations with older users often shape feature selection, the later stages of app development tend to be guided by technical constraints and industry design standards rather than ongoing user feedback. This disconnect can result in applications that do not fully meet the needs and expectations of older adults, highlighting the importance of sustained engagement throughout the co-design process [13].

Moreover, mHealth apps for older adults should not only focus on individual mindfulness practices but also support broader well-being. Research suggests that older users benefit most from integrated solutions that combine mindfulness exercises with health tracking, medication reminders, and communication with caregivers or healthcare providers. Such an approach aligns with older adults' preferences for comprehensive tools that assist in multiple aspects of daily life, rather than standalone wellness applications [13].

Since older adults are the primary users of this project, their specific needs must be carefully considered. Several factors influence their interaction with digital health applications, including visual clarity and readability [14], cognitive effort required for engagement [15], ease of navigation and interaction [16], and trust in privacy and security settings [15]. Research has shown that overlooking these factors can lead to lower adoption rates and disengagement from digital interventions. Therefore, addressing these considerations is essential to ensuring that digital mindfulness applications remain accessible, effective, and engaging for older users.

Despite the advancements in mHealth applications, the evidence base for mindfulness apps designed explicitly for older adults remains underdeveloped. Many existing apps lack rigorous usability testing and fail to address the unique challenges faced by older users [17]. Future research should emphasize the development of

holistic design frameworks that integrate accessibility, personalization, and engagement strategies to optimize digital mindfulness interventions for older adults [9, 12].

3 Methods

The development of the LugnAI application followed a structured, five-step process grounded in a user-centered design (UCD) methodology. UCD has been widely recognized as an effective approach for developing digital health applications tailored to the needs of specific user groups, particularly older adults [12]. This study adopted a UCD framework by actively involving older adults in the second iteration of the mindfulness application's development. While the first iteration—conducted prior to this thesis—focused on evaluating the core voice-based technology and interaction model, the second iteration emphasized direct user involvement through structured workshops. This approach ensures that the application remains accessible, engaging, and user-friendly by incorporating feedback from potential users at various stages.

The research process began with a **Literature Review** to identify key design principles and accessibility considerations for user interfaces aimed at older adults. These findings served as the foundation for the design process and were used to inform subsequent decisions.

In the second step, a **Visual Design** of the mobile application was created using Figma. This UI/UX design incorporated mid-fidelity elements aligned with accessibility standards. Design priorities included high contrast, large text, intuitive navigation, and voice-based interactions to reduce cognitive load and support older users.

In the third step, the Figma prototype was translated into a functional **Application Prototype** using Flutter in Visual Studio Code, with a focus on iOS compatibility. This development phase aimed to implement the accessibility features defined in the design while ensuring responsive and smooth interactions. The app's navigation system, settings, and mindfulness session screens were built in accordance with Apple's Human Interface Guidelines (HIG) [18].

In the fourth step, two **Co-Design Workshops** with older adults were conducted to explore key design aspects such as personalization, input modality, and visual style. Participants were presented with the LugnAI interface and provided feedback to inform further design refinements.

In the fifth step, the **User Feedback** from the workshops was analyzed. This method enabled the identification of recurring user needs, preferences, and usability barriers. Themes such as trust in data handling, interface clarity, interaction modality preferences, and the desire for meaningful customization emerged from participant feedback. Based on the gathered user feedback, a set of design recommendations was formulated.

A visual representation of this methodological workflow is provided in Figure 1.

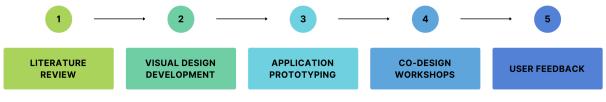

Figure 1: Visual representation of the proposed workflow

3.1 Literature Review

Before beginning the design process, a literature review was conducted to identify accessibility and usability principles relevant to older adults. This research helped ensure that the design choices were evidence-based and appropriate for the target demographic. The review focused on mobile health (mHealth) applications, user interface accessibility, and cognitive considerations for aging populations, laying the foundation for an inclusive and user-friendly application.

The findings of this review informed the prioritization of high-contrast visuals, large text, labeled icons, minimalist layout, and intuitive navigation - all aimed at reducing cognitive load and enhancing accessibility for older users [14–16, 19, 20]. Furthermore, the review emphasized the importance of aligning the application with the Human Interface Guidelines (HIG) for iOS [18] to meet industry standards for usability and compliance.

The key insights drawn from this literature are presented in the following sections, each addressing a specific area of design consideration that shaped the application's user experience.

