

# The Impact of Using a Robot Mannequin (*RoMa*) in Visual Merchandising

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**ABSTRACT:** Social robots applications are becoming more and more popular in our daily life. Advertising, in this case, apparel advertising, is an area that humans must deal with every day. *RoMa* is a social robot mannequin that has been designed and developed as a mobile robot for use in the field of advertising and visual trading. In this paper, characteristics such as the interaction of people with *RoMa*, the impact of using a social robot on the sustainability of a store's brand name for customers, the desire to revisit the store for another purchase, and the robot's structural features were measured in a Tehran retail store using various tools such as questionnaires, cameras, and a microphone. Finally, customer preferences for the process of selecting and buying clothes as well as an examination of the mannequin's display features have also been studied.

**KEYWORDS:** Robot Mannequin, Social Robot, Smart Showcase, *RoMa*

## 1. Introduction

Visual Merchandising is the use of customized programs and various product views to maximize sale of a product. In other words, the salesperson is trying to attract more customers by offering a product in a different way. One of the many ways in which the merchandise can be presented is the arrangement of store products, the use of mannequins, lighting, showcase space and store environment, music, coloration, seasonal displays, etc. A mannequin is often used to attract customers in the apparel industry as it allows the customer to imagine that outfit on themselves, which allows the person to easily communicate with the product. Results of a study by Jain and colleagues in the field of impact of visual trade on female customer behavior showed that the proper use of a mannequin encouraged women to buy clothes from that store (Jain, Sharma, Narwal 2012).

Retailers have many different ways to attract customers. A study examining the attractiveness and attraction points in a showcase by the Point of Purchase Advertising International (POPAI) organization revealed that no other factor attracts customer attention as much as the moving window of a showcase, and statistical data and analysis showed that this can increase sales by about 310% (www.popai.co.uk). Previous research has examined several factors that influence an increase in retail sales, and specific factors, such as robots, the internet of objects, virtual reality, etc., have been found to have a direct impact on this area (Grewal, Roggeveen, Nordfält 2017). Arousing a customer's feelings can lead them to certain actions. In other words, merchandizing can be used to sell a product by stimulating people's opinion about that product (Darrat, Amyx 2016). The design of a showcase, especially a smart showcase, can excite the emotions and affect the viewer, which could cause the length of pause and amount of eye contact with the desired item to increase during the period of viewing.

Technology is rapidly changing the nature of the services provided to the customer, and it is anticipated that by 2025 services using humanoid robots will become very common. In Van Doorn, Mende et al. (2017), the ability to use technology as an automated social presence in service work is examined. The paper states that technology can be used to add a social factor in services provided to people. Social robotics is an emerging field in modern research that examines the social behaviors involved in interaction between humans and robots. Social robots are being built and designed for use in a variety of fields, including education (Meghdari, Alemi, et al. 2013), medical treatment (Meghdari, Alemi, et al. 2016 and Kwakkel et al. 2008), and social services (Smarr, Mitzner, et al. 2014; Severinson-

Eklundh, Green, Hüttenrauch 2003). These robots are also being used for entertainment and promotions. As social robots are designed to live in human society, the most important factor in their design is the ability to communicate with humans. This relationship can be a verbal, animated or physical interaction. In a study conducted in the Social and Cognitive Robotics Laboratory of Sharif University of Technology, Meghdari and Alemi investigated the use of social robots to teach a foreign language to children (Meghdari, Alemi, et al. 2013), educate and rehabilitate children with autism (Taheri, Alemi, Meghdari, et al. 2015), and to teach sign language to deaf children (Zakipour, Meghdari, Alemi 2016).

In this paper, the social robot *RoMa* was used as a smart animated mannequin in the field of fashion and clothing. Mannequins are a simplified model of the human body in a stationary state. This robot, with its 9 degrees-of-freedom, has the ability to display many human upper body movements. The robot was designed specifically to meet the needs of fashion and apparel (Alemi, Meghdari, et al. 2017). In our study, the following parameters were investigated in the real environment of a women's clothing shop in Tehran, Iran.

- 1- Customers' priorities when buying clothes such as materials, the dress model, the way the dress fits the ins and outs of the body, etc.
- 2- People's interaction with the mannequin-operated smart showcase.
- 3- Analyzes of the robot's structural features such as beauty, human likeness, and natural movements.
- 4- Reusability of the robot.
- 5- Increasing brand durability in customers.

