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The Use of Artificial Intelligence Systems in Tourism and Hospitality: The Tourists' Perspective

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Abstract: A myriad of types of artificial intelligence (AI) systems—namely AI-powered site search, augmented reality, biometric data recognition, booking systems, chatbots, drones, kiosks/self-service screens, machine translation, QR codes, robots, virtual reality, and voice assistants—are being used by companies in the tourism and hospitality industry. How are consumers reacting to these profound changes? This study aims to address this issue by identifying the types of AI systems that are used by tourists, the purposes they are used for in the present, and how likely they are to be used in the future. This study also aims to identify the types of emotions (positive vs. negative) that tourists associate with the use of AI systems, as well as the advantages and disadvantages they attribute to them. Considering the exploratory nature of the research, data were collected through an online survey shared on social media, which was available from September to December 2023. Results show that most respondents have already used several AI systems, assign more advantages than disadvantages to their use, and that the emotions they associate with their use are significantly positive. Moreover, compared to the small number of respondents (13.7%) who associate negative emotions with the use of AI systems, respondents who claim to feel positive emotions when using AI systems also evaluate them more positively in terms of their usefulness for tourism and hospitality. They identify more advantages, use a greater diversity of AI systems, and admit that they would use a more diverse range of AI systems in tourism contexts in the future.

Keywords: artificial intelligence; AI systems in tourism; emotions; perceived advantages; perceived disadvantages; tourism and hospitality

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1. Introduction

The new industrial revolution spearheaded by the developments of artificial intelligence (AI) is already having a profound impact on all industries, including tourism and hospitality (Samala et al. 2022). AI can be described as the development of computer systems that can perform tasks and activities which require human intelligence (Russell and Norvig 2016). Although AI is a very recent research topic, a 2018 study by Tata Consultancy Services (TCS) already reported that 85% of travel and hotel service providers use AI in their business (Anurag 2018).

AI has garnered considerable attention within the tourism and hospitality domain (Knani et al. 2022) and as a consequence of the massive adoption of AI systems by companies, travel planning is now easier than ever before. AI provides personalized, automated, and intelligent travel services and makes it easier to learn the tourists' behavior, choices, and preferences, and to provide them with a personalized experience.

The profound change that service industries, including tourism, are undergoing is due to the rapid progress made in a wide variety of technological applications that incorporate AI, namely AI-powered site search systems, augmented reality, biometric data recognition, booking systems, chatbots, drones, kiosks/self-service screens, machine translation, QR

codes, robots, virtual reality, and voice assistants (Gajdošík and Marciš 2019; Knani et al. 2022; Reis et al. 2020; Samala et al. 2022). For example, robots can perform various tasks in tourism and hospitality, including frontline services (Knani et al. 2022; Reis et al. 2020; Samala et al. 2022). Virtual travel agents and chatbots with voice recognition capabilities can offer online information assistance 24 h a day, 365 days a year (Gajdošík and Marciš 2019). Likewise, virtual reality and augmented reality applications are used to increase the visual and emotional involvement of tourists, helping to increase the competitiveness of destinations (Claveria et al. 2020; Marasco et al. 2018).

Considering the implications of the introduction of various AI systems to the tourism industry, it is important to research the perspectives of the end users themselves: the clients/tourists. What is the position of tourists in the face of the profound and diverse changes taking place in the technological ecosystem of the tourism and hospitality industry? Are they eager, desirous, or at least willing to use and adopt the innovative solutions made available to them by companies? Which AI systems are they most willing to use? And, considering the whole "tourist journey", in which activities do they find the use of AI systems more useful? What advantages and disadvantages do they associate with their use? And how do they react emotionally to the use of these new systems for mediating the tourist experience?

This study is an exploratory approach to this complex issue, attempting to ascertain how receptive tourists are to the new AI systems used in tourism and hospitality. In order to develop the study, a literature review was carried out to identify the various AI systems that are currently being implemented in tourism and hospitality, the advantages and disadvantages that have been mentioned in empirical studies on this subject, as well as the emotional implications of using AI systems.

2. Literature Review

2.1. Defining Artificial Intelligence (AI)

Despite the increased interest in AI from academia, industry, and public institutions, there is no standard definition of what AI actually is. AI has been described by certain approaches in relation to human intelligence, or intelligence in general. John McCarthy (2007), the mentor of AI, states the following definition: "Artificial Intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs". Generally, the term "AI" is used when a machine simulates functions that humans associate with other human minds, such as learning and problem solving. Kirtil and Aşkun (2021) state that "AI functions similarly to a human brain as it thinks, learns, makes decisions and inferences through given data by using intelligent machines; the main purpose of AI is to enable machines to complete tasks automatically without needing a human brain" (p. 206).

One of the major challenges with these definitions of AI is that they often define AI as machines that behave like humans or are capable of actions that require intelligence (McCarthy 2007; Nilsson 1998; Russell and Norvig 2016). As human intelligence is difficult to measure, the objective definition of something as subjective as intelligence gives the impression of something that is impossible to achieve (Kaplan 2016). Nevertheless, it is important to dwell on how AI has been defined in the most recent studies, which follow the evolution of the concept.

Despite the fact that AI is described differently by each author, there are points of convergence in the definitions presented. Thus, it is understood that AI is a science that involves the use of machines, software, and/or algorithms capable of developing tasks autonomously and working with a large volume of data in order to promote the best decisions and the most efficient results.

Artificial intelligence is commonly characterized as a collection of technologies capable of replicating human intelligence when addressing problem-solving tasks (Lai and Hung 2018).

Indeed, within the domain of artificial intelligence, numerous emerging technologies have been developed, playing a crucial role in delivering a novel and essential experience for tourists.

2.2. Artificial Intelligence Technologies

In the age of digitization, the use of artificial intelligence technologies has come to be used by most industries, including the tourism and hospitality sector. These artificial intelligence technologies allow the sector to offer tourists a new experience (Samala et al. 2022).

Some of the AI technologies include language translators, chatbots and virtual assistants, AI-powered site search, kiosks/self-service screens, virtual reality and augmented reality, booking systems, biometric data recognition, QR codes, and drones and robots (Bulchand-Gidumal 2022; Doborjeh et al. 2021; Huang et al. 2021; Samala et al. 2022; Sharma et al. 2022).

2.2.1. Chatbots and Virtual Assistants

Conversational systems are sometimes referred to as chatbots or virtual agents (Buhalis et al. 2019). They involve technologies such as natural language processing (NLP) and speech recognition and are currently ubiquitous. They exist as personal assistants in smartphones and home speakers and as textual chatbots in websites and kiosks.

Chatbots are typically computer software machines, which are pre-programmed to answer the simple questions raised by the customers (Oh et al. 2017). There are primarily two categories: text-based chatbots and voice-based chatbots. Text-based chatbots provide message services to the queries of customers in the form of text messages. Voice-based chatbots provide message services to the queries of the customers in the form of voice-based messages (Kumar et al. 2018).

Chatbots and conversational voice formats would enable visitors or agents to discuss preferences and options (Yadav et al. 2021). Voice-based chatbots provide a high-profile personalized service to their customers. They serve the customers by offering a wide range of services like ordering food services, cab services, reading out messages, scheduling tasks and appointments, setting up alarms, room services, house-keeping services, and informing about the hotel facilities, among others. (Gajdošík and Marciš 2019).

2.2.2. Language Translators

Artificial intelligence that is empowered by machine learning and NLP is helping the development of automatic translation applications and simultaneous translation systems. Engaging in travel and tourism typically entails encountering diverse languages. Automatic translation can facilitate the tourists' navigation of the destination, allowing them to explore and engage in all types of activities.

Language translators can be extremely useful when travelling, as they allow travelers to speak in their own language and record a voice message, which is then translated into the target language (local language). Then, the translation is dictated in the target language, thereby conveying the travelers' message to the local people (Azis et al. 2011). While personalization aids tourists in discovering novel locations (Marasco et al. 2018), automated translation can simplify tourists' navigation of the destination, enabling them to explore and participate in various activities where language barriers could be a challenge.

