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Personality Is To A Conversational Agent What Perfume Is To A Flower

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Abstract—Although there has been a growing interest for conversational AI (CAI) agents in the consumer electronics (CE) community, how these agents are personified by humans has been an unexplored area. Creating personality traits for CAI agents is important as it will enable providing more personalized services. Accordingly, we propose a multi-dimensional approach involving two distinct phases and three different experiments for generating the CAI personality by integrating concepts from human, brand, and website personality frameworks. We identify eight unique personality types, three of which are proposed for the first time. Accordingly, the research implications are discussed.

■ **IN THE** recent years conversational AI (CAI) has been a hot research topic in the consumer electronics (CE) community. Advancements in AI, machine learning, and natural language processing (NLP) techniques have made voice a new modality of human-to-machine (H2M) communication. This new communication modality is totally different from traditional ways of H2M communication that is prevalent in the graphical user interface (GUI) paradigm. Ability of the CAI devices to strike human-like communication, and even mimic human behavioral characteristics, e.g., using filler words like “mmm” or “hmmm” during conversations make them more human-centric. This anthropomorphic feature is a specialty of the CAI paradigm. While existing CE research has focused on human speech characteristics and how these CAI agents recognize human speech emotions [1], [2], the opposite aspect of how

“humane” these devices are perceived to be, and how users personify them has been a less explored area. Extant research has shown that humans like to engage with machines that exhibit human-like personality, however, what describes the CAI agent's personality in the first place is a fundamental problem [3]. A few studies have tried to answer this in terms of well-known human personality frameworks, like, Big Five Factor Model (FFM), Myers-Briggs Type Indicator (MBTI), or the Stereotype Content Model (SCM) [4], [5]. The problem is these frameworks although well-known, are heavily grounded on human personality. So it remains unclear how effective they will be towards describing the machine personality. For example, the FFM dimension of “openness” might not be relevant for CAI agents, whereas “naturalness” of voice maybe more appropriate – an aspect current human personality framework cannot explain.

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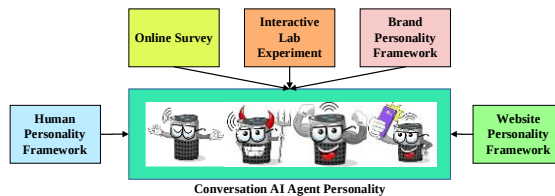


Figure 1. CAI Agent Personality

Accordingly, in this work we have tried integrating concepts from different domains like brand personality, human personality, and website personality for illustrating CAI agent personality. Additionally, an online survey and lab-based interaction study is conducted for investigating any unexplored areas. **Figure. 1** presents the overall concept. We believe that for the CAI paradigm to succeed, there needs to be two-way matching between human and machine personalities, and as CE researchers what constitutes such machine personality is of significance.

HUMAN AND CAI AGENT PERSONALITY

To begin with we would like to briefly outline the major personality frameworks, and what are the benefits of developing personality for CAI agents. MBTI, FFM, SCM and Edwards Personality Preference Schedule (EPPS) are some of the commonly used personality frameworks in Human Computer Interaction (HCI) research. These frameworks capture different human traits like openness, conscientiousness, extraversion, agreeableness, neuroticism, dimensions of warmth, competence, intelligence and many more. Over time FFM has emerged to be the most prominent model in personality research as it depicts individuals' perceptions of feeling, thought, and behavior [6]. Moreover, it is relatively robust across cultures.

Apart from the human personality aspect, there is a concept of brand personality [7], and website personality [8]. People attribute human like characteristics to brands, websites, and even mobile interfaces. This is best explained in terms of the media equation where people treat computers as real social actors [9]. In this respect the notion of machine mannerism is equally important that should control the H2M interactions [10]. As evident the factors comprising of brand or website personality are different when compared to human personality, which is obvious due to the different nature of the objects.

