UMSI research from 2021 CHI proceedings

University of Michigan School of Information faculty and PhD students have earned two Best Paper and two Honorable Mention designations at the 2021 ACM CHI Conference on Human Factors in Computing Systems.

Best Paper awards go to the top one percent of accepted papers at ACM CHI, the premiere international conference on Human-Computer Interaction. Honorable mention awards go to the top five percent of accepted papers.

In addition to these four papers, UMSI faculty and students had nearly thirty additional research papers, late-breaking works and workshops accepted.

This year's conference will take place virtually from May 8-13 due to the ongoing COVID-19 pandemic.

See below for a complete list of UMSI research. School of Information faculty, students and researchers are listed in bold, and the names of other University of Michigan scholars are italicized.

Papers

Best Paper Award
Paper: "Getting Ourselves Together: Epistemic Burden and Data-centered Participatory Design Research"
Jennifer Pierre, Roderic Crooks, Morgan Currie, Britt Paris, **Irene Pasquetto**
Data-centered participatory design research projects—wherein researchers collaborate with community members for the purpose of gathering, generating, or communicating data about the community or their causes—can place epistemic burdens on minoritized or racialized groups, even in projects focused on social justice outcomes. Analysis of epistemic burden encourages researchers to rethink the purpose and value of data in community organizing and activism more generally. This paper describes three varieties of epistemic burden drawn from two case studies based on the authors' previous work with anti-police brutality community organizations. The authors conclude with a discussion of ways to alleviate and avoid these issues through a series of questions about participatory research design. Ultimately, we call for a reorientation of knowledge production away from putative design solutions to community problems and toward a more robust interrogation of the power dynamics of research itself.

Best Paper Award
Paper: "LGBTQ Persons' Pregnancy Loss Disclosures to Known Ties on Social Media: Disclosure Decisions and Ideal Disclosure Environments"

Cassidy Pyle, *Lee Roosevelt*, *Ashley Lacombe-Duncan*, Nazanin Andalibi
Pregnancy loss is a common yet stigmatized experience. We investigate (non)disclosure of pregnancy loss among LGBTQ people to known ties on identified social media as well as what constitutes ideal socio-technical disclosure environments. LGBTQ persons experiencing loss face intersectional stigma for holding a marginalized sexual and/or gender identity and experiencing pregnancy loss. We interviewed 17 LGBTQ people in the U.S. who used social media and had recently experienced pregnancy loss. We demonstrate how the Disclosure Decision-Making (DDM) framework explains LGBTQ pregnancy loss (non)disclosure decisions, thereby asserting the framework's ability to explain (non)disclosure decisions for those facing intersectional stigma. We illustrate how one's LGBTQ identity shapes (non)disclosure decisions of loss. We argue that social media platforms can better facilitate disclosures about silenced topics by enabling selective disclosure, enabling proxy content moderation, providing education about silenced experiences, and prioritizing such disclosures in news feeds. CAUTION: This paper includes quotes about pregnancy loss.

Best Paper Honorable Mention
Paper: "'It's Complicated': Negotiating Accessibility and (Mis)Representation in Image Descriptions of Race, Gender, and Disability"
Cynthia L. Bennett, Cole Gleason, Morgan Klaus Scheuerman, Jeffrey P. Bigham, Anhong Guo, Alexandra To
Content creators are instructed to write textual descriptions of visual content to make it accessible; yet existing guidelines lack specifics on how to write about people's appearance, particularly while remaining mindful of consequences of (mis)representation. In this paper, we report on interviews with screen reader users who were also Black, Indigenous, People of Color, Non-binary, and/or Transgender on their current image description practices and preferences, and experiences negotiating theirs and others' appearances non-visually. We discuss these perspectives, and the ethics of humans and AI describing appearance characteristics that may convey the race, gender, and disabilities of those photographed. In turn, we share considerations for more carefully describing appearance, and contexts in which such information is perceived salient. Finally, we offer tensions and questions for accessibility research to equitably consider politics and ecosystems in which technologies will embed, such as potential risks of human and AI biases amplifying through image descriptions.

Best Paper Honorable Mention
Paper: "PrivacyMic: Utilizing Inaudible Frequencies for Privacy Preserving Daily Activity Recognition"
Yasha Iravantchi, Karan Ahuja, Mayank Goel, Chris Harrison, *Alanson Sample*
Sound presents an invaluable signal source that enables computing systems to perform daily activity recognition. However, microphones are optimized for human speech and hearing ranges: capturing private content, such as speech, while omitting useful, inaudible information that can aid in acoustic recognition tasks. We simulated acoustic recognition tasks using sounds from 127 everyday household/workplace objects, finding that inaudible frequencies can act as a substitute for privacy-sensitive frequencies. To take advantage of these inaudible frequencies, we designed a Raspberry Pi-based device that captures inaudible acoustic frequencies with

settings that can remove speech or all audible frequencies entirely. We conducted a perception study, where participants "eavesdropped" on PrivacyMic's filtered audio and found that none of our participants could transcribe speech. Finally, PrivacyMic's real-world activity recognition performance is comparable to our simulated results, with over 95% classification accuracy across all environments, suggesting immediate viability in performing privacy-preserving daily activity recognition.