2.2.3. AI-Powered Site Search

AI-enhanced website search belongs to the use of artificial intelligence technologies in website search functionalities to improve the search experience and provide users with more precise and pertinent search results. This involves employing sophisticated algorithms, natural language processing (NLP), machine learning, and other AI techniques to comprehend user queries, interpret the context, and generate intelligent search outcomes (Merrill 2023).

This technology makes it possible to receive results based on previous searches, which generally stem from the user's preferences and needs. Thus, users receive, for instance, price updates, travel guides, and promotions, among others, resulting in a more personalized and relevant delivery for the user of these platforms.

2.2.4. Virtual Reality and Augmented Reality

Virtual reality (VR) technology typically employs VR headsets to generate a simulated environment, providing users with an immersive virtual reality experience. Through this technology, customers can extensively engage with a three-dimensional, digital world, enhancing their overall experience (Guttentag 2010).

Virtual reality allows the visual presentation of tourist spots and hotel locations by using 3D videos. This technology helps hoteliers to describe their hotel on their website, create a virtual hotel tour, virtual travel experiences, and a virtual booking interface (Samala et al. 2022).

There are various virtual reality applications used in the tourism and hotel industry. A few of them are virtual hotel tours, virtual travel experiences, and virtual booking interfaces. Virtual hotel tours include the visual presentation of the hotel environment and its facilities in the form of 3D videos. Virtual reality technologies are perfect gateways to travel and explore the unseen locations beforehand.

Augmented reality (AR) is a digital technology that alters an individual's perception of the physical surroundings when observed through a specific device. While sharing similarities with virtual reality, AR does not substitute the real-world environment; instead, it enhances it by superimposing digital elements (Barten 2023).

The integration of augmented reality allows hotels and comparable businesses to deliver instant, on-demand access to additional information to their customers.

The travel sector is actively creating augmented reality applications, enabling tourists to use their smartphones to gather real-time information about buildings or landmarks by simply pointing the device at them.

2.2.5. Biometric Data

Biometric data are a type of personal information that can be used to uniquely identify an individual. They are usually collected as a part of a digital identity verification process. Biometric data can include fingerprints, voiceprints, iris scans, and facial recognition systems.

In the tourism industry, the most widely used is face recognition. This technology can be used in the check-in process, both in hotels and airports, but also to count the number of people in a given area and detect emotions in people as they go through a certain point, for instance, the happiness of those leaving the breakfast buffet (Bulchand-Gidumal 2022).

2.2.6. Robots

A robot is an autonomous machine (a physical object) that includes AI and senses the environment, both of which allow the robot to make decisions and perform actions (Bulchand-Gidumal 2022).

These technologically driven assistants leverage the Internet of Things (IoT) technology to perform basic tasks, such as activating bedroom lights, powering down the television, automating luggage check-in processes, and welcoming guests to a hotel (Samala et al. 2022).

There are two types of service robots: professional service robots and personal service robots (Li et al. 2019). These robots are used to simplify processes and improve tasks that were normally carried out by hotel employees.

2.2.7. Drones

Drones are unmanned, aerial devices used for a variety of purposes (Mehmet Tuğrul 2023). When they were first developed, these devices were manually and remotely controlled. Now, however, drones often incorporate artificial intelligence, automating some or all of their operations.

The incorporation of AI enables drone vendors to use data from sensors attached to the drone to collect and implement visual and environmental data. These data enable autonomous or assisted flight, making drone operation easier and increasing accessibility.

Drones equipped with AI can process and analyze data in real-time, making them more efficient for applications like surveillance and monitoring.

Within the tourism sector, drones can be utilized to offer live virtual tours of open-space tourist destinations, contributing to innovative and environmentally friendly practices (Elkhwesky et al. 2024). Another use for drones is the delivery of a service, for example, the delivery of food to the customer's selected location (Snead and Seibler 2017).

2.2.8. Kiosks/Self-Service Screens

The integration of artificial intelligence (AI) elevates self-service kiosks from static machines to intelligent and interactive assistants. AI-powered kiosks analyze customer behavior and preferences, enabling highly personalized recommendations and offers.

A self-service kiosk refers to a terminal, allowing customers to interact with a computer system to access information. These versatile devices support diverse functions, including menu navigation, travel itinerary checks, inventory inquiries, and more. Furthermore, these kiosks serve as self-service checkpoints for managing queues, in addition to facilitating order placement and payment transactions (VirtuBox Infotech Pvt Ltd. 2023).

2.2.9. Booking Systems

Booking systems with artificial intelligence can help reduce costs, automate tasks, reduce errors, and optimize resources. What is more, AI can improve the customer experience with personalized interactions, offers and rewards, as well as faster and easier bookings. "SmartStay", for instance, is an AI-driven hotel booking platform that understands travelers' preferences, such as amenities, room types, and locations. It uses machine learning to recommend the most suitable accommodation for each user, enhancing their overall travel experience (Barten 2023).

2.2.10. QR Codes

A QR code is a two-dimensional matrix barcode capable of encoding data in four different ways: numeric, alphanumeric, binary, and kanji (Jaesny 2023). This type of QR code can be created using a simple QR code generator available online.

Nowadays, advanced QR code software can generate a QR code with a short URL leading to an online page that can host files like images, documents, audio files, and videos. artificial intelligence can be an asset when integrated into QR codes, because it has the ability to improve reading accuracy and improve image quality for faster recognition. As it is also able to learn from the data it collects, it can devise ways to counteract reading challenges.

AI can analyze not only the textual content of a QR code, but also explore its context and underlying meaning, thanks to natural language processing. NLP algorithms allow AI to better understand the purpose of a QR code. Beyond simple character recognition, NLP also analyzes the meaning and context of the data (Jaesny 2023).

AI integrated into QR codes makes it possible to create personalized experiences because this technology can analyze tourists' behavior and preferences. Another advantage of this integration is related to security, since AI can detect the content of the QR code and warn you if it contains a phishing link or leads to a malicious website.

In the tourism industry, the QR code has been used to issue tickets, provide additional information at airports, tourist sites, and accommodation, among others, and for contactless payments.

The fact that AI is integrated into different technological solutions means that the simple user is often unaware of its presence. Does a QR code user realize that it has AI integrated? Or when asked if they would use a QR code in an AI study, do they answer affirmatively because they have already used the QR code, without taking AI integration into account? The invisibility of AI integration in different technological solutions to the common eye can make it difficult to recognize its presence and therefore its use.

2.3. AI Systems in Tourism and Hospitality

Artificial intelligence (AI) has garnered considerable focus within the tourism and hospitality domain (Knani et al. 2022), experiencing exponential growth in its application within this sector in recent years. The integration of robots, artificial intelligence (AI), and service automation in the hospitality and tourism industry has been leveraged to enhance customer experiences, improve service quality, and streamline operations. Studies have highlighted the impact of AI on various aspects of the industry, such as customer service, decision-making, and service recovery (Xu et al. 2024; Kong et al. 2024; Ghesh et al. 2024). Additionally, the use of AI technologies like ChatGPT has been explored for applications in tourism, with a particular emphasis on the benefits, risks, and implications for stakeholders (Carvalho and Ivanov 2024).

The integration of AI has enhanced service efficiency and optimized the overall tourism experience. As an illustration, robots have been employed across various roles within the tourism and hospitality sector, including frontline services (Reis et al. 2020). The research conducted by these authors underscores the integration of robots in the field of hospitality, encompassing tasks such as reception duties, guest services, and cleaning. Additionally, the authors showcase examples such as a stationary robotic arm responsible for transporting and storing luggage, as well as the implementation of vending machines within hotels to offer various amenities. Furthermore, robots play a role in transporting guests' luggage to their rooms. The studies conducted by Reis et al. (2020), Samala et al. (2022), and Knani et al. (2022) emphasize an additional application of robots within guest rooms. These robots respond to voice commands and utilize AI technology such as speech recognition to manage various amenities, like controlling the television, lights, temperature, and more, based on guests' requests. Certain robots possess the ability to offer instantaneous responses to inquiries, recommend noteworthy attractions, identify the best local restaurants and autonomously enhance their performance through learning. Notably, within airport environments, robots are increasingly being deployed as guides and assistants.