3.1.1 Coloring for Accessibility. To enhance readability for older adults, the application design adopted a color contrast ratio of 7:1, which is significantly higher than the standard 4.5:1 ratio typically used for middle-aged users. This decision aligns with accessibility guidelines and ensures that text and interface elements remain legible for users with reduced visual acuity [14]. In addition, color combinations such as red-green and blue-yellow were deliberately avoided to ensure compatibility with color blindness accessibility standards [16], further improving inclusivity.

3.1.2 Typography and Font Size. The typography used in the application was carefully selected to support visual accessibility and reduce cognitive load. A minimum font size of 16 pixels was established, with an option to increase the text size to at least 50% for users requiring enhanced legibility [14]. Sans-serif fonts, including Arial and Helvetica, were chosen due to their improved screen readability and ability to facilitate word recognition. These fonts are commonly preferred in digital interfaces as they minimize visual complexity and help reduce cognitive strain [15]. Bold text was used selectively to emphasize key elements, while italics were avoided, since research suggests that italicized text reduces readability by approximately 18% [21].

3.1.3 Icons and Buttons. Icons within the application were designed with clarity and accessibility in mind. They were labeled with text to improve visual recognition, ensuring that even users with reduced ability to interpret visual cues could navigate the interface effectively. Moreover, the button sizes exceeded Apple's minimum target size of 9.6 mm, thereby accommodating older users who may have difficulties with motor precision. While Apple's guideline provides a baseline, research supports the use of even larger buttons to enhance usability for older adults [15]. The interface followed a minimalist design principle, displaying only essential information per screen to minimize cognitive overload. Progressive disclosure was applied to prevent users from becoming overwhelmed with too much content at once, particularly considering slower information processing speeds in older adult populations [15, 18].

3.1.4 Cognitive Load and Privacy. Several strategies were implemented to reduce cognitive load and ensure privacy. Task design prioritized simplicity by limiting the number of simultaneous actions required from users, avoiding scenarios in which multiple tasks needed to be performed on a single screen. This approach helps maintain user focus and comprehension, particularly for those who may experience age-related cognitive decline [15, 19, 20]. Furthermore, privacy settings were designed to be intuitive and easy to understand, using clear and concise language. Transparent explanations regarding data handling were included to build user trust and ensure that older adults could confidently manage their privacy settings without confusion [15, 19, 20].

3.1.5 Personalization and User Preferences. To enhance user engagement and provide a tailored experience, the application includes several customizable options based on research on digital mindfulness interventions for older adults. Studies suggest that personalization increases adherence and satisfaction in mindfulness applications by allowing users to adapt the experience to their individual preferences.

The application offers users the ability to select their preferred coach (avatar) to lead meditation sessions. Research suggests that the characteristics of the voice guiding the meditation, such as tone, speed, and warmth, influence user comfort and engagement. Providing multiple options allows users to choose a voice that best suits their personal preference, which has been linked to improved adherence to mindfulness practices. The background sound options available in the application are designed to support different user needs and levels of meditation experience. These include Alfa, featuring minimalist alpha wave meditation music to enhance relaxation and focus [22, 23]; Natur, which provides ambient nature sounds such as ocean waves and rainforest, commonly used for stress reduction and mindfulness [22, 23]; Melodisk, offering soft instrumental melodies selected to evoke emotional warmth without distraction [24]; Djup, composed of deep tones and minimalist patterns that support sustained attention and concentration [22, 23]; Binaural, which integrates binaural beats tuned to alpha and theta brainwave frequencies for meditative absorption [22]; and Tysta, a silent mode preferred by advanced practitioners seeking undisturbed deep meditation [22, 23]. These options are grounded in research showing that structured audio benefits novice users, while experienced meditators often favor silence or minimal auditory input [22–24].

In addition to sound customization, users can personalize their meditation experience by selecting from various techniques tailored to different needs. Options include Loving-Kindness Meditation (LKM), which focuses on cultivating compassion and positive emotional states [25–28]; Sleep Meditation, which combines guided relaxation, breath awareness, and calming auditory environments to support sleep onset and reduce sleep-related stress [1, 22, 29]; Body Scan Meditation, a foundational practice that enhances bodily awareness and attentional control [26]; and Mindful Walking, which integrates movement and mindfulness to promote present-moment awareness and reduce cognitive distraction, with added benefits for balance and emotional well-being in older adults [25, 26, 30]. These practices are supported by research showing differential benefits based on user characteristics and contexts [1, 22, 25–30].

