# THE IMPACT OF HOME SERVICE ROBOTS' ANTHROPOMORPHISM LEVEL ON CONSUMER ATTITUDE

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# ETHICAL DECLARATION

I hereby declare that I am the sole author of this thesis and that I have conducted my work in accordance with academic rules and ethical behaviour at every stage from the planning of the thesis to its defence. I confirm that I have cited all ideas, information and findings that are not specific to my study, as required by the code of ethical behaviour, and that all statements not cited are my own.

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# ABSTRACT

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The main purpose of this study is to analyze the effects of anthropomorphic levels of service robots and people's negative attitudes towards robots on customer attitudes. The home environment, called the domestic area, was chosen as the environment where the work is organized because this area is where many companies produce their new robots and will be one of the environments in the service sector in the coming years. Determining the appropriate anthropomorphic levels for robots to be used in home environments is very important to meet customers' expectations and increase customer-robot interaction. In addition, investing in the right robot profile for practitioners will reduce possible extra costs and increase efficiency, making it easier to achieve a good position in the industry. In this context, understanding the effect of the anthropomorphism level of the robot to be used in the home environment on customer attitude has become an increasingly important issue for both academics and practitioners. This study shows the effect of perceived ease of use, which is affected by the anthropomorphism level of robots and their negative attitudes towards robots, on customer attitude through scenario-based experiments. The results show that increasing the anthropomorphism level of robots in the home environment negatively affects the perceived ease of use and that there is a positive relationship between this perceived ease of use and customer attitude. Additionally, as a result of the analysis, it was seen that perceived ease of use had a full mediating effect on customer attitude.

Keywords: Anthropomorphism, Service Robots, Home, Technology Acceptance Model, Uncanny Valley Theory, Negative Attitudes Towards Robots.

# ÖZET

EV HİZMET ROBOTLARININ ANTHROPOMORFİZM SEVİYELERİNİN TÜKETİCİ TUTUMU ÜZERİNDEKİ ETKİSİ

Çiçek, Derya

İşletme Yüksek Lisans Programı

Tez Danışmanı: Prof. Dr. Gülem Atabay

Haziran, 2024

Bu çalışmanın temel amacı hizmet robotlarının anthropomorfik seviyelerinin ve kişilerin robotlara karşı negatif tutumlarının müşteri tutumu üzerindeki etkilerini analiz etmektir. İç alan olarak adlandırılan ev ortamı çalışmanın düzenlendiği ortam olarak seçilmiştir çünkü bu alan birçok firmanın yeni robotlarını ürettiği alandır ve hizmet sektöründe ilerleyen yılların popüler ortamlarından biri olacaktır. Ev ortamlarında kullanılacak robotlar için uygun anthropomorfik seviyelerinin belirlenmesi, müşterilerin beklentilerini karşılamak ve müşteri-robot etkileşimini arttırmak için oldukça önemlidir. Buna ek olarak, uygulayıcı firmalar için doğru robot profiline yatırım yapmak hem olası ekstra maaliyetleri düşürecek hem de verimliliği arttırıp sektörde iyi bir konuma ulaşılmasını kolaylaştıracaktır. Bu bağlamda ev ortamında kullanılacak robotun anthropomorfizim seviyesinin müşteri tutumuna etkisini anlamak hem akademisyenler hem de uygulayıcı firmalar için giderek daha fazla önem arz eden bir konu haline gelmiştir. Bu çalışma robotların anthropomorfizim seviyesinin ve robotlara karşı negatif tutumlarının etkilediği algılanan kullanım kolaylığının müşteri tutumu üzerindeki etkisi senaryo bazlı deneyler ile gösterilmektedir. Sonuçlar robotların anthropomorfizim seviyesinin ev ortamında artmasının algılanan kullanım kolaylığını negatif yönlü etkilediği ve bu algılanan kullanım kolaylılığı ile de müşteri tutumu arasında pozitif bir ilişki olduğunu göstermektedir. Ayrıca, yapılan analizler sonucunda algılanan kullanım kolaylılığının müşteri tutumu üzerinde tam aracılık etkisi olduğu görülmüştür.

Anahtar Kelimeler: Anthropomorfizm, Hizmet Robotları, Ev, Teknoloji Kabul Modeli, Tekinsiz Vadi Teorisi, Robotlara Karşı Negatif Tutumlar.

***In memory of the 100th anniversary of the Republic of Türkiye...***

***And for all the people who lost their lives in Palestine under the cruelty of the oppressor and for their sense of humanity...***

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***"Someone asked a wise man what poison is. The wise man said, 'Everything in excess is poison. Excessive power, excessive rest, excessive food, excessive sorrow, excessive fear, excessive calmness, excessive anger, excessive joy, excessive hatred, even excessive goodwill.' Remember, the essence and remedy of life lie in maintaining balance."***

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**Derya ÇİÇEK**

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# LIST OF ABBREVIATIONS

ABOT: Anthropomorphic Robot

AU: Actual Use

BI: Behavioral Intention

CA: Customer Attitude

HRI: Human Robot Interaction

M-HOM: Mahru Home

M-HOT: Mahru Hotel

NATEIR: Negative Attitude Toward Emotions in Interaction with Robot

NATR: Negative Attitude Toward Robots

NATSIR: Negative Attitude Toward Situations and Interaction with Robot

NATSR: Negative Attitude Toward Social Influence of Robots

N-HOM: Nadine Home

N-HOT: Nadine Hotel

PEU: Perceived Ease of Use

PU: Perceived Usefulness

SPSS: Statistical Package for the Social Sciences

TAM: Technology Acceptance Model

# CHAPTER 1: INTRODUCTION

*"Robots will help us understand what humans are most of all."*

*Cynthia Breazeal*

This chapter provides an introduction to the main idea and general objectives of the study. First, the basic concept and general purpose of the research were emphasized and the main focus of the study was explained. Then, the importance of the study and its place in the existing literature were mentioned, and the contributions of the research were emphasized. Then, the research questions of the study were introduced and the specific problems on which the study would focus were determined. Finally, the holistic structure of the thesis is explained to the reader by presenting a brief summary of the structure and sections of the thesis.

## *1.1.Introduction to the Main Idea and The Study's Overarching Objectives*

The relationship between humans and robots is complex and has various dimensions. With the rapid advancement of robotic technology, robots have started to engage with humans in everyday settings, such as homes, schools, hospitals, and museums, leading to an increase in interaction. For instance, Amazon's Astro robot can be remotely controlled by the user and can also navigate the house autonomously, detecting and alerting the user to any unusual occurrences. The robot also features camera and microphone controls, but deactivating them renders the robot immobile. Another robot, called Walker, developed by Chinese company UBtech Robotics, is designed to assist with daily tasks and manage smart home systems. The production of these robots and the ongoing work of major companies like Tesla in this field suggest that human-robot interaction will become even more critical in the future. As these robots become increasingly prevalent in homes and service environments, this area is a promising and worthwhile research field.

The degree of social and emotional interaction between humans and robots is a critical factor in the adoption of these new technologies (Young et al., 2011). People's attitudes and emotions towards robots affect how they interact with them. The ability of robots to communicate with humans in everyday life makes them useful in many areas. However, there are concerns that some personality traits may hinder the acceptance of robots. Research has shown that people's views on robotic communication tend to be polarized (Nomura et al., 2008). Additionally, studies indicate that people's desire to form emotional bonds and intimacy with robots increases as robots become more humanoid in appearance. Gender is another crucial factor to consider in human-robot interaction. Research shows that men and women may not behave similarly toward robots, even if they have the same anxiety levels and negative attitudes toward robots (Nomura et al., 2008). Finally, the physical form of the robot is a crucial determinant of social and emotional interaction.

Robots come in a variety of physical forms, and the size of their heads and facial features affect how people perceive them (DiSalvo et al., 2002). The appearance of a robot's legs is a crucial factor that has been categorized into three groups: rotating legs like wheels, legs resembling living beings, and arthropod legs like those of snakes (Bakırcıoğlu and Kalyoncu, 2019). Research indicates that people have different reactions depending on the appearance of robots, and therefore the shape and structure of a robot determine social expectations (Yanco and Drury, 2004).

The interaction between robots and humans is influenced by the environment in which they operate. There are no clear criteria for measuring the success of humanoid robots interacting with their environment, and some criteria are subjective, making it difficult to determine their effectiveness (Şabanovic and Yannier, 2003). It is estimated that the economic impact of robot technology will be between 1.7 and 4.5 trillion dollars annually by 2025, with between 800 billion and 2.6 trillion dollars of this impact coming from the improvement of people's quality of life (McKinsey, 2021). Home service robots, which are designed to make people's lives easier, are expected to have an economic impact of 200-500 billion dollars. Given the significant impact of these robots on the environment, it is important to understand how the relationship between humans and robots is organized in the home environment and which factors affect people's acceptance of robots. This is a new area of research, and there are relatively few studies compared to other fields. Specifically, there is limited research on robots in the home environment. Therefore, the objective of this study is to analyze how the level of anthropomorphism in-home service robots affects consumer purchasing intention, using the Technology Acceptance Model framework. The aim is to visually present key points for innovative researchers who are interested in this field but lack expertise in humanoid robots.

The proliferation of robots and the rise of Industry 4.0 have contributed to an increased interest in robots among individuals, leading to the introduction of robots into homes, workplaces, and hospital areas. There are studies that argue that there are deep differences of opinion among people about communicating with robots. It is crucial to understand the factors that regulate social acceptability between humans and robots. This is a new stream of research, so the number of studies can be said to be less compared to other fields. In particular, we see that there is a very limited effort on robots in the home environment in research. Although many and multilevel studies have been conducted on the interaction of robots in social environments with humans, this effort is very limited in the home environment. Accordingly, the objective of this study is to analyze the impact of the anthropomorphism level of home service robots on consumer purchasing intention and will be analyzed from Technology Acceptance Model perspective. Since this subject is of interest to many disciplines, it is aimed to visually present the focal points of the subject to innovative researchers who want to work in this field and do not have expertise in the field of humanoid robots.

The aim of the study to investigate the impact of home service robots' anthropomorphism level on consumers' attitude.

### *1.2. Importance of Study*

In the technological era, the application of artificial intelligence and machine learning to robotic technologies has presented a number of growth opportunities for the service robot market. The rapidly advancing robotics industry has also pioneered the worldwide home integration of robots. One of the most important factors shaping the robot industry is the increasing interest and demand of consumers for autonomous robot technologies (Pereira and Romero, 2017). The need to limit individual intervention and increase efficiency contributes to wider global acceptance of home service robots. Home service robots are autonomous service robots that are specially designed for various home services such as house cleaning, cooking, pool cleaning, lawn mowing, and perform these tasks without the need for human intervention. Home service robots are not only limited to in-home activities, but can also be used to manage sleep-wake processes and interact with family members. These robots are considered as mechanisms operated autonomously by an onboard control system to carry out specific tasks. At the same time, they can seamlessly connect to WI-FI networks and are capable of successfully performing their tasks with a high level of autonomy. The expected sales amount for home service robots in the coming years is expected to reach 48.6 million units by 2023 (International Robotics Federation, 2020). This growth trend is driven by factors such as increasing levels of automation of home appliances, rising labor costs in developed countries, and increasing security concerns related to the effects of the global pandemic. These factors play a key role in driving the global home service robot’s market. The size of the global home service robots’ market in 2021 was recorded as 6.81 billion USD. It is expected to expand with a compound growth rate of 20.7% by 2030, and the market size is expected to reach 30.7 billion USD. The global home service robots market is divided into geographical areas. The market for home service robots in North America, in particular, has enormous development capacity. This region's high standard of living, robust technical infrastructure, and rising demand among consumers have made it a vital market for home service robots. This region represents a 63% share of the global home service robot’s market. North America is projected to grow and maintain its leading position in this market with a CAGR of 20.3% by 2030. Europe currently holds the second place, representing 22% of the home service robot’s market. Companies that are considered the world's major players originate from a variety of nations and have a diverse geographical distribution. Samsung Electronics Co. Ltd and LG Electronics Inc, both located in South Korea, are renowned in the electronic products area. While iRobot and Neato are established in the United States, Chinese Ecovacs and iLife Innovation also have a strong presence in this market. BSH Hausgeräte and Miele of Germany are major players in the home appliance sector, while Dyson of the United Kingdom is at the forefront of cleaning and new technology. These leading robot manufacturers are dedicating significant financial resources to the rapid development of autonomous technologies. They now spend these financial resources on the appearance part rather than the technological part. The humanoid physical appearance of home service robots that does not appeal to the end user stands out as an important challenge that limits the expansion of the robot industry.

It has become critical to comprehend customers' opinions on the physical features of robots. Consumers' attitudes towards robots also vary depending on a robot's height, body size, arm length, eyes, head movements or human-likeness. In this context, this study contributes to the literature by comparing anthropomorphism levels in robots in home and hotel environments.

This research investigation is expected to contribute a larger addition to the literature than comparable research. First of all, there are no studies in the literature examining the effect of the level of robot anthropomorphism in the home environment. In addition, the study offers the opportunity to retest and compare previously examined relationships (the level of anthropomorphism of the robot in the hotel environment).

### *1.3. Research Questions*

By simultaneously testing the effect of level of anthropomorphism in home service robots on perceived ease of use, customer attitude and effect of negative attitudes toward robots on perceived ease of use, three related research questions are also addressed;

**RQ1:** Do anthropomorphism level of home service robots' impact their perceived ease of use?

**RQ2:** Do perceived ease of use of home service robots impact customer attitude towards them?

**RQ3:** Does negative attitudes toward robots' impact perceived ease of use of home service robots?

### *1.4. Structure of Thesis*

This study begins with Chapter 2, where the term robot is explained, the history of its origin is explained, and the value of robots for the coming years is discussed. This section also includes a section where detailed robot classification is made, and this section is supported by existing robot examples. Afterwards, there is a detailed analysis of the service robots' part, which is the main subject of the research, and this is explained under 4 different groups in terms of social relations and environment.

In Chapter 3, anthropomorphism is first defined and then examples from existing studies in the literature are presented. In addition, the characteristics of existing anthropomorphism types are discussed. Then, body manipulators, surface look, facial features and mechanical form, which are important factors in the formation of anthropomorphism within the framework of the robot, are discussed. Finally, the uncanny valley theory is also reviewed within the framework of anthropomorphism discussed throughout this chapter.

In Chapter 4, the internal factors that create positive or negative feelings towards robots are discussed and supported with examples from the literature on this subject.

In Chapter 5, the technology acceptance model on which the study is based is explained in detail, each step that makes up this model is analyzed in detail within the framework of the literature, and what kind of results are seen in which context are discussed.

Chapter 6 includes research model, measurement items, variables, materials, participants and design sections. Additionally, manipulation evaluations of the scenarios are also included in this section.

And in the last part, Chapter 7, the results of the analyzes are discussed and the theoretical contribution of these results to the literature and sectoral management are presented. Additionally, the limitations of this study were discussed and finally suggestions were made for future studies.

# CHAPTER 2: ROBOTIC ECOSYSTEM

The robotic ecosystem is a growing field in the core of today's technology advancements, with significant implications for numerous industries. The robotic ecosystem necessitates a novel multidisciplinary approach that includes automation, artificial intelligence, machine learning, and human-robot interaction. In this section, the current knowledge and research needs in this field are examined, focusing on the basic elements, classification and importance of the robotic ecosystem.

## *2.1. Robot*

The word robot was used for the first time in 1920 in the theater play "Rossum's Universal Robots" (R.U.R.) by the famous Czech writer Karel Čapek. The game deals with the production of human-like machines and their work for humans. Thanks to this game, the foundations of modern robots were laid. In 1937, the concept of artificial neural networks was created as a result of the work of Claude Shannon and Warren McCulloch. These artificial neural networks were used to control the basic functions of robots. In an age where technology is advancing rapidly, the term "robot" no longer appears only in science fiction games or industrial facilities, but is now a part of our daily lives, if not more. When we look at its origin, it comes from the Slavic word "robota", meaning labor or drudgery. To date, more than one diagnosis has been made by certain institutions. According to the Oxford English Dictionary, the term robot is defined as it is a computer-controlled mechanical gadget that has been configured to do primarily repetitive activities. It is properly described as an automated machine capable of performing activities that people do or cannot do (Oxford English Dictionary, 2024). According to the International Federation of Robotics, it is a programmable, manipulative device designed to perform a large number of tasks automatically. They can also perform tasks such as information processing, data analysis, and environmental sensing, as well as the ability to physically mimic humans. Robotic applications are widely available in various forms in today's contemporary living spaces, in many different fields, from residences to the industrial production sector, from the pharmaceutical industry to marketing strategies or the entertainment sector.

By 2025, the impact of disruptive technologies (Artificial Intelligence (AI) and Machine Learning, VR (Virtual Reality) and AR (Augmented Reality), Blockchain Technology, etc.) on the global economy is expected to be in a range between approximately 14 trillion dollars and 33 trillion dollars. It is predicted that the contribution of robot technology to the global economy will reach a value between 1.7 trillion dollars and 4.5 trillion dollars annually by 2025 (McKinsey, 2019).

Three basic features stated by roboticists; Having the ability to constantly automatically perceive their environment, analyze and interpret the data they perceive, and thus have the ability to perform physical or non-physical tasks. These capabilities support robots' ability to successfully perform various tasks and take them to the peak of autonomy (Wildhaber, 2016). These key features expand the capabilities and applicability of robots, allowing them to strengthen their competitive advantage in the robot power market.

### *2.2. Robot Classification*

When we look at the studies conducted to date, each study has classified robots in different categories. A study conducted; It has divided robots into 5 main categories according to their Usage Areas, Power Sources, Abilities, Sectoral Usage and Movement States.

According to their areas of use, robots are designed and used considering specific functions and tasks. This category is divided into two parts: Industrial Robots and Mobile Robots. Industrial robots have reprogrammable, autonomous or semi-independent functions that are used in the manufacturing sector and assist human workers. These robots can successfully perform mechanical and repetitive tasks and precisely manipulate objects with pre-programmed movements. They are widely used for purposes such as increasing efficiency in manufacturing processes, automating repetitive tasks and ensuring occupational safety. Mobile robots can be controlled by remote control or satellite-based guidance, and they have the ability to act autonomously thanks to the artificial intelligence algorithms they contain. These types of robots' access information about their environment, usually through cameras and various sensors, and have the capacity to understand the objects, obstacles and road conditions in their environment by processing this information. Mobile robots are divided into 6 categories: Humanoid, Multiple, Swarm, Micro-nano, Bio-inspired and Collaborative robots. Humanoid robots are robots designed for professional service purposes and are characterized by the ability to imitate human movements and interactions (Wang et al., 2010). The main purpose of multi-robot systems is to ensure that more than one robot with certain hardware and features cooperates and performs a certain task successfully. These systems have the capacity to perform complex tasks partially or fully autonomously and with a coordinated teamwork approach, thanks to the robots' ability to communicate with each other (Birk and Carpin, 2006). Swarm robots are robot systems in which many robots with similar and simple functions work collaboratively, instead of a single unified robot (Dorigo and Birattari, 2007). Micro-nano robots refer to robots that can perform precise operations on a micro-scale, including macro-scale robots as well as micro-scale robots. Bio-inspired robots are robots that mimic the physical properties and movement abilities of biological organisms. These robots design the natural features and mechanisms of living things with inspiration from nature; Therefore, it borrows and reconstructs external appearances, sensors, mechanical components and autonomous movement abilities from natural creatures. Collaborative robots are robots that can interact with humans in the same workspace and perform this interaction safely (Kousar et al., 2020). However, such robots form part of technological developments aimed at creating highly integrated workspaces, which form the basis of the Industry 4.0 paradigm.

