



Delft University of Technology

## DECI

### A Tutorial on Designing Effective Conversational Interfaces

Gadiraju, Ujwal; Abbas, Tahir; Allen, Garrett

#### DOI

[10.1145/3581754.3584165](https://doi.org/10.1145/3581754.3584165)

#### Publication date

2023

#### Document Version

Final published version

#### Published in

IUI 2023 - Companion Proceedings of the 28th International Conference on Intelligent User Interfaces

#### Citation (APA)

Gadiraju, U., Abbas, T., & Allen, G. (2023). DECI: A Tutorial on Designing Effective Conversational Interfaces. In *IUI 2023 - Companion Proceedings of the 28th International Conference on Intelligent User Interfaces* (pp. 187-189). Association for Computing Machinery (ACM).  
<https://doi.org/10.1145/3581754.3584165>

#### Important note

To cite this publication, please use the final published version (if applicable).  
Please check the document version above.

#### Copyright

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

#### Takedown policy

Please contact us and provide details if you believe this document breaches copyrights.  
We will remove access to the work immediately and investigate your claim.

***Green Open Access added to TU Delft Institutional Repository***

***'You share, we take care!' - Taverne project***

**<https://www.openaccess.nl/en/you-share-we-take-care>**

Otherwise as indicated in the copyright section: the publisher is the copyright holder of this work and the author uses the Dutch legislation to make this work public.



# DECI: A Tutorial on Designing Effective Conversational Interfaces

Ujwal Gadiraju  
Delft University of Technology  
Delft, Netherlands  
u.k.gadiraju@tudelft.nl

Tahir Abbas  
Delft University of Technology  
Delft, Netherlands  
t.abbas-1@tudelft.nl

Garrett Allen  
Delft University of Technology  
Delft, Netherlands  
g.m.allen@tudelft.nl

## ABSTRACT

Conversational User Interfaces (CUIs) have been argued to have advantages over traditional GUIs due to having a more human-like interaction. The growing popularity of conversational agents has enabled humans to interact with machines more naturally. There is an increasing familiarity among people with conversational interactions mediated by technology due to the widespread use of mobile devices and messaging services and a hungry market for conversational agents. Based on the recent advances in conversational AI, as a result of the proliferation of large language models, the signs are that the future of human-computer interaction will have a significant conversational component. Today, over two-thirds of the population on our planet has access to the Internet, with ever-lowering barriers to accessibility. This tutorial will showcase the benefits of employing novel conversational interfaces for *crowd computing*, *human-AI decision making*, *health and well-being*, and *information retrieval*. Given the widespread adoption of AI systems across several domains, we will discuss the potential of conversational interfaces in facilitating and mediating people's interactions with AI systems. The tutorial will include interactive elements and discussions and provide participants with insights to inform the design of effective conversational interfaces.

## CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)**; **Interaction paradigms**; *Interaction techniques*; *Empirical studies in HCI*;

## KEYWORDS

conversational user interfaces, conversational crowdsourcing, human-AI interaction, human-AI decision making, conversational AI

## ACM Reference Format:

Ujwal Gadiraju, Tahir Abbas, and Garrett Allen. 2023. DECI: A Tutorial on Designing Effective Conversational Interfaces. In *28th International Conference on Intelligent User Interfaces (IUI '23 Companion)*, March 27–31, 2023, Sydney, NSW, Australia. ACM, New York, NY, USA, 3 pages. <https://doi.org/10.1145/3581754.3584165>

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).  
*IUI '23 Companion*, March 27–31, 2023, Sydney, NSW, Australia  
© 2023 Copyright held by the owner/author(s).  
ACM ISBN 979-8-4007-0107-8/23/03.  
<https://doi.org/10.1145/3581754.3584165>

