# An Examination of Dispositional Trust in Human and Autonomous System Interactions

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**Abstract.** The rapid advancement of technology has changed the human and AS interactions, blurring the boundaries of what must be a human or automation action. The successfully implementation of human-in-the-loop is essential for the new relationship between humans and AS, in which control is shared and a team-mate collaboration arises. We believe that only through the best understanding of human factors and individual differences it will be possible to work towards the formation and calibration of trust in human and AS interactions. Therefore, this study conducted an online questionnaire to investigate the influence of personality traits, culture orientation, and individual differences on dispositional trust, as an effort to map out humans' baseline trust in autonomous systems. We found that while some factors presented significant relation with trust in autonomous systems when analyzed as an isolated variable, such as agreeableness trait, they do not have significant results when investigated concomitantly to other factors. Thus, we were able to identify that some individual differences – cultural values, extroversion trait, and age – presented stronger influence on the dispositional trust in automation. Thus, our study provides valuable information about human factors that mediate trust, which supports the optimization and improvement of the overall interaction between humans and autonomous systems.

**Keywords:** Trust · Autonomous systems · Personality · Cultural orientation

## 1 Introduction

Autonomous Systems (AS) plays an essential role in our daily lives, having significant potential to extend human capabilities and adapt to different demands in complex environments, particularly the ones in which safety-critical situations

endanger human lives—such as disaster rescue missions. While our specific interactions with AS may vary, the frequency is certainly increasing and we are going to depend on these systems in many more aspects of our life [23].

AS has dramatically changed with the rapid advent of computing technologies in recent years. Human and AS interactions are becoming more intricate, independent and even human-like [23], changing some human tasks towards minimal or no human intervention or into a collaborative process with the AS. The decrease of the need for humans to be in direct and manual control of AS alters some of these systems from 'object-based' to 'agent-based' systems. As consequence, it becomes progressively more difficult to distinguish the causes and effects in human and AS interactions [23]. In other words, human operators are no longer just controllers, rather they are teammates sharing the control with AS.

As these new collaborative interactions between humans and AS increase and become more critical and complex in their nature, the design of AS and underlying human tendencies, such as trust in these systems, become a vital area of study. Human-centered computing becomes essential as we move towards a scenario in which we will respond to the behavior of machines and machines will respond to our behaviors. While there are sophisticated efforts into enhancing the capabilities of AS, human factors and how individuals interact with AS have not been adequately researched or considered.

When introducing autonomy into human-dominated fields, for example autonomous vehicles, integrating humans is crucial to reaching successful aspirations, particularly in cases where a human is in the loop and is monitoring the performance of the system [9]. Most AS used in daily life require human input, and how this interaction is understood and designed from the humans' trust point of view will have a profound impact on their continued use and adaptation [27]. In addition, the teammate relationship between human and non-human agents raise an essential but challenging question: How do humans develop and maintain trust in AS interactions?

Just as it does in interpersonal relationships, trust is crucial in determining and guiding human–automation reliance in order to avoid the misuse, disuse, or abuse of automation [16]. A poor trust calibration in automation often degrades the system performance in safety or efficiency. Thus, users' trust and system capabilities should be carefully balanced. Hoff and Bashir [16]proposed that interpersonal trust and trust in AS are two different constructs and should be investigated as such. They developed a theoretical and dynamic model of trust in automation based on three different dimensions, previously identified by Marsh and Dibben [28] - dispositional trust, situational trust, and learned trust. Each dimension reflects the main sources of variability in human–automation trust, which are the human operator, the environment, and AS itself.

Prior to any interaction with automation, humans have an inherent baseline degree of dispositional trust toward AS, which is based on personal characteristics, individual differences, and the reputation of the system [16,27]. However, when it comes to secondary and recurrent trust in AS, in other words the

calibration of trust after initial interactions, previous research found no significant influence of personal factors. The only impacting factor was the initial trust, and therefore, individuals may use the baseline of primary trust to calibrate their secondary trust in AS after more interactions with it [19]. Since it is until unclear what exact human factors affect human trust in AS and how, the focus of this paper is on the dispositional trust dimension as an effort to initially map out the baseline trust in AS.

