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Conceptual Article

The Ethics of Artificial Intelligence and Robotization in Tourism and Hospitality – A Conceptual Framework and Research Agenda

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Abstract

The impacts that AI and robotics systems can and will have on our everyday lives are already making themselves manifest. However, there is a lack of research on the ethical impacts and means for amelioration regarding AI and robotics within tourism and hospitality. Given the importance of designing technologies that cross national boundaries, and given that the tourism and hospitality industry is fundamentally predicated on multicultural interactions, this is an area of research and application that requires particular attention. Specifically, tourism and hospitality have a range of context-unique stakeholders that need to be accounted for in the salient design of AI systems is to be achieved. This paper adopts a stakeholder approach to develop the conceptual framework to centralize human values in designing and deploying AI and robotics systems in tourism and hospitality. The conceptual framework includes several layers – 'Human-human-AI' interaction level, direct and indirect stakeholders, and the macroenvironment. The ethical issues on each layer are outlined as well as some possible solutions to them. Additionally, the paper develops a research agenda on the topic.

Keywords

artificial intelligence; robotics; tourism; hospitality; ethics; research agenda

1. Introduction

Nearly four decades ago, Collier (1983) recognized the opportunities to automate the service delivery processes. Initially, tourism and hospitality (TH) companies started to use self-service kiosks (e.g., Rastegar et al., 2021). Still, they were lagging behind other service sectors such as banking and retail in the adoption of automation, probably because the latter included more repetitive tasks that could be easily automated while TH involves much emotional labor in service delivery (Khetjenkarn & Agmapisarn, 2020; Marques et al., 2018). The recent advances in artificial intelligence (AI) and robotics (Miller & Miller, 2017; Russell & Norvig, 2016) allowed the active use of these technologies in the TH context as well (Ivanov & Webster, 2019). AI is a computer "system's ability to correctly interpret external data, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation" (Kaplan & Haenlein, 2019, p. 15). In the TH context, AI is used for image and facial recognition at border controls, chatbots, autonomous vehicles, service robots, speech recognition in digital assistants, automated pricing decisions, sentiment analysis of customer reviews, etc. A robot is an "actuated mechanism programmable in two or more axes with a degree of autonomy, moving within its environment, to perform intended tasks" (International Organization for Standardization, 2012). While AI is a generic empowering technology in the form of software, robots are physical devices one can interact with. Within tourism and hospitality, robots provide information, cleaning, room service delivery, disinfection of premises, waiters and cooks in restaurants, cutting grass in gardens, etc.

Previous studies have shown that AI and robotics improve a company's productivity and competitiveness (Makridakis, 2017; Stoilova, 2021), service quality (Naumov, 2019), TH experiences (Tung & Au, 2018), and can promote decent work within the organization (Tuomi et al., 2020). At the same time, AI and robots replace human employees in the service delivery process (Deschacht, 2021; Ivanov, 2020) and nurture fears of technological unemployment (Ivanov, Kuyumdzhiev & Webster, 2020). Moreover, Wagner (2021a) states that AI can leverage the dark side of management by facilitating micromanagement, monopolization, and dataveillance. AI can also effectively change human behavior, including the behavior of tourists, through nudging (Tussyadiah & Miller, 2019; Wagner, 2021b). In recent years, there has been a growing interest in the role and application of artificial intelligence and robotization in tourism and hospitality (Cain et al., 2019; Ivanov & Webster, 2019; Samala et al., 2020). However, the topic of AI and robotics ethics is largely overlooked. These technologies raise various ethical issues in tourism and hospitality related to privacy and surveillance and tourists and employees, biases in decision-making, manipulation of behavior of tourists and employees, and many others. Although the field of tourism ethics is growing (Jamal, 2019, 2020; Lovelock & Lovelock, 2013; Macbeth, 2005), only a few papers in the tourism/hospitality domain have recognized the importance of AI/robotics ethics (Bulchand-Gidumal, 2020; Mercan et al., 2020; Tussyadiah, 2020), thus forming a significant gap in the literature. In this regard, this paper follows the call of Tussyadiah (2020) for

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greater research on the ethical issues of applying AI and robotics in tourism and hospitality to try to partially fill in this literature gap. Specifically, it aims to: *a*) develop the conceptual framework of the ethics of AI and robotics in tourism and hospitality, and *b*) outline some critical future research directions.

The topic of AI and robotics ethics in tourism and hospitality is essential for several reasons. First, in contrast to other technologies, AI systems in TH can learn and make decisions based on complex and big data (e.g., travel data of tourists). Managers have transferred some decision-making processes to AI and do not always have complete control over it (Ivanov, 2021). This raises questions about the control, accountability, fairness, and trust in the AI systems' decisions. Second, AI systems in TH utilize vast quantities of data, some of which are of a personal/confidential nature (e.g., name, gender, travel history of the person, photos of faces, etc.), which raise privacy concerns (Tussyadiah, 2020). Third, the use of AI and robotics by TH companies influences directly and indirectly many stakeholders whose interests and wellbeing might be affected – tourists, other TH companies (hotels, restaurants, travel agencies, airlines, museums, guides, etc.), suppliers from various sectors of the economy (construction, agriculture, financial services, etc.), destination management organizations, employees, local residents, public authorities, among others. For instance, an AI system might increase prices for some tourists and provide discounts to others for the same product and booking terms (e.g., lead period, number of overnights, check-in/out date, room type, etc.) based on their assumed willingness-to-pay. By doing so, the AI system will not only violate some national legal regulations about price discrimination strategies, but it would challenge the fairness of companies' revenue management practices (Tang et al., 2019) due to the unequal treatment of its customers. Additionally, the pricing decision of the AI system would influence the revenue of the TH company, its own price competitiveness and that of its competitors, and the revenue of its intermediaries who work on the commission-based agency model. At the same time, the use of AI and robots by TH companies is influenced by the decisions of software developers and robotics engineers over which it essentially does not have control. Fourth, from a political economy perspective, the use of robots and AI changes the power of market players (Kiggins, 2018). Some TH companies or AI developers may gain too much bargaining power or control over the provision and distribution of TH services that would stifle competition in the industry. Fifth, international tourism inevitably involves people from different cultures and perceptions of what is acceptable or unacceptable in terms of behavior that AI systems in TH need to consider.