In the next section, the hypotheses on which each of these parameters is based is explained.

## **2. Effective parameters of the social robot *RoMa***

The following factors were examined to investigate the impact of the use of a social robot in the field of visual trade.

### ***2.1 Priority of customers in buying clothes***

People do not buy products just because they are products, they pursue certain goals such as tidying up their environment, enjoyment, attracting attention, and so on. Therefore, the retailer must provide the buyer an incentive to buy their product (Jain, Sharma, Narwal 2012). The primary priority of clothing and apparel buyers includes factors such as price, clothing material, color, dress style, the way the dress fits the ins and outs of the body, seasonal conditions, clothing comfort, etc. In this paper, these factors are divided into two parts. The first type, as mentioned above, includes factors such as price, clothing material, color and comfort of clothing. These factors are not affected by the mannequin type. Additionally, stimulation of customer sentiment has little effect on these factors. The second type of factors, such as the dress style and the way the dress fits the ins and outs of the body, are factors that are shown by mannequins.

For this study we choose a factor, the clothing material, from the first group and compared its effect on customer sentiment with the criteria of the second group. Since the poll was taken randomly it is expected that there will be people of different ages and attitudes, but all are expected to consider the way the dress fits the ins and outs of the body as more important than the clothing material.

### ***2.2 People's interaction with smart showcase***

A recent study claims that a store's showcase should motivate the customer and bring people into the store (Alemi, Meghdari, et al. 2017). The showcase should create an allure for the viewer, and by increasing the duration of pausing in front of the showcase, stimulates the customer's emotions and motivates him/her to enter the store. Using a moving mannequin in a showcase should cause some form of social interaction between people and the product; thereby, causing the person to respond appropriately and enter the store. When the client feels that his presence is identified by the mannequin, he/she starts interacting with that

mannequin. The role of the robot mannequin in the showcase is to interact with the customer by communicating in a visual, verbal and animated way. Since the robot is able to move with very human-like gestures, an initial interaction is formed and the consumer is gradually enticed into the store by the appeal of this phenomenon, and after entering the store they seek out the desired product. Three different methods of buying a dress have been investigated in this research. Online shopping, clothes displayed on mannequins, and trying on clothes before buying. In addition, we studied the method people preferred to use when selecting clothes.

### 2.3 Analysis of robot mannequin features

When using a humanoid robot as a mannequin it must include factors to attract the attention of the clients. These factors are discussed in an article on the robot's conceptual design and have been applied to *RoMa* (Alemi, Meghdari, et al. 2017). All degrees of freedom of the robot have been selected in such a way that the robot is able to correctly emulate humanoid moves. One of the issues that should be considered in the design and construction of humanoid robots is the Uncanny Valley hypothesis. Psychologists believe that when a humanoid robot resembles a human being too closely it creates an unpleasant sensation for the audience (Mori, MacDorman, Kageki 2012). Fig. 1 illustrates the graph of the amount of a robot's appeal based on its likeness to humans. Additionally, people should not expect the robot to function entirely like a human. In this aesthetic assumption, the more a robot looks like a human but is unable to act like a human the more repulsive it is. As this hypothesis was incorporated into *RoMa*'s design, we should be able to avoid the uncanny valley in the consumer/audience in this study.

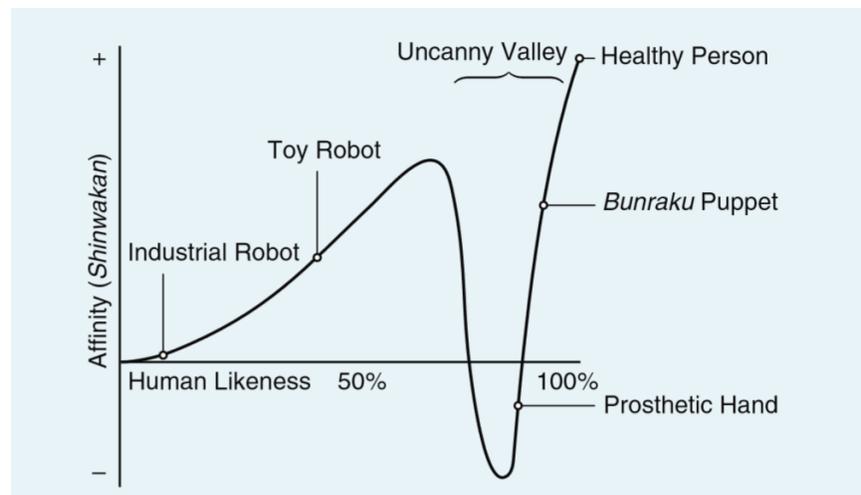


Fig. 1. The Uncanny Valley in the Affinity chart based on the percentage of robot likeness to humans (Mori, MacDorman, Kageki 2012)