Best Paper Honorable Mention
Paper: "Yes: Affirmative Consent as a Theoretical Framework for Understanding and Imagining Social Platforms"
Jane Im, Jill Dimond, Melody Berton, Una Lee, **Katherine Mustelier**, Mark S. Ackerman, Eric Gilbert
Affirmative consent is the idea that someone must ask for, and earn, enthusiastic approval before interacting with someone else. For decades, feminist activists and scholars have used affirmative consent to theorize and prevent sexual assault. In this paper, we ask: Can affirmative consent help to theorize online interaction? Drawing from feminist, legal, and HCI literature, we introduce the feminist theory of affirmative consent and use it to analyze social computing systems. We present affirmative consent's five core concepts: it is voluntary, informed, revertible, specific, and unburdensome. Using these principles, this paper argues that affirmative consent is both an explanatory and generative theoretical framework. First, affirmative consent is a theoretical abstraction for explaining various problematic phenomena in social platforms—including mass online harassment, revenge porn, and problems with content feeds. Finally, we argue that affirmative consent is a generative theoretical foundation from which to imagine new design ideas for consentful socio-technical systems.

Paper: "The Annoying, the Disturbing, and the Weird: Challenges with Phone Numbers as Identifiers and Phone Number Recycling"
Allison McDonald, **Carlo Sugatan**, **Tamy Guberek**, Florian Schaub
Phone numbers are intimately connected to our digital lives. People are increasingly required to disclose their phone number in digital spaces, both commercial and personal. While convenient for companies, the pervasive use of phone numbers as user identifiers also poses privacy, security, and access risks for individuals. In order to understand these risks, we present findings from a qualitative online elicitation study with 195 participants about their negative experiences with phone numbers, the consequences they faced, and how those consequences impacted their behavior. Our participants frequently reported experiencing phone number recycling, unwanted exposure, and temporary loss of access to a phone number. Resulting consequences they faced included harassment, account access problems, and privacy invasions. Based on our findings, we discuss service providers' faulty assumptions in the use of phone numbers as user identifiers, problems arising from phone number recycling, and provide design and public policy recommendations for mitigating these issues with phone numbers.

Paper: "Avoiding the Turing Tarpit: Learning Conversational Programming by Starting from Code's Purpose"
Kathryn Cunningham, Barbara J. Ericson, **Rahul Agrawal Bejarano**, Mark Guzdial

Conversational programmers want to learn about code primarily to communicate with technical co-workers, not to develop software. However, existing instructional materials don't meet the needs of conversational programmers because they prioritize syntax and semantics over concepts and applications. This mismatch results in feelings of failure and low self-efficacy. To motivate conversational programmers, we propose purpose-first programming, a new approach that focuses on learning a handful of domain-specific code patterns and assembling them to create authentic and useful programs. We report on the development of a purpose-first programming prototype that teaches five patterns in the domain of web scraping. We show that learning with purpose-first programming is motivating for conversational programmers because it engenders a feeling of success and aligns with these learners' goals. Purpose-first programming learning enabled novice conversational programmers to complete scaffolded code writing, debugging, and explaining activities after only 30 minutes of instruction.

Paper: "Beyond Show of Hands: Engaging Viewers via Expressive and Scalable Visual Communication in Live Streaming"
John Joon Young Chung, Hijung Valentina Shin, Haijun Xia, Li-yi Wei, Rubaiat Habib Kazi
Live streaming is gaining popularity across diverse application domains in recent years. A core part of the experience is streamer-viewer interaction, which has been mainly text-based. Recent systems explored extending viewer interaction to include visual elements with richer expression and increased engagement. However, understanding expressive visual inputs becomes challenging with many viewers, primarily due to the relative lack of structure in visual input. On the other hand, adding rigid structures can limit viewer interactions to narrow use cases or decrease the expressiveness of viewer inputs. To facilitate the sensemaking of many visual inputs while retaining the expressiveness or versatility of viewer interactions, we introduce a visual input management framework (VIMF) and a system, VisPoll, that help streamers specify, aggregate, and visualize many visual inputs. A pilot evaluation indicated that VisPoll can expand the types of viewer interactions. Our framework provides insights for designing scalable and expressive visual communication for live streaming.

Paper: "CoCapture: Effectively Communicating UI Behaviors on Existing Websites by Demonstrating and Remixing"
Yan Chen, Sang Won Lee, **Steve Oney**
UI mockups are commonly used as shared context during interface development collaboration. In practice, UI designers often use screenshots and sketches to create mockups of desired UI behaviors for communication. However, in the later stages of UI development, interfaces can be arbitrarily complex, making it labor-intensive to sketch, and static screenshots are limited in the types of interactive and dynamic behaviors they can express. We introduce CoCapture, a system that allows designers to easily create UI behavior mockups on existing web interfaces by demonstrating and remixing, and to accurately describe their requests to helpers by referencing the resulting mockups using hypertext. We showed that participants could more accurately describe UI behaviors with CoCapture than with existing sketch and communication tools and

that the resulting descriptions were clear and easy to follow. Our approach can help teams develop UIs efficiently by bridging communication gaps with more accurate visual context.

Paper: "Crowdsourcing More Effective Initializations for Single-Target Trackers Through Automatic Re-querying"
Stephan J. Lemmer, Jean Y. Song, Jason J. Corso
In single-target video object tracking, an initial bounding box is drawn around a target object and propagated through a video. When this bounding box is provided by a careful human expert, it is expected to yield strong overall tracking performance that can be mimicked at scale by novice crowd workers with the help of advanced quality control methods. However, we show through an investigation of 900 crowdsourced initializations that such quality control strategies are inadequate for this task in two major ways: first, the high level of redundancy in these methods (e.g., averaging multiple responses to reduce error) is unnecessary, as 23\% of crowdsourced initializations perform just as well as the gold-standard initialization. Second, even nearly perfect initializations can lead to degraded long-term performance due to the complexity of object tracking. Considering these findings, we evaluate novel approaches for automatically selecting bounding boxes to re-query, and introduce \textit{Smart Replacement}, an efficient method that decides whether to use the crowdsourced replacement initialization.

