Artificial Intelligence and Robotics in Marketing

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Artificial Intelligence and Robotics in Marketing

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This chapter illustrates the role of artificial intelligence (AI) and robotics in marketing and will help managers develop a deeper understanding of its potential to revolutionize the service experience. We summarize the use of AI and robots in practice and show that the adoption of AI predominantly occurs at the task level rather than the job level, implying that AI takes over some tasks that are part of a job and not the entire job. Based on these insights, we discuss opportunities and drawbacks of AI and robots and reflect on whether service robots will complement or substitute human employees. Moreover, we explain why many consumers are still reluctant to engage with these new technologies and which conditions should be met in order to benefit from using service robots.

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TABLE 0

The idea in brief

Issue	Response	Bottom Line
What is artificial intelligence (AI), what is a robot and how can it generate value for firms	AI can correctly interpret external data, learn from it, and apply what it has learned to perform specific tasks. A robot is AI with a physical casing around it. It offers a wide range of potential benefits, including cost reduction, revenue growth, productivity gains, scalability, security, as well as improved customer retention.	Firms need actionable guidance on how, when, and to what extent AI and robots should be adopted. Further, they need to understand consumers' attitudes and behaviors towards it.
How should service robots be deployed and which tasks should they take over	Robots will not steal jobs in the near future; rather they should take over mundane tasks first because they can deliver services in an efficient, reliable, accurate, convenient and fast way.	A seamless incorporation of robots into the service team and good AI-human collaboration is a must. Robots have the potential to revolutionize the service experience in many industries.

What is artificial intelligence, what are robots?

"California restaurant turns to robot for extra help as it struggles to hire workers", "Robotic technology and AI revitalize the hotel experience", and "Are robots stealing our jobs?" are some examples of the increasing news headlines about the rise of service robots. They highlight that advances in robotics and artificial intelligence (AI) are gaining broad attention across all industries. Given the accelerating adoption of robotic technologies, it is estimated that approximately half of today's work activities could be automated by 2055 (McKinsey Global Institute 2017). While industrial robots are already widely employed in manufacturing and production, robots are increasingly used also in service provision. Worldwide revenue of customer service robots reached US$53.77 million in 2016. The global market for customer service robots is predicted to grow seven times faster than the market of industrial robots (Business Insider 2015), and expected to reach a market value of US$87.97 million by the end of 2022 (Tractica 2017). A robot is defined as "embodied artificial intelligence", i.e., artificial intelligence with a physical casing around it.

Artificial intelligence can correctly interpret external data, learn from it, and apply what it has learned to perform specific tasks in a flexible way. By doing so, artificial intelligence mimics parts of our human intelligence and may perform activities such as learning speech and recognition (Huang and Rust 2018). In customer service, AI can have a virtual presentation, like Apple's virtual assistant Siri or a physical presentation, like the robot Pepper or the C-3PO Star Wars character. A robot as embodied AI can therefore perform both physical and non-physical tasks with a high degree of autonomy and in an environment that is complex (Jörling, Böhm and Paluch 2019).

In addition, robots can either have a humanoid or non-humanoid appearance. On the one extreme, there is the humanoid robot Sophia who looks like a real person and even was offered the citizenship of Saudi Arabia, thus being the first robot to be given legal personhood anywhere in the world. On the other extreme, there are non-humanoid robots like the Roomba vacuum cleaner or the da Vinci Surgical System (Wirtz et al. 2018).

Robotics and AI offer a wide range of potential benefits to organizations and can include cost reduction, enhanced reliability, productivity gains, scalability, improved security and compliance, revenue growth, as well as improved customer retention and improved creativity of managers. Furthermore, the deployment of AI and robots can be a solution in industries that face personnel shortages, such as health care.

The use of AI and robots in practice

Many companies are currently heavily investing in AI. Robotics has the potential to revolutionize customer engagement by transforming the service experience and influencing the extent to which customers intend to use a brand. Chui, Manyika, and Miremadi (2016) stress that although robotics first found its way in industrial manufacturing, its greatest potential lies in customer service. Table 1 summarizes the use of robotics in practice.

TABLE 1

The use of robotics in practice (Adapted from Mende et al. 2019)

Industry	**Example**	**Scope and investment**	**Companies using the technology**	**Robot type**
Food Services / Restaurants	"Pepper" waiter taking orders and processing payments		Pizza Hut and Mastercard	Humanoid
	Robot waiter	Restaurants in China	Different restaurants	Humanoid
	"DRU" pizza delivery robot	$17.2 million by Starship Technologies: will roll out in all 12.500 Domino's stores	Domino's	Nonhumanoid
	Bionic bar	$2.2 million	Royal Caribbean	Nonhumanoid
	Robot barista	$5 million	Café X Technologies	Nonhumanoid
	Delivery robot that cooks pizza while driving	$48 million > 1.000 human employees in 2018	Zume Pizza	Nonhumanoid
	Robot waiter serving drinks and entertaining customers	16 robots	Enjoy Budapest Café	Humanoid
	Robo Chef		Moley	Humanoid
Hospitality / Travel	"Pepper" enhances visitors' experiences	Six museums	Smithsonian Institute	Humanoid
	Hotel staff		Henn-na Hotel, Hilton	Humanoid
	"Pepper" in customer service in train stations and airports	3 train stations in France, Oakland airport	SNCF	Humanoid
	Robotic butler "A.L.O."	$2 million	Starwood Hotels Aloft	Nonhumanoid

