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## Article

# Acceptance of social service robots in the hotel industry

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# Marketing Review St.Gallen

## Service Management in the Age of AI and Robotics

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Die Jungfraubahnen im neuen Zeitalter

How Many Tourists Next Weekend? –  
Conceptualizing AI-based Forecasts for  
Visitor Management in Tourism

Employee Responses to Robots  
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Acceptance of Social Service Robots  
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KI bei Bürgerdienstleistungen  
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KI-basierte Verhandlungsroboter  
im B2B-Bereich – Einfluss, Status quo  
und Zukunftsperspektiven

Mittelstand meets KI-Zukunft!



# Acceptance of Social Service Robots in the Hotel Industry

Robots represent technological modernity and are often used for marketing purposes in the hospitality sector to demonstrate an innovative culture. In this paper the guest characteristics determining the use of service robots in hotels were identified. The developed personas confirm the potential of using social service robots in hotels.

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The areas in which robots are used have increased in recent years. In particular, the use of service and social robots in tourism has intensified (Belanche et al., 2021; Ivanov & Webster, 2020; Kılıçhan & Yilmaz, 2020; Pitardi et al., 2024; Wirtz et al., 2018). Wirtz et al. (2018, p. 909) define a service robot in the context of providing services to customers (so-called frontline services) as follows: “Service robots are system-based autonomous and adaptable interfaces that can interact, communicate and deliver service to an organization’s customers.” In addition, social robots are capable of communicating with humans and can establish a relationship with them (Bendel, 2021). A social robot can be made humanoid by transferring human aspects such as facial features (e.g., eyes), facial expressions and gestures (Bendel, 2021). A social service robot is a social robot that provides services to customers.

The Henn na hotel in Nagasaki, Japan, was the first robot hotel to open, providing a practical example of the use of robots in the hospitality sector. In 2019, however, the Henn na Hotel “laid off” about half of its 243 robots, either because they created more work for the employees, disturbed guests or were unable to handle their basic requests (Hertzfeld, 2019). The fact that the technology was quickly becoming outdated further exacerbated the problems. As the robots were designed specifically for usage in this hotel, keeping up with technological developments and guest expectations proved too costly (Gale und Mochizuki, 2019). More recent developments in robot technology and the emergence of software design agencies focusing on programming robots have made it possible to adapt robots for specific service contexts.

Looking at the Swiss hotel industry, most of the robots in use today are service robots without the ability to communicate. In Saas Fee, a pilot project is currently being implemented in partnership with Swiss Post, where a robot is transporting guests’ luggage to their hotel. As a result of new areas of application, an increasing number of companies will be asking themselves how they can utilize service robots to make their processes more efficient, which in turn will have an impact on demand (Belanche et al., 2021; Kılıçhan & Yilmaz, 2020; Wolan, 2020).

In order to ensure the continued usage of robots in hotels, it is crucial to predict how guests will respond to human-robot interactions imposed on them by certain settings.

The aim of this study was therefore to cluster customer segments with respect to attitudes towards social service robots in hotels, demographic variables and hotel stay variables. To obtain the required data, guests of two Swiss hotels were asked to respond to a structured online questionnaire regarding their attitudes towards robots. The questionnaire was developed based on a literature review on the use of service robots and



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robot acceptance (e.g., Bo et al., 2022; Ivanov & Webster, 2019a, 2019b; Ivanov et al., 2020; Wirtz et al., 2018). With these attitudinal questions, we extend the existing literature, as most papers have only analyzed user acceptance according to robot functionalities.

