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We Shape Our Tools and Thereafter They Shape Us: The Role of Digital Acculturation in Human-Robot Interaction

Miraç Yücel Başer[1] · **Metin Kozak**[2] · **Tuba Büyükbeşe**[1]

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Abstract
While culture plays a significant role in shaping attitudes towards human-robot interaction (HRI), cultural dimensions of societies do not always influence these attitudes as they should. Previous research has linked various factors with this phenomenon, e.g. media and popular culture. However, little research has been conducted to explore the bidirectional relationship between HRI and culture in digital acculturation. The current study aims to answer the question of how individuals can adopt new consumption patterns beyond cultural norms in HRI. The data collected from 302 Turkish participants were analyzed using the PLS-SEM approach. Digital technologies digitized consumer culture, causing individuals to adopt consumption patterns associated with different societies and not belonging to a particular society. Despite the cultural dimensions of Turkish society that negatively affect the attitude towards robots, the findings revealed that participants had a positive attitude towards HRI with digital integration.

Keywords Acculturation · Digital acculturation · Consumer culture · Digital technologies · Human-robot interaction

1 Introduction

In recent years, human-robot interaction (HRI) has rapidly grown in various fields, such as manufacturing, healthcare, space exploration, agriculture, education, military, and service industries. This has made it one of the fundamental areas of research in the 21st century [94]. Although progress in robotics cannot be ignored in technical and engineering contexts, how individuals' behaviour, feelings, and thoughts toward robots are shaped by the culture to which they are attached remains crucial [71].

Previous studies support that culture and its dimensions play a crucial role in different levels of attitudes toward the HRI [20, 36, 46, 81]; however, cultural stereotypes may not always be valid in HRI [23, 40]. The differences in how people from the Western and Eastern cultures perceive and interact with robots have been studied extensively [71]. For instance, Koreans and Japanese generally have a more positive attitude towards robots and do not always view them favourably [47, 65]. Otherwise, participants from the USA have the least negative perspective on interacting with robots [7]. Belanche et al. [11] examined the moderating role of culture in adopting robo-advisors in Portugal, the UK, and the US sample. Despite their high scores on individualism, the US and UK contradict Hofstede's cultural dimensions. Compared to Portugal, the influence of subjective norms on the Intention to adopt robo-advisors was more significant in the US and the UK sample. Individualistic cultures prioritize personal achievements and independence; however, results presented a counterargument by reaching high subjective norms. Joosse et al. [54] found that despite participants from China and Argentina coming from high-contact cultures, which would suggest they perceive robots closer than those from low-contact cultures, this was not the case for Argentine participants. In another study, Başer et al. [9] investigated the Intention of the Turkish participants to use service robots. Despite concerns about the unauthorized secondary use and collection of personal information, participants expressed interest in using service robots. Considering the uncertainty avoidance cultural dimension of Turkish society [3], this and previous results led to the questions:

✉ Miraç Yücel Başer
myucel.baser@std.hku.edu.tr

[1] Faculty of Economics, Administrative and Social Sciences, Hasan Kalyoncu University, Gaziantep, Turkey

[2] School of Communication, Kadir Has University, Istanbul, Turkey

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RQ1 How can individuals adopt new consumption patterns beyond cultural norms in HRI?

RQ2 Despite the influence of cultural dimensions on consumption preferences, can there be a "common culture" in HRI?

Media and popular culture can influence individuals' attitudes towards robots [46, 73, 100]. Sundar et al. [96] have found that the media can lessen anxiety towards robots and increase the chances of people accepting them. Inexperienced individuals may have strong emotions towards robots due to their portrayal in popular culture and media [100]. On the other hand, contrary to the popular belief that the Japanese love robots, previous studies reveal that the Japanese have concerns about their potential impact on society. The Japanese media may have caused concerns by highlighting the shortcomings of robots [8]. However, the contemporary media of the 21st century is not only limited to traditional channels such as TV and newspapers but also includes heavy involvement in online activities, interactions, and technology usage. Therefore, digitalization helps to understand how individuals can adopt new consumption patterns beyond cultural norms in HRI.

According to [90], digitalization has become a significant part of mainstream consumption patterns. Furthermore, it can lead to the homogenization of local cultures as they integrate with global culture's values and norms. In other words, individuals become more digitalized in various aspects of their lives, such as online activity and technology usage, which changes their consumption behaviour and habits. Over time, this may result in the integration of a new culture, known as acculturation [77].

Traditional acculturation theory highlights that acculturation emerged from physical interaction with other cultures [14]. However, recent studies concluded that acculturation also emerged as being online besides physical displacement [53, 60, 68]. This intersection of culture and digitalization sheds light on the examination of HRI. In terms of cultural practices and day-to-day life, digital acculturation involves adopting digital technology and online platforms as part of one's lifestyle [29], that in turn changes consumption habits and cultural meanings over time. For instance, according to Airoldi and Rokka [1], algorithmic systems, within the context of algorithmic consumer culture, can normalize certain consumption patterns by incentivizing specific products based on user behaviour. This normalization can influence cultural norms related to consumption. Thus, a common consumption culture could emerge through digital acculturation within the scope of HRI.

While there have been no direct studies on this relationship, Rau et al. [83] hinted at the connection between acculturation and HRI years ago. The authors examined how communication style and culture influenced the acceptance of robot recommendations among Chinese and German participants. Chinese participants exhibited a higher tendency to accept robot recommendations, owing to high-context cultures that rely on non-verbal cues. Nonetheless, the authors did not find a significant difference between the two nations regarding explicit communication, highlighting that global advancements and contact with people can influence cultural phenomena.

Based on the aforementioned, the current study aims to analyze the relationship between HRI and acculturation in digitalization. To achieve this, we focus on digital acculturation. Thus, in response to the growing need for research to delve into cultural backgrounds and contextual concepts in HRI [66, 82, 87, 91; Belanche et al. [12], the study is expected to contribute to the literature by examining how digitalization in the today's mobile, dynamic, and technology-driven environment affects consumer behaviour and HRI. The study also introduces the intersectionality of acculturation, digitalization, and HRI into the literature, providing empirical findings for future research.