The reason we are stressing on the personification aspect is because current research has shown that

products having personality have numerous advantages [3], [5]. Personification improves consumer engagement, loyalty, elevates brand trust, and overall helps in shaping a positive attitude in consumer's mind. At the same time HCI researchers have shown that for any anthropomorphic technology (specifically CAI agents), users unconsciously make personality inferences, just like for humans. More importantly, the acceptance and credibility of these agents are determined in terms of these having a consistent and favorable personality. Therefore, as CE researchers for ensuring a widespread diffusion of these products into the society, it becomes fundamental to explore the CAI agent personality from a multi-disciplinary perspective – an area that needs further research.

The existing personality frameworks (human, brand, or website) fall short due to the uniqueness of CAI agents in terms of their conversational style, speaking rate, pitch of voice, and their interaction behavior with the users, for e.g., mannerism [3]. The users perceive these CAI agents to be somewhere between alive and lifeless, and to have a certain degree of “robotic” trait. Consequently, although some of the general preferences of the users towards CAI agent personalities are known (e.g., preferences for warmth, competence, or supportive), there is no clear evidence that how these personalities are designed, nor what users think about them. Moreover, how effective the existing frameworks will be in generating CAI agent personality is unknown, yet very important that motivated this research.

THE TWO-PHASE APPROACH

For identifying the CAI personality, we used a two-pass design approach. **Figure. 2** outlines the entire procedure. The objective of the first pass was to generate an initial personality inventory as applicable to the CAI agents. Two distinct experiments were performed in this regard: an online survey (Step 1), and an interactive lab experiment (Step 2). The results from these two studies were augmented with the existing concepts from human, brand, and website personality frameworks for creating the initial repository (Step 3). In the second pass a final survey was conducted based on the initial inventory (Step 4), followed by conducting an Exploratory Factor Analysis (EFA) on the collected dataset for exploring the structure and relationship among the different items present in the inventory and coming up with the final principal personality components (Steps 5 & 6).

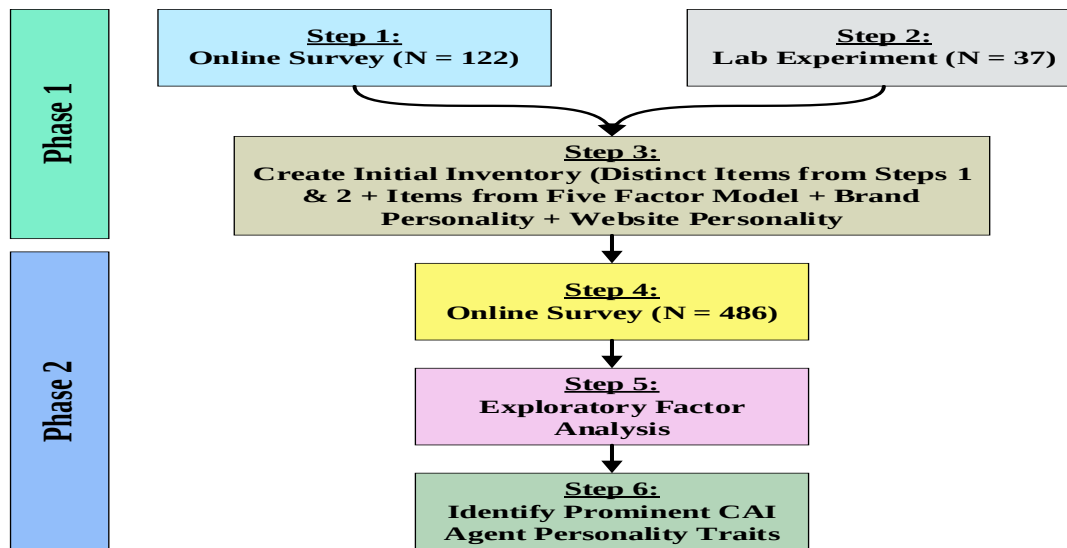


Figure 2. The Two-phase Design Approach

Online Survey (Phase 1)

