The Importance of the Person's Assertiveness in Persuasive Human-Robot Interactions*

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Abstract. In social robotics, user-personalised messages is a technique that can be used to persuade a person to do something. Those messages can be personalised according to the personality of whom will receive this message. So, it is essential to know the personality traits of the target. However, we have many traits, e.g., a person can be extroverted, assertive, logical, among others. Because of that, it is challenging to create a strategy that can reach all the traits. In this sense, we chose to focus our persuasion strategies to approach the assertive trait of a person. The strategies were applied in a storytelling scenario with an autonomous social robot behaving assertively using strategies to suggesting the person change the decision with assertive messages and nonverbal persuasive techniques. Besides, we take into account the assertiveness level of the participant to measure if this level influences the acceptance of robot suggestion or not. We observed from the results that a person's assertiveness level might influence the perception regarding the persuasive agent and the decisions-made in the task.

Keywords: Persuasion · Personality Traits · Assertiveness · Human-Robot Interaction.

1 Introduction

Researchers have observed that the person's personality identification can be used to achieve some goals, such as identifying the possible consumers of a specific product. Also, it has been found that the inherent behaviour of some characteristics is sought for specific positions. For example, people with more accentuated assertive trait tend to be good leaders [11]. For this reason, the identification of a person's personality trait related to the behaviour that this

* We would like to thank the State University of Rio Grande do Norte (UERN), National Council for Scientific and Technological Development (CNPq) program Science without Border: 201833/2014-0 - Brazil and Agência Regional para o Desenvolvimento e Tecnologia (ARDITI) - M1420-09-5369-000001, for PhD grants to the first and second author, respectively. This work was also supported by Fundação para a Ciência e a Tecnologia: (FCT) - UIDB/50021/2020.

trait may present has been a strategy used to apply personalised persuasion. For example, if according to the behaviour presented in the task a person is identified as extroverted, it is possible to personalise persuasion strategies for this trait.

Although the idea of using persuasion based on personality seems promising, the development of persuasion strategies that can identify a person's personality trait and can create personalised messages for that identified trait is not a simple task to be carried out. There are some essential factors to consider, some of them are: which trait the strategy should identify; how to identify this trait; how to create tailored-messages to approach the trait identified; how to delivery this tailored-message to the audience; how to recognise if the personalised message was effective; among others.

As is known, a person can present different traits of personality, e.g. a person can be introverted, lovable, logical and neurotic. Besides, each trait individually or combined can identify a behaviour, for example, people considered more assertive are those who exhibit the behaviour of having more self-confidence, sincerity, honesty, among others. Because of the behaviour that each trait can represent, it is essential to identify the traits that can best be addressed for each task. This identification can be made through a person's behaviour in front of a task, the answers provided by a questionnaire, a drawing, among other strategies. After identifying the person's personality traits, it is time to define the strategies of influence that will be used and how to perform the persuasion. For example, the use of gazing at the desired target by a persuasive agent plays a significant role in the persuasion task [9]. Another persuasive strategy is the use of words that can affect our perceptions, attitudes, beliefs and emotions [8]. Therefore, the way words are spoken and connected is essential to influence a person. Plus, the use of strategies that can increase a person's trust level, as performing small-talk before the interaction between the participant and persuasive agent, is essential to boost persuasion efficacy [18, 21]. Besides, the interlocutor, such as a storyteller, virtual or physical agent, is unique in terms of gender, age, personality and background, and such characteristics are important to understand the nature of social influence [8]. Therefore, it is essential to define the persuasive agent's behaviour with qualities that can enhance the credibility of this agent. For example, the agent can be perceived with a high level of assertiveness which is a trait widely used in situations where influence is required [17, 20, 19].

Thus, in the context of the creation of user-tailored technology, all the factor mentioned are aspects of paramount importance to consider. For example, in the field of social robotics, the importance of creating user-personalised messages and techniques to gain trust to influence a person to do something is evident. Because of that, we notice an increasing number of research projects that consider the human's personality as an essential factor [2, 14, 7]. In this sense, we developed an Interactive Storytelling (IS) scenario with an autonomous social robot behaving assertively to suggest the person to change the decision. Besides, as we perceive that people with a higher level of assertiveness will be harder to influence than people with lower levels, we considered in the persuasion strategies this level of assertiveness. To identify this level, we used a questionnaire that allows the

person to make a self-assessment of their level of assertiveness [5]. In addition, as our scenario provides behaviours in situations in which the person must imagine himself, personality theories that classify the traits according to this type of scenario were investigated to identify if other traits stand out in this type of task. As result, the Myers-Briggs Type Indicator (MBTI) [13][5] was the one chosen to use. We observed from the results that a person's assertiveness level might influence the perception regarding the persuasive agent and the decisions-made in the task. Also, regarding the MBTI classification, some traits demand less effort to influence than others and can be approached with more straightforward and less complex strategies.

