

A Study on the Acceptance Attitudes of Chinese Populations Towards Service Robots in the Midst of an Epidemic

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Abstract. Before the World Health Organization declared novel coronavirus pneumonia (COVID-19) a pandemic in 2019, service robots were already in use and in the process of being further developed. In the wake of the COVID-19 outbreak, frontline service robots became a hot topic of discussion to keep social distance and control the outbreak. And now, as each country adapts to the new crown epidemic normality, China is still pursuing a dynamic clearance policy. In this particular context, and in turn, the analysis online review examines the perceptions and attitudes of the Chinese public towards the application of robots in the service industry. Their evaluations of service robots on five dimensions are summarized. It is concluded that the public is more receptive to service robots, finds them useful for epidemic prevention and control and is amused and curious. This provides a reference for those in charge of many service industries, such as the hospitality tourism industry, to take advantage of this opportunity to develop services as a combination of robots and humans to further broaden the market.

Keywords: service robot; COVID-19 pandemic; human-robot interaction; Robotics impact attitude.

1. Introduction

With the further development of automation in recent years, especially humanoid robots have further developed and refined drive and control technology [1]. Rapidly improving manufacturing technology, becoming better, smarter, smaller, and cheaper technology will bring change to almost all service sectors [2]. There is a wide range of industries trying to apply robots in the back office to assist production to increase efficiency. Several service industries try to apply humanoid robots on the front line, and some of them, such as low-skilled and low-paying jobs, will gradually be automated [3]. With the further development of robots, automated machines gradually replaced part of the service industry occupations. The first fully automated hotel, the Henn na chain in Japan, realized the possibility of fully automated service, creating a unique stay for the customer, but also entailing the risk of a disrupted service experience. First reported in 2019, the World Health Organization (WHO) declared this strain of coronavirus (SARS-CoV-2) a global pandemic on March 11, 2020 [4]. Due to advances in artificial intelligence (AI), miniaturization, and other technologies, robotics has grown increasingly more viable in hospitality and tourism industry settings to provide concierge, housekeeping, food, and other service tasks [5]. Service robots applied on the frontline are still trying to be put into use more and more, even establishing new fully automated hotels such as FlyZoo Hotel.

In the context of COVID-19, the population's perceptions and attitudes toward the use of service robots on the front line have also changed. In addition, China has continued to maintain a strict attitude toward epidemic prevention and control in recent years, adhering to a dynamic zero policy for epidemics and having a more specific epidemic prevention policy from the world's perspective. Therefore, a study will be needed to investigate the perceptions and attitudes of the Chinese population toward the use of robots in the service industry in the post-epidemic era. The significance of this study is to investigate the customer acceptance of service robots in the service industry in the post-epidemic era so that individual hotels and restaurants can adjust the extent and application of service robots in their businesses. It also provides a particular perspective on customer perceptions and opinions of service robot applications worldwide. This study uses reviews from video websites for online comment analysis to explore public perceptions and attitudes toward diverse service robots applied in the service industry in the context of special epidemic control in China and compares them

with people's evaluations of service robots before the epidemic to summarize the shift in customers' attitudes toward service robots after the new crown epidemic.

2. Model analysis process

2.1. Case selection, data sources

In this study, customer evaluations and perspectives about the use of robots in the hospitality business on Chinese video websites were categorized and filtered, and online reviews were then evaluated to look into travelers' attitudes and perceptions on this subject. Earlier literature analyzed 1,001 customer-generated feedbacks on Yahoo's review system to discover the factors related to the rating of online merchants [6]. Bilibili is a video-sharing website based in China, where users can upload, view and add comments to videos [7]. On this video platform, the study discovered three examples of videos that were relevant to the study's subject and had a combined audience of 2,731,000 views and 1,174 comments. The three films are about robotic hotel applications that automatically transport food, automatically cook traditional pasta, and automatically provide room service.

2.2. Research Methodology

Rooting theory is one of the types of qualitative research methods that emphasize the conceptualization, categorization, and theoretical abstraction work of primary data in constant comparison, including the triple coding analysis process of open coding, selective coding, and theoretical coding, where coding refers to the constant comparison between events and between events and concepts, which leads to the formation of categories and features and the conceptualization of data [8]. The subdivision process consists of an initial sampling from the video's comments to select a research sample of appropriate topics for study, followed by theoretical sampling. After completing all the sampling the data are step by step open coding, selective coding, and theoretical coding. After completing the coding the theory is developed based on the coding results, resulting in a systematic theory of administration. Finally, a closing analysis discussion was conducted.