2 Theoretical Framework

2.1 Acculturation — Consumer Culture Within the Digitalization

Acculturation refers to the interaction between individuals or groups from different cultures and the resulting changes in cultural patterns of one or both parties [15]. Although acculturation was traditionally limited to residential areas, the 21st century has given rise to new forms of acculturation. Activities, such as tourism, bring people from different cultures together, allowing remote acculturation and promoting the cross-cultural exchange of ideas [35]. Furthermore, as acculturation involves cultural values, norms, and local and global consumption cultures, modern mechanisms of globalization have become an effective force in this process [29]. As people adapt to the online world, cultural shifts in consumption patterns and habits have given rise to digital consumer culture [29, 58]. Therefore, measuring the relationship between digital consumer culture and acculturation is important.

The digitalization and usage of technology significantly influence consumer culture. This can lead to the creation of a new type of consumer culture that goes beyond national borders and may lead to a universal format in the future. It is so that it can bring about a shift in consumption patterns related to cultural norms, ranging from assimilation to globalization [24]. Miyake [75] highlights the significant

impact of online consumption on the intersection of virtuality and (im)materiality worlds. The author discusses that cultural experiences such as virtual reality can alter physical world consumption habits. For instance, social media enables the acquisition of information about different cultures [111] and influences individual consumption behavior [32]. Beyond this, digital devices, such as tablets, smartwatches, phones, and computers, have given rise to new consumption identities and practices [25].

Based on the role of digitalization in consumption practices, Cochoy et al. [26] address how digital devices influence consumer behavior by providing access to information and transactions, shaping the decision-making process. Considering consumers' growing dependence on digital devices, the authors highlight the concept of the digital "devitrification" of consumer culture. This concept is related to how consumers perceive digital/technological devices as essential to their daily routines due to their usefulness and convenience in various activities, such as communication, entertainment, shopping, information retrieval, and social networking. Airoldi and Rokka [1] have discussed how algorithms can act as active agents in shaping consumer culture. These algorithms can direct consumers towards particular products and services based on their past interactions and behaviors. This can influence how consumers decide what to consume and how to consume it. Therefore, digitalization can change consumption patterns, potentially affecting social norms and values [72].

However, while there is a consensus on the impact of digitalization on consumption patterns, differing perspectives regarding its role in shaping cultural norms and values have been discussed. This further contributes to the ongoing debate on whether digitalization leads to cultural homogenization or heterogeneity. Digitalization can dominate shared norms and values by colonizing local cultures, and it can sustain heterogeneity by giving access to diverse cultural ideas and products [77]. In this point, digital acculturation provides a framework for understanding the influence of adapting to the digital world on how we consume products and services and express our identities. Digital acculturation has three significant outcomes: integration, separation, and deprivation [29]. For instance, individuals incorporate technology with digital integration to enhance their offline experiences. In digital separation, technology and social media do not change individuals' identity, self, or consumption habits; instead, they assist them in maintaining intra-group communication and everyday habits. Consequently, HRI, which emerges within specific patterns shaped by communities' cultural norms, can extend beyond these norms in the digital world.

2.2 Is Culture Important in HRI? A Synthesis of Cultural Dimensions — Reassessment

Societal cultures and their associated values have a significant impact on user behaviour, resulting in different levels of HRI [71, 103]. The differences can be attributed to the dimensions of cultures. Hofstede [49] categorizes culture into these dimensions: power distance, uncertainty avoidance, individualism-collectivism, masculinity-femininity, and long – short-term orientation. Power distance refers to authority relationships and power inequality within a society. Uncertainty avoidance reflects how individuals attempt to avoid ambiguity and uncertainty. Individualism–collectivism represents the nature of social relationships within a culture. In individualistic societies, individuals primarily care for themselves and their immediate families, whereas in collectivist cultures, individuals belong to communities that provide for their well-being. Masculinity–femininity refers to societal priorities and role distributions. In masculine cultures, achievement and competition are dominant values, whereas quality of life and social well-being take precedence in feminine cultures. Long-term and short-term orientation reflects a society's focus on success and effort. Long-term-oriented societies prioritize future planning, while short-term-oriented societies emphasize the present situation (e.g., traditions) [50, 95].

For instance, Li et al. [69] found that German participants had a negative attitude towards robots because of their masculine cultural orientation and individualistic tendencies, preferring more control over the robots. Participants from collectivist China and Korean cultures with moderate masculinity showed a positive attitude towards the robot. They were more susceptible to communication and tended to accept suggestions from others. On the other hand, tourists from high power distance cultures, such as Russia, may perceive service personnel's communication initiation attempts negatively as they feel superior. Thus, they may prefer to use service robots instead of interacting with human service providers [5, 51]. Yu and Ngan [109] found that individuals with higher power distance tend to perceive robot employees as more competent and reliable than human employees. This is because individuals with low power distance typically prefer less hierarchical structures and display positive emotions towards those in lower positions, e.g., front office agents.

Hall [45] classifies culture as a high and low context. In low-context cultures, communication is explicit and conveys the message through words. In contrast, in high-context cultures, communication is indirect, with less information in the message and the context providing the necessary knowledge. Wang et al. [103] discovered that Chinese participants were more inclined to follow the robot's advice when it

communicated implicitly. High-context cultures rely heavily on nonverbal cues [56]. In HRI, individuals use the same social cues and context as everyday social interactions. Therefore, in T&H service environments, tourists from high and low-context cultures exhibit different attitudes towards robots [5].

As discussed above, the cultural characteristics of societies shape individuals' attitudes and behaviours toward robots, making culture one of the key driving forces in HRI [63]. However, the various cultural values accumulated throughout our lives can result in different attitudes [33]. The differences in HRI cannot be attributed solely to cross-cultural variations. Instead, they are influenced by various social and political factors, such as the degree of technology integration into daily life and the prevalence of data protection laws [16]. Individuals may have different perspectives regarding HRI than their cultural norms [7]. Broadly accepted, even Hofstede's cultural dimensions may not predict attitudes towards HRI, as expected. Thus, for different cultural groups, a standard robot algorithm is suggested instead of cultural-context-specific algorithms [40, 99]. This transition from cultural robots, which align with societies' culture, norms, and values, to a standard robot algorithm is fundamentally driven by digitalization [30].