Paper: "Datamations: Animated Explanations of Data Analysis Pipelines"
Xiaoying Pu, Sean Kross, Jake M. Hoffman, Daniel G. Goldstein
Plots and tables are commonplace in today's data-driven world, and much research has been done on how to make these figures easy to read and understand. Oftentimes, however, the information they contain conveys only the end result of a complex and subtle data analysis pipeline. This can leave the reader struggling to understand what steps were taken to arrive at a figure, and what implications this has for the underlying results. In this paper, we introduce datamations, which are animations designed to explain the steps that led to a given plot or table. We present the motivation and concept behind datamations, discuss how to programmatically generate them, and provide the results of two large-scale randomized experiments investigating how datamations affect people's abilities to understand potentially puzzling results compared to seeing only final plots and tables containing those results.

Paper: "Detecting Data Falsification by Front-line Development Workers: A Case Study of Vaccination in Pakistan"
Amna Batool, **Kentaro Toyama**, **Tiffany Veinot**, Beenish Fatima, Mustafa Naseem
Front-line workers in global development are often responsible for data collection and record-keeping about their own work. The authenticity of such data and the role of mid-level supervisors, however, remains understudied. We report on the case of immunization in Pakistan, where, through interviews with 30 mid-level vaccination managers in Punjab district, we find that data falsification by vaccinators is common, though not necessarily rampant. Because of an intricate protocol for record-keeping, supervisors can detect data falsification, and we find they have devised an array of methods, broadly classifiable into four types: triangulation, supplementary data collection, anomaly detection, and interrogation. We also find that the strategies that supervisors use to detect falsification seem linked to their style of

management, with authoritarian supervisors preferring supplementary data collection and spot checks, while supportive supervisors use triangulation. Our findings lead to recommendations for designing technologies intended to monitor and manage front-line data.

Paper: "'Disadvantaged in the American-dominated internet': Sex, Work, and Technology"
Catherine Barwulor, *Allison McDonald*, Eszter Hargittai, Elissa M. Redmiles
How do people in a precarious profession leverage technology to grow their business and improve their quality of life? Sex workers sit at the intersection of multiple marginalized identities and make up a sizeable workforce: the United Nations estimates that at least 42 million sex workers are conducting business across the globe. Yet, little research has examined how well technology fulfills sex workers' business needs in the face of unique social, political, legal, and safety constraints. We present interviews with 29 sex workers in Germany and Switzerland where such work is legal, offering a first HCI perspective on this population's use of technology. While our participants demonstrate savvy navigation of online spaces, sex workers encounter frustrating barriers due to an American-dominated internet that enforces puritan values globally. Our findings raise concerns about digital discrimination against sex workers and suggest concrete directions for the design of more inclusive technology.

Paper: "Eliciting Tech Futures Among Black Young Adults: A Case Study of Remote Speculative Co-Design"
Christina Harrington, **Tawanna R. Dillahunt**
The question of who gets to contribute to design futures and technology innovation has become a topic of conversation across HCI, CSCW, and other computing communities. This conversation has grave implications for communities that often find themselves an afterthought in technology design, and who coincidentally could benefit most from technological interventions in response to societal oppression. To explore this topic, we examined `futuring' through co-designed speculative design fictions as methods to envision utopian and dystopian futures. In a case study, we examined technology's role in the imagined futures of youth participants of a Chicago summer design program. We highlight emerging themes and contribute an analysis of remote co-design through an Afrofuturism lens. Our analysis shows that concepts of utopian futures and technologies to support those futures are still heavily laden with dystopian realities of racism and poverty. We discuss ways that speculative design fictions and futuring may serve to address inclusivity in concept generation for new technologies and provide recommendations for conducting design techniques remotely with historically excluded populations.

Paper: "Examining Mobility Among People Living with HIV in Rural Areas"
Juan F. Maestre, **Tawanna R. Dillahunt**, Alec Andrew Theisz, Megan Furness, **Vaishnav Kameswaran**, **Tiffany Veinot**, Patrick C. Shih
The rise of ridesharing platforms has transformed traditional transportation, making it more accessible for getting to work and accessing grocery stores and healthcare providers, which are essential to physical and mental well-being. However, such technologies are not available everywhere. Additionally, there is a scarcity of HCI work that investigates how vulnerable populations such as rural-dwelling people with HIV face and overcome transportation barriers.

To extend past research, we conducted 31 surveys and 18 interviews with people living with HIV (22 surveys, 14 interviews) and their case coordinators (9 surveys, 4 interviews) in rural areas. Contrary to past research, we found that the use of alternative vehicles, extensive support networks, and nonprofit health organizations facilitated transportation. However, distance, the lack of trust and infrastructure, stigma, and other cultural underpinnings made popular forms of urban transportation unappealing. We contextualize our findings with prior research and contribute implications for future research and design.