## 1 RELEVANCE OF CONVERSATIONAL USER INTERFACES

Virtual companions, intelligent assistants, and task focused chatbots have become prevalent in our daily lives [8], serving various purposes, from customer service to automation in smart environments. The rise of conversational user interfaces (CUIs) can be attributed to several factors, including the increased use of messaging apps, the growing popularity of voice assistants, and the need for more efficient and personalized communication [12]. In addition, the advancements in artificial intelligence and natural language processing have made conversational interfaces more intelligent and responsive, allowing them to understand user intents better and respond effectively to natural language queries [17]. With the increasing demand for seamless and efficient communication, conversational interfaces are poised to become even more commonplace. They offer a convenient and accessible way to interact with technology, making them a valuable tool in numerous industries, from healthcare [1, 16, 18] to finance [10, 23, 26] to retail [14]. Overall, the ease of use and potential for personalization make conversational interfaces an attractive option for many consumers [13, 24], increasing their popularity and widespread adoption.

This tutorial is fundamentally relevant to the IUI community owing to its relation to intelligent conversational interfaces. More recently, researchers in IUI have been drawn to investigate CUIs for a variety of application domains, including learning a second language [25], sexual harassment prevention [5], qualitative interviews [3], and music production [4], among others. Furthermore, this tutorial will emphasize the distinctive characteristics of CUIs, ushering the IUI community to redefine and expand the scope of CUIs. For instance, we will provide detailed insights and hands-on training on employing conversational interfaces to improve worker engagement and satisfaction across the microtask crowdsourcing landscape. In addition, we will expand on the possibilities of allowing people to learn new affective support skills through CUIs and how these affective support tasks can be delivered in near real-time through embodied conversational agents by leveraging real-time human computation. We will also demonstrate how CUIs can better support individuals in information retrieval (IR) tasks.

Furthermore, this tutorial will discuss opportunities to build conversation-based Explainable AI (XAI) methods that can facilitate interactive two-way communication between AI systems and users to increase the intelligibility of AI systems and foster *appropriate trust* and *reliance* [2]. Recent works in the HCI and AI suggest that human interaction with AI systems can be enhanced by leveraging conversational interfaces to improve engagement, and build trust [7]. This tutorial will synthesize design concepts and recommendations for developing more effective conversational

interfaces based on many creative application domains of CUIs that have not been fully investigated.

## 2 ORGANIZERS

**Dr. ir. Ujwal Gadiraju**<sup>†</sup> is a tenured Assistant professor in the Software Technology Department of the EEMCS Faculty, Delft University of Technology. He co-directs the TU Delft “Design@Scale” AI Lab and is a member of the program management team of the TU Delft AI Labs. In addition, Ujwal co-leads a research line on Crowd Computing and Human-Centered AI at the Web Information Systems group. His research interests lie at the intersection of Human-Computer Interaction (HCI), Artificial Intelligence (AI), and Information Retrieval (IR). Ujwal has published over 135 peer-reviewed articles, including at premier venues such as ACM CHI, ACM CSCW, ACM TOCHI, AAAI HCOMP, ACM TheWebConf, ACM SIGIR, ACM UBICOMP, ACM CIKM, ACM WSDM, ACM HT, ACM UMAP, ACM IUI, among others. His work has been recognized with honors, including best paper awards at top-tier HCI and AI conferences. Ujwal’s prior work in Crowd Computing has explored methods to improve the effectiveness of the crowdsourcing paradigm, running large-scale human-centered experiments to understand the interaction between humans and machines and the societal impact of algorithmic decision-making. His current research focuses on creating novel methods, interfaces, systems, and tools to overcome existing challenges on our path toward building trustworthy AI systems and facilitating better reliance of humans on AI systems.

