39th ANNUAL
HCIL
SYMPOSIUM

Presentation Summaries
& Other Information
May 26th 2022

UNIVERSITY OF
MARYLAND

Human-Computer Interaction Lab (HCIL)
University of Maryland, College Park

The Human-Computer Interaction Lab (HCIL), launched in 1983 at the University of Maryland, has a rich history of transforming the experience people have with new technologies. From understanding user needs to developing and evaluating these technologies, the lab's faculty, staff, and students have been leading HCI research for nearly 40 years.

The HCIL was established as an interdisciplinary effort within the University of Maryland's Institute for Advanced Computer Studies (UMIACS). Today, HCIL participants include faculty, staff, and students from the following units on campus: Information Studies (iSchool), Computer Science, Psychology, Education, English, Engineering, Journalism, and American Studies. In addition, HCIL faculty are members in a number of centers and institutes on campus, including UMIACS, the Maryland Institute for Technology in the Humanities (MITH), the Applied Research Laboratory for Intelligence and Security (ARLIS), the Maryland Cybersecurity Center (MC2), the Social Data Science Center (SoDa), and the Dingman Center for Entrepreneurship.

This booklet contains Symposium presentation summaries and selected highlights of our faculty and students' news and accomplishments over the past year.

Please visit our website (https://hcil.umd.edu) for more information about the research happening in the HCIL.

If you would like more information, please contact:

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HCIL Director's Letter
HCIL's 39th Annual Symposium | May 2022

As I write this letter, I'm sitting in a nook at the New Orleans Convention Center, where I'm attending CHI, my first in-person conference in 2.5 years. The conference is just getting underway, but the energy in the air is palpable: we're expecting about 1800 people to show up in person, and about as many have signed up for virtual attendance. I'm also proud to note that at least 23 HCIL students and faculty are participating in CHI via papers, panels, and workshops, in person or virtually.

Importantly, for many student attendees, CHI 2022 may be their first in-person conference, and people are excited to interact with colleagues from around the globe without the barrier of a computer screen. It's been amazing to engage with folks like this again after several years. The technology that has made virtual conferences possible will never fully capture the energy and electricity in the air at in-person events. That said, CHI has worked hard over the last two years to make the conference experience as interactive and engaging as possible for virtual attendees—no easy feat.

Looking back at the director's letter Niklas wrote for last year's symposium, there is much to be grateful for. The vaccines that were rolling out a year ago have proven effective and, in the US, are widely available to people ages 5+. Even as we contend with new virus variations, the country is regaining some semblance of normality. Most classes at UMD were taught in person this past semester, and the transmission rate has been low on campus. We're not out of the woods yet, and we must continue to remain vigilant, but we can also celebrate the progress we've made.

In planning this year's symposium, we were faced with a similar dilemma: should we hold the symposium virtually, as we have the last two years, hold it fully in-person like in pre-pandemic years, or have a hybrid event, which is more challenging but also more accessible? In the end, we decided on a hybrid event, with the talks streamed to virtual attendees and a poster session/reception for those who can make it to campus. We hope this balanced approach provides a safe option while recognizing the importance of face-time and providing our many student researchers networking opportunities.

The last year has been challenging for many, but it has also been a time of productive research by our lab members, and we have much to celebrate! First, let me officially welcome the four faculty members who joined the lab this year – Jason Aston (iSchool), Cody Buntain (iSchool), Hal Daumé III (Computer Science), and SJ Terp (iSchool). We're excited to continue expanding the breadth and depth of HCI-related work our members contribute to, and you'll get a chance to learn more about their research during the symposium.

HCIL faculty and students have collected numerous awards and honors over the last year, and I'll highlight a few here (see the full list in the program). First, I congratulate Jonathan Lazar for his recent induction into the ACM SIGCHI Academy. Next, two HCIL faculty have been awarded prestigious funding from the National Science Foundation through CAREER awards: Amanda Lazar for her research on inclusive design for people with dementia and David Weintrop for his work

developing computer science curriculum that supports learners and develops positive attitudes toward computing. Finally, I want to note that Ben Shneiderman ("Human Centered AI") and Jonathan Lazar ("Accessible Technology and The Developing World") have each published books in recent months. These achievements are on top of significant publishing and paper awards from faculty and students across the lab.

Today's event highlights the tremendous diversity in research that the HCIL supports. I'm excited to welcome Dr. Lucy Dalglish, Dean of the Philip Merrill College of Journalism at UMD, who will help us open the symposium. HCI is a truly interdisciplinary field, and the increasing use of social and mobile media raises new questions that can be best addressed by scholars spanning social and computational sciences, as well as those in the arts and humanities, business, and journalism. For example, HCI researchers and journalists are working to find the best ways to design online social spaces to reduce harassment and misinformation. You'll learn more about the work the HCIL is doing in this space during our afternoon panel on information quality and online influence.
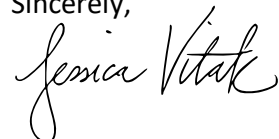
In addition to three plenary talks, we also have nearly 30 lightning talks from students and faculty this year on a wide range of topics. We've organized these talks into six clusters, covering child-centered design, technology & aging, privacy & security, creativity & AI, accessible & interactive design, and communication & collaboration. Attendees will have an opportunity to learn more about these projects through short talks (and the abstracts in this program); in-person attendees will get to chat further with HCIL members during the poster session and reception.

The work we do in the lab would not be possible without support, including from campus units, funding agencies, and our sponsors, so I want to offer my sincere gratitude to our industry sponsors (Adobe, TIBCO, and Rice Murtha Psoras) and our campus sponsors (College of Information Studies, Philip Merrill College of Journalism, College of Computer Science, Math, and Natural Sciences, Computer Science Department, and the Institute for Advanced Computer Studies). I also want to thank Sarah Grun, who has been a tremendous asset to me this semester as we planned the symposium.

As we spend time together today to share ongoing research from the lab, I hope you are as inspired as I am by the people who have made HCIL one of the preeminent HCI research labs in the United States for nearly 40 years. Stay tuned for more announcements this summer as we begin planning a year of celebration and events for our 40th anniversary and—hopefully—the end of the pandemic.

Welcome to the 39th annual HCIL symposium!

Sincerely,

Jessica Vitak
Director, Human-Computer Interaction Lab
Associate Professor, College of Information Studies
University of Maryland, College Park

39ᵗʰ Annual Human-Computer Interaction Lab (HCIL) Symposium

May 26, 2022

Brendan Iribe Center, University of Maryland

All times listed in Eastern Time (ET)

Pre-Symposium Events | Iribe 0318	
9am-10am	**Tutorial:** State-of-the-"art": machine learning for graphics and UI designs Lead: Yuexi (Tracy) Chen
10am-12pm	**Workshop:** Designing effective data visualizations without programming Lead: Leo Zhicheng Liu

Registration Opens at 12pm | Atrium

Main Symposium | Iribe 0324	
12:30pm	**Welcome Address**
	• Joel Chan, Associate Director, HCIL • Lucy Dalglish, Dean, Merrill College of Journalism
12:45pm	**Plenary Talks**
	• Hal Daumé III: From Human Explanation to Model Interpretability • Hernisa Kacorri: Machine Teaching: How People's Supervision of AI Training Data Can Help With Accessibility and Inclusion • Tamara Clegg: Data Everyday: Athletes' Critical Data Literacy Practices in Collegiate Sports
1:45pm	**Lightning Talks**
	• Cluster 1: Child-Centered Design and Learning • Cluster 2: Technology and Aging
2:25pm	**Coffee Break | Atrium**
2:45pm	**Lightning Talks**
	• Cluster 3: Privacy and Security • Cluster 4: Creativity & AI
3:30pm	**Panel: Information Quality and Online Influence**
4:30pm	**Lightning Talks**
	• Cluster 5: Accessible and Interactive Design • Cluster 6: Communication and Collaboration
5:25pm	Concluding Remarks

5:30pm	**Reception & Poster Session | Atrium**

Sponsorships

The research that happens in the lab—and the lab itself—cannot happen without financial support, and we are grateful to our corporate, campus, and research sponsors, especially those who have contributed to HCIL and its members in the last year.

Corporate Sponsors:

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Department of Defense, Washington Headquarters Services
Defense Advanced Research Projects Agency (DARPA)
Maryland Procurement Center
National Institutes of Health
Department of Education
Institute of Museum and Library Services
Maryland Center for Computing Education

WORKSHOP AND TUTORIAL OVERVIEWS

State-of-the-"Art": Machine Learning for Graphics and UI Designs

Yuexi (Tracy) Chen
Department of Computer Science
Contact: ychen151@umd.edu

Human creativity has remained the only way to achieve high-quality designs for a long time. However, with the rapid advances in artificial intelligence, some machine learning models also display the potential to generate high-quality designs.

This tutorial will introduce applications and mechanisms of machine learning models in graphic and user interface designs, including how to retrieve design inspirations and generate layout automatically. This tutorial also provides discussion questions to bridge designers and AI researchers.
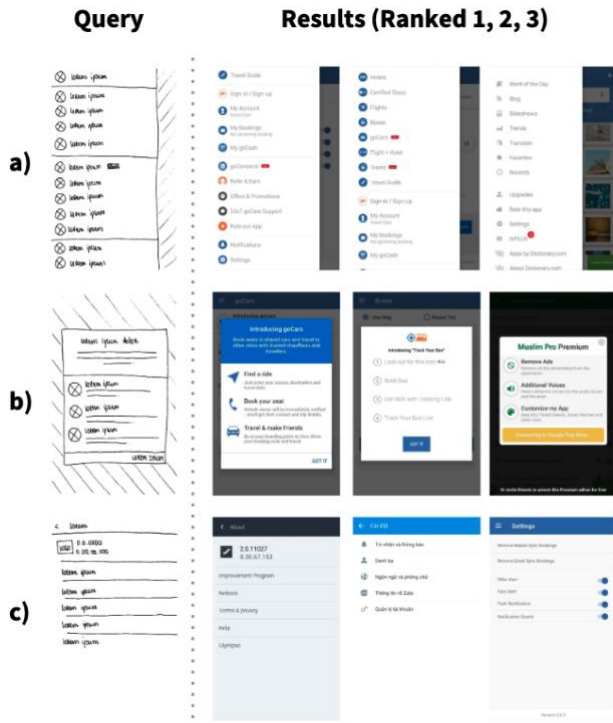

Figure 1. Find App UI designs by sketch

Figure 2. Auto-generated vs. designer-generated posters

PAPERS

1. Huang, Forrest, et al. "Swire: Sketch-based user interface retrieval." *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. 2019.

2. Guo, Shunan, et al. "Vinci: an intelligent graphic design system for generating advertising posters." *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. 2021.

Designing Effective Data Visualizations without Programming

Zhicheng Liu

Department of Computer Science

Contact: leozcliu@cs.umd.edu

Data visualizations are effective analytic and communication tools for a wide range of problems across multiple domains. Creating effective and expressive visualizations, however, remains a challenging and time-consuming task. This tutorial will introduce the participants to the concepts, theories, and guidelines for visualization design. The participants will also be performing hands-on design exercises with Data Illustrator, a direct manipulation tool for creating visualizations without programming.

In the first part of the tutorial, we will cover fundamental concepts such as tidy data table, data types, visual encodings, and scales. We will illustrate these concepts with real-world examples. We will then introduce the effectiveness and expressiveness criteria in visualization design and explain how to choose visual channels for different types of data variables. Based on these theories, we will walk through a number of commonly used chart types for multivariate datasets, and discuss the design trade-offs when using these chart types for effective depiction of data.

In the second part of this tutorial, we will apply the conceptual knowledge in action, and create data visualizations in Data Illustrator, a visualization authoring tool. We will provide an overview of the core operations such as repeat, divide, and densify in the Data Illustrator framework, and demonstrate how we can compose expressive visualizations (Figure 1) through a graphical direct manipulation interface. If we have time, we will also cover an additional tool, Data Animator, which takes the visualizations produced in Data Illustrator as keyframes in an animation, and allows users to compose animated data graphics with full control of temporal pacing and data-driven stage and staggering effects.

This tutorial is open to anyone who is interested in designing and creating data visualizations. No prior knowledge or experience with visualization is required.