After cluster analysis and its optimization, two distinct clusters were identified. Our results show that the propensity to use

## Management Summary

In recent years, the utilization of robots has increased significantly. To the best of our knowledge, all papers have analyzed the acceptance of robots in terms of their functionalities. None of the papers have focused on creating personas based on findings regarding attitudes towards service robots. To determine the acceptability of social service robots in the hotel industry, a structured online survey of hotel guests was conducted, resulting in two clusters of positive and neutral attitudes towards robots in general and positive and negative attitudes towards social service robots in hotels. While demographic attributes were not found to influence acceptance, key attributes were the general attitude towards robots, previous use of robots, and the fear of competition with humans. Using the derived personas, hotel managers can develop a tailored strategy.

robots is not related to demographic characteristics, but rather to attitudes and previous experience with robots. The potential of using robots to assist frontline staff in their daily work was confirmed for both hotels analyzed in this study.

## Literature Review

This section briefly describes the literature related to attitudes towards robots and to customer segmentation.

### Attitudes Towards Robots

First, there are different attitudes in society towards the use of robots in general and social robots in the hotel industry in particular. Therefore, a successful deployment of social service robots in the hotel industry depends on the attitudes of the guests who have to interact with them. Since attitudes are heterogeneous, it is only logical that not all guests will accept a robot as a service provider.

Kazandzhieva and Filipova (2019) generally distinguish four different groups:

- (1) Active supporters, who have a positive attitude towards robots and actively use them.
- (2) Passive advocates, who have a positive attitude towards the use of robots and support the use of robots, but do not use them.
- (3) Active critics, who have a negative attitude towards robots and do not use them.
- (4) Passive critics, who are opposed to the use of robots, but use them in certain situations.

As the quality of services provided by robots increases and the benefits provided to the guest increase as well, the proportion of passive supporters and passive critics will increase as a result (Belanche et al., 2020; Ivanov et al., 2020; Kılıçhan & Yilmaz, 2020). In addition, the number of active critics is expected to decrease in the future due to generational change.

Studies have shown that attitudes toward robots depend on the gender, age, and nationality of the guests (Ivanov et al., 2018). For example, men and younger individuals are generally more likely to have positive attitudes toward robots than women and older individuals (Ivanov & Webster, 2019a, 2019b). According to Kamide and Arai (2017), different cultures have different attitudes towards robots. These are mainly based on



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how people assess the behavior of non-human agents, taking into account known human behavior (Kamide & Arai, p. 537). In this context, Adkim et al. (2023) have shown that robots that are less humanoid tend to elicit more positive attitudes and, interestingly, that their acceptance almost reaches the level of human employees.

The added value for guests (Bo et al., 2022; Song & Kim, 2022) and the perceived ease of use (Ivanov & Webster, 2019a, 2019b) are also decisive factors. Service robots that provide services in low-cost settings in contexts that are more transaction-based (in contrast to interaction-based) are seen as most appropriate (Adkim et al., 2023).

## Customer Segmentation

Hotel managers aim to provide their hotel guests with the best experience and to meet their expectations, which increases guest loyalty (Alsayat, 2023). To better understand the characteristics and behavior of groups, customer segments are constructed (Wedel & Kamakura, 2000). To create personas, data-driven marketing methods are applied using unsupervised learning techniques (van Leeuwen & Koole, 2022). For this purpose, customer behavior data are used to create customer segmentation. This allows a strategy to be tailored to a specific group (van Leeuwen & Koole, 2022).

In design thinking, customer segments are described by personas. A persona is the description of a typical customer who exhibits many of the attributes that characterize a particular group, for example, by considering attitudes or behaviors (Chen & Liu, 2015). Personas represent a descriptive person which characterizes the cluster. The personas used to illustrate the customer segmentation in this study were derived from the results of the cluster analysis. The personas are used to reduce the level of abstraction so that hotel and marketing managers can devise strategies and work operationally with images of real-life people rather than abstract clusters.

## Methods

The goal of forming personas or customer segments is to create groups with similar patterns, as described above. This is done using unsupervised machine learning methods such as clustering. Clustering reveals the underlying structure of the data and allows for the creation of groups with similar attributes. For this study, the most common clustering method, called k-means, was applied to create clusters (James et al., 2013; Kuhn & Johnson, 2013) and determine the similarities between guests. The personas are described based on the centers of the clusters.