**Dr. Tahir Abbas** is a Postdoctoral Researcher in the Web Information Systems group at the Delft University of Technology. His research interests include Conversational User Interfaces (CUI), real-time Human Computation (HCOMP), Artificial Intelligence, and Human-Computer Interaction (HCI). His Ph.D. dissertation addressed important challenges in crowd-powered conversational systems, and he previously worked as a lecturer at a public sector university in Pakistan. Tahir has published scientific articles at premier venues, such as ACM/IEEE HRI, ACM CHI, AAAI HCOMP, PACMHCI journal, ACM CSCW, MDPI Sensors journal, and the international journal of HCI. Tahir focused on leveraging CUIs to address crowd workers’ work-related and emotional needs, leveraging real-time HCOMP for building affective crowd-powered conversational systems, and utilizing crowd creativity for the internet of things.

**Garrett Allen** is a Ph.D. candidate in the Web Information Systems group at Delft University of Technology. Garrett is an avid learner with a BS and MS degrees in Computer Science from Boise State University. His Master’s thesis focused on re-ranking search results for children in the K-4th Grades (using the American education system). He is an experienced investigator with exposure to the intersections of Human-Computer Interaction, Natural Language Processing, Information Retrieval, and Education and has published at top international conferences such as AAAI HCOMP, ACM RecSys and ECIR. Before choosing the path of academia, Garrett worked as a software engineer/developer for a collection of startups.

<sup>†</sup>Corresponding author.

## 3 TUTORIAL FORMAT

### 3.1 A Primer on CUIs

The tutorial starts with a primer on conversational interfaces in different domains. During this session, we will give participants an overview of the state of the art of conversational user interfaces (CUIs). We will also compare conversational interfaces with traditional interfaces, vet the context and scope for CUIs, and discuss what makes good conversational interfaces.

### 3.2 CUIs for Crowd Computing

In the second part of this tutorial, we will introduce the logic and workflow of conversational agent design for quickly deploying crowdsourcing tasks in customizable conversational interfaces. We will compare conversational crowdsourcing with the traditional web-based microtask crowdsourcing to explain the advantages of conversational crowdsourcing in terms of increasing user satisfaction, improving user engagement, and decreasing perceived workload [15, 20]. Next, we will explain the effect of using different conversational styles [27, 28], and share empirical insights into how we can define a conversational style, how to estimate the conversational style, and how to exploit the conversational style to facilitate an effective task design [19]. Finally, we will showcase conversational crowdsourcing in a variety of domains, such as supporting microtask execution and aiding informational web search [22]. In this session, we will also provide a step-by-step breakdown of implementing a conversational crowdsourcing interface using TickTalkTurk [21] for different crowdsourcing task types [6] and reflect on the metaphorical representation of conversational agents [11].

### 3.3 CUIs for Affective Crowdsourcing, Applications in Mental Health, and Human-AI Decision Making

In this part of the tutorial, we will first present the Trainbot CUI and discuss how effectively it can teach non-experts motivational interviewing skills essential for providing mental health support [1]. We will then showcase some different ways conversational agents have been proposed to tackle various challenges in healthcare. We will also review the opportunities and concomitant challenges of using CUIs for human-AI decision-making and the potential that CUIs offer to foster appropriate trust and reliance in AI systems, in comparison to traditional interfaces [9, 29, 30].

## REFERENCES

- [1] Tahir Abbas, Vassilis-Javed Khan, Ujwal Gadiraju, and Panos Markopoulos. 2020. Trainbot: A Conversational Interface to Train Crowd Workers for Delivering On-Demand Therapy. In *Proceedings of the AAAI Conference on Human Computation and Crowdsourcing*, Vol. 8. 3–12.
- [2] Gagan Bansal, Alison Marie Smith-Renner, Zana Bućinca, Tongshuang Wu, Kenneth Holstein, Jessica Hullman, and Simone Stumpf. 2022. Workshop on Trust and Reliance in AI-Human Teams (TRAIT). In *CHI Conference on Human Factors in Computing Systems Extended Abstracts*. 1–6.
- [3] Denis Bulygin. 2022. How Do Conversational Agents Transform Qualitative Interviews? Exploration and Support of Researchers’ Needs in Interviews at Scale. In *27th International Conference on Intelligent User Interfaces (Helsinki, Finland) (IUI '22 Companion)*. Association for Computing Machinery, New York, NY, USA, 124–128. <https://doi.org/10.1145/3490100.3516478>