ADDITIONAL INFORMATION

https://data-illustrator.cs.umd.edu/

PAPERS

1. Zhicheng Liu, John Thompson, Alan Wilson, Mira Dontcheva, James Delorey, Sam Grigg, Bernard Kerr and John Stasko. Data Illustrator: Augmenting Vector Design Tools with Lazy Data Binding for Expressive Visualization Authoring. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 2018*
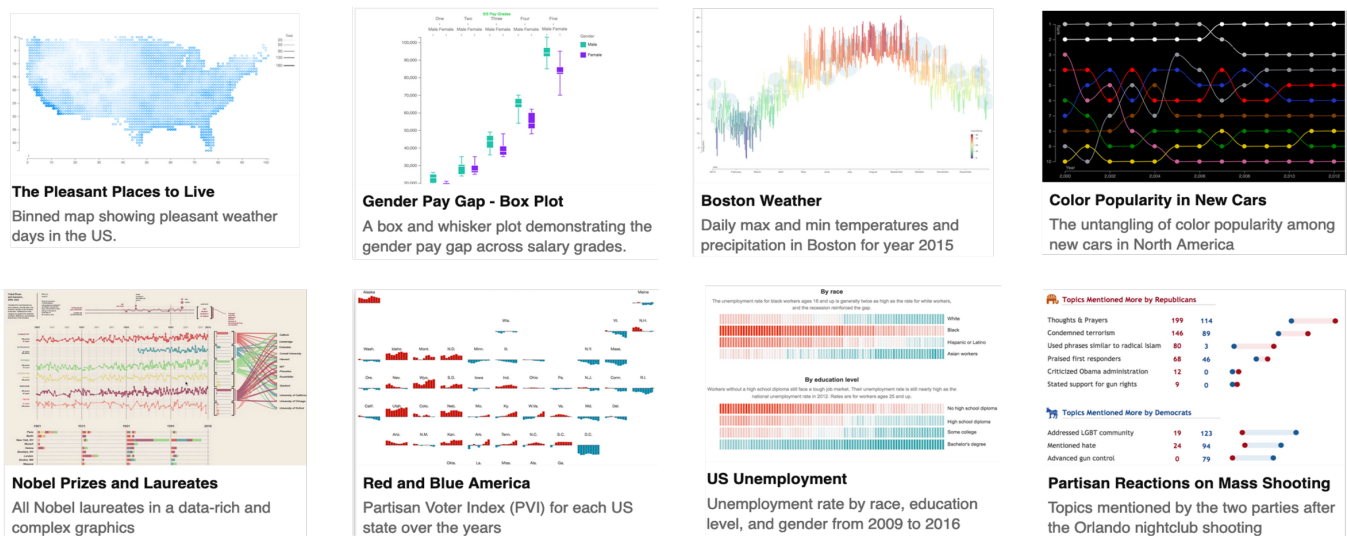

The Pleasant Places to Live
Binned map showing pleasant weather days in the US.

Gender Pay Gap - Box Plot
A box and whisker plot demonstrating the gender pay gap across salary grades.

Boston Weather
Daily max and min temperatures and precipitation in Boston for year 2015

Color Popularity in New Cars
The untangling of color popularity among new cars in North America

Nobel Prizes and Laureates
All Nobel laureates in a data-rich and complex graphics

Red and Blue America
Partisan Voter Index (PVI) for each US state over the years

US Unemployment
Unemployment rate by race, education level, and gender from 2009 to 2016

Partisan Reactions on Mass Shooting
Topics mentioned by the two parties after the Orlando nightclub shooting

Figure 1. You will be able to create visualizations like these after the tutorial.

PLENARY SPEAKERS AND PANEL DESCRIPTION

Plenary Speaker: Hal Daumé III, Pier Giorgio Perotto Endowed Professor, Computer Science

From Human Explanation to Model Interpretability: A Framework Based on Weight of Evidence

Abstract: When an AI-infused system makes a prediction, or recommends a decision, how can a user of that system know why it did so? Questions like this form the basis of explainable artificial intelligence and, in the particular case of machine learning-based systems, interpretable machine learning. These are naturally human-centered questions: the explanation an AI-infused system provides is to be consumed by a person. I'll start by discussing how people tend to provide explanations to one another, and use these findings to motivate some principles to which machine explanations should adhere to ensure legibility by users. I'll present one method for explaining the decisions of black box systems that mostly aligns with these principles, a tool we built based on that method, and some findings from studies of how people use that tool.

Bio: Hal Daumé III is a Perotto Chair Professor in Computer Science and Language Science at the University of Maryland, and a Senior Principal Researcher at Microsoft Research. His research focuses on developing learning algorithms for natural language processing, with a focus on interactive learning methods, and techniques for mitigating harms that can arise from automated systems. He earned his Ph.D. from the University of Southern California in 2006, was an inaugural diversity and inclusion co-chair at NeurIPS 2018, is an action editor for TACL, and program co-chair for ICML 2020.

Plenary Speaker: Hernisa Kacorri, Assistant Professor, iSchool
Teachable Interfaces for Accessibility and Inclusion

Abstract: We interact with machine learning applications every day and often, we even shape their behavior through every click, scroll, and like. This is largely unintentional and only those building these applications may be involved in actively collecting or engineering the datasets used to train machine learning models. As end users, we are all typically seen as passive consumers rather than creative directors of AI-infused technology. Teachable interfaces provide an opportunity to change this paradigm. They invite us to personalize machine learning models, make them work better for our use cases, and perhaps uncover basic underlying concepts as we tinker with them. In this talk, I will present a series of studies with teachable interfaces that involve diverse user groups such as youth, older adults, and people with disabilities to demonstrate the potential of this human-centered paradigm for accessibility and inclusion.

Bio: Hernisa Kacorri is an assistant professor in the College of Information Studies. She holds an affiliate appointment in the Department of Computer Science and the Human-Computer Interaction Lab at the University of Maryland, College Park and serves as a core faculty at the Trace R&D Center. She received her Ph.D. in Computer Science from The Graduate Center at City University of New York, and has conducted research at the University of Athens, IBM Research-Tokyo, Lawrence Berkeley National Lab, and Carnegie Mellon University. Her research focuses on accessibility and human-centered artificial intelligence. Hernisa is recipient of a Mina Rees Dissertation Fellowship in the Sciences and was recognized by the Rising Stars in EECS program of CMU/MIT. Her collaborations with students, colleagues, and advisors have received honorable mention and best paper awards at ACM ASSETS, ACM CHI, IEEE WACV, IEEE VL/HCC. Her work is funded by NSF and NIDILRR.

Plenary Speaker: Tamara Clegg, Associate Professor, iSchool
Data Everyday: Athletes' Critical Data Literacy Practices in Collegiate Sports Contexts

Abstract: In this talk, Dr. Clegg will present an investigation of the community-driven data science happening authentically in elite athletics as a means of engaging a community of learners - collegiate athletes, many of whom come from underrepresented groups - in STEM. Our research team aims to recognize the data literacy practices inherent in sports play and to explore the potential of *critical data literacies* for enabling athletes to leverage data science as a means of addressing systemic racial, equity, and justice issues inherent in sports institutions. We leverage research on critical data literacies as a lens to present case studies of two athletes at an NCAA Division 1 university. We focus on athletes' experiences as they engage in critical data literacy practices and the ways they welcome, adapt, resist, and critique such engagements. Our findings indicate ways in which athletes (1) readily accept data practices espoused by their coaches and sport and (2) critique and intentionally dis-engage from such practices, and (3) develop their own new data productions. In order to support community-driven science, our findings point to the critical role of athletics' organizations in promoting athletes' access to, engagement, and agency with data practices on their teams.

Bio: Tamara "Tammy" Clegg is an associate professor in the College of Information Studies at the University of Maryland, where she co-directs the Youth eXperience (YX) Lab. She received her Ph.D. from Georgia Tech's College of Computing and her B.S. in Computer Science from North Carolina State University. Tamara's work focuses on designing technology (e.g., social media, mobile apps, e-textiles, community displays) to support life-relevant learning where learners, particularly those from underrepresented groups in science, engage in STEM in the context of achieving personally relevant goals. She seeks to understand ways such learning environments and technologies support STEM disposition development. Tamara's work has been funded by the National Science Foundation, the Institute of Museum and Library Studies, and Google.

Panel: Information Quality and Online Influence

Description: This panel convenes experts from journalism, public policy, computer science, and information studies to discuss the information ecosystem, the risks posed to it by malevolent actors, the structural and social issues that led us to this point, and possible paths toward a more resilient and informative environment. Particular topics of discuss include sense-making during conflict, cross-national disinformation campaigns and their effects, and the challenges these and other risks pose to finding quality information.

Panel Moderator: Cody Buntain
Assistant Professor, College of Information Studies,
University of Maryland

Panelist: Giovanni Ciampaglia
Assistant professor, Department of Computer Science and Engineering, University of South Florida

Panelist: Charles Harry
Associate Research Professor, School of Public Policy,
University of Maryland

Panelist: Naeemul Hassan
Assistant professor, Philip Merrill College of Journalism and College of Information Studies, University of Maryland
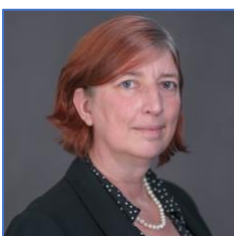
Panelist: SJ Terp
Lecturer, College of Information Studies,
University of Maryland

Cluster 1: Child-Centered Design

Paper Title	Presenting Author
Impact Libraries: Using the Design-Based Implementation Research (DBIR) Method to Create Computational Thinking Assessment Tools for Youth Programs in Public Libraries	Nitzan Koren
Designing a Physical Robotic for Youth Supporting Multiple Programming Approaches	Yuhan Lin
Working with Youth in the Game Design Process	Anthony Pellicone
Youth and Representational Fluency in Making Spaces	Caro Williams-Pierce

Impact Libraries: Using the DBIR[1] Method to Create Computational Thinking Assessment Tools for Youth Programs in Public Libraries

Nitzan Koren[1]**, David Weintrop**[1,2]**, Mega Subramaniam**[1]
College of Information Studies[1], College of Education[2]
Contact: nkoren@umd.edu
https://impact.ischool.umd.edu/

In recent years, Computational Thinking (CT) has emerged as a skill for "all youth to succeed in our technology and information-rich world" (p. 290) [1]. The last decade has seen a rapid growth in programs and projects across formal and informal settings that emphasized the importance of learning CT skills. Following this trend, libraries are offering CT programs for youth, developing CT-related professional development initiatives for their staff and are becoming essential venues in which youth from all backgrounds are introduced to foundational CT concepts, skills and dispositions.

However, previous research mapping the landscape of CT assessments in various educational settings [2] did not identify any CT assessment tools designed to be used in public libraries [1]. Given the lack of CT assessments for library settings, library staff struggle to determine if their CT programs are successful and instead rely on attendance and retention to show the impact of their programs [3], which do not provide insight into learning or attitudinal outcomes. This gap in assessment tools for measuring CT-related outcomes is important to address as many CT programs are offered to youth in public libraries to broaden participation in computing, and resources are dedicated to these programs, with little way of knowing their impact on youth.

Over a three year period, we conducted a three-phased study to address the problem using the Desgin-Based Implementation Research method [4] and principles. The contributions of our work are two-fold - first, we demonstrate how the DBIR method can be applied in similar work, considering the four principles. Second, it demonstrates the potential of DBIR to change practitioners' perspectives through the process of resolving the above-mentioned problem of practice and facilitating the design of sustainable solutions.

During this work, we designed seven different assessment instruments that we split into tool snippets to ensure the tools meet the needs of library staff. The instruments measure outcomes identified in interviews and focus groups with library staff. Each tool is available (through an interactive toolkit) in paper-based or digital resources. Tools include design scenarios, interviews, focus groups protocols, talkback boards, rubrics, observation checklists, surveys, and facilitator self-assessment tools. The assessment tools can be accessed through our website and are open to the public. We are currently working with the iConsultancy to improve the website design, involving participants from all phases of our project in user testing. So far, we have authored seven case studies documenting how youth-serving library staff was able to use the assessments to improve their CT programs, collecting immediate feedback from youth, and reflecting on the data.

REFERENCES
[1] Weintrop, D., Morehouse, S., & Subramaniam, M. (2021). Assessing computational thinking in libraries. *Computer Science Education, 31*(2), 1-22.

[2] Tang, X., Yin, Y., Lin, Q., Hadad, R., & Zhai, X. (2020). Assessing computational thinking: A systematic review of empirical studies. *Computers & Education*, *148*, 103798.

