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# Factors influencing trust assessment in technology

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**Abstract.** This study presents exploratory research on how to measure perceived Trust in technology across culture. Builds from a validated Human-Computer Trust Model (HCTM) questionnaire (12 items) to efficiently measure users' predispositions to trust a technological artefact (e.g. WhatsApp). This approach aims to provide results that are not tied to a specific context while also focusing on underexplored populations. Two central research questions guided this research: RQ1: Can the Human-Computer Trust Scale (HCTS) be used to map trust behaviors across different cultures? And RQ2: Can the Human-Computer Trust scale be used to support trustworthy design practices? This research aimed first to gain new insights on how to measure users Trust in technology across-culture and second, reflect how useful the trust scale is to map user's Trust in a system. The study contemplates designers (n = 5) and users (n = 91). Results indicate that the Human-Computer Trust scale (HCTS) can be a useful, easy-to-use tool to map users trust predispositions but needs to be complemented with additional guidance on how to analyze and interpret the results. Same regards on mapping trust behaviors across culture if analyzed with complementary indicators like gender differences, privacy perception.

**Keywords:** Trust in technology · User research · Human factors · User Experience

## 1 Introduction

In this fast-changing post-truth era context [12] trust plays a decisive role. Trusting can affect users' acceptance, and uptake [10] of technology and determine its adoption. Although one of the major issues in trust research in technology is the failure to recognize the construct's subjective and multi-dimensional nature [14] [22]. Trust, in fact, can be interpreted from different lenses affecting how we assess its characteristics and influences in users interactions. Despite that, few insights highlight that difference or focus on the effects of trust when studying a human-artefact relationship [1][15] [20]. More, detrimentally of the default mainstream attention given to ethics, privacy and security, we continue to feel threatened and not know how our data is being used or misused [17] [21].

This has given more importance to studying the trust effects in technology. For instance, on how to identify gender differences [23] [3][2] or what characteristics can affect propensity trust among individuals. In the literature since Muir & Moray [16] study on how to measure trust in automation other studies emerged like: Empirically derived (ED) [9], Human-Computer Trust (HTC) [13], SHAPE Automation Trust Index (SATI) [4] [11]. However, the oversupply of model and a "mixed conceptualization" makes it difficult for non-experts to choose and apply the adequate measurement. The Human-Computer Trust Scale (HCTS) analyzed in this study, besides being recent (2019), demonstrated to be reliable as it went through a rigorous empirical testing process [8]. Assessing the scale validity in four distinctive technological applications - E-Voting, Siri and two futuristic scenarios home for life and futures schools [6] [7][22]. It portrays perceived trust in technology through 3 main attributes: Risk Perception, Competence, and Benevolence. Thus the reason for adopting it in this study.

## 2 Method

This study is guided by two central research questions: RQ1: Can the Human-Computer Trust scale (HCTS) be used to map trust behaviors across different cultures? along with RQ2: Can the Human-Computer Trust scale (HCTS) be used to support trustworthy design practices? Two main research focuses were taken in consideration here: (1) deploying a cross-cultural online survey focused on mapping trust behaviors across three countries, Brazil, Portugal, and Mozambique. (2) measuring the usefulness of the HCTS to support trustworthy design practices.

**The survey** aim was on assessing users' trust in a single object, WhatsApp. The technological object was present as a journey map usage scenario. The reason for choosing WhatsApp included its popularity, and since Facebook owned it in 2016, some concerns raised regarding recent privacy changes and its potential use for phishing and misinformation. The survey included a total of 31 questions. The HTCS psychometric instrument (12 items) in Portuguese [18] and complementary questions like demographics (e.g. country, age range, gender, and WhatsApp usage); and questions measuring users' adoption [5] and Privacy concerns and awareness [19]. Convenience sampling was used for data collection during April and May 2021. A total of 91 responses were analysed. The majority of the respondents are from Portugal (58.2%), then from Brazil (23,1%) and Mozambique (18.7%). 59,3% were females, 34,6% males and 1,1% non-binary respondent, not considered in the analysis because of low representativeness. Their age ranges grouped according to generations ranges - 62,6% from Generation Z (up to 24 years old), 25,3% Millennials (between 25 and 40 years old), 10,9% from Generation X (41 to 56 years old), and 1,1% Baby Boomer (57 or more years old), which was also not considered.