Additionally, LugnAI offers flexible session durations to accommodate varying experience levels and user schedules. Research highlights the impact of session length on engagement, adherence, and effectiveness, particularly for older adults. Shorter sessions (5–10 minutes) are effective for beginners and older users, promoting consistency and reducing barriers to participation [29, 31, 32]. While they may lack the depth of advanced techniques, they offer stress reduction and improved well-being [29, 32]. Medium sessions (15–30 minutes) offer a balance between depth and practicality, with daily adherence typically stabilizing around 16–23 minutes [25, 29]. These are suited for users transitioning to intermediate levels but may still be challenging to maintain [25, 29]. Longer sessions (45–75 minutes) support advanced practices like full-body scans and extended breathing, though adherence declines at these durations [25, 29, 31, 32]. Studies suggest that limiting session length to around one hour can preserve psychological benefits while improving user engagement [32].

Currently, the application is developed in Swedish. While the interface includes mock-up elements for language selection, such as drop-down menus in the design prototype, full multilingual functionality has not yet been implemented. This feature is included in the road-map and visual design to support future integration. Studies on digital health applications emphasize the importance of linguistic inclusivity, particularly for older adults who may feel more comfortable engaging with content in their native language. As part of the future road-map, the application aims to offer customization in Swedish, Danish, Norwegian, Finnish, and English to ensure that mindfulness practices are accessible to a broader audience. By incorporating these language options, the application seeks to foster inclusivity and allow users to engage more effectively with meditation content in a language they understand best. By integrating these personalization features, the application ensures that mindfulness practices remain inclusive, accessible, and adaptable to the diverse needs of older adult users.

3.2 Visual Design Development

Building on the insights from the literature review, the initial design of the mindfulness application was developed using Figma[1], a collaborative UI/UX design tool. The goal was to create a prototype that translated accessibility principles into practical visual and interactive components suitable for older adults.

The resulting prototype was interactive, allowing for simulation of core user flows such as launching a mindfulness session, navigating the interface, and adjusting settings. This enabled early testing of navigation logic and accessibility features in a realistic, hands-on format.

To ensure that the design accurately reflected real user needs and behavior, a set of structured use cases was created alongside the prototype. These use cases served to define and validate the intended interactions within the app, helping to anticipate how users would engage with various features and where usability challenges might arise. They were instrumental in aligning the interface logic with user expectations and ensuring that each function was intuitive and purposeful.

[1] https://www.figma.com

Use cases are a tool used to understand, interpret, and organize the features of an application by illustrating how users interact with it [33]. They help outline who the users are, their goals, the steps they take to accomplish tasks, and how the system responds to these actions. Additionally, use cases serve to brainstorm potential misuses and malfunctions of the application and how to respond to them. When creating a use case, it should contain several key elements [34]:

- **System:** The software being discussed within the context of the use case. In the case at hand, the LugnAI mobile application prototype.
- **Actors:** They represent entities that exhibit behavior when interacting with the system. In the case at hand, it refers to the users, who are primary actors that initiate interactions with the system. For this project, the created persona is utilized as the user to formulate the use cases.
- **Scenario:** It is a specific sequence of actions and interactions between actors and the system under discussion. It is also known as a use case instance usually numbered.
- **Use case:** Use cases outline both successful and unsuccessful scenarios that may arise when actors interact with the system.

The defined use cases covered core functionalities such as profile creation, session configuration (voice, background sound, technique, duration, language), resuming previous sessions, viewing personal statistics, and adjusting general settings. These scenarios were fundamental to shaping a user experience that is both accessible and aligned with the goals of older adult users. A full list of use cases is provided in Appendix A.

3.3 Application Prototyping

Following the creation of the interactive Figma prototype, the application was translated into a functional mobile prototype using Flutter[2], with development carried out in Visual Studio Code[3]. The implementation aimed to reproduce the design features established during the prototyping phase, ensuring that the application remained accessible, intuitive, and aligned with the preferences of older adult users.

Flutter was selected due to its cross-platform capabilities, which allow a single code-base to support both iOS and Android development. This approach ensures scalability for future releases and reduces maintenance complexity. In addition, Flutter offers a flexible UI framework with built-in accessibility support, making it suitable for translating a design aimed at older users into a responsive, high-fidelity app.

Key interface elements—such as the navigation structure, screen layouts, touch targets, and personalization settings—were replicated and refined in code, maintaining consistency with the original design. Special attention was given to preserving accessibility attributes such as font scalability, color contrast, and button size throughout the development process.

The app was developed specifically for iOS devices, following Apple's Human Interface Guidelines (HIG) [18] to ensure compliance with platform-specific usability and accessibility standards. The transition from Figma to Flutter also allowed for interactive testing of functionality, enabling iterative improvements based on observed behaviors and user feedback.

[2]https://flutter.dev
[3]https://code.visualstudio.com

3.4 Co-Design Workshops

Two co-design workshops with older adults—one involving four participants and the other three—were conducted to gather user insights and validate our design decisions. The aim was to collaboratively explore preferences and expectations for an AI-driven mindfulness app, with a focus on accessibility, interaction style, and visual design.