[3] Subramaniam, M., Koren, N., Morehouse, S. & Weintrop, D. (2022). Capturing Computational Thinking in public libraries: An examination of assessment strategies, audience, and mindset. *Journal of Librarianship and Information Science*.

[4] Fishman, B., Penuel, W., Allen, A. R., Cheng, B., & Sabelli, N. O. R. A. (2013). Design-based implementation research: An emerging model for transforming the relationship of research and practice. *Teachers College Record*, *115*(14), 136-156.

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[1] Design-Based Implementation Research

Designing a Physical Robotic for Youth Supporting Multiple Programming Approaches

Yuhan Lin, David Weintrop, Jason McKenna
Department of Teaching and Learning, Policy and Leadership
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In this lightning talk, we introduce VEX 123 (Figure 1), a new programmable robot designed for young learners that supports multiple programming approaches to scaffold learners as their programming knowledge and skills grow. To accomplish this, the VEX 123 can be programmed in three distinct ways: 1) direct manipulation, where programs are defined by pressing buttons directly on the robot, 2) a tangible programming approach that utilizes a novel, unplugged Coder and Coder Cards (Figure 2) where commands written on plastics strips can be sequentially arranged and then sent to the robot, and 3) a block-based programming environment (Figure 3).
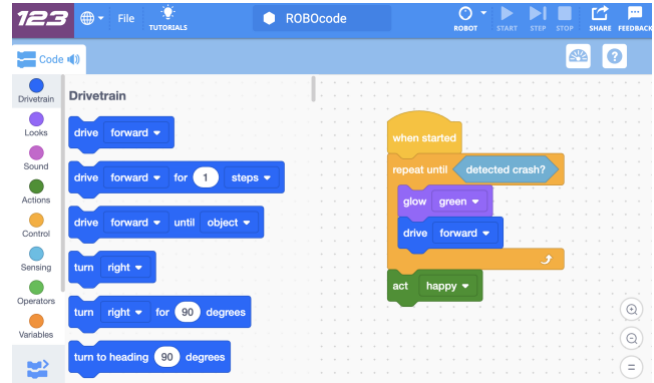
Figure 3 - virtual programming environment

Along with introducing VEX 123 and its design, this lightning talk also discusses the design principles that informed the VEX 123 robot and each of its three programming approaches. We also present the results of a small-scale classroom study where 1ˢᵗ and 2ⁿᵈ-grade learners (ages 6-8) programmed the VEX 123 robot, first using the direct manipulation press-and-go approach and then transitioning to using the tangible Coder and Coder Cards. This paper contributes a new tool (VEX 123) and programming approach (the Coder and Coder Cards) to the growing ecosystem of ways to introduce young children to the practice of programming. In presenting the VEX 123 alongside a pilot study with young learners, this work advances our understanding of ways to design introductory programming tools that support the younger users and can scaffold them from basic to more complex programming interactions.

Figure 1 - The VEX 123 Robot

Figure 2 - Coder and Coder Cards

Working with Youth in the Game Design Process

Anthony Pellicone
College of Information Studies and UMIACS
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Game-based learning (GBL) has become increasingly prevalent as games have become more accepted as both entertainment and learning technologies. Games designed for educational purposes are frequently deployed in classroom settings or are used in informal learning to help youth learn across varying academic domains. Alongside the growing use of games is a mature body of research, which suggests that games are broadly useful for learning, but also have a number of limitations.

Although well designed games are effective learning technologies, games must balance conceptual fidelity, accessibility, and the nebulous concept of 'fun'. Fun, while highly subjective, is core to the theoretical underpinnings of GBL, which position fun and enjoyment as an intrinsically motivating element of the experience. Games that do not strike this balance run the risk of alienating players, potentially having negative impacts on learning and self-efficacy. Therefore, designers of GBL have a daunting task: they must represent concepts in a manner that is both authentic to the domain in which they are teaching, but also do so in a way that is enjoyable and approachable for their audience – typically school-aged youth.

The craft of game design has been studied extensively, and there are many practitioner texts for approaches to effective game design. Consistently, these texts recommend iterative playtesting with a designer's target audience as a key component of the design process. While playtesting has been studied extensively for *commercial* games, very little work has been done on how to playtest effectively with youth participants for *game-based learning*.

Incorporating Youth into the Game Design Process
We report on work conducted over a multi-year GBL project[1], which is focused on creating a game designed to introduce underrepresented youth to the field of cybersecurity. We first review established methods of incorporating youth into the design process for software generally, and then discuss how these methods interact with game design more specifically. We report on our experiences
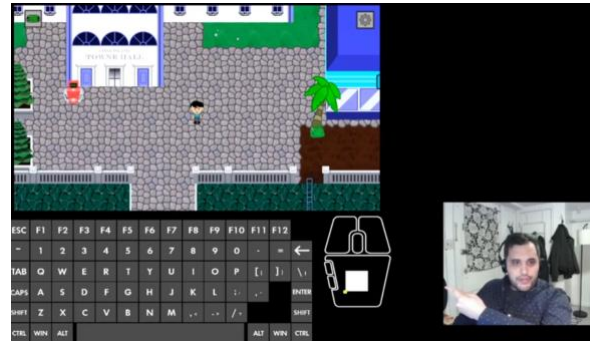

Figure 1 – A screenshot of a novel method of data collection that uses game streaming as a model for player feedback

with using several of these methods: traditional playtesting, a novel method using streaming as a model to solicit player feedback[2] (see Figure 1), and cooperative inquiry. We conclude by offering practical take-aways and next steps for other designers seeking to employ GBL in their own work.

PAPERS
1. Shokeen, E. Pellicone, A., Weintrop, D., Ketelhut, D. J., Pierce, C. W., Plane, J., Cukier, M., & Rahimian, F. (2021). An Iterative Design Cycle: Using Productive and Unproductive Frustration to Guide Re-Design. In Proceedings of the 15th International Conference of the Learning Sciences - ICLS 2021. (pp. 957-958).

2. Pellicone, A. Weintrop, D. Ketelhut, D. Shokeen, E. Cukier, M. Plane, J. Rahimian, F. 2022. Playing aloud: Leveraging game commentary culture for playtesting. *IJGCMS 14*(1). Pp 1 – 16.

Youth and Representational Fluency in Making Spaces

Caro Williams-Pierce

College of Information Studies
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In this study, we examined students' representational fluency (Lesh et al., 1987; Moore et al., 2013) in a semi-structured making environment. Specifically, we considered how students rely on gestures and other forms of representations to convey their mathematical thinking. In our analysis of video data of students engaging in non-formal makerspace robotic activities, we found that gestures add value for understanding students' experiences and communication in non-formal making activities. Prior works on representational fluency frameworks are missing an important element—gestures. Through this theoretical contribution, we extend the prior representational fluency model from five elements to six: Realistic, Concrete, Pictorial, Language, Symbolic, and Gestural.

Cluster 2: Technology and Aging

Paper Title	Presenting Author
Co-designing User Manuals for Makerspaces with Older Adults	Ruipu Hu
Using Theoretical Approaches to Explain External Sources of Older Adults'Tensions With ICTs Use	Pooja Upadhyay
A Posthumanist Perspective on HCI Research in Aging	Alisha Pradhan

Co-designing User Manuals for Makerspaces with Older Adults

Ruipu Hu, Alisha Pradhan, Amanda Lazar
College of Information Studies
Contact: rhu12@umd.edu

A major focus in HCI is designing technologies that are useful and accessible for older adults. In gerontology, researchers study older adults' adoption of technologies. With this focus on early design in HCI and the later focus on adoption in gerontology, there is little emphasis on the stages in between: how older adults (can be supported to) learn to use or adapt to updates of technologies.

Some past research has shown that older adults prefer user manuals to learn about new technologies [1]. In our work, based on the insufficiency of the current manuals for the machines at the makerspace where we are invited as researchers, we are examining what aspects of user manuals are important to older adults, and how older adults approach designing user manuals for new technologies. In this process, we co-designed user manuals for five machines: a button maker, cricut, jewelry making, and sewing machine. In our preliminary analysis of data gathered through a multi-stage co-design process we are learning the following:

No strict preference on the amount of information

Some research has suggested minimal design is key for more effective learning progress [2]. In contrast, we found participants do not have a strict preference for the amount of information provided in the manuals. Among all the machines, participants found the manual for button maker to be relatively easy to follow and use. The manual for the button maker is a one-page text-and-picture-based manual. The operation procedure for making a button is short, and only needs the user's input for picking the preferred picture on top of the button. However, participants perceive the cricut machine and 3D printer as machines that involve multiple operating stages. To our surprise, they were comfortable with a fifty-page manual that we showed as an example. They propose that more instructions and details should be provided in the manuals for machines involving more steps and functions.

Linear learning process

When learning a machine involving software and hardware such as a cricut or a 3D printer, participants wanted to begin by working on a simple task. Individuals who were not familiar with the machines wanted to follow the manual with a slowly-progressing difficulty so that they can process the knowledge of new technologies step by step, and build upon the prior knowledge. In the process of co-designing manuals and observing participants use the cricut machine, we transformed the design from a general operation guide to one specific simple task of making a greeting card. During a session where they used this guide, they asked for the next one to be building on these skills to using software to design their own flowers.

The Importance of User Manuals in HCI

Past work focused on increasing the adoption of new technologies for older adults often strives to design for intuitive use. Our work shows that intuitive use is not always possible, such as for machines that involve many steps, software and hardware that older adults may not be familiar with, or when individuals want to use technologies for versatile purposes. Given that past research has indicated that older adults prefer manuals, but face challenges in the way they are designed, there is an opportunity to bring the design of user manuals under the umbrella of aging research in Human-Computer Interaction.

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Using Theoretical Approaches to Explain External Sources of Older Adults' Tensions With ICTs Use

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Information and Communication Technologies (ICTs) are a diverse set of networks, tools and devices through which people experience aspects of their everyday realities, now more so than ever. But many groups of people, e.g., older adults, **do not experience the same conditions around using ICTs** as other groups such as young adults, who often gain familiarity with how technologies and tools function in learning and work environments. Low ICT adoption has been reported for older adults [1] consistently through the past ~20 (2000-now) years of research, across which ICTs have changed dynamically in appearance, interactivity, and functionality. Yet, the problem of access persists, posing greater risks of exclusion – and appears to be a "structural-functional" [2] issue. This points towards sources of complexity in use that may lie outside the user. However, much past research reporting "low technology proficiency" in older adults puts the burden of this change on users.

Recent calls in HCI [3] reference seminal ontological approaches explaining inseparability of the social-technical, epistemological approaches such as Agential Realism* to rethink social science production in explaining agency and sources of power vs Human-centered and fixed functionality views. Along with this, past work in HCI around ethnomethodology, system abstractions and functionality, materiality and artifact views of technology in CSCW gave us theoretical tools to collect and examine empirical data of everyday interactions.

We use early ethnographic data of older adults' engagement with ICTs (avg. 77yrs) to understand community practices (language, behavior and sensemaking related to technology), and then conducted around 25 participant observation tech-support sessions. By looking at the material configurations of technology in use (graphical screen information in a heterogenous, networked system of inter-tool, tool-internet, tool-device communication), we identify how political, economic and design considerations actively mediate older adults' interactions in use, causing barriers.

The following are some examples that came up in tech sessions. These were self-reported as "*don't know how [tool] works*", yet the issues pertained to many assumptions behind smooth everyday use:

- Assumed procedural knowledge of how tools are to be accessed differently across devices created barriers to use (*"I use Google chrome as my browser, I don't have to sign in to get it on my laptop, but i'll have to download the youtube app on smartphone?"*) as well as barriers to maintaining use ("*If you update [zoom] on one browser (web client), does that update automatically follow through on any other browser?*").

- Black box communication across tools materialized activities [*zoom link-> meeting*], but left users with incomplete information when breakdowns happened - which tools are in use, as well as how to access those tools (*browser> zoomlink> zoom - "[clicked on zoom link]..it would spin and spin [loading screen] and not go in*")

- Further, visual display of tools across entire screens on touch devices [*zoom meeting ID received on email*] made it unclear how tools can be used together [opening zoom with email open to enter ID] without losing the screen [typed in ID]. (*Instead, the user printed out the zoom ID on paper to type it*)

These early findings show that task-based designs of tools, and assumptions of ideal configurations setup before use (as common in workplace technology) leave gaps in everyday use. Gaps are filled by user labor behind setting up, becoming familiar with, and troubleshooting use and maintenance of tools within configurations. Without this embodied familiarity, our data shows that older adults may not be equipped with enough resources (cues on technology screens itself) that uphold access.

