

Chatbot Personalities Matters

Improving the user experience of chatbot interfaces

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Abstract. In this study, we investigated the impact of a match in personality between a chatbot and the user. Previous research have proposed that personality can offer a stable pattern to how chatbots are perceived, and add consistency to the user experience. The assumptions regarding the effects of personality was investigated by measuring the effects of two chatbot agents, with two levels of personality, on the user experience. This study found that personality has a significant positive effect on the user experience of chatbot interfaces, but this effect is dependent on context, the job it performs, and its user group.

Keywords: Chatbot Personality · User experience · Conversational agents · Conversational Interfaces · Personality framework · User-centred design

1 Introduction

Recent advances in machine learning have contributed to fast improvements in Artificial Intelligence (AI) and Natural Language Processing (NLP) of conversational user interfaces (CUI). Access to AI has become widespread, and through Application Programming Interfaces (API's), chatbots have access to vast amounts of information and knowledge through thousands of databases online. All this sounds promising, and explains in large part why chatbots have seen a rebirth recently, but all this does not matter if chatbots cannot live up to the expectations of users. Predictions find chatbots to be a big part of an AI powered future, but recent reviews have found them to be unintelligent and non-conversational [22, 23]. We should therefore not be carried away by the positive outlook researchers presents in regards to the possibilities of advances in AI for chatbot technology, as the reality is that most chatbots are "falling flat" [23]. Despite cautions and recent negative reviews, 57 % of companies have implemented or are planning to implement a chatbot in the near future [9] and chatbots are estimated to save companies \$8 billion by 2022 [12]. Companies reap the benefits of chatbots, while users find them unintelligent and pointless; what effects might this have on the user experience and the future of chatbots?

In an effort to improve how chatbots are perceived and the value they can potentially provide, we propose that personality can be used to improve the user

experience of chatbots. Through this paper we will provide evidence to support that a match in personality between a chatbot and the user will have a positive effect on the user experience. We investigated this by designing and comparing two chatbot personalities: one agreeable and the other conscientious. The agreeable personality was designed through a user-centred design approach based on the personality framework presented in the author's Master's Thesis [27]. The conscientious personality was designed to be the opposite of the agreeable personality, and therefore assumed to not be appropriate for the user group. The user experience of both chatbot versions were measured by using the AttrakDiff measurement instrument created to assess the pragmatic and hedonic quality and attractiveness of interactive products. The experiment found that the agreeable chatbot personality had a significant positive effect on the user experience when compared to the other conscientious chatbot personality. The goal of this research is to contribute to the understanding of how we can improve the design of chatbots, and fill a gap in research related to the user experience of chatbots, by focusing on personality.

2 Background & Related Research

Emotional intelligence is an important part of how humans perceive themselves as intelligent beings. Psychologists describe emotional intelligence as the ability to tailor behaviour to environment through necessary emotional processing [4]. This ability is crucial to conversation, as conversation happen through dynamic relationships between the conversational actors. Human social interactions consists of much more than just language understanding, and if we want to improve how chatbots are perceived by users we have to understand how we can make them become convincing social actors. Emotional intelligence is important for humans to perceive conversational agents (CAs), such as chatbots, as thinking beings with a mind of their own [10, 1, 17]. Research on CAs and emotion have mainly focused on embodied conversational agents (ECA) [15, 28, 2, 25] as the focus has been on "affective computing". Chatbots, however, are limited to a textual interface (including text-to-speech) where its ability to display physical gestures and read users physical expressions is limited. It is therefore necessary to understand how chatbots can be perceived as convincing social actors through written interactions.

