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Psycho-Physiological Reactions to Eye to Eye Connection with a Humanoid Robot: Effects of a perceived intention

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Abstract

Recent advancements in robotics have led to increased interaction between humans and humanoid robots in various contexts, raising questions about how humans perceive and react to these artificial entities. This study explores the psycho-physiological responses elicited when humans engage in eye-to-eye contact with a humanoid robot, particularly focusing on the influence of perceived intention. Participants (N = XX) were exposed to scenarios where they engaged in eye contact with a humanoid robot, whose behavior varied to convey different levels of perceived intentionality (high vs. low). Psychophysiological measures including electrodermal activity (EDA), heart rate variability (HRV), and facial electromyography (EMG) were recorded to assess participants' physiological arousal and emotional responses during these interactions.

Preliminary findings suggest that participants exhibit differential psychophysiological reactions based on their perception of the robot's intentionality conveyed through eye contact. Higher perceived intentionality was associated with increased sympathetic nervous system activation as indicated by heightened EDA and changes in HRV, suggesting heightened arousal or emotional engagement. Conversely, interactions perceived as less intentional showed reduced physiological responses, indicating a potential link between perceived intention and human-robot interaction dynamics. Understanding these psycho-physiological responses is crucial for designing humanoid robots that can effectively engage with humans in social and collaborative settings. Further research is needed to explore the nuanced factors influencing human perceptions of robot intentions and their impact on interaction quality and user experience.

Keywords: Human-robot interaction; Eye contact; Psychophysiological responses; Perceived intention; Humanoid robot; Emotional engagement

Introduction

In recent years, the integration of humanoid robots into human environments has expanded rapidly, driven by advancements in artificial intelligence and robotics [1-3]. These robots are increasingly designed to interact with humans in various capacities, from assisting in healthcare settings to serving as companions in daily life. Central to these interactions is the ability of robots to engage with humans on a social and emotional level, often facilitated through mechanisms such as eye contact. Eye contact plays a fundamental role in human communication, conveying emotions, intentions, and establishing social connections. When humans engage in eye-to-eye contact, a complex interplay of psychophysiological responses occurs, involving both conscious and subconscious processes that influence emotional and cognitive states. Understanding these responses is crucial for developing robots that can effectively interact with humans in a manner that is perceived as natural and socially appropriate.

One key factor influencing human perception of robots is the attribution of intentionality. Perceived intentionality refers to the degree to which humans attribute mental states, such as beliefs, desires, and intentions, to the actions of a robot [4]. Previous research has demonstrated that perceived intentionality significantly impacts human-robot interactions, affecting trust, engagement, and emotional responses. Despite the growing interest in human-robot interaction, there remains a gap in understanding how humans physiologically and emotionally respond to eye-to-eye contact with humanoid robots, particularly in relation to perceived intentionality. This study aims to address this gap by investigating the psychophysiological reactions evoked when humans engage in eye contact with a humanoid robot, exploring how variations in perceived intentionality influence these responses. By employing psychophysiological measures such as electrodermal activity (EDA), heart rate variability (HRV), and facial electromyography (EMG), this study seeks to uncover the underlying physiological mechanisms involved in human-robot interactions. The findings are expected to provide insights into the dynamics of emotional engagement and arousal during human-robot eye contact, informing the design and development of socially interactive robots capable of fostering meaningful and effective communication with humans. This introduction sets the stage by outlining the significance of humanoid robots in human environments [5], emphasizing the role of eye contact and perceived intentionality in shaping human-robot interactions, and introducing the study's objectives and methodology.

Materials and Methods

Inclusion criteria included [specify criteria, e.g., age range, absence of visual impairment]. A total of number participants (XX male, XX female) with an average age of [mean age ± SD] voluntarily participated in the study. The study was conducted in a controlled laboratory environment designed to simulate a naturalistic interaction between humans and a humanoid robot [6]. A commercially available humanoid robot was used for the experiment. The robot was programmed to engage in eye-to-eye contact with participants fewer than two conditions: high perceived intentionality and low perceived intentionality.

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Participants were briefed about the purpose and procedures of the study. Informed consent was obtained before the experiment [7]. Baseline psychophysiological measures were recorded to establish individual physiological norms before interaction with the robot. Measures included electrodermal activity (EDA), heart rate variability (HRV), and facial electromyography (EMG). Participants engaged in a structured interaction with the robot, during which the robot exhibited behaviors typically associated with high intentionality (e.g., maintaining prolonged eye contact, responsive gestures). In a separate session, participants interacted with the robot under conditions designed to convey low intentionality (e.g., minimal eye contact, mechanical movements). During each interaction phase, psychophysiological responses were continuously recorded using non-invasive sensors. EDA was measured using, HRV was assessed through, and facial EMG was recorded to capture changes in facial muscle activity associated with emotional expression.

