Finding "H" in HRI:

Examining Human Personality Traits, Robotic Anthropomorphism, and Robot Likeability in Human-Robot Interaction

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ABSTRACT

The study examines the relationship between the big five personality traits (extroversion, agreeableness, conscientiousness, neuroticism, and openness) and robot likeability and successful HRI implementation in varying human-robot interaction (HRI) situations. Further, this research investigates the influence of human-like attributes in robots (a.k.a. robotic anthropomorphism) on the likeability of robots. The research found that robotic anthropomorphism positively influences the relationship between human personality variables (e.g., extraversion and agreeableness) and robot likeability in human interaction with social robots. Further, anthropomorphism positively influences extraversion and robot likeability during industrial robotic interactions with humans. Extraversion, agreeableness, and neuroticism were found to play a significant role. This research bridges the gap by providing an in-depth understanding of the big five human personality traits, robotic anthropomorphism, and robot likeability in social-collaborative robotics.

KEYWORDS

Agreeableness, Big Five, Conscientiousness, Extroversion, HRI, HRI Implementation, Neuroticism, Openness, Robot Likeability, Robotic Anthropomorphism, Social-Collaborative Robotics, Uncanny Effect

INTRODUCTION

Technology has been improving our lives dramatically and drastically in the last several decades. COVID-19 pandemic and the changing landscape presents a testimony to the above statement. Technology is playing an important role in our lives today, and we are trying to find a new normal during the present world crises through technology usage. The 'new normal' emerging out of the current turbulent times will subsequently need more technology usage and enhancement whether it means connecting students online; schools and Universities experimenting more with online/hybrid classes; continuous and consistent sanitation requirements of high touch areas in both developed and emerging economies; remote work possibilities for people who are sick, unwell, elderly or sensitive; reduced face-to-face interaction for increasing productivity, and much more. For achieving all this, we will need 'social robots' in our everyday lives to meet the new demands of the ever-changing

global world. Social robots provide comfort to the elderly and have shown to improve their well-being (Wada & Shibata, 2007). People who feel lonely, tend to anthropomorphize robots more than others (Samuel, 2019). These social robots may serve as tools and agents to alleviate their loneliness (Eyssel & Reich 2013) and additionally decrease their stress levels (Wada et al. 2004). Social robots are known to have been used in a variety of situations including (but not limited to) patients suffering from dementia, therapeutic applications for children with autism, adults with health issues, mental health issues, and in stroke patients' recovery processes (Tapus, Ţăpuş, & Matarić 2008; Ab Aziz 2015; Libin & Libin 2004).

Human-robot interaction (HRI) is a research domain dedicated to understanding communication between robots and humans (Kaplan, 2019). This research area is gaining popularity and attention in the diverse fields of study – science, technology, engineering, and mathematics (STEM), along with business and management (Arora & Arora, 2020). One of the early contributions to HRI study is artificial intelligence research. Artificial Intelligence (AI) is a term used for robotic technologies, which refers to the ability of computers/robots to acquire knowledge and think like humans (Arora & Arora, 2020). With the advancement in AI technology and the expansion of HRI, social-collaborative robots have emerged in HRI space in the past few years (Lungarella et al., 2003). According to the Big Five trait taxonomy, personality can be broadly classified as being comprised of five significantly different traits. These five characteristics are Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness (Goldberg, 1981), and the generalizability of the Big Five dimensions remains constant across all cultures (McCrae & Costa, 1997; Pulver *et al.*, 1995; Salgado, 2002). 'Extraversion' is a trait that is energetic and enthusiastic to social settings, and typically emotionally positive. 'Agreeableness' can be described as affectionate, altruistic, modest, and sympathetic. 'Conscientiousness' refers to an organized, responsible, reliable, goal-oriented, and controlled personality style. 'Neuroticism' is characterized as tense, anxious, fearful to the world around, and typically, emotionally negative and sad. The 'Openness' characteristic is described as open-minded, having broad interests, insightful, and curious (John & Srivastava, 1999). People utilize such personality variables in describing themselves and others as well as in how they perceive the world around them (John & Srivastava, 1999). In this new era of social-collaborative robots where robots are continuously assuming roles of family members, teammates, and/or therapists, Big Five traits can be a strong predictor of differential reaction to robots, and play a crucial role in successful HRI implementations. Given the current turbulent times and the emerging focus on adapting to humanless touch technology, there is a dire need to study and examine Big Five human personality dimensions to understand the field of HRI through the lenses of robotic anthropomorphism, robot likeability, and successful HRI implementation. Our research aims to fulfill this gap.

Robotic anthropomorphism refers to the attribution of human form, behavior, or characteristics to robots (Bartneck et al., 2009). In addition to employing human personality traits or Big Five to understand human/consumer behavior towards robots, we conceptualize that anthropomorphism (along with the Big Five) will help researchers understand HRI. Previous research has examined the impact of anthropomorphism in the field of social robotics (Kaplan, Sanders, and Hancock, 2019). Still, not much literature is available on the role of the Big Five personality traits in the context of robotic anthropomorphism. Robot likeability refers to a positive initial impression (usually within seconds) of robots, and the concept of robot likeability significantly influences our positive or negative judgments about social-collaborative robotics (Bartneck et al., 2009).

There is a dearth of human psychology and consumer behavior research in the field of human-robot interaction. The success of HRI between humans and social-collaborative robotics cannot be assessed without recognizing human judgment towards different levels of robotic anthropomorphism and its subsequent influence on robot likeability. Social-collaborative robotics exhibits social characteristics that are more human-like than traditional artificial intelligence designs. Therefore, developers utilize both robotic anthropomorphism and likeability into account when designing social-collaborative robots for consumers of all ages with either emotional (therapeutic) or physical needs. In order to bridge

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