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What Fits Tim Might Not Fit Tom: Exploring the Impact of User Characteristics on Users' Experience with Conversational Interaction Modalities

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Abstract. Companies increasingly implement conversational agents (CAs), which can be text- or voice-based. While both interaction modalities have different implications for user interaction, it ultimately depends on the users how they perceive these design options. Research indicates that users' perception and evaluation of information systems is affected by their individual characteristics – their dispositional traits and needs. To investigate the impact of user characteristics on the user experience with text- and voice-based CAs, we draw on task-technology fit (TTF) theory and develop a research design including a lab experiment. So far, we developed and tested two CAs and conducted a pilot study of the experiment. Initial results indicate that user characteristics influence how users perceive the user experience with text- and voice-based CAs. We expect the results of our research to extend TTF theory to the context of conversational interfaces and guide companies in designing their CAs to deliver a satisfying user experience.

Keywords: user characteristics, user experience, conversational agents, interaction modality, human-centered design

1 Introduction

Conversational agents (CAs) are increasingly implemented across domains (e.g., healthcare, e-commerce, banking), with interest being particularly strong in customer service [1, 2] – e.g., to answer customers' frequent questions [3]. Due to their advanced natural language processing capabilities, CAs can bridge the gap between human service employees and self-service technology [3, 4]. They can automate service encounters [5], while providing customers with human-like and personalized interactions [2, 6]. When implementing CAs, companies have the choice between voice- and text-based conversational interfaces, with both design options having different implications for user interaction [2, 7].

Existing research shows that voice interaction promotes a more human-like perception of CAs, leading to positive attitudes towards them [8, 9]. Speaking is also

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found to be faster than typing with regard to input performance [10], whereas total interaction time is longer for voice interaction than for text interaction [11]. In addition, text interaction was found to provide more control to users, especially for certain task types [12]. Thus, when comparing text- and voice-based interaction modalities, neither modality can be considered clearly superior. Which interaction modality provides the better user experience depends on the perception of the individual user [13].

The relevance of human factors for human-AI interaction is further underlined by Zhang et al. [14], who point out that the interaction between users and information systems, is not only influenced by system characteristics (e.g., the interaction modality), but also by the users and their characteristics (e.g., their cognitive abilities such as their approach to information processing). In other words, users' individual characteristics – their dispositional traits and needs – considerably affect how they perceive and evaluate their user experience with CAs. However, the impact of users themselves on the human-AI interaction and outcome are under-researched [15]. Against this background, we intend to answer the following research question: *How do user characteristics influence the user experience with different conversational interaction modalities?*

This research-in-progress paper presents the research design we will apply to address this question. Drawing on the task-technology fit (TTF) theory [16] and insights from cognitive psychology [17], we derive a research model. We aim to evaluate the impact of user characteristics on the user experience with text- and voice-based CAs by conducting a lab experiment. Thereby, we expect to show the influence of the interplay of user characteristics and CA design choices on user experience. The results will extend TTF theory to the context of conversational interfaces. Moreover, our findings can guide companies in designing their CAs to deliver a satisfying customer experience.

2 Theoretical Background and Conceptual Model

CAs are AI-based systems that interact with users in natural language, thereby offering a more natural and intuitive user interface [7, 18]. User interaction with CAs can be either text-based, as in the case of chatbots, or voice-based, as in the case of voice assistants [7]. Both interaction modalities have different implications for the user experience: Voice interaction is considered natural and intuitive, therefore providing advantages in terms of convenience and ease of use [18]. Text interaction, on the other hand, allows users to adjust their information processing speed (e.g., by skimming the text) [19], enabling increased efficiency [11]. Nevertheless, whether users experience one or the other interaction mode as better depends not only on their particular properties, but is further affected by the task context and users' individual characteristics [14, 15]. Research is already intensively investigating the application of CAs in different task contexts [e.g., 20, 21]. In contrast, the influence of individual user characteristics on the user experience with text- and voice-based CAs is only marginally addressed [14, 15]. To explore the interplay of individual user characteristics and interaction modalities, TTF theory [16] provides a useful theoretical foundation.