### 2.4 Reusability of the robot

An important point in using a robot is to maintain its long-term attraction in the eyes of the audience. People should not become accustomed to seeing the robot after several viewings, and it should not become a normal or common phenomenon for them. An article by Leite and colleagues (Leite, Martinho, Paiva, 2013), studying the interaction between humans and social robots reports that robots have finally been able to captivate an audience/consumer for an extended period of time. In another study a robot named Valerie was used to greet people, give weather forecasts, tips for routes, and so on for nine months (Gockley, Bruce, et al. 2005). The researchers found that as the robot's similarity to humans increased, humans

interacted with the robot for a longer time (Gockley, Bruce, et al. 2005). To further investigate this the robot's motions can be varied and the results monitored over a period of time. As the use of a moving factor is effective in increasing the charm of the showcase, it is anticipated that over time the robot will remain attractive to audiences, and people will tend to continue to be influenced by the showcase whenever they go to the store.

### **2.5 Brand durability in customers**

In another study a social robot was used to help teach English as a second language to school students in Tehran, and learning and retention rates were found to be far higher than traditional educational methods. This research also showed that the use of robots to teach English vocabulary led pupils to learn in less time than traditional educational methods (Alemi, Meghdari, Ghazisaedy 2015). A similar study done in Japan by Takayuki Kanda also found the results were better than other groups of children who learnt English in traditional methods (Kanda, Hirano, et al. 2004). These studies show the use of a robot makes learning more attractive and long-lasting with students able to retain the words after longer periods of time (Meghdari and Alemi 2018). Extending this hypothesis to the research conducted with *RoMa*, people should remember the brand name and the location of the apparel longer, and as time goes by this will increase the number of store customers. In the next section, a framework test designed to meet the requirements for measuring the desired parameters is explained.

### **3. Designing a framework test for the robot mannequin**

The Robot Mannequin is located in the showcase of a women's clothing store in Tehran. This store is one of the well-known clothing brands in Tehran, and is visited daily by many people. Two robot mannequins wearing women's dresses were placed at the front of the store's showcase. This retailer is located on a crowded street, with lots of customers with different tastes and various cultural and social levels buying from this store. The showcase of the store is facing and slightly above the street, so that the showcase is easily visible to pedestrians. Fig. 2 shows the front showcase of the store.



Fig. 2. A view of the mannequins posed in the front window of the retailer's clothing store

Inside the store, there are two CCTV cameras to record the reaction of pedestrians and customers who enter the store to both the mobile mannequins and fixed mannequins. Fig. 3 shows a view of the camera position

relative to the mannequins. Outside, where passing pedestrians can stand and view the showcase, a microphone was placed to record the verbal responses of the audiences to the robots. Fig. 4 shows the location of the microphone.

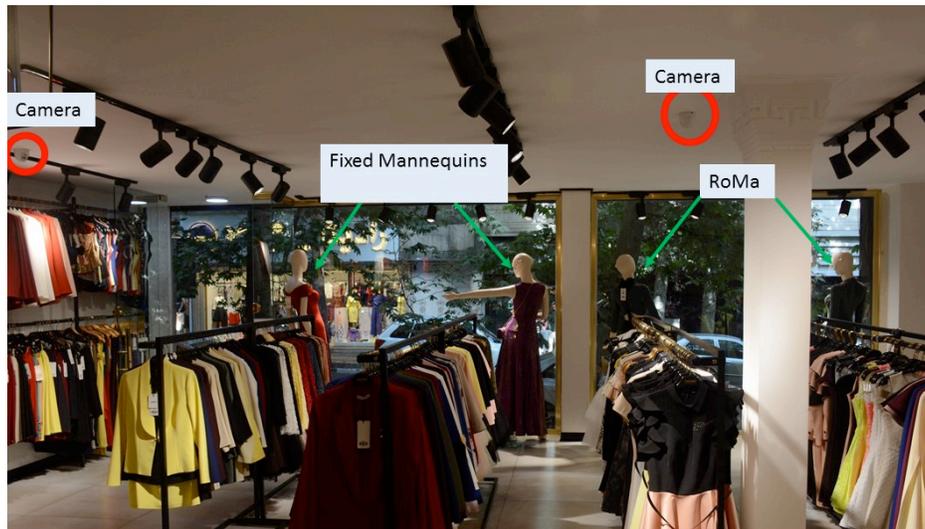


Fig. 3. Location of the cameras relative to the showcase, the *RoMa*, and the fixed mannequins