By strengthening the mutual symbiotic relationship between technology and culture, digitalization aligns technological integration and cultural innovation [105]. Technologies such as digital media tools have become essential to our lives, permeating every aspect of our daily routines and further enhancing how we interact and exchange information. This has led to a new culture where individuals adapt to these technologies, leaving behind their traditional cultures [6, 110]. Allouch et al. [13] state that social and technological contexts influence HRI, shaping each other mutually. Sætra [89] emphasizes that adopting robots to social environments will inevitably modify cultural and social norms to rapport with these new beings. According to Sayago [92], algorithms are increasingly responsible for characterizing concepts, individuals, items, and locations, altering how culture is expressed. This reshapes culture as more than just a byproduct of human activity and enables the formation of a new robotic culture. As Culkin [27], p. 70) aptly stated, "We shape our tools, and thereafter, they shape us." The current state clearly indicates how the technologies we create and shape are continuously influencing and shaping our social norms, cultures, consumption habits, and relationships.

3 Conceptual Framework and Hypotheses

Individuals undergo a process of acculturation due to changes in consumption cultures. Therefore, in the evolution of consumption habits that are changing with the influence of digitalization and technology into a culture, consumption culture must be addressed simultaneously. In essence, consumer culture is a system in which their relationship with material and symbolic resources in the market shapes the cultural values and practices experienced by individuals in their daily lives [2]. Within digital acculturation, consumer culture is the shared sets of individuals' consumption behaviour shaped by digital technology, whether directly or indirectly [29]. Previous studies have discussed that digital consumer culture includes autonomy, access to digital technologies, and online engagement [10]. Dey et al. [29] identified three key elements of digital consumer culture: consumer empowerment, reciprocity between the online and offline world, and decompartmentalization of identities. As depicted in Fig. 1, the proposed theoretical model of the study is based on digital consumer culture, digital acculturation, and real-time experience.

Acculturation is a dynamic process with antecedents, strategies, and consequences that can change various physical, cultural, political, and social domains—for instance, moving to a new place or adopting a different belief system [14]. Regarding digital acculturation, changes in individual

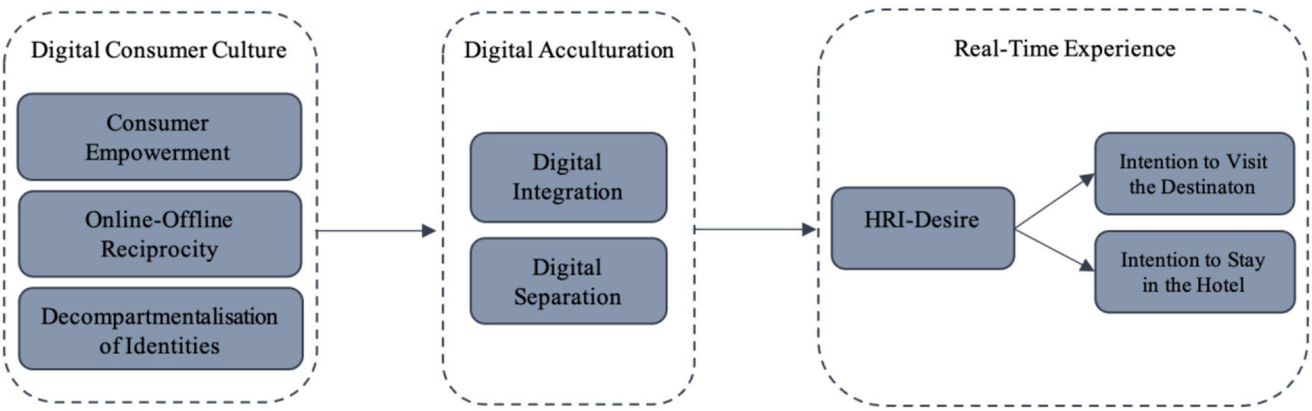

Fig. 1 Proposed conceptual model

consumption patterns can be better understood in the context of real-time experiences. Digital technology's functions, including communication, processing, perception, and activation, lead to real-time experiences in many aspects of life (Trischler & Trischler [98]). For instance, Asian culture is known for its high-context communication codes. People from such cultures usually depend on non-verbal cues, such as body language and facial expressions, to convey their messages [79]. In a recent study, the habits of Chinese participants were positively correlated with continuance intention to use chatbots in tourism activities [112]. Moreover, there has been a shift from booklets to augmented reality in recreational activities such as visiting exhibitions and museums. Individuals prefer experiencing the historical sites' reenactments through augmented reality instead of relying on traditional booklets during museum tours [19]. Hence, we grounded the examination of the relationship between acculturation and HRI to encompass real-time experiences, explicitly considering the Intention to visit destinations and stay at hotels. The hypotheses are discussed below.

3.1 Consumer Empowerment

The digital empowerment of consumers is their ability to use technology to access information, make informed decisions, and influence businesses and organizations [29]. Over the past decade, social media and the internet have empowered consumers to make better-informed decisions in the digital world [41]. As it empowers individuals to make reservations, collect information, and share experiences, it can create digital awareness. This has transformed consumers from passive buyers to active players, enabling them to share their vacation experiences online and influence products and services [88]. Thus, digital technologies have empowered consumers and given them more control. They have evolved the ability to create an impact beyond geographical and cultural boundaries. In this scope, a positive approach of empowered consumers towards digital technology can lead to a new consumer culture. Therefore, we put forward the following hypotheses:

H1 There is a positive relationship between consumer empowerment and digital integration.

H2 There is a negative relationship between consumer empowerment and digital separation.