Robots need power sources, namely motors, to perform physical tasks and move. Robots are divided into 3 categories according to their power sources; Servo Stepper Motor, Pneumatic and Hydraulic. Servo Stepper motors are designed to control parameters such as speed or mechanical angle by driver circuits (Kameron,2018). They also contain control circuits and motor driver. Pneumatic motors are a type of motor that can provide high torque at low speeds and is resistant to sudden loads. Pneumatic motors may exhibit behaviors such as slowing down or stopping completely in case of overload. These types of robots are often the preferred option for systems where high-speed cycles and precise control are needed (Lee et al., 2005). Hydraulic motors refer to a mechanism that can produce large torques in small volumes. In addition, these motors have features that can easily change the direction of rotation and adjust the speed continuously while in motion.

The basis of robot technology is based on motion applications, and these applications are basically divided into two main categories: Stationary and Mobile robots. Stationary robots are defined as robots that continuously perform repetitive tasks without changing their positions. Such robots are typically located in a fixed location and perform their functions in a single location (Tan et al., 2019). The name stationary robots come from the fact that they have a base that does not move. However, in some cases, these robots may have certain components, such as a moving head or arm. Mobile robots, on the other hand, are types of robots that generally require complex control systems and many sensors to perform desired tasks due to their free movement capabilities. There are various types such as wheeled, crawler, legged, winged, floating, snake-like and elastic. These robots can be autonomous (self-propelled) or guided by computer-assisted control.

Robots are complex machines with the ability to perceive, learn, plan and act to interact with their environment. Therefore, they are developed as systems equipped with numerous features and capabilities. In recent years, while efforts to increase the physical abilities of robots have continued, studies have also been carried out on reducing their energy consumption. Robots can generally be divided into five main categories according to their abilities: Sequential Control, Playback, Controlled Trajectory, Feedback and Intelligent Robots. Sequentially controlled robots are robots in which details such as the order of the tasks they will perform and the completion time of each stage are determined in advance. The sequence and duration of work-related steps are clearly defined in advance. Playback robots, as the name suggests, have the ability to repeat a taught task at certain intervals. These robots can save learned tasks to repeat later and perform these tasks at regular intervals as programmed (Huang et al., 2016). In robots that perform controlled trajectory tracking, the robot's movement path is predetermined only between certain coordinates. These robots move by following a trajectory between specified coordinates and thus can follow a specific route. Feedback robots are considered robots that are actually capable of self-training. These robots analyze the difficulties or obstacles they encounter while performing a given task, first try to solve these problems and then develop alternative methods. This process enables robots to cope with such challenges by improving their own abilities when they encounter obstacles. Intelligent robots are, as a basic principle, robots that contain high-level artificial intelligence capabilities (Dautenhahn,2007). These intelligent robots can create and execute an execution plan based on the commands given by the human handler and the recognition results. They can also adjust their rules of behavior appropriately under changing environmental conditions. Such corrections involve self-learning and adaptation mechanisms to maintain their original functioning.

Finally, robots are categorized based on the sector they use. It is divided into 7 categories: Industrial, Medical and Health, Defense Industry, Agricultural Industry, Education, Service and Other robots. Industrial robots are robots specifically designed to automate repetitive or challenging processes. They are widely used in the production and manufacturing sectors to speed up business processes and increase efficiency (Li et al., 2021). For example, there are many different examples such as robots in automatic production lines, robots used in product packaging processes, or robots performing product assembly and assembly operations. The main goal in the use of robots in the field of medicine and health is to increase precision in order to minimize human-caused errors. Medical and health robots have the ability to move certain robotic components under the control of doctors in areas that require intervention, and they are designed to perform the necessary medical interventions using different manipulators (Kenngott et al., 2012). Since the defense industry is one of the sectors with high risk levels, the use of robots in this field is of extremely critical importance. Defense industry robots have the capacity to perform certain tasks instead of humans in hazardous conditions or risky tasks. In this context, swarm drones, weapon-equipped robots and military robots are some of the examples of such applications. Robots used in the agricultural industry are designed to perform different functions such as planting, harvesting and product separation. They also provide support to the agricultural industry in surveys and data collection, offering the ability to collect more in-depth information on each crop, potentially increasing productivity and reducing input costs (Vougioukas,2019). In this context, examples of agricultural robots include robotic harvesters, weeding robots, and fruit-picking robots. Robots used in the education and entertainment industry are used for multiple purposes, especially as assistant instructors, teaching materials or peer tutors used in various educational contexts such as the teaching of science, technology, engineering and mathematics (STEM) fields, the education of children with mental disabilities and autism, and foreign language teaching (Belpaeme et al., 2018). In addition, robots in this sector are also used for hobby purposes or as toys and also find a place in entertainment-oriented applications. Service Industry Robots are defined as robots designed to assist humans with different tasks and provide specific services. These robots are used in different applications, such as robots that can take orders and perform service operations in restaurants, robots that can provide room service in hotels, or robots that can serve food to passengers on airplanes. Finally, special purpose robots such as rescue robots, firefighting robots and underwater robots that do not fall into these six categories are included in other robot categories.

### *2.3. Service Robots*

The ability of robots to establish social interaction in service processes causes service robots to attract more attention (Paluch et al., 2020). The International Organization for Standardization (ISO) specifies "service robot" in academic terms as "an automated system that performs tasks useful to humans or equipment, in the context of individual or professional use." Service robots function under the guidance of artificial intelligence, which can operate completely autonomously, without requiring special instructions or human intervention (Wirtz et al., 2018). Service robots are considered social robots with characteristics similar to human intelligence with their ability to perform complex actions and adapt, and as a result, many industries are undergoing a shift in which spontaneous service methods are gaining prominence while conventional human employee positions in the service sector are being reduced. The necessity of limiting contact, especially caused by the Covid-19 pandemic, has led to a faster adoption of service robots (Huang and Rust, 2018). Service robots can be classified as for personal or professional use and have many different morphological and structural features as well as various application areas (Zielinski, 2010). The main factors contributing to of the rise in the usage of service robots in the professional and personal service sectors include the need to reduce high labor costs and efforts to increase work efficiency and service quality. Service robots are used in a wide variety of applications to perform different tasks in various service sectors. It is classified according to social status and professional or personal use:

### 2.3.1. Professional Non-Social Service Robots

Robots that provide professional services, excluding social interaction, have been developed to provide services to individuals or organizations. These robots are designed to perform specific tasks that generally this mechanism is distinguished by a shortage of personal touch amongst employees and clients, as well as a dynamic that does not entail individually interaction between staff and customers (Luk et al., 2005). These robots can operate both indoors and outdoors and can be customized to suit specific environmental requirements (Read, 2017). Robots included in this category are specifically designed to meet the cleaning needs of different types of buildings (Kuo et al., 2017). They have been developed to perform a variety of facade cleaning tasks, such as a robot used to clean the vaulted glass hall at the Leipzig Trade Fair in Germany. The barista robot that makes coffee and then washes dishes in Karaca stores in Turkey. Similarly, robots with up-down and left-right movement capabilities for cleaning the exterior walls of tall buildings such as the National Grand Theater of China can also be included in this category (Colby et al., 2016). These robots have also been developed for specific professional tasks, such as carrying documents in an office environment or used in surgeries and rehabilitation centers in hospitals. By excluding social interaction, these robots play an important role in increasing work efficiency, automating routine tasks and ensuring the safety of human workers.

### 2.3.2. Professional Social Service Robots

Professional social service robots respond quickly to needs by providing customized and interactive services to employees and customers (Share and Pender, 2018). These robots are designed to increase customer satisfaction, improve business processes and provide personalized experiences. As an example, the autonomous service robot called "LoweBot" can be given by Lowe's in San Francisco, which operates in the retail industry. LoweBot acts as a robot that can answer store customers' questions, guide customers and help them find the products they want in the store (Chuah et al., 2021). As an example from Turkey, the service robot called "Marbot" used to provide fast service in a pharmacy in Yalova is also included in this category. Marbot performs tasks such as greeting pharmacy customers and providing information about patients' conditions and medications. Additionally, professional social service robots are also used in the hotel industry. For example, the robot named "Churi-Chan" at the Henn-na Hotel can perform functions such as turning on and off the lights in the rooms by responding to hotel customers' commands (Kikuchi, 2018). It can also alert you when it detects you're snoring loudly to avoid disturbing other guests. These types of robots are used to improve customer experience, provide fast and personalized services, and empower employees to focus on more strategic tasks (Chen et al., 2020). In this way, businesses can increase their competitiveness and strengthen customer loyalty.

### *2.3.3. Domestic Non-Social Service Robots*

Non-Social Domestic Service Robots are a type of robot that does duties in the house but does not engage in interpersonal interactions, often giving practical support to homeowners in their everyday lives, engaging on a range of chores within the home, and assisting users in making better use of their time (Rossi et al., 2020). Numerous robots, such as robot vacuum cleaners, hot meal preparers, lawn mowers, hot drink makers, air cleaners, helper robots, and toys that aid the elderly and disabled (Villaronga, 2018), strive to maximize everyday life by doing household activities (Whelan et al., 2018). As an instance, the Mint company has created a robot that cannot just sweep floors but also clean using washable or disposable cloths. Care-o-bot, created by Fraunhofer Institute researchers, is a robotic assistant system meant to give practical assistance to people living at home in their everyday life (Graf et al., 2004). The primary functionalities of Care-o-bot involve capabilities to make home life simpler, such as arranging desks, watering plants, and regulating lighting. In a similar manner the Hug robot features a warm and soft surface as well as sensors that can engage with physical contact. Its characteristics seek to encourage nonverbal communication between older persons and family members, particularly activities such as embracing and snuggling (Foster, 2018).

### *2.3.4. Domestic Social Service Robots*

Domestic social service robots are robots that can engage with users and are often designed to give services to populations in need of social assistance, such as the elderly, the disabled, or persons who live alone. The distinction between these robots and non-social domestic robots is that they can reply orally to requests from humans and act on them using an artificial intelligence system (Graaf et al., 2019). These robots like as Jibo was created in 2014 and is one of the earliest domestic social robots designed for individual users. This robot is a family robot meant to live in homes of individuals, form social bonds, and function as a personal helper (Rane et al., 2014). Pearl, a mobile autonomous robot created by Carnegie Mellon University, is specifically designed to assist older people in their everyday living activities at home and to enhance their health management (Pollack et al., 2002). This robot has the capability of supporting users with the process of taking drugs, reminding them of health appointments, and enhancing their mobility around the home. In the same vein, small robots such as Dinsow are capable of effectively completing a number of jobs such as reminding users when to take prescriptions, providing personal assistant responsibilities, checking skill, exercise assistance, and managing conversations (Hung et al., 2019). Paro, a little seal-like social robot from Japan, is designed as both a practical aid and a social companion. These robots, which are specifically intended for people with restricted access and dementia sufferers, aim to give social support in addition to practical help (Pfadenhauer and Dukat, 2015). Paro may identify noises in its surroundings using sound sensors and distinguish certain phrases such as names, greetings, and compliments; in this manner, it can respond to the user's emotional needs (Aminuddin et al., 2016).

# CHAPTER 3: THE PSYCHOLOGICAL THRESHOLD OF ANTHROPOMORPHISM, UNCANNY VALLEY THEORY AND NEGATIVE ATTITUDES TOWARDS IN THE CONTEXT OF SERVICE ROBOT DESIGN

Service robots play an essential role in today's society due to their capacity to connect with people. Nevertheless, as technology progresses, it is critical to concentrate on individual's physiological and physical reactions to robots. Furthermore, the psychological constraints of anthropomorphism, Uncanny Valley, and negative attitudes become crucial variables in service robot design. In this context, Uncanny Valley theory and delving deeper into human-robot interaction help us understand the challenges faced in the design of service robots. In this part of the study, the effects of robots' anthropomorphism levels and people's negative attitudes on perceived ease of use were examined.

## *3.1. Anthropomorphism*

Anthropomorphism consists of the combination of the Greek words “anthros” meaning human and “morphos” form. Anthropomorphism is literally defined as "personification of abstract objects or animals, attributing human characteristics to non-human beings" (Merriam-Webster). It seems that anthropomorphism has been defined in many different ways. While some researchers argue that anthropomorphism is the attribution of human or human-like features to animals (Asquith, 1984; Brown, 2010; Daston & Mitman, 2005), others have emphasized that these features mean attributing these features to objects (Kassarjian, 1978). Others have defined anthropomorphism as the attribution of human characteristics to non-human beings by placing it in a more general framework (Kiesler, 2006; Schiffman and Kanuk, 2009).

Anthropomorphism displays its characteristics in four distinct manners in the role of general (DiSalvo et al., 2005):

*Structural Anthropomorphic Form:* An anthropomorphic form of structure is a concept in which an object or system is designed to resemble or function like the human body. This can be achieved through the utilization of forms, amount, and mechanics or assemblies that replicate the form or workings pertaining to the structure of human beings parts or systems. The aim of creating such forms is to allow for easier and more intuitive interactions between humans and technology or other objects, as well as to facilitate better understanding and analysis of human movement and behavior. The presence of a structural anthropomorphic form can provide valuable insights into the design principles and intentions behind an object or system, as well as its intended use and user experience.

*Gesture-Based Anthropomorphic Form:* Anthropomorphic shape that uses gestures refers to the replication of human body language and behavior in the design of objects or systems. This approach places emphasis on imitating the how individuals have conversations with one another through their bodies, with unique attention is given to the actions of individuals. This is achieved through usage of steps and gestures, which are the primary components of conduct among individuals, to convey meaning, intention or direction. An illustration of gesture-based human-like shape can be seen in the design of interfaces or control systems that incorporate hand gestures or body movements as input methods, allowing for more intuitive and natural interactions between humans and technology. The use of gesture-based anthropomorphic form can enhance the overall user experience and create a greater sense of familiarity and ease of use.

*Character-Based Anthropomorphic Form:* Character-centered anthropomorphic morphology is a design process technique that seeks to mimic people's character aspects, positions in society, and duties in things or systems. This design paradigm seeks to imbue items with a distinct personality and social identity while retaining human-like characteristics. It is hoped that by doing so, people will form an emotional link and have a pleasant engagement experience. This approach is concerned with creating a non-animate item mirror the features and practices that indicate who individuals are. The effectiveness of character-based anthropomorphic form is demonstrated by the ability of designed objects or systems to accurately convey human-like qualities, such as emotions, attitudes, and behaviors, through their appearance, functionality, or interactions. An example of character-based anthropomorphic form can be seen in the design of virtual assistants or chatbots that are programmed to display a range of human-like characteristics, such as empathy, humor, or intelligence, in order to create a more engaging and relatable user experience. The use of character-based anthropomorphic form can help to humanize technology and create a stronger connection between humans and designed objects or systems.

*Awareness-Based Anthropomorphic Form:* Awareness-based anthropomorphic form is a design approach that involves replicating human thinking and questioning abilities in objects or systems. The fundamental principle behind this form is to imbue objects or systems with a level of awareness that allows them to interact with their environment in a manner similar to human beings. The use of robotics and artificial intelligence (AI) applications today provides examples of awareness-based anthropomorphic form. These technologies are designed to perceive, reason, and make decisions in ways that resemble brain functions in humans, like that learning, memory, as well as identifying and solving issues. An example of awareness-based anthropomorphic form can be seen in the design of self-driving cars that use sensors, cameras, and algorithms to perceive their surroundings, analyze traffic patterns, and make decisions about navigation and safety. The use of awareness-based anthropomorphic form has the potential to create more intelligent and responsive objects or systems that can adapt to changing environments and provide more personalized and efficient experiences for their users.

Perceived anthropomorphism level means more commitment and loyalty (Chandler and Schwarz, 2010). It is stated that by increasing perceptual fluency, human interaction with an anthropomorphic product increases the personal value that consumers attribute to the product (Hart et al., 2013). When anthropomorphic traits are added to a product, the chance of consumers connecting with it increases. Thus, consumers create emotional experiences with their presence (Chandler and Schwarz 2010). Thanks to anthropomorphism, strong emotional bonds can be created between the product and the consumer (Cusick, 2009). It is seen that making a product look like a human affects the consumer's feelings and closeness towards these products and positively affects the perceived usefulness of consumers towards these products (Landwehr et al., 2011). As a result of the human proclivity to anthropomorphize things, individuals naturally tend to attribute human characteristics to service robots (Abdi et al., 2022). Because the human similarity of robots is a factor that strengthens the desire to forge emotional ties with robots and emerges as a fundamental driving force of social relations (Murphy et al., 2019). Anthropomorphizing service robots have been found to influence observed satisfaction with service, first-visit motivation, desire to spend money, and enhanced warmth assumptions (Yoganathan et al., 2021). The higher the anthropomorphic level of robots, the stronger social relationships they establish with humans, and therefore consumers want to devote greater consideration to humanoid robots (Belanche et al., 2020). In a study conducted in the field of tourism, it was revealed that the usability and ease of use variables for humanoid robots increase the attitude towards these robots, but have no effect on behavioral intention (Ghazali et al., 2020).

Although using a design with a high level of anthropomorphism in robots facilitates social interaction within robots and humans, in contrast, it also has the potential to cause users to have wrong expectations and emotions. For instance, in literature, the effect of providing personal assistants with anthropomorphic features on consumers' privacy concerns and perceived ease of use was examined. When the perceived anthropomorphism was high, the privacy concerns of the customers were higher, which decreased the perceived ease of use when using personal assistants (Uysal et al., 2020). In another study, it was found that customers perceived the service generated from a person that is friendlier than the service generated from a service robot, thus leading to lower perceived usefulness levels for the service robot (Hu et al., 2021). According to the findings of a research investigation on consumer perception of various kinds of artificial intelligence, consumers are not yet ready to embrace anthropomorphic traits on growing robots. According to the research, when outfitted with human-like traits, artificial intelligence-powered robots can influence customers' opinions about this technology, and there is some resistance in this respect (Ene and Badescu, 2019). In another study, it was observed that the failure of anthropomorphic looking robots creates different levels of dissatisfaction (Fan et al., 2020). In another study, it was expected to determine whether there is a difference in terms of interpersonal warmth and perceived ease of use in the services provided by human personnel with anthropomorphic robots with different degrees of head inclination. It has been observed that customers perceive the anthropomorphic robot with various levels of tilting of the head and human personnel very differently in terms of interpersonal warmth and perceived ease of use (Yu and Ngan, 2019). It has been determined that consumers are willing to use humanoid robots in areas such as kitchens and cleaning, but their perceptions of robots in service processes that require interaction are negative (Zemke et al., 2020).