Fig. 4. Location of the microphone relative to the showcase, the *RoMa*, and the fixed mannequins

To measure important client factors, an audience/potential customer survey is asked from willing participants before seeing the robot mannequins. The questions were about their tendency to buy apparel in person or otherwise and important client factors as discussed above, such as price, clothing material, color, the way the dress fits the ins and outs of the body, seasonal conditions, clothing comfort, etc., for the purchase of the dress. After seeing the robots the same people will finish the survey by answering questions about the characteristics of the robot, its attractiveness, brand name reminder, and the measurement of brand-name durability after seeing the robot.

The questionnaire was completely randomized from 100 female clients aged 18 to 62 years old with an average age of 28 years and a standard deviation of 10.1. All questions in this questionnaire used

the Likert scale with scores by customers from grade 1 (very low), 2 (low), 3 (average), 4 (high) to 5 (very high). The text of this questionnaire can be found in Appendix 1.

#### 4. Analyze and review the results

Different parameters affect the interaction between social robots and humans. Section 2 presents the parameters used by the social robot *RoMa*. After testing the robot and conducting a survey about customers' preferences when buying clothes as well as about the features of the robot, the results and analyzes are as follows:

##### 4.1 Priority of customers when buying clothes

As stated in Section 2, the customer's priorities when buying clothes are divided into two categories. The first category is the factors that cannot be provided or influenced by mannequins, and the second is the factors that can be presented to the customer by mannequins. The dress material was selected from the first group, and the way the dress fits the ins and outs of the body and the dress style were selected from the second group for a customer survey. The survey results are presented in Table 1.

Table 1. The Results of the Customer's Priority in Buying Clothes

|   | Standard Deviation | Average (From 5) |
|---|--------------------|------------------|
| The way the dress fits the ins and outs of the body | 0.75               | 4.42             |
| Dress material                                      | 1.12               | 3.54             |
| Dress style   | 0.89               | 4.36             |

The survey results show that customers' preferences when buying clothes are more focused on the dress style and the way the dress fits the ins and outs of the body. Therefore, it is concluded that when people are buying clothes they are paying attention to how the dress is presented; thus, customer attention can be drawn and stimulated to the appropriate clothing through a smart showcase.

##### 4.2 People's interaction with the smart showcase

In another section of the survey, the customer's method of buying was addressed. In the questionnaire, customers were asked to choose between online shopping, seeing clothes on mannequins, and buying clothes after trying them on. Table 2 presents customer clothes buying method preferences.

Table 2. The Results of the Customer Clothes Buying Method Preferences

|                               | Standard Deviation | Average (From 5) |
|-------------------------------|--------------------|------------------|
| Online shopping               | 1.1                | 1.68             |
| Seeing clothes on a mannequin | 1.07               | 3.1              |
| Buying after wearing          | 0.36               | 4.9              |

A notable result of this question is that the purchase of clothing after wearing got the highest score. Online shopping got the lowest score which shows that this choice is not at all a priority for customers to buy a dress. The result of the question is that these customers do not have enough confidence to buy clothes from the internet rather prefer to be able to actually carefully examine the clothes. These results are in agreement with a report from ([www.salehoo.com](http://www.salehoo.com)), which shows that only 13.5% and 2.1% of sales were online in 2014 in England and Italy, respectively. Customers were also asked if they would buy a dress without

trying it on. Answers showed that only 32% of people said they might buy clothes without trying it or seeing it on a body. From the review of comments, it is concluded that people pay much more attention to the way the dress fits the ins and outs of the body. This factor can easily be shown to the customer by the mobile robot mannequin. The advantage of the robot mannequin is that it displays a myriad of upper body shapes and movements allowing the potential customer to easily imagine the dress on their own body.