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NOTE: *Agential realism vs. social constructivism – considering agencies in the act of observation/ knowledge production and observing "agency" as a product of intra-action/ relational between humans, and materials enacted within observation.

A Posthumanist Perspective on HCI research in Aging

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Till date, research on aging in HCI and CSCW has largely adopted human-centered approaches, such as user-centered and participatory design. However, recent research in critical gerontology questions a focus on the 'human subject' alone, as this can fail to capture the lived experiences and social relations that involve both the human and nonhuman world [1]. Consider how implant technologies such as pacemakers involve material manipulation of older adults' bodies (i.e., insertion of new materials), where it becomes hard to distinguish the difference between the human and the nonhuman. Surveillance and monitoring technologies such as fall detection sensors are entangled with older adults' bodies, routines, families, and care providers. With existing and emerging technologies, "the aging body becomes enmeshed in technological fields and networks…so almost inevitably arises as a site for the convergence of the human and the nonhuman (hence being 'more-than-human')" [1].

A *posthumanist* turn in aging attunes to the agency of nonhuman world and the 'more-than-human' aspects of aging [1]. In this work, we present a case of adopting posthumanist perspectives in the context of HCI research on aging through studying older adults' use of emerging voice-based technologies. We conducted interviews with 20 older adults focusing on their use of voice assistants on smart speakers such as Alexa or Google Assistant. Our analysis draws upon the theoretical orientation of two posthumanist entanglement theories previously used in the context of technology design: Actor-Network Theory [2], and Post-Phenomenology [3,4].

Our analysis reveals how nonhuman actors, including materials as well as norms, shape older adults' preferences for and use of voice assistants. For example, paper manuals, as material actors which are currently missing for voice-based technologies, create barriers and frustration in learning the technology. Additionally, we the voice assistant plays an active role in mediating relations between older adults and their larger social world (including humans and pets), and this in turn shapes social practices around what it means to give company to pets (e.g., P5 using an Alexa skill to give company to her cat when away from home) or to give and receive care. In terms of giving and receiving care, mediations through Alexa resulted in extending caregiving capabilities of a human (e.g., allowing P1 to "nag," or care for, her husband remotely through Alexa), and also shaped new possibilities for a pet animal to care for a human (e.g., P18's service dog following Alexa's command to get P18's medicine).

Based on these findings, we argue that there is value in adopting entanglement perspectives in the context of aging: in terms of thinking about the relations that older adults develop with and through their technologies, and the implications in assigning responsibility to nonhuman actors.

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Cluster 3: Privacy and Security

Paper Title	Presenting Author
When the Sword Becomes the Shield: Analysis of Security Advice on Social Media for Survivors of Intimate Partner Violence	Julio Poveda
SoK: A Framework for Unifying At-Risk User Research	Noel Warford
Is Cryptographic Deniability Sufficient? Non-Expert Perceptions of Deniability in Secure Messaging	Nathan Reitinger
Shared Mental Models in Smart Homes: Implications for User Privacy	Sunyup Park
Designing Privacy and Security Curriculum for Elementary School Children and Teachers	Elana Blinder

When the Sword Becomes the Shield:
Analysis of Security Advice on Social Media for Survivors of Intimate Partner Violence

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Intimate Partner Violence (IPV) is a societal problem that affects millions of people around the world. Prior work has documented how abusers weaponize numerous digital technologies to monitor and harass their victims. However, current understanding on how primary and secondary survivors of IPV interact on social media platforms to obtain technology advice is limited, as well as the knowledge on the quality of the advice survivors receive by those means. In this lightning talk, we will present our ongoing qualitative study that seeks to analyze IPV survivors' interactions on Reddit and Twitter in which they ask for help and learn strategies to tackle technology-enabled abuse.

We collected tweets and Reddit posts related to security advice in the context of IPV posted in the past two years. Then, through inductive coding we are developing a codebook to ascertain themes of the advice seekers' and advice providers' remarks and supplement our findings with lexical usage analysis. Our preliminary findings suggest survivors look for actionable advice on various technologies. Additionally, a significant percent of the shared advice does not consider the unique IPV threat model, thus, the recommended actions can put survivors' life at risk. Moreover, we discuss the idea of *scalable care infrastructures* to expand the scope of support services and increase the effectiveness of advice sharing on social media platforms. Finally, our study yields insights into how technology advice for IPV survivors on social media can be better targeted and designed to better match their needs.

SoK: A Framework for Unifying At-Risk User Research

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Anyone can experience attacks related to their security, privacy, or safety online (i.e., digital safety), but at-risk users have risk factors that augment or amplify their chances of being digitally attacked and/or suffering disproportionate harms. For example, some activists are surveilled by government actors due to their work; people who are LGBTQ+ face elevated risk of harassment by anonymous attackers on social media; and women in repressive regions experience pervasive sexual harassment online and sometimes severe consequences from their community as a result.

A growing body of research has explored how the digital-safety needs of at-risk users may be unmet by existing security, privacy, and safety threat models that tend to focus on a mythical "average user." A common recommendation from researchers in this space is to consider at-risk users during the technology creation process. However, for technology creators, it can be bewildering to consider dozens of different at-risk populations, each with disjoint and sometimes contradictory digital-safety needs. Accordingly, we argue that there is a need for synthesis: to organize what is known into a framework that can be used to reason about at-risk users' risks and needs, and to identify gaps in knowledge for future work.

We systematically identified and reviewed 95 papers focused on the digital-safety experiences of at-risk populations and developed a framework that can be used to reason about at-risk users. Based on an analysis across 31 distinct population categories (e.g., journalists, refugees, older adults), we identified 10 contextual risk factors that cross-cut at-risk populations, yielding a set of circumstances that technology creators and researchers can consider in research, design, and development. We also found that at-risk users currently rely on varied, often ad-hoc protective practices, ranging from leaning on social connections to relying on a patchwork of technical strategies to try to minimize risks and harms. We provide an at-risk framework comprised of these contextual risk factors and protective practices, which we use to discuss barriers that limit or prevent at-risk users from enacting digital protections, and to show how competing priorities, a lack of digital safety awareness, and broken technology assumptions compound the challenges at-risk users face.

The at-risk framework can be used in multiple ways by researchers and technology creators, including guiding research and developing technologies to be inclusive of at-risk users. The framework can be used to help identify where knowledge of at-risk users is underdeveloped, sparse, or missing, giving researchers a way to prioritize their efforts. Technology creators can also use the at-risk framework to better support a wide range of at-risk users in their products. Our framework simplifies the challenging but important process of thinking through potential risks and needs of multiple at-risk populations together.

Going forward, our framework can be used to identify opportunities for future research and to provide a structure for researchers and technology creators to scalably and more comprehensively ensure that everyone—including at-risk users—can engage safely online.

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Is Cryptographic Deniability Sufficient? Non-Expert Perceptions of Deniability in Secure Messaging

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Cryptographic deniability—a problem long considered largely theoretical—has recently come to play a major role in world events. In the closing weeks of the 2016 U.S. presidential election, approximately 58,000 emails from Hillary Clinton's campaign were publicly leaked. The Clinton campaign broadly denied the authenticity of the emails, claiming that the emails were doctored and part of a smear campaign. Generally, email communications are unauthenticated and therefore provide plausible deniability: conversation participants may claim they did not author a message. Unfortunately for the Clinton campaign, security researchers soon pointed out a problem with the denial: the emails were cryptographically signed—not by the authors— but by the Mail Transfer Agents' (e.g., Google's servers) use of Domain Keys Identified Mail, a security feature implemented by many email providers to combat spam. The messages were verifiably unaltered. Cryptographic signatures on the emails rendered the campaign's denials ineffective, a pattern that has repeated in subsequent incidents as recently as March 2022 (Hunter Biden's laptop).

Cryptographic deniability In 2004, Borisov, Goldberg, and Brewer proposed Off-the-Record (OTR), a protocol for encrypting and authenticating text messages while removing the "non-repudiation" (i.e., un-deniable) property, a propriety provided in then-standard, signature-based approaches for authenticated, encrypted communication, such as GPG and S/MIME. In this way, OTR, and similar protocols, offer deniability—chat participants know messages are authentic during a chat, but there is no way to transfer this knowledge to anyone else because there are no signatures a third party can verify.

Since 2004, deniability in encryption protocols has seen considerable activity, both in academia and industry. Successors to OTR are now deployed in over two billion devices worldwide. Cryptographic deniability has been popularized through applications like WhatsApp and Signal, which rely on OTR-like protocols as privacy pitch-points.

Cryptographic deniability protocols like OTR, however, implicitly make a strong assumption: the absence of signatures on messages is both necessary and sufficient for deniability—i.e., unsigned messages, when revealed to third parties or the public, will not be trusted as authentic. This leaves out a critical, non-technical factor: how people perceive authenticity and deniability in the "real world." To our knowledge, the question of how the status quo in cryptographic deniability interacts with human perceptions—and what might be better—has not previously been studied.

Approach We conducted a survey study with 1,200 people that presented various arguments for deniability to different participants and gauged their reactions. To remove as many potential confounds as possible, but retain a context that would feel realistic for our participants, we used a criminal trial as the scenario in our survey. Participants played the role of jury members and were asked to judge the guilt of a hypothetical politician, who is accused of bribery. The evidence for the bribery charge is a screenshot from the politician's messaging history.

As potential defenses, participants evaluated one of six different forms of deniability evidence. This deniability evidence fell into three general categories: (1) no supporting evidence (control); (2) experts who testify about the properties of the protocol; and (3) the demonstration of tools that make transcript forgery trivial. After participants reviewed the evidence, we asked participants about their beliefs, and then to make a decision (i.e., guilty–not guilty) based on the case presented.

Key results We offer two key findings. First, one might assume that widespread familiarity with "photoshopped" images, "fake news," and even "deepfake" videos would support the cryptographic perspective on deniability: anything that cannot be affirmatively authenticated should be assumed to be fake. This assumption is not true. To our surprise, nearly three quarters of participants who saw no deniability evidence believed that a simple screenshot— lacking in authenticity—convincingly demonstrated wrongdoing. On the flip side, participants who saw any type of deniability evidence overwhelmingly (70%+) returned a "not guilty" decision.

Second, some types of deniability evidence are more convincing than others: participants who tried out an interactive forgery tool were significantly more likely to believe a denial than those who made their decisions on the basis of testimony from expert cryptographers. In other words, deniability is obtainable, but messaging applications can do more to help make deniability effective in practice.

Shared Mental Models in Smart Homes: Implications for User Privacy

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Smart home devices such as smart speakers and lights are among the most popular applications for the Internet of Things (IoT). IoT technology works by collecting, analyzing, and distributing user data. Privacy is of particular interest in the smart home context since these devices are situated in the home—where user expectations of privacy are high. Current smart home privacy research and measures, however, focus on the individual experience, and especially on primary users who use and manage most of the devices. Acknowledging that smart home devices collect data not only from these primary users but also from other household members, this study provides a qualitative description of the complex privacy dynamics that emerge when using smart home devices with household members to understand their collective privacy perceptions.

Mental models (MMs) provide a useful framework for analyzing the privacy and security implications of smart home technologies. A mental model is a psychological representation of a cognitive process. MMs were adopted by human-computer interaction (HCI) researchers to examine how users interact with a certain technology. However, mental models not only deal with domain-specific understandings but also can be used to represent abstract constructs such as privacy and security.

MMs have previously been used to understand users' perceptions of privacy and security in smart homes [3, 4]. MMs research in smart home privacy shows two trends: First, studies including non-users suggest that perception, expectation, and concerns about privacy do not vary significantly between users and non-users [3, 4]. Second, many studies limit the scope of smart home technology to a specific device since people have different privacy expectations for different devices [1, 2]. However, prior work on smart home privacy studies generally does not consider the shared usage and experience of smart homes. To address this gap in literature, this study proposes two main research questions:

RQ1: What are the similarities and differences in mental models between household members who share smart home devices?

RQ2: How do household members' shared mental models affect their attitudes and behaviors regarding smart home privacy?