Equipping service robots with anthropomorphic features allows them to take on different roles, especially in various social service sectors such as restaurants, hotels and airports. In these sectors, a robot's anthropomorphism encourages easier acceptance by humans, trust, greater interaction, and a higher level of tolerance for the robot's errors. However, when this area is a domestic area, such as a home environment, the situation is the opposite. It is becoming difficult for people to accept anthropomorphic robots. The significant negative relationship of level of anthropomorphism of home service robot and perceived ease of use is also supported by other studies in the literature (Zemke et al., 2020; Fan et al., 2020; Ene and Badescu, 2019; Uysal et al., 2020). From this point of view, the H1 that anthropomorphism level of home service robot bears a detrimental impact for perceived ease of use is set up as follows:

**H1: There is a negative relationship between the level of anthropomorphism and perceived ease of use.**

### *3.2. Anthropomorphism Dimensions*

The lack of a widely accepted system that can be used to evaluate similarities between robots and humans has led to existing research often being based on a limited number of robot samples, which has increased uncertainties in the field of research. To eliminate these uncertainties, the Anthropomorphic Robot database was created by academics and students of Brown University. ABOT (Anthropomorphic roBOT) Database is a collection of robots with varying levels of anthropomorphism. This collection provides about 250 prescribed photos of current robots with various anthropomorphic traits. The scoring method between 0 to 100 used to measure each robot's anthropomorphism degree allows for a more comprehensive and quantitative analysis of the human-like qualities of robots. This extensive database is a valuable resource for studying the progress of the notion of anthropomorphism in the creation of robots and cognition. Scoring system indicates how human-like characteristics each robot has. A score of 0 here means that the robot is not humanoid, and a score of 100 indicates that it has highly humanoid features.

Figure 1. The status of 251 human-like robots in the Anthropomorphic Robot (ABOT) Database, ranked from the lowest anthropomorphism level to the highest anthropomorphism level, is presented. (Source: Kim et al.,2022)

Existing studies in the literature have stated that anthropomorphism is examined in a single-dimensional structure through the physical characteristics of robots. However, this anthropomorphic structure can be divided into four separate categories: surface appearance, body manipulators, facial features and mechanical movement dimension. This distinction was made in order to evaluate the human-like appearance and behavior of robots in more detail. This resulting overall score includes four main dimensions of robot appearance characteristics identified by principal component analysis. First, surface features are evaluated in this dimension, and this includes external features such as the robot's skin, gender, hair texture, and eyebrows. Secondly, facial features are evaluated, which includes parts of the face such as the structure of the head, facial expressions, the shape of the eyes and the design of the mouth. Third, the body manipulators size includes the movable body parts of the robot such as legs, arms, torso. Finally, the mechanical movement dimension evaluates the robot's mechanical features and movement capabilities, such as steps or wheels. These four dimensions form a comprehensive evaluation framework used to determine the anthropomorphic degree of each robot. One of the studies on this subject in the literature examined the effect of anthropomorphism levels on environments where robots are preferred. The results obtained from the study show that high anthropomorphic level robots are preferred for social interaction environments where human-robot interaction will be high, and low anthropomorphic level robots are preferred for mechanical and power-requiring environments. In this context, these results show that the external appearance of the robot should be suitable for the environment in which it will be used, and this reveals that the level of anthropomorphism affects its functionality (Goetz et al., 2003). Another study in this field examined in detail the relationship of robots with their duties in the social service sector. The result of the study showed that high-level anthropomorphism robots are preferred in professions where social interaction is important, but the important criterion is that this robot has an easily understandable difference in appearance from humans. Another result of this study showed that robots with a low level of anthropomorphism, that is, robots with a more mechanical appearance, are suitable for use for routine and challenging tasks. In the context of these results, the effect of the appearance of robots on functionality should also be evaluated as perceptual factors (Złotowski et al. 2015). Academic research has also examined in detail the effects of different robot morphologies on human perception abilities and general evaluations. These studies reveal that the physical appearance of robot designs also plays an important role in determining perceived abilities and performance expectations. Theory of Mind is a framework that describes the process by which individuals understand and interpret the mental states of others, namely their thoughts, intentions, and desires. This theory emphasizes that facial features are an important factor in the process of attributing minds to others (Cohen et al., 1997). The same theory applies to robots; A robot with a highly humanoid face can create a human-like mind perception, and monitoring the movements of the robot's eyes provides evidence that the robot has mental perception (Broadbent et al. 2013). A similar study revealed that robots' human-like appearance affects their moral judgment. It was concluded that robots with high levels of anthropomorphism equally share the moral judgments directed at humans, while robots with low levels of anthropomorphism are evaluated differently in humans. Additionally, another study in the literature investigated the relationship between the appearance of robots and the emotions felt by humans, and concluded that the level of emotion varies depending on human similarity levels. While the level of emotion was low at low human similarity, this level decreased at medium level of human similarity. At high human similarity, the emotion level increased to the highest level, but at very high human similarity it decreased again. This situation also confirms the uncanny valley theory. So in short, robots' human likeness tends to trigger more intense negative emotions, especially when they have a human-like surface appearance. The results obtained from studies in the literature show that the physical appearance of robots with different morphologies is an important factor in terms of their social characteristics and acceptance.

### *3.3. Uncanny Valley Theory*

The Uncanny Valley Theory, whose Japanese equivalent is 'bukimi no tani', was put forward by Japanese roboticist Masahiro Mori in 1970. In numerous languages, the term "uncanny" has distinct connotations. While it is used in Latin to denote "an uncanny area" and to depict a difficult late at night, it also means "a foreigner" in Greek and "troubling", "worried", "sad", and "distressing" in English. However, the concept of the uncanny is mainly associated with literature. To put it in more depth, the concept of the uncanny stands out as a literary term in the sense of describing fiction in a way that is close to reality. Equipping imaginary beings with a realistic life, constantly recurring events, extraordinary coincidences, and trance state are among the examples of the concept of the uncanny.

According to this concept, there is a non-linear relationship between robots' human similarity and human perceptions of familiarity with these artificial entities. In other words, human-like robots attract people's attention to a certain extent. Because of this similarity, people can empathize with these robots. However, after the level of reality increases and reaches a certain stage, this empathy can be replaced by negative emotions such as disgust, fear, and hatred. The emergence of these emotions takes place at a stage where the robot's human resemblance to a very high level. However, despite this similarity, robots that do not fully resemble humans continue to be disturbing for humans. According to one explanation proposed within the scope of the Uncanny Valley idea, uneasiness with a "uncanny" robot reflects contextually supported fortifications of the intrinsic dread of mortality and the necessity to cope with the likelihood of death. Aesthetic anomalies in humanoid robots, for example, elicit the intrinsic dread of death in humans by conjuring the notion of sickness, prompting the creation of cultural defensive mechanisms to deal with this anxiety.

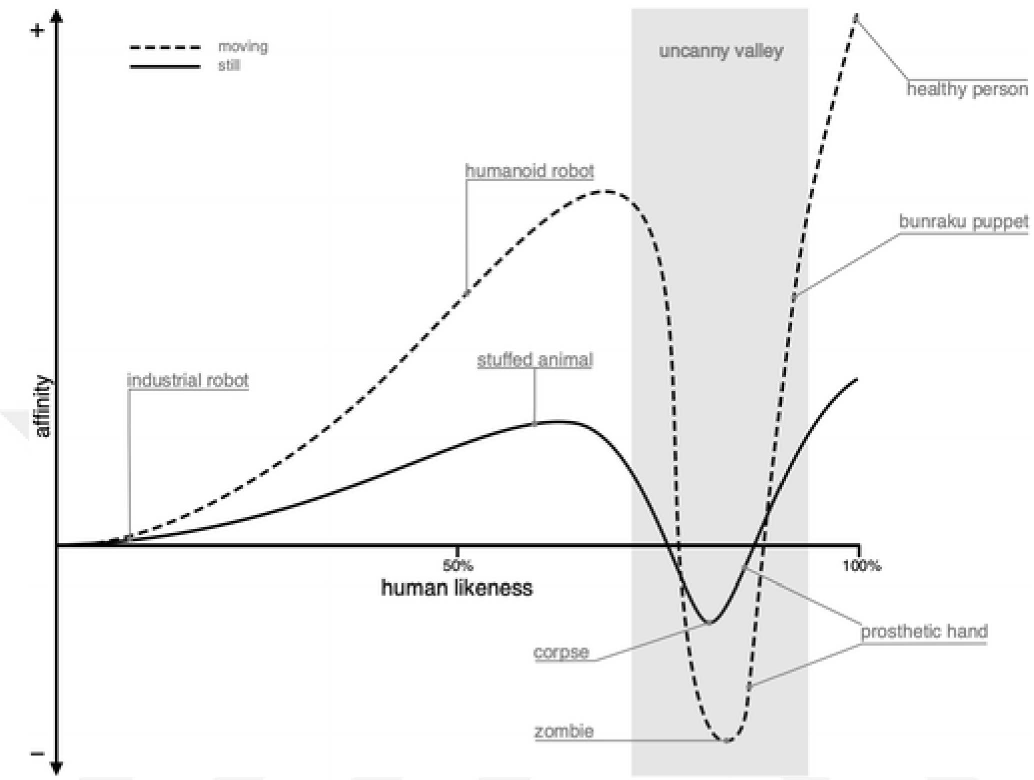


Figure 2. Uncanny Valley Theory (Source: Mara et al., 2020)

In the graphic expressing the Uncanny Valley concept developed by Mori, it is observed that industrial robots are at the starting point. This suggests that human response to robots is at minimal levels of familiarity. The graph indicates that among the static designs, the most attractive ones are toy animals. On the other hand, it is observed that the most striking among animated designs are humanoid robots. It is emphasized that low anthropomorphic virtual characters with humanoid features but a non-humanoid appearance are located on the first hill before reaching the pit. Mori's work generally suggests that across the spectrum of low to moderate visual anthropomorphism, increasing levels of human likeness have a linear relationship with levels of acceptance and liking. In this context, it is expected that the sympathy for a more humanoid robot instead of an industrial robot will strengthen. However, an increasing curve follows along the human similarity continuum; After an initial positive peak is reached, this effect should reverse when a fairly high level of nearly realistic human likeness is achieved. At this stage, the level of acceptance is expected to decrease and the android will evoke a negative feeling of uncanniness, an effect particularly associated with spookiness and disturbingness. However, when this resemblance to humans reaches a perfect level, when these pictures and robots cannot be distinguished from humans, this situation will become attractive and attractive to the person, and even an ordinary person will approach this situation with sympathy (Geller, 2008).

The Uncanny Valley theory has a very controversial aspect and is criticized by some researchers. It is expressed with the argument that factors such as people's closeness to robots, familiarity, and emotional effects are not taken into account sufficiently. Despite these criticisms, considering the lack of empirical evidence that forms the basis of the Uncanny Valley theory, there are also researchers who argue that the acceptance of robots will increase as their human similarity increases (Belanche et al., 2020). In this context, The Uncanny Valley Theory has regained prominence in recent years. The basic cause behind this dilemma is that as technology advances, the possibilities for producing objects or fictional entities human-like expand. Understanding the influence of Uncanny Valley effects on different interactions with service has therefore become a significant problem, particularly in order to enhance acceptance of services provided by service robots.

### *3.4. Negative Attitudes Towards Robots*

Negative Attitude Towards Robots refers to people's negative feelings, attitudes and behaviors towards robots. Negative Attitudes Towards Robots (NARS) targets human-robot interaction, social effects of robots, and related emotions in specific situations that occur, by integrating social attitudes and psychological responses. This provides a broad perspective when evaluating people's attitudes towards robots (Nomura et al., 2006). Although the outcomes of investigations utilizing NARS point to its ability to accurately envision human behavior approaching the robots, which is still controversial, uncertainty on this issue remains. However, NARS remains an important tool for understanding robot depictions of society and impressions, on the side how they are accepted in society. A study in this field in the literature conducted research using the Negative Attitude Towards Robots. Negative attitudes between humans and robots and robot anxiety were evaluated within this framework. The human-robot interaction scenario included elements such as greetings and the bodily interaction involving the person with the robot. The findings demonstrated that unfavorable views and nervousness influence conversation evasion actions in the setting of Human-Robot Interaction (HRI), and this avoidance negatively affects perceived ease of use (Nomura et al., 2006). Studies have indicated that individuals may experience feelings of disgust when encountering robots that exhibit characteristics falling within the 'uncanny valley,' where they possess a high degree of similarity to humans but are not completely identical in appearance (Broadbent, 2017). Rage or dread are examples of negative feelings for robots. (Dekker et al., 2017; Hinks, 2020). Another significant emotion worth mentioning is "intergroup anxiety" (Stephan and Stephan, 1985). It refers to a negative sensation of uncertainty that arises when individuals interact with members of an outgroup. This anxiety stems from not knowing how to behave appropriately, fearing the possibility of insulting an opposing individual as well as coming across as biased. Between-group stress frequently result in outsiders' rejection and encourages awkward and tense encounters among distinct groups. For individuals without specific training, interacting with robots can elicit feelings of anxiety and uncertainty, akin to the experience of interacting with someone from a different racial or ethnic background (Haryanto, 2022; Hong et al., 2023; Nomura et al., 2006). Attitudes are formed based on personal, cultural, or family factors, and they represent individuals' constant and persistent ideas and values towards objects, people, institutions, or subjects. These attitudes have the potential to influence behavior in alignment with the individual's beliefs and values (Chaplin, 1999). The scale employed in study assesses people's attitudes towards robots across three factors: negative attitude towards interacting with robots, negative attitude towards the social effects of robots, and negative attitude towards emotions involved in interacting with robots. A higher score on this scale indicates a greater degree of negative attitude towards robots (Nomura et al., 2006). A study shows that the negative attitudes of consumers flocking to restaurants and bars robots negatively impress their opinions about ease of use. The potential for robots to deliver inefficient or subpar service, resulting in users may resist embracing this sort of technology as a result of unneeded hassles. (Guan et al., 2021). The perceived risk factors related to privacy, financial aspects, time, performance, and psychological concerns have detrimental effects on customers' attitudes, ease of use, and behaviors (Hwang et al., 2021). Another study shows that persons who have an unfavorable mindset regarding robots are not as capable of comprehending robots' movements and work (Riek et al., 2010). Additionally, studies have highlighted that people's perceptions about robots have a relationship to certain prejudices, exemplarity the types and tasks of robots (Nomura et al., 2006). People's unfavorable attitudes regarding robots have varied effects on industrial use as well as social sector robots. Although industrial robots and social service robots have similar mechanisms, people's negative attitudes towards robots do not have an effect on industrial robots, but have a great impact on social service robots. For this reason, negative attitudes towards robots will negatively affect the perceived ease of use both on robots in social environments such as hotels, restaurants, and travel agencies, and on service robots in domestic environments such as the home environment. From this point of view, the H2 that negative attitude towards robots may have a negative effect on the perceived ease of use is set up as follows:

**H2: There is a negative relationship between the negative attitudes towards robots and perceived ease of use.**

### *3.5. Factors Affecting Consumer Behavior*

Consumer behavior can be defined as a human action consisting of multiple movements; These movements form an active whole by creating an effective cycle within the continuity of interaction. Consumers are under the influence of a number of factors throughout their lives. It is accepted that internal and external factors are important factors in shaping consumers' behavior (Novita and Husna, 2020; Toha and Danadyaksa, 2023; Nagarkoti, 2014; Boca, 2021; Dhaliwal, 2020; Mittal, 2013; Ramya and Ali, 2016).

Culture is one of the primary factors affecting consumer behavior (Shavitt and Cho, 2016; Chiu et al., 2014; Galina et al., 2018; Banyte and Matulioniene, 2005; Kire and Rajkumar, 2017). Culture is an integrated system of learned behavioral styles of individuals of societies, and these behavioral styles are distinct characteristics that distinguish individuals of a community from others. The main reason for an individual's behavior is culture, because the individual grows up in a society from childhood and his/her behaviors, attitudes and basic value judgments are shaped by the culture of that society (Clevelond et al., 2015; Soyez, 2012; Kau and Jung, 2004). Looking at the studies in the literature, the Japanese are more familiar with the idea of robots having human characteristics than people living in Western countries. In this context, research shows that although the Japanese like robots less than Americans, they've become much more worried about the societal implications of robots compared to the Chinese, Dutch, or Germans. (Bartneck et al., 2007). Another multi-cultural study of people's attitudes about robots with humanoids found disparities among Japan, Korea, and the United States. It has been revealed that Korean participants think that the possibility of robots playing a more active role in the field of healthcare is acceptable, while American participants think that robots are highly probable to have been utilized in risky professions that humans find challenging to perform. In particular, they stated that the Japanese, compared to other ethnic groups, assume that robots with humanoid bodies are particularly susceptible with sensations, and hence can behave closer to human beings than devices, and that robots may carry out their conversation function at home (Nomura et al., 2008). Japanese people's greater exposure to robots supports the idea that individuals in this culture may be more aware of the existence and acceptance of robots than Western people (Bartneck et al., 2005). This provides an important perspective in terms of understanding how cultural differences can affect perceptions about robotic technology and how societies approach this technology.

Another important factor affecting consumer behavior is age (Yoon and Occeno, 2015; Gajjar, 2013; Qazzafi, 2020; Moschis, 2007). Physical, emotional and social needs change with age, causing individuals to develop age-specific priorities, needs and create new perspectives. Additionally, the needs of each age group are different in their reactions to new technologies. Due to the existence of differences in the tendency to adopt new technologies between generations Y and Z, it has been emphasized in the literature that the role of the age variable in the acceptance of robotic technologies should be examined in detail (Asoba and Mefi, 2022; Calvo-Porral and PesqueiraSanchez, 2020). A study on the impact of effort expectancy and facilitating conditions on behavioral intention revealed that generational differences play a moderating role. Age differences create fundamental differences in perception, especially towards technology. Observations reveal that the younger age group's perception of new technologies is at a more moderate level compared to the older age group (Brown, 1984). Another similar study determined that while younger generations focus on performance expectations, the older age group attaches high importance to facilitating conditions (Khechine et al., 2014). Another study conducted in this field emphasized that the effect of social influence on behavioral intention is decisive, especially for older age groups. It has also shown that new technologies integrated into the tourism system are generally received more positively by the younger generation (Zaremohzzabieh et al., 2014). A similar study shows that generations Y-Z believe at a higher level that humanoid robots will make the restaurant experience easier, compared to Generation X. On the basis of these findings, individuals in Generation X are thought to have a higher risk perception towards adopting a new technology (Lian and Yen, 2014).

Gender identity represents the totality of gender-related emotions that individuals perceive in a way that is sometimes compatible or sometimes incompatible with their biological gender and that they contain in their psychological infrastructure (Dittmar et al., 1995). Findings have been revealed that gender is a critical factor in the purchasing decision process and reactions to new technologies (Palon, 2001; Pirlympou, 2017; Ye et al., 2017; Bakshi, 2012; Ronaghi et al., 2013). In a study conducted in the literature, it was determined that the gender of the user is a determinant of how people react to robots (Taggart et al., 2005). A harp seal robot was used in this research. In particular, it has been observed that men ask more questions about the technical aspects of Paro, while women focus more on its name. In this context, it was revealed that women made more positive evaluations in terms of their desire to interact with Paro and their feeling of comfort. Another similar study found that men have stronger psychological connections between anxiety about robot behavior and negative attitudes about the social impact of robots than women (Nomura et al., 2008).