The rest of the paper is organized as follows. The following section provides a focused review of the literature on AI and robotics ethics. Section 3 develops the conceptual framework of AI and robotics ethics in tourism and hospitality. The final section provides discussion, elaborates on the theoretical and managerial implications, generates research questions for future studies and concludes the paper.

2. Literature Review

2.1. AI and Robotics Ethics

Research on AI and robotics ethics is gaining momentum as several research monographs have been published in recent years (Coeckelbergh, 2020; Leben, 2019; Lin et al., 2012; Lin et al., 2017; Rambukkana, 2021). In addition, a dedicated academic journal (*AI and Ethics*) was also launched by Springer in 2020. For decades now, with more emphasis on the topic within the last twenty years, the ethical issues surrounding artificial intelligence and robotics have garnered a host of scholarly and popular attention. Some of the general issues surrounding AI and robotics include their risks if used, ethical use of them, aligning their behaviors with our values, and how, if at all, we can mitigate potential recalcitrance, among many others. Due to space limitations, this section briefly outlines some of the central debates within the field of AI and robotics ethics in the directions highlighted by Müller (2021) and visualized in Figure 1 that are relevant for this study. The following section 2.2. focuses specifically on the studies on AI and robotics ethics in tourism and hospitality.

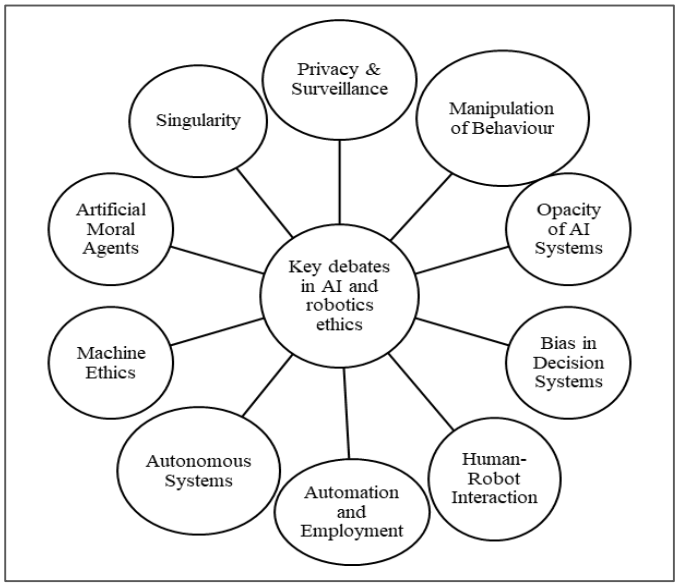


Fig. 1. Key debates in AI and robotics ethics (based on Müller, 2021).

2.1.1 Privacy and Surveillance

The issues surrounding privacy and surveillance typically revolve around how data is identified and to whom, bringing with it issues of different actors that are capable, if at all, of having access to personal data that is not their own (Macnish, 2017; Mazurek & Małagocka, 2019). AI allows ubiquitous and constant surveillance of people and a shrinking scope of privacy (Belk, 2021; Zuboff, 2019). Many digital technologies have been brought under scrutiny given their constant collection of data, much of which is not accessible to the data subject but to the organizations seeking the gold mine that is Big Data Analytics (Stahl & Wright, 2018).

2.1.2 Manipulation of Behavior

Data collection can be used to direct human behavior by providing humans with 'nudges' towards the desired outcome of the AI system's designers. Although these types of nudges are not always maleficent, the extent to which business models are predicated on how they collect and use user data and behaviors to then push those users towards other behaviors (such as online retailers' recommender systems showing users potentially attractive products based on pages they clicked, search history or previous purchases) can indeed be used to execrate addictive behaviors (Thaler & Sunstein, 2008). On a larger scale, manipulating individuals' behavior facilitated by ubiquitous surveillance may lead to social engineering (Belk, 2021).

2.1.3 The Opacity of AI Systems

The opacity of an AI system refers to the lack of transparency in its decision-making process (Müller, 2021). While the system may use various machine learning techniques to identify patterns in the data, it is unclear how the AI system reached specific conclusions and whether they are optimal. This raises the questions of transparency, auditability, accountability of the AI decision-making process, and humans' involvement in the decision-making process (Kazim et al., 2021). In practical terms, humans can be kept in, on- and off-the-loop in decision-making

(Ivanov, 2021). In the 'in-the-loop' case, the AI system recommends a decision (e.g., a price change), but the human implements it. In the 'on-the-loop' scenario, the AI system takes and implements a decision, but humans can always override it. In the final 'off-the-loop' situation, the human is shielded from taking and implementing a decision and has no control over it. The opacity-related concerns increase with the decrease of the control humans have over the decision-making process.

2.1.4 Autonomous Systems

An example of human 'off-the-loop' in the decision-making process is autonomous systems such as autonomous vehicles and military robots/drones. Military robots and drones are already employed by many armies (Springer, 2013). They take autonomous decisions to strike the enemy positions because human soldiers are too slow to accept and implement a decision from a distance, raising concerns about whether AI should be allowed to take live-or-die decisions as its decisions are often opaque (Umbrello et al., 2020; Umbrello & Wood, 2021). Autonomous vehicles hit the streets of some cities (Van Uytsel & Vargas, 2021). They raise ethical issues related to the safety and the life of the passengers that use them, the passengers in other vehicles, pedestrians and other traffic participants (Rhim et al., 2021). Suppose, due to circumstances, a crash is inevitable. In that case, the autonomous vehicle needs to decide how to react to the changed traffic conditions that may require its AI system to put weights on and choose between different people's lives (Umbrello & Yampolskiy, 2021). Therefore, the AI would need decision criteria that humans may question.