Dispositional human factors that interfere in the process of trust formation, like personality traits, cultural orientation, and individual differences must be carefully studied and understood in order to optimize performance and unlock the potential of interactive AS. Therefore, through an online questionnaire this paper aims to answer the following research question: Do individual personality traits, cultural orientation, and demographics influence their dispositional trust in AS? Drawing from Huang and Bashir's study [20], we investigate the relationship between trust in AS with personality traits and cultural orientation concomitantly. Understanding the influences of human factors and individual differences on trust formation and calibration allows for the optimization and improvement of the overall interaction between humans and AS through the development of personalized systems that can be adjusted to better suit human factors and preferences.

## 2   Research Background

Trust between humans and AS have various definitions and we adopt the most widely employed one, in which trust is defined as 'the attitude that an agent will help achieve an individual's goals in a situation characterized by uncertainty and vulnerability' [25]. Prior research shows that people often exhibit a positive bias in trusting a novel AS [10]. Therefore, users' initial trust is based on faith. However, this initial trust rapidly dissolves following system errors or situational features, and as relationships with AS progress, dependability and predictability replace faith as the basis of trust [27]. Therefore, trust in AS can be considered a dynamic and evolving process.

Different studies have identified several individual factors that affect users' trust in AS, including propensity to trust, personality traits, age, gender, culture, portrait ethics, and values [19,20,35]. Although these studies have acknowledged the impact of human factors on trust formation, there is still a lack of empirical evidence on how they influence users' dispositional trust in AS.

As previously mentioned, by adopting Hoff and Bashir's model [16], we understand trust in AS as a dynamic process and intrinsically correlated with three broad sources of variability in human-automation trust: the human operator, the environment, and the automated system itself. Thus, we concentrate our study on the understanding of dispositional trust and the human operator, as an effort to initially identify and map the baseline trust in AS, as shown in Fig. 1 [16].

In this model, dispositional trust represents an individual's enduring tendency to trust in automation, while situational trust depends on the specific
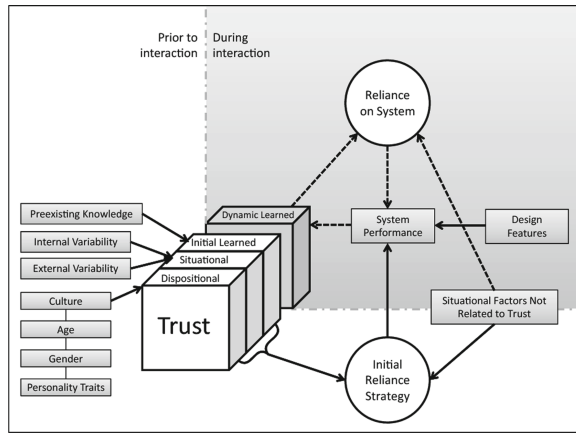
**Fig. 1.** Full model of factors that influence the dynamic trust in automation developed by Hoff and Bashir [16].

context of an interaction. Hoff and Bashir [16] suggest two broad sources of variability in situational trust: the external environment and the internal, which are context-dependent characteristics of the operator. The environment exerts a strong influence on situational trust, but context-dependent variations in an operator's mental state can also alter situational trust. The final dimension, learned trust, is based on past experiences relevant to a specific AS. Learned trust is closely related to situational trust, since both are guided by past experience [16,20].

Although this theoretical model [16] is one of the most compelling models that acknowledge the importance of human factors for the development, calibration, and understanding of trust in AS, it is to the best of our knowledge that no previous research has adopted the entire model and simultaneously explored its three dimensions. We believe that an in-depth investigation of each dimension is necessary to validate the role and influence of each human factor and individual differences that comprise the dispositional trust dimension. Therefore, in this paper we concentrate our efforts on dispositional trust, as the representation of an individual's overall tendency to trust in AS, independently of context, situation, or type of AS. Moreover, it refers to long-term tendencies arising from both psychological and environmental influences. Although it can change gradually over time (e.g., cultural values, age, and personality traits), it is generally stable within the course of a single interaction [9]. In the next section we present a brief review of relevant studies that examine the different components of dispositional trust in AS.