# CHAPTER 4: THE EFFECT OF ANTHROPOMORPHIS ON KEY VARIABLES IN THE CONTEXT OF THE TECHNOLOGY ACCEPTANCE MODEL

In recent years, the impact of anthropomorphism on key variables in TAM has become a subject of increasing interest. In this context, understanding the impact of anthropomorphism on key variables in TAM is important for a deeper understanding of technology acceptance. In this part of the study, the subheadings of the technology acceptance model were examined in detail and the connection between perceived ease of use and customer attitude was discussed in depth.

## *4.1. Technology Acceptance Model*

The day-to-day development of technology often leads to uncertainty when it is not fully understood by people, and it takes time to adapt to these new technologies. In this context, there are many models and theories to explain the situations in which individuals cannot fully understand or accept innovations. One of the many models produced to articulate the general acceptance of innovation is the Technology Acceptance Model is a framework designed to clear up and forecast the behavior of technology users (Davis,1989). This model, developed and scaled by Davis in 1989, was based on the theory of reasoned action. Davis's model possesses the distinctive characteristic of being the predominant choice in research endeavors investigating the utilization of information systems. TAM also appears in research as a model used to evaluate consumers' use of service robots. The essential objective of the Technology Acceptance Model is to offer a concise structure that thoroughly investigates the complex dynamics affecting how users act within information systems, specifically their proclivity to adopt new technologies (Venkatesh, 2000). This model is methodically designed to reduce excessive complexity by selectively combining a small number of variables, all while assuring theoretical rigor and validation. TAM consists of five factors that measure their relations with each other. These; perceived usefulness, perceived ease of use, customer attitude, behavioral intention, and system use (Davis, 1989). According to this model, perceived ease of use and perceived usefulness affect the behavior of users towards an information system. This behavior drives a person's willingness to use their system, leading them to accept it. It is stated that TAM is one of the most valid models in the use of technology. (McFarland and Hamilton, 2006). Statistical analyzes have been made on the technology acceptance model in various fields and as a result of these, it is understood that the technology acceptance model is a valid and robust model. These studies show that the technology acceptance model is widely used and has future applicable aspects (King and He, 2006).

#### *4.1.1. Perceived Ease of Use*

It displays a person's strong belief that employing a certain technology will deliver a particularly comfortable and trouble-free experience (Venkates, 2003). This essentially reflects a person's ability to perceive how much time and effort they need to spend to use the relevant technology (Thadatritharntip and Vongurai, 2021). PEU provides an important interaction by establishing a direct and effective relationship between CA and PU. This situation enables users to get more efficiency from the use of technology thanks to its ease of use, and the perceived ease of use indirectly affects the purchase intention of the individual (Belkhamza and Wafa, 2009). This became apparent as features such as perceived ease of use, utility, and competence facilitate mobile internet use and have a favorable impact on it (Lee et al., 2002). Examining the behaviors of passengers while purchasing tickets in airline transportation, it was concluded that the PEU procured a favorable impact on the attitude of consumers when purchasing tickets (Guritno and Siringoringo, 2013). One study focused on understanding the meaning of anthropomorphism in service delivery with robots and, in this context, investigated how the anthropomorphism variable affects the PEU. Corresponding to the results obtained in the research, the anthropomorphism variable tends to affect the PEU associated with the robot. However, the study also noted that this effect modifies based on things including the type of robot used and the type of service offered (Blut et al., 2021). In another study, the use of virtual cards was examined within the framework of the TAM and it was concluded that the PEU is an important determinant of the level of consumer attitude according to the data obtained (Kalyoncuoğlu,2018). Similarly, in the research on mobile commerce, it is revealed that PEU possesses a substantial impact on the attitude to use mobile commerce (Wu and Wang, 2005). The significant relationship between PEU and CA is also supported by other studies in the literature (Verkasalo et al., 2010; Chau & Hu, 2001; Legris et al., 2003; Lu et al., 2013; Lee et al., 2002; Nath et al., 2014; Guritno and Siringoringo,2013). From this point of view, the H3 that PEU may have a positive effect on the customer's attitude is set up as follows:

**H3: Perceived ease of use towards robot anthropomorphism has a positive effect on customer attitude.**

### *4.1.2. Perceived Usefulness*

The level of PU is alluded to as of belief a user has in the performance increase that the technology, she/he uses will provide her/him with when performing certain tasks or solving problems (Keller, 2005). According to the TAM, there is a direct relationship between PU and PEU, which are the determining parameters in the technological adoption approach, and this relationship determines technology intention (Yun and Park, 2010). In a study conducted in Korea, it was found that PU positively affects BI regarding the use of artificial intelligence-based smart products (Sohn & Kwon, 2020). Depending on the outcomes of a discipline investigation of tour guidance, it has been determined that augmented reality technology is considered very useful by tourists and the use of this technology in guidance services can increase tourist satisfaction. Concurrently, it became apparent as tourists' intentions to use augmented reality applications in guidance services were high depending on perceived usefulness. Similarly, a study conducted on humanoid robots revealed that PU and PEU variables favorable affected the attitude towards humanoid robots, but did not have any effect on BI (Ghazali et al., 2020). In research conducted in Turkey, it was found that PU favorably influences tourists' online purchasing attitudes (Çetinsöz, 2015). In another study, the effect of perceived usefulness on the adoption of internet banking was examined and it was emphasized that it had positive effects on the intention to use (Rawal et al., 2021). With another associated research, some variables influencing the acceptance for QR code use in shopping were investigated along with the outcomes revealed that the perceived usefulness of the QR code application had an influence regarding an application's desire to utilize (Eyüboğlu and Sevim, 2016). In another example, in a study conducted on a country basis in China, the parameters influencing user approval of Alipay, a payment system, were investigated along with the outcomes revealed that PU and PEU had a favorable effect on users' intention and attitude to use Alipay (Li et al., 2019). This strong attachment has also been supported by other studies in the literature (Yaghoubi and Bahmani, 2010; Lule et al., 2012; Ghazizadeh et al., 2012; Rawal et al., 2021; Son et al., 2012; Chitungo and Munongo, 2013; Wallace and Sheetz, 2014)

#### *4.1.3. Customer Attitude*

Attitude refers to the cognitive and emotional approach an individual displays towards a behavior based on the knowledge and experiences he/she has (Bagozzi and Burnkrant, 1985; McGuire, 1985). Attitude is not an innate instinct of the individual, but a learned tendency. This tendency is affected by factors such as experiences, family structure, belief system, environmental factors and social-psychological dynamics. This impulse, which can change over time, shapes the individual's attitude towards objects, people or events (Çakar, 2018). In the Technology Acceptance Model, customer attitude refers to users' beliefs about the possible consequences of using a particular technology or device and their evaluations of these consequences (Park and Pobil, 2013). Perceived ease of use and perceived usefulness are considered crucial elements within the technology acceptance process, affecting users' attitudes and behaviors (Davis, 1989). Customer Attitude performs a critical position in figuring out an intention and actual behavior towards a particular behavior. It affects the favorable or unfavorable traits to people decision to perform the behavior and at the same time creates a general framework for the presence or absence of the intention to perform the behavior. In short, attitude creates the motivation of a person is to execute through his action and subsequently affects the behavior itself (Eroğlu, 2019). In a study conducted in the field of social sciences, it was found that existing attitudes are a prerequisite for individuals to engage in certain behaviors (Fishbein and Azjen, 1975). There are numerous research that may be found in the published works detailing the relationships between perceived ease of use, perceived usefulness and customer attitude, in addition to within customer attitude and intention to use. In a study on computer use, it was determined that perceived usefulness has become an essential factor which influences the utilization with a computer and the intention to use it (Ma et al., 2005). A study examining the behavior of students who are undergraduates enrolled attend Hong

Kong Institute of Education towards online courses reveals that attitudes based on perceived usefulness and perceived ease provide a favorable impact for students' behavioral intentions towards online courses (Shroff et al., 2011).

#### *4.1.4. Behavioral Intention*

Intention is the measure of a person's effort and desire to carry out a certain behavior. According to the TAM, BI represents the stage immediately preceding behavior, and this intention tends to directly influence behavior. Within the framework of the TAM, the main determinant of individuals' embracement and use of technologies is behavioral intention, and the factor that is effective in the formation of this intention represents the person's favorable or unfavorable perspective attitude towards the use of technology. While behavioral intention establishes an indirect relationship between attitude and actual behavior, it is located in a context where it is directly affected by perceived usefulness and attitude (Bayraktar, 2019). Numerous research findings have been published in the field of research explaining this connection. As an instance, consider research on consumers' intention to use white goods with Internet of Things (IoT) technology was evaluated within the framework of the TAM. With a consequence from the investigation, it has been observed that consumers' intentions to use smart white goods are most affected by consumer attitude. Additionally, the analyzes pointed to a result in which the interaction within PU and moreover PEU was low. Depending on these findings, consumers think that using smart products will enhance their standard of living, make their lives easier and save them time. However, the fact that Internet of Things technologies have not yet been widely adopted causes consumers to exhibit a hesitant attitude due to concerns that the use of these technologies will be complicated. Another study in the literature examined consumers' acceptance processes for new technologies and evaluated consumers' intentions to use mobile payment technologies. The study's findings indicate a favorable association involving perceived usefulness along with intention to utilize. However, no direct effect was observed among with PEU as well as the purpose to utilize. However, it was concluded that PEU had a flat-out impact on PU (Türker, 2019). In investigations accomplished in the interest of comprehend the use of tools such as online education platforms, online shopping platforms, mobile phones, computers and robots, it has been emphasized that PEU and PU have a favorable and significant influence on the desire of using (Ghazizadeh et al., 2012; Chau & Hu, 2002; Wallace and Sheetz, 2014; Moon & Kim, 2001). A study on the use of home health robots also emphasizes that PU and PEU favorably influence individuals' intentions to use (Thadatritharntip and Vongurai, 2021). Other studies conducted in the service industry have stated that consumers' personal attitudes towards service robots such as robot chefs and robot waiters influence the desire to utilize robots for service (Park and Pobil, 2013; Legris et al.,2003; Cha, 2020; Hwang et al., 2021; Song et al., 2022).

#### *4.1.5. Actual Use*

While making future behavioral decisions, the individual makes a general evaluation by referring to his attitudes based on his previous knowledge and experiences, and develops an intention for behavior in line with this evaluation. The individual's behavior is directed depending on his/her motivation and intention to perform a certain action. The actual behavior, in short, the frequency and intensity of the individual's use of technology is an important factor that indicates the individual's level of interaction with these technologies (Çivici and Kale, 2007). To give an example within the framework of the literature, in a study examining the attitudes and behaviors of university students regarding social media use, it was found that PU and PEU positively affected the attitude towards the behavior; It was concluded that this attitude positively affects the intention towards the behavior and the subsequent behavior (Arı, 2016). A meta-analytic study found that an individual's intentions play an important role in predicting their behavior, using data from 90 previous studies in the context of the use of e-government systems (Hooda et al., 2022). Another example in the literature is a study examining consumers' implement digital cards to improve the security of payments via the internet within the framework of the TAM, revealing that the consumer's PU, PEU, attitude and behavioral intention levels have significant determining effects in terms of actual behavior (Kalyoncuoğlu, 2018).

# CHAPTER 5: RESEARCH METHODOLOGY AND FINDINGS

The methodology for the research constitutes an essential component of the research process and is critical to ensuring the reliability and validity of the findings. In these circumstances, this section of the study provides a detailed explanation of the research approach, data collection and analysis methodologies, and the research model applied. This section also discusses crucial information such as participant profiles and manipulation tests, as well as presenting a framework that emphasizes the research's methodological quality.

## *5.1. Research Design*

Experimental design is a method applied to create a context in which a hypothesis can be proven true or false (Bell,2009). The main reason why experimental design is commonly utilized in many different kinds of disciplines, especially in fields for instance psychology, education, behavioral economics and marketing, is due to its ability to minimize external effects. Experiments are one of the most general research methods that aim to systematically determine the causal effect of an independent variable on another dependent variable. Experiments are a method used to robustly determine cause-effect relationships (Dolnicar and Ring, 2014). Additionally, unlike survey studies, experiments have the potential to go beyond randomness and cross-sectional data and overcome limitations such as results being based solely on participants' self-reports. With these features, they stand out as extremely useful tools in subjects such as experiments, theory testing and comparison of relationships between variables in different environments. One of the main characteristics that distinguishes experimental design from other research methods is random assignment (Doğan, 2019). The assigning of individuals to testing circumstances by chance is referred to as random assignment, in other words, where the probability of participants being selected for any of the experimental conditions is equal. In this way, the participants included in the control group and the experimental group will have similar qualities in many aspects. The main purpose of random assignment is to systematically eliminate potential systematic differences or error elements other than planned differences between experimental conditions (Field and Hole, 2003). This is intended to ensure accurate interpretation of experimental results and reliable assessment of cause-effect relationships. In accordance with the principle of random assignment, the only possible difference that may occur as a result of the comparison between two conditions will be the effect of the manipulation applied to the experimental group (Keppel and Wickens, 2004).

A 2(home and hotel) x 2(level of anthropomorphism high, level of anthropomorphism low) experimental design quantitative method used in this study. The 2x2 study calls for volunteers to be coincidental allocated to one of four scenarios (information on the scenarios may be found in the Appendix). Responded data collected via Google Forms. The evaluation utilizes a 5-point Likert Scale, with responses ranging from 1 to 5, with 1 indicating strongly disagree and 5 indicating strongly agree, was used as a data collection tool. Benefits of applying experimental designs provide researchers with a structured methodology for conducting rigorous investigations (Trochim and Donnelly, 2008) or facilitates the identification of cause-and-effect relationships, providing a robust foundation for theory development and practical applications (Kerlinger and Lee, 2000). Convenience sampling used to accelerate the research. The convenience sampling approach alludes to a sampling technique in which the investigators choose respondents freely within a pool of people who are easily accessible and appropriate in the study's purpose. The focus of the research covers a wide age group from 18 to 65 and above. The main purpose of choosing this age group is to collect a wide range of data, covering the opinions and attitudes of both current and future potential customers. Additionally, people from every income group and every education level were included in this research. This approach increased the diversity of the data collected and allowed to reflect the opinions of participants from different socioeconomic backgrounds. Examining the attitudes of individuals with different income levels and education levels plays an important role in understanding the diversity of marketing strategies and product designs for humanoid home robots. It is also a method that accelerates research (Gravetter & Forzano, 2012). In order for the survey not to lose its credibility and it is aimed to have at least 400 usable questionnaires.

Variables, sources and related measurement items are shown in Table1.

Table 1. Details of Measurement Items

| VARIABLE | SOURCE | CRONBACH'S ALFA | MESAUREMENT ITEMS |
|---|---|---|---|
| Perceived Ease of Use | Gürbüz and Şahin, 2017 | 0.895 | • Robot ile kurulan iletişim açık ve anlaşılırdır.<br>• Robotu kullanmanın kolay olduğunu düşünüyorum<br>• Robot ile iletişim kurmak çok fazla çaba gerektirmez.<br>• İstediğim şeyi robot ile yapmayı kolay buluyorum. |
| Customer Attitude | Gürbüz and Şahin, 2017 | 0.934 | • Robotu kullanmanın iyi bir fikir olduğunu düşünüyorum.<br>• Robotu kullanmanın zevkli olduğunu düşünüyorum.<br>• Robotun kullanılmasını cazip buluyorum. |
| Negative Attitudes Towards Robots | Nomura and Kanda, 2003 | 0.786 | • Robotların gerçekten duyguları olsaydı huzursuz olurdum.<br>• Eğer robotlar canlı varlıklara dönüşürse, kötü şeyler olabilir.<br>• Robotlarla konuşurken kendimi Rahat hissederdim.<br>• Bana robotların kullanıldığı bir iş verilseydi kendimi huzursuz hissederdim.<br>• Robotların hisleri olsaydı, onlarla arkadaş olabilirdim.<br>• Duyguları olan robotlarla birlikte olmak bana kendimi Rahat hissettirirdi.<br>• "Robot" kelimesi benim için hiçbir şey ifade etmiyor.<br>• Diğer insanların önünde bir robot kullanıyor olsam gergin hissederdim.<br>• Robotların ya da yapay zekaların bir şeyler hakkında yargıda bulunması fikrinden nefret ederdim.<br>• Sadece bir robotun karşısında durmak bile çok sinir bozucu hissettirirdi.<br>• Robotlara çok fazla güvenirsem kötü bir şey olabileceğini hissediyorum.<br>• Bir robotla konuşsam kendimi paranoyak hissederdim.<br>• Robotların çocuklar üzerinde kötü bir etkiye sahip olacağından endişeliyim.<br>• Gelecekte topluma robotların hâkim olacağını hissediyorum. |

Cronbach alpha values were used to evaluate the accuracy of the scale's items. Cronbach's alpha coefficient is a more objective metric than other reliability assessment techniques since it requires less subjective viewpoints. The coefficient is projected to be near 1 to indicate that the items have a high level of internal consistency (Tavşancıl,2005). 0.7 is the lowest allowed coefficient value. In this case, when we look at the cronbach alpha coefficient values of the scale used, the Negative Attitudes Towards Robots scale has a cronbach alpha value of 0.786 at an acceptable level, the Perceived Ease of Use scale has a cronbach alpha value of 0.895 at a good level, and finally the Customer Attitude scale with a cronbach alpha value of 0.934 is considered at an excellent level. Thus, it is possible to conclude that all scale components have a reliable measurement level.

### *5.2. Model of the Research*

The model to be tested in the study within the framework of all the hypotheses expressed can be seen in Figure 3.

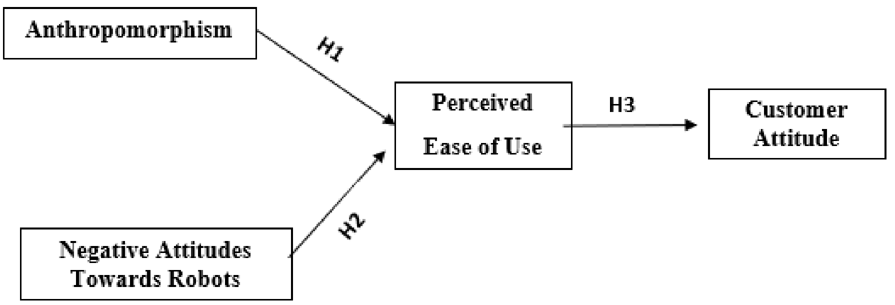


Figure 3. Research Model

According to this research model, the hypotheses of this thesis are as follows;

**H1: There is a negative relationship between the level of anthropomorphism and perceived ease of use.**

**H2: There is a negative relationship between the negative attitudes towards robots and perceived ease of use.**

**H3: Perceived ease of use towards robot anthropomorphism has a positive effect on customer attitude.**

### *5.2.1. Variables*

The dependent variables of this study are; Perceived Ease of Use, Customer Attitude and Negative Attitudes Towards Robots. The independent variable of this study is; Anthropomorphism.