In human interaction we make use of several social cues that dictates how we behave and how we are perceived by our conversational partners. Five primary social cues have been defined [8]:

1. **Physical:** face, eyes, body, movement
2. **Psychological:** preferences, humour, feelings, empathy
3. **Language:** interactive language use, spoken language, language recognition
4. **Social dynamics:** turn-taking, cooperation, praise, question answering, reciprocity
5. **Social Roles:** doctor, teammate, opponent, teacher, pet, guide

Our social interactions are dynamic, in which we mirror and change our behaviour to our conversational partners. Our social role influences how we behave in different situations; we act differently if we take on the role as a parent than we would as a friend. One of the driving forces behind how humans behave as social actors is personality. Our personality can be used to influence our environment, emotions and cognitions as well as our motivations. Personality has been believed to be the stable pattern that dictates the behaviour of a CA [4, 30]. Personality is defined as a "dynamic and organized set of characteristics possessed by a person that uniquely influences their environment, cognitions, emotions, motivations, and behaviors in various situations" [16]. Research have found that personality plays an important part in regards to how users perceive CAs, and can be the determining factor to whether users wish to interact with the agent again [4]. In addition personality has been found to offer consistency to the interaction [4, 21], in particular, for CAs a consistent personality helps users feel that they are talking to only one person throughout the conversation.

2.1 Anthropomorphism and Humanness

To understand how humans perceive CAs and why personality plays an important part to managing this, we must first understand the concept of anthropomorphism. Anthropomorphism is defined as "the attribution of human personality or characteristics to something non-human, as an animal, object, etc" [6]. Anthropomorphism is therefore human's ability to attribute human characteristics, motivations, beliefs, and feelings to non-human entities. Researchers have found that anthropomorphism is a normal occurrence in human-computer interaction [25, 13], and that personality can be used as a design variable to manage how users anthropomorphise computers [30]. The "humanlike mind" is an essential component of anthropomorphism, as humans needs to consider the machine as a thinking being to some extent in order for them to perceive the CA as having a mind of its own [26]. Which personality the individual users attribute to the inanimate object however can be very different based on how it behaves, how it looks, and the personality of the individual user.

While anthropomorphism is encouraged in order to build an emotional relationship between the human and the CA, humanness can be used to determine the extent to which we want humans to anthropomorphise the system. Humanness is defined as "the extent to which an agent is designed to act and appear human [...] encompassing the objectively established human capabilities (having eyes, a face or the ability to respond politely)" [18]. Researchers have found that levels of humanness affects how humans anthropomorphise a CA, as well as being an important factor for managing trust [24, 18, 5, 7, 14]. Researchers distinguish between anthropomorphism and humanness in that anthropomorphism relates to the psychological attribution of humanlike features on to something non-human, while humanness relates to the extent to which something looks or acts human [7, 19, 20]. This distinction is important, because while anthropomorphism is encouraged, different levels of humanness can have both negative and positive effects on how humans perceives the agent. The much cited term "the

uncanny valley” [19] describes the effects high levels of humanness can have on human users. Robots that resembles humans to a very high degree are perceived as creepy, and humans interacting with them feel uncomfortable or fearful of it.

When users anthropomorphise a CA, the humanlike characteristics they attribute to the system is determined by how they perceive the system. Therefore, designers can control, through personality, how users attribute characteristics to the CA, and use humanness to manage user’s expectations and trust. The level of humanness should support the given personality, and manage expectations users have regarding what it can do and how it behaves.

3 Design Methodology

The chatbot personalities built for this experiment were based on a personality framework defined and presented in the original publication [27] and summarised in this section. This framework follows a user-centred design (UCD) approach to gather the necessary insights and knowledge to build a suitable personality for the intended user group. As most chatbots implemented today acts as extensions of services provided by brands, this framework will focus on designing chatbot personalities that are suitable for users and the brand they represent. The four identified components are as follows:

1. The brand mission, goals and values
2. A deep understanding of the users and their needs
3. The role/job of the chatbot
4. An appropriate personality model

The first component must be met to ensure that the chatbot’s personality and behaviour are consistent with the goals, values and tone of voice of the brand it represents, and supports the mission of the brand. The second component must be met to ensure that the personality supports the goals of the users, and to determine which personality traits that are appropriate for the user group. The third component is important as it dictates the social role of the chatbot, which again will help find appropriate traits that are compatible with its role. The final component, an appropriate personality model, is necessary to organise and map out the personality traits into a suitable framework. This project used the five-factor model.

3.1 Brand and User Group

The chatbot domain was based on a real brand, to apply the framework in a real life setting with real users and real needs. This will help inform suitable personality traits, the appropriate social role, and focus the research around a specific use case. The chosen brand and domain was chosen at random and only used to provide as an example to build the personality framework to inform the chatbot personality. The brand’s mission is to increase consumption of fruit and vegetables, and the intended user group for the chatbot prototype are young couples living together, in the age group 25-40, preferably with small children.

