Computers in Human Behavior Reports 19 (2025) 100763

Contents lists available at ScienceDirect

Computers in Human Behavior Reports

journal homepage: www.sciencedirect.com/journal/computers-in-human-behavior-reports

Mapping trust and cultural dimensions in Human-Robot Interaction: A scoping review approach

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ARTICLE INFO

Keywords:
Human-robot interaction
Trust
Cultural background
Robotic systems
Usability
Acceptability

ABSTRACT

In the field of Human-Robot Interaction (HRI), understanding the variables that shape human responses to robotic systems is essential for advancing technology adoption and optimizing user experiences. Trust and cultural dimensions have been identified as potentially significant yet underexplored influences on HRI. This review systematically examines studies that address these factors within the HRI domain. A comprehensive search of the Scopus and PubMed databases yielded 104 relevant articles, of which only seven met the inclusion criteria. Notably, none of these studies involved direct interactions with physical robots; instead, they utilized virtual reality environments to simulate HRI scenarios. Several studies suggest that trust plays an important role in shaping user intention to engage with robots, particularly in service contexts indicating that fostering trust may enhance robot acceptance across various applications. Cultural background was also shown to significantly shape user intentions and behaviors toward robotic technology. This review highlights the current tools and methodologies used to evaluate trust and cultural impact in HRI, providing a foundation for future research aimed at refining these assessments and further understanding their implications for HRI design and deployment.

1. Introduction

The global proliferation of robotic agents has increasingly integrated them into various facets of human life. In recent years, Human-Robot Interaction (HRI) research has progressed substantially, primarily aiming to enhance the acceptability of robots in everyday contexts. These efforts have encompassed not only structural and aesthetic modifications but also behavioral adjustments to elicit positive responses from human users (Han & Conti, 2020). Researchers have focused on identifying social signals most likely to foster favorable human reactions, as well as developing tools to assess human factors that may influence these interactions.

Despite this progress, limited research has systematically examined the influence of cultural background on HRI. This gap is partly due to the logistical complexities of conducting studies with large, culturally diverse samples. Studies specifically addressing the role of trust within these interactions are even rarer, despite trust being fundamental to effective human-robot relationships. As shown by Hancock et al. (2011), trust directly impacts individuals' willingness to accept and follow information provided by robots. Yet, trust remains a subject of active debate among researchers, with its definitions and implications in various contexts still lacking consensus (Long et al., 2017).

In order to fully understand the dynamics of trust, it is essential to distinguish it from related concepts such as confidence, familiarity, and emotions. In Luhmann (2000) the difference between these concepts is well explored. Regarding emotions, in Dunn and Schweitzer (2005) report the results of five experiments in which they assessed the influence of emotional states on trust in unrelated contexts. They found that positively connotation emotions (such as happiness and gratitude) increased trust while a negatively connotation emotion (anger) decreased it. In the study, emotions did not influence trust when individuals were aware of the source of their emotions or when they were very familiar with the trustor. This need for clarity becomes especially critical when cultural dimensions are considered. Also culture aspects are a notoriously extremely broad concept.

Furthermore, Song (2009) indicated that religion, nationality, language and race are categories that have been incorporated or synonymous considerations of the concept of culture and it is difficult to establish its boundaries. In Choi et al. (2025) the authors highlight how culture and race/ethnicity are often confused. In the studies we examined, culture was identified with nationality.

This scoping review offers a comprehensive synthesis of the last

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https://doi.org/10.1016/j.chbr.2025.100763
Received 14 November 2024; Received in revised form 15 July 2025; Accepted 2 August 2025
Available online 5 August 2025

decade's literature on the construct of trust as it relates to cultural factors within HRI studies, aiming to bridge this critical gap in understanding.

2. Trust

In the study of HRIs, multiple factors influencing this interaction have been systematically examined, including both the structural characteristics and behavioral attributes of robots, with the goal of enhancing acceptability and usability. This scoping review aims to evaluate two still not very well explored together aspects of HRI: trust and culture. Current literature reveals a notable gap in studies that thoroughly explore these dimensions.

Specifically, with reference to trust, Firmino de Souza et al. (2025) conducted a systematic review of the literature on trust and reliability in HRI. The results highlight the lack of conceptual clarity that is manifested in the lack of studies that present a clear definition of trust. In fact, 29.4 % of the studies examined do not define trust and 29.4 % use an ad hoc definition. Only in 17.6 % of the cases is a definition of trust given. The same study also reports that only 20.6 % of the studies used community-approved research tools to assess trust. Furthermore, Wang et al. (2023) provide an overview of human-robot trust models, providing an in-depth discussion of the categorization, formulation, and analysis of the trust model in robotics. The authors differentiate between human-robot trust, generic trust between agents, interpersonal trust, and human trust in machines, and also provide a list of factors that influence trust.

