The Influence of Disease Threats on Preferences for Robot Services over Human Services

Yiheng Tian[1,a], Xin Luo[2]*

[1]Beijing No.4 High School International Campus, Beijing, China
[2]Zhejiang University, 866 Yuhangtang Rd, Hangzhou 310058, P.R. China

[a]tianyihengemail@163.com; *786051162@qq.com

Abstract. In recent years, the use of robot services has been growing in various sectors such as education services, public services, and home services. It is crucial for both the robot industry and marketers to understand how people's preferences for robot services are developed and how other factors influence these preferences. However, there has been limited research on this topic. Addressing this gap, I have investigated how people's preferences for robot services are affected by a specific situational factor - disease threat. I am particularly interested in the impact of disease threat on people's relative preferences for robot services compared to human services. Through an experiment involving 126 Chinese participants, I discovered that disease threats lead to an increased relative preference for robot service over human service among consumers. These findings contribute to the existing literature on disease threat and human-technology interaction, and more importantly, have practical implications.

Keywords: disease threat, robot service, human service, human-technology interaction

1 Introduction

The service robotic market size is expanding gradually. It was valued at USD 42.8 billion in 2022 and there is forecasted growth at a Compound Annual Growth Rate exceeding 25% from 2023 to 2032.[7] This anticipated expansion signifies a substantial increase in the demand for robot services over the next decade, which indicates a broad prospect for the development of robotics. Furthermore, robot services have become increasingly integrated into people's daily lives, with robots being utilized in home services, education services, public services, and medical services. In recent years, shopping malls, hotels, and restaurants have also adopted robots to offer customers guidance, consultation, delivery, and other services. The impact of COVID-19 has created new development opportunities for the global service robot industry.

In the early days of the COVID-19 outbreak, individuals were informed through their mobile devices and televisions about the emergence of an unfamiliar form of pneumonia in China. News reports depicted the severity of the symptoms and the state of hos-

D. Rad et al. (eds.), *Proceedings of the 2024 5th International Conference on Mental Health, Education and Human Development (MHEHD 2024)*, Advances in Social Science, Education and Humanities Research 857,
https://doi.org/10.2991/978-2-38476-271-2_96

pitals in the affected regions. Even in cities that were not directly affected, people experienced a heightened sense of uncertainty and the potential risk of infection. As a result, there was a significant shift in behaviour, with individuals wearing masks and gloves as a precautionary measure. More importantly, contactless deliveries were adopted to minimize the risk of cross-infection. Going beyond human-human interaction, this paper is interested in how such disease threat impacts human's interaction with non-human agents, specifically robots. Will disease threats alter the way individuals interact with robots?

2 Theoretical Framework

2.1 Disease Threat

When people perceive the risks associated with contracting diseases like the common cold, influenza, respiratory disease, or other infectious diseases, they respond psychologically to the situation. This means that their attitudes, emotions, and behaviours can be influenced by disease threat. Disease threat is defined as "a potential threat posed by an infectious disease". [16] People experience this threat as a feeling of vulnerability and discomfort in an environment where disease is a concern. Throughout human history, diseases have always been a major threat to our safety and health. The consequences of exposure to harmful pathogens and parasites can be severe, including temporary loss of function, physical deformities, social exclusion, and even death. Currently, both individuals in developing and industrialised nations are still at risk of contracting infectious diseases, which account for up to 15 percent of deaths. [2]

Not only do diseases pose physical threats, but they also have an impact on individual attitudes and behaviours. Previous research on disease threat demonstrated that individual susceptibility to diseases can predict conformity attitudes. This means that when individuals perceive a higher threat of infectious diseases, they are more likely to conform to social norm. [18] From an evolutionary perspective, conformity helps humans and animals respond to environmental threats and avoid predation. Many social norms serve as protective measures against specific dangers and threats. [10][11] Controlling infectious diseases, which often have a latency period, largely depends on adhering to norms and regulations. Individuals who go against these norms may be viewed as potential threats to others. [4] [17] As a result, humans may have evolved an inclination towards conformity and compliance with social norms, considering the benefits and effects they provide. Additionally, as the perceived threat increases, people tend to become more sensitive and vigilant towards moral behaviour. [17] Another explanation for this phenomenon is that binding moral concerns, such as authority, loyalty, and purity, enhance in-group cohesion and create boundaries for other groups.[8] [17] This can help reduce the risks of infection throughout history. During the COVID-19 pandemic, many governments around the globe implemented strict policies and regulations to control the spread of infection. These measures are more focused on authority rather than individuality, and people are complying with social norms. Consequently, the risks of infection have been reduced.