Retail	"Pepper" providing customer service for coffee machines	1.000 Nescafé stores	Nestlé	Humanoid
	LoweBot, OSHBot		Lowe's	Humanoid
	Greeter in shopping mall	2.000 SoftBank shops	SoftBank stores, Mitsukoshi department store, Carrefour	Humanoid
	Hologram robot		Microsoft	Humanoid
	"Tally" monitors product pricing and inventory		Target	Nonhumanoid
	Delivery robots (food, groceries, parcels)	>1,500,000 autonomous deliveries; $85 million	Starship Technologies	Nonhumanoid
	Roomba robot vacuum cleaners	>30 million robots sold	iRobot	Nonhumanoid
Healthcare	"Zora" bot for health and elderly care	Over 400 sold, worth $ million	Hospitals and other healthcare facilities	Humanoid
	DaVinci surgical system	$6.1 million	Cincinnati VA Medical Center	Nonhumanoid
	Rehabilitation robots	$1 billion	Toyota	Nonhumanoid
	"TUG" robots	130 hospitals	Healthcare facilities	Nonhumanoid
	"ElliQ" social companion robot	$14 million by the Toyota Research Institute	Elderly homes	Nonhumanoid
	"Moxi" assisting clinical staff		Hospital or clinical environment	Humanoid
	Companion robot	Used at >80 institutions in US	Hospitals and other healthcare	

Owing to challenges associated with aging populations and an ever-increasing shortage of personnel, the healthcare sector has invested heavily in robots and other technological solutions. This is where the greatest growth in robot deployment in the Netherlands is expected (Rijksdienst voor Ondernemend Nederland 2017). For example, the robot Zora regularly comes into action in different nursing home organizations across the Netherlands, used for pleasure and entertainment or to stimulate the physical activities of clients in residential care (Huisman and Kort 2019).

Next to the healthcare industry, technological advancements can also be found in hospitality. Scholars indicate that 73% of the activities that employees perform in food service and accommodations could be automated (Chui, Manyika, and Miremadi 2016), including preparing and serving food and drinks, cleaning food-preparation areas, and collecting dirty dishes. A restaurant in China has already replaced its waiters with robotic ones, which can take orders, deliver food, and speak to customers in simple Mandarin phrases (Nguyen 2016). Also Starwood Hotels has started to notice the potential of using service robots. The company has launched robotic butlers into their Aloft line to deliver toothbrushes, razors, and similar items to guest rooms (Solomon 2014).

Similar robotic applications can be found in the retail industry, with several companies implementing AI solutions to their stores. For instance, Lowe's introduced an autonomous retail service robot in 11 of its stores throughout San Francisco in 2016. North Face utilizes Watson as its in-store sales assistant that asks customers several questions and then makes a recommendation accordingly. Walmart has announced to deploy robotic floor cleaners, in-store pickup towers, shelf scanners, and truck unloaders across its hundreds of stores in the U.S. for the purpose of cost cutting. Its robotic shopping cart, called Dash, is now in the trial and evaluation period and will enter production soon.

Overall, the accessibility of AI-delivered services gives not only larger but also smaller companies the potential benefit of remarkable economies of scale and scope, given that the majority of costs arise in their development. Although robots or AI systems have its price (e.g., 20.000€ for the humanoid robot Pepper), one should keep in mind the huge scalability. Particularly, virtual AI services such as customer chatbots can be deployed at insignificant incremental cost, scaled at close to zero (Wirtz, Kunz and Paluch 2021). Cost saving is often still the main driver for organizations to deploy robots in their service settings. For instance, customer service costs can be reduced by up to 30% by using chatbots and virtual assistants as conversational solutions (Techlabs 2017).

In other instances, technical solutions have to be considered due to unaffordable human labor costs, which can often be found in healthcare services. For example, a German research team is currently working on a system of smart speakers and home automation solutions that send people with dementia back to bed when they get up at two in the morning and get dressed. Such intensive supervision is nearly impossible with normal human carers, thus, AI might be deployed in a way without unduly compromising patients' care experience (Amiribesheli and Bouchachia 2018).