A semi-structured group interview was conducted with 23 household members of various relationships (partner/spouse, siblings, and roommates/housemates). The interview protocol consisted of general questions about smart home usage, mental model drawing activity, and data/privacy concerns in smart homes. Data analysis, including transcription and coding, is still in progress.

PRELIMINARY FINDINGS
- Mental models were different in households where the secondary user is not interested in smart homes or delegates authority to the primary user about smart homes.
  - Primary users with technical backgrounds can influence secondary users' understanding.
- Mental models were similar among household members where both household members were primary users regardless of their levels of understanding.

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Designing Privacy and Security Curriculum for Elementary School Children and Teachers

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While there has been an abundance of research focusing on adults' privacy and security skills and behaviors, children are an under-researched user group who are at risk from a range of online privacy and security threats. Children face these threats from a young age, with many using smartphones, tablets, apps, and websites before starting school. Beyond that, the shift to remote school during the COVID-19 pandemic has highlighted the need for a more comprehensive and collaborative approach toward digital security and privacy education.

Designing Elementary School Curriculum to Facilitate Discussions of Digital Privacy and Security

A challenge for developing curriculum that covers privacy and security-related content is identifying appropriate ways to scaffold learning throughout elementary school. In this project, we use a simple game—Would You Rather?—to encourage students to think about decisions they face in their daily lives. Would You Rather gives you two options (e.g., would you rather have pizza or ice cream for the next year?) and asks people to pick an option and talk about why they selected it.

Between December 2021 and March 2022, the research team held three sessions with Kidsteam groups at the University of Washington, University of Maryland, and University of Boise (ID). Kidsteam is an intergenerational design team that works with groups of 6-8 children in elementary and middle school to codesign child-relevant technologies.

In these sessions, we explained the game and went through a number of scenarios to identify life-relevant content for these children (see Figure 1 for an example). We then asked children to reflect on some of the challenges that digital technology pose when it comes to their privacy and security.

Currently, the team is conducting co-design sessions with elementary school teachers to refine the activity and embed it within a "micro-lesson" that provides a short and flexible lesson plan for running the activity, including ways to connect an in-class lesson to an at-home activity.

Fig 1: Example of "Would You Rather?" game tested with three remote Kidsteam groups. In this case, children could indicate their response by placing their hand above, at, or below their nose (left-side image) or using the appropriate Zoom reaction button.

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Cluster 4: Creativity and Human-Centered AI

Paper Title	Presenting Author
Computational Analogy: Supporting Creative Problem Reformulation with AI-generated Analogies	Jason Ding
The Invasion of Vorgaria: A Task and a Platform for Studying AI Supports of Team Cognition in Intelligence Shift Handovers	Susannah Paletz
Considering Creativity in Artificial Intelligence and Work	Sarah Vahlkamp
Exploring Presentation Interaction Effects on Mechanism of Inspiration from Diverse Examples	Jason Ding

Computational Analogy: Supporting Creative Problem Reformulation with AI-generated Analogies

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Design problem

Stakeholder: K-12 students
Context: smart devices are widely used nowadays
Goal: focus on study and think deeply
Obstacle: too many attractive apps on smartphone

AI-generated analogous design problem

Stakeholder: a mother with young children
Context: at home
Goal: get children to eat healthy food
Obstacle: children only want to eat junk food

Figure 1 Language models such as Generative Pre-trained Transformer 3 (GPT3) can generate analogous design problem (right) based on the input design problem (left).

Effective problem formulation is necessary for creative knowledge work. Analogies—abstract parallels between two different things—can power creative breakthroughs by stimulating effective problem (re)formulation [1]. However, analogical retrieval in humans is dominated by surface similarity. Therefore we investigate how we can design systems to support problem reformulation by analogy.

Computational analogical matching systems are a promising direction, but abstracting away details of the problem domain remains a difficult challenge. We are curious if transformer language models could achieve abstraction, to be part of a system that can help expose innovators to analogies and help them use the analogies to reformulate their problems in generative ways. Our goal in this first step of the project is to systematically investigate whether and how generative language models might be able to generate analogous problem statements.

The language model we study is Generative Pre-trained Transformer 3 (GPT3), a state-of-the-art language model, with some anecdotal evidence of being able to generate complex analogies [2]. GPT3 can conduct text completion tasks based on an input prompt which is referred to as "prompt programming". The prompt can include several examples to show GPT3 the structure and content of the expected output (few-shot learning) or even no examples (zero-shot learning). As an initial step, we study the prompt design for GPT3 to improve the quality of generated analogies.

Our design iterations revealed that providing a structure of the input problem and the output analogy by dividing a design problem into four components—stakeholder,

context, goal and obstacle (see Figure 1)—led to higher quality outputs. It also enabled us to balance the distance (stakeholder and context are different) and usefulness (goal and obstacle are similar) of the generated analogy:

> "I want you to generate a new situation that has a very different x (stakeholder, context) but very similar y (goal, obstacle) as the output."

An example of input problem and output analogy is shown in Figure 1. Our next step is to study how people perceive and use the problem analogies generated by GPT3 in problem solving tasks. Our pilot studies suggest that a large proportion of GPT-3's outputs appear to be usable a priori for stimulating problem reformulation and finding analogous ideas. This impression also seems to bear out in the evaluation task, although there are some substantial individual differences in responses to the analogous statements.

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The Invasion of Vorgaria: A Task and a Platform for Studying AI Supports of Team Cognition in Intelligence Shift Handovers

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With the increase in the volume and velocity of information, team problem solving has become even more challenging. The development of artificial intelligence (AI) tools to facilitate information management and team cognition is in its infancy. The goal of this project was to develop a platform and research paradigm for studying team problem solving in the context of intelligence analysis shift handovers, specifically, and the potential role of AI.

We created an experimental platform, a fictional world and an intelligence task, and questionnaires to measure problem solving success and team cognition such as shared mental models, transactive memory systems, and inaccuracy blindness with regards to the prior analyst in the shift handover.

Experimental Platform

We developed a flexible web-based platform to enable training and screening participants and testing different AIs. The platform presents resizable frames that contain: a clickable directory of documents, a view pane for displaying a selected file, an area for collecting measures via prompts, an area that integrates/displays Qualtrics surveys, and a scratchpad to record notes (Figure 1). The platform supports participant search and copy-paste. It captures keystrokes, timestamps, and the contents of the scratchpad, and it has a timer at the top. The participant's progression is controlled through timed interactions. Importantly, the platform is adaptable: It can be configured to display customizable tasks, materials, interventions, and measures.

The Fictional World and Task

To avoid issues with real-world examples, we created a fictional world involving a former empire, Stradikovia. The participant plays the part of an intelligence analyst in the breakaway country Vorgaria. For this task, the participant receives a shift handover document on troop movements within Stradikovia from a previous analyst, who is
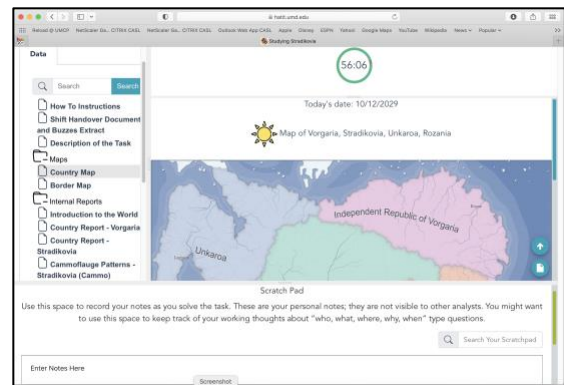

Figure 1 – The study platform

concerned about an impending invasion. We created dozens of documents for participant review: country reports, emails, maps, social media posts, news articles, and memos. At timed intervals, requests for information from a superior and new data appear, simulating a busy, information-overloaded environment. For our first study, half the participants have an AI named Illuminate, indicated with a sun icon, which displays document summaries and topic models of social media posts.

Currently, our AI interventions are static experimental manipulations, but we will test more sophisticated AIs as funding allows. Future studies can also leverage the flexibility of the platform to change the task and materials.

Considering Creativity in Artificial Intelligence and Work

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AI is used daily to complete work tasks, and some worry about human relevance in the workforce of the future. Research has looked at the impact of AI in areas like manufacturing, fast food service, and sales check-out. Much of this and related research points to a need for concern among employees of fields with repetitive, easily-automated tasks, while some show that the impacts to knowledge work will be stronger than previously believed. I conduct a document analysis using data from O*Net and documents related to AI's creative capabilities to determine if creative occupations should be examined for susceptibility to AI intrusion and contrary to assumptions, creative work might not be much safer. Findings show overlap between creative requirements in occupations and creative abilities of AI and indicate that it may be prudent to take a more nuanced look at how occupations requiring creativity will be impacted by AI.

Exploring Presentation Interaction Effects on Mechanism of Inspiration from Diverse Examples

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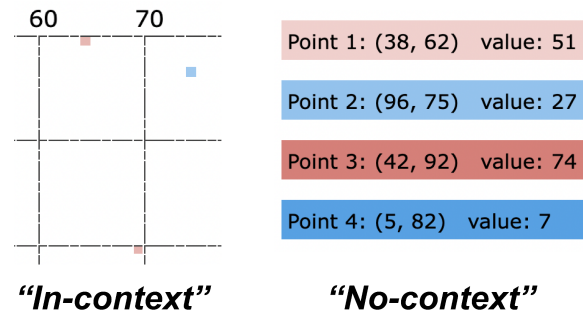**Contact: ding@umd.edu**

Figure 1 "In context" interface (left) with small pixel examples shown in the 100x100 grid and "no-context" interface (right) with examples shown in a scrollable list on the right instead of the grid.

Interactive systems that facilitate exposure to diverse examples can substantially augment designers' creative performance [1, 2]. However designers of such systems are often faced with many practical design decisions with little clear theoretical guidance, such as showing examples in a feed vs. a small curated subset via recommendation, or what information to present alongside an example.

To investigate whether and how example interaction design choices might influence the degree to which people benefited from diverse examples, we conducted a controlled experiment with 121 participants. This experiment adopted a format of stylized design task: we gave people the task of searching for treasure in a 2D grid as shown in Figure 1. Participants were given a set of 10 examples as starting points, and we varied both the diversity of examples and the types of presentations: 2 (diversity: low vs. high; within-subjects, counterbalanced) x 2 (presentation: in-context vs. no-context, between-subjects). We designed this task paradigm to give us a high degree of control over properties of the task (complexity, difficulty) as well as direct comparability between examples. This 2D search task was also the same task as in [3], giving us comparability with previous results on creative problem solving.

Our findings were twofold. First, the in-context interface was associated with better design performance, regardless of example diversity; this advantage held overall, but was especially prominent early on. Second, the in-context interface was associated with different example usage strategies: more "no-context" participants did hillclimbing for the first 30 moves with low-diversity examples than other combinations of the presentation and example sets, and "in-context" participants self-reported more model-based usage of examples compared to "no-context" participants. These findings suggest that in-context presentation of examples may maximize their positive impact on design ideation.

