Shaping Gestures to Shape Personality: Big-Five Traits, Godspeed Scores and the Similarity-Attraction Effect

Extended Abstract

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ABSTRACT

This paper explores the role of personality as a mediation variable between observable behaviour of a robot — in this case, gestures of different energy and spatial extension — and the experience of its users according to the Godspeed questionnaire, a standard instrument for gathering subjective ratings of human-robot interaction. The results show that the personality traits that the users attribute to a robot are, to a certain extent, predictive of the subjective scores, i.e., of the quality of the interaction they have with it. Furthermore, the experiments show that 15 of the 30 observers involved in the experiments tend to like the robot more when they attribute traits to it that more similar to their own. The observation that only part of the observers display such a tendency — known as similarity-attraction effect — might explain why previous investigations of the same phenomenon have provided contradictory results.

KEYWORDS

Automatic Personality Synthesis; Gestures; Similarity-Attraction Effect, Godspeed Scores.

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1 INTRODUCTION

Social Cognition shows that '*people make social inferences without intentions, awareness, or effort, i.e. spontaneously*" [25]. This means that the very presence of others activates cognitive processes that take place outside conscious awareness and aim at deriving "*evaluations and impressions of a target*" [12], i.e., aim at making sense of others while identifying the best way of interacting with them. These processes are so pervasive and spontaneous that they take place not only in face-to-face interactions [26], but also in technology mediated settings — e.g., when observing people in a video [20] — and during interactions with machines that can display human-like behaviours, e.g., during the interactions between people and talking machines [15].

The goal of this work is to investigate a particular aspect of this phenomenon; specifically, the association between the personality traits that people attribute to a robot and the gestures that it displays. In other words, this work tries to show whether the synthesis of gestures with a humanoid robot makes it possible to perform *Automatic Personality Synthesis* (APS), i.e., the task of conveying personality impressions with machines [27]. The main reason for focusing on gestures is that these convey messages more effectively than speech when the level of acoustic noise is high [17, 18]; one of the main characteristics of the public spaces where the gestures investigated in this work will actually be adopted for Human-Robot Interaction (HRI). The main motivation behind the focus on personality is that people have been shown to more positively evaluate those machines to which they attribute more desirable traits [15], or that have traits more similar to their own [10, 23, 24]. In addition to the above, this work tries to verify whether the *similarity-attraction* effect — the tendency of people with similar personality to like one another [14] — applies in the case of synthetic gestures as well.

2 METHODOLOGY

The experiments presented in this paper were conducted using 45 gestures that were synthesized by varying the *amplitude* and *speed* — two aspects that have been shown to characterize the expressiveness of a gesture performed by an artificial agent [9] — of 5 core gestures on the Pepper robot: *Disengaging*, *Engaging*, *Pointing*, *Head-Touching*, *Cheering*. Each of the 45 gestures were shown to each of the 30 human observers (20 female and 10 male) of the experiment. They were asked to rate themselves, and the robot, in terms of the *Big-Five* [22]; the five personality traits known to capture most observable individual differences [6]: *Openness*, *Conscientiousness*, *Extraversion*, *Agreeableness*, and *Neuroticism*. The Big-Five personality model is the most commonly adopted and effective personality model both in psychology [13], and computing [27], and the questionnaire adopted in this work is the *Big Five Inventory 10* (BFI-10) [19]. The BFI-10 was used both for the observers to self-asses their own personality traits, and for them to attribute personality traits to the Robot while it displays the gestures. In addition the observers were also asked to fill out the Godspeed questionnaire [3] for each gesture. It was selected because it is widely used in HRI to measure the following tendencies associated with the interaction between humans and robots: *Anthropomorphism*, *Animacy*, *Likeability*, *Perceived Intelligence*, and *Perceived Safety*. The observers were selected randomly from a pool of assessors available at the university where the experiments were performed, and they received payment corresponding to the minimum legal hourly wage in the country where the experiments were performed.

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3 EXPERIMENTAL RESULTS

On the question of whether there is an association between the gestures that a robot displays, and the traits that human observers attribute to it, the results show that, at least for some traits, there is a statistically significant association between the amplitude and speed of the gesture, and the personality scores as assigned by the observers.

Statistically significant effects were observed for Extraversion, Agreeableness and Neuroticism, but not for Openness and Conscientiousness. One possible explanation is that the latter traits are less socially oriented than the former, suggesting that the adoption of communicative gestures inherently targeting a scenario of interpersonal interaction is likely to reduce their chances to emerge clearly. In the case of Extraversion there are statistically significant effects for the variants of all core gestures except Disengaging. The probable reason is that Extraversion accounts for the tendency to attract social attention [2], while the main communicative goal of the Disengaging gesture is to reject it.

