RESEARCH STATEMENT ANDRÉS MONROY-HERNÁNDEZ

My research aims to revolutionize how people connect and collaborate through computing systems, both inside and outside the lab. My team and I have published and received best-paper awards at the top human-computer interaction venues and created social computing systems used by millions of people around the world. With a decade of experience in the tech industry, I have witnessed firsthand the negative societal impact of power centralization in profit-driven tech platforms. To address these issues, I transitioned to academia to study, design, and develop technologies that empower communities. Working closely with partner organizations, my team at Princeton is designing community-centered technologies along three axes: democratizing (spatial) computing, decentralizing social media, and reimagining the future of (gig) work,

DEMOCRATIZING (SPATIAL) COMPUTING

Past research: social computing to support children as interactive media creators

I began my research career turning end-user computer programming into a more creative and social experience for children and novices. Inspired by the literature on commons-based peer-production (2) and the emergence of participatory culture (10), I created the Scratch Online Community as a space for young people to create and share computational media projects, such as animations and video games (12). The goal of the system was to support a learning philosophy focused on creating instead of consuming (15; 17) and to do this in the context of a community (19).

I led a team of students and staff to grow the Scratch community from zero to over a million online participants in five years. Today, the community has more than *100 million accounts* and is arguably the most widely used online space for children to learn programming.

The Scratch community also became an online laboratory. Along with social science collaborators, we ran several *studies of collaboration* at scale using large datasets from Scratch. For instance, in one study, we found evidence to suggest that children who engage in remixing, i.e., building on prior work, learn a wider range of computational thinking skills (5). However, in another study, we found that children whose work was remixed were unsatisfied with algorithmically generated attribution messages; they expected human-written credit-giving (14). In yet another study, we examined the impact of online collaboration on the quality of the work and found evidence to suggest that collaboration improves the quality of *functional* works like code but that it works less well for *artistic* works like images and sounds(7).

I closed my work on Scratch by enabling others to study collaboration at scale. We published an anonymized dataset of five years of public activity in Scratch the online community. The dataset comprised information on more than 1 million accounts, nearly 2 million projects, and more than 10 million comments (8). Dozens of computational social scientists have used this dataset.

Ongoing research: social computing to support children as augmented reality creators

Today's children are active users of spatial computing applications, i.e., augmented reality (AR). They interact with digital characters in games like Pokémon GO, enhance their videos with AR effects on TikTok, and use AR filters on Snapchat. In fact, my team at Snap and I pioneered some of the first co-located playful AR experiences enjoyed by millions on Snapchat (4; 16). However, these technologies are primarily for consumption. Children aren't often given the chance to create with AR - they can read but not write. We aim to change this.

At Princeton, my team is working on Capybara, a mobile social AR app that empowers children to create virtual

characters that interact with their surroundings. The app uses readily available computer vision technology, allowing children to engage with these characters primarily through the camera, making the physical world the main interaction platform. For instance, children can code their characters to respond to visual cues like a hand, a tree, or another person. The characters' code is visible and can be remixed, fostering social creativity. Capybara gives children control over spatial computing.

We are developing Capybara with a federated social structure, enabling the creation of small, hand-curated communities such as families, peer groups, or schools. These communities can interact with each other if allowed by their administrators, facilitating cross-community engagement. This approach addresses content moderation concerns and empowers communities to establish their own norms.

Our technologies are not developed in a vacuum. Dr. Amna Liaqat, a postdoc in my team, spearheads a collaboration with an Argentinian after-school center. The children and facilitator from the center participate in co-design sessions with our team, influencing the technology's development. Dr. Liaqat's funding comes from Princeton's Presidential Fellowship and the Center for Information Technology and Policy fellowship, while the Argentinian collaboration is supported by Princeton's Program for Latin American Studies.

DECENTRALIZING SOCIAL MEDIA

Past research: crowdsourcing news production on social media

As Scratch and other social computing platforms became more popular, I was intrigued by how they fostered offline collective action. I spent two years studying how Latin Americans used social media to bypass drug cartel censorship (13; 6) and organize government protests (18). As part of this effort, my team and I analyzed tweets from Mexican cities affected by drug violence, discovering that communities self-organized on social media during violent events. We observed the rise of "war correspondents" who aggregated, verified, and spread information (13). Lastly, we observed how people's activity on social media mapped onto offline violence and revealed their "affective desensitization" over time (6). This research received extensive media coverage and allowed me to engage with policy-makers on both sides of the border.