- [4] Fabio Catania, Giorgio De Luca, Nicola Bombaci, Erica Colombo, Pietro Croviri, Eleonora Beccaluva, and Franca Garzotto. 2020. Musical and Conversational Artificial Intelligence. In *Proceedings of the 25th International Conference on Intelligent User Interfaces Companion* (Cagliari, Italy) (IUI '20). Association for Computing Machinery, New York, NY, USA, 51–52. <https://doi.org/10.1145/3379336.3381479>
- [5] Hyo Jin Do, Seon Hye Yang, Boo-Gyoung Choi, Wayne T. Fu, and Brian P. Bailey. 2021. Do You Have Time for a Quick Chat? Designing a Conversational Interface for Sexual Harassment Prevention Training. In *26th International Conference on Intelligent User Interfaces* (College Station, TX, USA) (IUI '21). Association for Computing Machinery, New York, NY, USA, 542–552. <https://doi.org/10.1145/3397481.3450659>
- [6] Ujwal Gadiraju, Ricardo Kawase, and Stefan Dietze. 2014. A taxonomy of microtasks on the web. In *Proceedings of the 25th ACM conference on Hypertext and social media*. 218–223.
- [7] Ujwal Gadiraju and Jie Yang. 2020. What can crowd computing do for the next generation of AI systems?. In *2020 Crowd Science Workshop: Remoteness, Fairness, and Mechanisms as Challenges of Data Supply by Humans for Automation*. CEUR, 7–13.
- [8] Jonathan Grudin and Richard Jacques. 2019. Chatbots, humbots, and the quest for artificial general intelligence. In *Proceedings of the 2019 CHI conference on human factors in computing systems*. 1–11.
- [9] Akshit Gupta, Debadeep Basu, Ramya Ghantasala, Sihang Qiu, and Ujwal Gadiraju. 2022. To Trust or Not To Trust: How a Conversational Interface Affects Trust in a Decision Support System. In *Proceedings of the ACM Web Conference 2022* (Virtual Event, Lyon, France) (WWW '22). Association for Computing Machinery, New York, NY, USA, 3531–3540. <https://doi.org/10.1145/3485447.3512248>
- [10] Christian Hildebrand and Anouk Bergner. 2021. Conversational robo advisors as surrogates of trust: onboarding experience, firm perception, and consumer financial decision making. *Journal of the Academy of Marketing Science* 49 (2021), 659–676.
- [11] Ji-Youn Jung, Sihang Qiu, Alessandro Bozzon, and Ujwal Gadiraju. 2022. Great chain of agents: The role of metaphorical representation of agents in conversational crowdsourcing. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. 1–22.
- [12] Lorenz Cuno Klopfenstein, Saverio Delpriori, Silvia Malatini, and Alessandro Bogliolo. 2017. The rise of bots: A survey of conversational interfaces, patterns, and paradigms. In *Proceedings of the 2017 conference on designing interactive systems*. 555–565.
- [13] Ahmet Baki Kocaballi, Shlomo Berkovsky, Juan C Quiroz, Liliana Laranjo, Huong Ly Tong, Dana Rezazadegan, Agustina Briatore, and Enrico Coiera. 2019. The personalization of conversational agents in health care: systematic review. *Journal of medical Internet research* 21, 11 (2019), e15360.
- [14] Chi Hong Leung and Winslet Ting Yan Chan. 2020. Retail chatbots: The challenges and opportunities of conversational commerce. *Journal of Digital & Social Media Marketing* 8, 1 (2020), 68–84.
- [15] Panagiotis Mavridis, Owen Huang, Sihang Qiu, Ujwal Gadiraju, and Alessandro Bozzon. 2019. Chatterbox: Conversational Interfaces for Microtask Crowdsourcing. In *Proceedings of the 27th ACM Conference on User Modeling, Adaptation and Personalization*. ACM, 243–251.