Anthropomorphism has been the practice of assigning traits comparable to human beings or psychological states on not human beings' and objects, whether real or hypothetical (Epley et al., 2007). Perceived Ease of Use; learning the use of a certain technology without much effort, being easy to use (Davis, 1989). Perceived ease of use has a direct and strong effect on attitude and perceived usefulness (Davis, 1989). Customer Attitude; It is the tendency to react positively or negatively (Ma et al., 2005). The correlation underlying attitude and intention positively affects system use behavior (Davis, 1989). Within the framework of the Technology Acceptance Model, perceived usefulness, behavioral intention and actual use sections were not included in this study. Perceived usefulness is a conceptualization which arose as the consequence from the physical interaction between robot and human. In other words, in order to use the perceived usefulness scale, participants must be in contact with robots in a physical environment. However, since this situation is not likely to occur within the framework of this study, the perceived usefulness scale was not included in this study. The other scale not included is behavioral intention. An individual's effort to perform a particular behavior is often a reflection of his or her behavioral intention to perform that behavior. In the Technology Acceptance Model, perceived usefulness has an impact on behavioral intention, and for this reason, perceived usefulness must be measured in order to measure behavioral intention (Davis, 1989). In this study, the behavioral intention scale was not indirectly included because perceived usefulness was not included in the research. And finally, actual use on the other not included scale. It is emphasized that behavioral intention is the determinant of actual usage behavior. That is, an individual's intention to use a technology is considered a key determinant of actual behavior. Studies reveal that individuals' behavioral intentions to use a technology are a determining factor in shaping usage behaviors that occur consistently in different contexts and time periods (Cheung and Vogel, 2013; Lee and Lohte, 2013). In this context, the actual usage scale was not included in this study because the behavioral intention scale was not indirectly included. Negative Attitudes Towards Robots; refer to the negative emotions, perceptions, and beliefs that individuals may hold towards robots. This can include feelings of distrust, fear, and discomfort towards robots, as well as negative stereotypes and beliefs about their capabilities and limitations (Eyssel et al., 2012).

### *5.3. Robot Design*

The robots to be used in this study were selected from the ABOT (Anthropomorphic roBOT) database. This database was used because it contains the most types of robots, from the most mechanical robots to robots with highly humanoid features. Each of the 251 robots in this database has its own overall score. Each of these general score points consists of facial feature, body manipulators and surface look points that the robot has. The first of the robots selected for the study is the robot named Mahru, produced by the Korean Institute of Science and Technology. When we look at the dimension scores of this robot, Facial Feature is 0.714 points, Body Manipulators is 0.879 points and finally Surface Look is 0.124 points. Within the framework of these dimension scores, the overall score of the Mahru robot is 47.65. The second of the selected robots is the robot named Nadine, produced by the University of Geneva. When we look at the dimension scores of this robot, Facial Feature is 1.00 points, Body Manipulators is 0.99 points and finally Surface Look is 0.99 points. Within the framework of these dimension scores, the overall score of the Nadine robot is 96.95.


Figure 4. Anthropomorphism dimensions of Nadine which robot with high anthropomorphism level (Source: ABOT (Anthropomorphic Robot) Database)

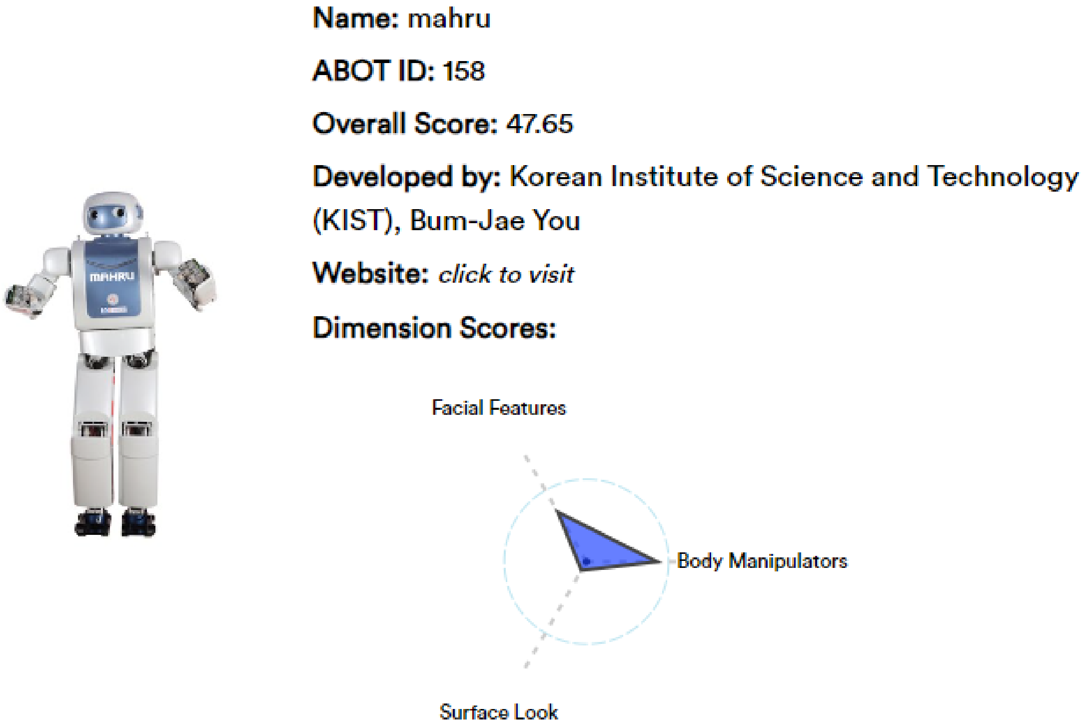


Figure 5. Anthropomorphism dimensions of Mahru which robot with low anthropomorphism level (Source: ABOT (Anthropomorphic Robot) Database)

Two photos of the robots used were used for each scenario. The first photo is the photo in which the robot's external appearance is visible, with nothing in the background of the robot. Secondly, a background suitable for the scenario environment was selected and a new photograph was created.

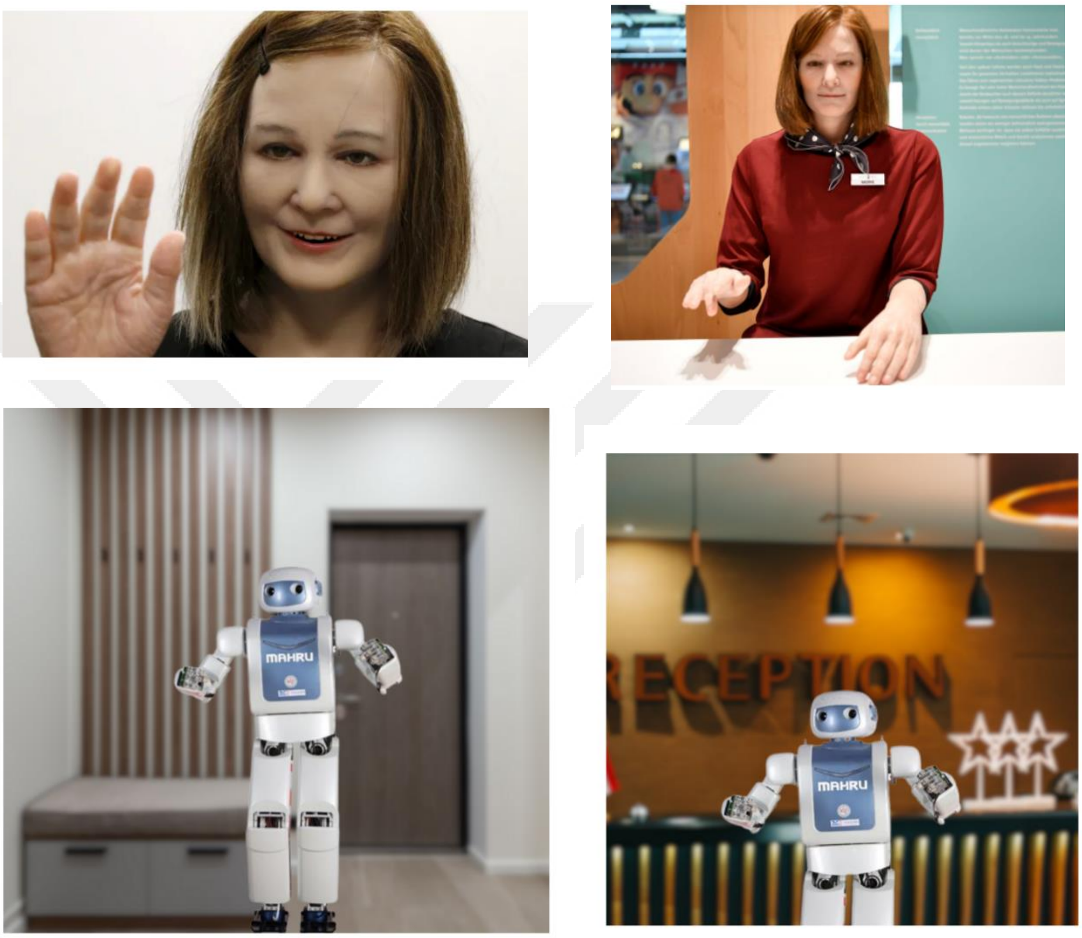


Figure 6. Photos of Robots Used in Scenarios, from left to right: Mahru (Home), Mahru (Hotel), Nadine (Home), Nadine (Hotel) (Source: ABOT (Anthropomorphic Robot) Database

### *5.4. Participant and Design*

Three hundred forty-two participants were purposively sampled online during the period from February 29, 2024, to April 29, 2024. In the context of this current study, these individuals were subjected to random assignment into one of four distinct groups. After all groups answered socio-demographic questions, they placed the robots in scenarios in different environments. In the first group survey, after reading the scenario in which Mahru robot was in a hotel environment, in the second group, the scenario in which Mahru robot was in a home environment, in the third group, after reading the scenario in which Nadine robot was in a hotel environment, and finally in the fourth group, after reading the scenario in which Nadine robot was in a home environment; They must answer a total of 21 questions: 4 in the perceived ease of use category, 3 in the customer attitude category, and 14 in the negative attitude towards robots category. It is essential to note that all participants voluntarily partook in the study and received no compensation or remuneration for their involvement.

### *5.5. Operationalization of Key Constructs*

Table 2. Operationalization of Key Constructs

| **Operationalization of Key Constructs** | |
|---|---|
| **Levels** | |
| | **Environment** |
| **Home** | Nexorobotics şirketi, temmuz ayı itibariyle akıllı ev robotları sersini piyasaya sürmeye hazırlanmaktadır. Bu serinin ilk robotu, sizi eve geldiğiniz zaman karşılayan aynı zamanda sizi dışarı çıkarken de uğurlayan bir hizmet robotudur. Robot eve geldiğinizde sizden çantanızı ve montunuzu alıp terliklerinizi size getirmektedir. Aynı zamanda siz koltuğunuzda dinlenirken bu sırada içecek bir şeyler almak isteyip istemediğinizi sormakta ve bir talebiniz olması doğrultusunda temin etmektedir. Araştırma ve geliştirme ekibi bu robota şimdilik Nadine/Mahru adını vererek yukarıdaki tasarımı önermiştir. |

Table 2 (Continued). Operationalization of Key Constructs

| | |
|---|---|
| **Hotel** | Nexorobotics şirketi, temmuz ayı itibariyle akıllı otel hizmet robotları sersini piyasaya sürmeye hazırlanmaktadır. Bu serinin ilk robotu, sizi otele geldiğiniz zaman karşılayan aynı zamanda siz otelden ayrılırken de sizi uğurlayan bir hizmet robotudur. Robot otele geldiğinizde sizden bavullarınızı ve montunuzu alıp odanıza kadar size eşlik etmektedir. Aynı zamanda siz odanızda koltukta dinlenirken bu sırada içecek bir şeyler almak isteyip istemediğinizi sormakta ve bir talebiniz olması doğrultusunda temin etmektedir. Araştırma ve geliştirme ekibi bu robota şimdilik Nadine/Mahru adını vererek yukarıdaki tasarımı önermiştir. |
| | **Anthropomorphism** |
| **Low** |  |

Table 2 (Continued). Operationalization of Key Constructs

| | |
|---|---|
| **High** |  |

### *5.6. Manipulation Check Findings*

As part of the initial research, manipulation checks were performed to determine if there was a noticeable difference in ratings when respondents were exposed to scenarios depicting interactions with a robot in either a home or hotel environment. To accomplish this goal, two distinct scenarios were created, and respondents were instructed to rate their perception on a 5-point Likert scale with statements such as "I think the script took place in a home environment" and "I think the script took place in a hotel environment." A total of 40 participants, 20 for each scenario, were selected and completed the questionnaire for preliminary analysis. Furthermore, to assess the respondents' perception of the scenarios' realism, they were asked to rate their agreement with the statement "I believe that such things are likely to happen in real life" (Webster & Sundaram, 1998) using a 5-point Likert scale.

Table 3, illustrates the mean scores and standard deviations for the "Home" and "Hotel" groups as a result of the manipulation check.

Table 3. Descriptive Statistics for Environment Manipulation

| **Group** | | **N** | **Mean** | **Std. Deviation** | **Std. Error Mean** |
|---|---|---|---|---|---|
| | Home | 20 | 4.90 | 0.44721 | 0.10000 |
| | Hotel | 20 | 5.00 | 0.0000 | 0.10000 |

The manipulation test demonstrated a statistically important alteration in results by home ($M_{Home}$= 4.90 ; $SD_{Home}$= 0.4472) and the hotel ($M_{Hotel}$ =5.00 ; $SD_{Hotel}$ = 0.000), where $t(39)$= 4.457 ; $p$= 0.000. The survey participants considered each scenario plausible, with both receiving high mean scores home ($M_{Home}$= 4.65 ; $SD_{Home}$= 0.5871) and the hotel ($M_{Hotel}$ =4.75 ; $SD_{Hotel}$ = 0.4442), confirming a high level of ecological reliability.

Table 4 shows the outcomes of Levene's Test for examining the equality of variances between variables, as well as the t-test findings for equality.

Table 4. Independent Samples T-test Statistics for Environment Manipulation

| | **Levene's Test for Equality of Variances** | | **T-test for Equality of Means** | | | | |
|---|---|---|---|---|---|---|---|
| | **F** | **Sig.** | **t** | **df** | **Sig. (2-tailed)** | **Mean difference** | **Std. Error Difference** |
| **Equal Variances assumed** | 4.457 | 0.041 | 39.000 | 38 | 0.000 | 3.90000 | 0.10000 |

Table 5, illustrates the mean scores and standard deviations for the "High Anthropomorphism" and "Low Anthropomorphism" groups as a result of the manipulation check.

Table 5. Descriptive Statistics for Anthropomorphism Manipulation

| **Group** | | **N** | **Mean** | **Std. Deviation** | **Std. Error Mean** |
|---|---|---|---|---|---|
| | High Anthropomorphism | 20 | 5.00 | 0.0000 | 0.00000 |
| | Low Anthropomorphism | 20 | 4.90 | 0.3077 | 0.06882 |

That also existed a considerable disparity in the results between the high anthropomorphism ($M_{High}$= 5.00 ; $SD_{High}$= 0.000) and the low anthropomorphism ($M_{Low}$= 4.90 ; $SD_{Low}$= 0.3077), where $t(38)$= 10.688 ; $p$= 0.000. The survey participants judged both situations plausible, with both receiving strong mean scores high anthropomorphism ($M_{High}$= 4.70 ; $SD_{High}$= 0.5712) and the low anthropomorphism ($M_{Low}$= 4.80 ; $SD_{Low}$= 0.413). To summarize, the respondents' perception of the scenarios' authenticity is significantly high, thereby ensuring ecological validity.

Table 6 shows the outcomes of Levene's Test for examining the equality of variances between variables, as well as the t-test findings for equality.

Table 6. Independent Samples T-test Statistics for Anthropomorphism Manipulation

| | **Levene's Test for Equality of Variances** | | **T-test for Equality of Means** | | | | |
|---|---|---|---|---|---|---|---|
| | **F** | **Sig.** | **t** | **df** | **Sig. (2-tailed)** | **Mean difference** | **Std. Error Difference** |
| **Equal Variances assumed** | 10.688 | 0.002 | 56.666 | 38 | 0.000 | 3.90000 | 0.06882 |

# CHAPTER 6: INTERPRETATION OF ANALYSISES

This section of the study entails a thorough evaluation and interpretation of the data gathered during the research process. This part discusses the findings of t-tests, one-way ANOVA analyses, correlation analyses, and moderator and mediator studies. All of these statistical techniques have been used to address research concerns and evaluate hypotheses. T-tests were employed to detect significant differences between groups, while One-Way ANOVA analyses were utilized to investigate variance differences between groups. Furthermore, correlation analyses were performed to evaluate the correlations between the variables, as well as moderator and mediator analyses to have a better understanding of the interactions. The outcomes of these analyses corroborate the study's primary conclusions and give answers to the research questions.

## *6.1. Data Analysis Method*

During the study, the data were evaluated using the SPSS-27 program, and a table of frequencies with sociodemographic details was prepared in depth. For two-group parameters, the t-test for independent samples was employed to analyze the variations in group means among variables in further depth. Simultaneously, One-Way Anova Analysis was conducted to variables with three or more groups, and the findings were thoroughly examined. The overall trajectory and degree of the association amongst the scales were determined using the method of Pearson correlation analysis. Analyzes were applied at alpha=0.05 level.

## *6.2. Analysis of Data and Information*

Table 7 summarizes the main statistical properties of the measurement tools used in the study. The means, standard deviations, Kolmogorov-Smirnov test results, skewness and kurtosis values and Cronbach alpha reliability coefficients of scales such as Perceived Ease of Use, Customer Attitude and Negative Attitudes About Robots are presented.

Table 7. Normality Assumption Analysis and Reliability Analysis

| **Scale** | **n** | **Avg.** | **SS** | **Kolmogorov Smirnov (p)** | **Skewness** | **Kurtosis** | **Cronbach's Alpha** |
|---|---|---|---|---|---|---|---|
| Perceived Ease of Use | 342 | 15,48 | 5,434 | ,000 | -1,201 | -,050 | ,978 |
| Customer Attitude | 342 | 11,39 | 4,595 | ,000 | -,985 | -,693 | ,985 |
| Negative Attitudes toward Situations and Interactions with Robots | 342 | 15,15 | 2,987 | ,000 | -1,011 | 1,419 | ,827 |
| Negative Attitudes toward Social Influence of Robots | 342 | 28,40 | 1,751 | ,000 | -1,318 | 1,249 | ,900 |
| Negative Attitudes toward Emotions in Interaction with Robots | 342 | 13,21 | 2,211 | ,000 | -1,553 | 1,956 | ,820 |
| Negative Attitudes Toward Robots | 342 | 57,90 | 4,218 | ,000 | -,891 | 1,404 | ,931 |

To evaluate the normality of the research data, a comprehensive analysis was undertaken to scrutinize the skewness and kurtosis values embedded within the dataset. The acceptable limits of skewness and kurtosis values are determined as within the range of +2 and -2 (George, Mallery, 2010). Compliance with these defined parameters is indicative of a dataset adhering to a normal distribution. In light of these considerations, and upon meticulous examination of Table 7, it becomes evident that the dataset conforms to a normal distribution.

### *6.3. Socio-Demographic Characteristics of the Research Sample*

This section contains the frequency and percentage distributions regarding the socio-demographic details about the individuals taking part in the research. Table 8 presents the demographic distribution of the study's participants in terms of gender. The data indicates that out of the total 342 participants, 49.4% are identified as female, while 50.6% are identified as male.

According to the data, 17.0% of the 342 participants fall within the age bracket of 18-25. Additionally, 17.8% the majority of the people taking part are between the ages of 26-35, and 16.7% are situated in the 36-45 age category. Further, 16.7% of the people taking part are among 46 and 55 years of age, 15.5% fall within the 56-65 age range, and 16.4% are aged over 65.