## 3    Variable Descriptions and Previous Findings

### 3.1    Individual Differences

**Age:** Aging influences information processing on every stage and component, such as executive functions, working memory, attention, speed of information processing, among others [44]. Although it is possible to say that age has an impact on the types of systems trusted and the likelihood that automation will be adopted, previous studies have found inconsistent results. Researches who have investigated different types of AS, such as decision aids for medication management [15], adaptive cruise controls [7], and autonomous vehicles [34] claim that older adults tend to rely more on automation and are more complacent, leading to over trust [30]. Rather, some later studies, that have not explored the direct correlation between age and trust in AS, found that younger adults are generally more comfortable and receptive with the idea of automation when compared to older adults [6]. A major hypothesis to explain the tendency of older adults for over-reliance and complacency is that age-related cognition changes in working memory, making it more difficult to detect automation faults [15]. Therefore, we hypothesize that younger participants present higher scores on trust in AS.

**Gender:** The influence of gender on trust in AS has been explored as a demographic variable in academic and market surveys. Although earlier explorations found no gender influence on trust in automation development [33,40], many recent surveys have explored humans' acceptance and perception of specific types of AS, like driverless cars. These studies found that men are more likely to have a positive attitude towards automation and are less concerned about functionality or possible failures [6,14,22,24]. Moreover, males are more comfortable with higher levels of automation than women [24]. Thus, we hypothesize that our data will follow the same pattern and men will present a higher level of trust in AS when compared to women.

### 3.2    Personality Traits

Different theories have been applied to understand human personality and how it might reflect and shape behaviors and social attitudes [32]. In the dispositional theory, traits are defined as enduring dispositions, being relatively consistent over situations and influencing behaviors. Traits can be considered as contrary to states, which are more transitory dispositions [5].

The Big Five Model describes five broad dimensions of human personality, namely openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. It has been subject to substantial amount of research and validated by various works across different contexts and cultures [32].

**Neuroticism** is defined as a tendency to experience the world as threatening and distressing. High scores on neuroticism describe individuals who are anxious, vulnerable to stress, depressed, insecure in relationships, moody, and

easily frustrated [3]. We expect that participants with high scores on this trait will have lower propensity to trust.

**Extraversion.** This term generally describes the tendency toward highly active behavior, positive emotional feelings, assertiveness, and being out-going [43]. We expect that participants with high scores on this trait will trust more in AS.

**Conscientiousness** refers to differences in volitional control of an individual's behavior and cognition. People who score high on this dimension are described as responsible, playful, attentive, careful and orderly. Moreover, these trait is related with a high need for individual achievement and high commitment to work [5]. Our hypothesis is that people with higher conscientiousness will present higher trust in AS.

**Agreeableness** refers to the quality of interpersonal behaviors. Individuals with higher scores on agreeableness are empathic, considerate, generous, polite, warm, and harmonious in relationships with others [5]. We expect that participants with higher scores on agreeableness will exhibit higher trust in AS.

**Openness** refers to a general propensity toward new experiences, creativity, intellectual curiosity, and aesthetic sensitivity [32]. This factor is the least understood of the Big Five and the only one not mapped onto the temperament substrate [3]; therefore, we hypothesize that those with higher scores in this trait will trust more in AS.

While the 44-item Big Five Personality Inventory Questionnaire [13] is the most adopted measure to identify the five personality traits, the shorter version of the questionnaire Mini-IPI [8]has gained much popularity due to its validity. Previous research that have employed the 44-item version have not found statistical significance to claim that personality traits are correlated to trust in AS. However, Chien and colleagues [4], showed that only two dimensions, agreeableness and conscientiousness, are significantly correlated to an individual's initial trust, and higher values in an individual's personality traits will result in higher initial trust in AS.

### 3.3   Cultural Orientation

Cultural orientation is considered to be the patterns and inclinations of thinking, feeling, and behaving in a way that is culturally determined by people across different cultures. It defines the basis of differences among cultures such as self-identity, interpersonal relationships, communication, and resolving conflict [17, 18]. Therefore, these cultural patterns lead people to view their world through different lenses, attaching different meanings to life events, which is considered one of the reasons why societies are different [41]. One of the most important dimensions of cultural difference in social behaviour is the relative emphasis on individualism and collectivism. Independently of their culture, humans have access to both individualism and collectivism cognitive structures; however, what differs is the accessibility of these structures [42].