3.2 Online-Offline Reciprocity

It refers to the symbiotic relationship between the online and offline worlds and how they impact each other [29]. Digital technologies have led to the transfer of people's offline selves to their online presence – and have caused online fads to shape offline lifestyles and consumption habits [58]. For example, social media can help individuals develop different aspects of their offline identities by facilitating the creation of information related to hobbies and areas of interest [63]. The reciprocity between online and offline interactions can also happen in reverse. Individuals seek to save time offline by efficiently searching, communicating, and purchasing. This inclination of offline consumption drives individuals to adopt digital technologies such as chatbots. In a study, 87% of consumers were willing to interact with chatbots during their journeys [102]. During the COVID-19 pandemic, people could not travel due to restrictions and safety concerns. They started engaging in virtual tourism activities, e.g., 360-degree videos [70]. Thus, online and offline reciprocity has triggered a new way of consumption. Based on this observation, we propose the following hypotheses:

H3 There is a positive relationship between online reciprocity and digital integration.

H4 There is a negative relationship between online reciprocity and digital separation.

3.3 Decompartmentalization of Identities

It refers to blurring traditional boundaries between aspects of a person's identity [29]. The digital age has brought about a significant transformation in how individuals manage and present their identities. Nowadays, people are not limited to a single identity or direction. Digital platforms have made the expression of diverse identities possible. It showed that individuals can have multiple interests, passions, and identities [85]. Sayago [92] argues that technology enables the exploration of online life and the simulation of various identities, leading to enriched experiences of social interaction and constantly expanding social networks. Thus, they can express their identities more relaxed and compromise their privacy [58]. As a result, social media and digital technologies have become powerful tools that influence the formation of an enriched identity in individuals' minds, as they allow individuals to integrate identities associated with various interests without isolation. Therefore, we propose the following hypothesis:

H5 There is a positive relationship between the decompartmentalization of identities and digital integration.

H6 There is a negative relationship between the decompartmentalization of identities and digital separation.

3.4 Digital Integration

It is adopting characteristics of different cultures through online interactions while retaining one's identity [29]. In our study, we extend it to forming a new identity and consumption pattern through digital technology and media, including reshaping habits, preferences, and daily routines. In digital integration, individuals can accept technology as an active transformation (learning application) tool in their online lives and gain competence. They can actively engage with technology by evolving into a digital consumer [93]. Frias et al. [38] emphasize the significance of digital integration in shaping consumption behaviour. This may impact decisions regarding activities and services that meet individuals' needs and preferences. Moreover, digital media also provides meeting new people and exploring new cultures, which can shape an individual's preferences. Platforms like TikTok have been observed to encourage individuals to explore new destinations beyond their usual preferences through visual and written content [114]. Li et al. [68] highlighted that social media is crucial in virtual acculturation. It helps individuals research, explore, plan, and share their travel experiences, enabling them to learn and embrace a new culture. Therefore, we propose the following hypothesis:

H7 There is a positive relationship between digital integration and HRI-desire.

3.5 Digital Separation

This concept refers to using digital platforms simply for facilitating interactions among individuals within a group and strengthening bonds [58]. This study extends the definition of digital separation as the process in which digital technology and online movements do not drive an individual's identity, consumption patterns, or way of life. Seeking new connections is not the primary purpose of relationship patterns in the digital world. Instead, some people prefer to communicate with those with similar values and beliefs. This limited exposure to differing viewpoints may prevent them from adopting new attitudes and consumption habits [29, 108]. Camilleri and Kozak [18] discuss how engaging content can enhance individuals' online social interaction behaviours and bring them together. In a way, social media encourages individuals in the same orientation to interact with other online users. Moreover, digital technology does not drive an individual's daily routine in the digital separation. Even if someone consistently uses digital technology, it does not necessarily result in acquiring new consumption habits, such as online shopping, over time. Such individuals may not be inclined to embrace digital technology, which may conflict with their established values and norms. Thus, they prefer traditional practices. As a result, they may choose traditional hospitality and warm welcomes instead of trying out new experiences in tourism activities [22, 86]. Based on this information, we suggest the following hypothesis:

H8 There is a negative relationship between digital separation and HRI desire.

3.6 HRI-Desire

Desires represent the state of mind where appraisals are transformed into a motivation to do so [80]. In this context, HRI desire refers to individuals' motivations, preferences, and wishes to interact with robots in service environments. Zhu [115] found that individuals' interest in robotic restaurants positively influenced their intentions to experience them. Visiting a robotic restaurant was positively associated with individuals' interests, which motivated their behaviours. According to Choi et al. [21], there was a strong correlation between the interaction with robot baristas and the intention to visit coffee houses where there are robot baristas. Having such experiences may also stimulate the individuals' interest in similar activities once there has been a prior experience. As a result, the desire to interact with service robots will lead consumers toward destinations and hotels where they can obtain experiences aligned with their desires since tourism is based on experiences [76]. Thus, we posit the following hypothesis:

H9 There is a positive relationship between HRI desire and Intention to visit the destination.

H10 A positive relationship exists between desire and Intention to stay in the hotel.

4 Methodology

This study was based on conducting a questionnaire survey. All questionnaires consist of seven-point Likert scales ranging from (1) strongly disagree to (7) strongly agree. A three-item questionnaire developed by Leung and Jiang [67] was employed in the study to measure participants' intention to visit the destination. The intention to stay at a hotel was measured using a three-item survey from Yang et al. [107]. HRI desire was measured with a three-item questionnaire from Hwang et al. [52]. A four-item questionnaire was also used by Kim and Chen [57] to measure digital consumer empowerment. The authors revised and developed the five-item questionnaire on the decompartmentalization of consumer identities [106] and the four-item

questionnaire on promoting reciprocity between the online and offline world [4]. Based on the previous studies [29, 58, 97, 104], the authors developed six-item digital integration and six-item digital separation questionnaires. Appendix presents all statements and their sources. To assess the validity and reliability of the questionnaires and to make sure that the statements were clear to understand, a preliminary test was conducted with 68 participants. The results of this test showed that the alpha values for all constructs varied between 0.793 and 0.938, while the Average Variance Extracted (AVE) values varied between 0.595 and 0.890. It was found that the R2 values for digital integration, digital separation, HRI-desire, Intention to visit destination, and Intention to stay at the hotel are 0.733, 0.291, 0.252, 0.673, and 0.695, respectively. Hypotheses were also analyzed to test the theoretical validity of the proposed model. 60% (H3, H5, H6, H7, H9, H10) of hypotheses were found to be significant.