### Main Propositions

- 1 The two customer clusters do not differ along demographic variables.
- 2 Decisive factors are general attitude towards robots, previous use, and fear of competition with humans.
- 3 The two customer clusters differ along the variables representing attitudes towards social service robots in hotels.
- 4 The results indicate a potential use of robots for each hotel, but not as a stand-alone feature.

In k-means, the number of clusters needs to be determined at the beginning of the execution of the algorithm. The optimum number of clusters was determined using the gap statistic, which is a less subjective method than the elbow method or the silhouette score (see Tibshirani et al., 2001). The results of the gap statistic, hence, give us the optimal number of personas to address in this paper.

## Dataset Description

The aim of this study was to identify customer segments according to the attitudes of Swiss hotel guests towards social service robots. Today's technological development, as described in the introduction, confronts hotels with the question of whether they should deploy social service robots. At the time the project was conducted, no data existed on the attitudes of Swiss hotel guests towards social service robots. To collect these data, a structured online questionnaire survey was conducted in two Swiss hotels in the Zurich region. One is a superior three-star hotel close to the airport offering rooms, suites, and serviced business apartments. The other is a luxury boutique city hotel in the center of Zurich that prides itself on being digitally innovative. The authors designed a questionnaire that included questions about guests' attitudes toward social service robots, about their hotel stay, travel arrangements, and demographic background. The attitudes towards social service robots were determined using Likert scales with five options ranging from extremely negative to extremely positive or from strongly disagree to strongly agree, depending on the question. Further questions were included to gather data on the hotel stay via the following variables: length as well as purpose of stay and whether it was their first stay at the hotel or not. Also, a distinction was made between different types

of travel parties (e.g., solo guests, guests with partners, colleagues or friends and families). For the demographic variables, age, sex, country of residence and educational level were collected. The variable “age” was collected as a specific number rather than in age groups, while for other questions participants had to choose from a list of options. All variables and the corresponding options are described in Table 1 in the online Appendix.

It is of great importance for hotels to understand their guests' attitudes well to be able to assess whether the use of social service robots is worthwhile.

A link to the online questionnaire was sent to all guests of the participating hotels via the standard after-stay email. The structured online questionnaire was live from November 2020 to November 2021. Therefore, data collection was strongly affected by the COVID-19 pandemic, with very low numbers of guests staying in the hotels. As a result, the number of responses was much lower than anticipated. Over the course of one year, 318 complete responses were collected. Unfortunately, the project ended while the COVID-19 restrictions were still in place and no further data acquisition could be performed.

## Cluster Analysis

The detailed results of the cluster analysis are presented in Table 2 in the online Appendix. Small values indicate that the variable has no influence, while high values indicate an important contribution. All values are scaled between 0 and 1. The optimal number of clusters was determined via the gap statistic as outlined above. The two customer clusters obtained cannot be differentiated by gender, nationality, travel party or level of education. Rather, the general attitude towards robots, combined with the previous use of robots and the fear of competition with humans, allows to describe the two customer clusters in opposition to each other. These variables determine the acceptance of social service robots in the hotel industry.

The characteristics of the two cluster centers were used to create descriptive personas (see Table 2 in the online Appendix). To make the personas more relatable, each cluster was given a name. As only the attitudinal variables towards the use of social service robots allow differentiation of the clusters, these characteristics are used to describe the personas. The two personas are described as follows:

- Cluster 1 (49% of respondents): “Riley” has a positive attitude towards robots and does not believe that the use of robots will lead to less human-to-human interaction. He believes that robots should be used to simplify complex work processes. He uses both self-service checkout machines and household robots in his daily life. Consequently, “Riley” is seen as a robot user in the context of hotels.
- Cluster 2 (51% of respondents): “Alex” has a neutral attitude towards robots in general. He is critical of the ever-expanding areas of their application and thinks that robots will eventually reduce human-to-human interaction. Additionally, he is convinced that robots will take away jobs and should therefore only be used for routine tasks. “Alex” thus has a negative attitude towards the use of robots in the context of hotels.