In collectivist cultures, people are mainly motivated by the norms and duties imposed by the collective entity. They are closely linked individuals who view themselves primarily as parts of a whole, be it a family, a network of co-workers, a tribe, or a nation, and their social behavior is largely determined by goals, attitudes, and values that are shared with some collectively [18,41]. While in individualist cultures people are motivated by their own preferences, needs, and rights. In other words, they give priority to personal rather than to group goals [18,41].

Although prior research has indicated that individualism is positively related to general trust in automation, it is uncertain whether collectivism has a similar impact [27]. Huang and Bashir [20] found that both horizontal individualism and collectivism are significantly positive predictors of trust in automation, suggesting that people holding more horizontal values are more inclined to have higher trust in automation, regardless of their collectivism or individualism orientation.

Horizontal individualism and collectivism emphasize equality, while vertical values regardless of collectivist or individualist orientation emphasize hierarchy [41,42]. Thus, drawing from Huang and Bashirs' findings, we also adopt Triandis' perspective [41], examining the relationship between the four dimensions of collectivism-individualism: horizontal collectivism, horizontal individualism, vertical collectivism, and vertical individualism. According to this perspective, vertical values relate to achievement and power, and horizontal values relate to universalism and benevolence. Therefore, we hypothesize that (H3) our results are going to follow the same previous results and participants with horizontal values will have higher trust in AS, and there will be no significant relation between trust and collectivism versus individualism.

## 4    Method

This study is an investigation to validate and better understand the human factors and individual differences related to the human dispositional trust in AS. To answer the research question and validate the previously mentioned hypotheses we conducted an online survey with three hundred and forty-four participants in the United States (N = 344). Since there is no standardized and validated measurement for dispositional trust in automation, we adopted the 12 items from Singh et al. [39], which we believe is an adequate measurement available to assess trust propensity in automation. To explore individual differences, we adopted the 16-item scale developed by Triandis and Gelfland [41] to assess the four cultural dimensions of collectivism and individualism, and the interpersonal propensity to trust assessment developed by Mayer and Davis [29]. Regarding the examination of personality traits, we decided to employ the Mini-IPI Scale [8], which is a shorter alternative to Goldberg's questionnaire. In addition, we assessed individual differences such as gender, age, education, household income, and occupation.

Participants were recruited on Amazon MTurk and received $1 US dollar for their participation after completing the study. Regarding the demographic

distribution, 48.58% of the respondents were female and 54.06% were between 23 and 38 years old. For education, 59.29% of participants held a bachelor degree or higher. To better analyze the age groups, we classified the participants as Gen Z (up to 22 years old), Millennials (23–38), GenX (39–54), Boomers(55–73), and the Silent Generation (74–91) adapted from Howe and Strauss [15].

## 5 Results

### 5.1 Preliminary Analysis

We began our analyses by examining the relationship between participants' trust in AS and their personality traits (see Table 1) and cultural orientation (see Table 2), by performing independent linear regressions. In addition, we investigated if age and gender presented significant relationships with both cultural orientation and personality traits.

We found a relationship pattern between personality traits and trust in AS, and neuroticism is the only trait that has not showed a significantly relationship (p = 0.9052). Extroversion presented a negative relation (std = −0.2337, p = 0.0249), while openness, conscientiousness and agreeableness have a positive relation with trust in AS.

Regarding individual differences, we observed that gender presents a significant and negative relation with openness (p = 0.0163), agreeableness (p = 1.487 * 10^-05), and conscientiousness (p = 00622), meaning that males tend to have lower scores when compared to females. Rather, gender did not present a significant relationship to explain the scores on extroversion and neuroticism. When examining the relationship between personality traits and age, we found significant results on neuroticism (p = 0.001608), agreeableness (p = 0.00227), and conscientiousness (p = 1.18 * 10^-05). Younger participants (GenZ, Millenials, and GenX) have higher scores in neuroticism, and lower scores on agreeableness and conscientiousness than baby boomers and older adults. No significant relationship was found between extroversion and openness traits.