The workshop followed a structured agenda: it began with a brief introduction to the project and current research, followed by a short mindfulness exercise and a demonstration of basic AI concepts. The interactive Figma prototype of the LugnAI app was then presented by the researchers. The decision to use the Figma prototype, rather than a functional version of the application, was intentional—our goal was to elicit feedback specifically on the visual design, interface clarity, and overall aesthetic appeal, without introducing potential distractions related to technical performance or interaction behavior. Participants were guided through the interface and invited to share their impressions, focusing on elements such as layout, readability, and visual coherence. This activity helped surface both strengths and areas for improvement in the user interface design.

In parallel, participants discussed interface elements such as avatar styles, color preferences, and layout features in a moderated focus group discussion, contributing additional insights into visual and emotional aspects of the design.

In addition, the group discussions throughout the workshop were audio recorded to ensure accurate capture of qualitative input. This combined approach enabled a rich understanding of both individual and collective perspectives.

3.5 User Feedback & Design Recommendations

All qualitative data gathered during the co-design workshops from audio-recorded group discussions. The analysis enabled the identification of recurring patterns, ideas, and user expectations that emerged across the different workshop tasks.

Key themes related to usability, accessibility and personalization were revealed. Participants emphasized the importance of clear and calming visual design, intuitive navigation, trust in data handling, and having control over features such as background sounds, coach voice, and reminders. Preferences around avatar appearance and interaction modality (e.g., speaking vs. typing) also surfaced as important factors for comfort and engagement.

Based on these findings, a set of design recommendations was developed to inform future iterations of the application. These recommendations aim to enhance usability for older adult users, ensuring that the mindfulness experience is not only accessible but also meaningful and supportive.

4 Results

4.1 Interface Design

The start screen (see Figure 2) offers multiple entry options with generously sized buttons to accommodate users with limited motor

precision. The minimalist layout supports low cognitive load, and visible privacy elements reflect users' desire for trust and transparency.

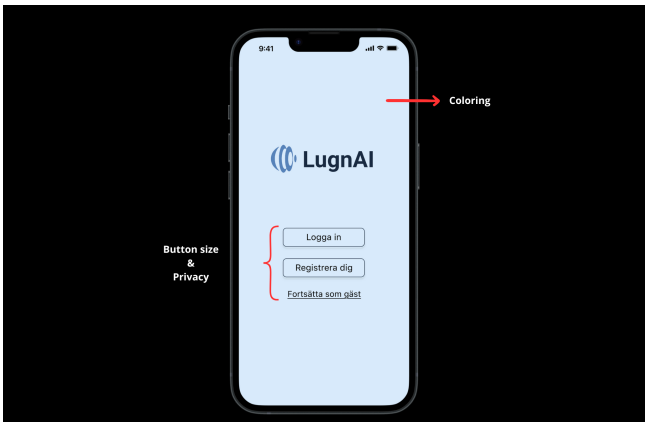

Figure 2: Login screen: high contrast background, large accessible buttons.

The registration screen (see Figure 3) was designed to minimize cognitive effort during the sign-up process by grouping related fields and using plain, concise language. The privacy agreement is made visible and clear, addressing the need for data transparency emphasized by users.

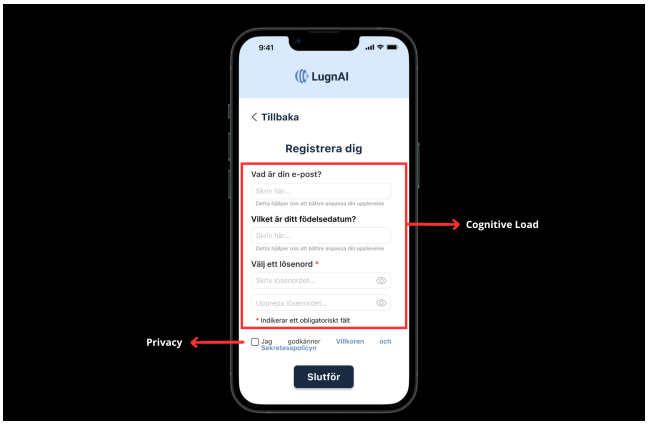

Figure 3: Registration screen: clear layout, sans-serif text, privacy consent.

The settings page (see Figure 4) emphasizes accessibility, incorporating large, clearly labeled buttons and toggles. The option to enlarge text reflects feedback around visibility and ease of reading, while intuitive icons aid navigation for users with limited digital literacy.