3.2 Chatbot Personality Description

In order to test the chatbot’s personality in relation to the user experience, two levels of personality were designed and tested. The first, Chatbot A, was given an agreeable personality that was the result of the user-centred design approach defined using the personality framework mentioned earlier. The other, Chatbot B, was designed to be the opposite of Chatbot A and was given a conscientious personality. Chatbot A’s personality organised within the five factors are as follows:

Agreeableness: cheerful, trusting, amiable, humble, polite, helpful

Extroversion: affectionate, friendly, fun-loving, confident

Conscientiousness: reliable, consistent, perceptive

Openness: insightful, original, clever, daring

Neuroticism: no traits

Chatbot B on the other hand is low in agreeableness, extroversion and neuroticism, moderate in openness and high in conscientiousness. Both versions of the chatbot works as a dinner planner, helping young couples plan meals for the whole week. The appropriate social roles given to the chatbots were assistant and motivator, as their job is to assist with meal planning and motivate change. Both chatbots are equal in all regards expect their personalities; they offer the same services, performs the same tasks and creates the same value for users (at least in regards to achieving tasks). The differences in personality will be displayed through their choice of language and tone of voice (see Table 1).

Table 1. Difference in personality in responses between Chatbot A and Chatbot B

User Expressions	Chatbot A	Chatbot B
I need your help with dinner tonight!	Cool cool;) What are you in the mood for?	Do you have a preference?
Something that’s quick to make	In a hurry today huh? Here’s a selection of 3 meals that takes less than 30 minutes to make:	Quick recipes:
Dinner tonight was delicious!	That’s wonderful :D should I recommend this recipe again?	OK, recommend recipe in future?
My kids never eat enough vegetables! Can you help?	The struggle with childreney? They’re tricky when it comes to healthy foods, but I have a few tricks up my sleeve:	Yes, three ways to help children eat more vegetables:

Both chatbots were given the same appearance in the form of a graphic representation of a human avatar (see Figure 1). As mentioned earlier research



Fig. 1. Chatbot Bella's avatar

have found that higher levels of humanness increases trust and are more familiar to users [29, 20, 18], but to keep the distinction clear that the chatbot is not in fact human, the chatbots were given a human avatar rather than an image of an actual human. Chatbot A and Chatbot B were given the name Bella, and a female gender despite research suggesting that female agents are more likely to be attributed negative stereotypes, and receive implicit and explicit sexual attention and swear words [3]. Investigating the effects of gender was outside of the scope of this research, and a female gender was found to be appropriate in regards to the intended user group. Both personalities were quantitatively assessed throughout the design process to ensure that they were perceived as intended by users, and that users were in agreement regarding how they perceived the two personalities.

3.3 The Chatbot Prototype

The chatbot prototypes were built using the Chatfuel bot builder platform, and the experiment was run through Facebook's Messenger platform. The chatbots interact through written input and output, and did not support speech-to-text. The chatbot skills included, planning dinner for the whole week or evening, help using leftover ingredients, help eating healthier or increase consumption of vegetables, and add to and accessing grocery lists.

4 Experiment Methodology

The experiment was conducted to answer the research question: *Will chatbots with a defined personality improve the user experience of chatbot interfaces?* In the experiment the independent variable *personality* was manipulated into two levels (Chatbot A and B), to assess whether it has an effect on the dependent variable *User Experience*. The experiment uses the following hypotheses:

- H_{11} : *Personality affects the user experience of chatbots*
- H_{12} : *Chatbot A will have a positive effect over Chatbot B*

In addition to the hypotheses stated above, data was collected regarding participants preferred version and their reasoning for this.

4.1 Experiment Setup

Participants were recruited through convenience sampling, all within the age group of 25-40 years of age, 8 females and 8 males. The sample consisted of couples living together, either married or unmarried. 12 of the 16 participants had children in kindergarten or primary school. The participants were not aware of the goal of the experiment; they were invited to test two versions of a chatbot interface. Participants evaluated the two chatbots by completing a series of tasks using each chatbot. In order to compare the two chatbot versions, the participants will be their own control group as the experiment design will allow for a between & within-subjects design using a two by two factorial design, see Table 2. Half of the group will test Chatbot A first, while the second half will test Chatbot B first; to avoid a sequence/interaction effect. The participants will be presented with the same form for each chatbot.