2.1.5 Bias in Decision Systems

The AI systems process data to produce an output. Biases appear when the decision of the AI system is based on characteristics that should not be considered (Müller, 2021), e.g., recommending the approval of a new business loan while taking into account the gender or race of the applicant, not only the soundness of the business plan. The biases may place some social groups in systematic discrimination (Ferrer et al., 2021). The biases can occur due to problems with the training data or the decision rules. For instance, some demographic groups in terms of sex, race, religion, education, financial status, etc., may be significantly over- or underrepresented in the training dataset, thus leading to biased conclusions. Furthermore, the context (i.e., the characteristics of the individual, the task, the technology, the organization, and the environment) can influence people's perceptions and behavioral responses to the biases (Kordzadeh & Ghasemaghaei, 2021).

2.1.6 Human-Robot Interaction

The ethical debates in human-robot interaction refer to the safety characteristics of robots, their appearance, emotional intelligence and social skills, but their intended use as well. Chesher and Andreallo (2021, p. 95) point out that a "robot's face marks (or unmarks) distinct stylistic, technical, gendered and racialized identities that situate it in a cultural and historical milieu". Therefore, a robot's appearance might be perceived differently by people with different gender, cultural or racial backgrounds, thus creating potential ethical issues related to misrepresentation of specific genders or races and non-compliance to local cultural and religious norms. Cute-looking robots or anthropomorphic robots that humans associate with due to their appearance can be used to manipulate the feelings and behavior of people (Müller, 2021). Sex robots (Danaher & McArthur, 2017) may change people's perceptions of sexual relationships with other humans and human bodies' natural characteristics.

2.1.7 Automation and Employment

Since the First Industrial Revolution, machines have often been used to replace human labor (Frey, 2019), thus nurturing workers' fear of automation for their jobs (Ivanov, Kuyumdzhiev & Webster, 2020). Automation technologies have eliminated whole industries and employment in existing industries, but they have created many new job opportunities (Brynjolfsson & McAfee, 2014). While the replacement of human labor by automation is not an ethical issue *per se*, it creates various ethical challenges:

- When the displacement of human labor from the economic process takes proportions such that the newly created jobs cannot compensate for the jobs eliminated by automation, technological unemployment appears (Feldmann, 2013). Here, the microeconomic decisions of companies to use automation instead of labor lead to tangible negative macroeconomic and social consequences.

- The implementation of automation technologies has a depressing effect on wages (DeCanio, 2016). Hence, the economic wellbeing of employees is negatively affected by automation.

- AI can be used for micromanagement in organizations (Wagner, 2021a), thus worsening the working conditions of employees.

Universal basic income, automation impact assessments, free education and retraining, taxes on automation technologies and other solutions have been proposed in the literature with their own strengths, weaknesses and ethical issues (Ivanov, Kuyumdzhiev & Webster, 2020).

2.1.8 Other: Machine Ethics, Artificial Moral Agents, Singularity

Other ethical debates in the field of AI and robotics include machine ethics, artificial moral agents, and singularity that are largely beyond the control of tourism and hospitality companies. Machine ethics refers to the behavior of machines towards humans and other machines and whether it can be considered ethically acceptable (Anderson and Anderson, 2007). In addition, research has pointed out that ethics needs to be embedded in the AI systems design through encoding ethical principles in their software, i.e., they need to be 'ethical by design' (Crnkovic & Çürüklü, 2012).

AI systems and robots that have sufficiently developed ethical principles can be considered as artificial moral agents, i.e., they regulate their behavior concerning the harm they may cause through action or neglect of a duty (Wallach & Allen, 2008), and while they cause harm to others, they can be considered responsible for their actions (Behdadi & Munthe, 2020). However, this further raises the question about the rights of robots (Gellers, 2021; Gunkel, 2018) and the morality of humans' aggressive behavior towards robots (Bartneck & Keijsers, 2020).

The concept of technological singularity refers to when an AI system achieves superintelligence and becomes much more intelligent than any human. Coined by Vinge (1993), the concept was popularized by Kurzweil (2005) and Bostrum (2014). The singularity raises existential risks for humanity, giving Barrat (2013) the ground to consider artificial superintelligence as 'our final invention'.