In this study, cameras located inside the store filmed the behavior of pedestrians outside the front showcase during two periods before and after the installation of the *RoMa* mannequin. The data recorded was examined for different hours of the day. The results recorded before the installation of the *RoMa* showed on average about 5 people per hour looked at the store's showroom. After placing the robot mannequin in the showcase, that number increased to 19. This shows the creation of the mobility factor in the showcase drew people's attention to the shop windows. Data recorded from the microphone installed in front of the showcase store where pedestrians crossed in front of the showcase was also remarkable. Most people were surprised at the presence of the moving object simulating human movements inside the showcase.

### 4.3 Analysis of robot mannequin features

As stated above, during the design and construction of *RoMa* the designers considered certain factors to increase the robot attractiveness. The features of the robot were examined from the perspective of anthropology, animation and likeability.

#### 4.3.1 Anthropology

From this point of view, the naturalness or unnaturalness of the robot's movements compared to human movements from the perspective of customers have been examined. The results of this question are shown in Fig. 5.

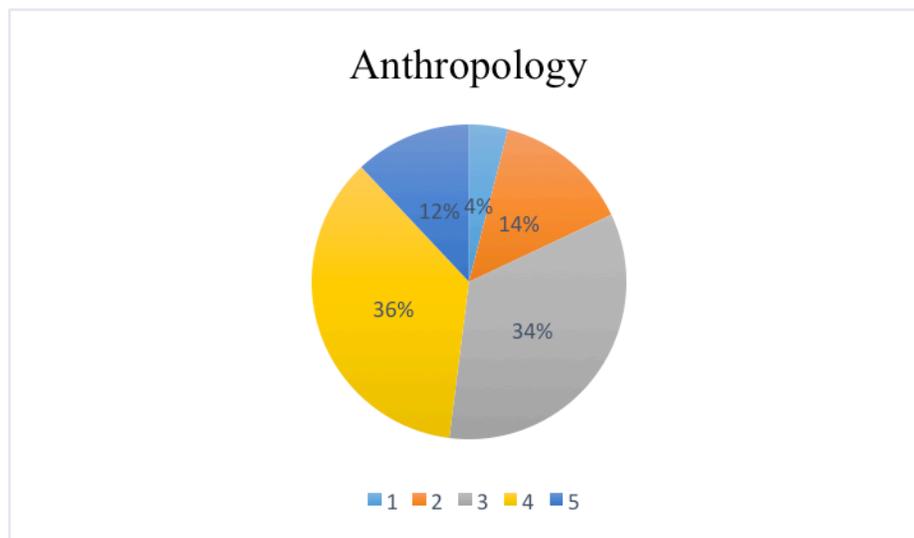


Fig. 5. The naturalness of the robot movements from the customer's perspective

As can be seen in Fig. 5, a significant number of people believe that the robot's movements are moderately similar to human movements. The standard deviation of this data is 1, which indicates that a significant number of people have voted for option 3 (medium) and 4 (high).

### 4.3.2 Animation

- Human-like or machine-like

The question relates to how human-like the robot operates. The movement of the robot's appendages in its workspace. The survey results are shown in Fig. 6.

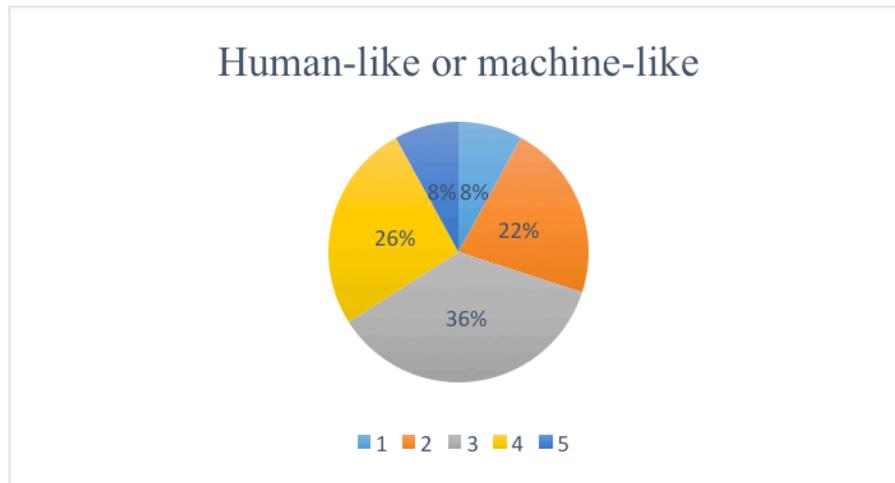


Fig. 6. Human/machine-like movements from the perspective of the customers

According to the results of Fig. 6, the majority of survey participants believe the robot movements were sufficiently human-like. A significant percentage voted for option 3 (medium) and 4 (high).