2.3. Category refinement and model building

Conceptualization and initial scoping (open coding stage) At the beginning of the study, the core research question of "customers' attitudes and perceptions towards robots in the hospitality industry" was always the focus of the study, and several videos about service robots in the hotel and restaurant industry on the Bilibili website were screened and repeatedly browsed through specific Visitor comments were carefully coded and categorized without any reader bias to generate initial concepts and discover conceptual categories from the original material. The comments that were helpful and valuable to the topic were screened out in the conceptualization process. In this study, nearly more than 200 original statements and corresponding initial concepts were refined in the conceptualization stage. The concepts expressed by the sample based on the larger sample size mostly crossed and overlapped, and after the categorization, more than 1,00 initial concepts eventually formed 19 categories.

2.4. Selective coding stage

Considering the broad meaning of the initial categories and the vague interrelationship between the categories, it is necessary to further put the initial categories back into the original data and analyze the original web review data. In-depth analysis of the attributes of the categories based on a full understanding of the research context and the research object, and categorization of the different categories according to their interrelationships and logical order through continuous comparison.

The number of categories obtained after the initial categorisation is large and the classification is complicated, which does not facilitate further analysis of the interrelationships between categories and the influence of the categories on the conclusions. Therefore, we compare several initial

categories, find the logical relationships and correlations between different categories, and further categorize and organize the initial categories that can be categorized. The 19 initial categories generated from the initial categorisation of the topic were synthesized and analyzed to form five main categories: shape, technology, experience, application scenario, and interaction, which encompassed the 19 initial categories within a relatively broad theoretical scope.

2.5. theoretical coding stage

After the selected materials have been analyzed in two stages of open coding and selective coding, the resulting main categories basically cover all the necessary elements of the research topic, and the new materials no longer contribute much to the theoretical construction, and the theory can be judged to have basically achieved saturation, and then enter the last stage of theoretical construction. At this stage, the relationship between the main categories and the main categories has formed a clearer vein and gradually emerged, so this study constructs a customer attitude model consisting of shape, technology, experience, application scenario and interaction. The main content of this model is the attitudes and perceptions of the customers served by the service robots, as well as the people's change of attitude and suggestions for the service robots under the epidemic situation.

3. The Six evaluation dimensions

3.1. Appearance

In terms of appearance, in this case, the structural design of the robot's appearance, where the service robot's appearance is mostly close to animals or animation, with 92% of the customers' positive comments on the appearance. People also have higher expectations of robots that are more humanoid in general (Nowak & Biocca, 2003). It has been reported that how people form positive impressions of others is to some degree dependent on the visual and vocal behavior of the targets. (Clark N, Rutter D, 1985). Customers mostly think that service robots that are close to animation images make people feel affectionate and cute.

3.2. Technology

In terms of technology, users commented on the robot's sensitivity, stability, and service capability. There are many negative comments about the robot's sensitivity, including "not sensitive enough", and positive comments, including "the robot moves freely" and "sensitive". The stability of the robot has a lot of negative comments, including "unstable" and "wobbly". The most negative comments questioned the robot's ability to serve and prepare food, saying that the food was not emotional.

3.3. experience

The experience here refers to customers' experience of seeing or touching a service robot and the impact it has on their lives or the economy. 90% of users say they have seen or touched a service robot. The impact on life and the economy is positive, with the perception that they can facilitate life. The negative rating was about the application of robots reducing human employment opportunities. This does happen in reality, wide application and use of robots in the service industries could cause a large number of people to lose their jobs [11].

3.4. application scenario

Application scenarios for robots are defined as robots taking on certain tasks and roles in various work environments and positions. In the comments about the application scenarios, the survey has received feedback from the public about its application in epidemic prevention environments, campuses, and restaurants. The most comments about service robots applied in epidemic prevention scenarios were 72%.

3.5. human – computer interaction (HCI)

Human – computer interaction (HCI) is defined as a multidisciplinary field of study focusing on the design of computer technology and, in particular, the interaction between humans (the users) and computers.

Of the total data screened to compile and content of comments about human-machine interaction, attitudes were divided into positive and negative attitudes. 83.3% of the thirty comments selected on this topic were positive attitudes, while 16.7 % of them were negative attitudes. The positive comments described the interaction experience as "cute" and "fun".