2 Goals and Hypothesis

This paper describes the study performed to measure the importance of the person's assertiveness in persuasive human-robot interactions. To reach this goal, we combined some persuasion strategies (details in section 3.3) used in previous studies. A between-subject study was performed in which the way the influence applied by the agent was manipulated. This way, we designed two study conditions: **C1)** the agent performs the influence contrary to the participant's personality, and **C2)** the agent performs the persuasion in congruence with the participant's personality. In this sense, the hypotheses defined are as follows:

H1: People with low assertiveness level will perceive the agent differently when the influence is according to their personality than people with high level.

H2: Participants with a higher level of assertiveness are more confident that the decisions made have influenced the course of story than less assertive ones.

H3: People identified with a lack of creativity and difficulty in responding to requests or accepting suggestions according to the MBTI will be the most difficult to persuade in our scenario.

3 Research Methods

3.1 Participants

A convenience sample of 38 participants was recruited on the campus of a technological institute (19 in each condition). Participants were on average 26 years old ($SD = 4.2$), and the majority of them were male (23). In the sample, 13 participants reported that they had never interacted with the social robot used in the study, and 7 (seven) had never interacted with a robot before. Eight (8) of the participants informed that they had interacted with a robot before only once, and 23 had already interacted several times with robots.

3.2 Procedures and Measures

Participants were invited to interact with a social robot in IS scenario. Plus, they were requested to perform the role of a country leader that have to make

[5] MBTI assumes 16 personality types from the combination of four opposite pairs, representing preferences or dichotomies. The pairs are Extraversion ('E')/Introversion ('I'); Sensing ('S')/iNtuition ('N'); Thinking ('T')/Feeling ('F') and Judging ('J')/Perceiving ('P').

decisions to save their people from the threats from an enemy country (similar in [15]). The participation in this study was designed into three stages:

(1) Pre-Interaction: Initially, each participant signed an informed consent before the beginning of the study. Next, the participant was asked to complete the 70-item questionnaire that classifies the MBTI person's personality[6]. Then, to check if the person's perception of the persuasive robotic agent is influenced by the study conditions, the participant was asked to complete the Godspeed questionnaire [3]. Next, the participant was asked to complete a survey to measure her/his level of assertiveness [5]. Finally, a socio-demographic questionnaire was apply for sample characterisation.

(2) Interactive Narrative-Interaction: The participant is invited by the researcher to stand in front of a large touchscreen table where the robotic agent is in the opposite position. On the screen, a central button is shown to start the narrative, and there is a background image in the theme style of the plot (medieval/middle ages) to influence the participant's immersion. Before starting the interaction, the researcher communicates that he is leaving the room, and when the participant is ready to start, s/he must press the button on the middle screen. After the button is pressed, the robot begins a small talk to try to increase the level of trust that a person can have regarding the agent. Firstly, the robot asks what is the participant's name in a complimenting way. After a few seconds of waiting for the participant's answer, the robot, introduces itself telling its role in the scenario. Finally, the storyteller sends good thoughts, praises the participant and explains how the interactive scenario will be performed. After the robot finishes all the utterances, the robot starts telling the story and the table screen changes.

The story was divided into scenes, where each scene is narrated by the storyteller and has a Decision Point (DP), with two options, that shows after the narration. The participant is required makes his intention of the decision and then, the agent performs the persuasion strategy by encouraging to keep the option selected or in opposition to it (details in section 3.3). So, the participant can confirm the intention or change it. If the participant chooses the decision that the persuasive agent had encouraged, the agent will simulate to be happy with the choice; otherwise, the simulation will be anger. After going through several DPs[7], the story comes to an end with the participant being victorious (defeating the enemy) or forced to pay a tax to the invading nation. Finally, the researcher returns to the room with the post-questionnaire.

