

## Research Statement

My research interests lie at the intersection of human-computer interaction (HCI), social computing, and human-centered Artificial Intelligence (AI). I am enthusiastic about exploring behavioral changes associated with the emergence of new technologies, and how these technologies may affect humans' well-being and quality of life. I am experienced in using mixed methods (Quantitative and Qualitative research methods) to address problems identified by behavioral studies and am also familiar with applying physiological computing to the design of multi-modal interactions. After aggregating knowledge through my studies, I always put it into action by developing new systems; and my theoretical contributions generally have arisen from the deployment of novel user-centered computing systems to answer specific research questions.

One high-level theme that guides my research agenda is the question of how technologies and interaction designs may play both active and auxiliary roles in shaping human behaviors and influencing social interactions. Technologies central to my interdisciplinary research have included 1) **Conversational AIs for improving human well-being** [1, 2, 3, 4]; 2) **new social-media mechanisms** such as crowdfunding [8], live-streaming [5, 6, 7], and online-learning platforms [9]; and 3) **physiological-computing applications**, including improvements to electroencephalogram (EEG), electrooculography (EOG), and eye-tracking processing through the application of machine learning and integration with the Internet of Things (IoT) [10, 11]. The inherent complexity of these technologies means that gaining deeper understandings of people's perceptions of and interactions with them is challenging.

The specific focus of my recent research is the potential for utilizing Conversational AIs (CAs) to mediate humans' transfer of information and trust. Since CAs are becoming more popular, and in the process of changing how humans interact with computer systems, I am interested in how they could serve as mediators: i.e., collecting information from their users and convince them to share it with third parties. This is a critically important topic because of the ethical and risk issues that will be involved once CAs have become a prevalent technology. While my research found that CAs could encourage users' in-depth self-disclosure and also suggested that people might place too much trust in it when CAs came to dealing with their sensitive information. My ongoing work tackles this challenge by leveraging the complementary strengths of humans and AI to facilitate human-AI collaboration [3, 4].

In the following paragraphs, I introduce my interdisciplinary research within the fields of HCI, AI, and social sciences, which I accomplished during my doctoral studies.

### **Designing Conversational AIs to Promote Self-disclosure and Behavior Change:**

With the advancement of AI technology, CAs are demonstrating their potential to improve people's mental well-being by eliciting their self-disclosure. Prior research has shown that people tend to disclose symptoms of depression more truthfully when talking to a CA than when talking to a human interviewer. However, most research focuses on the interaction between a CA and an individual, which tells us little about how CAs could be fitted into existing systems of healthcare provision, which are characterized by onward referrals to various human specialists. To explore this issue, therefore, it is important to understand how users will react when their CA becomes a conduit to proper human help. Though more work is still needed, my research has shown clearly that users' self-disclosure behavior – which can be further subdivided into

trust transfer, intimacy, and privacy modulation – changes when a mental health professional [2, 4] is communicating with the CA users, and the CA is serving as a mediator between them. A clear, nuanced understanding of these dynamics is fundamental to the effective design of human-in-the-loop AI (HIT-AI) systems.

Specifically, I developed and evaluated several versions of CAs that served as a mediator of people’s self-disclosure to a real mental-health counselor. Each of these CAs had a distinctive level of its own “self-disclosure,” i.e., high, low, or none. I also conducted longitudinal studies to investigate how these CA users’ behaviors and perceptions of them changed over time. My research yielded new understandings of the roles played by mutuality and by the passage of time in self-disclosure interactions, and has important implications for the design and use of CAs for eliciting deep self-disclosure. I was also able to establish, through the CA-mediated presence of a human counselor, that trust established in human-AI relationships may be transferable to human-human ones. I have published my preliminary findings of these findings in CHI2020 and CSCW2020 [1, 2].

### **How Economic Markets Impact Social Interaction on Social Media:**

Another long-standing research interest of mine is the societal benefits and risks of online social network sites (SNSs). I am interested in the effects of economic markets on social interaction and SNS users’ decision-making. For example, live-streaming platforms’ gift-giving features, whereby money or digital gifts are given by viewers to performers, have emerged a whole set of new social norms, which in turn profoundly affect both content and user experience. This live streaming gift-giving culture has become extremely popular in various Asia countries since 2015, and I was one of the first researchers to explore it. Nowadays, many live-streaming platforms (e.g., Twitch and YouTube Live) have started offering a digital gift-giving or donation features that allow viewers to directly reward streamers during their live sessions. Then, the platforms allow their streamers to exchange the digital gifts they have received for the money. This monetary incentive appears to influence how they interact with their viewers, and what live-streaming content they generate.