Acculturation studies typically involve examining different communities in a specific country—for example, South Koreans in Japan [78]. The current research focused on the Turkish community to test the proposed digital acculturation and HRI interaction. The Turkish community is generally characterized by a high power distance, uncertainty avoidance, and a masculine culture [3]. As mentioned earlier, these cultural dimensions negatively affect attitudes towards robots [20]. Nevertheless, a recent study has revealed that regardless of the cultural dimensions of the Turkish community, they demonstrate a favourable disposition towards HRI [9]. Hence, the Turkish community is regarded as one of the most suitable samples for examining HRI in digital acculturation. As a result, we assume that this sample is consistent with the primary aim of our research.

Table 1 Descriptive information of participants

Demographics	Categories	*N*	%
Gender	Female	174	57.6
	Male	124	41.1
	Other	4	1.3
Age	18–24	86	28.5
	25–34	89	29.5
	35–44	74	24.5
	45–54	34	11.3
	55–64	16	5.3
	65+	3	1.0
Marital status	Married	125	41.4
	Single	171	56.6
	Other	6	2.0
Educational level	Primary and secondary	3	1.0
	High school	41	13.6
	Associate degree	49	16.2
	Bachelor	126	41.7
	Master	56	18.5
	Doctorate	27	8.9

The data was collected using the convenience sampling method, often preferred since it saves time, is easily accessible, and is resource-efficient [34]. The data was collected among those people residing in Turkey via an online form (Google Forms) between 27 February and 3 April 2024. Respondents were directly approached through either their email or social media accounts. As indicated in Table 1, the profile of respondents was mixed in terms of age, education, gender, and marital status. It also conveys the broader geographical representation of communities within the country. The G*Power tool was used to determine the required sample size for the research [55]. With six predictors, an f of 0.15, α error probability of 0.05, and a power (1–β (Beta) error probability) of 0.95, 146 participants were considered sufficient. The data collection process involved 319 participants, which exceeded the required sample size. After eliminating incomplete responses, 302 respondents were used for further analysis.

The study analyzed the proposed conceptual model and hypotheses using the partial least squares (PLS) program within the structural equation modelling (SEM) method. In social science research, PLS-SEM is often preferred [84], as it outperforms CB-SEM in complex theoretical models [44] and does not require data to follow a normal distribution [113]. As this is the first study to explore the complex relationship between digital consumer culture, digital acculturation, and HRI desire, the PLS-SEM method was chosen for data analysis. The analysis involved testing the measurement models, analyzing the structural model, and investigating the hypotheses. SPSS version 29.0.2.0 was employed to generate descriptive statistics and evaluate data quality.

Due to data collection procedures, standard method bias (CMB) is a concern in social sciences. A single-factor Harman test evaluated CMB's impact on structures [39]. According to the test results, the single factor variance was 35.51%. This is below the recommended threshold of 50%, which means that CMB was not a concern in the study. In PLS-SEM studies, CMB is assessed by considering the variance inflation factors (VIF). According to Kock [61], VIF values should be 3.3 or lower. The range of VIF values in this study was between 1.000 and 1.913.

5 Results

5.1 Measurement Model

Following Hair et al. [43], the validity and reliability of the measurement were tested using item loadings, composite reliability (CR), Cronbach's alpha, average variance extracted (AVE), convergent, and discriminant validity. As seen in Table 2, the item loadings range between 0.706 and

Table 2 Measurement model results

	T-value	Loadings	A	AVE	CR (rho_a)	CR (rho_c)
Consumer empowerment			0.797	0.622	0.804	0.868
COEMP → COEMP1	21.456	0.734				
COEMP → COEMP2	28.129	0.796				
COEMP → COEMP3	38.015	0.805				
COEMP → COEMP4	42.626	0.817				
Online-offline reciprocity			0.715	0.632	0.747	0.837
ORECP → ORECP1	18.043	0.723				
ORECP → ORECP2	50.483	0.842				
ORECP → ORECP3	32.294	0.815				
Decompartmentalization of identities			0.811	0.567	0.828	0.867
DCOID → DCOID1	23.487	0.739				
DCOID → DCOID2	22.515	0.715				
DCOID → DCOID3	28.011	0.768				
DCOID → DCOID4	21.609	0.738				
DCOID → DCOID5	42.474	0.800				
Digital integration			0.844	0.563	0.847	0.885
DINTG → DINTG1	21.772	0.713				
DINTG → DINTG2	36.797	0.788				
DINTG → DINTG3	26.655	0.738				
DINTG → DINTG4	20.970	0.706				
DINTG → DINTG5	33.651	0.804				
DINTG → DINTG6	29.667	0.748				
Digital separation			0.816	0.577	0.820	0.872
DSPRT → DSPRT1	37.585	0.771				
DSPRT → DSPRT2	31.753	0.760				
DSPRT → DSPRT3	41.037	0.821				
DSPRT → DSPRT4	22.571	0.723				
DSPRT → DSPRT5	20.774	0.720				
HRI-desire			0.833	0.749	0.835	0.900
HRID → HRID1	44.963	0.835				
HRID → HRID2	51.624	0.867				
HRID → HRID3	74.107	0.895				
Intention to visit the destination			0.852	0.770	0.859	0.910
INTDE → INTDE1	65.637	0.866				
INTDE → INTDE2	52.563	0.880				
INTDE → INTDE3	70.598	0.887				
Intention to stay in the hotel			0.871	0.795	0.872	0.921
INTHO → INTHO1	75.373	0.901				
INTHO → INTHO2	62.685	0.889				
INTHO → INTHO3	72.057	0.884				

0.901, exceeding the threshold value of 0.70 [42]. The Cronbach's alpha values, ranging from 0.797 to 0.871, and the CR values, ranging from 0.747 to 0.921, exceed the threshold 0.70 [43], demonstrating strong internal consistency reliability. The AVE values for the constructs vary between 0.577 and 0.795. Thus, convergent validity has been established as the AVE values exceed the threshold 0.50 [42].