(3) Post-Interaction: This phase is essential for measuring the effects that the interaction with the storyteller robot had on the participant. The participant is asked to answer questions about his perception of the robot and its assertiveness level. Finally, 5 questions using a 5 points Likert scale from "Strongly Disagree" to "Strongly Agree" are presented to measure the participant's per-

[6] To compare the responses of the pre-questionnaire MBTI with the MBTI system classification based on decisions made in the system scenario.

[7] The narrative has a non-linear parallel structure, which makes the story go through different places and situations depending on the final decision at each DP.

ception regarding the influence of the robot in the decisions. The questions were: I realised that the robot reacted to my decisions; My decisions influenced the events of the story; I recognised the consequences of my decisions; The end of the story depended on my decisions; I believe that the decisions were according to my personality. The total time for the experiment took approximately 60 minutes, and each participant received a €6 movie ticket for the participation.

3.3 Manipulations

From previous studies, we used the strategy where the agent talks to the person (small-talk) to increase the level of person-agent trust [18]. Also, a MBTI personality identification system based on the decisions made in an IS was used. In sum, in this system each DP measures an MBTI dimension and depending on the decision made by the person, the system assumes that s/he has a specific preference. After the person goes through all the DPs in the task, the system is able to classify the personality [15]. Besides, because of we have the MBTI person's classification from the questionnaire applied before the interaction, it is possible to identify if the person is choosing an option in congruence or against of his personality. So, the agent can perform a persuasion to confirm or change the intention (depending the study condition). We also configured the agent to have an assertive behaviour, the settings change the robot's voice (pitch=x-low and rate=+20%), posture (pride=head position high) and gaze (the agent looks more to the participant) [16]. Combining the previous strategies and settings, we refined and adapted to this study.

Firstly, to improve the personality classification system, we added new DPs measuring the MBTI classification and DPs that measure the influence of the agent without the influence of the person's personality trait. For instance, in a specific decision, the participant may have to choose between presenting the rugs horizontally or vertically. In this case, there is no obvious characteristic of a particular personality trait, such as a decision to have to speak in public or to talk to a few people (that can be used to measure the participant's extrovert or introvert level). At these specific points, the persuasive agent will always convince the participant to change the decision after s/he has informed intention.

Secondly, we developed a strategy where the agent speaks utterances with persuasive arguments, trying to influence the change of decision or encouraging confirmation. In the latter case, the agent says that it agrees with the decision and believes that the participant is making the best choice. However, if a change of decision is necessary, the agent uses persuasive resources and cogent arguments. The persuasive resources that we used were empathy-building, data presentation, and developing rethinking (creating doubt). In the first case, the agent informs that it understands the participant's intention. In the second case, the agent presents data contrary to what the participant's intention informs. In the latter case, the agent asks the participant to think better of the decision as it may not be the best decision for his people.

3.4 Materials

In order to validate our hypotheses, a quantitative study was performed using one Emys head robot. The motivation for using this robot is due its ability to

display facial expressions simulating emotional feelings [10]. Also, a big Touchscreen table was used to display the interactive story and to allow the participant to indicate the intentions and final decisions. Plus, a speaker was placed near the robot to transmit the verbal utterances (male voice). Moreover, all the participants' interactions were video and sound recorded.

3.5 System Architecture

The architecture used is similar to the one described in [19]. Firstly, the system settings will receive the participant assertiveness level and personality, and the robot settings is settled according to the study condition. Secondly, when the participant starts the storytelling, the Trust Module (TM) and Persuasion Module (PM) are activated. The TM is responsible for enabling the agent to start the small-talk and some features (e.g. mentioning the participant's name, using facial expressions and gazing at the person). PM creates the persuasive gestures for the agent and sends them to the framework responsible for animating it.

After the small-talk finishes, the Interactive Storytelling System (ISS) is started. In this module, all the scenes, immersion elements, text and DP's are arranged accordingly and shown to the participant. After each scene, the PM is called again in order to set the proper persuasive gestures for the agent for the scene. Since each scene has a DP, and the participant needs to give their intention of selection, the robot gestures need to confirm (or not) with it. For this purpose, the PM is activated. If the user intention was according to the agent's wish, the persuasive gestures are going to evoke happiness and decision support. Otherwise, expression of anger and utterances with persuasive arguments will be said trying to make the participant change his mind.

