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Designing for All: Ethical and Social Considerations in Inclusive Human-Computer Interfaces

DEEN MOHAMMAD[1],

NAVITA BANSAL[2],

Assistant Professor

R.D. Engineering College, Ghaziabad

ABSTRACT

The widespread acknowledgment of personal computers significantly enhancing the autonomy and communication capabilities of individuals with special needs underscores the importance of well-designed user interfaces. The design of these interfaces plays a crucialrole in shaping the social lives of users with disabilities and ensuring their accessibility to opportunities. Moreover, personal computers prove invaluable for individuals with severe motor impairments, enabling them to manipulate their environment and enhance mobility, such as through the use of smart wheelchairs. This increased functionality fosters greater social activity and productivity among this demographic. Recognizing the pivotal role of accessible interfaces, several countries have enacted legislation to safeguard individuals from 'digital exclusion'. However, implementing such legislation poses challenges for inexperienced Human-Computer Interaction (HCI) designers. To address this, the paper advocates for the adoption of inclusive design guidelines, supporting the 'design for all' philosophy. The paper emphasizes the necessity of clear criteria to prevent negative social and ethical consequences for users.The analysis underscores the benefits of inclusive design guidelines in fostering a universal design focus, thereby mitigating the risk of social exclusion. Furthermore, it explores the need for ethical and social guidelines

to prevent undesirable side effects on users. The paper concludes by presenting preliminary examples of socially and ethically aware guidelines, offering insights into the ongoing efforts to promote inclusive, responsible design practices in the realm of human-computer interfaces.

Keywords: *Personal computers, Autonomy, Communication capacity, Special needs, User interface design, Social lives,*

1. INTRODUCTION

The transformative influence of personal computers on individuals with special needs has been widely recognized, particularly in enhancing autonomy and communication capabilities. At the heart of this empowerment lies the critical role played by well-designed user interfaces. This recognition extends beyond mere technological advancement; it underscores the profound impact on the social lives of users with disabilities, emphasizing the imperative of accessibility to diverse opportunities.Universally accessible interfaces emerge as key facilitators in fostering positive socialization among individuals with disabilities. These interfaces provide avenues for personal, direct, and remote communication, offering newfound possibilities for those with sensory disabilities. Moreover, personal computers prove to be indispensable tools for individuals facing severe motor impairments, enabling them to manipulate their environment and enhance mobility, such as through the innovative use of smart wheelchairs. This expanded functionality not only augments their mobility but also contributes to increased social activity and productivity within this demographic.Recognizing the significance of accessible interfaces, several countries have instituted legislation to protect individuals from the perils of 'digital exclusion.' However, the effective implementation of such legislation presents challenges, particularly for inexperienced Human-Computer Interaction (HCI) designers. Addressing these challenges, this paper advocates for the adoption of inclusive design guidelines, aligning with the overarching 'design for all' philosophy. These guidelines prove instrumental in navigating the complexities of accessibility and ensuring the positive social impact of technology. A clear need emerges for criteria that prevent negative social and ethical consequences for users.

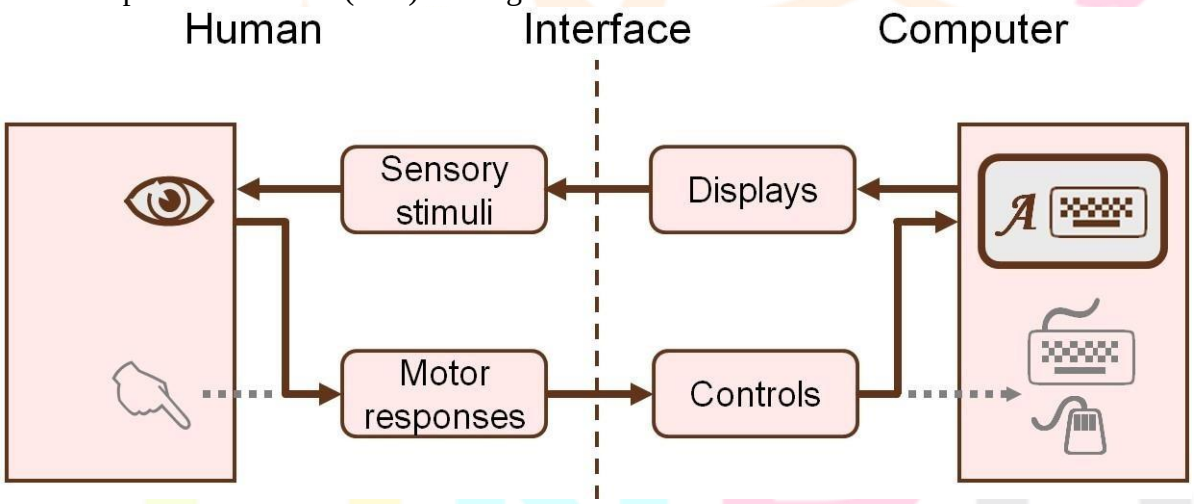
Figure 1: The illustration depicts the interaction between individuals and computers, along with the design theories and techniques employed to create an interactive system.