An alternative method of incorporating AI-enabled technologies in the hospitality industry involves deploying virtual agents and chatbots. These entities utilize speech recognition to assist guests in requesting room services, offering online information assistance, and operating seamlessly around the clock, seven days a week. As previously mentioned, the AI chatbot serves multiple purposes in travel planning, providing an array of services such as arranging food and cab services, reading messages aloud, scheduling tasks and appointments, setting alarms, coordinating room and housekeeping services, and informing guests about hotel facilities, as indicated by Gajdošík and Marciš (2019). Furthermore, Infante et al. (2021) indicate that artificial intelligence plays a pivotal role in various services, with potential exclusive applications in the future, including check-in, check-out, reception tasks, meal services, accommodation procedures, valet parking, communication via chatbots or chat blogs for direct interaction with customers, and the provision of room services directly through mobile devices. Other scholars also highlight the use of AI for activities such as room reservations, responding to customer queries, addressing common issues, and providing assistance with various hotel services. This technological approach contributes to tailoring the hotel guest experience, as emphasized by Citak et al. (2021), Ivanov et al. (2020), and Yang and Chew (2020). Hwang et al. (2021) underscore the potential significance of drones in the tourism and hospitality sector, particularly in response to the growing need for an efficient and rapid delivery system, as noted by (Snead and Seibler 2017).

A prevalent application of AI in the hospitality industry involves harnessing virtual reality (VR) to craft immersive travel experiences through 360-degree video technology. This technology, as highlighted by Citak et al. (2021), has the capability to replicate various facets of travel, spanning from the journey itself to the destination, showcasing key sights. Additionally, it is employed to illustrate tourist spots and hotel locations through 3D videos.

This technology is ideal for previewing unfamiliar locations in advance. A virtual booking interface enables customers to have a real-time, simulated walkthrough of an aircraft, facilitating the selection of seats. Additionally, customers can choose ancillary services such as a cab service and complete the payment process, as outlined by Samala et al. (2022).

Using virtual reality and augmented reality applications presents a simulated depiction of authentic experiences, enhancing both visual and emotional engagement. This heightened engagement contributes to the increased competitiveness of destinations, making them more appealing to tourists and elevating the likelihood of their visit, as noted by Marasco et al. (2018) and Claveria et al. (2020).

The importance of facial recognition technology lies in its ability to recognize the faces of tourists, cross-reference them with the details in their documents, and simplify the check-in procedure. This pioneering method enables tourists to navigate through airport and station check-ins effortlessly, eradicating the need for manual document verifications by authorities such as immigration and customs, as highlighted by (Samala et al. 2022).

Artificial intelligence offers a significant advantage in providing personalized services to customers, which include capturing and storing their location and their interests and preferences online, as discussed in studies by Yadav et al. (2021), Pei and Zhang (2021), and Samala et al. (2022).

Blockchain technology enhances the tourist experience by providing personalized solutions with minimized risks of data misuse, greater user control within a secure ecosystem, instantaneous international remittances, decreased exchange transaction costs, and real-time transactions, even in remote locations lacking readily available banking facilities. Additionally, the inherent advantages of smart tourism include cost-effective rebooking of hotel rooms and the elimination of double bookings, solving issues related to double spending through the integration of all travel means on a unified platform (Varelas et al. 2019).

Tourism and hospitality companies leverage AI with the goal of enhancing competitiveness through the accumulation and analysis of extensive data, as outlined by Köseoglu et al. (2019).

2.4. Advantages and Disadvantages of Use of Artificial Intelligence in Tourism and Hospitality

The main studies on the use of artificial intelligence in tourism and hospitality report that AI-based technologies allow an improvement in the efficiency of services and meeting customer needs (Citak et al. 2021; Infante et al. 2021; Grundner and Neuhofer 2021; Knani et al. 2022; Lalicic and Weismayer 2021; Pei and Zhang 2021; Samala et al. 2022; Sharma et al. 2022; Song et al. 2022; Zhang et al. 2022; Yadav et al. 2021). Artificial intelligence also makes it possible to personalize and enrich customer experiences (Knani et al. 2022; Lalicic and Weismayer 2021; Pei and Zhang 2021; Samala et al. 2022; Zhang et al. 2022; Yadav et al. 2021), since more current and real information about each customer can be obtained and their needs can be met in a more direct and concrete way, offering the products/services they are looking for and need (Knani et al. 2022; Samala et al. 2022).

For hospitality and tourism workers, AI can be an asset in the sense that it takes away the respective and standardized work that some machines or robots can perform (Sharma et al. 2022) and thus, staff can focus their attention on other activities and on the customer experience (Infante et al. 2021; Samala et al. 2022), as they can have more time and energy to provide personalized services (Song et al. 2022). By freeing up staff for other more complex activities and more customer interaction, it is then possible to offer more personalized services, adapted to the customer and with better quality (Song et al. 2022), as it allows them to offer a more humanized service (Pei and Zhang 2021).

The application of AI can also help improve value co-creation (Knani et al. 2022) and create value for customers by developing innovative services that have several advantages, such as convenience, time efficiency, ubiquity (always available), service, functionality, ease of use, better than other current formats (relative advantage), and a high level of personalization and flexibility (Lalicic and Weismayer 2021).

For tourists, one of the main benefits of using artificial intelligence is being able to navigate unknown environments without fear and anxiety, as they benefit from the help of AI. This can help develop new memorable experiences (Li et al. 2019).

On the other hand, the main risks of using AI that tourists have identified are related to fear of surveillance, lack of equal access for all, and a society entirely dependent on AI.

In the initial scenario, concerns arise regarding the potential privacy threats posed by AI systems, as they accumulate extensive data that can discern patterns and extract information from the gathered datasets (Gretzel 2011; Tussyadiah and Miller 2019). In a society without equal access to technologies, their use can be jeopardized by a lack of knowledge and skill in using AI. Also, the fear of human labor being replaced by machines means that there is a fear of job losses (Li et al. 2019).

Although this intelligence has increased the efficiency of transactions to some extent, the main studies on the use of artificial intelligence systems in tourism and hospitality report that privacy, security, and data management issues are the main concerns (Infante et al. 2021; Knani et al. 2022; Samala et al. 2022; Yadav et al. 2021; Hawlitschek et al. 2018). It is also necessary to consider problems of trust in intermediaries. Some studies also point out the value of the investment as a disadvantage, which is expensive and complex (Infante et al. 2021; Yadav et al. 2021).

Another major disadvantage of the use of artificial intelligence systems in tourism and hospitality is that, when compared to humans, robots, even with the incorporation of AI technologies, are still very limited in terms of soft skills such as empathy—an essential competence to meet customer needs—and communication, which may lead to incorrect or misleading information (Infante et al. 2021; Reis et al. 2020). According to Chan and Tung (2019), service robots provide high levels of sensory and intellectual experiences, but low levels of affective experience. As a consequence of these disadvantages, another one arises, which is the risk of certain types of positions and positions being required from staff (Infante et al. 2021). Despite the rapid evolution of artificial intelligence, a significant constraint persists in its adoption by individuals lacking digital literacy skills (Reddy 2006; Samala et al. 2022).

A study conducted by Lalicic and Weismayer (2021) reinforces the aforementioned disadvantages. When asked by the authors to indicate the reasons why they would not use AI chatbots in their trip planning, the top four reasons indicated by tourists were as follows: "difficulty to use"; "lack of confidence in AI technology"; "privacy concerns"; and the "need for personal interaction".

Recent research on AI identifies potential negative impacts, such as employees' fear of losing their jobs, changing employee roles and tasks, and reduced social interactions (Li et al. 2019; Reddy 2006). These factors may result in increased employee stress and anxiety, negative attitudes, lack of trust, reduced productivity, and co-destruction of values (Yadav et al. 2021; Pereira et al. 2021).