Furthermore, robot application can have skills that human workers do not have. One large advantage the current generation of robots has is their versatility regarding language. For instance, the robot FRAnny assists international travelers at Frankfurt Airport and guides customers through their service journey. The robot helps customers in multiple languages and answers questions like flight departure times or the nearest accessible restroom (Frangoul 2019). Also in a health care environment with an increasing inflow of multilingual clients, multilingual robots can be advantageous. With advancing age, people can experience language loss (attrition) and retreat to their first language, which can be a foreign language, but also a regional one. Previous literature indeed shows that a local accent of synthetic voices is more positively viewed than a non-local one (Alamasaputra et al. 2006; Tamagawa et al. 2011). Developing robots that can also adapt to their user in terms of language is therefore an important avenue for the future. One example is a Pepper robot equipped with a synthetic version of the local "Grunnegs" dialect (https://groningserobot.webhosting.rug.nl/). In a field study where respondents could interact with Pepper speaking the regional language "Grunnegs" or Dutch, researchers found that the regional robot voice is evaluated as better understandable, more natural, and more pleasant than the Dutch robot voice. This higher evaluation leads to higher trust in the robot. Yet, the robot speaking regional language was also perceived as more eerie (van Doorn 2020).

Which tasks can AI and robots perform?

The use of AI and robots predominantly occurs at the task level rather than the job level, implying that AI takes over some tasks that are part of a job and not the entire job. AI taking over tasks has the potential advantage that humans can better focus on and perform in core task, such as building customer relations. Originating from process automation, robots have become highly effective at performing repetitive tasks previously performed by humans, such as carrying objects and undertaking monotonous assembly jobs. Robots are increasingly capable of more sophisticated physical as well as cognitive activities, ranging from offering wealth management advice and identifying spills on a shop floor to detecting worsening dementia. More advanced functions of service robots are employed in professional services, such as financial auditing and assisting in medical procedures through voice-activated robotic arms.

Huang and Rust (2018) classify tasks as requiring different types of intelligence: mechanical, analytical, intuitive, and empathetic. *Mechanical intelligence* performs repetitive tasks for consistent and reliable performance such as the robot Pepper taking on frontline greeting tasks at a hotel lobby. Learning and adaptation is here at its minimum. *Analytical intelligence* analyzes and makes decisions rationally, which involves learning and adapting systematically based on specific, non-contextual data. An example would be Toyota's in-car intelligent system that replace problem diagnose tasks for technicians. *Intuitive intelligence* analyzes and makes decisions intuitively, which implies learning and adapting based on understanding and richer contextual data. For instance, an American news agency company announced in 2016 that Minor League Baseball games are now being covered by robot reporters. As such, they were upping its narrative sports reporting game by letting robots generate recaps. Lastly, *empathetic intelligence* has the capability to recognize, emulate, and respond appropriately to human emotions. Take the chatbot companion Replika, designed for anyone who wants a friend with no drama or judgment involved. The AI may counsel someone through insecurities and social anxiety, while being ever-patient and, thus, replacing psychiatrists for psychological comfort. This implicates learning and adapting based on experience.

These tasks are listed in the order of difficulty with which AI masters them (see Figure 1). While mechanical tasks are already taken over by AI – industrial robot or surgical robots for instance –, AI still struggles when taking over tasks that require higher intelligences. AI applications for analytical tasks can also increasingly be found, such as IBM's Watson in Accounting or self-driving car systems. Jobs that are comprised of tasks requiring different intelligences will be the best candidates for human–machine integration. A full overview is given in Table 2 by Huang and Rust (2018).

FIGURE 1

The four intelligences (Huang and Rust 2018)

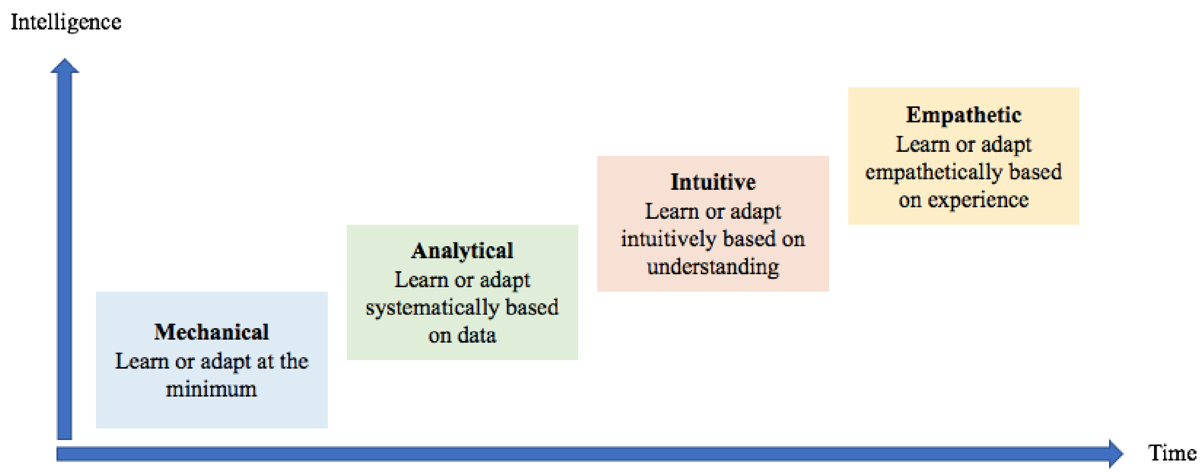


TABLE 2

Intelligences, Nature of Tasks, Job Replacement, and Service Implications (Huang and Rust 2018)