Trust is commonly understood as a multidimensional construct that spans numerous disciplines such as psychology, cognitive science, and sociology. Although there are numerous definitions available, one of the most recent, reported by Abbass et al. (2018), defines trust as a complex psychological attitude encompassing beliefs and expectations about the trustworthiness of an entity. Trust is shaped by previous experiences involving uncertainty or risk.

In light of prominent theoretical perspectives and recent empirical contributions, trust is understood not merely as a facilitating condition, but also as a dynamic intermediary within acceptance trajectories. The studies conducted by Ha and Stoel (2009), and Wu et al. (2011) demonstrated that trust serves as an important antecedent in technology acceptance; however, their research, primarily focused on trust's influence on consumer behavior within e-commerce rather than on interactions with social robots.

In HRI, trust has been considered an indirect predictor of robot acceptability. For instance, Lee et al. (2018) found that trust affects perceived usefulness in service robots within the restaurant industry. Similarly, Seo and Lee (2021) reported that trust significantly enhances both the perceived usefulness and ease of use of service robots, while also reducing perceived risk.

Furthermore, when individuals perceive a system or provider as trustworthy—demonstrating consistency, competence, and ethical behavior—they are more inclined to form positive usage intentions. To the best of our knowledge, few studies have directly assessed the impact of trust on the intention to use robots. Specifically, Chi et al. (2021) developed and validated the Social Service Robot Interaction Trust (SSRIT) scale to measure consumer trust in social robots. This scale identifies three trust indicators—propensity, reliable functioning and design of the robot, and context—each of which reflects different aspects of HRI. Propensity includes factors such as familiarity, self-efficacy, social influence, and attachment to technology, while robot design is linked to anthropomorphism and expectations regarding effort and performance. The contextual aspect encompasses perceived risks, service adaptation, and facilitating conditions (Chi et al., 2021).

Further, Tussyadiah et al. (2020) examined trust among U.S.-based travelers towards two types of autonomous technologies—self-driving vehicles and robotic bartenders. Their findings suggest that trust positively influences intention to use, driven by users' attitudes and general propensity to trust. Interestingly, the study found that a robot's physical appearance did not affect trust, a conclusion at odds with previous anthropomorphism-focused research (e.g., Castro-González et al., 2016; Lewis et al., 2018). Pakrasi et al. (2018) proposed a design methodology to create expressive robot features that promote trust, acceptance, and likability among users. While Chi et al. (2021) indicated that trust predicts the intention to interact with robots, Gursoy et al. (2019) suggested that emotional states are the primary drivers of user intentions. Chi et al. (2023) further clarified that users' intentions to engage with AI-driven service robots are influenced by both emotional responses and cognitive beliefs, such as trust.

2.1. Determinants of trust in HRI

Several studies have analyzed how robot anthropomorphism affects users' trust, treating it as a key variable in HRI. Specifically, Van Pinxteren et al. (2019) showed that anthropomorphic design can affect trust, intention to use, and enjoyment in HRI contexts. A comprehensive review by Hancock et al. (2021) identified three main categories of trust-influencing factors in HRI: human-related (e.g., cultural background), robot-related (e.g., anthropomorphism, reliability, autonomy), and context-related (e.g., collaborative task environments). These factors vary in importance depending on the specific interaction context. For instance, Robinette et al. (2016) demonstrated that participants' trust in robots fluctuated based on emergency versus non-emergency scenarios. Similarly, Soh et al. (2020) investigated the transfer of trust across tasks, finding that trust developed in one context (e.g., domestic tasks) may extend to other domains (e.g., driving simulations). Conversely, Xie et al. (2019) found that task-specific trust levels varied based on the type of activity (e.g., search, mapping, firefighting) using unmanned vehicles, highlighting the complex, context-sensitive nature of trust in HRI.

3. Cultural background

The definition of culture has been extensively explored in literature; however, arriving at a universally accepted and unambiguous definition remains a complex and elusive task. This topic continues to be a subject of considerable debate among anthropologists and researchers, with the quantification of cultural influences on human behavior representing a particularly intricate challenge (Lim et al., 2021). According to Roselli et al. (2025), the lack of a unified and comprehensive definition of culture makes it extremely difficult to operationalize it in empirical studies. However, numerous studies agree in considering the cross-country model proposed by Hofstede et al. (2010) one of the most used conceptualizations of culture. The author emphasizes that people learn culture from the environments in which they are immersed, that is, from social groups such as family and school. Culture is therefore defined as a collective and shared phenomenon (Hofstede et al., 2010). According to this model, people's cultural values can be analyzed across five dimensions: individualism-collectivism; aversion to uncertainty; distance from power; long-term orientation; and masculinity-femininity. This model was subsequently used by Hofstede and Minkov (2013) in studies involving samples from different countries, configuring itself as a cultural model based on nationality.

Moreover, Gallotti (2011) conceptualizes culture as a mechanism that facilitates the success and survival of a group by promoting cooperation, encapsulating shared patterns of norms, values, and attitudes, among other elements (Triandis et al., 2001).