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Cluster 5: Accessible and Interactive Design

| Paper Title	Presenting Author
NoteWordy: Investigating Touch and Speech Input on Smart-phones for Personal Data Capture	Yuhan Luo
Promoting Inclusion Through User-Selected Materials in Participatory Design	Salma Elsayed-Ali
FabHydro: Printing Interactive Hydraulic Devices with an Affordable SLA 3D Printer	Zeyu Yan
Understanding and Supporting Self-Tracking App Selection	Jong Ho Lee
FormA11y – A Tool for Making PDF Forms Accessible	Jonathan Lazar
DocDancer: Authoring Ultra-Responsive Documents With Layout Recommendations	Yuexi Chen

NoteWordy: Investigating Touch and Speech Input on Smartphones for Personal Data Capture

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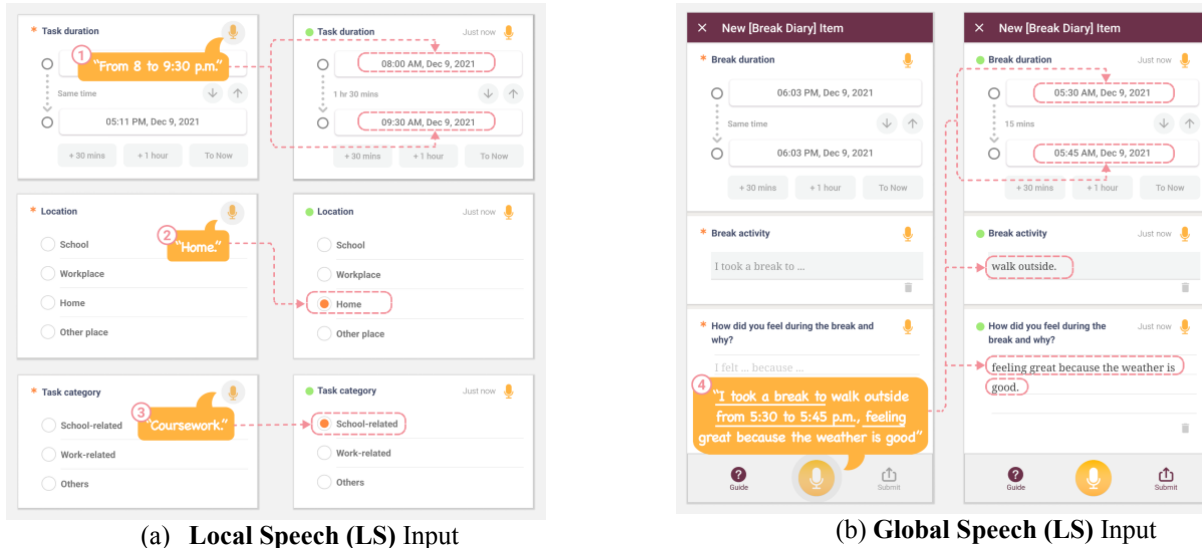
(a) **Local Speech (LS) Input**

(b) **Global Speech (LS) Input**

Figure 1. NoteWordy integrates touch and speech input to support people to capture different types of data. With touch input, people can pick time points, select multiple choices, and type text. With speech input, they can capture a single data field by pressing on the local speech (LS) button placed on that field ① ② ③, or multiple data fields together by pressing on the global speech (GS) button at the bottom center ④ (the keywords that helped the system segment and extract the information are underscored).

Speech input has been rapidly integrated into our daily life, ranging from speech-to-text services to natural language interfaces (NLIs) that respond to user intent. As a natural and low-burden input modality, speech has showed a great potential to support flexible and fast data capture. However, little is known about how people use speech input, together with traditional touch input, to capture different types of data in self-tracking contexts.

In this work, we designed and developed NoteWordy, a multimodal self-tracking application integrating touch and speech input. NoteWordy allows people to manually capture their data with touch input and offers two options for speech input: **local speech (LS)** input for entering one data field at a time (Figure 1(a)), and **global speech (GS)** input for entering multiple data fields at once (Figure 1(b)). We created two diaries, Productivity Diary and Break Diary in NoteWordy, and deployed them to 17 working graduate students in the context of productivity tracking for two weeks. In general, participants preferred touch input for capturing structured data, especially multiple choice and Likert scale questions, and preferred speech input for capturing free-form text. To capture timespan, participants frequently used both touch and speech input. Some participants praised the convenience of GS for capturing multiple data, while others felt more comfortable with LS or touch input. Additionally, we found that speech input reduced participants' time spent on completing the diary entries and enhanced the richness of free-form text. Drawing from the findings, we discuss opportunities for supporting more efficient personal data capture with multimodal input and implications for improving the user experience with natural language input to capture various self-tracking activities.

Promoting Inclusion Through User-Selected Materials in Participatory Design

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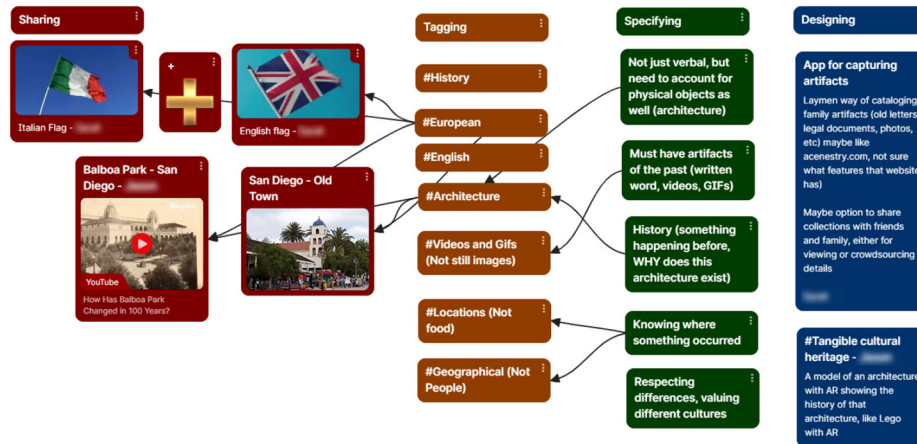College of Information Studies
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Figure 1 – Shared digital canvas and activities to scaffold the Participatory Design sessions

Participatory Design (PD) is an approach to involving end users throughout the system design process. While committed to empowering users to fuller participation and cooperation, PD in practice often falls short of its inclusive ideals. One way that PD may not live up to its ideals is when the materials are not situated in a context relevant to users. These generalized materials are frequently ascribed to users despite being imbued with sociocultural associations [2], values, assumptions, and ideas [1] that may undermine what users can contribute. For instance, previous work has found that ideation materials such as colored sticky notes and markers can make users feel belittled and raise skepticism [2]. Further, users may prefer to draw on intangible artifacts such as personal narratives and memories over tangible objects in their designs [1]. Thus, there is a need to give users more control and flexibility over the materials they design with.

In this study, we are interested in examining what happens when users bring in their own materials to design with. What sorts of materials do users bring in? How do users incorporate their own materials and other's materials in their designs? To explore these questions, we created a sociotechnical system to scaffold the process of users bringing in their own design materials, and then using these materials to refine the design problem and co-design solutions. Our system consists of a shared digital canvas with multimedia support and a series of participatory activities drawing on personal and found objects users contribute. To gauge its effectiveness and transferability across settings, we plan to evaluate this system in a series of case studies focused on cultural heritage preservation and Internet of Things.

Our goals are to enable partners to enact core aspects of their identity and lived experience in the design process; emerge with a sense of self-efficacy and power over their designs; situate themselves better with respect to the design context; and recognize the viability of everyday objects as design material.

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FabHydro: Printing Interactive Hydraulic Devices with an Affordable SLA 3D Printer

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Figure 1 – *FabHydro*: a) an off-the-shelf SLA printer with a modified tank and printing plate; b) a complete hydraulic device produced by *FabHydro*; c) a bending actuator is activated by an automatic generator; d) a printed lamp lights up with the change of its posture; e) a phone stand acts as an ambient display when the phone rings.

One of the long-term visions for additive manufacturing is to print devices with functionalities and interactivities [1]. For example, recent research has shown different approaches to print interactive components, including 3D speakers that generate sound with diaphragm coating, light bulbs that are printed with custom light channels using transparent material, and touch sensors with conductive thermoplastic. They allow 3D printed objects to have sound, light, and sensing capabilities, but these printed objects cannot move.

In this work, we propose *FabHydro*, a set of fabrication methods to democratize the printing of hydraulic-driven mechanical devices with consumer-grade 3D printers that cost less than 200 US dollars. Our core idea centers on low-cost stereolithography (SLA) printers, which can produce both stiff and flexible structures from a selected photosensitive resin in one printing process.

We first present the overall strategies and the printing material selections that warrant the successful print of flexible and deformable structures. These structures require special printing supports to overcome the local adhesive force formed at each new layer that may cause failed printing. We then detail two optional printing processes that seal the hydraulic liquid inside. With the first process, *Submerged Printing*, the entire hydraulic device, including the mechanical and the fluid inside, can be printed all at once. This is suitable for printing hydraulic prototypes for fast design iteration, as the printed device requires no manual assembly and is ready to test out-of-the-printer. The second process, which we called *Printing with Plugs*, allows the user to fill water or other liquids inside the

printed chamber and seal them with printed plugs as a post-process. The benefit of this method is that it requires no hardware modification to the printer. Following the printing methods, we provide a systematic design space and guidelines to use hydraulic components as building blocks. These building blocks include the printed hydraulic generator, transmitter, and actuator. We present geometric parameters and constraints of them based on a series of controlled mechanical experiment. The design guidelines can help users go through a successful design of a complete hydraulic device. To highlight the potential of *FabHydro*, we showcase a series of 3D printed examples: see Figure 1 c), d), e).

In summary, FabHydro contributes: (i) a set of new methods to print flexible and deformable structures with two liquid sealing techniques; (ii) a systematic design space for a complete printed hydraulic device; and (iii) multiple functional applications showcasing how the building blocks in the design space can be featured in hydraulic systems and various use cases of interactive hydraulic devices.

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Understanding and Supporting Self-Tracking App Selection

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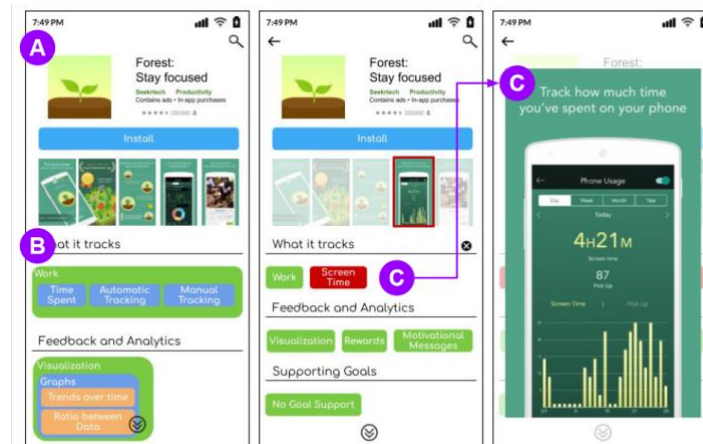**Contact:** jlee29@umd.edu

Figure 1 – A low-fidelity sketch that surfaces attributes of self-tracking apps in an app marketplace. (A) shows the general description of the app, (B) shows how tags describe features related to attributes of self-tracking, and (c) shows how screenshots can be shown to further describe what each tag means.

Personal tracking apps have the potential to improve people's lives such as managing chronic symptoms or achieving personal fitness goals. Despite the potential benefits of self-tracking apps, past literature highlights that people abandon tracking tools when they do not align with their expectations. Furthermore, there is limited knowledge in how people search for and select self-tracking apps, and how technology can support the process. To address this gap in knowledge, we identified important attributes people prioritize in self-tracking tools by reviewing prior literature. We then conducted semi-structured interviews with a low-fidelity prototype (Fig. 1) to understand self-tracking app selection and identify opportunities for support.

Drawing on related publications in personal informatics, we found seven attributes that people prioritized when using self-tracking tools: *data collected*, *feedback provided*, *goal-setting capabilities*, *privacy*, *social opportunities*, *style*, and *convenience*. After identifying the seven attributes, we developed a low-fidelity prototype that surfaces features pertaining to these attributes in a tag-based format (Fig. 1). The tags summarize an app's feature using few words and

are organized in a hierarchical manner, where the details are presented on-demand.

From our interviews, we found that trying out, or *trialing*, apps was an important process that people did when learning more about the apps. However, people sometimes had to resort to imagining how the apps will provide feedback since self-tracking apps require some accumulated data to produce insights. Furthermore, we find potential in a tag-based format as participants appreciated the succinctness of the tags and the ability to filter apps by features.

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FormA11y - A Tool for Making PDF Forms Accessible

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The Portable Document Format (PDF) enables documents to maintain consistent layout and styling across platforms and thus they are widely used in education, healthcare, government, and financial settings. PDFs are often not born-accessible – this means after creating a document, the document authors need to put in extra work to make it accessible for people with disabilities. Unfortunately, document authors often skip this part and as a result, a large number of PDF documents present on the internet are inaccessible to users with disabilities.

As an increasing number of research articles document the need for PDF accessibility [1] there has been an increase in the work done to improve the tooling for PDF remediation [2]. However, PDF documents come in different types, and the existing research has mostly focused on the accessibility of long-form or scientific PDF documents meant for reading. This research and development project focuses on a different type of PDF document—forms—where the end-user is expected to interact with the PDF document and enter data.