2.2. AI and Robotics Ethics in Tourism and Hospitality

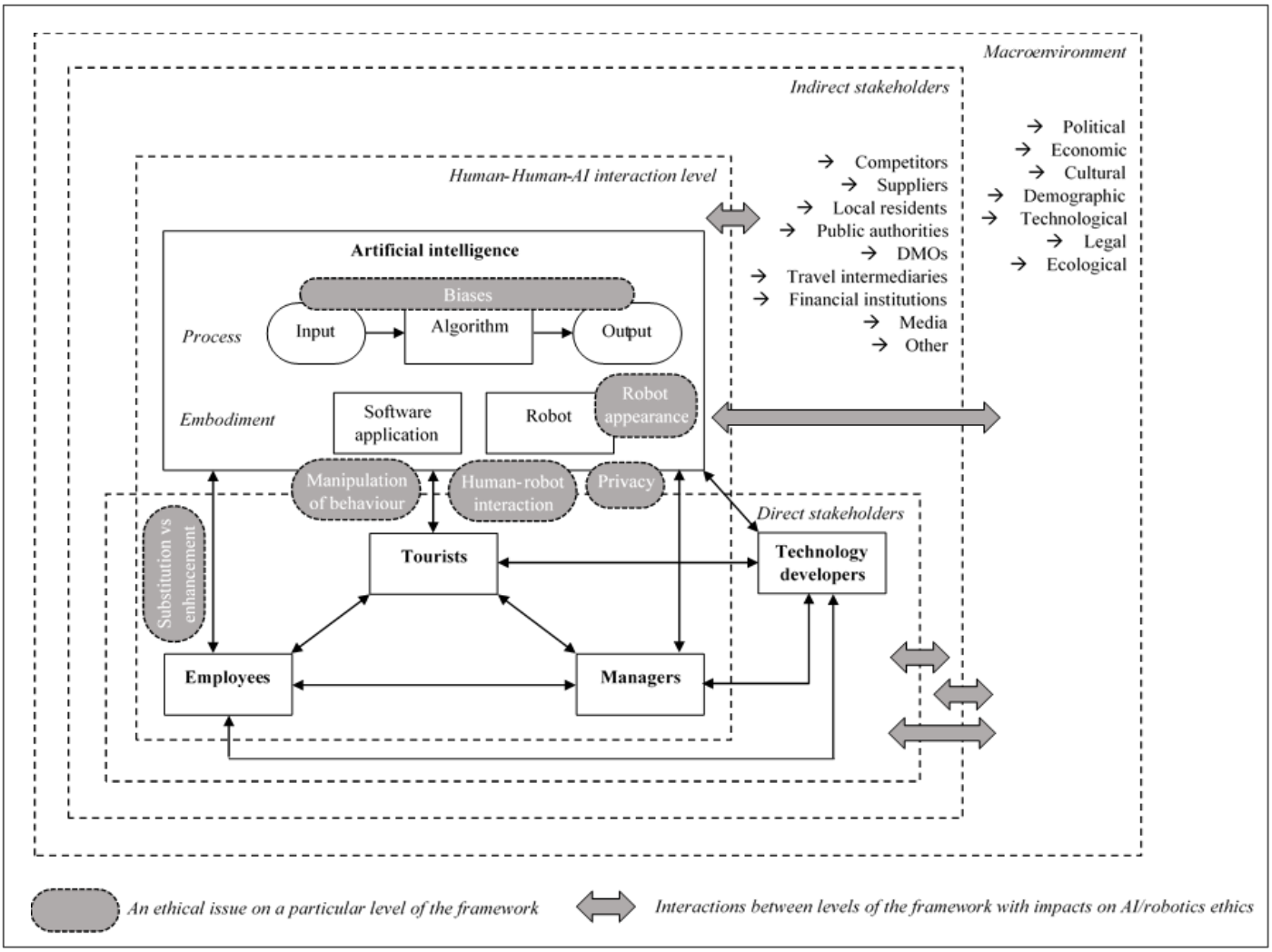
Within the context of tourism and hospitality, the debates on AI and robotics ethics are much more limited (in terms of several publications) and narrow (in terms of discussed directions).

Tussyadiah (2020) explicitly identifies AI/robotics ethics as one of the key research directions in the tourism and hospitality context. Following Lin et al. (2011), the researcher recognizes safety and errors, law and ethics, and social impacts as some of the main areas of robot ethics but does not go beyond outlining the ethical problems or providing solutions to them. The paper also acknowledges the loss of jobs, privacy concerns, and lack of control over AI and robotic systems as fundamental challenges of implementing automation in tourism. However, these are not explicitly mentioned as ethical issues in the paper. Bulchand-Gidumal (2020) discusses privacy, fear of a society guided by technology and biases in AI as the key ethical issues in the tourism and hospitality context. The author also mentions superintelligence, but as already explained above, this is a concept beyond the control of TH companies. Mercan et al. (2020) focus on data collection, data usage, and privacy in the context of TH's Internet of Things as critical ethical issues. The authors also emphasize that the new technologies require new sets of skills; thus, current employees may be frustrated about unemployment or adaption to the new realities. Privacy and excessive surveillance were acknowledged by Gretzel (2011) as critical issues in intelligent technologies in tourism and hospitality as well. In conclusion, the research on AI and robotics ethics in tourism and hospitality is scarce and still in its infancy.

3. The Ethics of Artificial Intelligence and Robotization in Tourism and Hospitality – A Conceptual Framework

Figure 2 presents the conceptual framework of artificial intelligence and robotization ethics in tourism and hospitality. The framework adopts a stakeholder approach to ethics similar to other studies (Baker-Brunnbauer, 2021; Friedman & Hendry, 2019; Friedman & Nissenbaum, 1996; Pan et al., 2021; Umbrello, 2020) and the Global Code for Ethics in Tourism (UNWTO, 1999) because it allows us to elaborate on how the use of AI and robotic technologies in tourism and hospitality influences the interests of the various stakeholders. As already outlined in the Introduction, the implementation of AI and robotics technologies by TH companies affects the welfare of multiple stakeholders who may not have control over the decisions of the TH companies. In contrast, it is affected by the decisions and actions of other stakeholders over which it does not exert control. The following text outlines some of the significant and most relevant ethical issues raised by AI and robotics in tourism and hospitality. However, the authors acknowledge that many other ethical problems may arise that one paper cannot encompass and should be subject to future research. Furthermore, some ethical issues are general and relevant to different settings outside TH industries, while others are specific for tourism and hospitality.