3.1. Cultural background and trust

It's important to reflect on why culture is truly critical to trust. We know that culture, understood as a set of shared values, beliefs, and norms, can shape a group's values. Culture influences how we perceive ourselves, how we perceive others, and how we interact with them,

creating frameworks that influence the propensity for trust and the way it is expressed and constructed. Trust is therefore strongly linked to belonging to a social group. Indeed, several authors have indicated that people who share a sense of belonging to a group are perceived as trustworthy (Brewer & Gardner, 1996; Yamagishi & Kiyonari, 2000). Furthermore, trusting behavior is directed more toward members of one's own internal group than toward external ones (Tanis & Postmes, 2005). The very process of perceiving oneself as belonging to a social group and sharing a "social identity" produces trust (Hogg et al., 2004). In Igarashi et al. (2008), people with a high level of generalized trust can become close and friendly with others, especially if they share similar attitudes in life. In the article, the authors identified some cross-cultural similarities and differences in the relationship between trust and social networks (Igarashi et al., 2008). Social networks are built by humans as social beings, and both evolutionary traits and cultural constructs encourage trust-based cooperation. Consequently, when robots are immersed in human environments, they are immersed in a highly complex network of social structures and mechanisms (Sætra, 2021). It is therefore important to understand them in order to design increasingly high-performance robots.

3.2. Cultural background impact in HRI

The relationship between culture and trust in robots is well demonstrated through various studies, highlighting as cultural factors play a pivotal role in shaping individuals' trust in robots (Lewis et al., 2018). Indeed, numerous studies have exanimated the influence of cultural background on trust in HRI, consistently concluding that individuals from different cultural backgrounds exhibit divergent levels of trust in robotic systems.

Evers et al. (2008) indicated that individuals from distinct national cultures exhibit varying responses to robots, thereby suggesting that universal predictions regarding HRI are not feasible. This perspective is supported by Belanche et al. (2020), who affirmed that both national cultures and individual cultural values significantly influence attitudes toward robots and the intention to adopt technological devices. For instance, Sun et al. (2020) investigated how cultural factors shape the use of technologies, highlighting that cultural context plays a crucial role in determining technological adoption behaviors.

A recent study by Bennett et al. (2023) explored cultural distinctions between Eastern and Western societies in terms of the social norms governing interaction behaviors during conversations. The authors emphasized the necessity of establishing "social fluidity" in HRI to facilitate human perceptions of robot interactions as natural and realistic. Notably, the research focused not only on the content of dialogues but also on the subtleties of speech, such as timing, tempo, and cadence-elements of speech that vary significantly across cultural contexts.

In a study by Andrist et al. (2015), the cultural effects on robot credibility were examined by comparing an Arabic-speaking robot in Lebanon with an English-speaking robot in the United States. The results showed that rhetorical cues had a greater impact on credibility assessments among Arabic-speaking participants than among for English-speaking counterparts. A follow-up investigation in Lebanon compared, a robot speaking Standard Arabic with one speaking a local Arabic dialect. While both robots initially provided limited knowledge, the Standard Arabic speaking robot was perceived as more credible. However, when both robots delivered a higher level of knowledge, users tended to favor the robot speaking the local dialect, likely due to a stronger sense of familiarity and cultural resonance.

Chien et al. (2016) conducted a comparative analysis involving individuals from Western, Middle Eastern, and Latin American cultures, finding that participants from Western cultures exhibited higher initial trust in robots, whereas those from Middle Eastern and Latin American cultures demonstrated lower initial trust and required more time to build it. Rau et al. (2009) investigated the influence of robot appearance, task type, and participant culture on HRIs, with participants from China, Korea, and Germany. Using four evaluative scales—liking, involvement, trust, and satisfaction—the study revealed significant cultural differences in participants' responses to the robots. Nomura et al. (2015) corroborated these results through a comparison of Japanese and British samples in their acceptance of humanoid robots. Evers et al. (2008) further demonstrated that Chinese participants exhibited greater comfort with robots than U.S. participants, along with a stronger sense of control and a higher tendency to anthropomorphize the robots.

Trust plays a pivotal role in robotics, especially when social robots are deployed in assistive roles, such as Social Assistive Robots (SARs) and Social Home Robots (SHRs). Langer et al. (2019) offer a comprehensive review focused on trust in social robots within rehabilitation settings for individuals facing linguistic or cognitive challenges. Their work not only surveys the tools used to measure trust but also delves into how cultural factors and prior experiences shape this trust. Multiple scholars argue that designing culturally attuned social assistive robots is essential to foster genuine trust in care and rehabilitation contexts (Lewis et al., 2018; Li et al., 2010). These insights collectively highlight a critical design imperative: understanding and integrating cultural nuances isn't optional, but foundational to the success of social robots.

To thrive in culturally diverse societies, robotic systems must be tailored to reflect cultural values and preferences, thereby cultivating meaningful user relationships and generating broad acceptance.