Intelligences			Job Replacement
AI	Skill / Labor	Nature of Tasks	AI Applications
Mechanical			
• Minimal degree of learning or adaptation • Precise, consistent, and efficient • For example, self-service technologies and service robots • Rely on observations to act and react repetitively	• Skills that require limited training or education • Call center agents, retail salespersons, waiters / waitress, and taxi drivers	• Simple, repetitive, standardized, routine, and transactional tasks • Tasks require consistency • Commodity service	• McDonald's "Create Your Taste" touch screen kiosks • Robot Pepper takes on frontline greeting tasks • Virtual bots turn customer service into self-service
Analytical			

• Learns and adapts systematically based on data • Logical, analytical, and rule-based learning • For example, IBM’s chess player Deep Blue • Rational decision-making	• Technical skills requiring training and expertise on data and analysis • Technology-related workers, data scientists, accountants, financial analyst, auto service technicians, and engineers	• Analytical, rule-based, systematic complex tasks • Tasks require logical thinking in decision-making • Information, data and knowledge-based service	• Toyota’s in-car intelligent systems replace problem diagnose tasks for technicians • IBM’s Watson helps H&R Block for tax preparation • Penske’s onboard technology takes over navigation tasks
Intuitive			
• Learns and adapts intuitively based on understanding • Artificial neural networks-based or statistical-based deep learning • For example, Watson’s Jeopardy, Google’s DeepMind AlphaGo, and AI poker player Libratus • Boundedly rational decision-making	• Hard thinking professionals that require creative thinking for problem-solving skills • Marketing managers, management consultants, lawyers, doctors, sales managers, and senior travel agents	• Complex, chaotic and idiosyncratic tasks • Tasks require intuitive, holistic, experiential and contextual interaction, and thinking • Personalized, idiosyncratic, experience- and context-based service	• Associated Press’s robot reporters take on the reporting task for Minor League Baseball games • Artificial intuition takes on the data interpretation task in Gestalt psychology • Narrative Science’s AI Quill writes as if human authors
Empathetic			
• Learns and adapts empathetically based on experience • Emotion recognition, affective computing, and communication style learning	• Soft empathetic professionals that require social, communication, and relationship building skills • Thinking jobs requiring people skill (e.g., politicians and negotiators) or feeling	• Social, emotional, communicative, and highly interactive service • Tasks that require empathy, emotional labor, or emotional analytics • High-touch service	• Chatbots communicate with customers and learn from it • Replika replaces psychiatrists for psychological comfort

• For example, Hanson's Sophia and chatbot Replika • Decision-making incorporates emotions	jobs (e.g., psychiatrists)		• Sophia robots interact with customers as if employees

Service robots are generally expected to take over the routine tasks from employees. For example, robots can outperform humans in data gathering and analysis, in handling generic customer inquiries and generally, in executing tasks that are typically repetitive, common and structured, with little to no differentiation. Service robots have the ability to deliver services in an efficient, reliable, accurate, convenient and fast way. Overall, service robots are expected to deliver services that fulfill either primarily functional needs (e.g., ticketing services). The Service Robot Deployment model states that service robots could take over service tasks with nearly any degree of cognitive almost all tasks with low social/emotional complexity (Wirtz et al. 2018; Paluch, Wirtz and Kunz 2020). Yet, service tasks that require high social/emotional complexity mostly have to be performed by employees given that service robots are not be able to engage in deep emotional acting in the near future. Since robots are controlled by algorithms and have no inner emotions, they are not a great fit for services that require empathy and uniqueness (e.g., intuitive and empathic intelligences). These service tasks should still be performed by human employees who can bring genuine emotions like excitement, compassion or joy to the service encounter.