Paper: "Examining the Use of Online Platforms for Employment: A Survey of U.S. Job Seekers"
Tawanna R. Dillahunt, **Aarti Israni**, **Alex Jiahong Lu**, *Mingzhi Cai*, **Joey Chiao-Yin Hsiao**
Online employment resources are now as important as offline personal and professional networks, which have been pivotal in finding employment. However, it is unclear, which specific online resources are key to employment and how job seekers take advantage of them. Therefore, in an online survey of 768 job seekers, we investigated which online platforms, specific job search phases, behaviors, and job search strategies job seekers used in their job search, and which of these were associated with positive outcomes. We examined whether these results correlated with demographic factors and found differences in online platform use among income, gender, years of education, and race. Our results suggest that higher-income job seekers were more likely to use different strategies and more likely to get callbacks than lower-income job seekers. We raise new questions around demographics and technology and discuss the need for practitioners to design for a wider variety of job seekers.

Paper: "Identifying Manipulative Advertising Techniques in XR Through Scenario Construction"
Abraham Hani Mhaidli, **Florian Schaub**
As Extended Reality (XR) devices and applications become more mainstream, so too will XR advertising — advertising that takes place in XR mediums. Due to the defining features of XR devices, such as the immersivity of the medium and the ability of XR devices to simulate reality, there are fears that these features could be exploited to create manipulative XR ads that trick consumers into buying products they do not need or might harm them. Using scenario construction, we investigate potential future incarnations of manipulative XR advertising and their harms. We identify five key mechanisms of manipulative XR advertising: misleading experience marketing; inducing artificial emotions in consumers; sensing and targeting people when they are vulnerable; emotional manipulation through hyperpersonalization; and distortion of reality. We discuss research challenges and questions in order to address and mitigate manipulative XR advertising risks.

Paper: "Interpretable Program Synthesis"
Tianyi Zhang, *Zhiyang Chen*, *Yuanli Zhu*, Priyan Vaithilingam, *Xinyu Wang*, Elena L. Glassman
Program synthesis, which generates programs based on user-provided specifications, can be obscure and brittle: users have few ways to understand and recover from synthesis failures. We propose interpretable program synthesis, a novel approach that unveils the synthesis process and enables users to monitor and guide the synthesis. We designed three representations that

explain the underlying synthesis process with different levels of fidelity. We implemented an interpretable synthesizer and conducted a within-subjects study with eighteen participants on three challenging regular expression programming tasks. With interpretable synthesis, participants were able to reason about synthesis failures and strategically provide feedback, achieving a significantly higher success rate compared with a state-of-the-art synthesizer. In particular, participants with a high engagement tendency (as measured by NCS-6) preferred a deductive representation that shows the synthesis process in a search tree, while participants with a relatively low engagement tendency preferred an inductive representation that renders representative samples of programs enumerated during synthesis.

Paper: "Learning from Healthcare Providers' Strategies: Designing Technology to Support Effective Child Patient-Provider Communication"
Woosuk Seo, Ayse G. Buyuktur, **Sanya Verma**, Hyeryoung Kim, *Sung Won Choi*, *Laura Sedig*, Sun Young Park
Effective patient-provider communication is critical to promote patient satisfaction, encourage patient involvement in care, and improve health outcomes. Although prior HCI works aim to enhance dyadic communication by improving patients' communication skills, little is known about healthcare providers' communication work to facilitate effective communication with their child patients. Through semi-structured interviews with 10 healthcare providers and clinic observations, our study identified four strategies that providers used in their communication with patients: building rapport, developing familiarity with care settings, respecting patients' communication modes and preferences, and delegating small decision-making and directing questions to patients. Based on these strategies, we discuss three key elements that providers value and work toward to achieve effective communication in pediatric care practice. Our study also uncovers the detailed process of how the providers develop their strategies to tailor their communication to the patients' specific needs and preferences, and we describe design opportunities for communication technology.

Paper: "LightWrite: Teach Handwriting to the Visually Impaired with a Smartphone"
Zihan Wu, Chun Yu, Xuhai Xu, Tong Wei, Tianyuan Zou, Ruolin Wang, Yuanchun Shi
Learning to write is challenging for blind and low vision (BLV) people because of the lack of visual feedback. Regardless of the drastic advancement of digital technology, handwriting is still an essential part of daily life. Although tools designed for teaching BLV to write exist, many are expensive and require the help of sighted teachers. We propose LightWrite, a low-cost, easy-to-access smartphone application that uses voice-based descriptive instruction and feedback to teach BLV users to write English lowercase letters and Arabian digits in a specifically designed font. A two-stage study with 15 BLV users with little prior writing knowledge shows that LightWrite can successfully teach users to learn handwriting characters in an average of 1.09 minutes for each letter. After initial training and 20-minute daily practice for 5 days, participants were able to write an average of 19.9 out of 26 letters that are recognizable by sighted raters.

Paper: "A Meta-Analysis of Human Personality and Robot Acceptance in Human-Robot Interaction"

Connor Esterwood, **Kyle Essenmacher**, **Han Yang**, **Fanpan Zeng**, **Lionel Peter Robert**
Human personality has been identified as a predictor of robot acceptance in the human–robot interaction (HRI) literature. Despite this,the HRI literature has provided mixed support for this assertion. To better understand the relationship between human personality and robot acceptance, this paper conducts a meta-analysis of 26 studies. Results found a positive relationship between human personality and robot acceptance. However, this relationship varied greatly by the specific personality trait along with the study sample's age, gender diversity, task, and global region. This meta-analysis also identified gaps in the literature. Namely, additional studies are needed that investigate both the big five personality traits and other personality traits, examine a more diverse age range, and utilize samples from previously unexamined regions of the globe.