This scoping review aims to map and synthesize the existing literature concerning the conceptualization and measurement of trust and culture within HRI. To guide this investigation, the following Research Questions (RQs) have been formulated. These questions focus on how trust and culture are defined, assessed, and understood in the HRI domain, as well as on their influence in shaping HRIs:

RQ1: How is trust defined in current HRI studies?,
RQ2: What tools or methods are used to assess trust in these studies?,
RQ3: How is culture conceptualized and defined within the HRI literature?,
RQ4: What approaches or instruments are employed to measure culture in the HRI context?,
RQ5: What is the nature and extent of the influence of trust and culture on HRI?,
RQ6: Do trust and culture play a role in real interactions with robots?

By addressing these research questions, this scoping review seeks to clarify theoretical and methodological trends in the field, identify gaps, and provide a comprehensive overview that can inform future research and practice.

4. Methodology

In the present review, it is essential to emphasize that while a systematic review aims to gather empirical evidence to answer a specific research question (Pham et al., 2014), a scoping review is intended to map the existing literature on a given topic, with the goal of synthesizing research findings within a broader field (Daudt et al., 2013). In this context, a scoping review should not be considered a less rigorous alternative to a systematic review, as the two approaches serve distinct purposes and are guided by different methodological frameworks (Pham et al., 2014).

4.1. Search strategy and eligibility criteria

Prior to initiating the review process, the two independent researchers reached a consensus on the evaluation procedure and criteria for assessing the search strategy. This alignment guaranteed uniformity in their assessments, resulting in a Cohen's Kappa agreement coefficient of 0.92. Whenever disagreements arose, key issues were addressed and resolved through joint discussions, ensuring both accuracy and

consistency in the evaluation process. Against this backdrop, we systematically examined all English-language studies published between 2015 and 2025 that addressed the topic of trust and culture in HRI. A comprehensive search was conducted using the Scopus and PubMed electronic databases, with predefined search terms to identify both peer-reviewed articles and grey literature.

The search strategy was designed to capture studies that discuss the concepts of trust and robot, as well as culture and robot, within the abstract or title of the articles.

Specifically, in Scopus, the following search query was used:

(ABS(trust* AND robot*) OR ABS(culture* AND robot*)) AND PUBYEAR >2014 AND PUBYEAR <2026

This query was set to retrieve articles in which the abstract contains both terms related to trust and robot or culture and robot. The asterisk (*) functions as a truncation operator to include all relevant word forms (e.g., "trust", "trusting", "robot", "culture", etc.). The publication years were limited using the PUBYEAR field, restricting results to studies published between January 1, 2015 and June 30, 2025.

Furthermore, in PubMed the search string was adapted to the syntax of the platform:

(trust*[Title/Abstract] AND robot*[Title/Abstract]) OR (culture*[Title/Abstract] AND robot[Title/Abstract])

In the same way as Scopus, this query targets articles whose titles or abstracts include terms related to trust and acceptance, or culture and acceptance. After running the query, a custom date range filter was manually applied in the PubMed interface to include only publications from 2015 to June 2025.

This search strategy facilitated a systematic and thorough identification of literature pertinent to the research topic, while consistently applying temporal limits across both databases.