Fig. 2. Conceptual framework of AI and robotics ethics in tourism and hospitality – a stakeholder approach



3.1. Direct Stakeholders

The direct stakeholders are those with a direct relationship with the design of artificial intelligence in tourism and hospitality or directly impacted by its application, namely: the technology developers, TH employees and managers, and the tourists. The technology developers are key direct stakeholders because their decisions determine what technologies are available on the

market and their characteristics. They design the AI solutions to be used by TH companies based on the current best practices in AI software design but consider the final product requirements set by TH companies. For example, TH managers advise what input data the AI software may use (e.g., the booking details) and what output they need (e.g., booking forecast). The AI product/system (e.g., chatbot, a room service delivery robot, software for sales forecasts) is used by the tourists, employees, and managers on the 'Human-Human-Artificial intelligence interaction' level of the framework (HHAI). Tourism and hospitality services and experiences are (co-)created and consumed on this level in different ways:

• *Entirely human-delivered services* – a 'human-human' interaction between the TH employees and the tourists in all front-of-house or back-of-house operations not mediated/facilitated by AI/robots. This is the way the overwhelming majority of TH companies currently operate.

• *AI in the back-of-house operations* – an 'AI-human-human' interaction. The TH employees interact with the AI, but the tourists do not, although the latter may interact/use the output of the AI: e.g. producing hotel booking forecasts, price setting by AI, robotic cooks in the kitchen, etc.

• *AI in the front-of-house operations* – a 'human-AI-human' interaction. The tourists interact with an AI: e.g. communicating with a chatbot on the social media page of the hotel/travel agency/airline.

• *AI in both back-* and *front-of-house operations* – an 'AI-human-AI-human' interaction. TH employees use the AI in the back-of-house operations, but tourists interact with AI. However, it may be a different software application than those used for back-of-house operation: e.g. the tourist books a hotel accommodation via a chatbot, while an AI determines the prices and room availability.

From a systems perspective, AI processes can consist of three elements – input, application of an algorithm, and output. The *input* consists of the data fed in the software – e.g. bookings, prices, faces of customers and employees, written text from a customer on the chatbot, voice data, etc. The *output* includes the results of using the AI software – e.g. a booking forecast, a price recommendation, an identified tourist or employee, response to a query on the chatbot or the voice-activated device, etc. Finally, the input data is processed via different *algorithms* to produce an output. The algorithms are trained via supervised or unsupervised machine learning (ML) approaches based on artificial neural networks (ANN). In supervised learning, the input and output data are labelled, while in the unsupervised, they are not.

There are many ethical issues regarding the design and deployment of AI regarding their potential threat to digital security (i.e., accelerated hacking), their impacts on TH jobs and their displacement, and their designed biases, which can, as already mentioned, exacerbate certain unwanted inequities. We first focus on the biases in AI systems in the context of tourism and hospitality (see also Figure 1), given that they are issues making themselves ever more manifest in current iterations of AI systems. Some of the problems that arise with regards to bias include, but are not limited to:

3.1.1 Human Bias in Data Selection

Bias in data selection, also called the 'selection bias', is when human agents fail to achieve a sufficient threshold for data randomization. As a result, the selected data are not representative of the sample population of data that the analysis aims to encompass (Bareinboim & Tian, 2015). Such bias would occur, for example, if an AI-based hotel pricing system is trained on weekday prices only and disregards the weekend prices, or when the competitive set includes hotels with different categories and locations that customers do not perceive as offering a similar product. In that way, the AI system would produce a price recommendation that would be irrelevant due to the erroneous data used to train the system.

3.1.2 Human Bias in Data Classification

When the data sets are collected, bias can nonetheless occur depending on the human agents' parameters to classify or categorize the data. For example, suppose the sample is sufficiently restricted to certain classes rather than others. In that case, the classifier system trained on such data sets can exacerbate that unwanted class or sub-optimal classifications (Dinan et al., 2020). An example would be the wrong or incomplete labelling of the bookings by customer type (FIT/fully independent traveler, corporate, group, etc.), leading to misleading forecasts by the AI system.

3.1.3 Bias in Outputs

Another issue with output is determining how we address emerging, unwanted behavior? Biases at any point before the system provides outputs can lead to the output themselves being biased depending on the data put in, the type and quality of training (supervised/unsupervised) as well as issues regarding practical steps for intervening and making necessary changes when the system is already deployed *in situ*. For example, an ML-based booking system may offer specific vacation destinations to customers based on zip codes. This can exacerbate specific results provided to those from zip codes associated with lower-income areas, significantly narrowing the available recommended options to those heralding from those areas. For example, Umbrello and van de Poel (2021) argue that full-lifecycle monitoring (i.e., having the technical ability to audit and monitor the system across its lifespan) is a necessary starting point for the design of systems employing ML and ANN systems, given that they are fundamentally opaque, with behaviors that emerge only after they are situated in their environment of use (often at a point that is too late to intervene otherwise). Furthermore, complete lifecycle monitoring allows us to initiate another design iteration (i.e., redesign) to address unwanted emergent behavior.

3.1.4 Technical and Contextual Biases

This is when the elements of a trained system fail to take its context into account sufficiently (e.g., Panch et al., 2019). This means that no single ML/ANN algorithm is a one-size-fits-all system, but they need to be bespoke to their use context. For example, this means that booking recommender systems, chatbots, or other systems that would be particularly attractive to the TH industry must be bespoke to their domain of use. Superimposing existing systems from other contexts risks this type of bias and can lead to recalcitrant or less-than-optimal results for the stakeholder interacting with those systems.

The AI can exist as a software application only or be embodied in a robot. All the above ethical issues are relevant regardless of whether the AI is embodied or not. *Robots*, being physical machines equipped with AI software, raise additional ethical issues in the context of the *human-robot interaction* debate (Figure 1). For example, the robot appearance, color, expressed gender, or religious attributes may cause a stir among some tourists, TH employees or local residents. An anthropomorphic waiter robot with a more feminine shape and a robotic concierge with a masculine appearance may be perceived as a reflection of gender role stereotypes of human employees. Similarly, a feminine looking robot without a scarf on its head might be considered offensive by people whose culture require females to cover their heads. This happened when Sophia Robot by Hanson Robotics was granted citizenship by Saudi Arabia (Sini, 2017). Additionally,

humans may transpose their racial biases to robots. For example, the systematic use of anthropomorphic robots with specific colors that users may associate with human races (e.g., white, yellow, brown, black) for tasks considered by humans as having a low status (e.g., cleaning, garbage collection) might be perceived as offensive if robots with other specific colors are used for higher status tasks (e.g., concierge, entertainment, guide). While robots are machines, do not have consciousness and are not concerned with their own assumed 'demographic' characteristics such as color, attire, or implied gender, their anthropomorphism in terms of appearance and communication skills may cause some ethical concerns among robot users that the TH managers need to consider.