2. The Role of Technology in Breaking Barriers

The analysis within this paper sheds light on the substantial benefits of inclusive design guidelines, emphasizing their role in fostering a universal design focus and mitigating the risk of social exclusion. Furthermore, the exploration extends to the necessity of ethical and social guidelines to preempt undesirable side effects on users. As a testament to ongoing efforts, the paper concludes by presenting preliminary examples of socially and ethically aware guidelines. These examples offer insights into the evolving landscape of inclusive and responsible design practices within the realm of human-computer interfaces.People engage in communication for various purposes, whether it's sharing information, expressing needs and desires, or cultivating social connections. Communication takes diverse forms, encompassing verbal expression, gestures, or reading, among other mediums. However, the presence of a disability can significantly impact how individuals acquire and comprehend information,

potentially limiting effective communication. Ensuring that information exchange caters to the communication needs of everyone requires messages to be not only perceivable but also easily understandable, conveyed through accessible mediums.The pivotal role of Information and Communication Technologies (ICTs) becomes evident in advancing inclusive communication. These technologies play a crucial part by facilitating, transforming, or amplifying messages and by enhancing overall interaction and communication. Emerging approaches in Human–Computer Interaction (HCI) leverage multimodal interfaces, Artificial Intelligence (AI), and Extended Reality (XR) to eliminate accessibility barriers (Figure 2). This, in turn, holds the promise of empowering individuals with disabilities to activelyparticipate in public life, articulate their thoughts and feelings, and establish as well as maintain social relationships. The integration of these innovative technologies opens up new possibilities for fostering inclusivity and breaking down communication barriers.

Figure 2: Computer Interaction (HCI) leverage multimodal interfaces



This special edition delves into research exploring the design, creation, assessment, and utilization of Information and Communication Technology (ICT) applications, tools, and systems with a focus on fostering communication and social interaction. The articles featured in this edition specifically tackle the imperative for innovative solutions, aiming to enhance

soft skills in children with ADHD, provide increased accessibility for individuals dealing with hearing and cognitive impairments, and empower users across various contexts.

From utilizing virtual reality as a platform for honing public speaking skills to developing accessible tools tailored for video calls and designing user-friendly interfaces catering to cognitive accessibility, the studies compiled here collectively highlight the transformative potential of cutting-edge technology. These advancements are shown to bridge gaps, improve accessibility, and enrich the lives of diverse populations.Through collaborative efforts and meticulous design considerations, the articles presented in this edition offer valuable insights and practical strategies. These contributions contribute to the ongoing effort of constructing more inclusive and interconnected digital landscapes that can positively impact individuals from various backgrounds.

3. Fostering Soft Skills in Children with ADHD through Collaborative Creation of Tangible Tabletop Games

The study focuses on implementing effective strategies to nurture soft skills in children with Attention Deficit Hyperactivity Disorder (ADHD) through the utilization of technology. Delving into various methods and frameworks, the research aims to enhance creativity and social skills within this specific group of children who may face challenges in these areas. To assess the practical application of these strategies, the study includes a pilot experience where children with ADHD actively participate in the creation of a game using tangible tabletops.The outcomes of the pilot experience yield promising results, indicating that the implemented strategies effectively contribute to positive behavioral changes. Notably, there are significant improvements observed in communication, collaboration, and creativity during the sessions. These positive developments suggest that technology-based interventionscan have a meaningful impact on fostering essential soft skills in children with ADHD.The research, therefore, not only provides valuable insights into the practical effectiveness of

these approaches but also offers potential avenues for future interventions and educational initiatives. By showcasing the tangible improvements in communication, collaboration, and creativity, the study contributes to the growing body of knowledge on how technology can be harnessed to address specific challenges faced by children with ADHD. This information is crucial for educators, parents, and professionals seeking effective and innovative ways to support the development of essential skills in this particular demographic, ultimately enhancing their overall well-being and success.