The assessment of discriminant validity was conducted using the heterotrait-monotrait (HTMT) [48] and the Fornell and Larcker [37] criteria. According to the HTMT criterion, the indicators should be less than the threshold values of 0.85 and 0.90. In the Fornell and Larcker criterion, the square root of the AVE for each construct should be higher than its correlation with other constructs—Tables 3 and 4 show that the study achieved discriminant validity based on both criteria.

5.2 Structural Model

Table 5 displays statistical values for the structural model. R^2 measures the explanatory power of endogenous constructs. The R^2 values for the endogenous variables digital integration, Intention to stay in the hotel, Intention to visit the destination, digital separation, and HRI-desire are 0.555, 0.462, 0.406, 0.351, and 0.265, respectively. Q^2 measures the predictive accuracy of the path model. Q^2 values greater than 0

Table 3 Discriminant validity

Construct	HTMT ratios							
	COEMP	DCOID	DINTG	DSPRT	HRID	INTDE	INTHO	ORECP
COEMP								
DCOID	0.784							
DINTG	0.797	0.709						
DSPRT	0.627	0.639	0.649					
HRID	0.500	0.595	0.486	0.583				
INTDE	0.607	0.643	0.632	0.632	0.749			
INTHO	0.443	0.586	0.444	0.582	0.795	0.811		
ORECP	0.760	0.752	0.796	0.583	0.535	0.551	0.488	

Notes: COEMP; consumer empowerment, DCOID; compartmentalization of identities, DINTG; digital integration, DSPRT; digital separation, HRID; HRI-desire, INTDE; intention to visit the destination, INTHO; intention to stay in the hotel, ORECP; online-offline reciprocity

Table 4 Discriminant validity

Construct	Fornell and Larcker							
	COEMP	DCOID	DINTG	DSPRT	HRID	INTDE	INTHO	ORECP
COEMP	**0.789**							
DCOID	0.641	**0.753**						
DINTG	0.662	0.610	**0.750**					
DSPRT	-0.512	-0.535	-0.544	**0.760**				
HRID	0.407	0.488	0.413	-0.483	**0.866**			
INTDE	0.503	0.551	0.537	-0.533	0.637	**0.878**		
INTHO	0.369	0.499	0.383	-0.491	0.680	0.701	**0.891**	
ORECP	0.580	0.581	0.635	-0.470	0.427	0.447	0.390	**0.795**

Notes: COEMP; consumer empowerment, DCOID; decompartmentalization of identities, DINTG; digital integration, DSPRT; digital separation, HRID; HRI-desire, INTDE; Intention to visit the destination, INTHO; Intention to stay in the hotel, ORECP; online-offline reciprocity, bold values that appear on the diagonal represent the square root of the AVE

Table 5 Quality of the model

	R^2	Q^2	SRMR
Digital integration	0.555	0.536	0.067
Digital separation	0.351	0.333	
HRI-desire	0.265	0.239	
Intention to visit the destination	0.406	0.221	
Intention to stay in the hotel	0.462	0.182	

Note: SRMR; standardized root mean residual

indicate some predictive relevance and values exceeding 0.25 and 0.50 indicate medium and large predictive relevance, respectively. In this study, the Q^2 values for endogenous constructs range from 0.182 to 0.536. The standardized root mean square residual (SRMR) value for the structural model was 0.067, which indicates a good fit of the model according to the suggested cut-off value of SRMR ≤ 0.08 [19].

To evaluate the hypotheses, we used bootstrapping with 5,000 subsamples. We calculated β coefficients, t-values, and 2.5–97.5% bias-corrected confidence interval (CIBC) ranges. Figure 2; Table 6 present the values related to hypothesis testing. Accordingly, there was a positive relationship between consumer empowerment and digital integration (β = 0.349; t = 6.120, $p < .01$) and a negative relationship between consumer empowerment and digital separation (β = -0.227; t = 3.588, $p < .01$). Thus, confirming H1 and H2. Online-offline reciprocity exhibited a positive relationship with digital integration (β = 0.315; t = 5.644, $p < .01$) and a negative relationship with digital separation (β = -0.170; t = 2.742, $p < .01$), supporting H3 and H4. The decompartmentalization of identities showed a positive relationship with digital integration (β = 0.203; t = 3.596, $p < .01$) and a negative relationship with digital separation (β = -0.291; t = 4.554, $p < .01$), thereby supporting H5 and H6.

The hypothesis testing results revealed significant pathways between endogenous constructs. Consequently, there was a positive relationship between digital integration and HRI desire (β = 0.214; t = 3.204, $p < .01$), while the relationship between digital separation and HRI desire was negative (β = -0.367; t = 5.919, $p < .01$), thus supporting H7 and H8. Finally, confirming H9 and H10, we found that HRI-desire had a positive relationship with Intention to visit the destination (β = 0.637; t = 17.520, $p < .01$) and Intention to stay in the hotel (β = 0.680; t = 19.345, $p < .01$). All hypotheses were supported because the p-values for path coefficients were $p < .01$, t-values were t > 1.96. The 97.5% CIBC did not include zero.

6 Conclusion and Implications

Due to the noted significant gaps in the literature, this study has aimed to answer how individuals may adopt new (digital) consumption patterns beyond cultural norms in HRI in the context of digital acculturation. The research findings

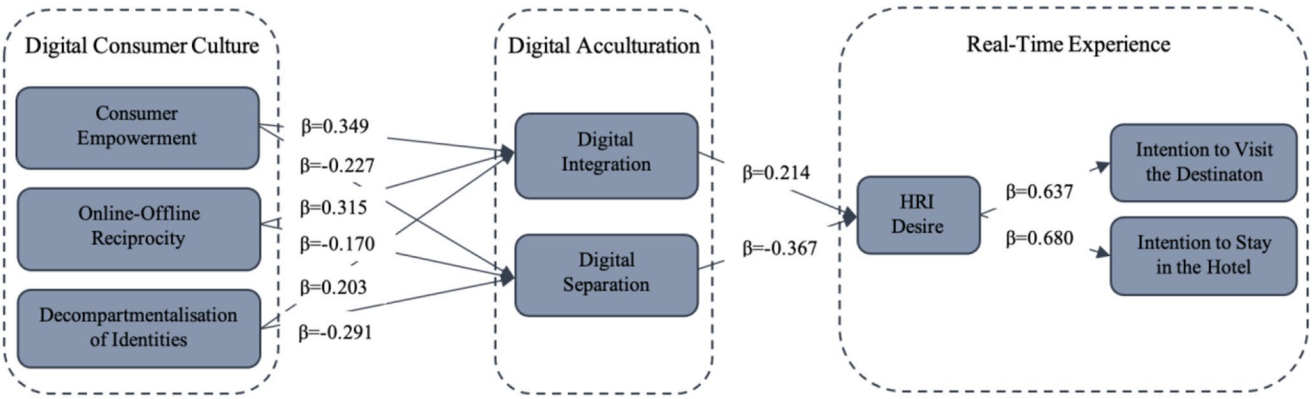

Fig. 2 Structural model (all hypotheses significant at $p < .001$)