Overview of the educational backgrounds of the study's participants based on their most recent completed levels of education. Within the cohort of 342 participants, 16.4% reported primary school as their highest educational attainment, 9.6% indicated the completion of secondary school, and 17.3% had earned high school diplomas. Additionally, 20.2% disclosed the accomplishment of undergraduate degrees at a university, while 18.1% had pursued and attained master's degree. Furthermore, it is pertinent to mention that 18.4% of the respondents had recently culminated their academic journeys by obtaining doctoral degrees.

An in-depth breakdown of the study's participant distribution in accordance with their respective professions. Out of the total 342 participants, 8.8% indicated their status as non-employed, while 8.5% were identified as students. A noteworthy segment, constituting 21.1%, reported their occupation within the public sector, whereas a substantial 37.1% were actively employed in the private sector. It is worth highlighting that 2% of the participants were characterized as retired individuals.

Within the cohort of 342 participants, 17.3% reported monthly incomes of 10000 Turkish Lira (TL) or less. A notable 20.8% of participants positioned themselves in the income bracket of 10001-20000 TL, with an additional 27.8% declaring monthly earnings between 20001-30000 TL. Significantly, 34.2% of the participants delineated their monthly income at the threshold of 30001 TL and beyond.

Table 8. The Sample's Demographic Characteristics

| | | N= 342 | Percentage (%) |
|---|---|---|---|
| Gender | Male | 173 | 50,6 |
| | Female | 169 | 49,4 |
| Age | 18-25 | 58 | 17,0 |
| | 26-35 | 61 | 17,8 |
| | 36-45 | 57 | 16,7 |
| | 46-55 | 57 | 16,7 |
| | 56-65 | 53 | 15,5 |
| | Above 65 | 56 | 16,4 |
| Educational Status | Primary School | 56 | 16,4 |
| | Secondary School | 33 | 9,6 |
| | High School | 59 | 17,3 |
| | University | 69 | 20,2 |
| | Master Degree | 62 | 18,1 |
| | Doctoral Degree | 63 | 18,4 |
| Professions | Unemployed | 30 | 8,8 |
| | Student | 29 | 8,5 |
| | Public Sector Employee | 72 | 21,1 |
| | Private Sector Employee | 127 | 37,1 |
| | Retired | 84 | 24,6 |
| Monthly Income | 0-10000 TL | 59 | 17,3 |
| | 10001-20000 TL | 71 | 20,8 |
| | 20001-30000 TL | 95 | 27,8 |
| | 30001 TL and above | 117 | 34,2 |
| Country of Homeland | Turkey | 322 | 94,1 |
| | Azerbaijan | 3 | 0,9 |
| | Germany | 13 | 3,8 |
| | Holland | 1 | 0,3 |
| | Belgium | 1 | 0,3 |
| | India | 1 | 0,3 |
| | Romania | 1 | 0,3 |
| Country of Residence | Turkey | 313 | 91,5 |
| | Holland | 3 | 0,9 |
| | Germany | 17 | 5,0 |
| | Belgium | 1 | 0,3 |
| | ABD | 2 | 0,6 |
| | France | 5 | 1,5 |
| | Russia | 1 | 0,3 |

Table 9. Technological Systems Used

| | | **Percentage (%)** |
|---|---|---|
| Voice Assistants (Alexa, Siri etc.) | 338 | 84,5 |
| Robot Vacuum Cleaner | 152 | 38,0 |
| Smart Home Systems (Nest Thermostat, Philips Hue, Amazon Echo, Samsung SmartThings etc.) | 129 | 32,3 |
| I do not use technological systems | 36 | 9,0 |

Table 9 provides information about the technological systems used by users. In this section, users can choose more than one option. 84.5% of the users stated that they use voice assistants (Alexa, Siri, etc.), 38.0% stated that they use robot vacuum cleaners, 32.3% stated that they use smart home systems (Nest Thermostat, Philips Hue, Amazon Echo, Samsung SmartThings etc.) and finally 9.0% stated that they did not use a technological system.

### *6.4. T-Test Exploration and Findings*

The t-test is used to examine if a discrepancy in mean values between two groups is result of by chance. The outcomes of a T-test assist researchers better grasp the data and assure the dependability of their findings. As a consequence, t-test findings are critical for obtaining precise and dependable results in academic research.

#### *6.4.1. Location Variable*

Independent Sample T-Test Analysis results for the Location variable are given in Table 10.

Table 10. Used Location Variable T-Test Table

| Scale | Group | n | Avg. | SS | t | Sd | p |
|---|---|---|---|---|---|---|---|
| Perceived Ease of Use | Home | 171 | 12,98 | 6,421 | -9,544 | 340 | ,000*** |
| | Hotel | 171 | 17,97 | 2,343 | | | |
| Customer Attitude | Home | 171 | 9,16 | 5,321 | -10,226 | 340 | ,000*** |
| | Hotel | 171 | 13,61 | 2,018 | | | |
| Negative Attitudes toward Situations and Interactions with Robots | Home | 171 | 15,65 | 2,465 | 3,135 | 340 | ,011* |
| | Hotel | 171 | 14,65 | 3,365 | | | |
| Negative Attitudes toward Social Influence of Robots | Home | 171 | 28,92 | 1,366 | 5,713 | 340 | ,002** |
| | Hotel | 171 | 27,88 | 1,936 | | | |
| Negative Attitudes toward Emotions in Interaction with Robots | Home | 171 | 13,57 | 2,058 | 3,019 | 340 | ,031* |
| | Hotel | 171 | 12,85 | 2,305 | | | |
| Negative Attitudes Toward Robots | Home | 171 | 58,71 | 3,815 | 3,593 | 340 | ,005** |
| | Hotel | 171 | 57,10 | 4,453 | | | |

**p<0,05, **p<0,01, ***p<0.001*

Perceived Ease of Use Scale Score differs statistically significantly according to the location variable groups used (p=,000<0,001). The Hotel Group's Perceived Ease of Use Scale score average is significantly different and greater than the Home group's Perceived Ease of Use Scale score average.

Customer Attitude Scale Score shows a statistically significant difference depending on the location variable groups used (p=,000<0,001). The Hotel Group's Customer Attitude Scale mean score is significantly different and greater than the Home group's Perceived Ease of Use scale score mean.

Depending on the location variable groups used, the Negative Emotions Scale for Situations Interacting with Robots Score differs statistically significantly (p=.002<0.01). The Home Group's Negative Emotions Regarding Situations Interacting with Robots Scale score average is significantly different and greater than the Hotel group's Negative Emotions Regarding Situations Interacting with Robots Scale score average.

According to the location variable groups used, the Negative Attitudes Towards Social Impact of Robots Scale Score differs statistically significantly (p=.000<0.001). The Home Group's Negative Attitudes About the Social Impact of Robots Scale score mean is significantly different and greater than the Hotel group's Negative Attitudes About the Social Impact of Robots Scale mean score.

Depending on the location variable groups used, the Negative Attitudes Towards Emotions While Interacting with Robots Scale Score differs statistically significantly (p=.003<0.01). The Home Group's Negative Attitudes Towards Emotions When Interacting with Robots Scale score mean is significantly different and greater than the Hotel group's Negative Attitudes Towards Emotions When Interacting with Robots Scale mean score.

Depending on the location variable groups used, the Negative Attitudes Towards Robots Scale Score differs statistically significantly (p=.000<0.001). The Home Group's Negative Attitudes Towards Robots Scale mean score is significantly different and greater than the Hotel group's Negative Attitudes Towards Robots Scale mean score.

### *6.4.2. Robot Type Variable*

Independent Sample T-Test Analysis results for the Robot Type variable are given in Table 11.

Table 11. Robot Type Variable T-Test Table

| Scale | Group | N | Avg. | SS | t | Sd | p |
|---|---|---|---|---|---|---|---|
| Perceived Ease of Use | Nadine | 171 | 12,74 | 6,248 | -10,786 | 340 | ,000*** |
| | Mahru | 171 | 18,22 | 2,256 | | | |
| Customer Attitude | Nadine | 171 | 8,97 | 5,165 | -11,435 | 340 | ,000*** |
| | Mahru | 171 | 13,81 | 1,977 | | | |
| Negative Attitudes toward Situations and Interactions with Robots | Nadine | 171 | 15,15 | 2,733 | -,018 | 340 | ,986 |
| | Mahru | 171 | 15,16 | 3,229 | | | |
| Negative Attitudes toward Social Influence of Robots | Nadine | 171 | 28,65 | 1,579 | 2,685 | 340 | ,008** |
| | Mahru | 171 | 28,15 | 1,880 | | | |
| Negative Attitudes toward Emotions in Interaction with Robots | Nadine | 171 | 13,64 | 1,972 | 3,686 | 340 | ,000*** |
| | Mahru | 171 | 12,78 | 2,353 | | | |
| Negative Attitudes Toward Robots | Nadine | 171 | 58,31 | 4,005 | 1,810 | 340 | ,071 |
| | Mahru | 171 | 57,49 | 4,394 | | | |

**p<0,05, **p<0,01, ***p<0.001*

Perceived Ease of Use Scale Score differs statistically significantly according to robot type variable groups (p=,000<0,001). The Perceived Ease of Use Scale score average of Mahru robot users is significantly different and greater than the Perceived Ease of Use Scale score average of Nadine robot users.

Customer Attitude Scale Score differs statistically significantly according to robot type variable groups (p=,000<0,001). The Customer Attitude Scale mean score of Mahru robot users is significantly different and greater than the Perceived Ease of Use scale score mean of Nadine robot users.

The Negative Attitude Towards Situations and Interacting with Robots Scale Score does not show a statistically significant difference according to the robot type variable groups (p=.986>0.05).

The Negative Attitudes Towards Social Influence of Robots Scale Score show a statistically significant difference according to the robot type variable groups (p=.008>0.05). The mean score of the Negative Attitudes Towards Social Influence of Robots Scale of the Nadine robot users is significantly different and greater than the Negative Attitudes Towards Social Influence of Robots Scale score of the Mahru robot users.

The Negative Attitudes Towards Emotions in Interaction with Robots Scale Score differs statistically significantly according to the robot type variable groups (p=.000<0.001). The mean score of Nadine robot users on the Negative Attitudes Towards Emotions in Interaction with Robots Scale is significantly different and greater than the Negative Attitudes Towards Emotions in Interaction with Robots Scale score of Mahru robot users.

The Negative Attitudes Towards Robots Scale Score does not show a statistically significant difference according to the robot type variable groups (p=.071>0.05).

### *6.5. One-Way Anova Exploration and Findings*

One-Way ANOVA Analysis results for the Robot type-Used location variable are given in Table 12.

Table 12. Robot-Used Location Condition Variable One-Way ANOVA Analysis

| Scale | Group | n | Avg. | SS | Var. K | K.T. | SD | K.O. | F | p |
|---|---|---|---|---|---|---|---|---|---|---|
| **PEU** | **M-HOT** | 85 | 17,91 | 2,741 | **GA** | 7439,764 | 3 | 2479,921 | 318,767 | ,000 *** |
| | **M-HOM** | 86 | 18,52 | 1,599 | **GI** | 2629,549 | 338 | 7,780 | | |
| | **N-HOT** | 86 | 18,03 | 1,881 | **Total** | 10069,313 | 341 | | | |
| | **N-HOM** | 85 | 7,38 | 4,197 | | | | | | |
| | **TOTAL** | 342 | 15,48 | 5,434 | | | | | | |
| **CA** | **M-HOT** | 85 | 13,49 | 2,333 | **GA** | 5939,333 | 3 | 1979,778 | 531,106 | ,000 *** |
| | **M-HOM** | 86 | 14,12 | 1,498 | **GI** | 1259,945 | 338 | 3,728 | | |
| | **N-HOT** | 86 | 13,73 | 1,655 | **Total** | 7199,278 | 341 | | | |
| | **N-HOM** | 85 | 4,15 | 2,124 | | | | | | |
| | **TOTAL** | 342 | 11,39 | 4,595 | | | | | | |
| **NASIR** | **M-HOT** | 85 | 14,47 | 3,705 | **GA** | 96,992 | 3 | 32,331 | 3,710 | ,012 * |
| | **M-HOM** | 86 | 15,84 | 2,520 | **GI** | 2945,795 | 338 | 8,715 | | |
| | **N-HOT** | 86 | 14,84 | 3,001 | **Total** | 3042,787 | 341 | | | |
| | **N-HOM** | 85 | 15,47 | 2,408 | | | | | | |
| | **TOTAL** | 342 | 15,15 | 2,987 | | | | | | |
| **NASR** | **M-HOT** | 85 | 27,53 | 2,002 | **GA** | 117,042 | 3 | 39,014 | 14,195 | ,000 *** |
| | **M-HOM** | 86 | 28,76 | 1,530 | **GI** | 928,997 | 338 | 2,749 | | |
| | **N-HOT** | 86 | 28,23 | 1,814 | **Total** | 1046,039 | 341 | | | |
| | **N-HOM** | 85 | 29,08 | 1,163 | | | | | | |
| | **TOTAL** | 342 | 28,40 | 1,751 | | | | | | |
| **NATEIR** | **M-HOT** | 85 | 12,40 | 2,416 | **GA** | 108,279 | 3 | 36,093 | 7,827 | ,000 *** |
| | **M-HOM** | 86 | 13,15 | 2,241 | **GI** | 1558,563 | 338 | 4,611 | | |
| | **N-HOT** | 86 | 13,30 | 2,109 | **Total** | 1666,842 | 341 | | | |
| | **N-HOM** | 85 | 13,99 | 1,769 | | | | | | |
| | **TOTAL** | 342 | 13,21 | 2,211 | | | | | | |
| **NARS** | **M-HOT** | 85 | 56,77 | 4,405 | **GA** | 283,871 | 3 | 94,624 | 5,530 | ,001 ** |
| | **M-HOM** | 86 | 58,21 | 4,290 | **GI** | 5783,216 | 338 | 17,110 | | |
| | **N-HOT** | 86 | 57,42 | 4,501 | **Total** | 6067,088 | 341 | | | |
| | **N-HOM** | 85 | 59,22 | 3,211 | | | | | | |
| | **TOTAL** | 342 | 57,90 | 4,218 | | | | | | |

*p<0,05, **p<0,01, ***p<0.001

Perceived Ease of Use Score differs statistically significantly according to the robot type-location used variable groups (p=,000<0,001). The average Perceived Ease of Use Score of individuals using Mahru at the hotel, Mahru at home, and Nadine at the hotel is significantly different and greater than the average Perceived Ease of Use Score of individuals using Nadine at home. The average Perceived Ease of Use Score of individuals using Mahru at the hotel and Nadine at the hotel is significantly different and greater than the average of the Perceived Ease of Use Score of individuals using Nadine at home.

Customer Attitude Score shows a statistically significant difference according to the robot type-location used variable groups (p=,000<0,001). The average Customer Attitude Score of individuals using Mahru at the Hotel, Mahru at Home, and Nadine at the Hotel is significantly different and greater than the average Customer Attitude Score of individuals using Nadine at Home. The average Customer Attitude Score of individuals using Nadine at the hotel is significantly different and greater than the average Customer Attitude Score of individuals using Nadine at home.

Negative Attitudes Towards Situations and Interacting with Robots shows a statistically significant difference according to the robot type-location used variable groups (p=.012<0.05). The average Negative Attitudes Towards Situations and Interacting with Robots Score of individuals using Mahru at home is significantly different and greater than the average of Negative Attitudes Towards Situations and Interacting with Robots of individuals using Mahru at the hotel. The average Negative Attitudes Towards Situations and Interacting with Robots of individuals using Nadine at home is significantly different and greater than the average of Negative Attitudes Towards Situations and Interacting with Robots of individuals using Mahru at the hotel and Nadine at the hotel.

The Negative Attitudes Towards Social Influence of Robots Score differs statistically significantly according to the robot type-location used variable groups (p=,000<0,001). The average score of Negative Attitudes Towards the Social Influence of Robots of individuals using Mahru at home and Nadine at home is significantly different and greater than the average of Negative Attitudes Towards the Social Influence of Robots scores of individuals using Mahru at the hotel.

The Negative Attitudes Towards Emotions Score When Interacting with Robots shows a statistically significant difference according to the robot type-location used variable groups (p=,000<0,001). The average Negative Attitude Score Regarding Emotions While Interacting with Robots of individuals using Nadine at home is significantly different and greater than the average of Negative Attitude Score Regarding Emotions While Interacting with Robots of individuals using Mahru at the hotel and Nadine at the hotel. The average Negative Attitude Score Regarding Emotions When Interacting with Robots of individuals using Nadine at the hotel is significantly different and greater than the average of Negative Attitude Score Regarding Emotions When Interacting with Robots of individuals using Mahru at the hotel.

Negative Attitudes Towards Robots Score shows a statistically significant difference according to the robot type-location used variable groups (p=.001<0.01). The average Negative Attitudes Towards Robots Score of individuals using Nadine at home, Nadine at the hotel, and Mahru at the hotel is significantly different and greater than the average of Negative Attitudes Towards Robots scores of individuals using Mahru at the hotel.

### *6.6. Correlation Analysis*

Correlation analysis results are given in Table 13.

Table 13. Correlation Analysis

| | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| Perceived Ease of Use (1) | 1 | | | | | |
| Customer Attitude (2) | ,933**<br>,000 | 1 | | | | |
| Negative Attitudes toward Situations and Interactions with Robots (3) | -,057**<br>,292 | -,053**<br>,331 | 1 | | | |

Table 13 (Continued). Correlation Analysis

| | | | | | | |
|---|---|---|---|---|---|---|
| Negative Attitudes toward Social Influence of Robots (4) | -,219** | -,199** | ,316** | 1 | | |
| | ,000 | ,000 | ,000 | | | |
| Negative Attitudes toward Emotions in Interaction with Robots (5) | -,178** | -,133** | ,593** | ,404** | 1 | |
| | ,001 | ,014 | ,000 | ,000 | | |
| Negative Attitudes Toward Robots (6) | -,206** | -,176** | ,531** | ,851** | ,517** | 1 |
| | ,000 | ,001 | ,000 | ,000 | ,000 | |

***%99;*%95*

As a result of correlation analyses, p values are less than 0.05, indicating that the relationships are statistically significant. This indicates that the findings are not random and apply to the population.

There exists a pronounced and statistically significant positive association between the Perceived Ease of Use Score and Customer Attitude Score (r=.933; p=.000).

A modest, albeit statistically noteworthy inverse relationship is discerned between the Perceived Ease of Use Score and the Negative Attitudes Toward Social Influence of Robots Score (r=-.219; p=.000).

There is a negative and very weakly significant relationship between the Perceived Ease of Use Score and Negative Attitudes Towards Emotions When Interacting with Robots Score (r=-.178; p=.001).

There is an unfavorable and weakly significant relationship between the Perceived Ease of Use Score and the Negative Attitudes Towards Robots Score (r=-.206; p=.000).

There is an unfavorable and very weakly significant relationship between the Customer Attitude Score and Negative Attitudes Towards Social Influence of Robots Score (r=-.199; p=.000).

There is an unfavorable and very minimally significant relationship between the Customer Attitude Score and Negative Attitudes Towards Emotions When Interacting with Robots Score (r=-.133; p=.014).