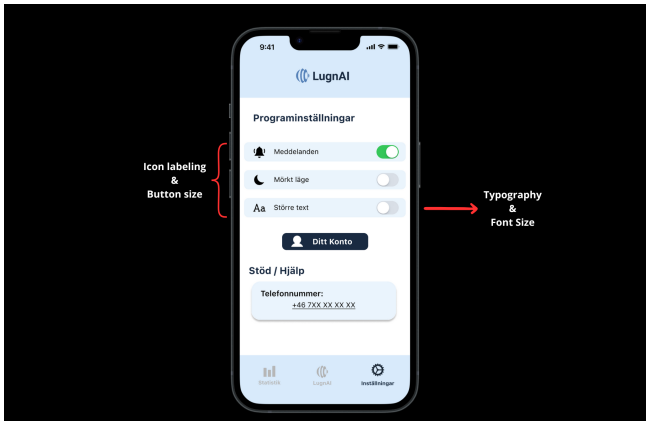

Figure 4: Settings Screen: larger text toggle, labeled icons, large buttons.

This screen supports user personalization (see Figure 5) by allowing them to choose both a voice for the mindfulness coach and a preferred background sound. These features respond directly to participants' desire for emotional comfort and familiarity in guided sessions.

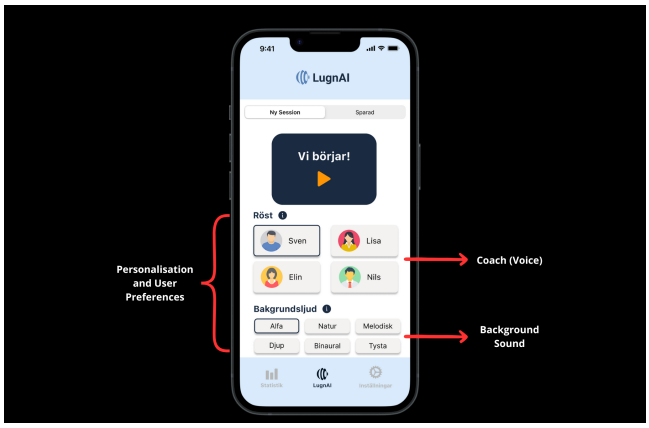

Figure 5: Main screen: voice and background sound preferences.

Users can select from a range of meditation techniques (see Figure 6) and session durations, supporting flexibility and personal relevance. These options reflect the need for different routines depending on user experience, daily context, or cognitive state.

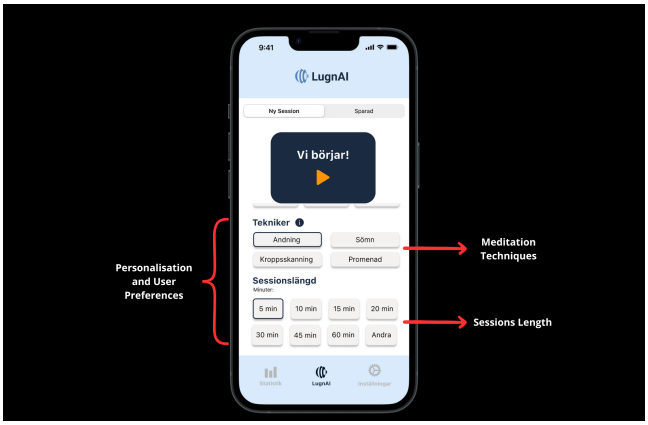

Figure 6: Main screen: meditation techniques and sessions length preferences.

This view (see Figure 7) adds a language selection feature, which emerged as a crucial accessibility factor for participants. It supports inclusivity by enabling users to engage with content in their preferred language, enhancing emotional connection and comprehension.

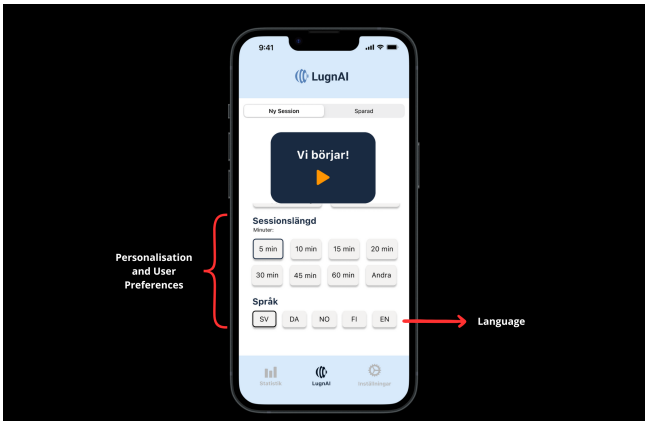

Figure 7: Main screen: language preferences (UI element included in the prototype for future implementation; not yet active in current app version).