Table 2. Experiment Design of the two-by-two factorial design

Experiment Design				
Group 1	Chatbot A	AttrakDiff Evaluation	Chatbot B	AttrakDiff Evaluation
Group 2	Chatbot B	AttrakDiff Evaluation	Chatbot A	AttrakDiff Evaluation

4.2 Data collection: AttrakDiff

User experience is defined in ISO 9241-210 as "all the users' emotions beliefs, preferences, perceptions, physical and psychological responses, behaviours, and accomplishments that occur before, during and after use". Usability is the most widely known definition to determine whether a product is good or bad, and therefore an important part to determine a great user experience. Usability is defined in ISO 9241-210 as the "extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use". Hassenzahl (2006) believes that this definition is too task oriented, focusing on task completion and reaching goals, simplicity and efficiency, and forgetting about the "fun". AttrakDiff was built to assess the user experience by looking at usefulness and usability in the pragmatic quality, independently from the hedonic qualities of stimulation, challenge and motivation, and attractiveness [11]. The AttrakDiff form assesses personal user rating of a products usability and design.

Pragmatic Quality: Usefulness and usability of the system.

Hedonic Quality: Motivation, stimulation and challenge for the user.

The AttrakDiff measurement instrument consists of 28 seven-step items of opposing adjectives ordered into a scale of intensity. The middle values of an item group creates a scale value for pragmatic quality (PQ), hedonic quality (HQ - include HQ-I and HQ-S) and attractiveness (ATT). HQ-I and HQ-S are the sub-qualities of stimulation and identity of hedonic quality. The pragmatic quality will assess usability and usefulness of the chatbot, while both hedonic and attractiveness qualities will be used to assess the satisfaction with each version.

5 Results

The data collected through the AttrakDiff form was analysed by running a paired samples t-test. The statistics will be used to test H_11 : *Personality affects the user experience of chatbots*, and H_12 : *Chatbot A will have a positive effect over Chatbot B*. Descriptive statistics and the results of the paired samples t-test of the AttrakDiff data can be found in Table 3. Personality has two levels (Chatbot B=conscientious, Chatbot A=agreeable) and user experience has four factors (Pragmatic Quality, Hedonic Quality-Stimulation, Hedonic Quality-Identity, Attractiveness).

Table 3. Descriptive statistics & paired samples t-test AttrakDiff results, B=Chatbot B, A=Chatbot A

Descriptive Statistics & Paired Samples t-Test								
	N	Minimum	Maximum	Mean	Std. Deviation	t	df	Sig.(2-tailed)
PQ _B	16	4	6,43	5,47	0,60			
PQ _A	16	4,86	6,71	5,93	0,56	-2,152	15	,048
HQ-I _B	16	3,57	5,43	4,77	0,57			
HQ-I _A	16	4	6,29	5,48	0,53	3,239	15	,006
HQ-S _B	16	2,57	6,57	4,78	1,19			
HQ-S _A	16	5,14	6,14	5,62	0,30	2,934	15	,010
ATT _B	16	3,9	6,3	5,34	0,78			
ATT _A	16	5,14	7	6,35	0,45	-4,069	15	,001

The paired samples t-test found that there is a significant difference in the scores between Chatbot B and Chatbot A, where all four factors of the user experience showed a significant positive effect between Chatbot B and A. These results suggest that personality has a positive effect on the user experience of chatbots, as all four factors of user experience were scored higher for Chatbot A than Chatbot B. As shown in Figure 2, Chatbot A performed better in both hedonic and pragmatic qualities than Chatbot B and shows the mean score of each user experience factor and how the two personalities scored compared to each other. Figure 3 shows both personalities compared in the attractiveness rating.