**Table 1.** Results of the linear regression of trust in AS and personality traits

| Variable | Std | p-value | Adjusted R-square |
|---|---|---|---|
| Neuroticism | −0.01391 | 0.9052 | −0028 |
| Extroversion | −0.2337 | 0.02498 | 0.01173 |
| Openness | 0.4466 | 3.887 * 10^-05 | 0.04557 |
| Conscientiousness | 0.3536 | 0.003491 | 0.02182 |
| Agreeableness | 0.4215 | 0.0006144 | 0.03094 |

Next, we examined the relationship between trust in AS and cultural orientation. As shown in Table 2, our linear regression analyses found a strong,

positive, and significant relationship with horizontal values (p = 6.99 * 10ˆ-06) and trust in AS, corroborating with results from previous studies. While these preliminary results related to vertical values and trust in AS demand further investigation (p = 0.01 and adjusted R- squared = 0.01), with perhaps more advanced statistical methods, the overall collectivism and individualism orientation show similar trends, as can be seen in Fig. 2. Interestingly, individual factors shows a significant relationship with cultural orientation values. Gender is related to individualism (p = 0.00069) and vertical values (p = 4.128 * 10ˆ-05) and males tend to demonstrate higher scores than females. Concerning the relation between age and cultural orientation, our results show that Millennials tend to have higher scores in individualism (p = 0.024), while GenZ has lower collectivism scores (p = 0.025) when both are compared against boomers. In other words, younger participants are more orientated to individualism, and this result confirms our study's hypothesis. Furthermore, cultural values showed similar trends. Younger participants presented lower scores for horizontal values (p = 0.0352) and higher scores for vertical values (p = 0.0279).

**Table 2.** Summary of linear regression results from trust in AS and cultural orientation

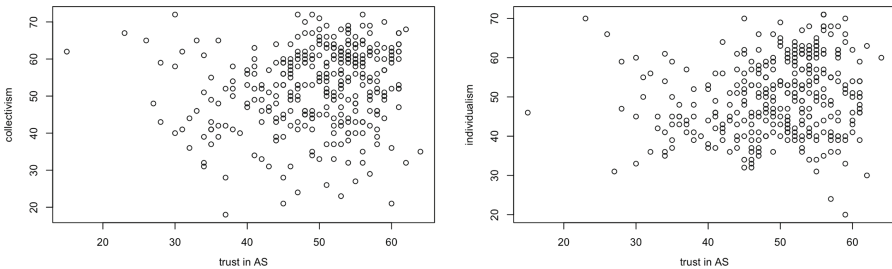| Variable | Std | pvalue | Adjusted R-Squared |
|---|---|---|---|
| Collectivism | 0.1225 | 0.0021 | 0.0243 |
| Individualism | 0.1401 | 0.0014 | 0.0266 |
| Horizontal values | 0.2288 | 6.99*10ˆ-06 | 0.0546 |
| Vertical values | 0.0090 | 0.0172 | 0.0236 |



**Fig. 2.** The spread of trust in AS score across cultural orientation.

Our statistical analyses did not reveal any significant correlation between gender and propensity to trust in AS (p = 0.649), while surprisingly both male and female followed a similar pattern regarding their trust scores.

## 5.2   Exploratory Analysis

In the preliminary analysis above, personality traits and cultural orientation were investigated as individual variables. However, we believe that these factors are not isolated and they are mutually influenced by each other as well as other individual differences. Therefore, the goal of this exploratory analysis is to investigate the possible changes in the relationship of human factors and individual differences with dispositional trust in AS, when they are simultaneously analysed. This exploratory investigation was conducted in two phases as follows.

During phase one, we identified how personality traits are related to cultural values using linear regression. Our results show that agreeableness ($p = 5.98*10^-14$) is the personality trait with the strongest relation with horizontal values, followed by conscientiousness. While, extroversion ($p = 2.514 * 10^-12$) has the strongest relationship with vertical values, followed by openness.

In the second phase we analysed two different combinations of individual factors, including age, gender, personality traits, and cultural values. The first combination investigated horizontal values, agreeableness trait, age, and gender with trust in AS. The results of the multiple linear regression show that horizontal values have a positive relationship with trust in AS even when other individual variables are added to the analysis. Although agreeableness has a highly significant relation with trust in AS ($p = 0.0006144$), when analysed with the other variables, no significant results were found (std = 0.20720 and $p = 0.133074$). In this same variable combination, gender did not show significant results, while GenX (participants between 40 and 54 years old) was negatively related to trust in AS. No other age group presented any significant results.