4.2 User Feedback & Design Recommendations

These design recommendations integrate insights from two sessions of co-design workshops with older adult participants. The workshops focused on gathering feedback from a presentation of the UX prototype followed by a focus group discussion. The quotes and reflections below are grouped under each recommendation to illustrate their user-driven rationale.

Voice & Tone Options. Participants emphasized the importance of a calm, respectful and neutral tone of voice in AI interactions. Many expressed discomfort with overly enthusiastic or directive tones, which they associated with feeling patronized or controlled. The desire for voice customization emerged as a way to enhance user autonomy and comfort.

> *"It should be calm. Never bossy."* —P7
>
> *"You want to feel some control. It shouldn't feel like you're being dictated to."* —P11

These preferences suggest the need for a multiple voice style options, allowing users to select a tone that aligns with their comfort level. Neutral, slow-paced voices were consistently preferred over emotionally charged ones.

Data Transparency & Privacy Control. Concerns about data use, anonymity, and surveillance were prominent. Participants were particularly uneasy about the possibility of being profiled or constantly monitored. They asked for simple, plain-language explanations of how data is used and stored, and emphasized the importance of having control over this process.

> *"If it's AI, is it learning from me? Is it profiled or anonymous?"*
>
> *"You always have your phone with you, but sometimes it sends mixed signals."* —P5

These responses underscore the importance of offering anonymous or "session-only" modes, as well as establishing visible trust signals, such as affiliations with known health institutions.

Soft Social Interaction. Rather than rigid or scripted interactions, participants preferred AI systems that allow for gentle, opt-in engagement. They valued being asked for consent before initiating conversations, as well as the ability to end or skip interactions without guilt or consequence.

> *"Make sure there's follow-up — not just hanging up the phone."* —P7
>
> *Ask: "Do you want to talk?" or "Would you prefer silence?"* —Drawing Annotation

This input supports designing for soft-start interactions and giving users control over pacing and frequency of social touch-points.

Bounded Personalization. Participants expressed interest in limited personalization - such as remembering preferences for session types - but resisted deeper emotional profiling or personality mapping. They wanted the ability to easily reset or clear personalization data at any time.

> *"I absolutely don't want that."* —P9
>
> *"Trying to map my personality — that can be unpleasant."* —P2
>
> *"Sometimes you want reminders, but not every day. Let me turn them off or adjust them myself."* —P11

These concerns inform the need for "bounded personalization": systems should remember helpful, non-sensitive information (like preferred practices) but avoid storing emotional or personal history unless explicitly permitted.

Flexible Progress Feedback. Rather than being evaluated by performance metrics, participants wanted reflective, self-guided progress tools. Some appreciated seeing records of past activity, but only if these were framed non-judgmentally and could be entirely optional.

> *"I'd like to see what I've done, but without judgment. Just for myself."* —P1
>
> *"Duolingo-style reminders make you feel punished. That's the opposite of mindfulness."* —P5

These comments suggest the value of symbolic or mood-based self assessments (e.g., tags like "I feel calmer"), with opt-in options for journaling or review.

Ambient, Off-Screen Formats. Participants highlighted the value of screen-free interaction modes that support mindfulness through sensory or ambient cues. Objects like soft lights or tactile tools were seen as comforting and intuitive.

> *"That little blue teddy lamp — if you have trouble sleeping, it could guide you through mindfulness as it dims."* —P8

> *"Stress balls — I like those at home. They're great."* —P9

This feedback supports integrating ambient formats such as fading lights, soft chimes, or tactile devices to mark transitions in mindfulness sessions.

Support Multi-Device Formats. Older users reported greater ease and enjoyment using larger screens. Tablets were described as more accessible and immersive than small mobile screens, particularly when multitasking.

> *"I want it on my tablet so I can do a puzzle at the same time."* —P2

> *"The bigger the screen, the more immersive it feels. That matters for older users."* —P1

Designing for multi-device compatibility - particularly across tablets and larger displays - would accommodate a range of physical comfort levels and visual needs.

5 Discussion

This study explored the user interface design of a voice-based mindfulness application tailored to older adults. Through two participatory co-design workshops, participants helped articulate how voice interaction, personalization, and feedback mechanisms should be shaped to support mindful engagement. The analysis revealed three overarching design priorities: voice interaction preferences that reflect older adults' communication needs, a move beyond screen-centered design, and nuanced approaches to progress tracking. These themes point to broader design considerations for conversational AI technologies that aim to support aging populations.

5.1 Age-Specific Design Preferences for Voice Interaction

Participants strongly preferred calm, slow-paced, and emotionally neutral voice interactions. Animated or overly expressive tones were often perceived as condescending or intrusive—qualities they associated with reduced agency and respect. These reactions are consistent with research showing that older adults are especially sensitive to "elder-speak" and overly directive systems, which can diminish trust and perceived autonomy in AI interaction [35].