When the agent finishes his argument, the participant is required to make his final decision. Afterwards, his decision is sent to the personality module, which builds his MBTI personality in real-time. Ultimately the PM will generate new persuasive gestures for the agent to align with the participant final decision. Finally, the ISS is called again, and the process starts again for the new scene.

4 Results

To reach the end of the narrative, each participant pass by between 27 to 30 DPs; at each point, the agent interacts influencing the participant to confirm or change the choice intention. From the interactions of all participants, 1117 DPs were analysed. Summarising the interaction: first, the participant must inform the intention, then, the agent performs the influence. So, the participant can change his decision based on the robot's influence or maintain it.

H1-H2 - The Importance of the Person's Assertiveness: The Godspeed answers in the pre- and post- questionnaire were analysed to validate these hypotheses. However, participants' answers were split according to their self-assertiveness level and by condition. To classify the participant's assertiveness level, a variable categorised the participants that scored beneath the middle point of the scale as having a *low level of assertiveness* and all the remaining participants as having a *high level of assertiveness*.

As the data did not present a normal distribution, the non-parametric Wilcoxon test was performed. In the C1 condition (persuasion in opposition to the participant's personality), the results suggest that participants had a different perception of the agent after interacting with it in terms of appearance ($Z = -2.111; p = .035$) and competence ($Z = -2.456; p = .014$) only when the participants have a high level of assertiveness. There was not found sig. diff. when the participant present a low assertiveness level in C1 condition.

Regarding the C2 (the agent tries to influence the participant to chose decisions in congruence with the personality), the people with a high level of assertiveness had a different perception in terms of appearance ($Z = -2.333; p = .020$), consciousness ($Z = -2.157; p = .031$), competence ($Z = -2.226; p = .026$) and intelligence ($Z = -2.070; p = .038$). In the case where the participant present a low level of assertiveness the different perception is in terms of consciousness ($Z = -2.640; p = .008$), friendliness ($Z = -2.460; p = .014$), kindness ($Z = -2.588; p = .010$) and agreeableness ($Z = -2.081; p = .037$).

To test the influence of person's assertiveness level on changing decision, two dichotomous variables were defined, the first reflecting the participant's choice to change their decision or not and the second, related to the level of the participants' self-reported assertiveness. Then, a Kolmogorov-Smirnov observed that the data did not present a normal distribution ($K - S(417) = .391; p < .001$). Then, the statistical results of Spearman's rank-order correlation reveal that there is not a correlation between the person's assertiveness level and changing decision ($r(417) = .046, p = .347$).

Next, a χ^2 test was performed, which revealed a sig. diff. in the distribution of the self-reported assertiveness and the assertiveness level the participants gave to the robotic agent ($\chi^2(1, N = 38) = 15.055; p < .001$). Besides, performing the Spearman's rank-order correlation, the assertiveness level of the participants presented a strong, positive correlation with the level of assertiveness perceived by the storyteller, which was statistically significant ($r(38) = .629, p < .001$). Also regarding the participant's assertiveness level, it was found a positive correlation with the participant's opinion if the decisions influenced into the story, but only when the persuasive agent was influencing according to the participant's personality (C1) ($r(19) = -.499, p = .029$). In C2, there is not a correlation between the person's assertiveness level and if the decisions made influenced the story ($r(19) = -.177, p = .468$).

H3 - MBTI Personality Classification: The intention column in Table 1, shows the number of DPs that the participant informed that were different or congruent with his personality. Final Decision column indicates the number of decisions that participants have chosen different or congruent to the personality.

In 394 intentions that the participants indicated different from their personalities, the majority (i.e. 21.32%) was measuring the Felling (F) preference. In 386 intentions were selected in congruence with the participant's personality. Thinking (T) preference was the one that most of the participants selected according to their personality (i.e. 20.05%). On the other hand, the preference that the participants indicated less intentions different from the personality was iN-

tuition (N, i.e. 3.55%). The preference congruent to the participant's personality with the lowest matches was iNtuition (N, i.e. 4.57%).