There have been changes in behaviour, such as avoiding crowds and increasing the distance of social interactions, which are obvious among travellers and consumers. [14] One possible explanation for this behaviour is the approach-avoidance model and Reinforcement Sensitivity Theory (RST), which examine the motivations behind social behaviour. [17] [1] Generally speaking, the Behavioural Inhibition System (BIS) drives avoidance responses, while the Behavioural Activation System (BAS) leads individuals to approach rewards. Considering the influences of the BIS and BAS motivational systems on decision-making, the BIS can be activated by perceived threats of infectious disease, resulting in the inhibition of social behaviour, including avoiding interactions with others and crowds.

Humans have developed a “behavioural immune system” to protect themselves against infectious pathogens. [3] This system allows people to detect signs of disease in their environment and develop cognitive and emotional responses to avoid potential sources of infection. However, this system can sometimes lead to overgeneralization, causing individuals to have an aversive response to people or objects that are not actually a threat. Previous research has shown that exposure to disease threats triggers instinctive reactions in interpersonal situations as individuals seek safety. [13]

Different from prior literature, I examined how disease threats will impact humans’ interaction with non-human agents. Specifically, current research has focused on the influence of disease threats on consumers ’relative preferences for robot services over human services. According to the aforementioned theory, when people are under disease threat, they may instinctively avoid more contact with other humans and thus tend to prefer services provided by non-humans although these are not completely free of the risk of spreading the virus. People tend to think of robots as safer objects to interact with.

2.2 Human-Technology Interaction

Human-technology interaction, as a hot topic, has attracted a lot of research attention from different fields, such as psychology, marketing, computer science, and communication. Social scientists have been interested in those factors that potentially impact human-technology interactions and preference of robot services. With the increasing utilisation of robot services such as robot waiters and services robots in shopping malls, hotels, etc., consumers have mixed views toward robot services and human services in different situations. Generally speaking, both technological and psychological factors contribute to people’s preference to use robot services. [19] [9] Higher reliability and more advanced technology can increase people’s willingness to adopt robot services. On the other hand, psychological factors such as people's sense of control over robots or consideration of individual needs and environmental impacts often play a crucial role in people’s concerns about robot services. [5] [15] For example, in situations that cause social discomfort, such as when the presence of others causes embarrassment, consumers tend to prefer robots over human services, which helps them reduce the pressure of social judgment. [13] In the context of tourism, Hou, Zhang, and Li (2020) found that crowding can lead to social withdrawal and decrease people’s desire to interact with others, allowing them to regain control over their personal space. [12] As a result, in crowded situations, people tend to favour the services offered by robots.

In addition, individuals frequently pursue uniqueness, which cannot be effectively fulfilled by robot services. Grandulo, Fuchs, and Puntoni (2019) found that compared with robotic labour, human labour generates a more unique value for consumers. [6] Therefore, when consuming products with higher (vs. lower) symbolic value, people prefer human labour (vs. robotic labour) more. I deviate from previous research by investigating an overlooked factor, potentially influencing human-technology interaction, that is, disease threat. The key hypothesis of the current study is that exposure to disease threat increases consumers' relative preferences for robot service over human service.

3 Study Section

This study aims to test whether disease threat has an effect on consumers' relative preferences for robot service over human service. To achieve this goal, this study adopts a one-factor two-cell between-subjects design. One condition is the disease-threat condition, and the other condition is a control condition. I predict that participants assigned to the disease-threat condition will have a stronger relative preference for robot service over human service compared to those assigned to the control condition.

3.1 Participants

We recruited 126 Chinese participants for this study. These participants were randomly assigned to either the disease-threat condition or the control condition. Finally, the disease threat condition has 64 participants while the control condition has 62 participants. Among the 126 participants, 69 were females, 54 were males, and 3 preferred not to disclose. Please see age distribution in Table 1.

Table 1. Age Distribution

Age Range	Number of Participants
Under 18	3
18-25	22
26-30	24
31-40	39
41-50	7
51-60	27
Above 60	4

3.2 Methods

Participants in the disease-threat condition were instructed to envision the presence of a new infectious virus, while those in the control condition were directed to imagine the emergence of new technology for treating a dental issue. After reading the instructions, the participants were instructed to write down their feelings. The detailed instructions were provided as follows.