The findings clearly show that guests in cluster 2 are neutral when asked for their attitude towards robots in general. However, when asked for more detailed assessments, these guests take a clearly negative position. “Alex’s” negative attitude towards the use of social service robots may be due to his view that the use of robots will reduce human interaction. In accordance with Kazandzhieva and Filipova (2019), “Alex” can be identified as an active or passive critic, while “Riley” is an active supporter or a passive advocate.

## Conclusion

In the era of the development of artificial intelligence and the simultaneous shortage of human resources, the use of robots or automated processes may counteract staff shortages. This paper analyzes whether service robots can be successfully

### Lessons Learned

- 1 Robots should not be used solely as a marketing tool. The integration of robots in hotels should be well aligned with guest expectations and needs.
- 2 Guest feedback needs to be continuously monitored and hotel operations should be adjusted accordingly to ensure alignment with changing guest preferences and attitudes over time.
- 3 Customer attitudes should form the basis for developing customer segments and for tailoring strategies for the use of social service robots in hotels.

deployed in hotel environments. For this purpose, customer segments were created using a clustering algorithm on the basis of a structured online questionnaire. The results of the cluster analysis provide an understanding of the attitudes towards the use of social service robots in hotels, and a tailored strategy can be developed based on the results. To help hotel managers get a better understanding of the customer segments obtained through clustering, the level of abstraction was reduced by converting the centers of the clusters to personas.

Contrary to Ivanov et al. (2018, 2019a, 2019b), the results show that demographic characteristics such as sex, age or nationality are not significant for the differentiation into separate clusters. The attitudes of guests towards robots in general and their

previous experience with robots are particularly important for customer segmentation. Thus, the research shows that it is of great importance for hotels to understand their guests' attitudes well to be able to assess whether the use of social service robots is worthwhile. Furthermore, our results show that in both hotels, almost half of the guests support the use of social service robots. Robots could therefore be used to address staff shortages, but not in all contexts. The results are a snapshot in time and are subject to change as attitudes continue to evolve. ■



For further supplementary tables to the article, visit:  
<https://unisg.link/MRSG-staud-mosedale>

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# Acceptance of Social Service Robots in the Hotel Industry

Table 1: List of the Variables Used in the Questionnaire and the Corresponding Response Options

Variables	Abbreviations	Format
<b>Attitudes to Robots</b>		
Attitude to robots	ATR	Categorical: Five-point Likert scale from extremely negative to extremely positive
Robots will encourage less human interaction.	ATR	Categorical: Five-point Likert scale from strongly disagree to strongly agree
Robots can make life easier.	RLI	Categorical: Five-point Likert scale from strongly disagree to strongly agree
Robots scare me.	RSM	Categorical: Five-point Likert scale from strongly disagree to strongly agree
Robots should only perform routine tasks.	RPT	Categorical: Five-point Likert scale from strongly disagree to strongly agree
Robots are a natural development of modernity.	NDM	Categorical: Five-point Likert scale from strongly disagree to strongly agree
Robots take away jobs.	TAJ	Categorical: Five-point Likert scale from strongly disagree to strongly agree
<b>Robots at the hotel</b>		
Personal attitude towards using humanoid service robots in hotels	PHR	Categorical: Five-point Likert scale from extremely negative to extremely positive
<b>Usage</b>		
Ever used or currently using robots	CUR	Binary: Yes or No
<b>Service</b>		
Self-service checkout choice	SSC	Categorical: Four-choice scale with never, rarely, usually, always.
<b>Hotel of residence</b>		
Hotel	HOT	One of two hotels where the questionnaire was completed
<b>Length</b>		
How many nights did you book?	NIG	Length of stay with options 1, 2, 3, 4, 5, 6, 7, more than 7
<b>Information on stay</b>		
First stay at the hotel	FSH	Binary: Yes or No
<b>Purpose</b>		
Main reason of stay	MRS	Categorical: With two categories, business and leisure/holiday
<b>Description of travel party</b>		
Travelling on my own	TMO	Binary: Yes or No
with partner	PAT	Binary: Yes or No
with colleague(s)	COL	Binary: Yes or No
with friend(s)	FRI	Binary: Yes or No
Family with children under 12	FCU	Binary: Yes or No
Family with children 12-17 years	FC17	Binary: Yes or No
Family with children over 17	FCO	Binary: Yes or No
<b>Demographic questions</b>		
Age	AGE	Numeric value
Sex	GEN	Binary: Female and Male
Education	EDU	Categorical: no schooling completed, primary, secondary, vocational, undergraduate, graduate, doctoral education
Country	COU	Categorical: All country options worldwide