Paper: "Method for Exploring Generative Adversarial Networks (GANs) via Automatically Generated Image Galleries"
Enhao Zhang, *Nikola Banovic*
Generative Adversarial Networks (GANs) can automatically generate quality images from learned model parameters. However, it remains challenging to explore and objectively assess the quality of all possible images generated using a GAN. Currently, model creators evaluate their GANs via tedious visual examination of generated images sampled from narrow prior probability distributions on model parameters. Here, we introduce an interactive method to explore and sample quality images from GANs. Our first two user studies showed that participants can use the tool to explore a GAN and select quality images. Our third user study showed that images sampled from a posterior probability distribution using a Markov Chain Monte Carlo (MCMC) method on parameters of images collected in our first study resulted in on average higher quality and more diverse images than existing baselines. Our work enables principled qualitative GAN exploration and evaluation.

Paper: "Online Transgender Health Information Seeking: Facilitators, Barriers, and Future Directions"
Taika Augustaitis, *Leland A. Merrill*, *Kristi E. Gamarel*, **Oliver L. Haimson**
Transgender people face difficulties accessing healthcare from providers, and thus often turn to online sources to seek health information. However, online platforms may not properly support trans health information seeking, and health information found online may be limited in accuracy. To examine how online platforms can best support trans health information seeking, we conducted online focus groups with trans people (n = 26) about their experiences with online health information and their needs and desires for online health information seeking platforms. We found that trans people face both facilitators and barriers to finding accurate, actionable information online. Facilitators include online community discovery, group privacy features, and the dual synchronous and asynchronous nature of online content. Barriers include platform censorship, misinformation, hate speech, and lack of tools to flag inaccurate content. We provide recommendations for how platforms can support trans health information seeking by ensuring that medical information is accurate, accessible, easy to locate, and relevant to a diverse set of trans identities and experiences.

Paper: "Personalizing Ambience and Illusionary Presence: How People Use 'Study with Me' Videos to Create Effective Studying Environments"

Yoonjoo Lee, *John Joon Young Chung*, Jean Y. Song, Minsuk Chang, Juho Kim

"Study with me" videos contain footages of people studying for hours, in which social components like conversations or informational content like instructions are absent. Recently, they became increasingly popular on video-sharing platforms. This paper provides the first broad look into what "study with me" videos are and how people use them. We analyzed 30 "study with me" videos and conducted 12 interviews with their viewers to understand their motivation and viewing practices. We identified a three-factor model that explains the mechanism for shaping a satisfactory studying experience in general. One of the factors, a well-suited ambience, was difficult to create because of two common challenges: external conditions that prevent studying in study-friendly places and extra cost needed to create a personally desired ambience. We found that the viewers used "study with me" videos to create a personalized ambience at a lower cost, to find controllable peer pressure, and to get emotional support. These findings suggest that the viewers self-regulate their learning through watching "study with me" videos to improve efficiency even when studying alone at home.

Paper: "Problem-Solving Efficiency and Cognitive Load for Adaptive Parsons Problems vs. Writing the Equivalent Code"

Carl C. Haynes, **Barbara J. Ericson**

Novice programmers need differentiated assessments (such as adaptive Parsons problems) to maximize their ability to learn how to program. Parsons problems require learners to place mixed-up code blocks in the correct order to solve a problem. We conducted a within-subjects experiment to compare the efficiency and cognitive load of solving adaptive Parsons problems versus writing the equivalent (isomorphic) code. Undergraduates were usually more significantly efficient at solving a Parsons problem than writing the equivalent code, but not when the solution to the Parsons problem was unusual. This has implications for problem creators. This paper also reports on the mean cognitive load ratings of the two problem types and the relationship between efficiency and cognitive load ratings. Lastly, it reports on think-aloud observations of 11 students solving both adaptive Parsons problems and write-code problems and the results from an end-of-course student survey.

Paper: "Religion and Women's Intimate Health: Towards an Inclusive Approach to Healthcare"

Maryam Mustafa, Kimia Tuz Zaman, Tallal Ahmad, **Amna Batool**, Masitah Ghazali, Nova Ahmed

We present findings from a three country study exploring the intersection between female intimate health and religious beliefs. Through a qualitative study with Muslim female populations in Pakistan, Bangladesh and Malaysia, three different Muslim majority contexts, we examine the deep impact Islamic beliefs have on female intimate health and well-being. Our study investigates the perceptions, attitudes and behaviours of Muslim women to their own intimate and sexual bodies through their experiences of menarche, marriage and reproduction and menopause. The intersection of religion and female sexual bodies and health is a neglected area within HCI and we highlight how inextricably specific Islamic values are linked with

women's reproductive health in Muslim communities. We further discuss the opportunities and challenges of designing technologies for religious, non-secular beliefs and values with the aim to improve intimate health practices amongst Muslim women and to broaden the scope of health design within HCI.

Paper: "Seeing Beyond Expert Blind Spots: Online Learning Design for Scale and Quality"
Xu Wang, Carolyn Rosé, Kenneth R Koedinger
Maximizing system scalability and quality are sometimes at odds. This work provides an example showing scalability and quality can be achieved at the same time in instructional design, contrary to what instructors may believe or expect. We situate our study in the education of HCI methods, and provide suggestions to improve active learning within the HCI education community. While designing learning and assessment activities, many instructors face the choice of using open-ended or close-ended activities. Close-ended activities such as multiple-choice questions (MCQs) enable automated feedback to students. However, a survey with 22 HCI professors revealed a belief that MCQs are less valuable than open-ended questions, and thus, using them entails making a quality sacrifice in order to achieve scalability. A study with 178 students produced no evidence to support the teacher belief. This paper indicates more promise than concern in using MCQs for scalable instruction and assessment in at least some HCI domains.