Instruction for the disease-threat condition: Imagine that you reside in a location where a novel respiratory infection virus, Z, has recently surfaced, proving to be more severe than past iterations of the coronavirus. Virus Z primarily spreads through respiratory droplets and contact. Prevention of human-to-human transmission is crucial to combatting the virus. Scientific research indicates that symptoms of this viral infection encompass breathing issues, high fever, fatigue, and in severe instances, respiratory failure.

Instruction for the control condition: Imagine that that a local hospital has just implemented a novel approach to addressing dental caries known as non-traumatic restorative therapy (ART). In this method, the caries are manually removed using specific instruments and then the cavities are filled with a new kind of glass ionic material that exhibits strong adhesion, pressure resistance, and wear resistance. One of the key benefits of this approach is that it does not necessitate electric dental equipment, making it convenient for surgeons to operate and readily accepted by patients.

To measure people's relative preferences for robot service over human service, we asked participants to imagine that they were eating in a restaurant. Either a robot or a human could provide services for them. Participants indicated whether they preferred a robot or a human to serve them. We utilized an 8-point bipolar scale to quantify their relative preferences, wherein a value in proximity to "1" signifies a preference for a human, while a value near "8" indicates a preference for a robot. A higher score reflects a stronger preference for robots, whereas a lower score indicates a stronger preference for humans.

4 Results

The mean value of the disease threat condition is 6.78, and the standard deviation is 1.94. In contrast, the mean value of the control condition is 4.68, and the standard deviation is 2.54. Please refer to Figure 1. We first conducted an independent sample t-test to examine our hypothesis. We found that those participants assigned to the disease-threat condition indicated a stronger relative preference for robot service over human service than those assigned to the control condition did ($t(124) = 5.21$, $p < .001$). Moreover, the effect is still significant when controlling participants' gender ($F(123) = 26.55$, $p < .001$) and age ($F(123) = 27.63$, $p < .001$). In addition, we wonder whether disease threat and gender will have an interaction effect. The Univariate analysis showed that there is no interaction effect between disease threat and gender ($p > .05$). We also tested whether participants' age could moderate the proposed effect of disease threat on consumers' relative preferences. The moderation analysis revealed that the moderation effect was not significant ($p > .05$), suggesting the absence of a moderation effect.

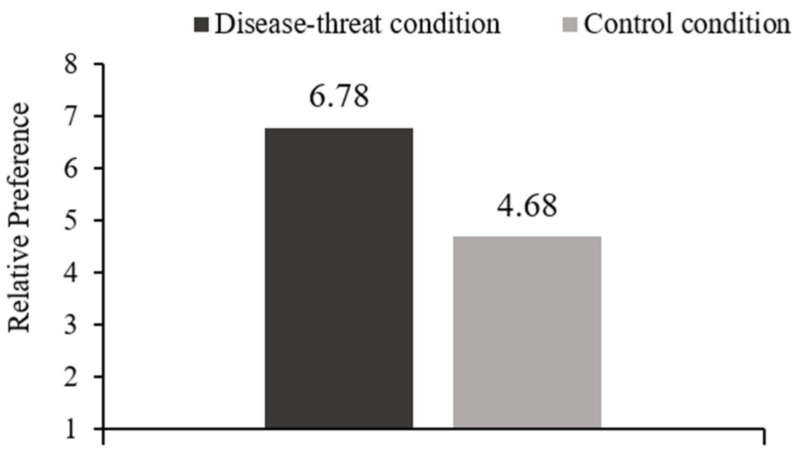

Fig. 1. Mean Value of Two Conditions

5 Conclusion and Discussion

By conducting a randomized experiment, I found that disease threat increases consumers' relative preferences for robot service over human service, which is consistent with the hypothesis. More importantly, the observed effect of disease threat on consumers' relative preferences remains after controlling consumers' age and gender, demonstrating the robustness of our effect.