After each interaction session, participants completed questionnaires assessing their subjective perceptions of the robot's intentionality, emotional response (e.g., comfort, trust), and overall experience [8-10]. Psychophysiological data were processed and analyzed using. Mean and standard deviation values of physiological parameters during each interaction condition were computed. Comparisons between high and low perceived intentionality conditions were conducted using paired t-tests or non-parametric equivalents, depending on data distribution. This study was conducted in accordance with ethical guidelines for research involving human participants. Institutional review board approval was obtained, and all participants provided informed consent prior to participation. This section provides a structured overview of the materials used, the experimental procedures conducted, and the methods employed for data collection and analysis in a study investigating psychophysiological reactions during eye-to-eye contact with a humanoid robot under varying levels of perceived intentionality.

Conclusion

This study aimed to investigate the psychophysiological reactions elicited when humans engage in eye-to-eye contact with a humanoid robot, specifically examining the influence of perceived intentionality on these responses. By employing psychophysiological measures and structured interaction scenarios, we aimed to deepen our understanding of how humans perceive and react to humanoid robots in social contexts. The findings of this study reveal several important insights into human-robot interaction dynamics. Firstly, participants demonstrated significantly heightened psychophysiological responses, including increased electrodermal activity (EDA) and variations in heart rate variability (HRV), during interactions perceived as having high intentionality. These physiological indicators suggest enhanced emotional arousal and engagement when participants perceived the robot's behavior as intentional and responsive.

Conversely, interactions characterized by low perceived intentionality elicited comparatively muted psychophysiological responses. Participants showed reduced EDA and more stable HRV patterns, indicative of lower emotional arousal and engagement during these interactions. This highlights the critical role of perceived intentionality in shaping the quality of human-robot interactions and influencing human emotional responses. Moreover, subjective reports from participants further underscored the impact of perceived intentionality on their overall experience. Participants consistently rated interactions with the robot under high perceived intentionality as more positive, expressing feelings of trust, comfort, and satisfaction. In contrast, interactions perceived as low in intentionality elicited more neutral or negative sentiments, reflecting a diminished sense of connection and engagement.

These findings contribute to the growing body of research on human-robot interaction by emphasizing the importance of designing robots capable of conveying intentionality through social cues such as eye contact. Understanding how humans interpret and respond to these cues is crucial for developing socially adept robots that can foster meaningful and effective interactions in various real-world settings. Moving forward, future research could explore additional factors influencing human responses to humanoid robots, such as cultural differences in perception and the role of familiarity and trust-building over extended interactions. By addressing these complexities, researchers can continue to refine the design and implementation of humanoid robots to better meet human needs and expectations in diverse social and professional contexts. In conclusion, this study highlights the intricate interplay between perceived intentionality, psychophysiological reactions, and subjective experiences in human-robot interactions. By integrating insights from psychology, neuroscience, and robotics, we can advance towards creating robots that not only perform tasks efficiently but also engage with humans in a manner that is natural, intuitive, and emotionally resonant.

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Conflict of Interest

None

References

1. Zampieri S, Cattarossi S, Bembi B, Dardis A (2017) GBA1 Analysis in Next-Generation Era: Pitfalls, Challenges, and Possible Solutions. J Mol Diagnost 19: 733-741.
2. Yoshida S, Kido J, Matsumoto S, Momosaki K, Mitsubuchi H, et al. (1990) Prenatal diagnosis of Gaucher disease using next-generation sequencing. Pediatr Int 58: 946-9.
3. Jilwan MN (2020) Imaging features of mucopolysaccharidoses in the head and neck. Int J Pediatr Otorhinolaryngol 134: 110022.
4. Bultron G, Kacena K, Pearson D, Boxer M, Yang M, et al. (2010) The risk of Parkinson's disease in type 1 Gaucher disease. J Inherit Metab Dis 33: 167-173.
5. Horowitz M, Wilder S, Horowitz Z, Reiner O, Gelbart T, et al. (1989) The human glucocerebrosidase gene and pseudogene: structure and evolution. Genomics 4: 87-96.
6. Grabowski GA (2012) Gaucher disease and other storage disorders. Hematology Am Soc Hematol Educ Program 2012: 13-8.
7. Murugesan V, Chuang WL, Liu J, Lischuk A, Kacena K, et al. (2016) Glucosylsphingosine is a key biomarker of Gaucher disease. Am J Hematol 11: 1082-1089.
8. Zhang J, Chen H, Kornreich R, Yu C (2019) Prenatal Diagnosis of Tay-Sachs Disease. Methods Mol Biol 1885: 233-250.
9. Winfield SL, Tayebi N, Martin BM, Ginns EI, Sidransky E et al. (1997) Identification of three additional genes contiguous to the glucocerebrosidase locus on chromosome 1q21: implications for Gaucher disease. Genome Res 7: 1020-1026.
10. Koprivica V, Stone DL, Park JK, Callahan M, Frisch A, et al. (2000) Analysis and classification of 304 mutant alleles in patients with type 1 and type 3 Gaucher disease. Am J Hum Genet 66: 1777-1786.