Although artificial intelligence systems have benefits, both monetary, by replacing employees, and non-monetary, by providing a unique customer experience, they cannot yet surpass human intelligence, as AI is still an emerging area (Laurent et al. 2015; Samala et al. 2022). Furthermore, chatbots are currently still limited, as they can only answer simple questions (Samala et al. 2022). Moreover, when there is an emergency and a complex problem to be solved, customers still prefer personal interaction (Li et al. 2019; Samala et al. 2022).

Grundner and Neuhofer (2021) propose a theoretical model called 'The Realms of AI Tourist Experiences'. The model has two axes: the first represents the axis of positive and negative value formation, manifested as value co-creation and value co-destruction. The second axis shows AI interaction and co-creation, as well as AI and the tourist experience, whose top layer consists of three sub-dimensions: information, personalization, and integration.

Thus, the authors' study (Grundner and Neuhofer 2021) highlights the impact of artificial intelligence on the tourist experience in the information sub-dimension, stating that

AI allows access to information in real time, allowing for time saving and individualization. On the contrary, it can cause overload of information, distraction, and missing out on non-individualized information. In the personalization sub-dimension, AI is portrayed as a way of increasing happiness, allowing for more entertainment and more time for experiences. In this sub-dimension, AI can also have a less positive impact because it is difficult to appreciate services if only perfectly personalized services are delivered; it can result in a loss of authenticity and a loss of general satisfaction.

Regarding the integration sub-dimension, the authors state "AI integrated with other ICTs could open the gate for holistic experiences" (Grundner and Neuhofer 2021, p. 8). In this sense, the authors argue that in the future, AI may merge with virtual reality (VR), which will open up a world of possibilities without limitations. "Tourists might visit destinations in VR and enter worlds that allow them to experience destinations from a distance" (Grundner and Neuhofer 2021, p. 8). The main obstacle will be isolation from the real world. Table 1 summarizes the main advantages and disadvantages of adopting AI systems in the tourism and hospitality literature.

Table 1. Advantages and disadvantages of using AI systems in tourism and hospitality industry.

Main Advantages	Example of Studies
AI systems improve efficiency of services and meet customer needs, personalizing and enriching customer experiences.	(Citak et al. 2021; Grundner and Neuhofer 2021; Infante et al. 2021; Knani et al. 2022; Lalicic and Weismayer 2021; Pei and Zhang 2021; Samala et al. 2022; Sharma et al. 2022; Song et al. 2022; Yadav et al. 2021; Zhang et al. 2022)
AI systems take away the standardized work that some machines or robots can take on, and thus staff can have more time and energy to provide personalized services.	(Infante et al. 2021; Pei and Zhang 2021; Samala et al. 2022; Sharma et al. 2022; Song et al. 2022)
AI systems allow the offer of a more humanized service and improve value co-creation, and can help develop new memorable experiences.	(Knani et al. 2022; Li et al. 2019; Pei and Zhang 2021)
AI systems offer more personalized services, with better quality (convenience, time efficiency, ubiquity, service, functionality, ease of use, high level of personalization and flexibility).	(Lalicic and Weismayer 2021; Song et al. 2022)
AI systems allow tourists to navigate unknown environments without fear and anxiety.	(Buhalis et al. 2019)
AI systems raise the concerns of privacy and security, related to data management issues.	(Gretzel 2011; Infante et al. 2021; Knani et al. 2022; Samala et al. 2022; Tussyadiah and Miller 2019; Hawlitschek et al. 2018; Yadav et al. 2021)
AI systems raise the fear of job losses, with human labor being replaced by machines.	(Li et al. 2019)
Robots and other AI tech are still very limited in terms of soft skills such as empathy and communication, which may lead to incorrect or misleading information.	(Infante et al. 2021; Reis et al. 2020)
Some studies also point out as a disadvantage the value of the investment, which is expensive and complex.	(Infante et al. 2021; Yadav et al. 2021)
There may be trust issues with intermediaries.	(Gretzel 2011)

Nevertheless, despite the fact that the various advantages and disadvantages of using AI in tourism and hospitality are repeatedly recognized in specific academic studies, there are still no studies on how these advantages and disadvantages are perceived by tourists themselves. This study seeks to shed light on this subject.

2.5. The Role of Sociodemographic Characteristics in Attitudes and Willingness to Use AI Solutions

Sociodemographic characteristics affect attitudes towards the use of and willingness to accept artificial intelligence's technological solutions. Some studies developed in recent years show that characteristics such as gender, age, education, and socioeconomic status can play a decisive role in the acceptance of artificial intelligence solutions (Bartneck et al. 2023; Choe et al. 2023; Méndez-Suárez et al. 2023; Pandey et al. 2023; Stein et al. 2024).

Méndez-Suárez et al. (2023) research the acceptance of products based on artificial intelligence, focusing on the sociodemographic factors that influence consumers' attitudes towards adopting these products. The study uses a mixed approach, combining qualitative and quantitative analysis with non-metrical multidimensional scaling (NMDS) to map opinions about digitally intensive products, such as robots and AI, as well as the attitudes towards innovation.

The results show that negative attitudes towards innovation are associated with negative opinions towards artificial intelligence, while positive attitudes towards innovation are associated with positive opinions towards robots and artificial intelligence. In addition, the study reveals that age and economic conditions moderate the effect of opinions towards AI. Thus, younger people and those with greater socioeconomic power tend to have more positive opinions of products based on artificial intelligence. In addition, the study highlights the influence of gender on opinions, showing how men have a more positive view compared to women.

Pandey et al. (2023) also studied consumer attitudes towards digital voice assistants, concluding that males show greater familiarity with this technological solution and younger consumers use it more often and learn to use it more quickly than older consumers. According to this study, younger consumers (under the age of 20) have learnt how to use voice assistants more quickly and without the need for technical help. On the other hand, older consumers (aged 30 and over) found the system more complex and felt the need for technical assistance to understand voice assistants. Similarly, younger consumers (under the age of 20) use assistants more frequently, while older consumers (aged 30 and over) use assistants less frequently.

Age seems to be the most decisive characteristic for the use of artificial intelligence. In their study on attitudes towards AI and associations with personality traits, Stein et al. (2024) also concluded that older people tend to have more negative attitudes towards AI than younger people.

The lack of familiarity and less positive attitudes towards the use of artificial intelligence solutions revealed by older and female consumers is then reflected in support for the strict regulation of artificial intelligence. Bartneck et al. (2023) concluded that the demographic characteristics most related to the desire to regulate artificial intelligence include female gender, older age, non-European ethnicity, living in rural areas, being single, having religious beliefs, and being a parent.

2.6. Emotions towards Artificial Intelligence

People commonly experience a range of emotions when interacting with AI that is perceived as having a mind. These emotions include surprise, amazement, happiness, disappointment, amusement, unease, and confusion. The interactions with AI agents evoke emotional reactions from the human interactants, leading to a variety of emotional responses. These emotions may be triggered by the anthropomorphic qualities of the AI, its realistic human-like behavior, social connections, or actions that indicate a human-like mental attribute. The emotions experienced by people in these interactions are related to perceptions of both agentic and experiential mind in the AI (Shank et al. 2019).

Understanding people's emotional reactions to AI with mind-like characteristics has implications for ethical design, the philosophy of mind, social interactions, as well as psychological and moral consequences (Shank et al. 2019).

Pantano and Scarpi (2022) reveal that different types of AI have different impacts on consumers' emotions, their satisfaction ratings, their emotional attachment to the brand, and their intention to continue using the technology, with positive emotions mediating these relationships. The relationship between consumer emotions and satisfaction and intention to continue using the technology shows that positive emotions, such as happiness and enthusiasm, have a significant positive impact on satisfaction and the intention to continue using the technology. Negative emotions, such as sadness and fear, have the opposite effect.