TH companies use AI and robotics technologies to collect data such as photos of guests and employees, guests' travel history, payment documents, the current location of people, their companions, etc., that raise *privacy and surveillance* concerns (Gretzel, 2011). For instance, a hotel/restaurant social robot programmed to address guests by their name makes photos of the customers to recognize them when interacting with them again. Such data is sensitive because guests may not wish the robot to acknowledge it has met them before in front of their companions. Additionally, the data may leak and be used against the interests of the guests/employees (e.g., unauthorized purchases with their credit/debit cards, unauthorized publishing of their photos, blackmailing, etc.). Moreover, in search of maximum convenience for the guests and employees, the social robots in a hotel chain may be connected to a cloud server where the photos of guests and employees are stored. Once a person interacts with a robot in one of the hotels in the chain, the rest of the robots in the chain connected to the server will be able to recognize the person, thus creating the feeling that the guests are being tracked. Although various tools exist to track tourists (Padrón-Ávila & Hernández-Martín, 2020), AI allows this to happen automatically and on an unprecedented scale.

Closely connected to a collection of private data and surveillance of tourists and employees, is the opportunity *to manipulate their behavior*. Although previous studies have pointed out that AI and robots can nudge tourists to have more sustainable behavior (Tussyadiah & Miller, 2019), the same technologies can be used to manipulate people (Wagner, 2021b). For instance, an AI-enhanced reservation system of an online travel agency may restrict the choices of hotels some customers see and increase their prices based on customers' booking history and search history. Such action may maximize the agency's revenue but may not necessarily be in the interest of its customers.

Besides the above relations that directly involve AI, ethical issues may arise indirectly from the implementation of AI and robotics in tourism and hospitality. The leading case here consists of AI's *substitution vs enhancement effect* on TH jobs in the context of the debate on the relationship between automation and employment (Figure 1). Through the enhancement effect, AI improves the productivity of human employees and allows them to serve more tourists and improve their experience. On the other hand, some human employees lose their jobs through the substitution effect by being replaced by AI (Ivanov, 2020). The substitution and enhancement effects of AI result from TH managers' decisions and actions. For example, the search for cost efficiency may justify their decision to use automation technology to cut labor-related costs, hence realizing the substitution effect of AI. However, it should be emphasized that automation is not always *de facto* better. Therefore, TH managers need to ask themselves if employing automation will create a better service or be at least as good as human employees. If not, then there is no need to use automation systems because tourists may decline the automated hospitality experience and prefer human-delivered services (see, for example, Lin et al., 2020) because they may consider automated services as not authentic (Seyitoğlu, 2021). Therefore, TH managers may be the ones to begin using AI systems in their domain, but it may ultimately be the tourist who determines this trend in the long term. Still, TH managers need to be aware of the sustainability of these technologies and how the industry in the long term will be affected. In this regard, the TH managers' decision to use AI may raise the following ethical concerns:

• The *usability* of those systems in productive ways is equal to or greater than the services rendered by their human counterparts. Systems intended to replace current practices within the TH industry must be sufficiently usable to ensure that the TH's experience is not hindered. This, of course, implicates other values like economic ones. Still, it likewise involves things like *accessibility* given how the system is accessed and by *whom* is a function of its *usability*.

• The *accessibility* of these systems is fundamental to design. Different design decisions implicate different technological literacy levels and thus restrict the potential group of users who will encounter these systems (see also Mercan et al., 2020). TH firms may risk being highly limited by their long-term choice at human labor replacement by AI systems if such systems are only accessible to a relatively select group of technologically literate individuals.

• *Autonomy* is another moral value that can foreseeably be implicated by introducing these systems into relatively familiar TH domains. The context in which the technology is situated and the dependency that TH users will abdicate to those systems will determine how autonomous users are in the domains of that system's use. For example, a system that requires contact connection with other systems to enter/leave facilities, check-in/out, and request bespoke services will implicate other systems (i.e., smartphones) and restrict things like *accessibility*, but it will also constrain human autonomy. The design of such systems can and *should* be oriented towards the maximization of human autonomy rather than its constraint (Floridi et al., 2020).

It should be noted that the direct stakeholders have different frequencies of the interaction of AI systems/robots. This may shape not only their perceptions towards AI/robots but also towards what is acceptable/unacceptable in the implementation of AI and robotics technologies. For example, tourists who visit the destination will have very few interactions with the AI/robots of the local TH companies; hence, in the context of interaction theory (Adams, 1967), they may not be quite involved in the ethical aspects of automation technologies used by TH companies because they may consider that the short (in terms of duration) and infrequent interaction with a robot at the reception of the hotel, for example, has a low probability of causing them harm in any way. At the same time, TH employees who use robots and AI daily may have better perceptions about their capabilities and might be more concerned with some of the ethical aspects of these technologies, such as their substitution effect. Therefore, the direct stakeholders would have a different level of involvement and vested interests in using AI and robotics in tourism and hospitality.

3.2. Indirect Stakeholders

Indirect stakeholders are those stakeholders who are impacted by the design of the AI technology in tourism and hospitality, but do not directly engage with it. Besides tourism/hospitality-related organizations such as competitors, suppliers, travel intermediaries, and the destination management organizations (DMOs), it includes local residents, public authorities, financial institutions, media, and other organizations as well because their decisions and actions may cause ethical concerns or solve some of the ethical issues arising from the AI system design or on the 'human-human-AI interaction' level.