4. Influence of Audience Familiarity on Anxiety within a Virtual Reality Public Speaking Training Tool

The authors present an innovative solution to the challenges inherent in honing the skill of public speaking, a critical competency in both professional and academic spheres. They directly address the difficulties individuals encounter in securing an appropriate environment and a willing audience for effective rehearsal, recognizing the pivotal role of these factors in skill development.To overcome these obstacles, the authors introduce a groundbreaking virtual reality environment. This environment incorporates 3D scans of real individuals, creating an authentic and recognizable audience within the virtual space. The intention is to provide a realistic and immersive experience for individuals seeking to improve their public speaking skills.The study conducted by the authors delves into the profound implications of presenting to a virtual audience, comparing the effects of presenting to a familiar audience versus an unfamiliar one. Additionally, the research explores whether exposure to customized virtual faces has a lasting impact on anxiety levels when individuals subsequently present to a real-life audience. Notably, the study reveals that individuals with a moderate fear of public speaking derive substantial benefits from presenting to a virtual audience with familiar faces, indicating the potential of this virtual reality approach as a confidence-building tool. Furthermore, the research goes beyond traditional metrics for anxiety detection, introducing

non-traditional measures. It sheds light on the significance of users' perception of virtual audience feedback, emphasizing a focus on facial expressions rather than body language. These findings provide valuable insights into the nuanced dynamics of virtual public speaking practice, highlighting the role of tailored virtual environments in not only building confidence but also effectively reducing anxiety levels, particularly for individuals with a moderate fear of public speaking. The research underscores the potential of technology- driven solutions in transforming the landscape of public speaking training and addresses the specific needs of individuals navigating the challenges associated with this skill.

5. Investigating Automated Text-to-Sign Translation within a Healthcare Context

The authors of this study embark on the critical endeavor of overcoming communication barriers between healthcare professionals and deaf patients, a challenge that has been exacerbated by the unprecedented circumstances of the COVID-19 pandemic. To address this pressing issue, they conceptualize and develop a prototype system designed to automatically translate common medical phrases—especially those pertinent to COVID-19—from Dutch or English to Dutch Sign Language (NGT). This innovative system employs a combination of pre-recorded videos featuring a human signer for specific sentences and computer-generated signing avatars for others.Upon evaluation, it becomes apparent that while the avatar accurately reproduces individual signs, there is a discernible decline in sentence comprehension and clarity compared to human signers. This observation underscores the need for further refinement in the underlying JASigning avatar engine to ensure optimal performance and practical utility in future applications. The research delves into the complexities of healthcare accessibility, shedding light on both the promising potential and the challenges associated with automated text-to-sign translation systems, particularly in the context of heightened communication difficulties during the COVID-19 pandemic. By tackling this crucial aspect, the study contributes to the ongoing discourse on inclusive

healthcare practices and emphasizes the significance of advancements in communication technologies to bridge gaps in accessibility and provide equitable healthcare services for all.

6. Embracing Inclusivity in AR/VR: Challenges to Accessibility in Immersive Technologies.

The authors of this study conscientiously address the intricate issue of accessibility barriers within the dynamic domain of augmented and virtual reality (AR/VR) for individuals with disabilities. Pioneering a multidisciplinary approach, they orchestrate collaborative sessions that bring together a diverse spectrum of participants, including academic researchers, AR/VR industry experts, individuals with disabilities, assistive technologists, and representatives from disability-focused organizations. This inclusive and comprehensive assembly of stakeholders allows for a holistic exploration of the challenges that individuals with disabilities encounter in AR and VR experiences.Through these collective efforts, the research unfolds key themes that emerge during the collaborative sessions, illuminating the nuanced nature of barriers within the realm of AR and VR. The study discerns interaction barriers across various impairments, encompassing physical, cognitive, visual, and auditory disabilities. By specifically identifying these barriers, the authors contribute valuable insights that deepen our understanding of the multifaceted challenges faced by individuals with diverse abilities in navigating AR and VR environments. In their conclusion, the authors not only encapsulate the findings but also present insightful recommendations for future initiatives aimed at effectively addressing and mitigating these identified challenges. The overarching goal is to inspire the development of more inclusive AR and VR experiences, fostering a technological landscape that prioritizes accessibility for individuals with diverse abilities. This research serves as a catalyst for positive change, propelling the discourse on inclusive technology forward and advocating for advancements that empower individuals of all abilities to fully engage and participate in the immersive world of AR and VR.