I conducted qualitative and quantitative studies of this under-explored phenomenon. I found that the streamers devised strategies for both content generation and social interaction with the specific objective of earning gifts from viewers: practices that, in some cases, appeared to limit the quality of their live-streaming content. I also discovered that the sampled streamers tended to have constrained social relationships with their viewers, in part because such relationships were seen as unequal or one-sided due to gift-giving behavior. Subsequently, I explored the same dynamics from the viewers’ perspective [7], and analyzed live-stream videos after categorizing them according to viewer-streamer social interactions and digital-gift values [5, 6]. This strand of my work has resulted in a deeper empirical understanding of how digital gifting drives a range of factors that affect live-streamers’ behavior and has filled an important gap in the theoretical literature on social media.

### **Designing Intelligent System to Support Decision-making:**

Early in my Ph.D. studies, I designed a new mechanism to improve crowdfunding campaigns for social goods. Crowdfunding websites' existing methods of matching donors to projects were simply to allow each donor to choose a single project to donate to at a time. However, when donors were interested in multiple crowdfunding projects, it was not immediately clear how best to allocate these individuals' limited capital across multiple projects in a way that effectively supported all of them. Thus, inspired by the economic theory of deferred acceptance (DA), my colleague and I proposed a new algorithmic method of spreading donations' benefits across more crowdfunding projects and ran a 700-user experiment to test how that method impacted complex crowdfunding dynamics. After the success of this experiment, We deployed our system in Taiwan to help charity organizations to raise funding, and published our findings in several conferences, including IUI2018 [8].

### **Physiological Computing:**

As my initial foray into HCI research [10, 11], I explored how human cognitive processing and mental status are impacted by interaction with information systems and design. Mainly utilizing EEG, I conducted usability testing aimed at devising new methods of evaluating user perceptions. For example, I applied EEG to the evaluation of the effectiveness of audio notifications under ambient-noise conditions appropriate to HCI applications. One of the novel aspects of this research was how closely its experimental conditions were to real-world scenarios, and this opened the door to extending the applications of EEG in the research of this kind. At the same time, I explored the benefits of pre-attentive sensory processing in the analysis of subjects' perceptions of sounds, and their attention-shifting while evaluating audio notifications in a more complex and realistic situation, by manipulating their cognitive states and mental workloads. These research results received an honorable mention award at CHI2014 [10].

### **Future Research Agenda:**

#### **Exploring and Designing Human-AI Collaboration:**

Digital assistants such as Alexa, Siri, and Google Assistant are among the most widely accepted AI technologies and have considerable potential to be further embedded in workplaces and other aspects of daily life. Based on my findings regarding human-to-CA disclosure and long-term social dynamics [1, 2], I have been reflecting on how future AI assistants should evolve next, especially in light of the goals of naturalistic communication and the achievement of tasks. I am especially interested in exploring how AI technologies can properly be incorporated into the healthcare eco-system. It can be used to encourage a healthy lifestyle and help healthcare providers to better understand clients' day-to-day patterns and needs to provide better treatment and guidance. Providing guidance to assist humans' decision-making may yet emerge as the best way for people and AI agents to work well together. My pioneering empirical work [3, 4] on the effects of incorporating human support into human-AI interaction has highlighted some of the new design opportunities and challenges that arise when chatbot systems, with and without human support, are used for long-term interventions. I will focus on this crucial topic in my future research.

#### **The Ethics and Fairness of AI for Healthcare:**

Building on my work on CAs as providers of guidance in reflective journaling [1, 2], I am satisfied that CAs capable of engaging humans in conversation through natural-language interfaces will emerge as long-term companions, which can assist clinicians in the collection of essential health information. Yet, despite

the increasing adoption of chatbots in healthcare and the apparent benefits thereof, many challenges must still be addressed. For example, **user safety** and **AI ethics** both need to be defined, since there are no rubrics for what kind of information an AI should, or should not, collect from its users – nor is the existing research on the links between chatbot use and healthcare outcomes particularly robust. Therefore, I plan to integrate expert and social support into CAs to enable a more meaningful evaluation of their users’ healthcare outcomes and address user privacy and autonomy in the healthcare system. Finally, I may lay down the ethical foundation for incorporating AI technology safely into the healthcare eco-system.