The results also show that gestures with increasing amplitude and speed also tends to be associated with lower Agreeableness scores for the Disengaging core gesture. The probable reason for this is that the main communicative goal of the gesture is to avoid interaction or reject users; two goals that are not aligned with the main tendency Agreeableness accounts for [22]. Increasing spatial extension and energy is likely to be interpreted as a more resolute attempt to avoid interaction and, hence, as a less agreeable attitude towards others.

Finally, there are statistically significant effects for Neuroticism corresponding with all core gestures except Head-Touching with a tendency to observe higher scores for the trait when amplitude and speed increase. One possible explanation is that the literature reports a relationship between emotional expressiveness and Neuroticism (see [4, 21]), with the reasoning that such a trait is often referred to as *Emotional Stability*.

On the question of whether personality can act as a mediation variable with respect to the quality of the interaction, the results show that there is a relationship between the attributed personality traits and the Godspeed scores assigned by the observers. This confirms that the personality traits are, indeed, predictive of the interaction quality between people and robots. The results suggest that the Big-Five traits are predictive, in particular, of Likeability and Perceived Safety. In both cases, the correlation is positive with socially desirable traits (Openness, Extraversion and Agreeableness) and negative with Neuroticism, the only trait of the Big-Five that is not socially desirable. This seems to embody the intuitive tendency to prefer and consider safe those robots that convey positive personality impressions or expectations of desirable behavioural tendencies, an evaluative aspect of social perception that has been shown to be typical of zero acquaintance judgements [7, 8].

In the case of Animacy, there is a positive correlation with Conscientiousness and Extraversion. The probable explanation is that the attribution of personality traits corresponds to the attribution of behaviour (see [8]), or inner processes allowing the robot to move "*without an external push or pull*" [3]; the very property Animacy corresponds to. As both Extraversion and Conscientiousness are socially desirable traits, the finding seems to suggest that the observers tend to consider robobts more life-like when they convey good personality impressions and, vice versa, more machine-like when they convey negative personality impressions. Finally, the relationship between Neuroticism and Perceived Intelligence appears to parallel similar effects observed in educational settings (see, e.g., [5]).

On the question of whether the similarity-attraction effect applies to the gestures, i.e., whether the human observers tend to prefer those robots to which they attribute personality traits more similar to their own [15, 16], the results show that the correlation between the Godspeed scores, and the personality difference between robots and observers tends to be negative. While this confirms that the effect does take place, the extent to which it occurs depends on the particular Godspeed dimension, and on the particular participant. For 4 observers the effect is too weak to be observed, for another 15 the correlation is negative with all Godspeed scores for which there is a statistically significant correlation, while in 2 cases the correlation is positive or negative depending on the Godspeed scores. For the remaining 9 observers the correlation is always positive, showing that for them, the tendency is towards a complementary-attraction effect. Such a difference across the observers is a possible explanation of the contradictory results observed in the literature about HRI, where the effect is sometimes observed [10, 23, 24] and sometimes not [11, 28, 29].

4 CONCLUSION

This work investigated the role of the Big-Five personality traits [22] as a mediation variable between the observable behaviour of a robot — amplitude and speed of gestures — and quality of Human-Robot Interaction according to the Godspeed questionnaire [3]. The experiments presented in this work investigated the relationship among the traits that 30 human observers attribute to themselves (the self-assessed traits), the traits that they attribute to the robot (the perceived traits) and the Godspeed scores. The results show that there is an relationship between the amplitude and speed of gestural stimuli and at least some of the Big-Five personality traits; in line with experimental observations since the earliest experimental studies on non-verbal communications between humans [1, 4]. Moreover, the results show that there are statistically significant correlations between attributed traits and Godspeed scores, again, in line with observations made about person perception in the case of humans [7]. Finally, the experiments show that the similarity-attraction effect takes place for the majority of the observers involved in the experiments, but not for all; possibly explaining why the evidence about the phenomenon is contradictory in the literature [27].

Overall the findings seem to confirm that social robots are indeed able to interface with the psychology of their users, and also to activate the same processes as those observed in human-human interactions. The main implication for the design of HRI is that this is likely to be as complex as human-human social interaction, and that these interactions are likely governed, at least to a certain extent, by the same underlying principles and laws.

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