

# Psychology and Technology Acceptance: A New Approach to Digital Inclusion & User Differentiation

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## Summary

The demographic shift marks the beginning of a social transformation with far reaching implications (United Nations, 2015). A way to alleviate some of the challenges that come with this demographic shift is assistive technology (Broadbent, Stafford, & MacDonald, 2009). In order to increase the effectiveness of such technologies, their acceptance by target populations must be evaluated (Beer, Prakash, Mitzner, & Rogers, 2011). Our study examines technology acceptance of socially assistive robots among the future elderly (N=188). Applying a scenario-based survey, our study investigates the interplay between age, personality, resilience, and technology acceptance. Our findings suggest that personality plays a significant role in determining acceptance of technologies such as socially assistive robots. To the best of our knowledge, our study is one of the first that considers and evaluates resilience as a factor of technology acceptance.

## 1 Introduction

According to the World Health Organization (2017), the consequences of aging are far reaching and many misconceptions still exist when it comes to the service needs of the elderly population. The process of aging is complex, whereby physical and cognitive functionality vary among individuals, the most common illnesses are non-communicable, and life expectancy is increasing disproportionately to healthy years of life. The demographic shift will have consequences on pensions, health and long-term care, employment markets, economies, family composition, mobility, and more (United Nations, 2015). The vast differences in the aging process

recorded across individuals renders one-size fits-all policy approaches ineffective and call for multi-dimensional and –sectoral action.

An area of increasing interest and investment as a way to alleviate some of the challenges that come with the demographic shift is assistive technology. In order to increase the effectiveness of such technologies, not only their design and functionality but also their acceptance must be evaluated (Beer et al., 2011). Our study examines technology acceptance (TA) of socially assistive robots (SARs) among the future elderly, namely those prone to fall into the high point of the demographic shift. Using a scenario-based survey methodology, our study investigates the interplay between the psychological constructs of personality and resilience, and TA.

## 2 Personality & Resilience

Research on individual psychological differences in personality and resilience, and TA is still rare and inconclusive (Svendsen, Johnsen, Almaas-Sorensen, & Vitters, 2013). The five factor model of personality includes the dimensions openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism, and describes personality as a set of relatively stable individual traits (Herzberg & Roth, 2014). The five factors are broadly defined in terms of adjectives or descriptions. Openness is defined as an interest in experiences, behaviors, and activities and a tendency to question norms. Conscientiousness is often measured based on the outcomes of a behavior such as adherence to rules or exactness of work. Extraversion is defined as the level of sociability while agreeableness measured the quality of interactions with other people. Lastly, neuroticism is a person's level of stress resistance. The five factor model of personality was found to have direct relationships with sub dimensions of TA, and to moderate the connections between acceptance sub dimensions (Devaraj, Easley, & Crant, 2008).

A working definition by Welter-Enderlin 2006 (as cited in Fröhlich-Gildhoff & Rönna-Böse, 2014, p. 10) defines resilience as “the ability of individuals to overcome crises in their lifecycle by drawing on personal and social resources, and using these crises as occasions for development”. The construct of resilience has not yet been studied in the context of TA to our knowledge. Coughlin, D'Ambrosio, Reimer, and Pratt (2007) imply that seniors with less resilience in dealing with functional limitations also have less trust in the functioning of technology. Rogers and Fisk (2010) advocate for further research in psychology, aging, and TA including the effect of the resilience of older adults on the multifaceted interactions between aging and technology. This study aimed to narrow this gap by exploring personality traits and resilience among the future elderly and their relationship with SARs.

## 3 Methodology

Using a convenience sampling method, German-speaking participants born between 1957 and 1997 (between the ages of 20 and 60) were recruited for the study. A total of N=188 completed the survey. The scenario was adapted from a study by Xu et al. (2015) and input media depicted

elderly users being assisted by a SAR in everyday tasks. The surveys used for the study were the Almere Model of Technology Acceptance by Heerink, Kröse, Evers, and Wielinga (2010), the Big Five Inventory – Kurz by Rammstedt and John (2005), and the Resilience Scale – 11 by Schumacher, Leppert, Gunzelmann, Strauß, and Brähler (2005). The original Almere Model consists of twelve subscales: attitude, anxiety, perceived ease of use, social influence, perceived sociability, perceived adaptivity, trust, perceived enjoyment, perceived usefulness, intention to use, facilitating conditions, and social presence (Heerink et al., 2010).