Participants also expressed a desire for greater control over how the system sounds, emphasizing the value of personalization in tone, pacing, and conversational style. Rather than one default voice, users wanted the ability to adjust the affective tone of the system to match their comfort level. This supports the broader trend in conversational AI toward customizable interaction models, and it highlights the importance of flexibility in voice design—not only for accessibility but for emotional safety.

This finding aligns with recent research showing that perceived emotional support and companionship are key predictors of older adults' adoption of voice assistants [36]. While some participants were open to more personable or emotionally attuned voices, others preferred a more transactional, low-key approach. These divergent preferences underscore the need for adaptive conversational systems—those that can modulate style, tone, and formality in response to individual user needs. The goal is not to create artificial companionship, but to support respectful, user-controlled interaction [35].

5.2 Designing Beyond Screen-Based Interaction

A major insight from the workshops was the strong preference for off-screen and ambient interaction formats. Participants responded positively to concepts involving lamps, tactile objects, and sound cues as mechanisms for guiding mindfulness sessions. These suggestions reflect a desire for more sensory-integrated, less cognitively demanding experiences—particularly important for older users who may experience screen fatigue or vision-related challenges.

The appeal of these non-visual formats lies in their ability to foster a more ritualized and embodied interaction, supporting presence without distraction. Participants described how a dimming lamp or a soft chime could signal the start or end of a session without requiring direct input or attention. These elements are especially relevant in mindfulness contexts, where minimalism and softness are core values.

From the perspective of conversational AI, this finding reinforces the potential of multi-modal interaction that goes beyond voice and screen. As highlighted in the recent CHI 2025 systematic review [35], older adults are increasingly interested in systems that blend natural language interaction with contextual, physical, and sensory feedback. Longitudinal studies also show that hybrid devices such as smart displays offer greater comfort and sustained use when they include tactile or visual elements alongside voice interaction [37]. Designing for these preferences requires expanding beyond voice-only or app-based systems to include situated, ambient technologies that integrate more seamlessly into the home environment.

5.3 Design Preferences for Feedback and Progress-Tracking

Participants expressed mixed feelings about progress tracking, with many rejecting traditional performance indicators like streaks, points, or daily goals. These features were often described as anxiety-inducing or incompatible with the goals of mindfulness. Instead, participants valued non-judgmental, optional feedback mechanisms—such as symbolic reflections ("I feel calmer") or self-authored notes that encouraged introspection without evaluation.

This aligns with concerns raised in existing literature around gamification in wellness apps, especially for older populations, where rigid goal structures may lead to disengagement or stress. As conversational AI systems increasingly take on roles in mental health and wellness, designers must rethink how "progress" is represented. For older users, success may be less about repetition or performance and more about mood, memory, or meaning [38].

Importantly, participants wanted full control over what was tracked and remembered. The idea of a system "remembering too

much" or trying to infer emotional patterns was viewed with caution. These concerns reflect broader anxieties around data privacy, profiling, and the boundaries of AI personalization—highlighted in Huang et al.'s review [35], which found that older adults consistently seek transparency and control in AI interactions.

Future systems should therefore offer bounded personalization, where users can choose what is remembered, reset preferences easily, and understand what data is stored. Conversational AI in this context must balance personalization with consent, supporting reflection without overreach.

6 Conclusion

This work presents a human-centered design approach for creating a mindfulness application adapted to the specific needs and expectations of older adults. By combining accessible visual and voice interaction design with an iterative co-design process, the LugnAI prototype advances the field of inclusive digital mental health tools.

The analysis from two rounds of workshops revealed critical preferences for emotional tone, personalization boundaries, privacy transparency, and ambient interaction. Participants articulated a nuanced vision for mindfulness: one rooted in calmness, choice, and emotional autonomy—not gamification or performance. The final design recommendations reflect these insights, offering concrete guidance for future AI-based mindfulness systems.

More broadly, this research shows that older adults are eager to engage with digital well-being tools—if those tools respect their cognitive rhythms, emotional states, and autonomy. Through deliberate design and ethical AI practices, mindfulness technologies can support healthier aging and address the growing need for accessible mental health support.

Future work will include usability testing of the full conversational prototype, further refinement of interaction flows, and potential integration with tangible devices for ambient engagement. Additionally, larger studies will be needed to assess long-term outcomes on well-being, stress regulation, and digital adherence.