This initial survey was conducted online by recruiting potential participants from university mailing lists in India and Thailand. Total 122 participants completed the survey (68% male, 71% studying undergraduate courses, mean age of 22.4 years). All the participants were experienced using some form of CAI agents in their daily life that was ensured by giving a screening question at the beginning of the survey. Apart from the demographic details the survey captured which CAI agent each participant had experience with, following which they were told to describe the personality of the CAI agent based on their experience using three relevant adjectives. During data analysis, wherever possible we replaced noun by its corresponding adjective (e.g., *trust* to *trustful*), and tried to simplify multi-word occurrences into a single word (e.g., *sometimes irritating* to *irritating*). Additionally, any other irrelevant mentions not related to personality were removed (e.g., *my privacy concerns are high*). We obtained 79 unique personality descriptors from this step, the top 5 being presented in **Table 1** together with their occurrence frequency. Interestingly, we found two traits in the top 5: unhuman, and robotic that are not captured by the current human, brand, or website personality frameworks.

Lab Experiment (Phase 1)

The purpose of the lab experiment was to explore the CAI personality traits based upon simulating a

Table 1. Top 5 personality traits

Online Survey		Experiment	
Friendly	42%	Informative	55%
Funny	33%	Friendly	48%
Irritating	19%	Decent	27%
Unhuman	12%	Funny	20%
Robotic	11%	Competent	16%

Table 2. The task details

#	Description
1	How is the weather like? What about tomorrow?
2	What is your gender?
3	Play me some songs of Celine Dion
4	What is COVID? How can I protect myself from it?
5	What do you look like? How old are you?
6	Do you ever get tired? Tell me some jokes
7	Give me some words of wisdom
8	What is today's date? What time is it now?
9	Make me a cup of coffee
10	How do I go to Fancy market?

real-time interaction scenario with these agents. A within-group design choice was used, wherein each participant had to interact with three popular CAI agents (Amazon Alexa, Apple Siri, and Google Home). They had to perform ten different tasks on each agent (**Table 2**). The order of presenting the CAI agents and the tasks were counterbalanced. Each participant was interviewed after the experiment. To make them comfortable and familiar with the personality aspect, first the participants were asked to describe the personality of some person close to them. Then, after each interaction they were asked to describe the personality of the CAI agents. Our

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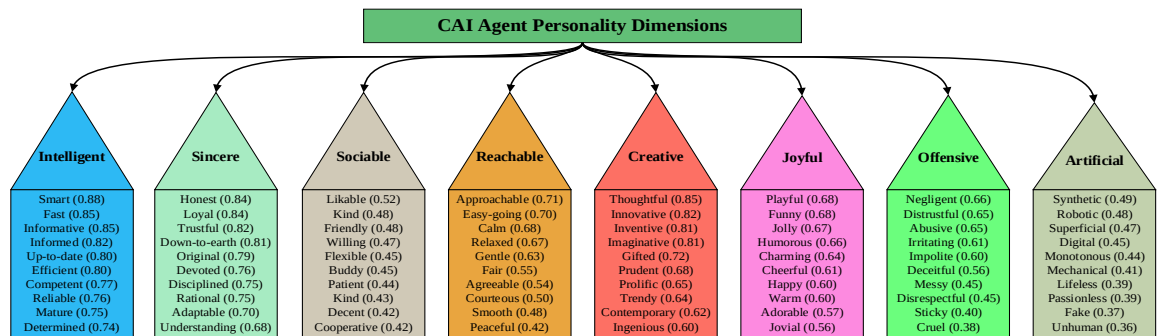


Figure 3. The Eight Personality Dimensions of CAI Agents

have a generalization and generate as many different personality types as possible. After transcribing all the interviews, the data was analyzed. Open codes were generated by two independent researchers that were finally discussed together and merged into one common set. Total 37 participants completed the experiment (46% male, mean age of 27.3 years) who were recruited based on personal contacts and further references (a mixture of convenience and snowballing approach). A total of 92 different personality traits were obtained in this stage, of which 55 were unique and not found from the previously conducted online survey. The top 5 personality descriptors are outlined in Table 1.