7. Automated Captions for Video Calls in Support of Older Adults

In navigating the significant surge in the utilization of video call and conferencing tools, particularly driven by the heightened demand during the unprecedented circumstances of the COVID-19 pandemic, the authors direct their attention to the unique challenges faced by older individuals with hearing difficulties. This demographic, due to their specific needs, may encounter difficulties in fully harnessing the benefits of video calls. In response to this pressing issue, the authors conceive and introduce an innovative solution—an automatic conversation subtitling tool. This tool harnesses the power of Automatic Speech Recognition and Speech to Text technology, providing a practical solution to address the communication barriers faced by older adults.The technological innovation does not stand alone; it is strengthened by the integration of the open-source Coqui STT tool. Significantly, the design of this tool emphasizes platform independence, ensuring that it is accessible to a broad spectrum of users, specifically targeting older adults and individuals with diverse hearing needs during video calls.To gauge the effectiveness and user experience of the automatic conversation subtitling tool, the study incorporates valuable feedback from older adults. This inclusion of user perspectives provides crucial insights into the benefits of the interface, preferences for configuration, and offers a foundation for proposing enhancements to the display of text. The overarching aim of this research is to elevate the video call experience for older individuals, recognizing the paramount importance of accessibility, particularly in the context of heightened reliance on virtual communication tools, a trend accentuated by the global pandemic. Through this innovative approach, the authors contribute not only to the development of technology but also to the broader conversation on inclusive design and the significance of considering the diverse needs of all users, especially those belonging to older age groups and individuals with varying hearing abilities.

8. Limitations

i. **Scope of Legislation Implementation**: The acknowledgment of challenges in implementing legislation underscores the need for deeper exploration into the multifaceted barriers faced by countries. A comprehensive investigation should extend beyond the recognition of hurdles to delve into the intricate dynamics shaped by diverse infrastructures, resource availabilities, and cultural contexts across different nations. Understanding the adaptability of legislation to varying technological landscapes is crucial for

gaining a nuanced understanding of the complexities involved. This exploration would involve an in-depth analysis of how legislative measures resonate with the technological infrastructures in place, considering factors such as accessibility to advanced technologies, digital literacy levels, and the availability of supportive resources. For instance, countries with robust technological infrastructures may encounter different challenges compared to those with limited access or resources. Similarly, the cultural context plays a pivotal role in shaping the acceptance and effectiveness of legislative measures. Exploring how legislation aligns with cultural values, societal norms, and attitudes toward technology is essential for crafting inclusive and effective policies.By undertaking this nuanced exploration, researchers and policymakers can uncover specific challenges faced by different countries, identify commonalities, and tailor legislative approaches to better suit the unique contexts of each nation. This in-depth analysis contributes to the development of more effective, adaptable, and culturally sensitive legislative frameworks that address the diverse challenges in promoting accessibility and digital inclusion on a global scale.

ii. **Generalizability of Inclusive Design Guidelines**: In mitigating potential limitations related to the generalizability of inclusive design guidelines, an in-depth research approach could involve an exploration of specific contexts or demographics where

hese guidelines may require tailored adjustments. Rather than assuming a one-size- fits-all approach, the research could delve into the intricacies of diverse user needs and preferences, recognizing that inclusivity is a dynamic concept that varies across different groups and environments.By investigating specific contexts, researchers can pinpoint unique challenges and opportunities that may influence the effectiveness of inclusive design guidelines. This tailored approach ensures that the guidelines can adapt to the distinctive characteristics of various user groups, such as individuals with different types of disabilities, varying levels of technological literacy, or diverse cultural backgrounds.Understanding the nuances of user needs and preferences is crucial for achieving widespread applicability. This involves considering factors like sensory preferences, cognitive abilities, and technological access disparities that may differ among demographic groups. The research could employ methodologies such as user surveys, interviews, or usability testing within these specific contexts to gather firsthand insights into the experiences and requirements of users.Ultimately, this nuanced investigation helps refine and customize

inclusive design guidelines to make them more responsive to the diverse and evolving nature of user requirements. By tailoring adjustments based on specific demographics or contexts, the research contributes to the creation of more inclusive and adaptable design principles that can positively impact a broader spectrum of users.