**The design study** aim was to understand to what extend the HCTS can be useful to support design practices. We invited five designers to apply the instru-

ment and observed how well they understood the trust assessment mechanism and reasoning for their evaluation choices, goal, stimuli. Including how easy it was for them to report the results and gather insights on user's trust in a system for their design process. Those observation procedures were followed by contextual laddering interviews. Among the participants, the majority had at least two or more years of design experience in the Human-Computer Interaction field. Their tasks included using the HCTS to evaluate users trust in a technological artefact, for instance, voice user interface systems (e.g. Google Home), contact tracing app (e.g. Hoia.me), social media applications (e.g. Facebook).

### 3 Results and Discussion

To understand the extent that the HCTS can be used to map trust behaviors across different cultures (RQ1). The cross-cultural survey results revealed that the overall score on trust in WhatsApp among the 91 responses was considered low but satisfactory [M = 3.24 in a 5 points Likert scale, SD=.79; CV=.79]. Also helped to identify the most problematic construct - the Risk Perception (RP) [M = 1.09; SD=1.09; CV1.19], that score very low rate, followed by Benevolence (BEN) [M = 3.06; SD=1.16; CV=1.13] and Competence (COM) [M = 4.00; SD=.96; CV=.92] is consider the less concerning. Then the detailed analysis by country revealed no significant differences, although Portugal [M = 3.50, SD=.53] and Mozambique [M = 3.50, SD=.53] had a significantly higher Trust Score than Brazil [M = 3.12, SD=.64]. It should be noted that during the analysis as the sample included more Participants from Portugal, and to ensure that each country surveyed had an equivalent representation, the sample (n = 91) was weighted by country of approximately one third. Regarding the trust difference across genders, results indicated that female's trust was slightly higher than males. However, the difference was not statistically significant ( $t(87)=0.95$ ,  $p=.34$ ). Results per generation confirm that although not all groups indicated significant differences, an independent t-tests, revealed that Generation Z (M = 3.51, SD=.70) has the highest Trust Score, which is significantly higher than Millennials' (M = 2.90, SD=.73),  $t(73)=3.66$ ,  $p \leq .01$ . Generation Z had also higher Trust Scores than Generation X (M = 3.11, SD=.94), but the difference was not statistically significant, nor was the difference between Generation X and Millennials. Still, these results are enough to demonstrate that there are significant differences in trust scores between the groups.

Additionally, the design study results helped generate new insights on the individual necessities of the instrument to support trustworthy design practices (RQ2). When asked how the instrument helped gain new insights on users trust in technology, the majority agreed that it was helpful, practical and easy to apply. However, some consider the results analysis to be confusing and difficult to interpret. The instrument needs additional explanation on how to perform the data analysis and interpretation of the results. Including more guidance on how the overall trust score and each construct results can guide them through their design in build trustworthy design processes.

## 4 Conclusion

In conclusion, although some designers considered to be challenging to understand and interpret the results, the majority agreed that the scale is easy to use and valuable. Highlighted points are the fact of being not technical in nature, practical, and simple to apply. Results also revealed that the HCTS could be used to map trust behaviors across cultures if analyzed with complementary indicators. Findings also highlighted the complex nature of the topic and the need to provide reliable and simple to use methods to facilitate further explorative studies that can explore cross cultural factor like gender and generation differences. The cross-cultural survey results, for example, contradicted the authors' expectations that the Portuguese population trusts more the Whatapp application when compared with Brazilians. Also indicated a link between contextual factors like gender and user generations and their willingness to trust a specific object [3]. In light of this, designers and technologists should consider users' mapping user's Trust in a system during their design process.

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