There is an unfavorable and very slightly significant relationship between the Customer Attitude Score and Negative Attitudes Towards Robots Score (r=-.176; p=.001).

There is a favorable and weakly noteworthy relationship between the Negative Attitudes Towards Situations and Interacting with Robots Score and Negative Attitudes Towards Social Influence of Robots Score (r=.316; p=.000).

There is a fairly substantial favorable relationship between the Negative Attitudes Towards Situations and Interacting with Robots Score and Negative Attitudes Towards Emotions When Interacting with Robots Score (r=.593; p=.000).

There is a favorable and fairly substantial relationship between the Negative Attitudes Towards Situations and Interacting with Robots Score and Negative Attitudes Towards Robots Score (r=.531; p=.000).

There is a favorable and fairly substantial relationship between the Negative Attitudes Towards Social Influence of Robots Score and the Negative Attitudes Towards Emotions When Interacting with Robots Score (r=.404; p=.000).

There is a favorable and extremely strong and substantial connection between the Negative Attitudes Towards the Social Influence of Robots Score and Negative Attitudes Towards Robots Score (r=.851; p=.000).

There is a favorable and fairly substantial relationship between the Negative Attitudes Towards Emotions When Interacting with Robots Score and Negative Attitudes Towards Robots Score (r=.517; p=.000).

### *6.7. Moderator Variable Analysis*

Moderator variable analysis is a statistical approach that determines if a variable influences the strength or direction of a connection and alters or impacts the relationship between independent and dependent variables.

In Table 14, A study model was developed to explore the moderating function of Perceived Ease of Use in the effect of the Negative Emotions About Situations in Interacting with Robots Scale on the Customer Attitude Scale.

Table 14. Moderator Variable Analysis Coefficients Table (Negative Emotions About Situations Interacting with Robots-Perceived Ease of Use-Customer Attitude)

| | **β** | **S.H** | **t** | **p** | **Confidence Interval Lower Limit** | **Confidence Interval Upper Limit** |
|---|---|---|---|---|---|---|
| **Fixed** | 11,384 | ,090 | 126,667 | ,000 | 11,207 | 11,561 |
| **Negative Attitudes Toward Situations and Interactions with Robots (X)** | ,018 | ,092 | ,192 | ,848 | -,163 | ,199 |
| **Perceived Ease of Use (W)** | 4,299 | ,091 | 47,171 | ,000 | 4,119 | 4,478 |
| **Effect Variable (X*W)** | -,081 | ,107 | -,760 | ,448 | -,292 | ,129 |

The provided information encompasses the effects of the variable of independent (X), the moderator (W), and the interaction between the two (X*W) on the variable that is the dependent (Y), which serves as the consequence variable.

The fact that the effect variable is not significant indicates that its moderating role in the model is not significant (p=.448>.05).

In Table 15, A study model was developed to explore the moderating function of Perceived Ease of Use in the effect of the Negative Attitudes Towards Social Impact of Robots Scale on the Customer Attitude Scale.

Table 15. Moderator Variable Analysis Coefficients Table (Negative Attitudes Towards Social Impact of Robots-Perceived Ease of Use-Customer Attitude)

| | **β** | **S.H** | **t** | **p** | **Confidence Interval Lower Limit** | **Confidence Interval Upper Limit** |
|---|---|---|---|---|---|---|
| **Fixed** | 11,356 | ,095 | 119,919 | ,000 | 11,170 | 11,542 |
| **Negative Attitudes toward Social Influence of Robots (X)** | ,079 | ,103 | ,766 | ,444 | -,123 | ,281 |
| **Perceived Ease of Use (W)** | 4,357 | ,109 | 39,852 | ,000 | 4,142 | 4,572 |
| **Effect Variable (X*W)** | -,151 | ,140 | -1,072 | ,284 | -,427 | ,126 |

The provided information encompasses the effects of the variable of independent (X), the moderator (W), and the interaction between the two (X*W) on the variable that is the dependent (Y), which serves as the consequence variable.

The fact that the effect variable is not significant indicates that its moderating role in the model is not significant ($p=.284>.05$).

In Table 16, A study model was developed to explore the moderating function of Perceived Ease of Use in the effect of the Negative Attitudes Towards Emotions When Interacting with Robots Scale on the Customer Attitude Scale.

Table 16. Moderator Variable Analysis Coefficients Table (Negative Attitude Towards Emotions When Interacting with Robots-Perceived Ease of Use-Customer Attitude)

| | **β** | **S.H** | **t** | **p** | **Confidence Interval Lower Limit** | **Confidence Interval Upper Limit** |
|---|---|---|---|---|---|---|
| **Fixed** | 11,386 | ,092 | 123,777 | ,000 | 11,204 | 11,567 |
| **Negative Attitudes toward Emotions in Interaction with Robots (X)** | ,157 | ,092 | 1,699 | ,090 | -,025 | ,338 |
| **Perceived Ease of Use (W)** | 4,323 | ,109 | 39,807 | ,000 | 4,110 | 4,537 |
| **Effect Variable (X*W)** | -,019 | ,132 | -,141 | ,888 | -,278 | ,241 |

The provided information encompasses the effects of the variable of independent (X), the moderator (W), and the interaction between the two (X*W) on the variable that is the dependent (Y), which serves as the consequence variable.

The fact that the effect variable is not significant indicates that its moderating role in the model is not significant (p=.888>.05).

In Table 17, A study model was developed to explore the moderating function of Perceived Ease of Use in the effect of the Negative Attitudes Towards Robots Scale on the Customer Attitude Scale.

Table 17. Moderator Variable Analysis Coefficients Table (Negative Attitudes Towards Robots-Perceived Ease of Use-Customer Attitude)

| | **β** | **S.H** | **t** | **p** | **Confidence Interval Lower Limit** | **Confidence Interval Upper Limit** |
|---|---|---|---|---|---|---|
| **Fixed** | 11,350 | ,093 | 127,973 | ,000 | 11,167 | 11,533 |
| **Negative Attitudes Toward Robots (X)** | ,130 | ,098 | 1,323 | ,187 | -,063 | ,322 |
| **Perceived Ease of Use (W)** | 4,376 | ,104 | 42,212 | ,000 | 4,172 | 4,580 |
| **Effect Variable (X*W)** | -,189 | ,127 | -1,492 | ,137 | -,438 | ,060 |

The provided information encompasses the effects of the variable of independent (X), the moderator (W), and the interaction between the two (X*W) on the variable that is the dependent (Y), which serves as the consequence variable.

The fact that the effect variable is not significant indicates that its moderating role in the model is not significant (p=.137>.05).

### *6.8. Mediator Variable Analysis*

Mediator variable analysis assists researchers in understanding how mediating factors contribute to the explanation of an independent variable's influence on a dependent variable. In this section, mediator variable analysis of the Negative Attitudes Towards Robots scale was performed.

Table 18 presents the coefficients and statistical significance of the regression models showing the effects of the NATSIR scale on the PEU and CA variables, as well as the effect of PEU on CA.

Table 18. Mediator Variable Analysis Model Coefficients of NATSIR Scale

| Regression Models | Variables | β | Standard Error | t | p | F | $R^2$ |
|---|---|---|---|---|---|---|---|
| **1** | NATSIR →PEU | -,104 | ,098 | -1,055 | ,292 | 1,114 | ,003 |
| **2** | NATSIR → CA | -,081 | ,083 | -,973 | ,331 | ,947 | ,003 |
| **3** | PEU → CA | ,798 | ,016 | 47,844 | ,000 | 2289,054 | ,871 |
| **4** | NATSIR → CA<br>PEU→ CA | ,001<br>,789 | ,030<br>,017 | ,032<br>47,697 | ,975<br>,000 | 1141,164 | ,871 |

When Table 18 is examined;

In model 1, the NATSIR scale does not appear to have a substantial and unfavorable effect on the Perceived Ease of Use scale (p=.292>.05).

In Model 2, the NATSIR scale does not appear to have a substantial and unfavorable effect on the Customer Attitude scale (p=.000>0.05).

In Model 3, it is seen that the Perceived Ease of Use scale has a substantial and favorable effect on the Customer Attitude scale (p=.000<.05). The Perceived Ease of Use scale explains 87.1% of the Customer Attitude scale. A 1 unit increase in the Perceived Ease of Use scale causes a 798-unit increase in the Customer Attitude scale. (β=.798).

In Model 4, it is seen that the NATSIR scale and the Perceived Ease of Use scale have a substantial effect on the Customer Attitude scale (p=,000<,05). The NATSIR scale and the Perceived Ease of Use scale explain 87.1% of the Customer Attitude scale. A 1 unit increase in the Perceived Ease of Use scale causes a 789-unit increase in the Customer Attitude scale. (β=.789).

When the β coefficients of the NATSIR scale are examined in model 2 and model 4, when the Perceived Ease of Use variable is included in the model, a substantial effect of the NATSIR scale on the Customer Attitude Scale is not detected, so it does not appear that the Perceived Ease of Use scale has a mediating effect on the effect of the NATSIR scale on the Customer Attitude scale.

Table 19 presents the results of a mediator analysis showing the effects of the NATSIR scale on the CA variable, the mediating role of PEU, and the direct, indirect, and total effects of these effects.

Table 19. Bootstrap Analysis of the Statistical Significance of the Mediating Effect of the NATSIR Scale

| **NATSIR → CA (The Mediating Role of Perceived Ease of Use Scale)** | **β** | **Standard Error** | **p** | **Confidence Interval Lower Limit** | **Confidence Interval Upper Limit** |
|---|---|---|---|---|---|
| Direct Effect | ,001 | ,030 | ,975 | -,058 | ,060 |
| Indirect Effect | -,082 | ,067 | - | -,210 | ,054 |
| Total Effect | -,081 | ,083 | ,331 | -,245 | ,083 |

It does not appear that the Perceived Ease of Use Scale has a mediating effect on the effect of the NATSIR scale on the Customer Attitude scale.

Table 20 provides the outcomes derived from a sequence of regression models, delineating the influence of the NATSR scale on the PEU and CA variables.

Table 20. Mediator Variable Analysis Model Coefficients of NATSR Scale

| **Regression Models** | **Variables** | **β** | **Standard Error** | **t** | **p** | **F** | $R^2$ |
|---|---|---|---|---|---|---|---|
| **1** | NATSR →PEU | -,680 | ,164 | -4,145 | ,000 | 17,177 | ,048 |
| **2** | NATSR → CA | -,521 | ,139 | -3,735 | ,000 | 13,948 | ,039 |
| **3** | PEU → CA | ,798 | ,016 | 47,844 | ,000 | 2289,054 | ,871 |
| **4** | NATSR → CA<br>PEU→ CA | ,017<br>,790 | ,053<br>,017 | ,321<br>46,688 | ,749<br>,000 | 1141,558 | ,871 |

When Table 20 is examined;

In model 1, it is seen that the NATSR scale has a substantial and unfavorable effect on the Perceived Ease of Use scale (p=.000<.05). The NATSR scale explains 4.8% of the Perceived Ease of Use scale. A 1 unit increase in the NATSR scale causes a 680-unit decrease in the Perceived Ease of Use scale. (β=-.680).

In Model 2, it is seen that the NATSR scale has a substantial and unfavorable effect on the Customer Attitude scale (p=,000<0,05). The NATSR scale explains 3.9% of the Customer Attitude scale. A 1 unit increase in the NATSR scale causes a 521-unit decrease in the Customer Attitude scale. (β=-.521).

In Model 3, it is seen that the Perceived Ease of Use scale has a substantial and favorable effect on the Customer Attitude scale (p=.000<.05). The Perceived Ease of Use scale explains 87.1% of the Customer Attitude scale. A 1 unit increase in the Perceived Ease of Use scale causes a 798-unit increase in the Customer Attitude scale. (β=.798).

In Model 4, it is seen that the NATSR scale and Perceived Ease of Use scale have a substantial effect on the Customer Attitude scale (p=.000<.05). The NATSR scale and the Perceived Ease of Use scale explain 87.1% of the Customer Attitude scale. A 1 unit increase in the Perceived Ease of Use scale causes a 790-unit increase in the Customer Attitude scale. (β=.790).

When the β coefficients of the NATSR scale are examined in model 2 and model 4, it is seen that the NATSR scale loses its significant effect on the Customer Attitude Scale when the Perceived Ease of Use variable is included in the model.

It is seen that the Perceived Ease of Use scale has a full mediating effect on the effect of the NATSR scale on the Customer Attitude scale.

Table 21, illustrates the mediation analysis results examining the impact of the NATSR scale on the CA variable.

Table 21. Bootstrap Analysis of the Statistical Significance of the Mediating Effect of the NATSR Scale

| **NATSR→ CA (The Mediating Role of Perceived Ease of Use Scale)** | **β** | **Standard Error** | **p** | **Confidence Interval Lower Limit** | **Confidence Interval Upper Limit** |
|---|---|---|---|---|---|
| Direct Effect | ,017 | ,053 | ,749 | -,086 | ,120 |
| Indirect Effect | -,538 | ,098 | - | -,733 | -,351 |
| Total Effect | -,521 | ,139 | ,000 | -,247 | -,199 |

It is seen that the Perceived Ease of Use Scale has a moderate mediating effect on the effect of the NATSR scale on the Customer Attitude scale (β=-.538).

Table 22, provides insights from regression models elucidating the relationship between the NATEIR scale and both PEU and CA variables.

Table 22. Mediator Variable Analysis Model Coefficients of NATEIR Scale

| Regression Models | Variables | β | Standard Error | t | p | F | $R^2$ |
|---|---|---|---|---|---|---|---|
| **1** | NATEIR →PEU | -,436 | ,131 | -3,326 | ,001 | 11,065 | ,032 |
| **2** | NATEIR → CA | -,277 | ,112 | -2,476 | ,014 | 6,130 | ,018 |
| **3** | PEU → CA | ,798 | ,016 | 47,844 | ,000 | 2289,054 | ,871 |
| **4** | NATEIR → CA<br>PEU→ CA | ,070<br>,794 | ,041<br>,017 | 1,702<br>47,517 | ,090<br>,000 | 1152,360 | ,872 |

When Table 22 is examined;

In model 1, it is seen that the NATEIR scale has a substantial and unfavorable effect on the Perceived Ease of Use scale (p=.001<.05). The NATEIR scale explains 3.2% of the Perceived Ease of Use scale. A 1-unit increase in the NATEIR scale causes a .436-unit decrease in the Perceived Ease of Use scale. (β=-.436).

In Model 2, it is seen that the NATEIR scale has a substantial and unfavorable effect on the Customer Attitude scale (p=.014<0.05). NATEIR scale explains 1.8% of the Customer Attitude scale. A 1 unit increase in the NATEIR scale causes a 277-unit decrease in the Customer Attitude scale. (β=-.277).

In Model 3, it is seen that the Perceived Ease of Use scale has a substantial and favorable effect on the Customer Attitude scale (p=.000<.05). The Perceived Ease of Use scale explains 87.1% of the Customer Attitude scale. A 1 unit increase in the Perceived Ease of Use scale causes a 798-unit increase in the Customer Attitude scale. (β=.798).

In Model 4, it is seen that the NATEIR scale and the Perceived Ease of Use scale have a substantial effect on the Customer Attitude scale (p=,000<,05). NATEIR scale and Perceived Ease of Use scale explain 87.2% of the Customer Attitude scale. A 1 unit increase in the Perceived Ease of Use scale causes a 794-unit increase in the Customer Attitude scale. (β=.794).

When the β coefficients of the NATEIR scale are examined in model 2 and model 4, it is seen that the NATEIR scale loses its substantial effect on the Customer

Attitude Scale when the Perceived Ease of Use variable is included in the model. It is seen that the Perceived Ease of Use scale has a full mediating effect on the effect of the NATEIR scale on the Customer Attitude scale.

Table 23, presents the findings of a mediation analysis examining the impact of the NATEIR scale on the CA variable.

Table 23. Bootstrap Analysis of the Statistical Significance of the Mediating Effect of the NATEIR Scale

| **NATEIR → CA (The Mediating Role of Perceived Ease of Use Scale)** | **β** | **Standard Error** | **p** | **Confidence Interval Lower Limit** | **Confidence Interval Upper Limit** |
|---|---|---|---|---|---|
| Direct Effect | ,070 | ,041 | ,090 | -,011 | ,151 |
| Indirect Effect | -,346 | ,087 | - | -,526 | -,179 |
| Total Effect | -,277 | ,112 | ,014 | -,496 | -,057 |

It is seen that the Perceived Ease of Use Scale has a moderate mediating effect on the effect of the NATEIR scale on the Customer Attitude scale (β=-.346).

Table 24, provides a comprehensive overview of regression models exploring the relationships between the NARS scale and both PEU and CA variables.

Table 24. Mediator Variable Analysis Model Coefficients of NARS Scale

| **Regression Models** | **Variables** | **β** | **Standard Error** | **t** | **p** | **F** | $R^2$ |
|---|---|---|---|---|---|---|---|
| **1** | NARS →PEU | -,265 | ,068 | -3,877 | ,000 | 15,035 | ,042 |
| **2** | NARS → CA | -,192 | ,058 | -3,296 | ,001 | 10,862 | ,031 |
| **3** | PEU → CA | ,798 | ,016 | 47,844 | ,000 | 2289,054 | ,871 |
| **4** | NARS → CA<br>PEU→ CA | ,018<br>,792 | ,022<br>,017 | ,841<br>46,973 | ,401<br>,000 | 1143,898 | ,871 |

When Table 24 is examined;

In model 1, it is seen that the NARS scale has a substantial and unfavorable effect on the Perceived Ease of Use scale (p=.000<.05). The NARS scale explains 4.2% of the Perceived Ease of Use scale. A 1 unit increase in the NARS scale causes a 265-unit decrease in the Perceived Ease of Use scale. (β=-.265).

In Model 2, it is seen that the NARS scale has a substantial and favorable effect on the Customer Attitude scale (p=,001<0,05). The NARS scale explains 3.1% of the Customer Attitude scale. A 1 unit increase in the NARS scale causes a 192-unit decrease in the Customer Attitude scale. (β=-.192).

In Model 3, it is seen that the Perceived Ease of Use scale has a substantial and favorable effect on the Customer Attitude scale (p=.000<.05). The Perceived Ease of Use scale explains 87.1% of the Customer Attitude scale. A 1 unit increase in the Perceived Ease of Use scale causes a 798-unit increase in the Customer Attitude scale. (β=.798).

In Model 4, it is seen that the NARS scale and the Perceived Ease of Use scale have a substantial effect on the Customer Attitude scale (p=,000<,05). NARS scale and Perceived Ease of Use scale explain 87.1% of the Customer Attitude scale. A 1 unit increase in the Perceived Ease of Use scale causes a 792-unit increase in the Customer Attitude scale. (β=.792).

When the β coefficients of the NARS scale are examined in model 2 and model 4, it is seen that the NARS scale loses its substantial effect on the Customer Attitude Scale when the Perceived Ease of Use variable is included in the model. It is seen that the Perceived Ease of Use scale has a full mediating effect on the effect of the NARS scale on the Customer Attitude scale.

Table 25, presents an in-depth examination of the mediation process, focusing on the role of PEU scale in mediating the relationship between the NARS scale and the CA variable.