- Dead or Alive

This question was asked from the customers. Does the mannequin in the showcase feel like it is alive to you? The results of this question are also noteworthy as shown in Fig. 7.

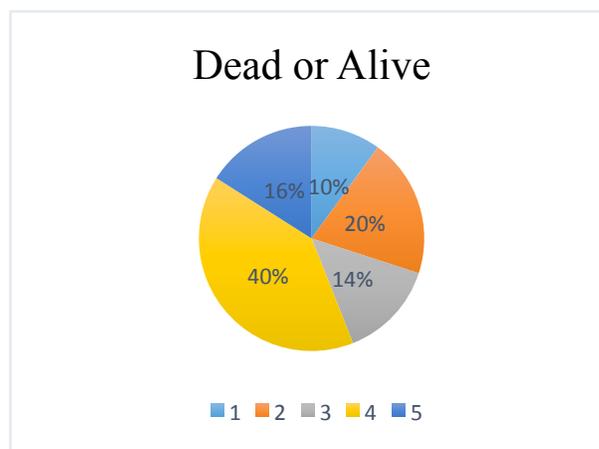


Fig. 7. The audiences/customer's sense about RoMA as a living creature

Seventy-four percent of customers believed that robot mannequins are more than 60 % similar to a living creature; therefore, they will interact with it as a living creature.

### 4.3.3 Likeability

From this perspective, three important factors have been studied and analyzed.

- Creation of a sense of relaxation or anxiety when seeing a robot

This is a very important factor, it is important that customers do not feel distracted after seeing the robot mannequin and that they are not afraid of the moving object inside the showcase. As seen in Fig. 8, 80% of the customers feel comfortable with the robot mannequin. The standard deviation of this data is also 0.8, which indicates that a significant percentage of customers did not feel afraid when seeing the robot mannequin.

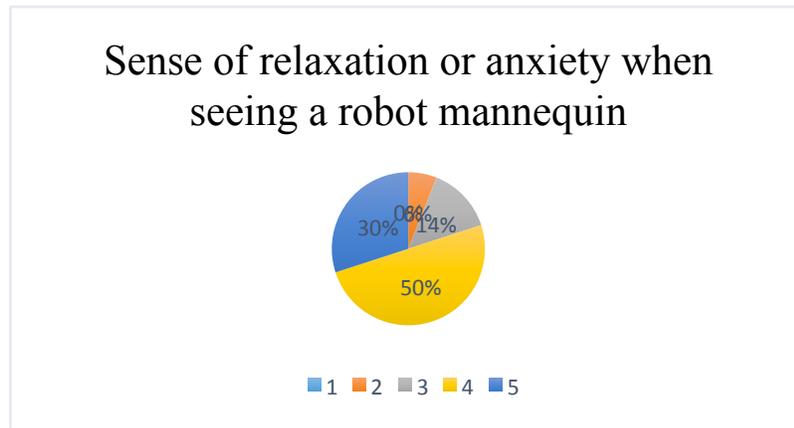


Fig. 8. The sense of relaxation or anxiety when seeing a robot mannequin from the audience's/customer's perspective

- Fearsome or Loveable

After seeing the robot, 78% of the customers believed the robot to be an attractive creature who mimics human movements inside the showcase. These results are presented in Fig. 9. The magnitude of the standard deviation of this feature examined by the Robot mannequin is 0.88, which suggests that the customers overwhelmingly believed that the Robot mannequin is a beautiful entity.

