Research Activities

The overarching vision of my research is to understand how technologies can shape and improve human self-awareness and interpersonal understanding in the context of human-computer interaction (HCI), thereby advancing our knowledge of *computer-mediated empathy*. During my graduate studies, my primary research area was computer music. Since starting my faculty position, I have transitioned to core HCI communities, aiming to transfer the empathic and expressive qualities inherent in music-making to general HCI.

Through my research at Virginia Tech, I have been developing multifaceted approaches to understanding computer-mediated empathy at various levels: the intrapersonal level (e.g., mitigating bias, self-reflection, computers as an expressive medium), the interpersonal level (e.g., perspective-taking, understanding online communication), and the group level (e.g., fostering a social and inclusive space). My research typically has one of the following contributions: (1) empirical understanding of how people behave and communicate in online spaces gained from various user studies (e.g., experiments, surveys, interviews, content analysis) and (2) evaluation of a design idea through the design, development, and validation of interactive systems.

I have published 32 refereed journal and conference papers since I started my professorship in Fall 2018. I primarily publish at the ACM CSCW (8) and CHI (7) conferences. I have also regularly published at IEEE VL/HCC (4) and ACM Creativity and Cognition (C&C) (3). I often present my research to HCI journals (e.g., IJHCS, TVCG) and other relevant HCI conferences, such as UIST, HFES, SUI, and CHIWORK. These conferences typically have acceptance rates below 30%. Below, I present my core research threads.

Facilitating Perspective-Taking and Mitigating Bias One of the fundamental steps toward realizing empathy is perspective-taking. I have studied how to design tools that facilitate this process. One such tool is OtherTube, a system that enhances understanding by allowing YouTube viewers to experience videos recommended to strangers [C.32]. AI algorithms curate recommended videos, often trapping users in a filter bubble, which limits their worldview and hinders empathic communication. To address this issue, we created a browser plugin that captures a stranger's recommended videos and swaps them with the user's videos. The results indicate that experiencing others' algorithmically curated videos helps users reflect on their filter bubbles and reduces stereotypes about certain populations, with the additional benefit of novel content discovery. This paper received an Honorable Mention Award at CHI 2022.

I also studied how biased points of view manifest in online content. For example, we published a paper examining how Wikipedia articles in three languages—Hindi, Urdu, and English—portray a regional conflict between India and Pakistan with biased and adversarial views, challenging the common belief that Wikipedia articles maintain a neutral point of view [J.7]. The paper was recognized by the Wikipedia community and was invited to the Wikimedia Foundation research showcase. Based on this work, one M.S. student won the Outstanding Thesis Award at Virginia Tech, an honor given to two M.S. students in the entire university.

In addition, I have studied how online news viewers can consume news articles more conscientiously to mitigate bias. This includes engaging news readers in annotation microtasks for consuming news articles with opposing points of view [C.36], nudging news readers to

recognize source credibility [J.8], and developing design cues that can foster transparency in journalism [J.9].

Fostering Social and Inclusive Informal Learning through Handheld VR I led an NSF project (NSF RETTL) with a team of four other Co-PIs to enhance group-based STEM learning within co-located informal learning environments, such as science museums, using handheld-device-based virtual reality (VR) technology. Handheld VR devices allow us to maintain the social interactivity inherent in informal learning settings, addressing the isolation often experienced with traditional VR headsets. Additionally, the suggested platform offers greater inclusivity than VR headsets by mitigating issues like nausea, age restrictions (e.g., children under 13), and concerns regarding makeup and hairstyle maintenance.

Our recent publications contribute to understanding how interactive content can be designed for group-based handheld VR experiences. One study investigated the impact of group size (2, 4, and 8 participants) and interaction methods (proximity-based vs. pointing-based) on user experience in co-located games [J.13], expanding the design implications for group-based handheld-based VR systems. Another study evaluated different object manipulation methods within handheld VR environments, particularly examining how users interact with virtual objects in room-scale spaces [J.16]. Additionally, we explored a group-based VR platform in artistic contexts, aiming to foster social and inclusive experiences through interactive artworks in an art gallery [J.15]. As part of the funded project, we have developed a unique informal learning program and validated our platform in the field. We are preparing three more papers detailing field study results from multidisciplinary perspectives, including education technology, informal learning, and HCI.

Facilitating Self-reflection through Personal Informatics in Work Context As I have studied various tools supporting perspective-taking, I recognize that empathy and self-reflection are closely related and often occur simultaneously [C.32, C.33]. I have examined how we can facilitate reflection through personal informatics in the context of work. A recent CHI paper demonstrates how watching a time-lapse video of a knowledge worker's computer screen can facilitate positive self-reflection [C.39]. We found that the rich contextual information in a time-lapse video could effectively facilitate self-reflection and foster a positive framing of productivity; perceived productivity was significantly higher when participants reflected on watching time-lapse videos than using traditional self-tracking tools. Relatedly, I also examined the effectiveness of screenshots as a medium to support mental reconstruction, task resumption, and resource management across applications in other publications [C.27, C.34]. This series of studies on productivity tools demonstrates how having multimodal cues in personal informatics can effectively support workers in developing better meta-cognition, leading to positive changes in their behaviors and time management.

