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Human Factors Engineering: Designing for Diversity and Accessibility

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As the Human Factors and Ergonomics Society Diversity, Equity, and Inclusion Committee enters its fifth year, it continues to encourage the society, annual meeting attendees, and human factors professionals to improve diversity and equity within the field. At the center of this field are humans and their widely varying needs and abilities. While HFE professionals devote themselves to these needs, their details are often overlooked in order to design for what is assumed to be a majority of users. These assumptions can then lead users to be rejected by products, systems, or objects. This rejection indicates a lack of accessibility, which affects millions worldwide. In this panel, experts in the areas of universal design, healthcare, and accessible design will discuss how to "do" accessibility while demonstrating that accessibility should be considered a required component of usability.

INTRODUCTION

At the core of the human factors and ergonomics field is the importance of human needs, goals, capabilities, and constraints in the design of systems that will work for people (Roscoe et al., 2019). However, despite this emphasis on human needs and capabilities, human factors professionals are often taught and encouraged to design for simple majorities, which constrain the variability of human experience within a normal distribution (e.g. the fifth percentile female up to the ninety-fifth percentile male) (Designing with extraordinary people, 2020). In this example, designs focus solely on anthropometry and do not consider a number of other factors (e. g. geographic location, disability status, and education level) which can influence how an individual interacts with a product or system or even reject them entirely (Holmes, 2020). These rejections extend into every aspect of life from the home to the doctor's office to the workplace and beyond (Holmes, 2020; Perez, 2019).

Central to an individual's well-being is the experience of autonomy and agency in daily life (Slemp, Kern, Patrick, & Ryan, 2018; Van den Broeck, Ferris, Chang, & Rosen, 2016). Exclusionary systems hinder a person's ability to achieve their full potential while simultaneously reducing their autonomy (Lui & Quezada, 2019; Schmitt, Branscombe, Postmes, & Garcia, 2014). As a result, the field of human factors has a crucial responsibility and opportunity to advocate for inclusion and equity (Roscoe, Chiou, & Wooldridge, 2019). As an individual who cannot access a resource is excluded from it, accessibility is a core component of both equity and inclusion.

Threats to accessibility or an outright lack of accessibility create barriers which affect millions worldwide. Differences in accessibility mean that some people can access a resource while others cannot—their experience is not equal. In the United States alone, 57 million individuals have a disability (Brault, 2012), however many instances of inaccessibility are not due to disability status. Inaccessibility may take many forms: based on senses (e.g., sight, sound), based on language (e.g., English-only, no translators or interpreters), based on physical bodies (e.g., mobility, reaching, lifting), based on resources (e.g. income, geographic location), and more. Accessibility is a very actionable problem of design. Human factors professionals can identify how people are excluded due to accessibility issues and then design accommodations. While such accommodations are often short-term, reactive solutions, new systems may then be designed with universal accessibility in mind.

As demonstrated by the concept of universal design, accessibility is beneficial to all: those who need a particular access method have it, and others who don't "need it" may still find it useful or may disregard it entirely (Henry, Abou-Zahra, & Brewer, 2014). A prime example of this beneficence is television captioning: those who require captions have them and can use them to fully engage with TV programming, and those who don't explicitly require captioning may still use them to ensure they don't miss dialogue or can simply turn them off.

Since its inception, the Human Factors and Ergonomics Society (HFES) Diversity, Equity, and Inclusion (DEI) Committee has been committed to supporting equity and inclusion efforts through a series of panels (2016-2018, 2020) and a mini-workshop (2019). As human factors professionals, HFES members and annual meeting attendees are uniquely positioned to take action on issues of accessibility. The objective of this panel is to bring together experts from various disciplines within human factors and ergonomics (HFE) to discuss how HFE professionals "do" accessibility. Further, the content of the panel will encourage attendees to view accessibility as a necessary component of usability.

Looking Inward

To provide professional, scholarly, and global leadership on accessibility, the Human Factors and Ergonomics Society can (and should) begin by reviewing and improving its own

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practices. Procedures and resources surrounding the Annual Meeting should demonstrate best practices for accessibility and inclusion, such as ensuring that (a) venues have physical accessibility for a range of bodies and mobility (e.g., elevators, stairs, ramps, gender neutral restrooms), and (b) presentation sites and modalities offer a range of equitable ways to experience the content (auditory, visual, etc.). Additionally, accessing these resources should be a smooth and straightforward process without inconvenience or stigma for requesting assistance. This conversation about HFES and accessibility has been ongoing and was also presented as a panel discussion at the 63rd Annual Meeting (Gomes, Nguyen, Stonewall, Davis, Coppola, Hallett, & Williams, 2020).