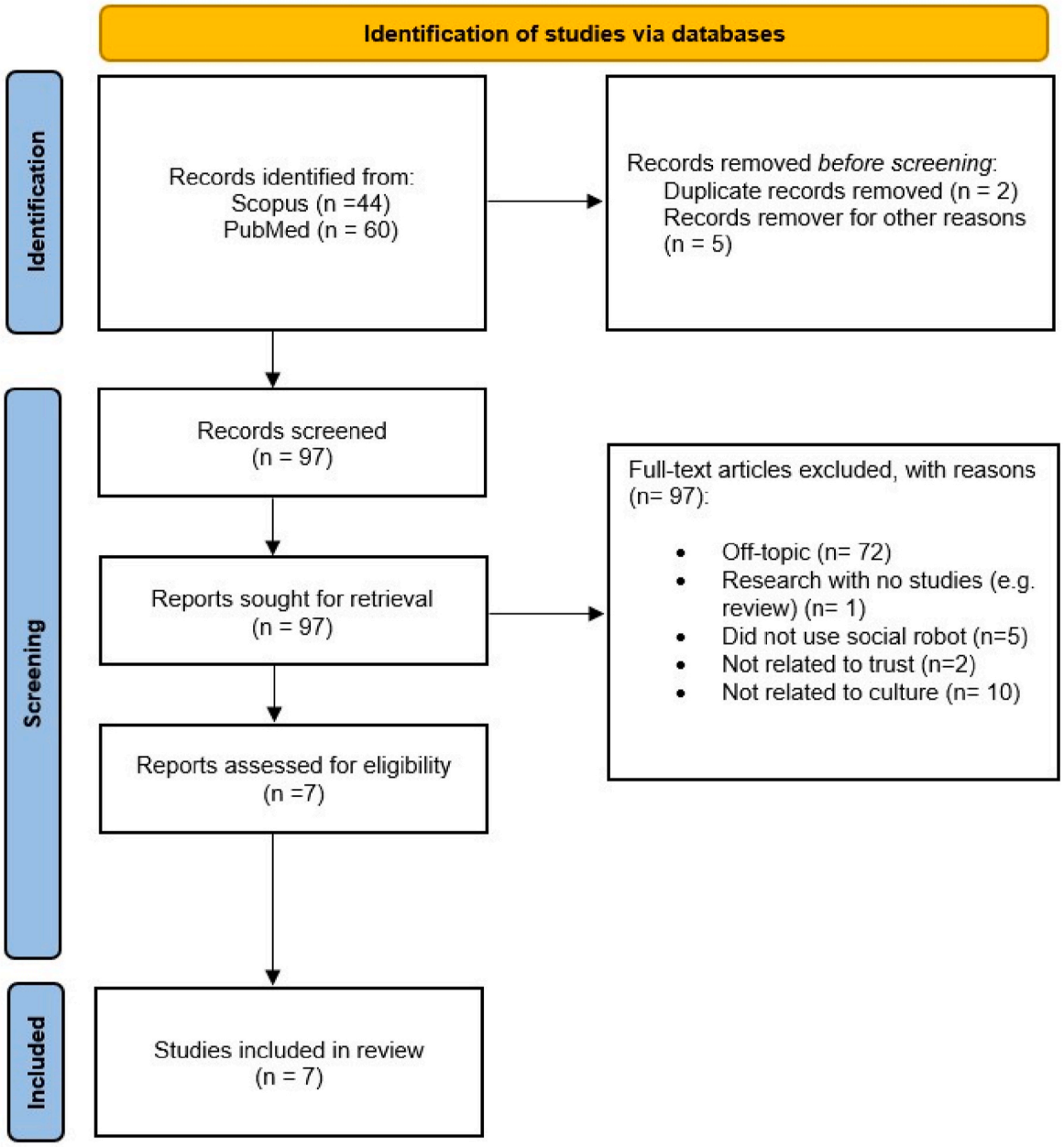

Fig. 1. The PRISMA Flow Diagram of the scoping review.

The inclusion and exclusion criteria for article selection are outlined in the PRISMA flow diagram (Moher et al., 2009), which manage the screening process within the Scopus and PubMed electronic databases.

The 104 articles retrieved from the databases were exported into an Excel spreadsheet containing, their respective metadata (e.g., author, title, DOI, etc.). Following the screening and selection process, a total of seven articles were retained. The relevant data for these studies articles were then consolidated into a single, curated Excel file.

Specifically, Fig. 1 presents the PRISMA flow diagram outlining the selection process that led to the inclusion of seven articles from an initial pool of 104. This diagram offers a descriptive overview of the current state of research at the intersection of trust and culture in HRI.

Table 1 presents a detailed summary of each selected article, including the study type (quantitative, qualitative or mixed), the methodology employed, the type of robot used, the nature of the interaction (direct or mediated), the sample size and participants' nationality, as well as the methods of analysis applied to assess trust and culture factors.

As shown in Fig. 2, all the studies were published between 2015 and June 2025, with 2017 and 2022 being the most prolific years (n = 2 each; 28.6 %). In total, the reviewed studies included 3127 participants.

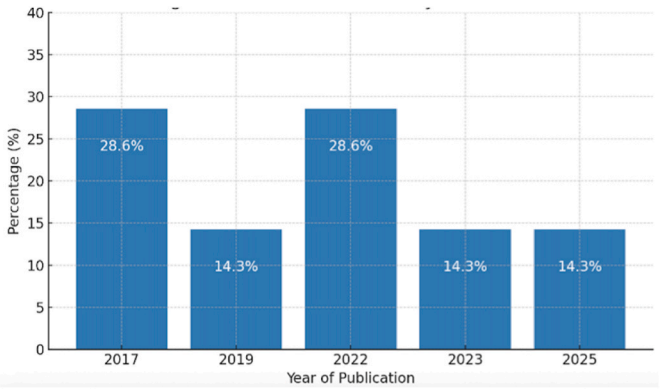

Fig. 2. Distribution of the reviewed studies by year of publication (2015–June 2025).

4.2. Article selection

Considering the objective of this review, only studies that specifically assessed both trust and cultural factors in the context of human-social robot relationships were included. Both quantitative and qualitative research designs were considered, whereas book chapters, systematic reviews, meta-analyses, and studies that lacked empirical measurements were excluded, thereby also excluding earlier studies, emerging preprints, abstracts, conference proceedings, and publications in other languages. Participant characteristics and types of exposure were not used as inclusion or exclusion criteria. Moreover, direct interaction with the robot was not a prerequisite, as all the studies included virtual reality-based interactions.

Table 1
Articles selected from Scopus and PubMed databases.