Understanding online communication Computer-mediated communication underpins computer-mediated empathy. My research contributes to understanding the nuances of online communication and collaboration, generating implications for social computing system design. In a recent CSCW paper, we analyzed how Reddit users solicit recommendations, particularly when existing recommender systems fall short [J.14]. We identified characteristics, such as requests for specific ethnicities or lesser-known artists, which could inform future intelligent recommender systems using natural language.

In another study, I examined how social media users' gender and race affect their choice of animated GIFs to express emotions [J.12]. We found that men and White participants selected more gender- and race-matching GIFs, respectively, raising questions about representation in GIF search engines and user preferences.

Additionally, I explored communication challenges in collaborative settings, such as music playlists [J.6], writing [C.37], and crowdsourcing [J.4].

Programming as an Expressive Medium Building on my research in computer music, I continued to conduct studies aimed at facilitating the use of programming as an expressive medium and lowering the barrier to programming education [C.28, C.38, C.42]. A recent study investigated how live coding musicians explore their musical ideas, highlighting the diverse version control requirements for composition, rehearsal, and live performance [C.41]. The paper won an Honorable Mention Award at ACM C&C 2024.

Future research: AI for Empowering Individuals Studying computer-mediated empathy, I recognize that empathy can be achieved not only by aiding individuals in empathizing with a target but also by empowering the target in various ways: helping them better understand/express themselves, promoting their well-being, and establishing an online environment where they feel safe. These approaches allow them to articulate their thoughts and emotions effectively, enabling others to empathize with them. My future research will leverage AI for empowerment, thus introducing an additional avenue for computer-mediated empathy. My new funding (Co-PI, NSF SaTC) in this space aims to utilize conversational agents to educate adolescents on recognizing and coping with cybergrooming. The project uses generative AI to empower adolescents, complementing the surveillance approach (e.g., ML risk detection) [P.42]. Another ongoing endeavor seeks to develop conversational agents using the large-language model to facilitate self-reflection through daily interactions, targeting workers' positive well-being and self-awareness [P.43].

Teaching

As an educator, I embrace the opportunity to nurture students' creativity and technical proficiency by fostering an active learning environment where they can thrive. Throughout my courses, I guide students in creating projects, often in teams, that they can take pride in. This philosophy is embedded in my teaching through project-based learning (PBL). I have taught several courses with open-ended team projects, including CS4644 Creative Computing Studio (undergraduate, 4 times), CS5734 Social Computing and CSCW (graduate, 3 times), and CS6724 Collaboration, Creativity, and Computing (graduate, twice). In these courses, while students choose topics of interest within the course theme, I provide a structured framework to help them self-direct their projects and participate actively in class.

Additionally, I have taught two foundational HCI courses: CS3744 Introduction to GUI and Graphics (undergraduate, twice) and CS5774 User Interface Software (graduate, once). I developed new course materials to teach students how to design and develop web-based interactive applications using modern frameworks like React. To give students an authentic front-end development experience without needing to learn back-end technologies, I provide a server built with Node.js, Express, and MongoDB, simulating collaboration with back-end developers or RESTful APIs. My teaching evaluations consistently exceed department and

college averages, with a few exceptions. Students often highlight my approachability and responsiveness to their needs.

Research Advising

I have graduated one Ph.D. student (co-advised), who is now an Assistant Professor in CS at the University of Minnesota Duluth. Currently, I am advising six CS Ph.D. students. I have advised the graduation of 11 M.S. students as a thesis chair and am presently advising four M.S. students. One of my M.S. students received the university-wide Outstanding Master's Thesis award, while another thesis work resulted in the Best Poster Award at ACM SUI. Additionally, I have offered research opportunities to all undergraduate students who approached me and showed interest. I have worked with 25 undergraduate students and accumulated 116 research credits in the last six years, advising them directly through individual meetings instead of asking Ph.D. students to advise them. Many of my students (10) pursued M.S. or Ph.D. degrees under my supervision at Virginia Tech or at other universities known for strong HCI programs (such as UW, UMD, Cornell Tech, and UofToronto). Furthermore, I have actively promoted diversity in my research group, working with 20 students from traditionally underrepresented groups in CS, including women (13), Hispanic individuals (3), African Americans (2), LGBTQ individuals (1), and people with disabilities (1).

Service and Outreach

Transitioning from computer music to HCI, I actively engaged with and contributed to the HCI community whenever asked by participating in various HCI conferences as a program committee member (9), including CHI, CSCW, and C&C, and as an organizing committee member (12). During the pandemic, I played a key role in helping the community transition to virtual conferences, serving as a technology chair for three conferences in 2021. Currently, I am serving as treasurer for UIST 2024 and C&C 2024.

I have actively participated in sharing my research findings in academia through external seminars (17) as well as engaging with the public through outreach events. As part of the NSF RETTL project, we collaborated with various local community organizations, including science museum summer camps, exhibitions, and STEM nights in public schools, organizing over 20 outreach events. Additionally, I have been selected to teach programming at TechGirls, a summer exchange program run by the US Department of State's Bureau of Educational and Cultural Affairs, which aims to empower young women (ages 15-17) from underdeveloped countries worldwide in their pursuit of higher education and careers in STEM fields.

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