Public authorities (national or supranational) develop the guidelines for the ethical use of AI. For instance, the European Commission established the High-Level Expert Group on Artificial Intelligence to advise its AI strategy. The group identified four

ethical principles for an ethical AI and seven key requirements for trustworthy AI systems that will influence AI design, including those AI systems and techniques used in tourism and hospitality. The ethical principles include: *respect for human autonomy*, *prevention of harm*, *fairness*, and *explicability*. The requirements relate to: human agency and oversight; technical robustness and safety; privacy and data governance; transparency; diversity, non-discrimination, and fairness; societal and environmental wellbeing; and accountability (High-level Expert Group on Artificial Intelligence, 2019). The guidelines need to be considered by technology developers when they design AI systems for tourism and hospitality. Thus, although TH companies are not directly involved in the coding of the AI software, they are indirectly influenced by the decisions of public authorities related to the AI systems they use.

Media companies help shape the public's perceptions about AI, form realistic expectations about AI's capabilities, benefits and challenges, and mitigate the fear of automation. However, they are often sensationalists and do not offer practical approximations of the future of AI or its impacts. They tend to get more clicks using terminator or apocalyptic anecdotes when referring to the dangers of AI. When they refer to its benefits, they often (incorrectly) impose a certain air of moral agency on the system and often overpromise what those systems can do. This type of radical pessimism and radical optimism, and overpromising has been the cause of previous 'AI Winters' where research funding in AI was cut because it did not live up to the promises that media outlets tended to push. Within tourism and hospitality, *Henn na Hotel* in Japan has received significant coverage by media that evolved over time. When the hotel opened in 2015, the media praised its innovativeness while acknowledging some of the hiccups accompanying the implementation of any new technology (e.g., Bridge, 2015), probably forming too high expectations about the automated hotel service robots would deliver. When Henn na hotel turned off nearly half of its robots in January 2019, the media's pendulum went in the other direction, overemphasizing some disadvantages of robots to humans and disregarding the value they create for tourists, employees, managers and owners (e.g., Shead, 2019). Therefore, although media companies are not involved in designing AI systems, they influence public opinion towards them, thus influencing their adoption in tourism and hospitality.

As indirect stakeholders, local residents form the main pool of employees for TH companies. Therefore, the substitution effect of AI systems in TH decreases the employment opportunities for local residents. Although previous studies have pointed out the lack of sufficient supply of human labor as the main long-term driver of automation in tourism and hospitality (Webster & Ivanov, 2020), local residents might consider that automation of TH services is unfair because it benefits the TH companies and tourists more than them. Thus, TH companies need to consider the interests of local residents and assess the impact of their automation decisions on them.

Data from competitors, suppliers and travel intermediaries is part of the input in the AI systems of TH companies, while they are affected by the output. For example, the sales forecasts and price recommendations of AI pricing systems may lead to diverting hotel room allotments from one intermediary to another with respective changes in prices and potential revenue of the intermediaries. The opposite situation is also valid – an AI system of an online travel agency may push sales to hotels it forecasts will generate more significant revenue for the company based on the rates, commission, and the probability of a booking. While not a problem *per se*, it may raise ethical concerns if such automated decisions lead to conflicts within the distribution chain related to price parity, fulfilment of contractual obligations between the parties, and unequal treatment of partners. Financial institutions may have preferential treatment of TH companies that use AI and robots due to their high-tech image, thus disadvantaging small TH companies without automation. Finally, from an AI ethics perspective, DMOs play a role similar to that of media – popularizing the application of AI technologies in the local tourism industry, thus creating potential hype that may lead to disappointment by tourists.

3.3. Macroenvironment

The macroenvironment plays a significant role in AI ethics because it determines the legal, political, demographic, cultural, technological, economic and ecological contexts in which a TH company operates. For instance, due to the COVID-19 pandemic, TH companies may be legally obliged to use touchless biometric technology to serve tourists or measure tourists and employees' health status (Ivanov, Webster, Stoilova & Slobodskoy., 2020). This means that TH companies will be forced to use AI regardless of the preferences of their owner, managers, employees and customers. Furthermore, the low birth rates in developed economies would further stimulate the greater use of AI and robotics in all sectors of the economy (Webster, 2021), including tourism and hospitality (Webster & Ivanov, 2020). Meanwhile, the local culture would determine what is acceptable and what is not regarding privacy, data sharing, etc. (Cockcroft & Rekker, 2016; Liyanaarachchi, 2021). Therefore, the macroenvironment may aggravate, mitigate or provide solutions to the ethical issues raised concerning the direct and indirect stakeholders. At the same time, the use of AI in TH can influence the factors from the macroenvironment. For instance, the massive use of automation technologies may decrease the entry-level job opportunities for human employees, reduce demand for labor, increase unemployment, decrease wages, and fuel automation fears (Ivanov, Kuyumdzhiev & Webster, 2020).

Furthermore, the design of AI systems may generate waste and pollution. For example, the robots and kiosks used by hotels, restaurants, airports, and other TH companies form e-waste when disposed. Moreover, the incompatibility of the design of robot parts among robot manufacturers decreases their reusability and the sustainability of operations of TH companies that employ the robots. Therefore, from an ethical perspective, the design of AI systems needs to consider the software design and the disposal and compatibility of the physical parts of the embodied AI system.