## 4 Results

**Age** – While previous findings suggest that the relationship between age and technology acceptance is complex, most agree that anxiety is higher and use lower among older users (Czaja et al., 2006). We found, however, that anxiety tends to decrease with increasing age, with highest levels among the youngest age group (20-29) and lowest anxiety among the oldest (50-60). In keeping with previous findings, the importance of social influence tended to increase with age (although not significantly so,  $p=0.06$ ).

**Openness to Experience** – Previous studies suggest that higher scores in openness tend to correspond with higher perceived ease of use. While we were unable to replicate these findings, we found that users with higher openness tended to have lower scores in perceived sociability of the SAR ( $r_s=-0.170$ ,  $p=0.019$ ), less intention to use the technology ( $r_s=0.165$ ,  $p=0.024$ ), and lower trust in the presented technology ( $r_s=-0.155$ ,  $p=0.033$ ).

**Conscientiousness** – Conscientiousness has previously been found to moderate the relationship between perceived usefulness and intention to use, and subjective norms and intention to use (Devaraj et al., 2008). We found that more conscientious people tended to have lower anxiety when it came to SAR ( $r_s=-0.184$ ,  $p=0.011$ ).

**Extraversion** – Our study did not find any significant relationships between extraversion and TA nor its sub dimensions.

**Agreeableness** – Previous findings by Özbek, Alniacik, Koc, Akkilic, and Kas (2014) showed a positive trend between perceived usefulness and agreeableness. In our study, we were able to replicate these findings and found that participants with higher scores in agreeableness tended to rate social influence ( $r_s=0.145$ ,  $p=0.047$ ), perceived sociability ( $r_s=0.200$ ,  $p=0.006$ ), attitude ( $r_s=0.167$ ,  $p=0.022$ ), perceived usefulness ( $r_s=0.192$ ,  $p=0.008$ ), intention to use ( $r_s=0.146$ ,  $p=0.046$ ), and enjoyment ( $r_s=0.158$ ,  $p=0.030$ ) more highly.

**Neuroticism** – Previous studies on neuroticism and technology acceptance contradict one another. Özbek et al. (2014) and Devaraj et al. (2008) found a negative relationship between neuroticism and the perceived usefulness of a technology while Claßen (2013) found that neuroticism and perceived usefulness are positively correlated. We were unable to find a relationship between neuroticism and perceived usefulness, however those with higher scores in neuroticism tended to perceive SARs as less easy to use ( $r_s=-0.208$ ,  $p=0.004$ ) and had higher anxiety about the technology ( $r_s=0.318$ ,  $p=0.000$ ).

**Resilience** – Resilience in the light of ageing is defined as the “capacity for adaptation in the face of ever-changing environmental challenges” (Kuh, 2007, p. 719). The ability to adapt in various situations could be projected onto technology and thus contribute to higher acceptance among individuals with higher resilience. To our knowledge, our study is the first that explores resilience and its relationship with technology acceptance. We found that people with higher resilience tend to be less anxious about SARs ( $r_s=-0.143$ ,  $p=0.05$ ) and perceive the technology as easier to use ( $r_s=0.153$ ,  $p=0.036$ ).

## 5 Summary

The objective of our study was to explore the relationship between the acceptance of SARs, personality, and resilience among the future elderly. We found that contrary to most previous studies, anxiety among users decreases with age. The findings also show that psychological dimensions play a role in technology acceptance and the dimensions agreeableness has the most significant impact. In view of technology development, an additional way of categorizing users may support targeted design according to user specifications. In addition, such user categorization may support targeted marketing or the identification of potential early adopters that may contribute to the diffusion of technology among the target population. The consideration of psychological factors such as personality and resilience in TA and design is relatively new. The significances found in our study merit further research and may contribute to a more holistic view of the factors that influence TA.

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