Existing research and tools do not yet address the challenges encountered by document/content creators in remediating PDF forms. These challenges include – 1) *the process of remediation is non-intuitive*: remediating a single form field can involve multiple steps which are hard to guess without prior knowledge of PDF form accessibility, 2) *the process is repetitive*: a form can have hundreds of fields, and thus a person would need to perform the same operations repetitively to make form accessible, 3) *forms have high information density*: many forms are densely packed with text and graphical information, so their remediation is cognitively demanding. Our research addresses these issues through the development of a form remediation tool – FormA11y.

FormA11y

The tool aims to make the repetitive and painstaking process of form remediation easier by leveraging machine learning models (for semantic segmentation, hierarchy detection, and bulk operations). FormA11y is an interface between ML models and the user. It allows users to review model suggestions, make changes to them, and use the changes to improve model suggestions in the remaining form.

The research work for FormA11y is in progress. We have interviewed PDF form remediation experts to understand their needs and iterated over the tool's design while incorporating engineering and pilot user feedback. Currently, we are actively prototyping the tool which will eventually be validated through a user study. Figure 1 shows a screenshot of our current prototype.
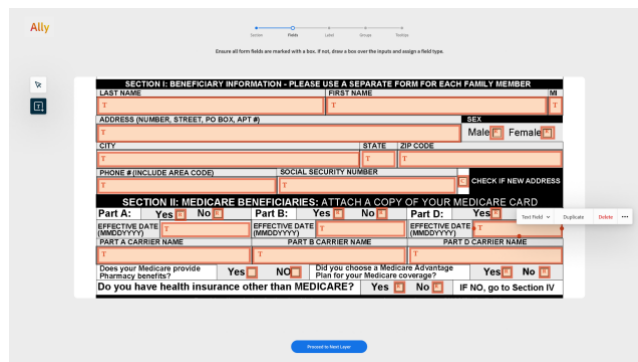

Figure 1 – FormA11y tool being used for adding fields to a form.

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DocDancer: Authoring Ultra-responsive Documents with Layout Recommendations

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Responsive design optimizes user experience by adapting layout and content to different display factors. However, existing tools for authoring responsive design primarily adapt to screen width only, and they either rely on predefined templates or require significant manual effort. To facilitate more expressive responsive designs, we introduce an ultra-responsive document model that allows multiple factors to affect both layout and content changes. This model treats design variations as instantiations of a document tree, where layout and content are customized based on responsive factors. We implement the ultra-responsive document model in an authoring tool called DocDancer, which supports designers interacting with multiple responsive factors via direct manipulation, enables designers to perform localized edits of content and layout, and provides responsive layout recommendations. A comparison user study with 16 participants shows that authoring responsive documents in DocDancer takes significantly less time and effort than a commercial tool for responsive design. A second user study with 9 participants on advanced features shows the ultra-responsive concept resonates with designers, and the workflow of creating ultra-responsive documents in DocDancer is effective.
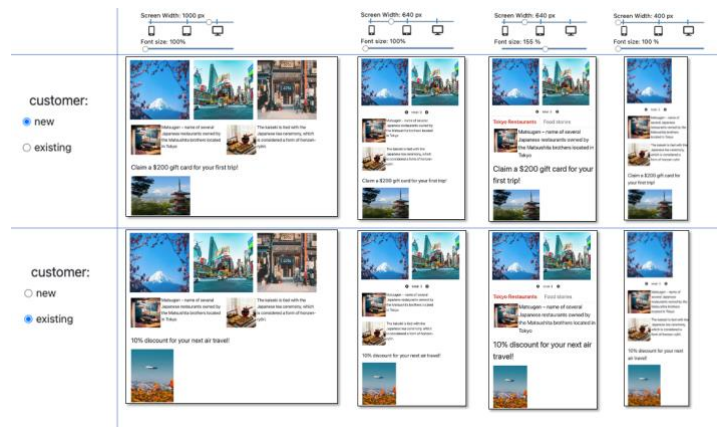

Figure 1 – Previews of an ultra-responsive document. They are eight different versions of a sample marketing newsletter of a travel agency, with varying layouts and unique content designed for different screen widths, font sizes, and customer types. Our tool DocDancer uses a single unified representation for all versions that designers can edit and preview easily.

Cluster 6: Communication and Collaboration

Paper Title	Presenting Author
Self-Presentation via Social Media Cross-Posting	Xiaoyun Huang
Enabling Difficult and Productive Conversations	Tammie Nelson
Mystique: Toward Interactive Reuse of Existing SVG Examples for Easy Chart Authoring	Chen Chen
Understanding and Supporting Collaborative Writing in Multilingual Teams	Yimin Xiao
How Do Nonprofit Organizations Involve Beneficiaries in the Design of Mission Programs and Services?	Sarah DiPasquale

Self-Presentation via Social Media Cross-Posting

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Social media has become a ubiquitous part of people's everyday lives, and people increasingly adopt multiple social media platforms that serve different self-presentational goals. Data from the Pew Research Center shows that 73% of the American adults use multiple social media platforms [1]. Self-presentation across multiple social media platforms is complicated and challenging, in part because people must navigate multiple tensions: they must understand how norms vary across each space, become familiar with the technical features and affordances for each platform, and manage audiences on and across these platforms [2].

In this study, we sought to understand how people navigate their self-presentation across their social media platforms by focusing on cross-posting, which we define as *the act of posting about the same thing to multiple social media platforms*. We focus on cross-posting because it is a clear example where the tensions of self-presentation are peaked. People need to re-evaluate their self-presentation goals and the norms of self-presentation on each of the platforms they cross-post to, figure out the features and affordances that support cross-posting (or not), and evaluate their desired audience for the cross-post vs. the actual audience who can see the cross-post. This study also extends the limited research on social media cross-posting, most of which used large-scale datasets to quantitatively measure the macro patterns of people's posting behaviors without answering the "why" questions that will help unpack the practice.

To the best of our knowledge, our study is the first to look at rationales behind social media cross-posting and specifically focuses on people's self-presentation goals and challenges negotiated in the process.

How We Assessed Cross-Posting Practices
We conducted interviews with 15 social media users who regularly cross-post to multiple platforms. We identified that the primary goal of cross-posting is to have the content reach the desired audience. Participants were aware of who their audiences were on different social media platforms. Some of them used platform insight tools to enhance their understanding of audiences, although this was generally limited to participants who sought a wider reach, such as podcasters and aspiring content creators.

When cross-posting, participants ensured they presented themselves properly to different audiences on different platforms. They carefully evaluated what to cross-post and often defaulted to cross-posting "safe" content, e.g., content they wanted to promote as content creators or for marketing purposes, or content appropriate for different audiences. They experimented with various features supporting cross-posting and made their decision on how they wanted to cross-post to present themselves in the best light, via these features or manually. They usually cross-posted from their primary platforms to other platforms where their desired audience resided, and where the content would be viewed as appropriate. They drafted the content to address the relevant audience and to accommodate different platform features.

Based on this data, we argue that social media cross-posting can be highly useful in connecting with large and diverse audiences that are not confined within a single platform. We also identify usability issues with existing platform features that support cross-posting and incompatibility issues of different platforms and different devices.

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Enabling Difficult and Productive Conversations

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We find ourselves in a time of highly publicized and sometimes dangerous divides and polarization. Simultaneously, we are being presented with an increasing slate of problems that can only be solved if we work together: pandemic, climate change, the impacts of systemic racism… Conflict presents opportunity. Productively working through difficult conversations where our viewpoints clash allows us to learn together and move towards solving our social and civic challenges.

However, discussion of controversial topics is frequently characterized by simplistic side-taking with escalating animosity, rather than productive problem solving. Humility, empathy, compassion, and perspective-taking of other people's lived experiences are often missing. When pushed to express an opinion, we are prone to dichotomous thinking, which keeps us from acknowledging the complexity and nuance of issues.

To address this, hundreds of organizations have formed, with the mission of civic bridge-building: conducting events that aim to establish respect and strengthen relationships across lines of difference. These organizations have an increasingly diverse menu of structured face-to-face experiences, both in-person and through virtual video conferencing platforms. However, despite these efforts, the divide continues to trend in the wrong direction [1], potentially reaching a tipping point from which polarization becomes irreversible [2]. My working hypothesis is that conversational interventions deployed by these organizations are not propagating to where most difficult conversations are actually happening, and modifications and adaptations are needed to achieve the scale of impact needed to address the problem. My dissertation tests this working hypothesis with a series of formative studies to understand how to increase the scalability and durability of bridge-building practices.

Recognizing the value of tacit knowledge and practitioner experience, for the first study of my dissertation I conducted a semi-structured interview study of 18 subject matter experts representing 15 bridge-building organizations. Applying grounded theory analysis, I have created a framework that illustrates the core working principles of their practices (see Figure 1). I have identified common ground and higher order solutions as end states; trust, intellectual humility, genuine curiosity, and

acknowledging complexity as intermediate states; and ground rules, facilitation, event structure, and storytelling as primary interventions used in these events. I have also identified inner work that amplifies the effects of these efforts, and derailers which impede these effects.
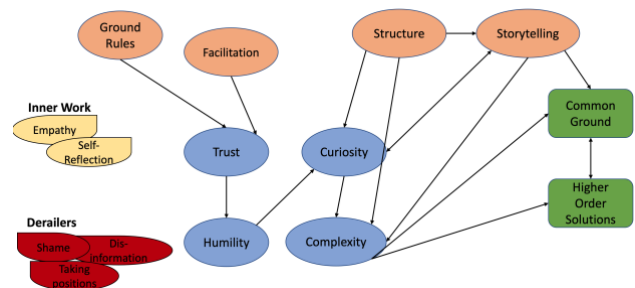

Figure 1 - Framework for Difficult and Productive Conversations

As a follow-up to my interview study, I plan to perform an analysis of a survey of bridge-building organizations (n=260), collected by the Listen First Project [3]. I will review my framework with study 1 participants and will perform a content analysis of ground rules, event guides and prompts, and structured workshop exercises, which I will collect from participants during this second interaction. My final formative study will be an autoethnography based on my five years of immersive experience as a participant in events held by civic bridge-building organizations.

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Mystique: Toward Interactive Reuse of Existing SVG Examples for Easy Chart Authoring

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In recent years, interactive authoring tools for data visualization, such as Lyra, iVisDesigner, Data Illustrator, and Charticulator, have emerged to enable the creation of bespoke charts without requiring programming knowledge and skills. However, they expect users to understand the underlying framework or grammar, and be able to use these building blocks to compose charts. Furthermore, the authoring process always starts with an empty canvas, which is not helpful if users do not have a specific design in mind.

Compared to starting from scratch, modifying and re-purposing an existing visualization are more natural to most visualization creators, and offer many benefits. Existing visualizations serve as concrete examples to inspire design ideas in terms of encodings, layouts, and visual styles. The authoring process can also be greatly simplified if supported by an effective tool.

Previous research on reusing existing charts assumes the examples are created using specific tools like D3.js or Microsoft PowerPoint. To broaden the scope of reusing examples, we argue that SVG (Scalable Vector Graphics) is a better input format because of two reasons: (1) it is a universal, tool-independent format and is supported in most charting libraries and systems, (2) every visual object in the chart is unambiguously specified as an SVG element: this is not true in raster images, where shapes have to be segmented and recognized.

We present *Mystique*, an interactive chart authoring tool for building expressive data visualizations using SVG examples. Unlike existing interactive authoring builders, with which a chart is created from scratch, Mystique enables the authors to start with an existing SVG chart composed of rectangle marks to reuse its semantic structure and visual styles. Mystique starts with preprocessing the input SVG example and extracting axes and legend, and then deconstructs the main chart content into four semantic components: *grouping*, *parametric layouts*, *encodings*, and *graphical constraints*. Based on this deconstruction result, Mystique provides a wizard interface to guide the user through a series of steps to specify mappings between data attributes and visual objects or channels, which leads to a new visualization. Through this process, visual styles from the input SVG are also preserved. We also present a chart re-production study conducted to evaluate the usability of Mystique. The participants were able to create new charts in a few minutes with Mystique by reusing the examples given to them.