TTF theory posits that there must be a match of the functionality of the technology, the requirements of the task, and the characteristics and abilities of the individual for

the technology to have a positive impact on performance. The better the fit between the user, the technology, and the task, the better the performance outcome of technology use will be (in terms of "improved efficiency, improved effectiveness, and/or higher quality" [16, p. 218]). Against this background, the theory suggests that there will be differences in the suitability of different interaction modalities for different users, which will impact user performance and experience. In accordance with prior research findings [13, 22], TTF theory implies that superior interaction outcomes can be achieved by matching CA design and user characteristics.

User characteristics are defined as users' dispositions and personality traits [23, 24], that determine the way they perceive, think, and feel [17]. Due to their fundamental and consistent nature, user characteristics can be conceptualized as stable over time and across task contexts [17, 25]. By shaping users' cognition and emotion, user characteristics are an important determinant of individuals' attitudes and behaviors towards information systems [25]. Thus, we explore the influence of individual user characteristics on the user experience with text- and voice-based CAs.

We hypothesize that users perceive the interaction with voice- and text-based CAs differently depending on their individual characteristics. To evaluate the user experience we draw on pragmatic (e.g., ease of use) as well as hedonic (e.g., enjoyment) attributes – as suggested by Hassenzahl et al. [26]. In particular, we compare text and voice interaction regarding their impact on users' perceived usefulness (PU) [27], perceived ease of use (PEOU) [28], perceived cognitive effort (COGEFFORT) [29], perceived control (CONTROL) [28], perceived information quality (INFQUAL) [30, 31], perceived enjoyment (ENJOY) [32], perceived social presence (SOCPRES) [32] as well as their overall satisfaction (SAT) with the interaction [33]. These variables are commonly used in prior studies investigating users' experience with technology [e.g., 28, 34, 35] and allow us to take a nuanced view. As suggested by TTF, the performance outcome of users' interaction with the CA is influenced by their individual cognitive abilities and dispositions [14, 16, 17]. Hence, we include variables assessing users' cognition, i.e., the way they absorb information best (visual/auditory cognitive style [36] and their approach to information processing (rational/experiential thinking style [37]). Furthermore, we consider users' dispositions relevant in a customer service context by including need for interaction [38], need for complete information [39], and desire for control [40], to account for the motivations driving their behavior [14]. The conceptual model is depicted in Fig. 1.

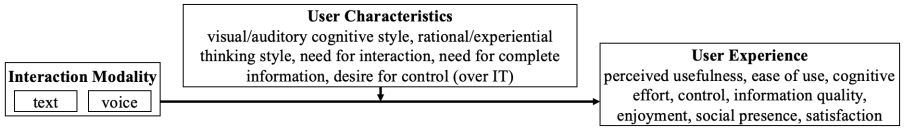

Figure 1. Conceptual model

Given that text and voice differ in their mode of information production and reception [10], users' mode of information processing will likely impact the effort they need to invest in the interaction. For example, when interacting via text, we expect to measure differences in perceived ease of use and cognitive effort for individuals with a visual cognitive style compared to individuals with an auditory cognitive style. Text

interaction might better fit users' visual cognitive style [36] and, thus, lead to lower perceived effort. In addition, individuals with a high need for interaction with service employees will likely perceive voice interaction as more enjoyable, as voice interaction is associated with increased human-likeness [8]. Due to space limitations, we are not able to present the detailed hypotheses in this research-in-progress paper. Overall, we aim to explore and measure how users' cognitive abilities and needs influence their user experience with text and voice interaction.

3 Design of Empirical Study and Pilot Study

To explore the influence of individual user characteristics on the user experience with text- and voice-based CAs, we conduct a lab experiment applying a within-subject design [41]. For the experiment, we iteratively developed and trained a chatbot and voice assistant that provides users assistance analogously. After validating the CAs in two pre-tests, we conducted a pilot study with 20 participants (50% women; average age=29.6 years, SD=14.7, range 18-65; 7 had prior experience in the task area). Participants interacted with both the chatbot (i.e., via text) and the voice assistant (i.e., via voice), each after being presented with a scenario. They performed a typical task in the service domain – selecting an insurance contract that best fits the requirements described in the scenarios. To prevent order effects, counterbalancing of scenarios and CA interaction modality was applied [42]. In the post-task questionnaire, we measured participants' user experience and satisfaction with the CA interaction as well as their user characteristics, adapting established seven-point Likert scales (for sources of items see Section 2) anchored from 'strongly disagree' to 'strongly agree'.