4. Literature review

Since the use of automated robots in the service sector, travelers have given some degree of feedback on their use. Prior to the outbreak, the use of hotel service robots was documented to be relatively preliminary, with customers mostly in the innovation and trial practice phase. In order for Artificial intelligence (AI) to continue to innovate and develop without threatening normal human employment and work, a theory of AI job replacement has been proposed. AI is evolving gradually, predicting its functions according to the four intellectual service tasks of mechanical, analytical, intuitive, and good understanding one by one [11]. Prior to the epidemic, public attitudes and perceptions of robots becoming front-line service workers in hotels, and potential users' perceptions of robots were usually negative, which was related to the robots' appearance[12].

Some people have a favorable attitude toward robot waiters. On the one hand, when humanoid service robots appeared in the public view, it brought freshness and further encouraged to increase people's consumption in the service industry. On the other hand, the perceived intelligence of a robot will depend on its competence[13]. the stability and service consistency of programmed robots bring convenience to customers and improve service efficiency. The emergence of high-tech novelty makes people expect too much from robots, and after the expectations are not met, customers will feel lost.

After the covid-19 outbreak in 2019, people advocate keeping social distance to prevent the spread of viral infections. The presence of robots, artificial intelligence, and human-robotic interactions increased to help manage the spread of COVID-19 in hospitals, airports, transportation systems, recreational and scenic areas, hotels, restaurants, and general communities. The development of service and travel robots is predicted to be a major growth opportunity after the outbreak becomes less severe [14].

In terms of methods to analyze the attitudes and evaluations of potential users, most of the analysis methods used in the past have been self-assessment reports[15]. Nowadays, the Internet is more developed and people tend to express their attitudes and opinions anonymously on the Internet. It has become a common method of data analysis to analyze and organize the large number of online reviews, which analyze customers' attitudes, perceive emotional patterns, and make leading suggestions and improvements [16].

Before study mentioned that when robots are applied in people's daily lives, the limitations of robots are likely to be spotted [17]. However, the current study still does not examine much about people's attitudes and evaluations of service workers after the outbreak, nor does it analyze the specific evaluations of the general public therein regarding the use of robots in the hotel and service industries. Nor does it compare the shift in attitudes toward frontline service robots before and after the outbreak.

In addition to this, given the continued spread of the COVID-19 outbreak, this new coronavirus is still strictly controlled and avoided in China. So far a zero-clearance policy has always been upheld, close contacts and outsiders need to be quarantined, which to some extent affects people's freedom of living as well as their mental health [18]. Therefore, robots can better help people to reduce the probability of infection, an advantage that has become more important and special in China. This has also influenced to some extent the attitude of customers towards reception robots.

5. Concluding Discussion

In this study, we analyze online reviews on video websites using rooting theory, and through the triple normative coding process of open coding, selective coding and theoretical coding, we initially obtain 19 initial categories and 5 main categories, and finally obtain a three-dimensional model built with the final categories of modeling, technology, experience, application scenario, and interaction, etc. According to the model, we further analyze and compare customers' attitudes and perceptions towards service before and after the epidemic. Based on the model, we further analyzed and compared customers' attitudes and perceptions towards the service robot before and after the epidemic.

According to the study, there are nearly 20 comments that customers have a good feeling about the robot when it is used in special epidemic prevention places.

Due to the decrease in comments about the effectiveness of the prevention of the COVID-19 and then the experience of the robot disrupting the service, people's attitude toward the rational use of robots in the new epidemic has changed. In terms of technology, customers were mixed, with 40% of customers expressing doubts about the robot-making technology, while the remainder approved of the convenient robot service technology. In terms of styling, based on the Valley of Terror theory, robots that are close to humanoid are frightening, but robots that are cute and cartoonish are popular. In terms of interaction, people feel more secure with robots after the epidemic and are more willing to engage with fresh robots, which include a variety of interactions such as voice interaction and behavioral interaction. In terms of experience, 65% of people said they had experience with service robots after the COVID-19, and some of those who had not had previous experience also said they were willing to try or were curious.

According to the analysis, it can be concluded that the public is currently more favorable to the application of service robots at the front desk, and has already experienced related robot services, China's hospitality industry services and other industries can seize this special opportunity to develop a new service model by combining manual services and machine services.

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