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The Race Between Cognitive and Artificial Intelligence:
Examining Socio-Ethical Collaborative Robots Through Anthropomorphism and Xenocentrism in Human-Robot Interaction

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ABSTRACT

Research on human-robot interaction (HRI) is growing; however, focus on the congruent socio-behavioral HRI research fields of social cognition, socio-behavioral intentions, and code of ethics is lacking. Humans possess an inherent ability of integrating perception, cognition, and action; while robots may have limitations as they may not recognize an object or a being, navigate a terrain, and/or comprehend written or verbal language and instructions. This HRI research focuses on issues and challenges for both humans and robots from social, behavioral, technical, and ethical perspectives. The human ability to anthropomorphize robots and adoption of 'intentional mindset' toward robots through xenocentrism have added new dimensions to HRI. Robotic anthropomorphism plays a significant role in how humans can be successful companions of robots. This research explores social cognitive intelligence versus artificial intelligence with a focus on privacy protections and ethical implications of HRI while designing robots that are ethical, cognitively and artificially intelligent, and social human-like agents.

KEYWORDS

Anthropomorphism, Artificial Intelligence, Ethical Designs, Human-Robot Interaction (HRI), Intentional Mindset, Roboethics, Social Cognitive Intelligence, Xenocentrism

INTRODUCTION

Human-Robot Interaction (HRI) is a growing area of interest in science, technology, engineering, and mathematics (STEM); and now researchers are expanding their research to investigate the business aspects of HRI. Humanoid robots are increasingly becoming a part of our daily lives since these artificially intelligent human-like agents are incorporated as 'social agents' in various human spheres like healthcare, education, heavy lifting, home cleaning, repetitive jobs, precision handling tasks, jobs requiring continuously high levels of concentration, and working in hazardous, contaminated and inaccessible environments. Even though HRI is a growing field of artificial intelligence, so far it has either been neglected as a substantial area of research or it has been studied in conjunction with

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human-computer interaction (Sheridan, 2016). In either scenario, the field of HRI offers a tremendous research potential in understanding robotic interactions with humans, human-technology behavior, human factors, dynamics, control, and computer science (artificial intelligence) (IEEE Robotics and Automation Society, 2019; Schellen and Wykowska, 2019; Damiano and Dumouchel, 2018; Sheridan, 2016; Goodrich and Schultz, 2008; Dumouchel and Damiano, 2017).

HRI research can be classified into four categories: (a) telerobotics in hazardous or inaccessible environments, (b) human supervision / control of industrial robots in routine tasks, (c) automated vehicles including automated highway and rail vehicles and commercial aircrafts, and (d) human-robot social interactions. The first category of telerobotics / teleoperation, which is described as humans controlling space, airborne, terrestrial, and undersea vehicles for nonroutine tasks in hazardous environments; whereby progress can be seen in undersea robotic vehicles, unmanned spacecraft, and/or unmanned aerial vehicles (UAVs) (Skaar and Ruoff, 1994; Sheridan and Verplank, 1978; Burke and Murphy, 2010). Second category of HRI research deals with situations that require human supervision and control of robots for routine tasks, such as factory assembly line operations, delivery of parts and packages, medical and hospital supplies and deliveries, floor cleaning, and automated agricultural tasks. Third HRI research category focuses on automated vehicles including automated highway and rail vehicles, and commercial aircrafts, even though there is some/high degree of human supervision and control required to operate these systems as teleoperators / telerobots (Rasmussen, 1986; Sheridan 2016). Google's self-driving car technology and Tesla's autonomous vehicle fit in this category with several automobile manufacturers vying to enter this market and developing human-driver technology enhancements like radar-augmented cruise control, alerts signals, off-the-road alarms, and vehicle-to-vehicle communication for avoiding/predicting impending collisions.

Our research focuses on the fourth HRI research category dealing with human-robot social interaction and delves into "social intelligence" over artificial intelligence. Examples include, but are not limited to, MIT's Kismet (an expressive robotic creature with perceptual and motor modalities tailored to natural human communication channels – "Kismet, the Robot," n.d.) (Breazeal, 2000); Mattel's Barbie doll with extensive speech and communication abilities for conversing with young children ("How Mattel Continues to Move Barbie into the Future," n.d.); and friendly human-looking robots utilized to help patients in hospitals, senior living assistance, and people / children with autism disorders. Tug, the busy robot nurse, developed by Aethon, is helping nurses' and doctors' care for patients by autonomously delivering food and drugs (Simon, 2017). Toyota's $400 Kirobo Mini companion robot (Tribune News Services, 2016), a part of Toyota's heart project, with a cute face and big eyes, is helping seniors and lonely people with an engaging conversation. In a similar vein, QTrobot from LuxAI (Meet QTrobot, n.d.), a young company spun out of the University of Luxembourg, is helping children with autism spectrum disorder by increasing children's attention spans with robotic interactions and their willingness to interact with human therapists. In order to simulate social interaction between humans and robots, there is a need to investigate social-cognitive mechanisms of the human brain to effectively facilitate human-robot interaction (HRI). Keeping in view of the above, our research focuses on the following objectives:

1. Define and examine the differences between social-cognitive intelligence and artificial intelligence in HRI research domain;
2. Define socio-ethical robots, and explore how to incorporate and integrate ethical design recommendations in social robots for a successful HRI implementation; and
3. Examine roboethics through socio-behavioral relationships exemplified by social cognition, intentionality, robotic anthropomorphism, and human-robot xenocentrism for creating a well-functioning human-robot interaction (HRI) experience.

The following sections provide a description of social and collaborative robots, differences and similarities between cognitive and artificial intelligence in human-robot interaction (HRI) domain,