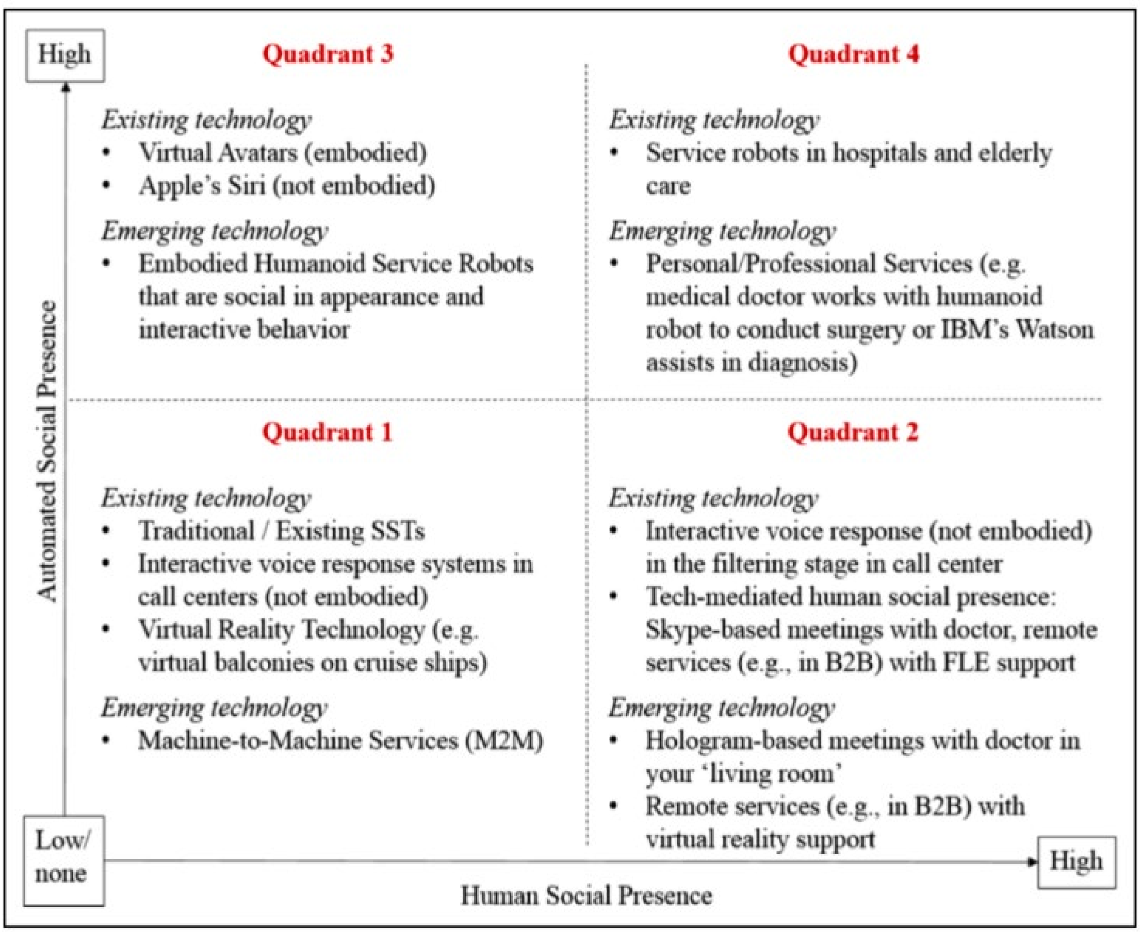
AI and robots with a social function: Automated Social Presence

An important question is how the current generation of automation (e.g., AI and robots) differs from previous generations of automation (e.g., cash machines). What makes AI and robotics fundamentally different? The answer is that these new technologies engage their users on a social level, thus, one interacts with the robot in much the same way as with service employees. Previous literature has coined the novel term "automated social presence" to denote that AI and robots distinguish themselves from traditional self-service technologies by "the extent to which technology makes customers feel the presence of another social entity" (Van Doorn et al. 2017, p.43).

Current and emerging AI technology can consist of different combinations of automated and human social presence. Figure 2 summarizes these different combinations, distinguishing between services with high and low human and high and low automated social presence (van Doorn et al. 2017). Overall, in quadrants 1 and 2, AI has no or low social presence and only performs tasks that require analytical and mechanical intelligence. In quadrants 3 and 4, AI has higher social presence and also performs tasks that require intuitive and empathetic intelligence.

FIGURE 2

A typology of technology infusions into customers' service frontline experiences (Van Doorn et al. 2017)



Low automated social presence and low human social presence (Quadrant 1)

Quadrant 1 includes services without any social element that are already largely automated, such as the automated teller machine (ATM). Further developments are expected by machine-to-machine communication and the so-called Internet of Things, as a result of which more and more everyday objects have sensors and are connected to the Internet, such as a smart thermostat.

Low automated social presence and high human social presence (Quadrant 2)

In quadrant 2 the focus is on human social presence, and technology is a tool to transport it (e.g., telepresence robots). This kind of robot is already regularly used not only in healthcare, but also for meetings and conferences. Hologram technology is also increasingly seen as a possible alternative when people cannot travel due to restrictions such as recently under the COVID 19 pandemic, or strive to reduce their travels to save time, or CO2 emissions.

High automated social presence and low human social presence (Quadrant 3)

To facilitate robot–customer service interactions, firms often prefer human-like service robots to increase a customer's perception of social presence. These robots show human characteristics, have a human shape, or mimic human behavior. There are already some humanoid robots in practice, such the waiter "Pepper" who takes orders and processes payments for Pizza Hut in cooperation with Master Cards in Japan. Another example is the Furhat robot calles FRAnny that speaks 40 languages and has been used in Frankfurt airport as a multilingual concierge, helping travelers find their way (Frangoul 2019).

