

# The Role of Anthropomorphic Visual Cues in Human Interactions with Conversational Agents

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## Abstract

With the increase of anthropomorphic conversational agents across several domains, research on the effects of anthropomorphism in conversational agents is also on the rise. However, prior studies present conflicting results and little is currently understood about how anthropomorphism can influence end user perception of conversational agents. This work-in-progress paper attempts to contribute towards filling this gap by analysing whether anthropomorphic visual cues used in conversational agents have an effect on the trust and satisfaction of users. We carried out a between-subjects experiment to this end, where the use of emojis and a profile image of four different levels of anthropomorphism were manipulated in a conversational agent based on Telegram. A total of 120 participants had a conversation with the agent and reported their experience. Based on our findings, we conclude that individual visual cues as well as a combination of them did not have any significant effects on the trust and satisfaction of users, and discuss future directions of research.

## Introduction

The advancement in technological areas like natural language processing and machine learning has resulted in a rise of conversation agents (CAs) (Araujo 2018; Diederich 2020; Rapp, Curti, and Boldi 2021). CAs, that can be defined as software that interacts with users in a natural human language (Diederich 2020; Seeger, Pfeiffer, and Heinzl 2017), ensure a smoother and more intuitive user experience (Seeger, Pfeiffer, and Heinzl 2021; Pfeuffer et al. 2019) and are now being employed to perform a wide variety of tasks (Araujo 2018; Seeger, Pfeiffer, and Heinzl 2017; Gnewuch et al. 2018). Because of their unique type of interaction, CAs go hand in hand with the theory of anthropomorphism, which can be described as assigning human-like attributes or traits to non-human agents or objects (Araujo 2018; Seeger, Pfeiffer, and Heinzl 2021, 2017).

With the increase in the use of CAs, the research on anthropomorphism and its role in CAs has also been on the rise (Rapp, Curti, and Boldi 2021; Diederich, Brendel, and Kolbe 2019). A problem noticed by multiple studies is that many of the conducted researches have conflicting results (Seeger, Pfeiffer, and Heinzl 2021; Gong 2008; Diederich

2020; Rapp, Curti, and Boldi 2021; Catrambone, Stasko, and Xiao 2002). Indeed, while many studies report positive effects of anthropomorphic CAs (Araujo 2018; Gong 2008), others have shown that anthropomorphism can lead to user frustration, confusion, and even feelings of eeriness (Pfeuffer et al. 2019; Diederich 2020; Diederich et al. 2021). Furthermore, recent literature reviews concluded that there is a general lack of research done on the design of CAs (Rapp, Curti, and Boldi 2021; Diederich, Brendel, and Kolbe 2019). In response to this research gap, we focus on visual cues in CAs; in particular, profile images and emojis.

Seeger, Pfeiffer, and Heinzl (2021) classify profile images as a part of the human identity dimension and argue that these type of cues will lead to users experiencing a higher perception of anthropomorphism. According to Araujo (2018), such perception consequently should lead to a better emotional connection between the users and the agent, resulting in a positive effect on the user-agent relationship. This is further supported by Go and Sundar (2019) who state that the use of human identity indicating visual cues lead to users perceiving the chatbot more human-like which encourages a more social response. Similarly, Gong (2008) argued that a more anthropomorphic computer representation will result in a more positive social judgement and a more trustworthy perception from the users. These studies provide a valuable insight into the effects of anthropomorphic profile images on users, therefore the following hypotheses were formulated:

**H1:** The higher anthropomorphism level of a profile picture in a CA, the higher user satisfaction will be.

**H2:** The higher anthropomorphism level of a profile picture in a CA, the higher user trust will be.

With regards to emojis as anthropomorphic visual cues, a study done by Beattie, Edwards, and Edwards (2020) concluded that chatbots that use emojis are perceived similarly to humans. Therefore, the overall usage of emojis in text can be considered an anthropomorphic quality. Additionally, Fadhil et al. (2018) performed a study on the role of emojis in health tracking CAs and concluded that emojis can increase enjoyment, attitude, and confidence towards the CA. Due to previous studies suggesting emojis positive effect on users of CAs, the following hypotheses were proposed:

**H3:** A CA that uses emojis will have a higher user satisfaction than a CA that does not use emojis.

**H4:** A CA that uses emojis will have a higher user trust than a CA that does not use emojis.

Lastly, the combination of the two visual cues could also lead to positive effects on users. For example, de Visser et al. (2016) performed a study where they manipulated visual cues together with social cues and concluded that adding such human-like features increases trust. Similarly, Diederich (2020) proposed a design for CAs, that, among other anthropomorphic cues, included both emojis and human avatar profile images, which resulted in users perceiving it as more useful and enjoyable. This gives a strong suggestion of the possible positive effects of combining anthropomorphic visual cues, therefore this study proposes the following hypotheses:

**H5:** Use of both emojis and high anthropomorphic level profile pictures in CAs will lead to a higher user satisfaction, in comparison to CAs that use none or only one of the visual cues.