The theory of discrete emotions indicates that emotions can be positive and negative, and that there are some fundamental emotions that are generally recognized in all cultures. There are six basic emotions, namely happiness, sadness, anger, surprise, fear, and disgust (Ekman 1992). Plutchik and Kellerman (2013) provided a comprehensive emotional model called Plutchik's wheel of emotions. Plutchik's wheel consists of eight emotions, namely fear, joy, sadness, trust, anger, surprise, anticipation, and disgust. For the author, other associated emotions that combine these eight primary emotions are derived by positional intensities.

The multidimensional emotions theory, on the other hand, recognizes that emotions are complicated and affected by numerous elements, such as personal experiences, cultural backgrounds, and individual variations (Khare et al. 2024). This approach provides a framework for understanding the richness and complexity of emotional experiences and allows for a more in-depth examination of emotional states. It is categorized as a two-dimensional (2D) and three-dimensional (3D) emotional space model. In the 2D emotional space model, emotions are divided into valence (V), which can be positive (Pos) or negative (Neg) and arousal (A), i.e., high activation or low activation (Yannakakis and Paiva 2014) (see Figure 1).

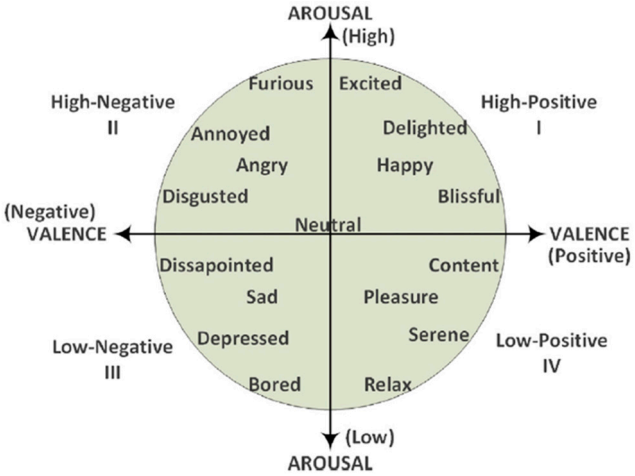

Figure 1. Two-dimensional VA emotion model.

Similarly, the 3D emotional space model (see Figure 2) maps several continuous dimensions, such as V (Pos or Neg), arousal (high or low activation) and dominance (D) (feeling in control or feeling controlled) (Mehrabian 1996).

Among the best-known stimuli for provoking certain emotions are virtual reality (VR), images, video games, music, audio/video clips, audio, and/or videos (Somarathna et al. 2022; Yannakakis and Paiva 2014). In this sense, the role of emotions in the use of AI is therefore paramount, because positive emotions guarantee the willingness and continued use of AI technological solutions, while negative emotions make this use unfeasible (Wilson and Russell 2003; Du et al. 2022).

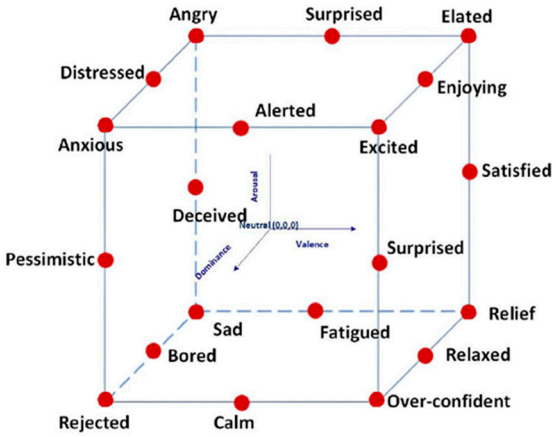

Figure 2. Three-dimensional VAD emotion model.

3. Method

Given the scarce research conducted to date on tourists' potential perceptions on the use of artificial intelligence in the different stages of the tourists' experiences, the current research is descriptive research with an exploratory nature. A convenience sample was used for this purpose. The use of convenience samples is not new in the social sciences (Ferber 1977) nor is it specific to tourism studies; literature reviews on social research issues regularly find most studies based on convenience samples (Ryan et al. 2001; Sherry et al. 2007; Sparbel and Anderson 2000). Convenience sampling is a non-probability sampling method where data are collected from an easily accessible and available group of people. Moreover, the authors assumed that in the current society, any respondent is a potential tourist and therefore, an online survey was conducted through social media and more particularly in tourism-related networks. In particular, the survey was distributed among the members of specific groups on Facebook and LinkedIn related to tourism research. Furthermore, the survey was sent by email to the members of different Portuguese research centers in tourism research and innovation. Data were collected from September to December 2023 and yielded a sample of 267 respondents.

In addition to the section on sociodemographic characterization of the respondents (age, gender, education, nationality, monthly income, and household size), the questionnaire included two sections. The first section focused on the respondents' degree of familiarity with the various AI systems that are used in tourism and hospitality. Respondents were asked to identify the following:

1. The AI systems they have already used when preparing their holiday trips or during their experiences at holiday destinations (1. AI-powered site search. 2. Augmented reality. 3. Biometric data recognition. 4. Booking systems. 5. Chatbots. 6. Drones. 7. Kiosks/self-service screens. 8. Machine translation. 9. QR codes. 10. Robots. 11. Virtual reality. 12. Voice assistants).
2. The type of tourist services they have used these systems for (1. Entertainment/leisure. 2. Catering/restaurants. 3. Accommodation. 4. Tourist attractions. 5. Transportation. 6. Tour guides. 7. Tour operators. 8. Travel agencies. 9. Equipment rentals).
3. When they used these systems (1. Before the trip. 2. During the trip. 3 After the trip).
4. The type of AI systems they imagine they will use in the future and for which tasks or activities (1. Translation from/to other languages. 2. Using maps/navigation systems. 3. Planning tourist itineraries. 4. Making travel bookings. 5. Visiting tourist attractions. 6. Using real-time assistance. 7. Requesting personalized recommendations. 8. Capturing photos and videos. 9. Managing expenses. 10. Using AR and VR applications).

The second section of the questionnaire was aimed at identifying the advantages and disadvantages, as well as the type of emotions (positive or negative) related to the use of AI systems in tourism and hospitality. The list of advantages was based on the

extensive literature review and allowed respondents to select several options based on their perception of advantages: (a) better quality of service; (b) more accurate and complete information; (c) more efficient communication; (d) more efficient services; (e) more personalized information; (f) quicker access to useful information; (g) shorter waiting/service times; (h) simpler booking processes; (i) better entertainment activities; (j) better tourist experience overall. Similarly, respondents could also choose the options that best matched their perceptions from a list of disadvantages: (a) data privacy and security; (b) difficulty in using AI solutions; (c) ethical issues; (d) high dependence on technology; (e) lack of transparency; (f) loss of authenticity; (g) more technical problems; (h) decrease in human interaction; (i) taking too long to use; (j) vulnerability to cyberattacks. In this section of the questionnaire, respondents were also asked to identify the type of emotion they feel when using AI systems, namely feeling bored, melancholic, desperate, dissatisfied, and angry (categorized as negative emotions); and relaxed, hopeful, satisfied, and amused (categorized as positive emotions). This second section of the questionnaire included one last question, where respondents were asked whether they consider that the use of AI systems in tourism and hospitality raises ethical issues and if so, to specify which ethical problems might be raised.

4. Presentation and Discussion of Results

4.1. Sociodemographic Characteristics

The current research is based on a convenience sample obtained through an online survey that took place between September and December 2023. The respondents are characterized by six variables (age, gender, education, nationality, monthly income, and household size), the purpose of which is simply to assess the extent to which each of these variables has a significant effect on the responses obtained.

Table 2 below summarizes the main characteristics of the sample, which consists of 262 respondents, mostly Portuguese (92%), with a clear prevalence of female respondents (61.5%) and predominantly higher education (42.4% with a degree or bachelor's and 35.5% with a master's or doctorate). In terms of age distribution, two segments stand out, namely young people under 27 (39.35%) and people of working age over 42 (36.6%). Also noteworthy is the low level of income, with only 8.4% claiming a monthly income of more than EUR 2000. Finally, the vast majority of respondents live in small households, with around 80.6% of respondents living in households of two to four people.

Table 2. Sociodemographic characteristics of the sample (N = 262).