- [16] Joao Luis Zeni Montenegro, Cristiano André da Costa, and Rodrigo da Rosa Righi. 2019. Survey of conversational agents in health. *Expert Systems with Applications* 129 (2019), 56–67.
- [17] Robert J Moore, Sungeun An, and Guang-Jie Ren. 2022. The IBM natural conversation framework: a new paradigm for conversational UX design. *Human-Computer Interaction* (2022), 1–26.
- [18] Robert R Morris, Kareem Kouddous, Rohan Kshirsagar, and Stephen M Schueller. 2018. Towards an artificially empathic conversational agent for mental health applications: system design and user perceptions. *Journal of medical Internet research* 20, 6 (2018), e10148.
- [19] Sihang Qiu, Ujwal Gadiraju, and Alessandro Bozzon. 2020. Estimating Conversational Styles in Conversational Microtask Crowdsourcing. *Proceedings of the ACM on Human-Computer Interaction* 4, CSCW1 (2020), 1–23.
- [20] Sihang Qiu, Ujwal Gadiraju, and Alessandro Bozzon. 2020. Improving worker engagement through conversational microtask crowdsourcing. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. 1–12.
- [21] Sihang Qiu, Ujwal Gadiraju, and Alessandro Bozzon. 2020. TickTalkTurk: Conversational Crowdsourcing Made Easy. In *Conference Companion Publication of the 2020 on Computer Supported Cooperative Work and Social Computing*. 1–5.
- [22] Sihang Qiu, Ujwal Gadiraju, and Alessandro Bozzon. 2020. Towards memorable information retrieval. In *Proceedings of the 2020 ACM SIGIR on International Conference on Theory of Information Retrieval*. 69–76.
- [23] Sophie Rentschler, Martin Riedl, Christian Stab, and Martin Rückert. 2022. Data Augmentation for Intent Classification of German Conversational Agents in the Finance Domain. In *Proceedings of the 18th Conference on Natural Language Processing (KONVENS 2022)*. 1–7.
- [24] Chong Eun Rhee and Junho Choi. 2020. Effects of personalization and social role in voice shopping: An experimental study on product recommendation by a conversational voice agent. *Computers in Human Behavior* 109 (2020), 106359.
- [25] Sherry Ruan, Liwei Jiang, Qian Yao Xu, Zhiyuan Liu, Glenn M Davis, Emma Brunskill, and James A. Landay. 2021. EnglishBot: An AI-Powered Conversational System for Second Language Learning. In *26th International Conference on Intelligent User Interfaces* (College Station, TX, USA) (IUI '21). Association for Computing Machinery, New York, NY, USA, 434–444. <https://doi.org/10.1145/3397481.3450648>
- [26] Suraj Sharma, Joseph Brennan, and Jason Nurse. 2021. StockBabble: A conversational financial agent to support stock market investors. In *Proceedings of the 3rd Conference on Conversational User Interfaces*. 1–5.
- [27] Deborah Tannen. 1987. Conversational style. *Psycholinguistic models of production* (1987), 251–267.
- [28] Deborah Tannen. 2005. *Conversational style: Analyzing talk among friends*. Oxford University Press.
- [29] Katharina Weitz, Dominik Schiller, Ruben Schlagowski, Tobias Huber, and Elisabeth André. 2019. "Do You Trust Me?": Increasing User-Trust by Integrating Virtual Agents in Explainable AI Interaction Design. In *Proceedings of the 19th ACM International Conference on Intelligent Virtual Agents* (Paris, France) (IVA '19). Association for Computing Machinery, New York, NY, USA, 7–9. <https://doi.org/10.1145/3308532.3329441>
- [30] Yixiao Zhang, Gus Xia, Mark Levy, and Simon Dixon. 2021. COSMIC: A Conversational Interface for Human-AI Music Co-Creation. In *NIME 2021*. <https://nime.pubpub.org/pub/in6wsc9t>