**H6:** Use of both emojis and high anthropomorphic level profile pictures in CAs will lead to a higher user trust, in comparison to CAs that use none or only one of the visual cues.

In summary, this research will contribute to filling the gap in the research of CA design. In particular, the main question that this paper will aim to answer is: *To what extent can a conversational agent with different levels of anthropomorphic visual cues improve the satisfaction and trust of the users?*

## Method

This research used a 4 (none vs low vs medium vs high level anthropomorphism picture) x 2 (emojis vs no emojis) between-subjects experiment design. Each participant received a set of instructions and a link to a conversational agent corresponding to their experimental group. Participants had a conversation with the CA about their well-being. After finishing the conversation, the participants received a link to a post-experiment survey about their trust and satisfaction with regards to the CA. The whole process of the experiment took around seven minutes to complete.

### Conversational Agent Design

The conversational agent used for the experiment was based on a *Telegram* bot called *Dandelion* (TU Delft 2021). Three images of different level of anthropomorphism were used as profile images and were based on the study done by Gong (2008). For the agent that did not have a profile image, a letter 'D' was displayed by Telegram.

All the groups received messages containing the same text, except for the groups that included emojis as visual cues. In those cases, the text was still identical but included a few emojis. The type and place of emojis was also identical among all the groups that used them. Furthermore, a casual, non-formal conversation style was used, since it has been shown to result in a higher user engagement, as opposed to a formal one (Kim, Lee, and Gweon 2019). The full script of the conversation with and without emojis can be found at [https://osf.io/hjtez/?view\\_only=257ed4774c984880a9d6fc3f1f6321c2](https://osf.io/hjtez/?view_only=257ed4774c984880a9d6fc3f1f6321c2).

## Participants

A total of 120 participants were recruited for this research. The sample consisted of 37% females and 62% males. The participants were recruited via Prolific.co platform and were paid 1£ for their participation.

## Measures

Items for measuring user trust were adapted from Jian, Bisantz, and Drury (2000). User satisfaction was measured by using items adapted from Barger and Grandey (2006) and Lee and Choi (2017). Both were measured on a 7-point Likert scale (*i.e.* 1 - strongly disagree, 2 - disagree, 3 - somewhat disagree, 4 - neutral, 5 - somewhat agree, 6 - agree, 7 - strongly agree).

## Results

The data collected from the experiment was analysed using a two-way ANOVA test ( $\alpha = 0.05$ ). For both satisfaction and trust, Lavane's test showed no violation of the assumption of homogeneity: satisfaction  $p$ -value = 0.97, trust  $p$ -value = 0.12. The full data set of the collected responses is made available at [https://osf.io/hjtez/?view\\_only=257ed4774c984880a9d6fc3f1f6321c2](https://osf.io/hjtez/?view_only=257ed4774c984880a9d6fc3f1f6321c2).

With regards to satisfaction, the results revealed no significant difference between different levels of profile image anthropomorphism ( $p$ -value = 0.27), use of emojis ( $p$ -value = 0.71) or correlation of the two variables ( $p$ -value = 0.23). Similarly, no significant difference between different level of anthropomorphic profile images ( $p$ -value = 0.997), the usage of emojis ( $p$ -value = 0.37), and the correlation between the two ( $p$ -value = 0.62) was found with regards to user trust. Therefore, none of the proposed hypotheses were confirmed.

## Limitations and Conclusion

This paper attempted to contribute to filling the gap in the research on CA design by analysing whether anthropomorphic visual cues used in CAs have an effect on the trust and satisfaction of the users. In particular, the effects of anthropomorphic profile images and emojis were analysed. The experiments revealed that CAs that employ emojis or a profile image of any level of anthropomorphism do not result in a significantly higher satisfaction nor increase trust. Furthermore, combining the two visual cues does not achieve such effects either.

However, this study included some limitations. Firstly, due to limited funds the sample size was too small, thus the same experiment could be repeated with a sample size of at least 400, as suggested by a power analysis (medium effect size,  $\alpha = 0.05$ , and power = 0.80) (Faul et al. 2007). Secondly, in comparison to similar studies (de Visser et al. 2016; Gong 2008; Go and Sundar 2019), the participants of the current study received a very limited exposure to the profile images, due to the used interface, which could have had an effect on the perceived anthropomorphism of the CA. Lastly, the type of the task given to the participants could have influenced the results, therefore it would be interesting to investigate how different types of tasks influence anthropomorphism and its effects on users of CAs.

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