After the above two steps we took all the 100 personality descriptors from FFM, 42 descriptors from the brand personality framework, and 38 descriptors from website personality framework, and merged it with our initial inventory to obtain 314 personality descriptors. We further refined this set in several iterations. We devised the following exclusion criterion: remove ambiguous words like “cool” or “spicy”, remove words that are related to outward appearance/aesthetics like “pretty”, “small”, or “bulky”, and remove traits that are lexically opposites like “honest” and “dishonest”. This process eliminated 58 entries, leaving with a final corpus size of 256.

Final Online Survey (Phase 2)

The final online survey was conducted using the professional SurveyMonkey platform as it enabled us to reach a diverse and large sample conveniently. This survey was also not restricted to any specific CAI agent, however, the participants needed to have at least 6 months of usage experience. The 256 personality descriptors were presented randomly to

objective through this experiment was not to compare the personality types of the different agents, but to the participants, which they had to agree or disagree upon. A 4-point Likert scale ranging from strongly disagree (1), disagree (2), agree (3) to strongly agree (4) was used. This scale was chosen since we wanted to avoid a neutral option. Items such as “My CAI agent is *smart*”, “My CAI agent is *innovative*”, “My CAI agent is *friendly*”, and likewise were used in the survey covering all the personality traits. Total 466 usable responses were obtained (60.3% male, mean age of 35.6 years, 49.1% having usage experience of 6 months to 1 year, and 50.8% having more than 1 year usage experience).

Exploratory Factor Analysis (Phase 2)

The EFA was carried out in SPSS software. Initially a reliability analysis was conducted on the 256 personality descriptors by checking the Cronbach’s Alpha value (should be higher than 0.60), and corrected item-total correlations (should be higher than 0.30). Following these 9 traits were eliminated (*jealous, indifferent, gloomy, aggressive, biased, reckless, clumsy, forceful, and cluttered*). Next, for determining the suitability of data towards factor analysis two conditions were checked: Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (KMO = 0.842) and Bartlett’s test of sphericity, both of which were significant ($p < 0.001$). Since we expected that many of our personality traits could be correlated, we performed a Principal Component Analysis (PCA) with direct oblimin rotation for giving the best results. A eight factor solution was obtained with the eigenvalue for each factor being greater than 1, and this solution explained 76% of the variance of CAI personality. **Figure 3.** shows our proposed eight personality dimensions. In each dimension the top 10 personality traits are shown.

Table 3. Implications of the eight CAI personality dimensions

Dimension	Implication
Intelligent	Scoring high means more competency, maturity, and up-to-date information provided by the CAI agents - indicating good usability and UX
Sociable	Scoring high refers to the friendliness and readiness of the CAI agent (e.g., in terms of visual indicator), or even willingness to give a more detailed response and be co-operative
Artificial	Scoring high means the agent presents itself as a machine (object) and is incapable to serve as a human proxy indicating a possibly weak or no anthropomorphic effect at all
Sincere	Scoring high means the agents are perceived to be more honest and trustful to their users, which in turn will help to establish a loyal user base
Creative	Scoring high means the agents are innovative, trendy, and able to happily surprise the users during their interaction, which in-turn may lead to better engagement and satisfaction level
Joyful	Scoring high means the CAI agents can interact in funny and humorous ways with users that can be entertaining. This may be possible in terms of functionalities like ability to crack jokes, play games or even give humorous responses to simple questions
Offensive	Scoring high means either the CAI agents do not respond favorably to the users (impolite or unfriendly tone), might not readily agree with the users, or may even refuse to perform as per user's wishes
Reachable	Scoring high means the CAI agent is always ready to serve the users, the voice interactions are easy to make (navigation ease), and appropriate feedback is provided by the agents irrespective of whether the user's request can be fulfilled or not

THE CAI PERSONALITY FRAMEWORK

Intelligent, sociable, artificial, sincere, creative, joyful, offensive, and reachable are the eight CAI personality dimensions. Intelligent refers to how effective, efficient, and reliable the CAI agents are when performing the users' tasks. This is like the competence dimension of brand personality framework.