High automated social presence and high human social presence (Quadrant 4)

Next to replacing human workers with AI, there is also the possibility of AI-human collaboration. Ivy is an automated virtual concierge based on IBM Watson and is implemented by Caesar's Palace and responds to guest requests. When Ivy cannot provide a confident response, a human front desk agent will be prompted to address requests or inquiries. According to Caesar's Palace, the average resolution time for manual guest text messages has been reduced to less than one minute. Another practical example is Humana, an U.S. based healthcare company that utilizes AI software trained to detect conversational cues to coach their call center agents and supervisors. The digital coach Cogito Dialog alerts call center agents to cues that signal increased agitation, such as a rise in the pitch of a customer's voice. Humana reports an 63% improvement of employee engagement scores and 28% improvement of customer satisfaction. Yet, the customer contact is handled entirely by the human (Nichols 2019).

Regarding the robot-employee working relationship, research has indicated that robots can simultaneously enhance employee satisfaction and productivity. For instance, Noone et al. (2012) suggested that robots could augment employees' cognitive capacity. In a healthcare context, Barrett, Oborn, Orlikowski and Yates (2012) found that the usage of pharmaceutical-dispensing robots in hospitals allows pharmacists more time to engage with and care for their patients.

Besides the potential benefits for employees, there is also a potential negative impact of robots on service employees. Service employees may experience perceived loss of autonomy and frustration in their jobs. In a healthcare context, service robots can challenge employees in their task coordination. These together can produce numerous tensions for employees such as feelings of dismemberment and disempowerment, depersonalization (i.e., experience of disengagement and disruption) and clinical voyeurism (i.e., service employees experiencing discomfort when watching their patients through the screen; Green, Hartley and Gillespie 2016). Robotics might also make it more difficult for employees to learn, leading to confusion, lower trust and increased miscommunication (Beane 2019).

Anthropomorphism or humanlikeness of Automated Social Presence

In the virtual context, chatbots' imitation of human behavior can often convince customers that they have been interacting with a real human worker. Novak and Hoffman (2019) note a growing consensus in psychology and marketing that anthropomorphism, or humanlikeness, is imperative for understanding how customers experience inanimate objects. Anthropomorphizing objects means imbuing "the real or imagined behavior of nonhuman agents with human-like characteristics, motivations, intentions, or emotions" (Epley, Waytz and Cacioppo 2007, p.864; Aggarwal and McGill 2007). For instance, the humanoid robot Sophia that has many human-like facial expression is recognized as highly anthropomorphic, whereas the non-humanoid robot vacuum Roomba is seen as much less anthropomorphic. The degree of anthropomorphism is one important element, which is inherently required for a robot's ability to engage in meaningful interactions.

While marketing has found anthropomorphism to increase product and brand liking (Aggarwal and Gill 2012), whether anthropomorphism in service robots enhances customers' experiences is largely unclear. One perception is that consumers respond positively to robots with human-like behavioral characteristics because they can relate easily to them and bond with them (Broadbent et al. 2013), and research results have highlighted the favorable impact of anthropomorphizing service robots on customers' trust, intention to use, and enjoyment (Van Pinxteren et al. 2019).

However, another school of thought cautions that robot anthropomorphism can also backfire, often building on the uncanny valley theory (Mori, MacDorman and Kageki 2012; Mende, Scott, van Doorn, Grewal and Shanks 2019). This theory proposes that with increased human-likeness, the affinity for the robot increases until it closely resembles a human and a strong feeling of uncanniness occurs, resulting in a radical shift from positive to negative responses. The reason for this is that a robot that looks human often cannot live up to the expected human behavior. Accordingly, consumers exhibit greater avoidance of encounters with highly human-like robots than with those appearing more machine-like because they bring the risk of raising expectations for certain cognitive capabilities which cannot be met by the robot. Discomfort towards a robot can also be explained by evolutionary theory because humans perceive robots as a potentially threatening other species or associate them with diseases. Robots can frighten us into losing control or evoke thoughts about intelligent robots that will rule over humanity. Overall, previous research has yielded mixed findings regarding the role of robot anthropomorphism, indicating positive (Stroessner and Benitez 2019), neutral (Goudey and Bonnin 2016), and negative effects (Broadbent, Jayawardena, Kerse, Stafford and MacDonald 2011). Thus, clear management guidelines are lacking, which is unfortunate given firms' need to "carefully consider how to use AI [artificial intelligence] to engage customers in a more systematic and strategic way" (Huang and Rust 2021, p.3).

Potential adverse reactions to AI and robots

Research on customer acceptance of service robots as physical, embodied AI has suggested that robots can contribute to facilitating and enhancing the customer experience (e.g., speed, convenience and accessibility), while also causing potential negative consequences. Next to the previously discussed importance of the level of anthropomorphism of the AI, scholars have found more critical factors that may cause adverse reactions.