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1. Chen Chen, Bongshin Lee, Yunhai Wang, Yunjeong Chang, Zhicheng Liu. Mystique: Toward Interactive Reuse of Existing SVG Examples for Easy Chart Authoring. Under submission.
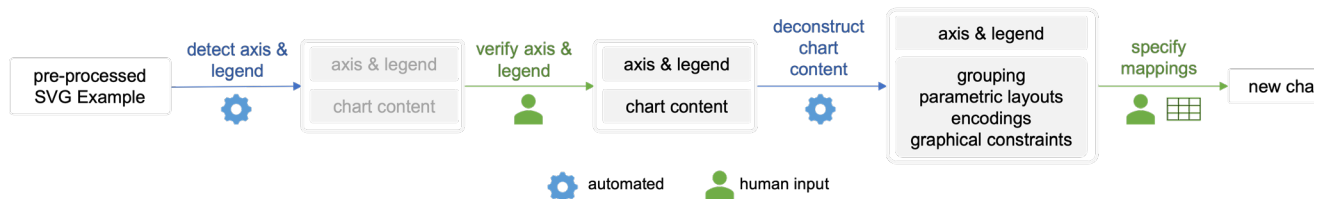

Figure 1 – The end-to-end pipeline for reusing an SVG example to create a new chart in Mystique.

Understanding and Supporting Collaborative Writing in Multilingual Teams

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Multilingual teams consist of people who come from different language backgrounds but perform collaborative tasks, such as writing, using a common language. While the common language (e.g., English) is native to some of the team members, others may not have a sufficient level of English proficiency to communicate. The imbalanced proficiency among team members frequently results in a lack of shared mental model and delayed solutions to collaboration issues.

In the current project, we ask two research questions: (1) What challenges do multilingual teams experience in the context of collaborative writing? (2) What are the potential design solutions to improve multilingual teams' coordination experience and outcomes?

Study Design
We conducted an online experiment with 29 multilingual teams each consisting of one native speaker (NS) of English in the United States and one non-native speaker (NNS) in Japan. Participants were asked to perform an English writing task via Google Docs over 5 days. Figure 1 illustrates the step-by-step workflow of the task.
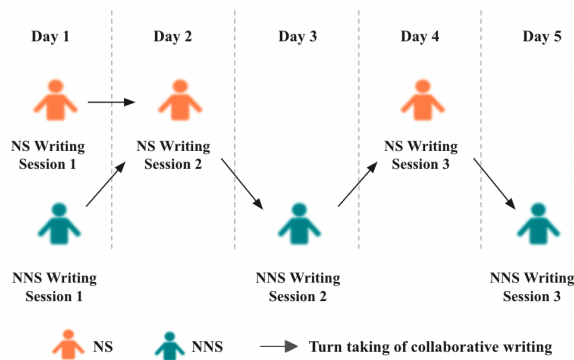

Figure 1 – The complete workflow of the collaborative writing task performed by participants. On Day 1, NS and NNS of the same team each drafted their initial responses to our writing prompts separately. From Day 2 to Day 5, they took turns to integrate and edit the writing product as a team.

We collected data that captured multiple aspects of participants' task experience and outcomes. Specifically, we asked participants to self-record their writing sessions, then share the recordings with us for analytical purposes. By the end of each turn-taking, participants completed one follow-up survey that asked for their collaboration experience with the teammates (e.g., the amount of contribution made by each person on the team, the amount of coordination required at the team level). By the end of the entire task, we surveyed and interviewed participants to learn about their overall experience over the past 5 days and any potential suggestions to improve multilingual teamwork in the writing context. In addition to the self-reported data mentioned above, we collected essays generated via the Google Docs as an objective measure of each team's writing outcome.

Preliminary Findings
Currently, we have identified the following findings from participants' writing session recordings and interview responses.

- NNS members of a team often produced less content on Google Docs than their NS partners. The video recordings showed that NNS spent much effort translating the task instructions and other information between English and Japanese, which left them less time for writing.
- NS members of a team often underestimated the language-related challenge faced by their NNS partners. As a result, members of the same multilingual team tended to evaluate their collaboration experience differently.

Next Steps
We will analyze participants' survey responses and writing products to pinpoint where the collaboration in multilingual teams went wrong. We will also draw insights from the interview data to outline design suggestions for quality teamwork in a multilingual setting.

How Do Nonprofits Involve Beneficiaries in the Design of Mission Programs and Services?

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There are nearly 115,000 human service nonprofits in the United States. More than half design programs and services intended for the public who may be experiencing homelessness, food insecurity, job loss or other hardships. Although human service nonprofits play an important role in providing vital services to our communities, little research has been done to understand how human service nonprofits involve beneficiaries in the design of these services (Amann & Sleigh, 2021; Benjamin, 2020; Bopp & Voida, 2020). Likewise little research has been done to understand what barriers human service nonprofits may face to engaging beneficiaries in the design of services through methods like participatory design.

Participatory design could be a valuable method for involving beneficaries because of the potential to increase beneficiaries' influence over decision-making, increase the quality of programs, increase nonprofit advocacy efforts and overall increase the likelihood of workplace democracy within a human service nonprofit. Despite these benefits, when participatory design methods are used they appear to be mostly used in the evaluation of phase of programs (Campbell, 2010; Fine et al., 2000; MacIndoe & Barman, 2013). The barriers for not using participatory design to engage beneficaries in the design of programs remain are unclear. Some research suggests there is not enough guidance to train nonprofits to use this method, while other studies mention possible constraints related to capacity, though these are often limited to observations in the paper discussion sections and do not go into detail.

Through semi-structured interviews conducted with nine human service nonprofit professionals, this research sought to better understand how human service nonprofits involve beneficiaries in the design and development of service programs, and what barriers exist for human service nonprofits to do participatory design. Our research argues participatory design can be used to engage beneficiaries in program design.

We found human service nonprofits interviewed for this study are doing participatory design at varying levels.

Participants that reported doing medium and high levels of particiatory design were doing so with the support of external experts and consultants. We also found human service nonprofits in this study face barriers that may stop them from doing participatory design. These barriers included concerns for staff capacity and funding, though the funding concerns were only mentioned by one participant. We also found a broader theme about nonprofit narratives that may also explain barriers to doing participatory design. These narrative themes included: defining who is responsible for developing solutions in client burden; deciding who the organization is accountable to in mission drift; understanding how client trust impacts nonprofits' ability to provide useful services; and cultivating awareness of reactionary versus proactive mindset in day-to-day operations.

These research findings provide a foundational understanding of how human service nonprofits are using participatory design: nonprofits are doing variations of paritcipatory design, with external experts; and uncovers barriers to help inform the solutions necessary to increase participatory design use at human service nonprofits: while a few staff capacity and funding concerns were identified; many of the constraints were related to narratives human service nonprofits believe about their role as service providers and the role of beneficiaries as service recipients.
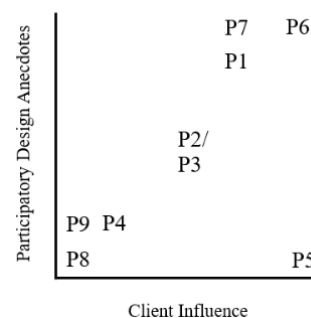

Figure 1 - Variations in Participatory Design

HCIL Honors and Awards

On the following pages, we celebrate some of the awards and honors that HCIL faculty and students have received in the last year.

Awards for research papers	
Eun Kyoung Choe	Honorable Mention at CHI for "Data@Hand: Fostering Visual Exploration of Personal Data on Smartphones Leveraging Speech and Touch Interaction" https://doi.org/10.1145/3411764.3445421
Eun Kyoung Choe and Young-Ho Kim	Best Paper Award & Methods Recognition at CSCW for "Reflect, not Regret: Understanding Regretful Smartphone Use with App Feature-Level Analysis" https://doi.org/10.1145/3479600
Alisha Pradhan and Amanda Lazar	Best Paper Award from TOCHI for "Use of Intelligent Voice Assistants by Older Adults with Low Technology Use" https://doi.org/10.1145/3373759
Alisha Pradhan and Amanda Lazar	Provocation paper honorable mention at Conversational user interfaces (CUI) for "Hey Google, Do You Have a Personality? Designing Personality and Personas for Conversational Agents" https://doi.org/10.1145/3469595.3469607
Utkarsh Dwivedi, Jaina Gandhi, Raj Parikh, Merijke Coenraad, Elizabeth Bonsignore, and Hernisa Kacorri	Best Paper Honorable Mention at IEEE VL/HCC for "Exploring Machine Teaching with Children" https://arxiv.org/pdf/2109.11434.pdf
Ebrima Jarjue, Hernisa Kacorri, and coauthors	Best Paper Nominee at ACM ASSETS for "ViScene: A Collaborative Authoring Tool for Scene Descriptions in Videos" https://doi.org/10.1145/3373625.3418030
Michelle Mazurek, Rock Stevens, and coauthors	Honorable Mention at CHI for "How ready is your ready? Assessing the usability of incident response playbook frameworks" https://doi.org/10.1145/3491102.3517559
Michelle Mazurek and coauthors	Distinguished Paper Award at USENIX Security for ""It's stressful having all these phones": Investigating sex workers' safety goals, risks, and practices" https://www.usenix.org/conference/usenixsecurity21/presentation/mcdonald
Cody Buntain and coauthors	Best Paper Award as ISCRAM for "Incident Streams 2020: TRECIS in the Time of COVID-19" https://trec.nist.gov/pubs/trec29/papers/OVERVIEW.IS.pdf

Rie Kamikubo	Simmona Simmons Best Student Paper on Diversity Award, UMD iSchool, "Sharing Practices for Datasets Related to Wellness, Accessibility, and Aging"
Utkarsh Dwivedi	Dean's Award for Outstanding iSchool Doctoral Paper, UMD iSchool, "Exploring Machine Teaching with Children"
Sabahat Fatima	First Place Student Research Competition, ACM ASSETS, "Activity Recognition in Older Adults with Training Data from Younger Adults: Preliminary Results on in Vivo Smartwatch Sensor Data"

Major Grant Awards / Funding

David Weintrop	NSF CAREER Award: "Situating Computational Learning Opportunities in the Digital Lives of High School Students"
Jessica Vitak	Facebook: "Transatlantic Privacy Perceptions Panel"
Joel Chan	Implementation Grant, Protocol Labs: "Accelerating Scientific Synthesis with New Authorship Models for Decentralized Discourse Graphs"
Joel Chan	Research Grant, TheGraph Foundation, "Decentralized Discourse Graph for Promoting Synthesis"

Books Published

Ben Shneiderman	Author, "Human-Centered AI," Oxford University Press, 2022. ISBN-13: 978-0192845290
Jonathan Lazar	Editor (with Michael Ashley Stein), ""Accessible Technology and the Developing World," Oxford University Press. ISBN: 9780198846413

Other Achievements

David Weintrop	Mentor of the Year Award, University of Maryland
Susannah Paletz	Elected to Board of Directors, Interdisciplinary Network for Group Research (INGRoup)
Jonathan Lazar	General chair of the ACM ASSETS 2021 conference
Jonathan Lazar	Named new director of the Trace Research and Development Center, University of Maryland

HCIL Student Graduation

Finally, we celebrate the many HCIL students who have graduated over the last year. Students are an integral part of the lab's success, and these students have worked with faculty on a range of important research projects in recent years. Congratulations and good luck to each of these students!

Student Name	Advisor	Graduation Date	Degree
Priya Kumar	Jessica Vitak	May 2021	Ph.D.
Yuting Liao	Jessica Vitak	December 2021	Ph.D.
Kimberly Glasgow	Jessica Vitak	December 2021	Ph.D.
Jonggi Hong	Hernisa Kacorri	December 2021	Ph.D.
Merijke Coenraad	David Weintrop	December 2021	Ph.D.
Marina Cascaes Cardoso	Jennifer Preece	May 2022	Ph.D.
Andrea Batch	Niklas Elmqvist	May 2022	Ph.D.
Yuhan Luo	Eun Kyoung Choe	May 2022	Ph.D.
Emma Dixon	Amanda Lazar	May 2022	Ph.D.
Kausalya Ganesh	Amanda Lazar	May 2021	M.S.
Ebrima Jarjue	Hernisa Kacorri	May 2021	M.S.
Rachael Zehrung	Eun Kyoung Choe	May 2021	M.S.
Shaan Chopra	Eun Kyoung Choe	May 2021	M.S.
Tripti Rajput	Jonathan Lazar	May 2021	M.S.
Debashish Pradhan	Jonathan Lazar	May 2021	M.S.
Matthew Patrick	Eun Kyoung Choe	December 2021	M.S.
Rachel Wood	Jonathan Lazar	December 2021	M.S.
David (AJ) Rudd	Joel Chan	May 2022	M.S.
Jarrett Lee	Eun Kyoung Choe	May 2022	M.S.

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