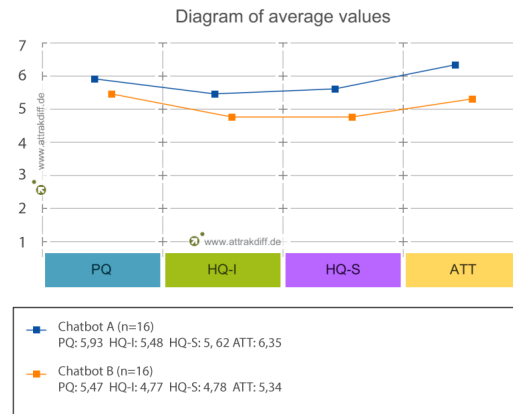


Fig. 2. Diagram of average values

In addition to the AttrakDiff evaluation, each participant was also asked at the end of the experiment to answer which of the two chatbots they preferred. Twelve of the sixteen participants preferred Chatbot A over Chatbot B, three males and one female preferred Chatbot B. Those who preferred Chatbot B also rated it higher in pragmatic qualities, but rated Chatbot A higher overall.

6 Discussion and Limitations

The agreeable personality of Chatbot A had a more positive effect on the user experience than the conscientious personality of Chatbot B. This does not mean that an agreeable personality is always better than a conscientious personality. Instead it shows that for this specific user group the agreeable personality was more suitable. In other situations where the chatbot represents another brand in another domain, towards a different user group, an agreeable personality might not be appropriate. The aim of our research was to support the assumption that a chatbot's personality should match its domain and user group.

The personality framework was built for chatbots that represents brands, where the chatbot acts as an extension of the services provided by the brand. Therefore the two personalities did not incorporate traits from the neuroticism factor, as traits found in this factor could represent the brand in a negative way. In addition to the lack of "negative" traits, users were only exposed to the two personalities in a short session. Longer exposure and interactions over longer periods could potentially have different results than those presented in this experiment. Another limitation in regards to the research methodology was the use of AttrakDiff, as it is not created for evaluating chatbots, but interactive products in general. AttrakDiff assesses interactive products through opposing adjectives, and participants noted that some of the adjectives included in the form was difficult to define when testing a chatbot. This is because some ad-

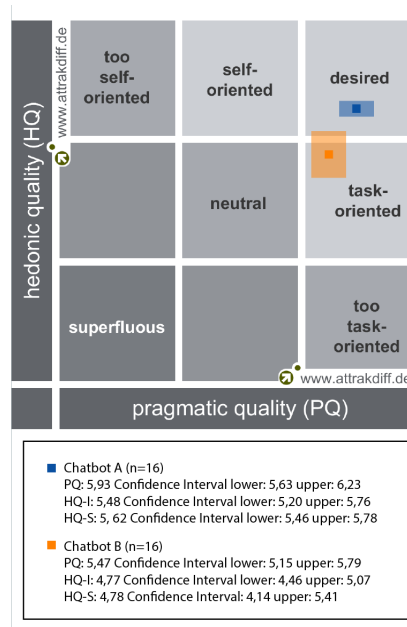


Fig. 3. Results Attrakdiff

jectives could be negative in a personality, but more positive when assessing a product. In addition, pilot tests found that minor errors made by the chatbot during interactions with users had a large impact on the overall perception, which made it necessary to limit user's freedom when interacting with the chatbot during the experiment. They were therefore not free to ask the chatbot whatever they wanted, but instead they were given tasks that the chatbots were trained to handle. Not allowing users to freely interact with the chatbots could have impacted the overall perception.

7 Conclusions and Future Work

The findings from the statistical analysis of the results found a significant difference between the pragmatic quality, hedonic quality and attractiveness of Chatbot A and Chatbot B. The results of the paired-samples t-test found that there was a significant positive effect on the user experience of Chatbot A compared to Chatbot B. Based on these results we can keep our research hypotheses H_11 and H_12 , and we can conclude that personality does affect the user experience of chatbot interfaces.

For future research we want to investigate the long-term effects of chatbot personalities on the user experience. In addition to developing the personality framework further; by implementing and evaluating the framework in different

domains and for other user groups. Another aspect for future research is to adapt the AttrakDiff measurement tool to become more suitable for CUIs. In addition to this, having a tool to be able to assess and evaluate the user experience when the CA grows and learns in regards to the specific user will become important.

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