One study has investigated the use of robots in elderly care, in particular how the use of a robot vs. a human coach motivates elderly to participate in exercise games (Čaić, Avelino, Mahr, Odekerken-Schröder and Bernardino 2019). The study also looked at how the robot affects feelings of warmth (being helpful or caring, indicating a positive or negative intent) and competence (being skillful, indicating the ability to effectively pursue the intent). Robot coaches were rated lower in warmth, competence and intentions to use than human coaches. According to another study (Mende et al. 2019), the use of humanoid robots in the restaurant sector triggers negative feelings, such as eeriness and human identity threats. Consumers respond to this threatening stimulus with compensatory behaviors, namely increased consumption of unhealthy food, buying status-signaling products, and seeking social affiliation. The effect of robots on attitudes and consumption can be attenuated by social belongingness (e.g., feeling more connected to other people), healthy food, and machinizing the robot by giving it a technical instead of a human name.

While prior work predominantly shows that consumers prefer human service providers over service robots because robots can trigger negative feelings, some empirical research has also found that consumers are not always reluctant to accept service robots. Accordingly, Merkle (2019) stresses that consumers may evaluate a service robot more favorably than a frontline human service employee after a service failure. In addition, consumers react more positively to robotic service providers if human presence is the source of potential negative feelings (Holthoewer and van Doorn 2021; Pitardi, Wirtz, Paluch and Kunz 2021). This relates to service encounters where human social presence causes apprehension of social judgment, such as when consumers need to acquire embarrassing products, are faced with criticism, or are confronted with their own mistakes. Other research has highlighted that preference for a robot over a human can be task-specific. For instance, older people preferred robotic to human assistance for some instrumental activities such as housekeeping or setting medication reminders but not for other common daily living tasks, such as shaving, walking, or getting dressed (Smarr et al. 2012).

TABLE 3

Potential negative reactions towards the artificial intelligence, service examples and possible counter measures

Adverse reactions	Service examples	Counter measures
Refusal to accept or comply with the AI / robot	• Robots can be perceived as less warm and competent, lowering behavioral intentions to follow a robot's advice • Customers are not familiar with new technologies and do not know how to use them • The elderly may feel deprived of human contact and usual social networks	• Higher acceptance when the AI speaks the local dialect • Direct speech with polite gestures is an effective way to increase patient compliance • AI should perform routinized, simple tasks and not perform services that require emotions or empathy • Use service robots in settings that might cause judgment, e.g. embarrassing medical examinations
Uncanniness and eeriness, feelings of threat	• The robot is anthropomorphic, i.e. highly human-looking	• Don't make the robot too human-like • Don't give the robot too much autonomy, let the customer have perceived control
Increased discomfort, leading to compensatory behaviors	• Consumers who interact with a service robot rather than a human employee favor purchasing status goods, seek social affiliation, and order and eat more food	• Emphasize that the robot is a machine, e.g. by not giving the robot a name
Misconception, prejudice, and anxiety	• Customers may avert AI-delivered services due a perceived loss of human touch • Consumer privacy issues may arise	• Organizations need to develop a set of guidelines on the responsible use of technology, e.g. in terms of storing data

Will service robots complement or substitute human employees?

Scholars believe that robots will act as a useful complement to the service force, and customers can expect to be served by a combination of a robotic and human workforce in most service encounters over the coming years (Xiao and Kumar 2021; Miremadi, Narayanan, Sellschop and Tilley 2015; Shah 2016). So far, robots are superior only at those simple, routine, repetitive, and algorithm-based tasks that require little creativity, expertise, and social skills but are not suitable for those creative or innovative tasks that require higher order thinking, which are beyond algorithmic enunciation (Miremadi et al. 2015; Nedelesu 2015). Lariviere et al. (2017) highlight two important roles that robots can play in customer-facing service scenarios: (a) augmentation (assisting and complementing human employees) and (b) substitution (replacing human employees). Frontline service robots substituting or replacing employees is perceived as a more innovative move, but frontline service robots augmenting frontline service employees appear better for the ethical/societal reputation of a service provider (McLeay, Osburg, Yoganathan and Patterson 2021). Augmentation of employees may provide a smooth transition for service organizations seeking to introduce frontline service robots, as it is not perceived to be as damaging to the ethical and societal reputation of a brand than substitution. Furthermore, robot may supplement human employees also with skills that are difficult to obtain for human workers, such as speaking many languages. In case robots substitute employees, the company should focus on moving employees replaced by frontline service robots to other roles where robots are unable to perform effectively and ensure customers are made aware of this to reduce reputational damage.

Nonetheless, in a time of service automation, employees can be understandably wary about their jobs as many routine tasks (e.g., those in many standard customer contact center) are likely to be performed by service robots and AI. Given the superiority of service robots in those tasks, scholars have highlighted the need for service employees to advance their skills to either act as managers and caretakers of the robots (Barrett et al. 2012) and/or remain superior in their service delivery capabilities. Beane (2019) highlights the importance for firms to reshape their service roles such that employees are incentivized to learn how to work and collaborate with robots and allow employees to make mistakes in their learning. Furthermore, the redesign of service roles should involve empowering employees to instruct and coach, and building a skill collection including the expertise and tools needed for robot infusion in service roles. Besides technical expertise, employees also have to develop relevant skills to not only operate robots but also build relationships with relevant stakeholders, thereby protecting themselves from being automated out of their jobs (Fleming 2018). Furthermore, and possibly most important, service employees should distinguish themselves by seeking professional development opportunities to sharpen human capabilities currently under-serviced in education and training. These prized soft skills include emotional intelligence, intuition, and creative thinking, specifically in relation to empathy, persuasion and social understanding (Huang and Rust 2018). Together, these skills allow service employees to focus on "feeling" tasks in order to meet customers' emotional needs (Huang et al. 2019).