Robot market is a rapidly growing market. With the increasing usage of robots in service contexts, marketers are confronted with a decision-making process concerning the selection of agents for adoption in service settings. Therefore, it is crucial for marketers to understand how consumers' inclinations towards robots or humans are formed, and how these preferences are influenced by individual and situational factors. In addressing this issue, the current study directs its focus towards a specific situational factor: disease threat. Through a randomized experiment, I found that participants assigned to the disease-threat condition displayed a stronger inclination towards robot service over human service compared to those assigned to the control condition, thus supporting the central hypothesis that disease threat increases consumers' preferences for robot service over human service. The current findings make contributions to the line of research on disease threat by examining the influences of disease threat on human interaction with non-human agents. Moreover, these findings add to the literature on human-technology interaction by suggesting and exploring a factor that may potentially impact human interaction with robots, namely, disease threat. Lastly, the present research provides important insights for marketers regarding the adoption of robot services under specific circumstances.

References

1. Berkman, E. T., & Lieberman, M. D. (2010). Approaching the bad and avoiding the good: Lateral prefrontal cortical asymmetry distinguishes between action and valence. Journal of cognitive neuroscience, 22(9), 1970-1979.
2. Cagliani, R., & Sironi, M. (2013). Pathogen-driven selection in the human genome. International journal of evolutionary biology, 2013.
3. Duncan, L. A., & Schaller, M. (2009). Prejudicial attitudes toward older adults may be exaggerated when people feel vulnerable to infectious disease: Evidence and implications. Analyses of Social Issues and Public Policy, 9(1), 97-115.
4. Fabrega Jr, H. (1997). Earliest phases in the evolution of sickness and healing. Medical Anthropology Quarterly, 11(1), 26-55.
5. Fast, E., & Horvitz, E. (2017, February). Long-term trends in the public perception of artificial intelligence. In Proceedings of the AAAI conference on artificial intelligence (Vol. 31, No. 1).
6. Granulo, A., Fuchs, C., & Puntoni, S. (2019). Psychological reactions to human versus robotic job replacement. Nature human behaviour, 3(10), 1062-1069.
7. Gujar, S., & Vishwakarma, D. (2023). Service Robotics Market - By Component (Robots, Peripherals), By Robots (Professional, Personal Household, Entertainment]) & Forecast, 2023 – 2032. In Global Market Insights Inc.https://www.gminsights.com/industry-analysis/service-robotics-market-size#:~:text=Service%20Robotics%20Market%20size%20was,the%20demand%20for%20service%20robotics.
8. Haidt, J., & Joseph, C. (2004). Intuitive ethics: How innately prepared intuitions generate culturally variable virtues. Daedalus, 133(4), 55-66.
9. Hengstler, M., Enkel, E., & Duelli, S. (2016). Applied artificial intelligence and trust—The case of autonomous vehicles and medical assistance devices. Technological Forecasting and Social Change, 105, 105-120.
10. Henrich, J., & Boyd, R. (1998). The evolution of conformist transmission and the emergence of between-group differences. Evolution and human behavior, 19(4), 215-241.
11. Henrich, J., & Gil-White, F. J. (2001). The evolution of prestige: Freely conferred deference as a mechanism for enhancing the benefits of cultural transmission. Evolution and human behavior, 22(3), 165-196.
12. Hou, Y., Zhang, K., & Li, G. (2021). Service robots or human staff: How social crowding shapes tourist preferences. Tourism Management, 83, 104242.
13. Huang, Y., & Sengupta, J. (2020). The influence of disease cues on preference for typical versus atypical products. Journal of Consumer Research, 47(3), 393-411.
14. Kim, J., Giroux, M., & Lee, J. C. (2021). When do you trust AI? The effect of number presentation detail on consumer trust and acceptance of AI recommendations. Psychology & Marketing, 38(7), 1140-1155.
15. Longoni, C., Bonezzi, A., & Morewedge, C. K. (2019). Resistance to medical artificial intelligence. Journal of Consumer Research, 46(4), 629-650.
16. Murray, D. R., & Schaller, M. (2012). Threat (s) and conformity deconstructed: Perceived threat of infectious disease and its implications for conformist attitudes and behavior. European Journal of Social Psychology, 42(2), 180-188.
17. Murray, D. R., Kerry, N., & Gervais, W. M. (2017). On disease and deontology: Multiple tests of the influence of disease threat on moral vigilance. Social Psychological and Personality Science. Advance online publication.

18. Murray, D. R., Trudeau, R., & Schaller, M. (2011). On the origins of cultural differences in conformity: Four tests of the pathogen prevalence hypothesis. Personality and Social Psychology Bulletin, 37(3), 318-329.
19. Zuboff, S. (1988). In the age of the smart machine: The future of work and power. Basic Books, Inc.