Paper: "Standardizing Participant Compensation Reporting in HCI: A Meta-Review and Recommendations for the Field"
Jessica Peter, Amanda Coupe, Rachel Pfafman, **Chanda Phelan**, Tammy Toscos, Maia Jacobs
The user study is a fundamental method used in HCI. In designing user studies, we often use compensation strategies to incentivize recruitment. However, compensation can also lead to ethical issues, such as coercion. The CHI community has yet to establish best practices for participant compensation. Through a systematic review of manuscripts at CHI and other associated publication venues, we found high levels of variation in the compensation strategies used within the community and how we report on this aspect of the study methods. A qualitative analysis of justifications offered for compensation sheds light into how some researchers are currently contextualizing this practice. This paper provides a description of current compensation strategies and information that can inform the design of compensation strategies in future studies. The findings may be helpful to generate productive discourse in the HCI community towards the development of best practices for participant compensation in user studies.

Paper: "Techniques of Use: Confronting Value Systems of Productivity, Progress, and Usefulness in Computing and Design"
Cindy Kaiying Lin, **Silvia Lindtner**
This paper turns to one of HCI's central value systems, i.e. its commitments to usefulness and the ideal that technology enables social progress, productivity, and excellence. Specifically, we examine how the seemingly "positive" ideal to make technology "useful" – i.e. to build systems and devices that advance social and technological progress – masks various forms of violence

and injustice such as colonial othering, racist exclusions, and exploitation. Drawing from ethnographic research, we show how design and computing methods from design thinking to agile theory and entrepreneurial approaches in tech production and higher education are the latest techniques in the cultivation of useful bodies on behalf of the state, the corporation, the university, and the economy. Aligning with feminist, critical race, and critical computing commitments, this paper offers a genealogical approach to show how injustice and violence endure, despite and because of a narrative of progress and positive change.

Paper: "'They See You're a Girl if You Pick a Pink Robot with a Skirt': A Qualitative Study of How Children Conceptualize Data Processing and Digital Privacy Risks"
Kaiwen Sun, **Carlo Sugatan**, **Tanisha Afnan**, *Hayley Simon*, *Susan Gelman*, *Jenny Radesky*, **Florian Schaub**
As children become frequent digital technology users, concerns about their digital privacy are increasing. To better understand how young children conceptualize data processing and digital privacy risks, we interviewed 26 children, 4 to 10 years old, from families with higher educational attainment recruited in a college town. Our child participants construed apps' and services' data collection and storage practices in terms of their benefits, both to themselves and for user safety, and characterized both data tracking and privacy violations as interpersonal rather than considering automated processes or companies as privacy threats. We identify four factors shaping these mental models and privacy risk perceptions: (1) surface-level visual cues, (2) past digital interactions involving data collection, (3) age and cognitive development, and (4) privacy-related experiences in non-digital contexts. We discuss our findings' design, educational, and public policy implications toward better supporting children in identifying and reasoning about digital privacy risks.

Paper: "Think-Aloud Computing: Supporting Rich and Low-Effort Knowledge Capture"
Rebecca Krosnick, Fraser Anderson, Justin Matejka, **Steve Oney**, Walter S. Lasecki, Tovi Grossman, George Fitzmaurice
When users complete tasks on the computer, the knowledge they leverage and their intent is often lost because it is tedious or challenging to capture. This makes it harder to understand why a colleague designed a component a certain way or to remember requirements for software you wrote a year ago. We introduce think-aloud computing, a novel application of the think-aloud protocol where computer users are encouraged to speak while working to capture rich knowledge with relatively low effort. Through a formative study we find people shared information about design intent, work processes, problems encountered, to-do items, and other useful information. We developed a prototype that supports think-aloud computing by prompting users to speak and contextualizing speech with labels and application context. Our evaluation shows more subtle design decisions and process explanations were captured in think-aloud than via traditional documentation. Participants reported that think-aloud required similar effort as traditional documentation.

Paper: "Toggles, Dollar Signs, and Triangles: How to (In)Effectively Convey Privacy Choices"

Hana Habib, **Yixin Zou**, Yaxing Yao, Alessandro Acquisti, Lorrie Cranor, Joel Reidenberg, Norman Sadeh, **Florian Schaub**
Increasingly, icons are being proposed to concisely convey privacy-related information and choices to users. However, complex privacy concepts can be difficult to communicate. We investigate which icons effectively signal the presence of privacy choices. In a series of user studies, we designed and evaluated icons and accompanying textual descriptions (link texts) conveying choice, opting-out, and sale of personal information --- the latter an opt-out mandated by the California Consumer Privacy Act (CCPA). We identified icon-link text pairings that conveyed the presence of privacy choices without creating misconceptions, with a blue stylized toggle icon paired with "Privacy Options" performing best. The two CCPA-mandated link texts ("Do Not Sell My Personal Information" and "Do Not Sell My Info") accurately communicated the presence of do-not-sell opt-outs with most icons. Our results provide insights for the design of privacy choice indicators and highlight the necessity of incorporating user testing into policy making.