The second combination investigated vertical values, extroversion trait, age, and gender with trust in AS. Through the multiple linear regression, we observed that vertical values have a very strong relationship with trust in AS ($p = 0.000113$). Independently, if its investigated isolated or with other variables, extroversion remains significant and negatively related with trust in AS ($p = 0.000440$). As seen in the previous combination, gender did not present significant results. Moreover, GenX has a negative relationship with trust in AS and it is the only age group presenting significant results.

## 6   Discussion

In this study, we present the results of an online survey assessing the influence of human factors and individual differences on dispositional trust in human and AS interactions. When analysing individualism versus collectivism, through the linear regression model, our results show no significance in terms of values nor in distribution to support the understanding of the effects of cultural orientation on dispositional trust in AS. We believe that cultural orientation should not be investigated as excluding or opposing factors, since one individual might have scores for both types of cultural orientation depending on the situation. Because our data was collected only in the United States, and as previous studies have shown, there is no significance results between cultural orientation factors and

trust in AS. Drawing from Huang and Bashir's findings, the study of cultural orientation must be investigated with the inclusion of cultural value dimensions - vertical and horizontal values.

Our results show a strong and significant relationship between horizontal values and trust in AS. Thus, participants who exhibited more horizontal values, such as benevolence and universalism, tend to have higher trust in AS, regardless of whether they are oriented towards collectivism or individualism. This sustains previous findings suggesting that people holding more horizontal values may also have more positive bias toward automation [27]. This relation can be better understood by closely examining world view versus a vertically oriented world view. According to Shavitt [36,37], vertical values emphasize hierarchy, thus one's self is different from others, as opposed to horizontal values, where one's self is more or less like others. Moreover, horizontal values may relate to the benefits of automation, regardless if it will enhance personal autonomy for each individual in society, as in horizontal individualism, or if it will advance the whole community or society, as in horizontal collectivism [20].

As previously explained in the methods section, we employed the Mini-IPI scale, which is a smaller version of the Big Five personality traits assessment. Since previous studies verified its efficiency, we believed that a shorter questionnaire would have a positive impact on the overall performance of participants in their response to the survey. Different from previous studies [1], our results did not show a significant relationship between trust in AS and neuroticism. Although we adopted a different questionnaire, some of this research has not analysed the direct relationship between personality traits and trust in AS, rather they analyze the compliance of a specific type of AS, and the perception of risk related to automation, among others indicators. Furthermore, the use of specific types of automation to contextualize the survey, such as autonomous vehicles or robots, might also exert influence on the results. Despite no statistically significant correlation, it was possible to observe that participants with higher neuroticism scores tend to have lower scores on trust in AS. This might be related to the perception of risk related to unknown situations or even to possible system's failure.

The negative relationship between trust in AS and extraversion opposes results from Merritt and Ilgen [33], that people who have a more extroverted personality show higher levels of trust in AS. However, it corroborates with the negative trend found by Huang and Bahsir's study [21]. Extraversion is highly related to socialization and people who seek stimulating activities [31]. Therefore, further investigation must be done regarding their perceptions on socialization with machines, and how it might affect their social relationship with other human beings. In addition, with participants associating AS to specific contexts, such as autonomous vehicles, their current understanding of socialization might change regarding the situation, lowering the scores of trust in AS.

By presenting a weak but positive relationship, participants who are more agreeable tend to trust more in AS. This result stands previous findings [1,21], where the same result was found independently of the level of automation or

the degree of congruence. Agreeableness is linked to compassion and cooperation, and important facets of this trait are trust and altruism [13], representing an initial bias towards the higher scores of trust in AS. Furthermore, conscientiousness also demonstrated a weak and positive relationship with trust in AS. People scoring high on conscientiousness tend to be less spontaneous, more self-disciplined, goal-oriented, an rational [13], thus, AS might be seen as a supporting tool for the accomplishment of these individuals' goals.