The final decision preference which were different from participant's personality that obtained the majority of choices was Feeling (F, i.e. 24.63%). The preference that had the majority of final decisions chosen according to the participant's personality was Extraversion (E, i.e. 24.34%). In contrast, the preference of the final decisions that obtained the least choice by participants that were different from their personality was iNtuition (N, i.e. 3.81%). The preference that had the least final decisions chosen according to the person's personality was Sensing (S, i.e. 6.45%).

Table 1. Participant's intentions and decisions congruent and different from their personality by preference.

	Intention		Final Decision	
Preference	Different	Congruent	Different	Congruent
E	45 (11.42%)	74 (18.78%)	39 (11.44%)	83 (24.34%)
I	37 (9.39%)	41 (10.41%)	28 (8.21%)	47 (13.78%)
S	64 (16.24%)	21 (5.33%)	55 (16.13%)	22 (6.45%)
N	14 (3.55%)	18 (4.57%)	13 (3.81%)	27 (7.92%)
T	54 (13.71%)	79 (20.05%)	36 (10.56%)	79 (23.17%)
F	84 (21.32%)	54 (13.71%)	84 (24.63%)	72 (21.11%)
J	29 (7.36%)	75 (19.04%)	18 (5.28%)	74 (21.70%)
P	67 (17.01%)	24 (6.09%)	68 (19.94%)	35 (10.26%)
Total	394	386	341	439

In Table 2, it is possible to note that the preference that the participant most changed from a different intention of his personality to a congruent personality decision was Introversion (I, 40.54%). The preference that least changed was Sensing (S, 15.63%). The intention that was congruent with the person's personality, and there was a change of intention to an incongruent personality decision, the preference that most presented this behaviour was Thinking (T, 17.72%). Perceiving (P, 0%) was that least presented the change of intention.

5 Discussion of the Results

H1-H2 - The Weight of the Person's Assertiveness: The level of assertiveness of a person and the situation in which he finds himself can provoke behaviour that can change his lifestyle, making him with more leadership in his attitudes and being able to change his perceptions. Our results show that people with high assertiveness level perceive the persuasive agent different in terms of appearance and competence when the agent influences contrary to their personality. In contrast, this does not happen to people who self-classified as being less assertive. In this case, when the persuasion is against, the perception has not changed in any Godspeed term. However, when the influence effort is according to the person's personality, when the person has a high level of assertiveness, the agent's appearance, consciousness, competence and intelligence score is higher

Table 2. Intention Different (ID) of the participant's personality with the Decision Congruent (DC) to the personality, and the Intention Congruent (IC) to the personality with the final Decision Different (DD) from the personality.

Dichotomy	ID x DC	IC x DD
E	8/45 (17.18%)	6/74 (8.11%)
I	15/37 (40.54%)	2/41 (4.88%)
S	10/64 (15.63%)	2/21 (9.52%)
N	3/14 (21.43%)	1/18 (5.56%)
T	20/54 (37.04%)	14/79 (17.72%)
F	14/84 (16.67%)	2/54 (3.70%)
J	11/29 (37.93%)	13/75 (17.33%)
P	12/67 (17.91%)	0/24 (0%)
Total	93	40

than other terms. Meanwhile, the less assertive people scored higher on the agent in terms of conscience, friendliness, kindness and agreeableness. These results reflect that the person's perception of the persuasive agent can be affected by the person's level of assertiveness and the way the agent performs persuasion.

Although there is a higher number of changes of intention in participants with lower levels of assertiveness than in the participants' with higher levels, it is not possible to correlate the decision change with the participant's assertiveness level. There are some factors that could explain this event, for example, highly assertive participants rate the robot's suggestions low in persuasiveness [4]. In this way, as more assertive is a person, fewer influence effects s/he suffers.

The results suggest a correlation between the participant's level of assertiveness and the level s/he perceived in the persuasive agent. This, evidence that the person's level of assertiveness may influence how assertive this person perceives the person/agent with whom s/he is interacting. However, it is known that many variables can affect this perception and thus warrants further research. We found that assertive people value themselves more and have greater confidence and satisfaction in the decisions they make than less assertive ones [6]. This may be a reason for the correlation found between the person's level of assertiveness and the question about if the decisions made influenced the story when the persuasion is in congruence with the person's personality. Furthermore, this correlation was not found when the persuasion is against the person's personality, this may have happened because the agent has always questioned intentions that are congruent with the person's personality, planting doubts in the decisions made.