Source: Own illustration.

**Table 2: Results of the Clustering, with Means for Each Cluster Along the Variables Used in the Questionnaire**

Variables	Cluster 1	Cluster 2
<b>Attitude to robots</b>		
Extremely positive	0.19	0.01
Positive	0.74	0.04
Neutral	0.06	0.74
Negative	0.01	0.018
<b>Robots will encourage less interaction.</b>		
Strongly agree	0.04	0.19
Somewhat agree	0.22	0.52
Neither agree nor disagree	0.22	0.22
Somewhat disagree	0.40	0.04
Strongly disagree	0.11	0.02
<b>Robots can make life easier.</b>		
Strongly agree	0.31	0.07
Somewhat agree	0.66	0.58
Neither agree nor disagree	0.03	0.26
<b>Robots scare me.</b>		
Somewhat agree	0.04	0.14
Neither agree nor disagree	0.05	0.30
Somewhat disagree	0.44	0.35
Strongly disagree	0.47	0.17
<b>Robots should only perform routine tasks.</b>		
Strongly agree	0.11	0.16
Somewhat agree	0.28	0.41
Neither agree nor disagree	0.23	0.32
Somewhat disagree	0.27	0.09
<b>Robots are a natural development of modernity.</b>		
Strongly agree	0.33	0.07
Somewhat agree	0.56	0.55
Neither agree nor disagree	0.07	0.27
<b>Robots take away jobs.</b>		
Strongly agree	0.09	0.23
Somewhat agree	0.26	0.43
Neither agree nor disagree	0.22	0.27
Somewhat disagree	0.34	0.07
<b>Personal attitude towards using robots</b>		
Extremely positive	0.13	0.01
Neutral	0.26	0.43
Negative	0.04	0.35
Extremely negative	0.03	0.11
<b>Currently using robots</b>		
Yes	0.72	0.43
<b>Self-service checkout choice</b>		
Always	0.35	0.09
Never	0.02	0.10
Rarely	0.09	0.30

Table 2: Results of the clustering, with means for each cluster along the variables used in the questionnaire (continuation)

Variables	Cluster 1	Cluster 2
<b>Hotel</b>		
Opera Hotel	0.71	0.65
<b>Length of Stay</b>		
1	0.59	0.52
2	0.16	0.23
3	0.10	0.11
4	0.06	0.06
<b>First stay</b>		
Yes	0.65	0.59
<b>Main reason of stay</b>		
Leisure	0.62	0.70
<b>Travel Party</b>		
Travelling on my own (Yes)	0.38	0.36
With partner (Yes)	0.35	0.37
With colleague (No)	0.96	0.94
With friend (No)	0.88	0.93
Family with children (No)	0.83	0.84
<b>Age</b>	0.48	0.52
Female	0.41	0.48
<b>Country</b>		
Germany	0.17	0.17
Switzerland	0.55	0.64
<b>Education</b>		
Bachelor	0.25	0.21
Doctorate	0.15	0.06
High School	0.03	0.09
Master	0.35	0.35
Trade/technical/vocational training	0.20	0.27

Source: Own illustration.