Table 25. Bootstrap Analysis of the Statistical Significance of the Mediating Effect of the NARS Scale

| **NARS→ CA (The Mediating Role of Perceived Ease of Use Scale)** | **β** | **Standard Error** | **p** | **Confidence Interval Lower Limit** | **Confidence Interval Upper Limit** |
|---|---|---|---|---|---|
| Direct Effect | ,018 | ,022 | ,401 | -,024 | ,061 |
| Indirect Effect | -,210 | ,046 | - | -,306 | -,123 |
| Total Effect | -,192 | ,058 | ,001 | -,306 | -,077 |

It is seen that the Perceived Ease of Use Scale has a moderate mediating effect on the effect of the NARS scale on the Customer Attitude scale (β=-.210).

# CHAPTER 7: DISCUSSION AND CONCLUSION

This part of the study discusses the main results of the research in detail and provides an in-depth analysis of the findings from a theoretical and practical perspective. First, the main findings of the research were summarized and it was focused on whether these findings were compatible with the hypotheses proposed by the thesis. Then, it is discussed how these findings can be related to the existing literature and contribute to the general knowledge of the field. Finally, the methodological and conceptual limitations of the study are highlighted and suggestions for future researchers are offered. In this way, the contributions and limitations of the research were meticulously evaluated, contributing to an in-depth understanding of the subject.

## *7.1. Discussion of the Results and Conclusion*

This research examines the effects of anthropomorphism in home service robots and negative attitudes towards robots on customers' perceived ease of use and analyzes the reflections of these effects on customer attitudes.

Anthropomorphism is supposed to enhance simplicity of usage. This suggests that in a service setting, consumers prefer to interact with a human-like service robot rather than a machine-like service robot (Goudey and Bonnin, 2016). Nevertheless, autonomous cars do not require that they resemble the human form; rather, they should look and perform similarly to other traditional devices. This strategy promotes user trust in technology by making them feel as if they can utilize these tools in a familiar sense (Choi & Ji, 2015). In a similar manner, automated vacuum cleaners with a low humanoid level are easier to handle than autonomous vacuum cleaners with a high humanoid level, allowing users to halt the sweeping process or change the path as needed (Vaussard et al., 2014). Customers like to interact with highly humanoid robots in locations such as airports, restaurants, and hotels because they are easy to use (Qiu et al., 2019). Nonetheless, this perceived ease of use differs with regard to whether people stay in a full-service hotel with highly anthropomorphic robots or a limited-service hotel (Lin et al., 2020). Four scenarios conducted with a variety degree of anthropomorphism (low anthropomorphism vs high anthropomorphism) and environment (home vs hotel) of the service robot revealed the effect of anthropomorphism on perceived ease of use. The findings of the research indicate that there is a negative relationship among customers' PEU of home service robots with high anthropomorphic levels, and that customers' NARS also have a supporting effect on this negative relationship. Based on the T-test analysis, there is a significant difference between the Nadine and Mahru groups in terms of PEU ($t = -10.786$, $p < 0.05$). The Nadine (high anthropomorphic robot) group scored significantly lower in terms of PEU than the Mahru (low anthropomorphic robot) group. When customers perceive home service robots at a high anthropomorphic level, their PEU of this robot decreases. This gives results that confirm the uncanny valley theory. Similar research findings from the Uncanny Valley theory indicate that people are uneasy when they confront a highly human-like robot. This indicates, people regard humans as entities with whom they can engage, and why robots mimic humans elicit unpleasant feelings (Kätsyri et al., 2015). These results and analyzes also confirm H1 of the study. The significant negative relationship of level of anthropomorphism of home service robot and PEU is also buttressed by other studies in the literature (Zemke et al., 2020; Fan et al., 2020; Ene and Badescu, 2019; Uysal et al., 2020).

**H1: There is a negative relationship between the level of anthropomorphism and perceived ease of use.**

Attitudes towards robots can be negative, positive, or neutral, depending on a variety of circumstances, which include attitudes toward other things or subjects. Individuals' attitudes regarding robots are shaped by elements that include their prior robot interactions, media portrayals of robots, cultural views, general attitudes toward technology, and personal attributes. Customers who contact a humanoid service robot perceive dread and a danger to their being as humans, and they express greater negative feelings toward an increasingly human-like robot. These troubling emotions have been demonstrated to have an adverse impact on the utilization of the humanoid service robot (Mende et al., 2019). Culture is one of the variables that influences whether people have positive or negative perceptions of robots. According to research in this domain, Japanese culture's strong appreciation and enthusiasm for technology facilitates the adoption of robotic technology (MacDorman et al., 2009). According to study outcomes, Japanese consumers have a more positive attitude toward robot technology and believe these robots to be simple to use, and this tendency is expected to expand to other Asian nations (Rau et al., 2009). Nevertheless, it deserves to be mentioned that this pattern could additionally correspond to a stereotype in society. According to research comparing cultural attitudes toward robots and perceived ease of use, Germans had lower levels of compassion and trust in encounters with anthropomorphic robots than Chinese and Koreans, and these sentiments had an adverse impact on perceived ease of use (Li et al., 2010). Researchers have attributed this discovery to German culture's strong individualistic inclinations and masculine traits. As a result, the Germans preferred huge, rapid mechanical robots. This adverse correlation in the literature is corroborated by the study findings. As a result of One-Way ANOVA analysis, evidently is a notable distinction among NARS on PEU ($F = 1979.778$, $p < 0.05$). This suggests that NARS have an impact on PEU. Additionally, correlation analyzes showed that there is an unfavorable correlation among PEU and NARS in general. This suggests that NARS in general decrease as PEU increases. These results support H2 in the study. The result of this study is also consistent with previous studies that customers' NARS negatively affect PEU.

**H2: There is a negative relationship between the negative attitudes towards robots and perceived ease of use.**

Research in the field of literature have found that if a technology is difficult to use, users may develop negative attitudes and this may affect technology acceptance (Kim et al., 2010; Guritno and Siringoringo,2013; Venkatesh et al., 2003). Some customers find it challenging to adjust to anthropomorphic service robots owing to their complicated framework, which influences their attitude toward choosing robots with extremely human-like appearances. The results also confirm that in the context of anthropomorphic home service robots, PEU positively affects CA. There is a strong positive relationship between PEU and CA, as the correlation coefficient (0.934) is very high. This means that how easy the anthropomorphic robot is perceived to use positively affects customers' overall attitudes. This also supports H3 of the study. Over and above this, it was concluded that PEU has a full mediating effect on CA.

**H3: Perceived ease of use towards robot anthropomorphism has a positive effect on customer attitude.**

### *7.2. Theoretical Implications*

The results obtained make significant contributions to the literature. This study expands the boundaries of robotics research by filling the gap in existing literature and integrating theories and models from the marketing literature. The contributions of this thesis are not limited only to marketing literature, but also offer implications in psychological and engineering fields. First of all, by introducing the concept of service robots and focusing on home service robots, the importance of a new subfield is emphasized. Although home service robots are increasingly adopted to contribute to global trade, the issues related to consumers' perceptions of these robots are not sufficient. It is worth noting that it has not been researched.

Specifically, this study examined the factors affecting customers' attitudes towards home service robots by adopting the technology acceptance model. This study argues against Mori's uncanny valley theory, reporting that customers have different preferences for the appearance of service robots in home and hotel environments. In addition, this research also indicates that there is a significant difference between anthropomorphic robots in terms of customers' attitudes towards service robots.

Believed that this study will contribute by guiding scientists who will conduct research in this field in the future. It is anticipated that home service robots will be better understood as studies in this field increase. This thesis offers a number of theoretical contributions by taking these issues into account.

### *8.3. Managerial Implications*

This study provides important managerial implications for marketing professionals, indicating that companies should focus primarily on providing a positive service experience and increased purchase intention through service robots. This priority emphasizes strategic approaches to efforts to improve customer-perceived ease of use and customer attitudes. Therefore, anthropomorphic cues are vital to the success of this new robot phenomenon, as they have a significant impact on the consumers perceive ease of use and customer attitude when using service robots.

This research focuses on the parts that decision makers and practitioners should pay attention to in order to design service robots more effectively. Our results show that two important factors in the design of service robots, namely the anthropomorphism level of the service robot and the service interaction environment, should be carefully considered to successfully serve targeted customers. Robot designers and companies may be eager to create the most realistic robots; However, our research shows that these robots are not equally suitable in every service environment. For example, the external appearance of service robots to be used in the home environment should present an understandable robot appearance in a way that does not cause people to become indecisive. However, there will be no problem if the service robot to be used in the hotel environment has a high level of anthropomorphism to aesthetically satisfy the customers.

Finally, it should be emphasized for businesses that service robots, which have become an integral part of life and homes today, will continue to grow in global commerce and the importance of these robots should not be ignored. Considering the reluctance towards robots that imitate humans with a high level of anthropomorphism, there is a need for practitioners to develop alternative strategies for providing services in the home environment. Businesses are expected to understand this implication and develop its applications in the production of new home service robots. In addition, considering these inferences, it is thought that practitioners will gain competitive advantages in the sector if they apply home service robots in their production processes.

### *7.4. Limitations and Future Research Directions*

Apart from the stated theoretical and practical contributions, this research has three main limitations. However, these limitations may present opportunities for further discoveries and new research directions.

One of the biggest limitations of this study is that it mostly covers Turkey in general. When we look at the robot perspective currently used throughout Turkey, industrial robots are widely used in sectors, cleaning robots used in homes as service robots, or robots with low anthropomorphic levels are used in places such as restaurants or hospitals. For this reason, the fact that they do not yet have one-to-one interactions with social service robots in their social environment and individually prevents social effects from being considered in depth in explaining behavior. In addition, future studies will provide a more useful insight by conducting research on one or more countries that exhibit similar characteristics to Turkey and presenting comparative results.

Another limitation is that the answers are collected through survey method using experimental design. The participants only read the script and looked at the photographs. This makes it difficult to accurately understand the relationship between the robot and the participant. Future studies can be deepened by collecting different data sources such as field observation or interviews and investigating different important social, emotional or relational factors affecting perceptions towards service robots.

Finally, since there was no direct relationship between the participants and the robots within the framework of this study, we did not include the Perceived Usefulness, Behavioral Intention and Actual Use sections from the Technology Acceptance Model in the analysis. Future studies can analyze the full version of the Technology Acceptance Model in situations where participants interact with robots.

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# APPENDICES

## Appendix A: Survey Questions

**Değerli Katılımcı,**

**Bu çalışma, İzmir Ekonomi Üniversitesi Tezli İşletme Yüksek Lisans öğrencisi Derya ÇİÇEK tarafından tez çalışması olarak, Prof. Dr. Gülem ATABAY danışmanlığında yürütülmektedir. Bu çalışmada insansı ev robotlarının tüketici tutumu üzerindeki etkisinin araştırılması amaçlanmaktadır.**

**Bu çalışmaya katılımınız ortalama 15 dakika kadar zamanınızı alacaktır. Katılım tamamen gönüllülük esasına dayanmaktadır ve sizden kimlik belirleyici hiçbir bilgi talep edilmemektedir. Cevaplarınız gizli tutulacak ve sadece araştırmacılar tarafından değerlendirilecektir. Elde edilen bilgiler bilimsel amaçla kullanılacaktır. Bu sebeple, sağlıklı araştırma sonuçları elde edebilmek için soruların samimi bir şekilde cevaplanması ve eksiksiz doldurulması önemlidir.**

**Çalışma bitiminde, konuyla bağlantılı daha fazla bilgi almak ve sorularınız için Derya ÇİÇEK ile adresinden iletişim kurabilirsiniz.**

**Araştırmaya katıldığınız ve zaman ayırdığınız için teşekkür ederiz.**

**Cinsiyetiniz**

- □ Erkek
- □ Kadın

**Yaşınız**

- □ 18-25
- □ 26-35
- □ 36-45
- □ 46-55
- □ 56-65
- □ 65 üstü

**En son tamamladığınız eğitim düzeyi nedir ?**

- ☐ İlkokul
- ☐ Ortaokul
- ☐ Lise
- ☐ Üniversite
- ☐ Yüksek Lisans
- ☐ Doktora

**Çalışma durumunuz nedir?**

- ☐ İşsiz
- ☐ Öğrenci
- ☐ Kamu Sektörü Çalışanı
- ☐ Özel Sektör Çalışanı
- ☐ Emekli

**Aylık Geliriniz**

- ☐ 0-10000 TL
- ☐ 10001-20000 TL
- ☐ 20001-30000 TL
- ☐ 30001 TL ve yukarısı

**Hangi ülkede büyüdünüz ?**

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**Hangi ülkede yaşıyorsunuz ?**

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**Lütfen aşağıdaki teknolojik sistemlerden kullandıklarınızı seçiniz. (Birden fazla seçim yapabilirsiniz.)**

- Sesli Asistanlar (Alexa, Siri vb.)
- Robot Süpürge
- Akıllı Ev Sistemleri (Nest Thermostat, Philips Hue, Amazon Echo, Samsung Smart Things vb.)
- Teknolojik sistem kullanmıyorum

**Nexorobotics şirketinin Ar-Ge departmanı, ev/otel ortamında çalışabilen bir hizmet robotunun prototipini geliştirdi ancak bu robot için kullanılacak tasarım hakkında müşteri geri bildirimleri aramaktadırlar. Lütfen aşağıdaki ürün açıklamasını okuyunuz ve ardından robot tasarımını göz önüne alarak aşağıda yer alan soruları cevaplayınız.**

**MAHRU EV VE OTEL**


**NADİNE EV VE OTEL**



**EV SENARYOSU**

Nexorobotics şirketi, temmuz ayı itibariyle akıllı ev robotları sersini piyasaya sürmeye hazırlanmaktadır. Bu serinin ilk robotu, sizi eve geldiğiniz zaman karşılayan aynı zamanda sizi dışarı çıkarken de uğurlayan bir hizmet robotudur. Robot eve geldiğinizde sizden çantanızı ve montunuzu alıp terliklerinizi size getirmektedir. Aynı zamanda siz koltuğunuzda dinlenirken bu sırada içecek bir şeyler almak isteyip istemediğinizi sormakta ve bir talebiniz olması doğrultusunda temin etmektedir. Araştırma ve geliştirme ekibi bu robota şimdilik Nadine/Mahru adını vererek yukarıdaki tasarımı önermiştir.

**OTEL SENARYOSU**

Nexorobotics şirketi, temmuz ayı itibariyle akıllı otel hizmet robotları sersini piyasaya sürmeye hazırlanmaktadır. Bu serinin ilk robotu, sizi otele geldiğiniz zaman karşılayan aynı zamanda siz otelden ayrılırken de sizi uğurlayan bir hizmet robotudur. Robot otele geldiğinizde sizden bavullarınızı ve montunuzu alıp odanıza kadar size eşlik etmektedir. Aynı zamanda siz odanızda koltukta dinlenirken bu sırada içecek bir şeyler almak isteyip istemediğinizi sormakta ve bir talebiniz olması doğrultusunda temin etmektedir. Araştırma ve geliştirme ekibi bu robota şimdilik Nadine/Mahru adını vererek yukarıdaki tasarımı önermiştir.

| ALGILANAN KULLANIM KOLAYLIĞI | | | | | |
|---|---|---|---|---|---|
| Robot ile kurulan iletişim açık ve anlaşılırdır. | 1 | 2 | 3 | 4 | 5 |
| Robotu kullanmanın kolay olduğunu düşünüyorum. | 1 | 2 | 3 | 4 | 5 |
| Robot ile iletişim kurmak çok fazla çaba gerektirmez. | 1 | 2 | 3 | 4 | 5 |
| İstediğim şeyi robot ile yapmayı kolay buluyorum. | 1 | 2 | 3 | 4 | 5 |
| **MÜŞTERİ TUTUMU** | | | | | |
| Robotu kullanmanın iyi bir fikir olduğunu düşünüyorum. | 1 | 2 | 3 | 4 | 5 |
| Robotu kullanmanın zevkli olduğunu düşünüyorum. | 1 | 2 | 3 | 4 | 5 |
| Robotun kullanılmasını cazip buluyorum. | 1 | 2 | 3 | 4 | 5 |
| **ROBOTLARA KARŞI NEGATİF TUTUMLAR** | | | | | |
| Robotların gerçekten duyguları olsaydı huzursuz olurdum. | 1 | 2 | 3 | 4 | 5 |
| Eğer robotlar canlı varlıklara dönüşürse, kötü şeyler olabilir. | 1 | 2 | 3 | 4 | 5 |
| Robotlarla konuşurken kendimi rahat hissederdim. | 1 | 2 | 3 | 4 | 5 |
| Bana robotların kullanıldığı bir iş verilseydi kendimi huzursuz hissederdim. | 1 | 2 | 3 | 4 | 5 |
| Robotların hisleri olsaydı, onlarla arkadaş olabilirdim. | 1 | 2 | 3 | 4 | 5 |
| Duyguları olan robotlarla birlikte olmak bana kendimi rahat hissettirirdi. | 1 | 2 | 3 | 4 | 5 |
| "Robot" kelimesi benim için hiçbir şey ifade etmiyor. | 1 | 2 | 3 | 4 | 5 |
| Diğer insanların önünde bir robot kullanıyor olsam gergin hissederdim. | 1 | 2 | 3 | 4 | 5 |
| Robotların ya da yapay zekaların bir şeyler hakkında yargıda bulunması fikrinden nefret ederdim. | 1 | 2 | 3 | 4 | 5 |
| Sadece bir robotun karşısında durmak bile çok sinir bozucu hissettirirdi | 1 | 2 | 3 | 4 | 5 |
| Robotlara çok fazla güvenirsem kötü bir şey olabileceğini hissediyorum. | 1 | 2 | 3 | 4 | 5 |
| Bir robotla konuşsam kendimi paranoyak hissederdim. | 1 | 2 | 3 | 4 | 5 |
| Robotların çocuklar üzerinde kötü bir etkiye sahip olacağından endişeliyim. | 1 | 2 | 3 | 4 | 5 |
| Gelecekte topluma robotların hâkim olacağını hissediyorum. | 1 | 2 | 3 | 4 | 5 |

**1: Hiç Katılmıyorum, 2: Katılmıyorum, 3: Kararsızım, 4: Katılıyorum, 5: Kesinlikle Katılıyorum**

# Appendix B: Ethical Board Approval

**SAYI:** B.30.2.İEÜ.0.05.05-**020**-*362* 07.03.2024

**KONU :** Etik Kurul Kararı hk.

**Sayın Prof. Dr. Gülem Atabay ve Derya Çiçek,**

**"THE IMPACT OF HOME SERVICE ROBOTS' ANTHROPOMORPHISM LEVEL ON CONSUMER ATTITUDE"** başlıklı projenizin etik uygunluğu konusundaki başvurunuz sonuçlanmıştır.

Etik Kurulumuz 29.02.2024 tarihinde sizin başvurunuzun da içinde bulunduğu bir gündemle toplanmış ve Etik Kurul üyeleri projeleri incelemiştir.

Sonuçta 29.02.2024 tarihinde **"THE IMPACT OF HOME SERVICE ROBOTS' ANTHROPOMORPHISM LEVEL ON CONSUMER ATTITUDE"** konulu projenizin etik açıdan uygun olduğuna oy birliğiyle karar verilmiştir.

Gereği için bilgilerinize sunarım.
Saygılarımla,

**Prof. Dr. Murat Bengisu**
**Etik Kurul Başkanı**