Despite its limited sample size, our pilot study offers initial insights into differences in user experiences between interaction modalities and influence of user characteristics. We conduct two-tailed t-tests to compare the means of the user experience variables for text and voice interaction, and thereby observe significant ($p<.01$) differences between text and voice interaction regarding participants' perceived usefulness. Significant differences ($p<.05$) can also be observed for perceived control and satisfaction. Participants rated the user experience with the chatbot significantly higher. Furthermore, we calculate correlation matrices (Table 1) of user experience variables and user characteristics, which cannot be fully displayed here due to limited space. We find significant differences regarding the evaluation of the CAs depending on individual user characteristics. For text interaction, the correlation results show that participants' desire for control over IT is significantly correlated with their perceived social presence ($r=0.50$, $p<.05$) and cognitive effort ($r=0.49$, $p<.05$). Further significant correlations can be found between users' rational thinking style and perceived cognitive effort ($r=-0.59$, $p<.01$) as well as for users' visual cognitive style and their perceived enjoyment ($r=-0.50$, $p<.05$). This indicates that the higher users' score for visual cognitive style, the lower they rated the perceived enjoyment during text interaction. For voice interaction, we observe significant correlations between users' faith in intuition and perceived cognitive effort ($r=0.59$, $p<.01$). In addition, users' need for interaction significantly correlates with their perceived cognitive effort ($r=0.45$, $p<.05$)

as well as perceived ease of use (r=0.46, p<.05). This implies that the stronger users' need for interaction, the higher they rated the perceived ease of use of the voice assistant. Overall, the results of the pilot study validated the CA and study design and promise interesting insights for the main study.

Table 1. Influence of user characteristics on perceived user experience (excerpt)

Correlations Text / Voice	**PU**	**PEOU**	**COGEFFORT**	**CONTROL**	**INF QUAL**	**ENJOY**	**SOC PRES**	**SAT**
Visual cognitive style						-0.50**		
Rational thinking style			-0.59***					
Intuitive thinking style	-0.39*		0.59***					
Desire for control over IT	-0.08*	0.42*	0.49**				0.50**	-0.43*
Need for interaction		0.46**	0.45**	0.39*				

Note: ***p < .01; **p < .05; *p < .10 / Excerpt only.

4 Conclusion and Expected Contribution

This study aims at examining the impact of individual user characteristics on the user experience with different conversational interaction modalities. Our pilot study of the research design already provides initial insights: We observe differences in user experiences between interaction modalities and find significant correlations between users' individual characteristics and their experience with text- and voice-based CAs. Building on the promising insights of the pilot study, we plan to conduct the main lab experiment to collect and analyze data from a larger sample.

We expect to contribute to research and practice alike. By drawing on TTF theory to evaluate the interplay of interaction modality and user characteristics, we reinforce the importance of the individual user as influencing factor on the fit between technology and task, as well as show the applicability of TTF theory to conversational interfaces in the domain of human-AI interaction. Future research could extend our research design to different task types and application areas. Furthermore, this study contributes to research on human-computer interaction by examining how users with different individual characteristics experience text and voice interaction. We specifically draw on a range of cognitive styles and user needs to provide a more nuanced view on the influence of human factors in human-AI interaction. Thereby, we extend prior studies that either focus on demographic aspects (e.g., age and gender [43]) or find indications of the influence of user-specific aspects only as a byproduct [e.g., 9]. Next, research could explore how to adapt CAs to best match users' cognitive styles, e.g., by adjusting information representation. These findings will provide valuable insights for practitioners evaluating different conversational interfaces to offer the best possible user experience for their customers.

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