Age Groups	**N**	**%**	**Monthly Income**	**N**	**%**
Under 27	103	39.3	Under EUR 500	38	16.0
27 to 42 years old	49	18.7	From EUR 501 to EUR 1000	70	29.5
43 to 58 years old	96	36.6	From EUR 1001 to EUR 2000	109	46.0
Over 59 years old	14	5.3	Over EUR 2001	20	8.4
Education	**N**	**%**	**Gender**	**N**	**%**
Secondary or lower	58	22.1	Female	160	61.5
University degree	111	42.4	Male	100	38.5
Postgraduate	93	35.5			
Nationality	**N**	**%**	**Household size**	**N**	**%**
Portuguese	241	92.0	One person	31	11.8
Other nationalities	21	8.0	Two people	68	26.0
			Three people	75	28.6
			Four people	68	26.0
			Five or more people	20	7.6

4.2. Use of Artificial Intelligence Systems in Tourism and Hospitality

Among the various AI systems in tourism and hospitality (Table 3), the most used by respondents are QR codes (used by 77.3% of respondents), automatic translation (60%), chatbots (53.8%), and voice assistants (50.8%). Conversely, the systems less used by respondents are robots (9.2%), drones (13.1%), and augmented reality (18.8%). In an intermediate position, with moderate levels of use, are AI-powered site search (44.6%), kiosks/self-service screens (43.8%), virtual reality systems (37.3%), booking systems (37.3%) and finally, biometric data recognition systems (32.3%). It should also be noted that chatbots are more frequently used by male respondents (66% vs. 46.3%), and conversely that kiosks/self-service screens and booking systems are more frequently used by female respondents. There were no statistically significant differences between genders in relation to the other AI systems.

Table 3. Use of artificial intelligence systems in tourism and hospitality (%).

	Total Sample	Female (n = 160)	Male (n = 100)	χ^2	Sig.
AI systems you have already used	86.2	86.2	86.0	0.66	0.719
QR codes	77.3	80.6	72.0	2.61	0.106
Machine translation	60.0	63.7	54.0	2.44	0.118
Chatbot	53.8	46.3	66.0	9.66	0.002
Voice assistants	50.8	53.1	47.0	0.92	0.337
AI-powered site search	44.6	45.0	44.0	0.03	0.875
Kiosks/self-service screens	43.8	49.4	35.0	5.17	0.023
Virtual reality	37.3	35.0	41.0	0.95	0.330
Booking systems	37.3	43.8	28.0	6.50	0.011
Biometric data recognition	32.3	30.6	35.0	0.54	0.463
Augmented reality	18.8	15.6	24.0	2.82	0.093
Drones	13.1	11.9	15.0	0.53	0.467
Robots	9.2	8.8	10.0	0.12	0.735
Type of companies you used AI with					
Entertainment and leisure	62.7	65.6	58.0	2.07	0.355
Catering/restaurants	56.5	63.8	45.0	9.91	0.007
Accommodation	55.8	60.0	49.0	3.23	0.199
Tourist attractions	54.6	55.6	53.0	1.90	0.388
Transport	50.0	54.4	43.0	3.48	0.176
Tour guides	33.1	30.0	38.0	2.33	0.313
Tour operators	26.2	26.9	25.0	0.54	0.763
Travel agencies	23.5	23.8	23.5	0.35	0.838
When AI is more useful					
At all stages	47.3	49.4	44.0	0.71	0.398
Before the trip	38.1	38.1	38.0	0.00	0.984
During the trip	33.8	35.0	32.0	0.25	0.619
After the trip	1.5	0.6	3.0	2.92	0.130
Activities in which you would use AI					
Translate from/to other languages	74.6	78.8	68.0	3.76	0.053
Use maps/navigation systems	68.8	74.4	60.0	6.07	0.048
Plan tourist itineraries	66.5	68.8	63.0	0.91	0.633
Make travel bookings	56.2	61.9	47.0	5.53	0.019
Visit tourist attractions	48.5	30.0	58.1	15.55	0.000
Use real-time assistance	41.9	43.8	39.0	0.57	0.450
Request personalized recommendations	36.2	41.3	28.0	4.68	0.031
Capture photos and videos	31.5	36.9	23.0	5.49	0.019
Manage expenses	26.5	29.4	22.0	1.72	0.190
Use AR and VR applications	27.7	24.4	33.0	2.29	0.131

Table 3 also shows that AI systems are used more frequently in five areas of tourist activity, namely entertainment (62.7%), catering (56.5%), accommodation (55.8%), tourist

attractions (54.6%), and transportation (50%). The following activities show more modest use rates: tour guides (33.1%), tour operators (26.2%), and travel agencies (23.5%). When comparing genders, there is only one statistically significant difference in relation to catering: female respondents use AI systems more often than male respondents in catering/restaurants (63.8% vs. 45%).

Regarding the time when AI systems are used during the tourist experience, some respondents say they are used "before the trip" (38.1%) and others say they are used "during the trip" (33.8%). However, an even greater number of respondents reported using them "at all stages of the trip" (47.3%). However, only 1.5% of respondents explicitly mention using AI "after the trip".

Regarding the types of activities in which respondents plan to use AI in the future, our findings show that AI is seen as more relevant in those activities that contribute more directly to travel planning and/or serve as facilitators/optimizers of the tourist experience, namely "translating from other languages" (74.6%), "using maps/navigation systems" (68.8%), "planning itineraries" (66.5%), and "making travel reservations" (56.2%).

It is important to note that the predisposition to use AI systems in the future is much stronger among female respondents. Women more frequently designate their intention to use AI systems in the following contexts: "translation into other languages" (78.8% vs. 68.0%), "use of maps/navigation systems (74.4% vs. 60.0%), "travel booking" (61.9% vs. 47.0%), "personalized recommendations" (41.3% vs. 28.0%), and "photo and video capture" (36.9%). In contrast, male respondents report a greater tendency to use AI systems when "visiting tourist attractions" (58.1% vs. 30.0%).

4.3. Perceptions and Emotions Related to AI Systems in Tourism and Hospitality

With regard to the advantages and disadvantages associated to the use of AI systems in tourism and hospitality (Table 4 below), it can be noted that respondents identify the following as the main advantages: "ease of access to information" (80%), which clearly stands out, along with "simpler booking processes" (45%) and "shorter waiting times" (38%). Other advantages related to the quality of the tourist experience are mentioned less frequently, namely "more efficient services" (21.9%), a "better tourist experience overall" (16.9%), "more efficient communication" (16.2%), with "more personalized information" (14.6%), and "more accurate and complete information" (13.8%). When comparing the genders of the respondents, there were no statistically significant differences.

It is important to note that when comparing the advantages and disadvantages of using artificial intelligence systems in tourism and hospitality, the respondents mentioned the advantages much more often. Among the disadvantages, the problems of "data privacy and security" (52.3%) and "high dependence on technology" (40.8%) clearly stand out. "Loss of authenticity" (25.4%), "vulnerability to cyberattacks" (25.0%), and "possible technical problems" (15.8%) are also on the list of disadvantages recognized by respondents. With regard to gender differences, male respondents seem to be more apprehensive than female: the former most frequently identify the options "loss of authenticity", "ethical issues", and "decrease in human interaction". On the other hand, female respondents most frequently identify technical issues, namely "vulnerability to cyberattacks" and "difficulty in using AI solutions".

The respondents' overall optimism regarding the benefits of using AI in tourism and hospitality (the idea that the advantages outweigh the disadvantages) is consistent with their answers to the question "How do you feel when interacting with Artificial Intelligence solutions?". Respondents had to choose one out of nine emotions, five of which were negative (bored; melancholic; desperate; dissatisfied; angry) and four positive (relaxed; hopeful; satisfied; amused). As shown in Table 3, only 8.8% of respondents associate a negative emotion with the use of artificial intelligence, compared to 86.2% who indicate positive emotions, namely "satisfied" (53.5%), "amused" (15.4%), "hopeful" (10%), and "relaxed" (7.3%). It should be noted that the level of satisfaction with the use of AI is more frequent among female respondents (58.8%) compared to male respondents (45%).