Part of the process of improving HFES entails educating ourselves about the issues, needs, technologies, and resources available. What are the needs of our members and attendees, and how are they being met elsewhere? How can we bring those same solutions to HFES members and events? We have HFES members who are experts in the area, so how can we leverage, promote, and incentivize their expert consultation?

By doing this work, we are directly benefitting our own members and ensuring that more people can participate fully and equitably in HFES activities. To the extent that we succeed at this, we serve as role models for similar organizations for “how it’s done.” Further, what we learn along the way can become lessons that we teach to others.

Advocating for Accessibility

As we invest in our own professional and scholarly development toward accessibility, we are also developing expertise and a “toolkit” that can be shared with others. HFES experts in design methods can (a) investigate how those methods apply to accessibility and (b) teach accessible design methods to others.

This focus on accessibility potentially represents a “mindset shift” in the workflow of HFE professionals. A common reason behind inaccessible design is a lack of consideration or awareness as opposed to planned exclusion (Evcil, 2012). Accessibility is universal to any human activity, and by being aware of the issue, we can look for accessibility concerns in anything that we or our clients do. With an accessibility-focused mindset, we can point out access barriers while identifying solutions and practices to mitigate them.

PANELIST STATEMENTS

Dimensions of Accessibility: Designing for Diversity

Claudia Mont'Alvão, Associate Professor, Pontifical Catholic University of Rio de Janeiro, Brazil

International agreements contributed to the global sense of the 'accessibility' definition. They were essential for the dissemination and development of technical terms used in this area. They also helped with disabled persons' rights. Accessibility knowledge was established from the comprehension about the distinction among different disabilities and which barrier represented each of them. The five dimensions of accessibility (Architectural, Communicational, Methodological, Instrumental, Programmatic, Attitudinal) proposed by Sassaki (2009) allowed a more refined search for access solutions. The lack of understanding about these dimensions must be aligned with approaches that aim to universalize methods for the conception of products and systems. This understanding leads to accessible and inclusive projects under development, in the same proportion, to the frustrating design. Universal Design, Design for all, among other approaches, are no longer universal after understanding the dimensions of accessibility. Those who design must consider a human-centred design approach considering theses dimensions, besides the well-known accessibility approaches.

Claudia Mont'Alvão, Bach in Industrial Design, M.Sc. and D.Sc. in Transport Engineering, is an Associate Professor of Design at Pontifical Catholic University of Rio de Janeiro, Brazil. Prof. Claudia is the author of Brazil's main books about Human Factors/ Ergonomics methodology and coeditor five volumes of build environment and accessibility, recently published. It is a recognized researcher by Brazilian National Council for Scientific and Technological Development (CNPq), with a 3-year grant for research and application of HF/E in informational design, human-computer interaction and the built environment.

The role of human factors science in helping to open the door to inclusion in clinical and healthcare research

Elizabeth Lerner Papautsky, PhD
University of Illinois at Chicago, Chicago, IL

Minorities make up <20% of participants in clinical trials, despite comprising ~40% of the US population (Eshera et al., 2015). Human factors science is in a position to support the development and implementation of strategies to increase diversity in clinical trials specifically, as well as healthcare research in general by informing human-centered messaging, enrollment, and retention in service of closing the gap in access to care and treatment for women and minorities. This also requires effective education and training of both patients and investigators, such as selecting and/or training investigators who have access to minority communities and/or share language and culture. Exclusion of metastatic breast cancer patients, as well as older patients (not to mention minority populations) from clinical trials is a topic that is currently receiving attention (Batra, et al., 2020). Dearth of research to understand ‘real-world’ patients and their needs with the goal of developing broader eligibility criteria and retention strategies that account for contextual and lifestyle factors, will on only continue to perpetuate disparities in cancer and other illnesses.

Of particular timely relevance is the topic of COVID-19 vaccines. Cancer patient receiving treatment, who are at a significant risk for COVID-19 complications, were excluded from both Pfizer and Moderna trials. Despite formal guidance around recommending vaccines to cancer patients from the American Society of Clinical Oncology and the Centers for Disease Control (ASCO, 2021), due to the uncertainty associated with lack of tangible data, anecdotal evidence suggests that messaging from providers has been inconsistent.

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Supporting access and accessibility to research through adopting and adapting human factors perspective and methods has the potential in helping to open the door to inclusion. Strategies of tailoring accessibility according to the needs of the historically excluded populations are critical. Human factors methods toolbox provides us with approaches to identify barriers to inclusion and can thus inform solutions for overcoming them. Examples may include partnering/collaborating with community organizations, representatives, and patients – including the 'patient voice' (Seidman, et al., 2020) to inform the design, recruitment, and retention of clinical trials and other research; providing childcare, transportation, compensation, parking and food vouchers, to research participants and budgeting for them in grants and contracts. Without this inclusion, we cannot inform tailored and effective solutions that are critically needed.