### **Social Computing for Online Economics Market:**

I would also like to broaden the scope of research on how AI and computer-supported cooperative work technologies could play an active role in HCI applications to support social goods and the sharing economy. Amid the rise of the gig economy, even before the COVID-19 pandemic, the workforce is becoming more mobile and ever more dispersed; thus, many online platforms become “societies in miniature” that dramatically affect their members’ financial status and lifestyles. However, how the designs of these platforms may “bake in” fairness or unfairness remains an under-studied phenomenon. I am also interested in how we can improve these platforms in light of both existing economic theory and information-system design. I believe this is an especially important topic, given the ease with which existing platforms, and/or new ones based on the same underlying concepts, could be rolled out at a much larger scale, with potentially massive effects on individuals, communities, and whole societies.

Finally, I should note that I have worked with many collaborators from different domains including psychology, economics, neuroscience, machine learning, communication, and education. As well as being beneficial to my research itself, these collaborations have enhanced my teamwork skills, and I look forward to working closely with my new colleagues on pioneering research.

### **References**

- [1] **Yi-Chieh Lee**, Naomi Yamashita, Yun Huang, Wai Fu, “I Hear You, I Feel You”: Encouraging Deep Self-disclosure through a Chatbot. CHI 2020
- [2] **Yi-Chieh Lee**, Naomi Yamashita, Yun Huang, Designing a Chatbot as a Mediator for Promoting Deep Self-Disclosure to a Real Mental Health Professional. CSCW 2020
- [3] **Yi-Chieh Lee**, Naomi Yamashita, Yun Huang. (Submit to CSCW2021)
- [4] **Yi-Chieh Lee**, Naomi Yamashita, Yun Huang. (Submit to CHI2021)
- [5] Dennis Wang, **Yi-Chieh Lee**, Wai-Tat Fu. I Love the Feeling of Being on Stage, but I Become Greedy”: Exploring the Impact of Monetary Incentives on Live Streamers’ Social Interactions and Streaming Content. CSCW 2019
- [6] **Yi-Chieh Lee**, Chi-Hsien Yen, Po-Tsung Chiu, Jung-Tai King, Wai-Tat Fu. Tip Me! Tipping is Changing Social Interactions on Live Streams in China. Montreal, CHI 2018
- [7] **Yi-Chieh Lee**, Chi-Hsien Yen, Dennis Wang, Wai-Tat Fu. Understanding How Digital Gifting Influences Social Interaction on Live Streams. MobileHCI 2019

- [8] Chi-Hsien Yen, **Yi-Chieh Lee**, and Wai-Tat Fu. Visible Hearts, Visible Hands: A Smart Crowd Donation Platform, Tokyo, IUI 2018
- [9] **Yi-Chieh Lee**, Wen-Chieh Lin, Fu-Yin Cherng, Hao-Chuan Wang, Ching-Ying Sung, Jung-Tai King. Using Time-Anchored Peer Commenting to Enhance Social Interaction in Online Education Videos. Proceedings of the ACM Conference on Human Factors in Computing Systems, Seoul, Korea. CHI 2015
- [10] **Yi-Chieh Lee**, Wen-Chieh Lin, Jung-Tai King, Li-Wei Ko, Yu-Ting Huang, Fu-Yin Cherng. An EEG-based Approach for Evaluating Audio Notifications under Ambient Sounds. April 26 - May 01 2014, Toronto, ON, Canada. Proceedings of ACM Conference on Human Factors in Computing Systems, CHI 2014
- [11] **Yi-Chieh Lee**, Wen-Chieh Lin, Li-Wei Ko, Fu-Yin Cherng. Visual Attention Monitor Based on Steady-state Visual Evoked Potential, IEEE Transactions on Neural Systems & Rehabilitation Engineering, TNSRE 2016, Issue 3