N.	Title	Type of Study	Procedure	Social Robot	Interaction (direct or indirect)	Sample Size and Nationality	Method used for the trust	Method used for the culture
1	Consumer acceptance of social robots in domestic settings: A human-robot interaction perspective (2025)	QT, QL	Online data collection platform	Social Home Robots (SHRs)	Video	N = 483 (China)	Ad hoc questionnaire	Comparison between samples
2	Customers' acceptance of artificially intelligent service robots: The influence of trust and culture (2023)	QT	Online data collection platform	Service robots	No	N = 491 (U.S.A.) N = 495 (China)	SSRIT Chi et al., 2021)	Hofstede's cultural theory (Hofstede,2010)
3	Exploring Factors Affecting User Trust Across Different Human-Robot Interaction Settings and Cultures (2022)	QT, QL	Questionnaire	Dog robot, teleoperated robot in healthcare, and a manufacturing robot	Video	N = 18 (Saudi Arabia) N = 18 (United Kingdom)	TPS developed by Schaefer (2013)	Comparison between samples
4	Socially assistive robots in health and social care: Acceptance and cultural factors. Results from an exploratory international online survey (2022)	QT	Questionnaire online	Socially assistive Robots	No	N = 1341 (19 nations employment in the health or social care sector)	Ad hoc questionnaire	Country Comparison Tool of Hofstede's model
5	Cross-Cultural Reactions to Peacekeeping Robots Wielding Non-Lethal Weapons (2019)	QT	Questionnaire and virtual reality	Peacekeeping in a Virtual environment developed in Unity3D	Video	N = 140 (American, Chinese and Japanese living in US; Americans and Chinese living in China; Americans and Japanese living in Japan)	TPS developed by Schaefer (2016)	Comparison between samples
6	Trust of Simulated Robotic Peacekeepers among Resident and Expatriate Americans (2017)	QT	Questionnaire and virtual reality	Peacekeeping in a Virtual environment developed in Unity3D	Video	N = 48 (20 living in America, 15 living in China, 13 living in Japan)	Short version of Chien et al. (2015) questionnaires	Comparison between samples
7	The Relationship of The Penny Beliefs Weapons Scale to Robotic Peacekeeper Compliance and Trust (2017)	QT	Questionnaire and virtual reality	Peacekeeping in a Virtual environment developed in Unity3D	Video	N = 113 (60 native 53 expatriate citizens from America, China, and Japan)	Chien et al. (2015) questionnaires	Comparison between samples

Notes. QT: quantitative study; QL: qualitative study.

5. Results

A total of seven articles were selected in this review, providing an overview of the current state of research in the field. Specifically, Table 2 summarizes the key findings, including the participants' nationality, sample size, the type of social robot used, the nature of the interaction, and the tools employed to measure trust and cultural influences.

The background of the samples was assessed in terms of nationality and sample size. Specifically, 26.67 % of the studies were conducted in the United States, 33.4 % in China, 19.9 % in Japan, 6.67 % in Saudi Arabia, 6.67 % in the United Kingdom, and in 6.67 % of cases, the nationality was not specified.

Regarding sample size, 28.57 % of the studies recruited between 0 and 100 participants, 28.57 % included between 101 and 400 participants, and 42.86 % involved more than 400 participants.

In terms of the type of social robot used, 33.33 % of the studies employed a peacekeeping robot; 11.11 % used a social home robot (SHR); 11.11 % used a service robot; 11.11 % involved a robot dog; 11.11 % featured a social assistive robot; 11.11 % included a teleoperated healthcare robot; and 11.11 % utilized a manufacturing robot.

None of the studies involved direct interaction between participants and robots. In 71.43 % of the cases, interaction with the social robot was mediated indirectly through videos, while in 28.57 % of the studies, no interaction occurred.

Finally, 71.43 % of the studies adopted a quantitative approach, 28.57 % used a mixed-methods design (quantitative and qualitative), and no purely qualitative studies were identified.

Table 2
Summary of the main results of the scoping review (N = 7).

	%	*n*
Included Studies		
Databases		
Scopus	85.71	6
PubMed	14.29	1
Nationality of the sample		
USA	26.67	>1
UK	6.67	1
China	33.4	>1
Saudi Arabia	6.67	1
Japan	19.9	>1
Not Specified	6.67	1
Sample size		
From 10 to 100	28.57	2
From 100 to 400	28.57	2
Over 400	42.86	3
Social Robots		
Social Robots used		
Social Home Robots (SHRs)	11.11	1
Service robot	11.11	1
Dog robot	11.11	1
Peacekeeping	33.33	>1
Social assistive robot	11.11	1
Teleoperated robot in healthcare	11.11	1
Manufacturing robot	11.11	1
Type of Interaction		
Direct	0.00	0
Via Video	71.43	5
No interaction	28.57	2
Method used to assess the Trust		
SSRIT (Chi, 2021)	14.29	1
TPS developed by Schaefer (2013, 2016)	28.57	2
Chien et al. questionnaires (2015)	28.57	2
Ad hoc questionnaire	28.57	2
Method used to assess the Culture		
Comparison between samples	71.43	5
Country Comparison Tool of Hofstede's model	28.57	2
Type of Studies (n = 6)		
Quantitative	71.43	5
Qualitative	0.00	0
Mixed methods	28.57	2

Legend: We use >1 to denote studies that included multiple cultures or multiple types of robots.