Furthermore, this research helped me identify new opportunities for designing novel social computing systems to support local news. For example, my team and I created and deployed Whoo.ly, a system that automatically identified tweets from a city's neighborhood and highlighted events, topics, people, and places nearby (9). While systems like Whoo.ly performed well in urban areas with high Twitter usage, they fell short in suburban neighborhoods. To address this, we developed systems like Eventful, a crowdsourcing application that creates on-demand reports of local events by leveraging offline crowd workers for information collection at physical locations. We deployed these systems at eleven events across the US (1), but they heavily depended on buy-in from social media platforms.

Ongoing research: decentralizing social media

Much of my local news reporting research relied on social media platforms, which have recently faced criticism for their negative impact on mental health and misinformation spread. After five years of working within such a platform, I found it challenging to align societal needs with the platform's incentives. This led me to explore decentralized social protocols like ActivityPub (used by Mastodon), AT (used by BlueSky), and blockchain-based ones (used by Nostr). Despite their promise and growing adoption, especially of Mastodon, user retention is challenging due to difficulties in discovering relevant content and people. We aim to address this.

My PhD student, Yuhan Liu, and I are studying the use of decentralized social media systems and engineering technology enhancements based on our findings. Findings from our interviews with people using Mastodon indicate

that Mastodon's chronological feed offers user control but complicates content and people discovery. We aim to prototype curation layers on ActivityPub, allowing users to manage their feeds without opaque heuristics. We will test a rules-based approach against a user-configurable recommendation algorithm and evaluate their performance with actual platform users.

With the backing of Princeton's DeCenter and the Center for Information Technology and Policy, we're planning a Spring 2024 conference on decentralized social media involving developers, moderators, and scholars.

REIMAGINING THE FUTURE OF (GIG) WORK

Past research: augmenting information workers with a scheduling chatbot

Around 2015, my team and I began exploring how conversational user interfaces could redefine the workplace, particularly through hybrid intelligence systems that combine human workflows and automation to create digital assistants for information workers.

Despite extensive AI research on digital personal assistants, early work on AI scheduling hasn't been successful due to low tolerance for errors and the need for large amounts of data for effective automation. To address this, we spent two years developing Microsoft's Scheduler, a virtual scheduling assistance service that handles the conversational back-and-forth required for scheduling meetings. The system effectively handled common scheduling scenarios through well-defined workflows and automation where possible–using off-the-shelf NLP—while unusual scenarios were managed by a trained human assistant (3).

The system has successfully automated over 70% of its tasks over time, becoming part of Microsoft Office product offerings and used by many organizations around the world. The insights we gained from this project are more relevant than ever, as large language models make these types of conversational systems more scalable.

Ongoing research: empowering gig workers with decentralized technology

Social computing systems manage much on-demand labor on platforms like Uber and DoorDash, despite societal harms identified by researchers and journalists ranging from exploitation to discrimination. My team and I are developing technology to mitigate these harms.

Firstly, with funding from the Mozilla Foundation and a CITP-funded postdoc, Dan Calacci, we initiated The Workers' Algorithm Observatory, a suite of applications empowering worker organizers to gather crowdsourced data for auditing gig work platforms. We are piloting this with a labor organization in Colorado to understand platform transaction percentages, aiding advocacy for legislative changes.

Secondly, my Ph.D. student Yuhan Liu and I, are developing a platform and protocol to facilitate the creation of locally-owned food delivery services. Our exploratory research indicates that the lack of reliable and interoperable software is a significant barrier for many indie food delivery platforms competing with mainstream platforms (11). For this reason, we are partnering with a restaurant-owned cooperative to create the software infrastructure that will power them and hundreds of other indie platforms. Our federated protocol, OpenDeli, will enable a network of interoperable independent services worldwide that are co-owned by workers and restaurants while exposing their services through various applications compatible with the protocol.

CONCLUSION

I have created effective research teams at MIT, Microsoft, Snap, and Princeton, able to work on research with real-world impact. I look forward to continuing our efforts to engage Princeton students and collaborate with external partners.