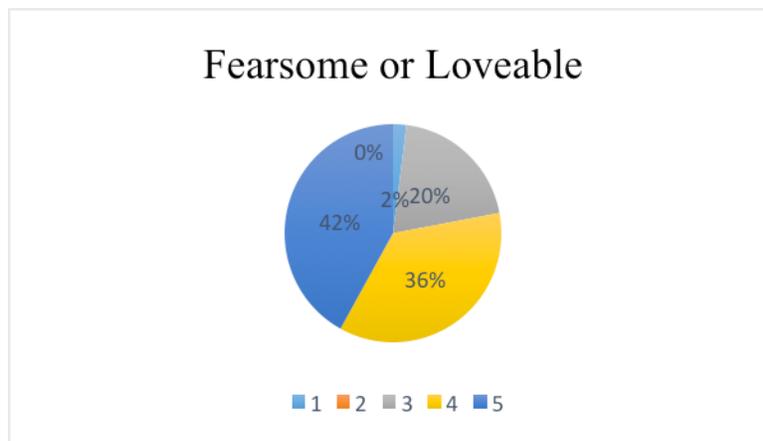


Fig. 9. The robot mannequin was fearsome or lovely from the audience's/customer's perspective

- Kind or Unkind

In another part of the questionnaire, customers were asked about the sense of intimacy they felt with the robot mannequin in their first encounter. In this question, 78% of the customers believed that they experienced a sense of humor and convenience in the first encounter. The results of this question are shown in Fig. 10. A number of customers had interesting views on this. Some expressed that this robot mannequin is like a living creature that mimics human movements, and thus a sense of intimacy in the first encounter between them was formed.

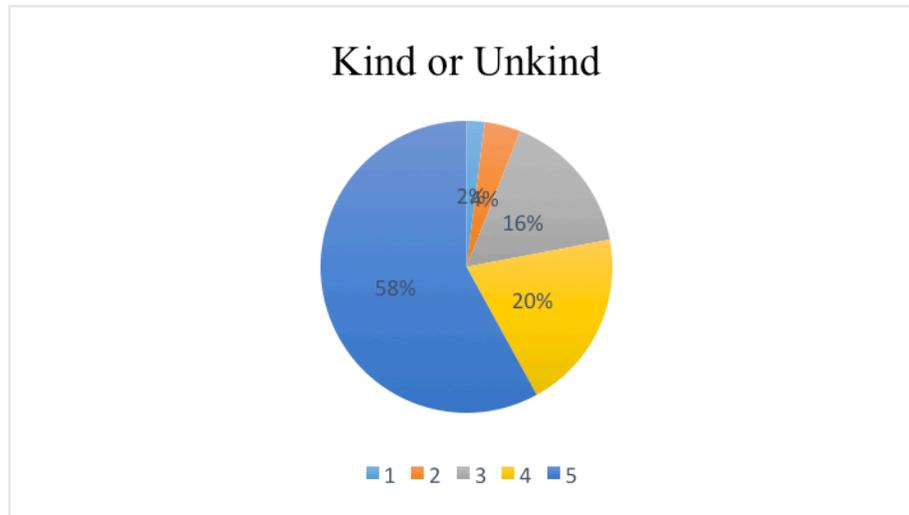


Fig. 10. Kindness of the robot mannequin from audience's/customer's perspective

From the analysis of data from Fig. 5-10 and data from the questionnaire, it is concluded that the uncanny valley hypothesis has been well documented in the mannequin design, and humans are not afraid of this human social robot.

#### 4.4 Reusability of the robot

One of the important features that a robot must have is to keep its attraction in the eyes of the audience/consumer over time. The amount of attractiveness of the moving robot in the audience's view was one of the questions raised in the questionnaire. The thought-provoking result of this question was that the robot maintains its charm in the eyes of 94% of the audience, so they tended to return to the store again not only to watch *RoMa* display different clothes but to buy the clothes.

#### 4.5 The durability of the store's brand name for customers

One of the important effects that the social robot had in dealing with human beings was to preserve the names and locations of the stores as described in the previous sections. The brand name of the store, shown in Fig. 4, remained in the mind for 60 percent of the people following the robot observation. In fact, the use of a mobile showcase caused people to pay more attention to the brand-name and shop location. This result suggests that the use of a social robot makes advertisement more effective and long-lasting in the minds of the audience/consumer.

## 5. Conclusion

The use of the robot mannequin in the showcase of a store and the smartness of the showcase caused it to increase the number of people who looked at the showcase by 280% during the day. Our results also showed that the customer's priority is the way the dress fits the ins and outs of the body and clothing style. Poll results indicated that people prefer to buy a dress after wearing it rather than online shopping. In fact, they preferred to see the dresses in person. These results indicate the significance of using a robot mannequin to display apparel to the customer. The results of the survey on the structural features of the robot showed that with this robot design, the uncanny valley hypothesis is met and customers will not experience any discomfort or anxiety when seeing the robot.

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