Paper: "Uncovering the Promises and Challenges of Social Media Use in the Low-Wage Labor Market: Insights from Employers"
Alex Jiahong Lu, **Tawanna R. Dillahunt**
Social media has become an effective recruitment tool for higher-waged and white-collar professionals. Yet, past studies have questioned its effectiveness for the recruitment of lower-waged workers. It is also unclear whether or how employers leverage social media in their recruitment of low-wage job seekers, and how social media could better support the needs of both stakeholders. Therefore, we conducted 15 semi-structured interviews with employers of low-wage workers in the U.S. We found that employers: use social media, primarily Facebook, to access large pools of active low-wage job seekers; and recognize indirect signals about low-wage job seekers' commitment and job readiness. Our work suggests that there remains a visible, yet unaddressed power imbalance between low-wage workers and employers in the use of social media, which risks further destabilizing the precarious labor market.

Paper: "XRStudio: A Virtual Production and Live Streaming System for Immersive Instructional Experiences"
Michael Nebeling, **Shwetha Rajaram**, **Liwei Wu**, Yifei Cheng, *Jaylin Herskovitz*
There is increased interest in using virtual reality in education, but it often remains an isolated experience that is difficult to integrate into current instructional experiences. In this work, we adapt virtual production techniques from filmmaking to enable mixed reality capture of instructors so that they appear to be standing directly in the virtual scene. We also capitalize on the growing popularity of live streaming software for video conferencing and live production. With XRStudio, we develop a pipeline for giving lectures in VR, enabling live compositing using a variety of presets and real-time output to traditional video and more immersive formats. We present interviews with media designers experienced in film and MOOC production that informed our design. Through walkthrough demonstrations of XRStudio with instructors experienced with VR, we learn how it could be used in a variety of domains. In end-to-end evaluations with students, we analyze and compare differences of traditional video vs. more immersive lectures with XRStudio.

Late-Breaking Work

Late-Breaking Work: "More than Shared Ethnicity: Shared Identity's Role in Transnational Newcomers' Trust in Local Consumer-to-Consumer E-commerce"
Joey Chiao-Yin Hsiao, Tawanna R. Dillahunt
Transnational newcomers, i.e., foreign-born populations who move to a new country, rely on consumer-to-consumer electronic commerce (C2C e-commerce) to access local resources for adaptation. However, with low trust among transnational newcomers who enter a new country, they often face difficulties in the adaptation process, and little is known about which determinants affect their trust in C2C e-commerce. Because social identity is often complicated in transnational newcomers' adaptation process, our work focuses on unpacking shared identity, a key trust antecedent in C2C e-commerce. We interviewed 12 transnational newcomers in the United States to identify the determinants of their shared identity in C2C e-commerce. Our preliminary results suggest that shared identity determinants include geographic proximity, life stage, ethnic background, and socio-economic status. We also uncovered ways that shared identity determinants influence transnational newcomers' trust in local C2C e-commerce. Our work contributes two research implications to future studies on transnational newcomers' technology use.

Late-Breaking Work: "Negotiating Intersectional Non-Normative Queer Identities in India"
Aparna Moitra, **Megh Marathe**, Syed Ishtiaque Ahmed, Priyank Chandra
Academic work dealing with queerness in HCI is predominantly based in the Global North and has often dealt with one identity dimension at a time. This work-in-progress study attempts to complicate the notion of queerness in HCI by highlighting how in the multi-religious, multi-ethnic, and multi-cultural context of India, LGBTQ+ movements and spaces are deeply fractured on the basis of various identity intersections. We interview 18 LGBTQ+ activists, lawyers, and allied activists in the Delhi, India to understand the issues faced by queer Indians from minority groups and their use of social media and discuss how they negotiate their non-normative identities to create safe spaces, gain access to resources, and engage in care work. The argument that we are bringing into HCI scholarship through this paper is geared toward a future endeavor for designing safe space for marginalized groups in the global south keeping in mind negotiations of power, legitimacy, and resources.

Late-Breaking Work: "Theory is in the Eye of the Beholder: Exploring Difficulties with Validating Intervention Mechanisms"
Sonali R. Mishra, Shefali Haldar, Ari Pollack, **Predrag Klasnja**, Wanda Pratt
Behavior change researchers frequently base their interventions on theory, targeting specific mechanisms of change to help users achieve their goals. Thus HCI researchers have sought to examine whether their intervention impacts the intended mechanism of change, in addition to evaluating the overall effect of the intervention. Yet an open question remains: how do we know our interventions successfully target the mechanisms we intend? We present results from two validation studies and one user study showing the difficulties of ensuring that behavior change

interventions target the mechanisms designers intend. Our findings indicate that experts disagree about what mechanism an intervention targets, that expert consensus on this matter can be hard to achieve, and that end users' reflections indicate they may follow different mechanisms than those predicted by experts. We recommend that researchers collect data about multiple potential mechanisms that their intervention could operate through, rather than the common single-mechanism approach.