5.1. Answering key research questions on trust in human-robot interaction

RQ1: How is trust defined in current HRI studies?

The definition of trust represents a fundamental aspect of the analysis of human-robot interactions. However, only a few studies have explicitly addressed this complexity. Specifically, only Chi et al. (2023) and Alzahrani et al. (2022) proposed specific definitions of trust. Chi et al.'s (2021) definition of trust is also adopted by Gao et al. (2025), who defined trust in interactions with social robots as "the belief that customer interactions with AI-based social robots can deliver positive service outcomes" (Chi et al., 2021, p. 11). In the other studies included in this review, although the term "trust" is frequently used, a clear operational definition is not provided. For instance, Bliss et al. (2019) do not present a formal definition of trust but consider both trust and compliance as relevant variables within their study. Conversely, Long et al. (2017) investigated trust through three distinct dimensions: participants' dispositional trust, overall trust toward a peacekeeping robot (RPK), and specific components of trust related to the RPK.

RQ2: What tools or methods are used to assess trust in these studies?

With reference to the tools used the Trust Perception Scale (TPS) was employed in 28.57 % of the studies to measure trust. Developed and validated by Schaefer (2016), the TPS consists of 40 items designed to assess specific trust perceptions in HRI. This scale provides a percentage score and also includes a 14-items subscale, which can be used as a shorter version. In 28.57 % of the studies, the questionnaire developed by Chien et al. (2015) was utilized. This tool evaluates both general and specific measures of cross-cultural trust in HRI.

In 14.29 % of the studies, the Social Service Robot Interaction Trust (SSRIT) scale was used, developed by Chi et al. (2021). The SSRIT scale is designed to measure consumer trust in interactions with AI-powered social robots within the context of service provision. It comprises three key indicators: the propensity to trust the robot, the robot's function and design, and the task and service context.

In only 28.57 % of the studies was trust in robots assessed using an ad hoc questionnaire. The study by Chi et al. (2023) demonstrated that trust, alongside other cognitive beliefs, can significantly influence customers' intentions to use AI robots for service provision. As such, trust can be considered a predictor of robot adoption and use. Finally, Karpinsky et al. (2017) employed two questionnaires developed by Chien et al. (2015) to measure intercultural trust at both general and specific levels.

5.2. Answering key research questions on cultural background

RQ3: How is culture conceptualized and defined within the HRI literature?

Papadopoulos et al. (2023) attempted to establish a univocal definition of culture; however, this effort proved unsuccessful. As a result, the authors adopted a pragmatic approach, defining culture in terms of national belonging. In contrast, Chi et al. (2023) grounded their study in Hofstede's cultural theory (Hofstede et al., 2010), which conceptualizes culture through five dimensions: individualism, power distance, masculinity, long-term orientation, and uncertainty avoidance. Other studies included in the review did not provide an explicit definition of

culture, yet implicitly referred to it as national affiliation. For instance, Long et al. (2017) compared samples from three different countries—the United States, China, and Japan—while Karpinsky et al. (2017) examined expatriate participants of various nationalities, again treating culture as synonymous with national identity. In Gao et al.'s (2025) study, the authors recommend caution in considering individual cultural factors. Their findings suggest that culture is multifaceted, and no single cultural factor appears to be able to fully explain people's responses to robots. The authors also underline how, due to the extremely rapid cultural contamination, cultural factors could evolve over time and may not always remain valid.

RQ4: What approaches or instruments are employed to measure culture in the HRI context?

Among the studies reviewed, 28.57 % employed Hofstede's cultural dimensions theory (Hofstede et al., 2010) to assess the impact of culture on HRI. Hofstede's framework identifies five key dimensions—individualism, power distance, masculinity, long-term orientation, and uncertainty avoidance—that vary across cultures and significantly affect interactions with technology. In 71.43 % of cases a comparison between samples from different nationalities was used. In fact, most of the studies in literature use the method of comparison between groups of different nationalities to understand national cultures and cultural distances regarding specific topics.

RQ5: What is the nature and extent of the influence of trust and culture on HRI?

The studies reviewed demonstrate that trust significantly influences individuals' willingness to use robots, and this trust is, in turn, shaped by various factors such as social influence, hedonic motivation, anthropomorphism, performance expectancy, and effort expectancy (Chi et al., 2023). In Gao et al.'s (2025) study on the acceptance of domestic social humanoid robots (SHRs), trust was also found to be affected by individuals' general trust in social support systems and concerns regarding privacy risks.