Sociable dimension refers to the willingness of the CAI agents to assist the users during their interaction with them. This dimension captures a positive tone of H2M communication, for e.g., willing, patient, kind or decent. This sociable aspect has not been reported either in brand or website personality frameworks but is similar to the agreeableness dimension of the FFM model.

Artificial dimension captures the unhuman or robotic nature of the CAI agents. Having personality traits such as synthetic, superficial, digital, or mechanical reflects the lifeless machine-aspect of these agents.

Sincere dimension reflects how much understanding, determined, disciplined, and honest the CAI agents are in terms of performing their tasks. This dimension is similarly aligned with the brand personality framework.

Creative dimension represents how much innovative and thoughtful the CAI agents are in providing information to the users. Being creative these agents will be able to eliminate boredom and make user interactions exciting. This dimension is similar to the excitement category of brand personality.

Joyful dimension captures the playful and humorous aspect of the CAI agents in terms of their

social behavior with users. This is like the fun dimension of the website personality framework.

Offensive dimension is characterized by negative personality traits like abusive, irritable, impolite, or disrespectful. Overall, it captures the adversarial scenarios that should be eliminated. This aspect has not been mentioned in previous works.

Reachable dimension refers to the approachable and welcoming nature of the CAI agents by incorporating personality traits like relaxed, courteous, and easy-going.

IMPLICATION AND RECOMMENDATION

The objective of this work was to understand the personification aspect of the CAI agents from a multi-disciplinary perspective covering human, brand, and website personality frameworks by conducting three distinct studies. We identified 8 personality dimensions, some of which are not covered by the existing frameworks, e.g., artificial, offensive, and reachable dimensions. **Table 3** presents the implications of the findings, wherein we have attempted to portray what to expect (and not expect) from the CAI agents having a specific personality type.

One continuing goal of both CE and HCI researchers is to make technology as human-like as possible- the very basic reason for the emergence of new H2M communication paradigm like voice. In fact, the presence of artificial dimension even confirms this aspect, however, it suggests that voice as a means of anthropomorphism is weak. Since the core idea behind voice as a communication modality is to mimic human conversations, we propose to include voice of famous personalities as machine-voice, which might be able to establish a deeper bond with the

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users. A second aspect which needs attention is the offensive personality dimension. Whatever the users might ask these CAI agents (even in case of offensive questions), the response should be in a friendly tone, and empathetic manner. Although further research is needed into what turns a CAI agent to be in the offensive mood, yet, whatever the reasons might be such user abuses should be ignored, and a suitable response style should be selected. Another aspect of the present study is we did not focus on any specific CAI agent, since our objective was to develop a generalized agent personality framework that reduces dependency on human personality models. Although all the CAI agents were assigned similar tasks, yet, we did not consider the possibility of whether different task types might influence the machine personality. Acknowledging these limitations, we encourage future researchers to investigate the effect of different CAI agents and task types on the personality descriptors. Our proposed dimensions do not match directly either with the FFM model, nor the brand or website personality frameworks. In fact, the artificial, offensive, and reachable dimensions are proposed for the first time.

The personality framework that we developed can further be extended by future studies for creating computational/prediction models that investigate the adoption aspect of these agents and their diffusion in the society. Present works consider mostly usability issues like ease of use, or usefulness. However, creating agent personality will help researchers investigate how such personalities lead to the formation of relationships between man and machines. Moreover, cognitive, and affective relationships that are inherent to any anthropomorphic technology can be better explained in terms of agent personality. Likewise, future work may also propose a two-way recommendation system that considers the personality of users together with the agents and provides the best suggestion in terms of matching between the two.

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