Openness presented the strongest relationship with trust in AS, which has also been observed in a previous investigation of trust in robot interactions [11]. Since this trait is associated with intellectual curiosity, coupled with a general disposition toward new experiences and intellectual curiosity [13], we speculate this relationship is a consequence of the novelty of working with AS, especially on primary interactions. Therefore, further investigation must be done to understand this relation throughout time and constant interactions.

Most researchers argue that personality influences outcomes in life not in a direct way, but rather by affecting someone's general tendencies to act. For instance, in a risky context where all parameters are known to the subjects, personality traits other than risk attitude do not have predictive power; conversely, in an uncertain setting, personality parameters do play a direct and indirect role in determining decisions [12] (2017). Hence, the influence of personality traits is essential during initial interaction with AS. After that, when further experience is achieved, openness, agreeableness, and neuroticism must be further studied to understand how the behavior related to these personality traits will endure over time.

Although there are significant and important findings regarding the individual relationship between the presented human factors and trust in AS, we believe that some of them might have a stronger influence than others. Moreover, as previously mentioned, these factors and individual differences might change their influence when combined with other variables. The isolated and individual investigation of their relationship with trust in AS might not present an accurate result. The exploratory analysis shows that while extroversion is negatively related to trust in AS regardless the other factors presented in the analysis, agreeableness did not present influence on trust when investigated with other variables. However, this is not a trend with all the factors analysed. Cultural values, for instance, showed significant results, both when analysed isolated or with other variables.

Although cultural orientation is a complex human factor and must be further investigated, our results show that cultural values - horizontal and vertical - are stronger related to trust in AS than collectivism and individualism. Furthermore, cultural values are also more constant than personality traits. Therefore, it is necessary to investigate how the five personality traits might change their influence on trust when other factors, like age and value orientation, are present. One reason why we believe that personality does not present a constant and significant influence on trust in AS is the fact that personality traits are accentuated when

individuals seek to transform novel, ambiguous, and uncertain circumstances into familiar, clear, and expectable social encounters [2].

Finally, based on our results, gender does not have a significant relationship with trust in AS, which means that other factors like individual personality for example, might exert more influence as one individual has more or less dispositional trust in AS. Notwithstanding, age presents significant results, and it must be analysed in terms of age groups. GenX is the only age group that was related to trust in AS, regardless of the type of analysis, isolated or concomitantly with other variables.

## 7     Limitations and Further Research

Despite the contribution of this study, this topic presents unique challenges like the difficulty of manipulating different experiences with different types of AS in a laboratory environment. Completely autonomous technology, for example autonomous vehicles with no human inputs, does not yet exist and research on how people behave towards certain AS is nearly absent or simulated [26]. Moreover, all our participants were recruited on Amazon Mturk, which brings an initial bias regarding adoption of technology and lack of diversity to our data and does not allow for any type of generalization. Although we found significant relation between specific cultural orientation and personality traits, further qualitative research must be done in order to empirically understand these individual behaviors.

The next steps of this research will narrow the investigation to only one type of automation. By adopting mixed methods – survey, in-depth interview and heuristic analysis – we believe that we will be able to fill the research gaps found in this paper.

## 8     Final Considerations

The rapid advancement of technology has changed human and AS interactions, blurring the boundaries of what is a human action versus what is an AS action. The successful implementation of human-in-the-loop is essential for the new relationship between humans and AS, in which control is shared and a teammate collaboration arises. We believe that only through the best understanding of human factors and individual differences will it be possible to work towards the formation and calibration of trust in human and AS interactions.

In this research, we aimed to investigate the influence of personality traits and culture orientation on dispositional trust in AS, as an effort to map out humans' baseline trust in AS. In sum, we do not expect to be able to explain trust in AS by only one personality factor. We believe that since personality has an influence on human behavior, it should at least contribute to the understanding of smaller interactions and user actions in the same way that analysis of cultural orientation will offer "several sources of value – as a predictor of new user psychology phenomena and as a basis for refining the understanding of known

phenomena" [38]. Therefore, considering that individual personality traits and cultural orientation influence humans' trust on AS, we suggest designers and developers to allow the customization of AS systems to meet different users' tendencies according to their personal and cultural dispositions through the full integration of human-in-the-loop.

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