Research Report

Chatbots Become Human(like): The Influence of Gender on Cooperative Interactions with Chatbots

CURRENT TECHNOLOGICAL ADVANCEMENTS OF CONVERSATIONAL AGENTS (CAs) PROMISE NEW POTENTIALS FOR HUMAN-COMPUTER COLLABORATIONS. YET, BOTH PRACTITIONERS AND RESEARCHERS FACE CHALLENGES IN DESIGNING THESE INFORMATION SYSTEMS, SUCH THAT CAs NOT ONLY INCREASE IN INTELLIGENCE BUT ALSO IN EFFECTIVENESS. THROUGH OUR RESEARCH ENDEAVOUR, WE PROVIDE NEW AND COUNTERINTUITIVE INSIGHTS THAT ARE CRUCIAL FOR THE EFFECTIVE DESIGN OF COOPERATIVE CAs.

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Introduction

CAs, such as chatbots, have only recently experienced a renewed interest, although the idea of communicating with information systems (IS) via natural language already emerged in the 1960s. Thanks to technological advancements in artificial intelligence (AI), not only the interaction capabilities but also the analytical abilities of CAs have improved, such that these systems are now tremendously permeating and shaping private and work lives. Gartner (2019) predicts that while only 2% of all current digital workers (i.e., people who use IT to increase workplace efficiency) use a virtual workplace assistant, this percentage will rise to 25% by 2021, exceeding USD 3.5 billion in customer and business spending. Similarly, a survey of CIOs and CTOs revealed that 56% of the surveyed executives claimed that CAs are driving factors of the disruption in their industry (Accenture, 2018).

Regarding the growth in importance and permeation of CAs, it is critical for businesses and IS designers alike to understand how to engineer such cooperative CA assistants. Previous research on CAs has mostly focused on rather competitive contexts, e.g., sales agents in e-commerce (e.g., Beldad et al. 2016), in which users may not fully trust CAs' advice as users naturally assume that the CAs also act in their employer's interest. We extend research by investigating CAs in the until now neglected cooperative contexts, in which human users make the decisions, while the cooperative CAs advise the users in the sole interest of the users. We incorporate two distinct, important, but neglected perspectives in our investigation: (1) a CA's gender and (2) a user's knowledge.

Regarding a CA's gender (for example, on gendered CA see: noora.ch, talmundo.com, askformoon.io, boibot.com, eviebot.com), humans socially respond to human-like IS in the same fashion as they would respond to humans (Nass et al., 1997). Consequently, by increasing human-likeness of CAs, designers may not only elicit favorable social responses but also unfavorable ones (e.g., Beldad et al., 2016; Koch et al., 2015): While, for example, the employment of female gender cues causes gender stereotyping in a user and, thus, leads to an increased perception of warmth, it typically also leads to a decrease in the perception of competence, especially for stereotypical male topics (Nass et al., 1997). This may have profound implications on the perception of competence (Koch et al., 2015), as well as on trust and advice-taking (Sniezek and van Swol, 2001).

Concerning a user's knowledge, scholars have observed that biases from personal beliefs about one's own knowledge can also induce advice discounting, such that judges are more inclined to reject the advice given by their advisors (Sniezek and van Swol, 2001). Especially egocentric bias, which we define as the irrational valuation of one's own (subjective) knowledge over the knowledge of others, appears to be a strong factor for advice discounting (i.e., reduction in value) and, thus, may result in a decrease in trust in advice given by CAs (Bonaccio and Dalal, 2006).

Methodology: Interaction Experiment

We, therefore, investigate gender stereotyping as well as egocentric bias that result from a CA's gender as well as from a user's (subjective) knowledge. These two factors are connected by the important aspect that both influence a user's trust perceptions of cooperative CAs. Thus, these factors will have serious consequences on the effectiveness of CAs of businesses, possibly deciding about their success or failure. Consequently, we postulate the following research question: *How do gender stereotyping and egocentric bias affect a user's trust in cooperative CAs?*

We conducted an online experiment, in which participants interacted with an AI-based CA via an instant messaging user interface to tackle this research question. Drawing on social response theory (Nass et al., 1997) and literature on trust and judge-advisor systems (Sniezek and van Swol, 2001), we empirically examined how both a CA's gender and a user's subjective knowledge affect a user's trusting intentions in a CA in two

stereotypical male knowledge fields (i.e., math and finance).

We put forward several hypotheses, which we tested through various statistical analyses, i.e., multivariate linear regressions and bootstrap analyses with 5,000 samples and 95% bias-corrected confidence intervals.

Empirical Findings and Implications
Through the analyses and the observations from the experiment, we are able to contribute to research and practice with several findings, which we will briefly summarize. First, we find counterintuitive evidence that CAs with female gender cues are perceived as significantly more competent than their male counterpart in stereotypical male knowledge fields. This conclusion seems to challenge previous research on interactions with computers and robots. In contrast, we extend theory by elaborating that users apply contextual reasoning to assess the fit of a gender in similar situations, which explains why users more strongly associate the female CA with competence in a cooperative CA context, irrespective of the CA's traits and knowledge field. Thus, we support and further explain the observations of scholars like Beldad et al. (2016) that female representations appear to be more suitable for advice-giving IS.

Second, we deliver insights to research that the effects of gender cues may not be mediated by agentic and communal traits. We, thus, introduce IS research to the idea that gender cues comprise more than what we can potentially measure with agentic and communal traits, and that further research may focus on investigating contextual differences for gender cues and various representations of gendered CAs.

Our third finding contradicts previous research which postulates that cues which convey competence are most important for competence perception of such agents. Instead, our observations of the significant effect of communal traits vs. the insignificant effect of agentic traits on a user's perceived competence of a CA indicate that cooperative human-computer interactions (HCIs) appear to be different from competitive ones. Thus, we enrich research on CAs by providing evidence that in interactions with cooperative CAs, communal traits lead to significant increases in a user's perceived competence of a CA, while agentic traits seem to be valued less.

As a conclusive contribution to theory, we draw attention to the conflict that an increase in users' subjective knowledge leads to a decrease in trust in CAs irrespective of the knowledge field. Consequently, analogous to the design of a CA's gender, our research suggests that CA designers and researchers must consider various cues and biases to understand a user's acceptance of CAs.

For practitioners, these findings imply that especially in a cooperative context, IS designers should pay attention to imbuing CAs with female gender cues and communal traits with special respect to the usage context, as prior research suggests (Beldad et al., 2016).

Furthermore, our observations lead us to the implication that the employment of CAs can be more effective in the intelligence augmentation of users who consider themselves unknowledgeable, such as when a user needs advice in novel and unfamiliar domains of knowledge.

Conclusion
In our research (Pfeuffer et al., 2019), we provide valuable insights on a cutting-edge technological topic at the intersection of AI and HCI. These insights will be useful for companies planning to invest in CA to increase productivity and customer communication alike, as well as for the technical and interaction designers of AI-powered CA.

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