4. Discussion and Conclusion

4.1 Implications

Artificial intelligence and robots will continue advancing into the territories once considered domains reserved for humans. Tourism and hospitality are no exception. However, the adoption of AI technologies needs to be implemented ethically to ensure that human values are respected and designed *for.* From a theoretical perspective, the proposed conceptual framework emphasizes that the ethical issues of AI and robotics in tourism and hospitality impact and are impacted by various stakeholders with different levels of involvement, influence, and vested interests. This is a fundamental realization that has come about within the philosophy of technology, particularly due to what has been called the 'design turn in applied ethics' (van den Hoven et al., 2017). This is particularly true of AI systems which are ubiquitous and pervasive, thus crossing national boundaries and impacting different societies and cultures that appropriate these systems in different ways. Similarly, the tourism and hospitality sector is fundamentally situated in a multicultural nexus. To have AI systems designed *for* this context, both direct and indirect stakeholders need to be enrolled into the design of these systems to ensure that they are aligned with stakeholder values. This does not only mean guests, for example, but also TH employees, business owners, mid-level management, and executives. Given these impacts, a design approach that centralizes stakeholders and their values must be adopted towards the design of these systems. Only through an explicit co-constructive orientation in design can these AI and robotics systems be modulated so that

they both support and respect important human values (Umbrello & van de Poel, 2021). For this reason, the value sensitive design approach was proposed given its nearly three decades of use in transformative technology design and its recent adoption and adaptation towards the design of socially beneficial AI systems.

From a managerial perspective, TH organizations must work closely with those industry partners to develop the systems they wish to adopt to address the ethical issues. In doing so, they act as a direct stakeholder enrolled into the design process (i.e., co-design). However, this is not sufficient in and of itself. What is required is centralizing critical human values, many of which have been discussed and expanded on in the philosophical and design literature on AI over the past decade (Baker-Brunnbauer, 2021; Floridi et al., 2020; Friedman & Hendry, 2019; Umbrello & van de Poel, 2021). Not doing so risks many of the unwanted impacts that biased and opaque AI systems have promised and are currently illustrating in real-world theatres of use. To direct the TH industry towards the fair, sustainable and widespread ethical use of AI systems in the TH domain, then an overt orientation towards the enrolling of the various stakeholder groups in the design of those systems and the centralizing of their values as primary. Properly addressing the ethical issues arising from the implementation of AI and robotics in tourism and hospitality by involving all relevant stakeholders would contribute to adopting these technologies by decreasing the resistance against them. This means that stakeholders are not only end-users, such as guests but managers, executives and designers themselves. To ensure that any unwanted emergent values can be dealt with seamlessly requires that those interacting most with the technology (i.e., TH managers) must be in constant contact with the designers of these systems. This is how full-lifecycle monitoring can most easily occur regarding AI systems, something that is practically warranted by dynamic systems like AI.

The framework elaborated in this paper shows that many stakeholders influence the ethical aspects of AI and robotics in tourism and hospitality or are affected by implementing these technologies in a TH context. However, not using AI/robots in a TH company does not mean there are no ethical issues. For example, as Tuomi et al. (2020) show, automation technologies can create decent work for human employees by automating dirty, dull, dangerous, and repetitive tasks. However, not using automation means that human employees are deprived of the opportunity to focus on more revenue-generating and intellectually challenging tasks, thus negatively influencing their productivity, psychological wellbeing, and incomes.

4.2. Future Research Directions

From a theoretical perspective, although some studies mention the ethical aspects of AI and robotization in tourism and hospitality (Bulchand-Gidumal, 2020; Mercan et al., 2020; Tussyadiah, 2020), this research field is still in its infancy. Further research needs to focus on the TH stakeholders' perceptions of ethical issues and their solutions, the outcomes of ethical AI and robotization, the collaboration between them to solve the ethical problems, and the consequences of the implementation of artificial moral agents by TH companies. In particular, future research may address some of the following specific research questions:

4.2.1 Perceptions Towards the Ethical Issues

• RQ1.1: What are the direct and indirect stakeholders' perceptions of the ethical issues raised by applying AI and robotics in the tourism and hospitality context?

• RQ1.2: What are the antecedents and consequences of these perceptions?

• RQ1.3: What organizational (e.g., company size, tourism subsector), personal (age, gender, job position), and cultural characteristics influence stakeholders' perceptions of the ethical issues and/or moderate the role of the factors?

4.2.2 Perception Towards the Solutions to the Ethical Issues

• RQ2.1: What are the solutions to the ethical issues raised by applying AI and robotics in the tourism and hospitality context?

• RQ2.2: What are stakeholders' perceptions of these solutions?

• RQ2.3: What are the antecedents and consequences of these perceptions?

• RQ2.4: What organizational (e.g., company size, tourism subsector), personal (age, gender, job position), and cultural characteristics influence stakeholders' perceptions of the solutions to the ethical issues and/or moderate the role of the factors?

4.2.3 Stakeholder Collaboration

• RQ3.1: What are the stimuli and barriers in front of stakeholder collaboration concerning ethical AI design and the solutions to the ethical issues raised by applying AI and robotics in the tourism and hospitality context?

• RQ3.2: What factors influence stakeholder collaboration?

• RQ3.3: What are the stakeholders' perceptions of the costs and benefits of adhering or not to the ethical principles in the application of AI and robotics in the tourism and hospitality context?

4.2.4 Ethical AI and Robotization Outcomes

• RQ4.1: How can AI and robotization be utilized to create a decent work environment for TH employees?

• RQ4.2: How can the applications of AI and robotization in tourism and hospitality contribute to achieving the UN Sustainable Development Goals?

4.2.5 Artificial Moral Agents

• RQ5.1: Should robots used by tourism and hospitality companies have rights as the employees, i.e., rest, holiday, non-discrimination, not to be abused? If yes, which rights?

• RQ5.2: How does aggressive behavior towards robots in tourism and hospitality influence tourists' perceptions of service quality?

AI and robotics provide a competitive advantage to TH companies that use them wisely. However, they also raise significant ethical issues that need to be addressed by all stakeholders. This paper outlined some of the critical challenges. The authors acknowledge that many ethical issues might be pointed out and hope future studies will address them in-depth.

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