

Generative, Malleable, and Personal User Interfaces

Haijun Xia

haijunxia@ucsd.edu

Foundation Interface Lab

University of California, San Diego

Abstract

The overarching research question that our lab is exploring is: What are the foundational principles for an information environment in which human cognition and digital computation are seamlessly integrated? We argue that recent advances of AI and paramount of HCI research both point to a need to redesign the underlying structure and behavior of the information environment. The generative, malleable, personal, and activity-centered information environment we are exploring could serve as a promising foundation to enable productive and convivial interaction with information. We believe that now is a critical moment of opportunity the HCI community must seize to explore interface paradigms that align with human cognitive abilities, to free us from the legacy application-centered paradigm that we have locked ourselves in for the past 50 years, and to avoid slipping into other convenient and yet limiting ones.

1 Introduction

Every revolutionary technology, though destined to fundamentally transform society, initially struggles against the inertia of path dependency when first introduced. This pattern is evident in the adoption of generative AI within our digital information environment. Today, significant efforts are devoted to integrating AI into applications, often in the form of chatbots designed to address domain-specific problems.

One of the key path dependencies shaping these efforts is the prevailing application-centric approach to developing information systems. Issues with this approach manifest at two levels. First, as Engelbart observed, systems and applications are often designed for “*large statistical populations*”. While this strategy is economically efficient, it inevitably fails to accommodate the diverse needs and abilities of individual users. In trying to serve everyone, it has led to both a proliferation of homogeneous applications with minor variations and bloated software overloaded with features. Second, at the level of information activities, our information environment provides limited interoperability and coordination across applications, resulting in fragmented workflows. As Bonnie Nardi observed, the application-centric paradigm “*does not reflect the complexity, flexibility, and sociality of human activity*”. Put simply, the path that our AI integration effort is depending on is not a promising one.

We are developing a new interface paradigm, which we call Generative, Malleable, and Personal User Interfaces. Our goal is to create an activity-centered information environment where interfaces can be dynamically generated based on a user’s context and can flexibly adapt or evolve to meet individual needs and preferences. An exposition of our vision can be found in Haijun’s talk at the Stanford HCI Seminar at January 2025¹

2 Research Team

We are pushing on this vision with the following members of the Foundation Interface Lab at UCSD. Several are here at CHI 2025, and we are looking forward to discussing these ideas with you all.



Yining ‘Rima’ Cao is a fourth-year Ph.D. student in the lab. Her research is centered around designing information spaces that people can become productive and stay in the flow, with a focus on how information structures should be generated, composed, and synchronized to support information activities. She has 3 papers at CHI 2025, also attending the Tools for Thought workshop.



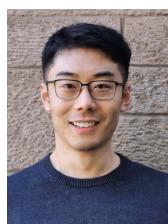
Bryan Min is a first-year Ph.D. student in the lab. His research focuses on improving malleability of user interfaces and reducing friction in our interaction with it. He is also drawn to the concepts of user-defined abstraction and feedforward design for GenAI. He is presenting a paper at CHI 2025, and also sharing his thoughts in the Tools for Thought workshop.



Peiling Jiang is a third-year Ph.D. student in the lab. His research focuses on designing and developing systems that help people navigate, manage, and understand information, augmenting and unleashing the power of human users in an era where we have AI superpowers. He enjoys deploying his research systems in the wild so that people can actually use them.



Jim Hollan is a distinguished professor and co-director of the lab. His work on dynamic information space, representations, and distributed cognition have been the theoretical and cognitive foundations for the research in the lab. Things that you frequently hear from Jim are “most difficult problems are representations”, “cognitive physics”, and “I have just bid yet another car”.



Haijun Xia is an assistant professor and co-director of the lab. Since the start of his HCI career, he has been looking for the essential theoretical and engineering pieces of the proposed information environment, and exploring how to piece them together to realize this vision. He is fortunate to stand on the shoulders of giants and with good company.

¹Generative, Malleable, and Personal User Interfaces. <https://youtu.be/MbWgRuM-7X8>