Table 4. Perceptions and emotions associated with the use of AI in tourism and hospitality (%).

	Total Sample	Female (n = 160)	Male (n = 100)	χ^2	Sig.
Advantages of AI solutions					
Quick access to useful information	80.0	83.1	75.0	2.54	0.111
Simpler processes	45.0	45.0	45.0	0.00	1.000
Shorter waiting/service times	38.5	40.0	36.0	0.42	0.519
More efficient services	21.9	21.9	22.0	0.01	0.981
Better tourist experience	16.9	14.4	21.0	1.92	0.166
More efficient communication	16.2	15.0	18.0	0.41	0.523
More personalized information	14.6	16.9	11.0	1.70	0.192
More accurate and complete information	13.8	18.8	14.0	0.01	0.955
Better quality of service	9.6	9.4	10.0	0.03	0.868
Disadvantages of AI solutions					
Data privacy and security	52.3	54.4	49.0	0.71	0.399
High dependence on technology	40.8	43.1	37.0	0.96	0.328
Loss of authenticity	25.4	21.3	32.0	3.76	0.053
Vulnerability to cyberattacks	25.0	28.7	19.0	3.12	0.077
More technical problems	15.8	16.3	15.0	0.07	0.788
Difficulty using AI solutions	7.3	10.6	2.0	6.76	0.009
Lack of transparency	6.2	5.0	8.0	0.96	0.327
Ethical issues	5.4	2.5	20.0	6.99	0.030
Decrease in human interaction	5.4	2.5	20.0	6.99	0.030
Takes too long to use	2.3	1.3	4.0	2.06	0.151
Negative emotions related to the use of AI					
1. Bored	4.6	3.8	6.0	0.71	0.400
2. Melancholic	1.2	1.3	1.0	0.03	0.854
3. Desperate	1.2	0.6	2.0	1.02	0.312
4. Dissatisfied	0.8	0.0	2.0	3.23	0.073
5. Angry	1.2	1.3	1.0	0.03	0.854
Negative emotions (1 + 2 + 3 + 4 + 5)	8.8	6.9	12.0	0.20	0.157
Positive emotions related to the use of AI					
6. Relaxed	7.3	6.3	9.0	0.69	0.407
7. Hopeful	10.0	8.8	12.0	0.72	0.395
8. Satisfied	53.5	58.8	45.0	4.68	0.031
9. Amused	15.4	13.8	18.0	0.85	0.355
Positive emotions (6 + 7 + 8 + 9)	86.2	87.5	84.0	0.63	0.427

To summarize, this study shows that the use of AI in tourism and hospitality is currently very well accepted by the tourists surveyed, and is fundamental in tourism marketing, both as a research tool on tourist destinations and products, as well as a communication tool and facilitator of tourist experiences. The perceived advantages of using AI far outweigh its disadvantages and its use induces predominantly positive emotions in its users.

Table 5 below summarizes the respondents' degree of involvement in using AI systems, conceptualized as the average number of items identified by respondents in response to four questions: "Number of different AI solutions already used", "Number of different activities in which I would use AI", "Number of advantages of using AI solutions", and "Number of disadvantages of using AI solutions". Only in the variable "Number of different activities in which I would use AI" is there a significant mean difference between genders: female respondents show a propensity to use AI systems in a greater number of activities in the context of the tourist experience than male respondents (M = 5.29 vs. M = 4.29).

As shown in Table 6 below, the experience of using AI systems is positively correlated with the propensity to use AI in different tourist activities (r = 0.47, $p < 0.001$), and both of these variables are positively correlated with the number of advantages associated with its use (respectively: r = 0.28, $p < 0.001$ and r = 0.32, $p < 0.001$).

Table 5. Degree of involvement in using AI systems.

	Overall Means	Female Means	Male Means	t	Sig.
No. of AI solutions already used	4.80	4.84	4.72	0.37	0.714
No. of activities in which I would use AI	4.90	5.28	4.29	3.14	0.002
No. of advantages of using AI solutions	2.57	2.59	2.52	0.73	0.465
No. of disadvantages of using AI solutions	3.64	3.50	3.81	1.74	0.083

Table 6. Correlations between the variables number of AI systems already used, number of activities in which you would use AI, number of advantages, and number of disadvantages.

	1	2	3	4
1. No. of AI solutions already used	1.00			
2. No. of activities in which I would use AI	0.47 **	1.00		
3. No. of advantages of using AI solutions	0.28 **	0.32 **	1.00	
4. No. of disadvantages of using AI solutions	0.02	0.12	0.18 **	1.00

** Correlation is significant at 0.001 level.

AI systems have emerged in the context of the digital ecosystem, so it is very plausible that the level of digital literacy of consumers/tourists directly influences their behavior and attitudes towards using these systems. This study does not directly include the "digital literacy" variable, but it does include three sociodemographic variables that are directly associated with it, namely "age", "schooling", and "income level".

In the light of the data presented in Table 7 below, we can say that "age" has a significant effect on the number of activities in which respondents admit they could use AI and on the number of disadvantages associated with AI systems. Specifically, it is young respondents under the age of 27 who report the lowest number of activities in which they plan to use AI systems; however, it is respondents in the 43–58 age bracket who associate the highest number of disadvantages with the use of AI.

Table 7. Effects of the "Age" variable.

	Up to 27 (n = 103)	27–42 (n = 49)	43–58 (n = 96)	>58 (n = 14)	Z	Sig.
Perception of IA usefulness in T&H	3.80	4.16	3.88	3.64	1.89	0.132
No. of AI solutions already used	4.73	5.27	4.67	4.50	0.74	0.530
N. of activities in which I would use AI	4.29	5.44	5.23	5.21	3.57	0.015
No. of advantages of using AI solutions	2.58	2.65	2.55	2.29	0.81	0.489
No. of disadvantages of using AI solutions	3.44	3.35	4.01	3.50	3.65	0.013

Regarding the effect of the "education" variable (Table 8), it is noticeable that the "Number of AI solutions already used" variable shows higher values among the respondents with a university degree and post-graduates (means of 5.15 and 4.99 respectively) than among the respondents with only secondary education (3.81). It is possible to observe a similar response pattern regarding the "Number of activities in which you would use AI" variable: the higher the educational level, the more tourist activities the respondents admit that they would use AI with in the future.

Table 8. Effects of the "Education" variable.

	Secondary (n = 58)	Uni. Degree (n = 111)	Post-graduate (n = 93)	Z	Sig.
Perception of IA usefulness in T&H	3.79	3.84	4.03	1.46	0.235
No. of AI solutions already used	3.81	5.15	4.99	6.17	0.002
N. of activities in which you would use AI	3.95	5.11	5.25	5.71	0.004
No. of advantages of using AI solutions	2.55	2.64	2.49	0.87	0.419
No. of disadvantages of using AI solutions	3.53	3.45	3.93	3.05	0.049

Lastly, the "Income" variable (Table 9) has a significant effect on the responses to two variables: "Perceived usefulness of AI in Tourism and Hospitality" and "No. of advantages attributed to AI". Both have higher averages in the "EUR 1001–2000" income bracket and lower averages in the "EUR < 500 " bracket.

Table 9. Effects of the "Income" variable.

	EUR < 500 (n = 38)	EUR 501–1000 (n = 70)	EUR 1001–2000 (n = 109)	EUR 2001–4000 (n = 20)	Z	Sig.
Perception of IA usefulness in T&H	3.68	3.73	4.09	3.75	2.85	0.038
No. of AI solutions already used	4.53	4.63	5.12	4.80	0.80	0.495
N. of activities in which you would use AI	4.55	4.99	5.15	5.30	0.63	0.600
No. of advantages of using AI solutions	2.29	2.54	2.69	2.40	2.65	0.049
No. of disadvantages of using AI solutions	3.32	3.67	3.81	3.85	1.18	0.319

In the light of these data, we can say that the three sociodemographic variables only partially corroborate the hypotheses that the higher the level of education and income, and the lower the age, (a) the lower the use of AI systems, (b) the greater the propensity to use them in a wider range of tourist activities, (c) the greater the number of advantages associated with their use and, conversely, (d) the lower the number of disadvantages attributed to them.