iii. **User Engagement and Compliance**: Delving into an in-depth exploration of the factors that influence user engagement and compliance with ethical and social guidelines is crucial for gaining a comprehensive understanding and developingeffective strategies. This multifaceted exploration entails a thorough investigation into various elements that shape user behavior and responses to ethical design practices.Studying user motivations is a pivotal aspect of this inquiry. By identifying what drives users to engage with and adhere to ethical guidelines, researchers can uncover key insights into the intrinsic and extrinsic factors that influence decision- making. This may involve examining the alignment of ethical practices with users' personal values, professional obligations, or broader societal expectations.Understanding potential resistance to ethical guidelines is equally important. This facet of the exploration involves recognizing barriers that users may encounter in adopting ethical design practices. By identifying and addressing these barriers, researchers can develop targeted interventions to mitigate resistance and promote more seamless integration of ethical considerations into design processes.Enhancing user commitment to ethical design practices requires a nuanced approach. This may involve developing strategies to cultivate a sense of ownership and responsibility among users regarding the ethical implications of their design decisions. Implementing educational initiatives, fostering a culture of ethical awareness, and providing tangible incentives are potential methods to bolster user commitment to ethical design principles.In essence, this in-depth exploration seeks to unravel the psychological, motivational, and contextual factors that shape user engagement with ethical guidelines. By gaining a profound understanding of these dynamics, researchers can contribute to the development of tailored strategies that not only enhance user compliance but also foster a culture of ethical awareness and responsibility within the design community.

9. Recommendations:

i. **User-Centric Research**: Advocate for extensive user involvement in research and design processes. The

recommendations could emphasize the importance of conducting user studies, gathering feedback, and iteratively refining design solutions based on the lived experiences of individuals with disabilities.

ii. **International Collaboration**: In recommending international collaboration, the paper could highlight specific platforms, forums, or mechanisms through which HCI designers, policymakers, and advocates can actively engage. Establishing a framework for cross-border collaboration can enhance knowledge sharing and standardization efforts.

iii. **Education Initiatives**: Specify actionable steps for integrating inclusive design principles into educational programs. This could include creating modules, workshops, or certification programs that equip HCI designers with the necessary skills and knowledge to implement ethical and inclusive design practices.

10. Future Aspects:

i. **Evolution of Technology**: Anticipate technological advancements and their potential impact on accessibility. Explore how emerging technologies such as Virtual Reality (VR), Augmented Reality (AR), or new interaction paradigms mightshape the future of universally accessible interfaces.

ii. **Long-Term Social Impact**: In the context of long-term social impact, suggest methodologies for conducting extended studies that assess the sustained benefits of inclusive design on the quality of life for individuals with disabilities. Consider qualitative indicators of well-being and social integration.

iii. **Policy Evolution**: Propose mechanisms for continuous policy evaluation and adaptation. This could involve establishing regular reviews, incorporating feedback from stakeholders, and agile policy frameworks that can swiftly respond to evolvingchallenges in the digital landscape.

iv. **Integration of AI**: Explore the potential role of Artificial Intelligence (AI) in enhancing accessibility features. Consider ethical considerations in integrating AI into design processes and highlight areas where AI can complement human effortsin creating more inclusive interfaces.

11. Discussion

In their exploration of designing user interfaces tailored to meet the needs of individuals with cognitive impairments and introduce a set of cognitive accessibility design patterns. These patterns are strategically applied in the development of the user interface for the Easier web system. The primary objective of the Easier web system is to address challenges faced by individuals with intellectual disabilities, specifically improving text content comprehension and readability. The Easier web system achieves its goals through an innovative approach: it identifies complex words within the content and provides users with simplified alternatives. Moreover, the system incorporates definitions for intricate terms, aiming to enhance overall understanding. This approach represents a significant leap in making digital content more accessible for individuals with cognitive impairments, acknowledging the importance of inclusive design in technology.The study's findings demonstrate the effectiveness of the Easier web system's interfaces for individuals with cognitive impairments. Users in this demographic reported a satisfactory and positive experience, showcasing the practical impact of incorporating cognitive accessibility design patterns into user interface development.In addition to sharing their research outcomes, the authors propose an innovative design concept within the article. They suggest the integration of a glossary mechanism into web interfaces featuring simplified texts. This proposed glossary mechanism serves as a valuable tool to further enhance comprehension and accessibility for users with cognitive impairments, providing additional support beyond the initial simplification of content.The guest editors express sincere gratitude to all the reviewers who contributed their expertise to the selection and improvement of the papers featured in this special issue. Their collaborative efforts have significantly enriched the

compilation, which is envisioned to serve as a valuable reference for those interested in advancing digital accessibility within the field of Human–Computer Interfaces. The hope is that readers will find inspiration and practical insights in this collection, contributing to ongoing efforts to create technology that is more inclusive and user-friendly for diverse audiences.

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