Table 6 Hypotheses test results

Hypothesis	B	T-values	CIBC		Results
			2.5%	97.5%	
H1: Consumer empowerment → digital integration	0.349	6.120***	0.236	0.464	Supported
H2: Consumer empowerment → digital separation	-0.227	3.588***	-0.345	-0.099	Supported
H3: Online-offline reciprocity → digital integration	0.315	5.644***	0.205	0.427	Supported
H4: Online-offline reciprocity → digital separation	-0.170	2.742***	-0.286	-0.042	Supported
H5: Decompartmentalization of identities → digital integration	0.203	3.596***	0.094	0.312	Supported
H6: Decompartmentalisation of identities → digital separation	-0.291	4.554***	-0.424	-0.172	Supported
H7: Digital integration → HRI-desire	0.214	3.204***	0.087	0.347	Supported
H8: Digital separation → HRI-desire	-0.367	5.919***	-0.489	-0.247	Supported
H9: HRI-desire → intention to visit the destination	0.637	17.520***	0.567	0.707	Supported
H10: HRI-desire → intention to stay in the hotel	0.680	19.345***	0.610	0.747	Supported

Notes: CIBC; confidence interval bias-corrected, ***$p < .001$

provide insights into online acculturation, supporting the theoretical framework of digital consumer culture and digital acculturation [29]. Previous studies have shown that acculturation may occur online, outside the physical realm. Social media has often been an acculturation agent [31, 53, 59]. Our results shed light on the impact of consumer empowerment, online-offline reciprocity, and the decompartmentalization of identities on digital acculturation and broadening the context of social media and technology.

Accordingly, instead of directly leading to acculturation, social media and technology digitalize consumer culture, fostering acculturation. Access to social media and technology empowers individuals digitally, leading to reconstitution in consumption patterns. Thus, digital means shape traditional consumption cultures as individuals gain influence over products and services and make informed decisions, leading to digital integration. Moreover, technology and social media play a crucial role in shaping our offline habits as they encourage digital integration among individuals and provide a platform for diverse identities to be openly shared, decreasing negative attitudes towards digital separation. Caliandro et al. [17] discussed this within the platformization of consumer culture, which means digital platforms transform consumer culture. According to the authors, digital technologies centre on consumer behaviour, resulting in the hybridization of online and offline identities. Hereof, our results revealed that the decompartmentalization of identities also rises in digital consumer culture and impacts digital integration. This allows individuals to freely manage their identities online without separating (e.g., work and personal life), enabling them to explore diverse interests and attitudes.

The current research has shown that online acculturation can occur through digital integration without requiring assimilation and can lead to a positive attitude towards HRI desire. This result supports the correlation between technological integration and cultural innovation [105] and indicates that the connection between culture and HRI may extend beyond cultural norms and values. Papadopoulos and Cleveland [77] express the impact of digitalization on cultural heterogeneity and homogeneity. Accordingly, digitalization promotes content associated with different cultures, leading to cultural heterogeneity, i.e. the preservation of various cultures or the formation of a common culture, that is homogeneity. The study reveals an increasing desire for robots within the Turkish community, contributing to the relationship between digital integration and cultural homogeneity. Baser et al. [9] proposed that Turkish society's favourable attitudes toward HRI may be credited to the media's role in raising public

awareness. The study also expands the idea that digital media significantly impacts public awareness within the context of digital consumer culture and acculturation. Moreover, our findings suggest that this attitude towards a desire for HRI is also associated with emerging consumption patterns that are not explicitly tied to a particular society. This is based on the fact that digital acculturation brings different cultural dynamics and technological integration.

Our findings also show that individuals' desire for HRI is positively associated with their Intention to visit the destination and stay at the hotel. Previous studies have revealed that online acculturation, such as purchasing behaviour, affects individuals' decision-making intentions [60]. The current findings show that for individuals who prefer digital integration, their desire for a robot experience leads to real-time consumption intentions. Digital integration can shape attitudes and lead to new consumption preferences. Our study indicates that these changes may extend to experiences, not daily activities. For instance, through digital integration, many practical tasks can now be carried out online rather than offline, without requiring physical presence. Our study proposes that digital integration can also guide individuals towards destinations and hotels where they can engage in HRI experiences, thereby fostering a desire for novel experiences. It has been argued that the cultural dimensions of Turkish society, emphasizing hospitality and warm communication, trigger a negative attitude towards robots in the tourism and hospitality service settings [101]. Nonetheless, digital integration can surpass these cultural patterns and redefine our approach to consumption and experiences. Furthermore, our theoretical framework, from consumer culture to robot acceptance, contributes to how consumer culture influences robot acceptance (Blanche et al. 2020), demonstrating how digitalization can converge attitudes and behaviours toward HRI across different societies.

6.1 Managerial Implications

With the spread of technology, digital acculturation has gradually increased its impact on consumerism in recent years. As in other fields of the business world, it is especially evident in consumer behaviour and marketing. Compounded with the impact of the pandemic, the shopping experience has moved primarily to digital platforms, and consumers have been able to complete their purchasing process in a shorter time. In addition, young generations who grew up with digital games are rapidly progressing towards becoming "digital consumers" in every aspect of their lives. This is likely the group that will most prefer using robots in service delivery in the future, so focusing on this segment in marketing activities is necessary. Further, in addition to cross-generational differences, a distinction can be made based on cultural differences that are open to technology versus those that are not. As a result, digital acculturation may also intensively emerge in the tourism industry due to its universal characteristics. Therefore, tourism service providers should also carry out their work in this direction by following improvements in digitalization.