Summary and managerial recommendations

With the increasing prevalence of robots in service settings, organizations that want to employ service robots need to understand consumers' attitudes and behaviors towards them. As successfully incorporating robots into customer service is a significant challenge for most organizations, organizations need actionable guidance on how, when, and to what extent service robots should be adopted. One major implication for employees is that robots will not steal jobs from people, but they will definitely change how people work (Muro and Andes 2015). Employees should welcome such change, because the tasks that robots can take from human workers are those mundane and boring predefined tasks with prestated outcomes, in which the engagement and the work productivity of human workers is low anyway (Nedelescu 2015). With robots taking over those less meaningful, dehumanizing, algorithmic tasks, employees can focus on the more creative, innovative, interesting, and valuable tasks (Brooks 2014; Nedelesu 2015). Nevertheless, if AI should take over intuitive or empathic tasks, we recommend to exercise great care. A robot's emotions can only be displayed are therefore not authentic. Depending on the task for the robot to take over, it might not be appropriate to simply show superficial fake emotional responses; rather customers expect that the service provider shows understanding and displays real emotions. Particular attention should also be paid towards the anthropomorphic design of the robot. Managers should avoid the uncanny valley when using AI, for instance by machinizing the technology rather than making it highly human-like.

But, how should robotics be deployed (frontline) customer service? The answer is absolutely not an easy one. It is much more complicated than purchasing some machines and getting them to work immediately. As mentioned earlier, robots cannot completely replace human service workers in the foreseeable future. Thus, for a substantial period of time, robots will co-work with human employees in the customer service sector. Therefore, it is very critical to seamlessly incorporate robots into the customer service team and good AI-human collaboration is a must. With smooth and efficient incorporation, companies can achieve an effective service team that utilizes the respective strengths of human employees and service robots when compared to service teams comprised of only human workers and might subsequently outperform them. AI's enormous data and knowledge has immense potential to improve and enhance the customer experience with more personalized products and services.

Overall, AI and robotics have great potential to revolutionize the service experience in many industries, among others healthcare, retail, hospitality and travel, as well as dining services and restaurants. Owing to challenges associated with aging populations and an ever-increasing shortage of personnel, the healthcare sector has invested heavily in service robots. Deploying service robots in hospitals, elderly care facilities or rehabilitation centers have the advantage to reduce the workload of human staff, thereby improving the quality of care and supporting patients. They could perform daily tasks such as physical monitoring, reminding patients to take their medication, conducting physio exercise trainings, playing games, or reducing loneliness of the elderly. Examples are the healthcare robot "Zora" that activates clients in physical exercise classes, or the "Paro" robot that serves as a pet-like companion. "Zorgmaatje" and "Tessa" are robots that can remind clients of medicine intake, and can help to structure the day. Again, it is important to keep in mind that the service robot assists, and not replaces, the human staff. Accordingly, robots functioning as assistive devices may help to bridge the widening gap between the need and supply of healthcare services. This is particularly relevant in healthcare services because replacing carers with service robots would deprive patients of human contact and usual social networks, thereby leading to the dehumanization of care.

Next to the healthcare industry, there are other service environments with robot frontline employees, such as hospitality. As discussed earlier, it is advisable to let robots execute simple, standardized tasks in which the AI will likely to be superior because it can deliver services in a reliable, fast, and efficient way. For instance, the "Pepper" robot greets and serves customers in restaurants, airports, and cruise ships, while always being friendly, attentive, and patient (Blut, Wang, Wünderlich and Brock 2021; Mende et al. 2019). AI taking over such tasks of a job has the potential advantage that humans can better focus on and perform in core tasks, such as building customer relations.

An important implication for businesses that aim to successfully deploy service robots is the amount of investment. This includes acquisitions costs, development of programmers and specialists, as well as building virtual networks and maintenance of systems. Hence, robots should be seen as a long-term investment. In the Netherlands, the company Welbo is an expert in helping their customers with high-quality robotics solutions to improve business processes. The company focuses on three segments – office spaces, municipal counters, and elderly care – and provide solutions for front desk reception, queue management, and gathering feedback. Next to the robot Pepper, the firm also offers a social robot transporter, which is highly configurable to the needs of your company and can service in restaurants, hotels, business offices, airports and more. In particular, the robot may provide customers with whichever item has been ordered through the app (e.g., a cup of coffee). Overall, Welbo emphasizes that service robots should be more seen as possibility to create a business case rather than being an expensive gimmick.

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