H3 - MBTI Personality Classification: People with a preference for Feeling (F) were those who most chosen options considered against their personality in the intentions and final decisions. In opposite, participants with a preference for Thinking (T), were those who most that pointed out the options following their personality in the intentions and, in the final decisions were the participants with preferences for Extroversion (E). The behaviour found in this study emphasises the behavioural characteristics of a person who has a preference from

Feeling. For example, the person with this preference tries to make a decision by assessing what is best for the people involved. Given the narrative of the scenario, where some situations have to make drastic decisions to avoid the country extermination, people with 'F' preference had to go against their natural behaviour to save the people. Thus, it can be inferred that the reason was stronger than the emotion or that the person's inner emotional response modulated and guided cognition to allow adaptive responses to the environment. When a person exhibits a certain level of emotion in the decisions made, s/he assesses in detail if the event, stimulus, or thought (or any of these together) leads to a reward or punishment, thereby producing an emotion [22]. Thus, options where there was a sense of reward rather than punishment, may have been chosen by these participants, even if the decision was against to their personality behaviour.

Regarding the majority of intentions responses to be in accordance with the preference Thinking (T), this behaviour fortifies the MBTI characteristics for this preference. People with this preference are considered logical and impersonal in their decisions, not letting their desires overflow. Thus, they are unaffected by emotions and make decisions based on their knowledge and understanding of the situation. Within an interactive strategy game scenario, where decisions must be thought before decisions are made, these characteristics stand out.

The behaviour of the Extraverts (E, those who most have chosen decisions in congruence with their personality) is in line with the MBTI characteristics for this preference. People with 'E' preference prefer to act, reflect and act again. With this behaviour, some participants may have chosen the intention on instinct, without much thought. So, the influence of the agent may have caused the reflection of the chosen intention and, consequently, the decision change.

In this scenario, participants with a preference for iNtuition (N) were those who least chose intentions and final decisions that are related to their preferences. Meanwhile, the Sensing (S) presented the lowest percentage for final decisions congruent with the participant's personality. According to the MBTI, sensing people pay more attention to physical reality and care more about what is current. People with a higher preference for the 'N' prefer to solve problems between different ideas and possibilities, and are more interested in doing things that are new and different, and prefer to see the big picture and try to find the facts. Given the above, it is perceptible that the scenario being an imaginary medieval story with decisions with only two options does not provide a conducive environment for assessing and measuring the 'SN' dimensions.

Regarding the change of intention, the agent was more effective when the participant's intention was different from their personality. The preference where participants most changed intention was Introversion (I). Different was the Sensing (S) preference, that participants least changed their intention. The behaviour of the 'I' preference may suggest that when the participant indicates an option against the personality, the intention change can be achieved with a persuasion strategy. The difficulty to make the intention-change in 'S' could be because of the developed scenario, since this preference has as features to have people paying more attention to physical reality and caring more about what is current.

The persuasion strategy was more effective when the intention is congruent with the participant's personality for the Thinking (T) and Judging (J) preferences, and less effective for the Perceiving (P). This behaviour is in line with the characteristics of these preferences in the MBTI. 'T' people may have regarded the agent's persuasive arguments as logical explanations and solutions to the impasse of choosing a decision option. In the meantime, people with a preference for 'J' like to have things decided, and the agent's suggestions may have caused the feeling of decision. The lack of decision change in 'P' must be due to the characteristic of these people to like to understand and adapt to the world rather than organize it.

6 Conclusion

The effectiveness of persuasion strategies can be improved when the personality traits of the target audience are considered [1], allowing to adapt the persuasive appeals to the psychological needs of the target audience [12]. Besides, personality is essential when there is audience interaction [14]. For this reason, the study of personality traits for persuasion purposes has been increasingly researched and applied in some areas of study, such as marketing, governance, education, health, games, human-robot interaction, among others.

This paper describes a methodology that can be used to fill some gaps in studies that use personality traits and persuasion in HRI, showing evidence that data on levels of assertiveness, environment, persuasive agent and personality traits need to be collected to create a personalised scenario with an acceptable level of persuasiveness. Besides, we bring the idea that there may be a perception of greater influence being inferred when the changes in decisions are in line with the personality. Finally, the branch of psychology that works with personality traits and social influence needs to be more explored, especially when in a context of narrative stories and social robotics.

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