6.2 Limitations and Future Research Directions

This study has several limitations from various perspectives. First, although we discussed the impact of cultural dimensions in the conceptual framework, we did not include them in the theoretical model. Furthermore, the study does not consider moderator variables that could better explain the relationship between digital consumer culture and digital acculturation. For instance, cultural tightness/looseness, which refers to the degree of tolerance of values and norms in societies, can be considered [74]. Tight cultures typically have less variation in cultural values because of the stronger expectation that individuals adhere closely to norms, while loose cultures exhibit the opposite. Similarly, considering the impact of various types of social media on the acculturation process [64] can lead to the development of theoretical models that offer more insights. Second, this study was conducted only in Turkey; the underlying assumption was that participants had access to technology. Hence, the study omitted digital deprivation, one of the three key outcomes of digital acculturation. Individuals may lack digital access due to government censorship or limited resources despite their desire for connectivity [29]. Third, the authors developed digital integration and separation scales. As digitalization continues to shape societies and associated consumption practices, the relevance of this topic will be maintained. Therefore, we strongly recommend further scale development studies focusing on digital acculturation. Fourth, the research findings have significant implications across various fields, including marketing, sociology, business, and tourism. Therefore, exploring the current topic in diverse contexts can be beneficial. For example, when deciding on holiday choices, consumers may consider factors such as self-confidence, needs, and meeting expectations [28]. Future research can broaden the understanding of consumer goals in tourism by investigating the connection between digital integration and destination choice. Lastly, the current study has not examined the intention to visit a destination or stay in a hotel within the scope of a specific destination or accommodation establishment in the context of real-time experience. Future research could consider specific destinations, such as Japan and Korea, and hotels offering full or partial robotic services, such as Henn-na Hotel. This could provide important insights into the impact of digital acculturation on real-time experiences.

Appendix

Variables and Items	Source
Digital consumer empowerment	Kim and Chen [57]
-In using digital technologies/apps, I feel I am in control	
-The ability to influence the facilities and services of digital technologies/platforms is beneficial to me	
-I feel good because of my ability to influence the choices offered to me by digital technologies/platforms	
-My influence over digital service outcomes has increased relative to the past	
Online-offline reciprocity	Ayouby et al. [4] and developed by the authors
-I believe that digital platforms influence my real-world experiences	
-My habits are often shaped through digital technology and online applications	
-I think that digital technologies facilitate my offline life	
-I believe that digital technologies enhance my work productivity	
Decompartmentalization of consumer identities	Yampolsky et al. [106] and developed by the authors
-Social media and digital technologies provide me with opportunities to express various aspects of my identity	
-My identities on online platforms influence my sense of self (identity, thoughts, emotions, etc.) by breaking down traditional boundaries	
-The various platforms I inhabit allow me the freedom to showcase different interests and passions	
-I consider each of my social media identities as part of my overall digital presence	
-I can experience and express different social media identities simultaneously	
Digital integration	Developed by the authors based on Testa et al. [97, 106], Dey et al. [29] and Kizgin et al. [58]
-I believe that digital technologies have changed individuals' cultures, lifestyles, and habits	
-The internet has made it easier for me to reach and get to know different cultures	
-Online interactions have altered my approach to traditional cultural values	
-Thanks to digital technologies, I can acquire new hobbies and dedicate time to them	
-I actively use digital technologies to streamline my work and daily life	
-I think that digital technology and platforms have turned me into a digital consumer	
Digital separation	
-I believe that traditional cultural values should not be changed with digital experiences	
-I see the internet not as a tool for cultural exchange, but rather as a means of acquiring information	
-Despite interacting with different cultures and perspectives through the internet, I don't believe it can change my cultural identity and habits	
-My online experiences haven't influenced my cultural identity	
-I have different preferences and lifestyles both online and offline*	
-The impact of digital technology on my daily life and habits is limited	
HRI-desire	Hwang et al. [52]
-I desire to interact with a robot	
-My desire to interact with a robot is strong	
-I want to use robotic service whenever possible	
Visit Intention to a destination	Leung and Jiang [67]
-I intend to visit a destination where I can experience service robots in the future	
-It is likely that I will visit a destination where I can experience service robots in the future	
-I plan to visit a destination where I can experience service robots in the future	
Intention to stay in the hotel	Yang et al. [107]
-I am willing to stay at a robotic hotel when traveling	
-I plan to stay at a robotic hotel when traveling	
-I prefer to stay at a robotic hotel when traveling	

*Removed model due to low indicator loading

Data Availability Data will be made available at a reasonable request.

Declarations

Ethical Approval This study was approved by the Ethics Committee of Hasan Kalyoncu University.

Conflict of Interest The authors declare that they have no conflict of interest.

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Miraç Yücel Başer is an alumnus of Giresun University of Tourism and Hospitality Management. He graduated with a master's degree in Tourism Management from Gaziantep University in 2021. He is pursuing a doctoral degree in the Department of Business Administration at Hasan Kalyoncu University. His research areas include Human-Robot Interaction, Blockchain, Artificial Intelligence, and other emerging technologies in tourism and management.

Metin Kozak is a Professor and Dean at the School of Communication, Kadir Has University, Türkiye. He received Master's degree in tourism, Dokuz Eylul University, Türkiye, and his doctoral degree at Sheffield Hallam University, UK. He has a total of 30+ years of teaching and research experience. His current research interests lie in marketing, consumer behavior and health sciences in an interdisciplinary context.

Tuba Büyükbeşe is a Professor of Business Management in the Faculty of Economics, Administrative and Social Sciences, and currently serves as the Acting Dean of the Faculty of Tourism at Hasan Kalyoncu University. She graduated from Uludag University in 1999 and then in 2002 she graduated from Banking and Insurance department at Anadolu University. She obtained her MBA and Ph.D. degrees from Sutcu Imam University. She has more than 20 years of teaching and research experience. Her research areas include human resource management, organizational behaviour, and leadership.