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A Use Cases

Table 1: Use Case 1: Create Profile

Use Case	Create Profile
Use Case Goal	To enable Alex to create a personal profile on LugnAI, tailored to their preferences.
Primary Actor	Alex Svensson
Preconditions	(1) Alex has downloaded LugnAI. (2) Alex has a stable internet connection. (3) Alex has info like username, password, and optionally: name, birth date, email.
Basic Scenario	(1) Alex opens LugnAI. (2) The app shows a welcome screen with "Register", "Log in", or "Continue as Guest". (3) Alex selects "Register" and enters details. (4) Alex accepts Terms and Conditions. (5) Profile is created, and Alex is redirected to the dashboard.
Alternative Scenarios	(1) If email is already in use, Alex is prompted to log in or use a different one. (2) If internet is lost, progress is saved and resumed later. (3) If optional fields are skipped, Alex can continue, but is reminded that more info improves personalization.

Table 2: Use Case 2: Start a New Session

Use Case	Start a New Session
Use Case Goal	To allow Alex to go on a new session after selecting the preferences: voice, background sound, technique, session length, and language.
Primary Actor	Alex Svensson
Preconditions	(1) Alex has downloaded LugnAI on their phone. (2) Alex has either logged in or continued as a guest. (3) Alex has selected the preferences for the new session (voice, background sound, technique, session length, and language).
Basic Scenario	(1) Alex logs into LugnAI or continues as a guest. (2) On the dashboard, Alex selects "New Session" on the segmented control bar. (3) The app prompts Alex to select preferences: • Röst (Voice) • Bakgrundsljud (Background Sound) • Tekniker (Technique) • Sessionslängd (Session Length) • Språk (Language) (4) After confirming selections, Alex starts the session. (5) The session begins with an introduction by the chosen voice guide, leading the mindfulness practice. (6) After the session, the app invites Alex to rate it, save preferences, explore statistics, and shows the updated streak.
Alternative Scenarios	(1) If preferences are not fully selected, the app suggests default options and continues. (2) If the app is closed or connection is lost mid-session, progress is saved and can be resumed. (3) If Alex starts a session without logging in, they are informed that history won't be saved unless they create an account.

Table 3: Use Case 3: Start a Saved Session

Use Case	Start a Saved Session
Use Case Goal	To allow Alex to go on a session using the preferences they selected during their most recent mindfulness session.
Primary Actor	Alex Svensson
Preconditions	(1) Alex has a profile and is logged into LugnAI. (2) Alex has previously completed a mindfulness session (Use Case 2).
Basic Scenario	(1) Alex logs into LugnAI and accesses the dashboard. (2) Alex selects "Sparad (Saved)", which loads their last session's preferences. (3) The session begins using the previously selected: • Röst (Voice) • Bakgrundsljud (Background Sound) • Tekniker (Technique) • Sessionslängd (Session Length) • Språk (Language) (4) After the session, the app invites Alex to rate it, save preferences, explore statistics, and shows the updated streak.
Alternative Scenarios	(1) If Alex has not completed a previous session, "Sparad (Saved)" is unavailable and they are redirected to "Ny Session (New session)". (2) If Alex wants to adjust preferences, they may modify them before starting the session.

Table 4: Use Case 4: Visualize Statistics

Use Case	Visualize Statistics
Use Case Goal	To provide Alex with a visual representation of their progress in the LugnAI app, including data on number of sessions, total minutes, and streaks.
Primary Actor	Alex Svensson
Preconditions	(1) Alex has a profile and is logged into LugnAI.
Basic Scenario	(1) Alex logs into LugnAI and navigates to the Statistik (Statistics) section. (2) The app displays a dashboard with: • Current streak (Dagar i sträck) • Total minutes meditated (Minuter) • Total completed sessions (Sessioner) (3) Alex can interact with the data by viewing graphs or filtering by day, week, or month.
Alternative Scenarios	(1) None specified.

Table 5: Use Case 5: Settings Management

Use Case	Settings Management
Use Case Goal	To enable Alex to personalize their profile settings, including notifications, light/dark mode, font size, and personal data.
Primary Actor	Alex Svensson
Preconditions	(1) Alex has a profile and is logged into LugnAI. (2) Alex knows how to access the Settings tab.
Basic Scenario	(1) Alex logs into LugnAI and opens the Settings tab. (2) Alex adjusts preferences: • **Meddelanden (Notifications)**: Enable/disable reminders. • **Mörkt läge (Dark mode)**: Choose light or dark mode. • **Stor text-läge (Large text mode)**: Increase text size. • **Ditt Konto (Your account)**: Edit profile/password, log out, or delete account. • **Stöd / Hjälp (Support / Help)**: View support contact number. (3) Alex saves the changes and the app updates the settings accordingly.
Alternative Scenarios	(1) If Alex tries to change settings without logging in, the app prompts them to log in. (2) If Alex chooses to reset/delete their account, the system provides a confirmation prompt before proceeding.

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