Dr. Papautsky holds a PhD in human factors psychology and is an Assistant Professor in the Department of Biomedical Informatics at University of Illinois at Chicago and a member of the University of Illinois Cancer Center. After working as a government contractor studying decision making in complex real-world environments (military, intelligence analysis, healthcare) for 10 years, she transitioned to academia to focus her research on patient-centered topics. Her primary research focus is on patient-provider communication and the patient's role in the clinically relevant information space, particularly in breast cancer treatment and survivorship.

Design for Diversity: Design for One or Design for All

Jon Sanford, Professor, Georgia Institute of Technology, USA

Typically, products, devices, buildings, and systems are designed for the "average" user with normative abilities and without impairments. Not surprisingly, most of these everyday designs present barriers to use by people who have limitations in their functional abilities. To overcome these barriers, compensatory specialized designs, including assistive technologies (AT) and accessible designs (AD), act as interventions to facilitate activity performance, which in turn will promote inclusion and participation. However, specialized design is, at its very core, design for one - whether it be a one-off design for *one individual* or a generic design intended for *one group of individuals* that share similar functional limitations. Despite its technical success in facilitating activity, specialized design for one contributes to segregation rather than integration, which in turn further exacerbates exclusion rather than inclusion.

Universal design is the "design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design." By focusing on all abilities of all individuals rather than on individuals or groups of individuals with a specific disability, universal design shifts the focus from design for one to design for all. In contrast to the hierarchical specialized design approach that claims engagement in activities is an outcome of design and participation is an outcome of activity engagement, activity and participation are treated as co-equal outcomes of universal design. To capture the constructs of both activity and participation the Principles of Universal Design provide a set of design goals and guidelines to enable usability and inclusion for all.

Jon Sanford, M. Arch, is a Professor of Industrial Design at Georgia Tech. Mr. Sanford is one of the few architecturally-trained researchers engaged rehabilitation research and is internationally-recognized for his expertise in universal design for aging in place. He is one of the authors of the Principles of Universal Design and the PI for the Rehabiliation Engineering Research Center on Technologies for Aging in Place for People with Long-term Disabilities, a 5-year grant from the DHHS Administration for Community Living. He has over 300 presentations and publications and recently authored the book: Design for the Ages: Universal Design as a Rehabilitation Strategy.

Children with Medical Complexity

Rupa Valdez, Associate Professor, University of Virginia, USA

A significant portion of Dr. Valdez's research, teaching, and advocacy focuses on the disability community. Her research focuses on the experience of both adults and children with disabilities in addition to their social network members, as it relates to managing health at home and in the community. Her teaching focuses on these topics in addition to more broadly focusing on disability in contemporary society. As an advocate, Dr. Valdez has worked both locally and nationally for the rights of people with disabilities. Personally, she lives with multiple chronic illnesses and disabilities that continue to shape her work.

In this talk, Dr. Valdez will speak specifically about her research focused on children with medical complexity. The focus of this NIH-funded project is to use a human factors approach to understanding how health management is distributed and negotiated among multiple social network members and to understand the ways in which multiple systems components interact to shape the experiences of health management for this patient population. Dr. Valdez will present the specific methodologies used in this work, preliminary results, and a discussion of future research directions relevant to the human factors and ergonomics community. She will also present lessons learned about conducting research in-person and virtually with members of the disability community.

This work was funded through the NIH, National Institute of Nursing Research (NINR) (R21NR017991).

Dr. Rupa Valdez is an associate professor at the University of Virginia with joint appointments in the School of Medicine and the School of Engineering and Applied Sciences. She is also a core faculty member of Global Studies and the Disability Studies Initiative. Dr. Valdez merges the disciplines of human factors engineering, health informatics, and cultural anthropology to understand and support the ways in which people manage health at home and in the community.

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Her research and teaching focuses on underserved populations, including populations that are racial/ethnic minorities, are of low socioeconomic status, or are living with physical, sensory, or cognitive disabilities. Her work draws heavily on community engagement and has been supported by the National Institutes of Health (NIH), Agency for Healthcare Research and Quality (AHRQ), and the Kellogg Foundation, among others. She serves as Division Chair of Internal Affairs for the Human Factors and Ergonomics Society (HFES) and as Associate Editor for Journal of American Medical Informatics Association (JAMIA) Open. She also helped establish the Disability and Chronic Illness Affinity Group within HFES. She is the founder and president of Blue Trunk Foundation, a nonprofit dedicated to making it easier for people with chronic health conditions, disabilities, and age-related conditions to travel.

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