REFERENCES

[1] E. Agapie, J. Teevan, and A. Monroy-Hernández. Crowdsourcing in the field: A case study using local crowds for event reporting. *AAAI Human Computation (HCOMP) - Best Paper Award*, August 2015.

[2] Y. Benkler. *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. Yale University Press, Oct. 2007.

[3] J. Cranshaw, E. Elwany, T. Newman, R. Kocielnik, B. Yu, S. Soni, J. Teevan, and A. Monroy-Hernández. Calendar.help: Designing a workflow-based scheduling agent with humans in the loop. CHI '17. ACM, 2017.

[4] E. Dagan, A. M. Cárdenas Gasca, A. Robinson, A. Noriega, Y. J. Tham, R. Vaish, and A. Monroy-Hernández. Project irl: Playful co-located interactions with mobile augmented reality. *Proc. ACM Hum.-Comput. Interact.*, 6(CSCW1), apr 2022.

[5] S. Dasgupta, W. Hale, A. Monroy-Hernández, and B. M. Hill. Remixing as a pathway to computational thinking. CSCW '16 - Best Paper Honorable Mention. ACM, 2016.

[6] M. De Choudhury, A. Monroy-Hernández, and G. Mark. "narco" emotions: Affect and desensitization in social media during the mexican drug war. CHI '14 – Best Paper Award. ACM, 2014.

[7] B. M. Hill and A. Monroy-Hernández. The cost of collaboration for code and art: Evidence from a remixing community. In *Proceedings of the 2013 Conference on Computer Supported Cooperative Work*, CSCW '13, pages 1035–1046, 2013.

[8] B. M. Hill and A. Monroy-Hernández. A longitudinal dataset of five years of public activity in the Scratch online community. *Scientific Data*, 4:170002, Jan. 2017.

[9] Y. Hu, S. D. Farnham, and A. Monroy-Hernández. Whoo.ly: Facilitating information seeking for hyperlocal communities using social media. CHI '13 – Best Paper Honorable Mention. ACM, 2013.

[10] H. Jenkins. *Convergence Culture: Where Old and New Media Collide*. NYU Press, revised edition, 2006.

[11] Y. Liu, A. Liaqat, Z. Xingjian, M. Fernandez Espinosa, A. Yang, V. Nanda, O. Papakyriakopoulos, and A. Monroy-Hernández. Mapping the landscape of independent food delivery platforms in the united states. *Proc. ACM Hum.-Comput. Interact.*, (CSCW), 2024.

[12] A. Monroy-Hernández. Scratchr: Sharing user-generated programmable media. In *Proceedings of the 6th International Conference on Interaction Design and Children*, IDC '07, pages 167–168, 2007.

[13] A. Monroy-Hernández, d. boyd, E. Kiciman, M. De Choudhury, and S. Counts. The new war correspondents: The rise of civic media curation in urban warfare. CSCW '13. ACM, 2013.

[14] A. Monroy-Hernández, B. M. Hill, J. Gonzalez-Rivero, and d. boyd. Computers can't give credit: How automatic attribution falls short in an online remixing community. In *Proceedings of the 2011 annual conference on Human factors in computing systems*, CHI '11, page 3421–3430, Vancouver, BC, Canada, May 2011. ACM Press. ACM ID: 1979452.

[15] S. Papert. *Mindstorms : children, computers, and powerful ideas*. Basic Books, New York, 1980.

[16] S. Reig, E. Principe Cruz, M. M. Powers, J. He, T. Chong, Y. J. Tham, S. Kratz, A. Robinson, B. A. Smith, R. Vaish, and A. Monroy-Hernández. Supporting piggybacked co-located leisure activities via augmented reality. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*, CHI '23, New York, NY, USA, 2023. Association for Computing Machinery.

[17] M. Resnick. Sowing the seeds for a more creative society. *Learning & Leading with Technology*, 35(4):18–22, 2007.

[18] E. S. Spiro and A. Monroy-Hernández. Shifting Stakes: Understanding the Dynamic Roles of Individuals and Organizations in Social Media Protests. *PLOS ONE*, 11(10):e0165387, Oct. 2016.

[19] L. S. Vygotsky. *Mind in Society: Development of Higher Psychological Processes*. Harvard University Press, 14th edition, Mar. 1978.