Late-Breaking Work: "What Makes a Well Documented Notebook? A Case Study of Data Scientists' Documentation Practices in Kaggle Notebooks"
April Yi Wang, Dakuo Wang, Jaimie Drozdal, Xuye Liu, Soya Park, **Steve Oney**, **Christopher Brooks**
Many data scientists use computational notebooks to test and present their work, as a notebook can weave code and documentation together (computational narrative), and support rapid iteration on code experiments. However, it is not easy to write good documentation in a data science notebook, partially because there is a lack of a corpus of well-documented notebooks as exemplars for data scientists to follow. To cope with this challenge, this work looks at Kaggle — a large online community for data scientists to host and participate in machine learning competitions -- and considers highly-voted Kaggle notebooks as a proxy for well-documented notebooks. Through a qualitative analysis at both the notebook level and the markdown-cell level, we find these notebooks are indeed well documented in reference to previous literature. Our analysis also reveals nine categories of content that data scientists write in their documentation cells, and these documentation cells often interplay with different stages of the data science lifecycle. We conclude the paper with design implications and future research directions.

Workshops

Workshop: "Consequences, Schmonsequences! Considering the Future as Part of Publication and Peer Review in Computing Research"
Miriam Sturdee, Joseph Lindley, Conor Linehan, Chris Elsden, Neha Kumar, **Tawanna R. Dillahunt**, Regan L. Mandryk, John Vines
Research in computing is becoming increasingly concerned with understanding and mitigating unintended consequences of technology developments. However, those concerns are rarely reflected in how we submit, review, and publish our own work. Specifically, in talking about how our new apps, devices, algorithms will change the world, we focus almost exclusively on positive consequences. There have been calls (including from an ACM working group) to require some speculation about negative impacts as part of the peer review process. This workshop will explore how to think about and report potential negative consequences in our papers in a way that's practical, inclusive, and achievable. The aim is to draw on scholarship around creative-yet-grounded speculation about technology futures and to consider how these might be applied to publication and peer review. The workshop aims to inspire the CHI conference and the computing research community to meaningfully consider and act upon the potential negative implications of their work.

Workshop: "'This Seems to Work': Designing Technological Systems with The Algorithmic Imaginations of Those Who Labor"
Lindsey Cameron, Angele Christin, Michael Ann DeVito, **Tawanna R. Dillahunt**, Madeleine Elish, Mary Gray, Rida Qadri, Noopur Raval, Melissa Valentine, Elizabeth Anne Watkins
Algorithmically mediated systems and tools are used by workers across the globe. Many of these workers are in low-power positions, where they have little leverage to make demands around transparency, explanation, or terms of use, yet, at the same time rely deeply on these systems for many aspects of their jobs. This tension between little power and high reliance drives the production of intensive algorithmic imaginaries, where workers engage in meaning-making to construct understandings of these systems. Yet, there has been little attention paid to the diversity and ingenuity of algorithmic understandings crafted by the workers. In this workshop, our goal is to bring together researchers and practitioners from across disciplines to create a research agenda, compare vocabularies, and discuss methodologies around this form of "folk tradecraft." This toolkit will help elicit insights into these phenomena and ultimately build mechanisms by which the labor of algorithmic meaning-making can be respected, understood, and leveraged for system design.

Workshop: "Trustworthy Conversational Agent Design for African Americans with Chronic Conditions during COVID-19"
Junhan Kim, Jana Muhic, Sun Young Park, Lionel Robert
This paper discusses preliminary findings on how to design chatbots that can increase African Americans' trust in health information, particularly those who have experienced chronic conditions during the COVID-19 pandemic. COVID-19 has disproportionately affected the African American community in terms of severity and mortality, and scholars point towards the long-held medical mistrust among this population as a possible reason. Recent studies on the impact of conversational agents (CAs) on increasing trust in health information suggest that CAs can be effective. Through interviews and design studies with ten participants, we present four findings on how to design trustworthy CAs for our target population.

Courses

Course: "Rapid Prototyping of XR Experiences"
Mark Billinghurst, **Michael Nebeling**
This course introduces participants to rapid prototyping for augmented and virtual reality. Participants will learn about physical prototyping with paper and Play-Doh and digital prototyping via visual authoring tools. After an overview of the XR prototyping process and tools, participants will complete two hands-on sessions. A combination of paper-based XR design templates and easy-to-use digital authoring tools will be used to create working interactive prototypes that can be run on XR devices. The course is targeted at non-technical audiences including HCI practitioners, user experience researchers, and interaction design professionals and students interested in XR design.

Special Interest Groups

SIG: Special Interest Group on Visualization Grammars
Xiaoying Pu, Matthew Kay, Steven M. Drucker, Jeffrey Heer, Dominik Moritz, Arvind Satyanarayan
Visualization grammars, often based on the Grammar of Graphics, are popular choices for specifying expressive visualizations and supporting visualization systems. However, there are still open questions about grammar design and evaluation not well-answered in visualization research. In this SIG, we propose to discuss what makes a grammar "good" and explore evaluation methodologies best suited for visualization grammars.

Student Research Competition

SRC: “Directly Controlling the Perceived Difficulty of a Shooting Game by the Addition of Fake Enemy Bullets”
Jiale Zhang
Adjusting the balance between the player’s game skill and the difficulty level is one of the most important factors to improve the player's engagement. However, it is still quite rare to find works that aim to straightly control the subjective difficulty perceived by the player. Our research question is whether or not it is possible to control the perceived difficulty just by adding enemy objects that do not raise the actual difficulty level. To investigate this issue, we designed a simple shooting game with two ‘fake enemy bullets’: Unreachable Bullets and Non-collisionable Bullets, which do not damage the player character. The experiment suggests that the non-collisionable bullet can efficiently increase the perceived difficulty level but the unreachable bullet does not. Such a study in novel techniques that can control the perceived difficulty without changing the actual difficulty could contribute to both research and practices in game design.