It was mentioned previously that respondents have a very positive view of the usefulness and advantages of using AI in tourism and hospitality and that this view is concomitant with the expression of positive emotions during its use. Therefore, in order to test the hypothesis that there is a strong connection in consumer/tourist behavior between the emotions experienced by respondents during the use of AI systems and the other constructs of this study (perceived usefulness, perceived advantages, frequency of use, and predisposition to the use AI in different activities), we compared the averages between the group of respondents who reported feeling negative emotions (n = 36) and the respondents who reported positive emotions (n = 226).

As Table 10 below shows, the differences are quite clear. Compared to respondents who report negative emotions, the majority of respondents who report positive emotions have a more positive perception of the usefulness of AI in tourism and hospitality (4.60 vs. 2.97), use or have used a greater number of AI solutions (4.92 vs. 4.90), admit to using AI in a greater number of activities (5.15 vs. 3.33), and associate it with a greater number of advantages (2.69 vs. 1.81).

Table 10. Effects of emotions (positive and negative).

	Global Mean	Positive Emotions (n = 226)	Negative Emotions (n = 36)	t	Sig.
Usefulness of AI in tourism and hospitality	3.90	**4.60**	2.97	7.33	0.000
No. of AI solutions already used	4.78	**4.92**	4.00	2.90	0.003
No. of activities in which you would use AI	4.90	**5.15**	3.33	4.71	0.000
No. of advantages attributed to AI	2.57	**2.69**	1.81	8.45	0.000
No. of disadvantages attributed to AI	3.64	3.60	3.83	0.82	0.414

Finally, there are the ethical issues inherent to using AI solutions. When questioned directly on the subject, only 27.3% of respondents admitted to the existence of associated ethical problems (see Table 11), with no statistically significant differences in responses based on gender.

Respondents who believe there are ethical problems in using AI solutions (27.3% of original sample) were asked to list the ethical problems they had in mind, which are summarized in Table 12. The most relevant concerns were, on the one hand, the foreseeable impact of AI on redefining labor relations and the extinction of many jobs (the classic prob-

lem always inherent to any technological revolution), and on the other hand, the problems of privacy, data protection, and confidentiality, the latter being a relatively recent problem which arose in the 21st century and could jeopardize citizens' constitutional freedoms.

Table 11. Ethical problems with the use of AI solutions in tourism and hospitality.

	Total Sample	Female (n = 160)	Male (n = 100)	χ^2	Sig.
Yes, AI poses ethical problems	27.3	26.3	29.0	0.23	0.628

Table 12. Respondents' spontaneous responses to ethical problems.

#	Ethical Problems Arising from the Introduction of AI in Tourism and Hospitality
27	Job cuts and loss of labor rights
16	Privacy, data protection and confidentiality
5	Lack of personal contact and lack of empathy
3	Manipulation of information
3	Reduction in consumer rights
3	Loss of authenticity
3	Disrespect for human dignity
2	Discrimination
2	Violation of third-party intellectual property rights
2	Consumer manipulation

5. Conclusions

One of the main objectives of the current research was to identify the types of artificial intelligence systems used by tourists and the purposes these are used for in the present. With the data obtained, we are able to conclude, similarly to what was concluded by authors such as Gajdošík and Marciš (2019), Infante et al. (2021), Citak et al. (2021), Ivanov et al. (2020), Yang and Chew (2020), and Samala et al. (2022), that the sampled tourists use a multitude of AI-related systems, namely QR codes, automatic translation, chatbots, and voice assistants. Also, similar to the previous authors' conclusions, these services are used for a multitude of purposes in the different stages of the trip (before, during and after the trip), mainly allowing tourist experiences to be tailored to their diverse needs and preferences.

A second goal of the research was to identify the types of emotions that tourists associate with the use of AI systems, as well as the advantages and disadvantages they attribute to them. Judging by the data obtained in this study, we may conclude that the introduction of AI systems to tourism and hospitality can be perceived favorably by tourists. This study reports a high predominance of positive emotions over negative ones. In fact, the number of respondents who associate a positive emotion with the use of AI (n = 226, i.e., 86.3%) is immeasurably higher than the number of respondents who associate negative emotions with this practice (n = 36; 13.7%). For most respondents, the use of AI systems in tourism and hospitality makes them feel satisfied (53.5%), amused (15.4%), hopeful (10%), or relaxed (7.3%). Only a small number of respondents feel uncomfortable with the innovations introduced by AI in tourism and hospitality. Furthermore, as might be expected, this study also shows that those who associate positive emotions with the use of AI systems not only find them more useful and attribute more advantages to them, but also use these technologies more widely and are more predisposed to using them in a more diverse range of tourist services.

Another relevant finding of this study is that respondents associate more advantages than disadvantages to the use of AI systems in tourism and hospitality. The main perceived advantages include quick access to useful information, simpler processes, shorter waiting times and more efficient services. In other words, perceived usefulness, pragmatism and effectiveness are the main reasons for using AI systems in tourism and hospitality, from a tourists' perspective. On the other hand, the main factors that tend to inhibit the use of

AI systems in tourism and hospitality are data privacy and security, high dependence on technology, loss of authenticity, and vulnerability to cyberattacks. In other words, some of the main perceived disadvantages of using AI systems in tourism and hospitality can also be overcome if the organizations supplying AI technologies offer guarantees of greater data security and privacy.

Still, on the subject of the disadvantages of using AI systems in tourism and hospitality, it should be noted that only 5.4% of respondents identified "ethical issues" as one of the disadvantages. However, the percentage of affirmative answers to "Do you think that the use of AI solutions in Tourism and Hospitality poses ethical problems?" was significantly higher (27.3%). It can thus be concluded that more than two-thirds of respondents do not associate any ethical problems with the use of AI systems in tourism and hospitality and only a small proportion of the minority of respondents who recognize that there are ethical problems (i.e., 5.4%) consider ethical problems to be a disadvantage of using AI systems in tourism and hospitality. It is also significant that the main type of ethical problem, spontaneously indicated by 27 respondents ("job cuts and loss of labor rights"), cannot even be considered an ethical problem in the strict sense, but rather a challenge that technological innovation poses to the labor market.

Also noteworthy is the fact that those with higher levels of education use AI solutions more intensively and are more predisposed to adopting them in a more diverse range of tourism activities in the future. This study therefore provides useful clues for tourism and hospitality entrepreneurs and companies, encouraging them to invest in the technological modernization of their production processes by introducing AI systems in the customer interface, since consumers (tourists) are clearly predisposed to incorporating these systems, considering them globally as a means of optimizing the consumer experience.

The implications of understanding people's emotional reactions to AI with mind-like characteristics are multifaceted and span across several domains, including ethical design, the philosophy of mind, social interactions, as well as the psychological and moral consequences. Understanding emotional reactions can guide designers in creating AI systems that are more acceptable and less likely to cause fear or discomfort among users. This could involve designing AI with certain emotional expressiveness or human-like characteristics to foster trust among tourists. Furthermore, understanding emotional responses can shape the development of social robots and virtual assistants, ensuring that they interact in ways that are socially and emotionally appropriate, fostering positive human–AI relationships.

Employment issues were also a main concern and the fear of job displacement due to AI is a classic concern with technological advancements. The implications include the need for policies that address workforce transition, retraining programs, and economic measures to mitigate the impact on displaced workers.

Conversely, concerns about privacy, data protection, and confidentiality emphasize the need for robust legal and regulatory frameworks, which include updating and enforcing data protection laws to ensure that AI systems handle personal data responsibly; ensuring that AI systems operate transparently, with clear accountability for data breaches or misuse; and building and maintaining public trust in AI systems through ethical practices and transparency.

Overall, these implications highlight the importance of considering emotional, ethical and social factors in the development and deployment of AI technologies, namely in the tourism and hospitality sector, to ensure they benefit society while minimizing potential harms.

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