Robot-related factors further influence trust. Alzahrani et al. (2022) found that trust in robots was associated with technical and perceptual elements such as power source, consistency, usability, noise levels, and brand value. Notably, trust varied depending on the specific tasks robots were assigned to perform. For example, participants expressed lower trust in robots used in healthcare settings compared to a robot dog guiding visually impaired individuals or robots employed in industrial production. These findings align with those of Papadopoulos et al. (2023), who examined healthcare professionals' attitudes toward social assistive robots (SARs) in clinical contexts. Their study revealed a general sense of opposition or uncertainty among healthcare workers across all the cultural groups analyzed.

Trust has also been examined as a predictor of compliance with robotic requests. Studies by Bliss et al. (2019), Long et al. (2017), and Karpinsky et al. (2017) used virtual simulations involving armed and unarmed robots and demonstrated that individuals' willingness to comply with robot requests depended on their level of trust and cultural background.

Culture plays a central role in shaping interactions with social robots. Across all reviewed studies, cultural attitudes were found to influence robot acceptance, both at the national level—understood as shared societal values—and at the individual level. Furthermore, differences in the impact of culture were not limited to contrasts between Western and Eastern countries (Alzahrani et al., 2022), but also emerged between natives and immigrants, between individuals of the same nationality residing abroad (Long et al., 2017), and between older and younger populations (Bliss et al., 2019).

RQ6: Do trust and culture play a role in real interactions with robots?

None of the studies reviewed involved direct interaction between humans and robots; rather, 71.4 % relied on video-based stimuli. To the best of our knowledge, no prior research has directly examined how trust and culture influence human–robot interaction through real-time, embodied engagement. This observation calls for a reflection on the rationale behind such methodological choices.

From a practical perspective, conducting research in real-world settings is costly, time-consuming, and subject to a wide range of uncontrollable variables. As a result, researchers often opt for laboratory-based experiments or the use of video stimuli and online questionnaires, which offer greater control and the ability to reach larger and more diverse samples.

Equally relevant are the challenges inherent in the design of cross-cultural studies involving robots. Investigating interactions across different cultural groups requires careful calibration of culturally specific factors, such as language, voice tone, proxemics, and social distance, all of which must be tailored to the particular audience with which the robot is expected to interact.

This gap in the literature points to a promising and underexplored area for future research. It reinforces the need for more ecologically valid approaches capable of capturing the nuanced and complex dynamics of trust and cultural influence in real-time human–robot encounters.

6. Discussion and conclusions

This scoping review aimed to provide a comprehensive overview of the role of trust and culture in the context of human–robot interaction (HRI), focusing primarily on seven studies published between 2015 and June 2025 – five employing quantitative methodologies and two using a mixed-methods approach.

While trust emerged as a recurring theme in the reviewed literature, it was rarely explicitly defined. Only two studies provided clear operational definitions, whereas the others employed the term without precise conceptualization, limiting both comparability and replicability. Similarly, culture was predominantly interpreted as national affiliation, with limited theoretical depth and few cross-cultural comparisons. Moreover, none of the studies involved direct interaction with physical robots; most relied on video simulations or virtual environments to represent robotic agents.

A noteworthy finding concerns the frequent presence of "peacekeeper" robots, identified in three of the studies. This highlights a growing interest in examining trust in robots operating in high-risk and socially sensitive contexts, such as peacekeeping missions. However, the lack of direct human–robot interaction significantly limits the ecological validity of the findings.

Despite its contributions, this review has several limitations. First, it included only peer-reviewed articles published in English between January 2015 and June 2025, thereby excluding earlier studies, emerging preprints, abstracts, conference proceedings, and publications in other languages. Second, the heterogeneity of instruments and measures used across studies hindered the application of more sophisticated quantitative methods such as meta-analysis, which require standardized and comparable tools (e.g., Borenstein et al., 2009). Finally, although the review aimed to consider cultural and demographic factors, most studies involved participants primarily from the United States, China, and Japan, with limited representation from other regions. In particular, research conducted in underexplored cultural contexts—such as Arab countries—remains scarce.

To address these gaps, future research should adopt more diverse methodological approaches capable of offering a richer and more contextualized understanding of how trust and culture influence HRI, also taking design aspects into account. Furthermore, with a larger number of studies, it would be possible to conduct a formal assessment of publication bias. This would improve the reliability and validity of the results by identifying and accounting for potential selective reporting or

publication effects, thus strengthening the overall conclusions.

A broader use of direct HRI is recommended to enhance the ecological validity of future studies. Moreover, the development and adoption of standardized instruments would enable the application of meta-analytic techniques (Mckenna et al., 2024). Additional efforts should be directed toward increasing cultural inclusion by expanding beyond Western and East Asian contexts. As highlighted by Alzahrani et al. (2022), it is essential to include participants from a wide range of countries to capture global cultural variability.

Future studies should also explore how contextual and situational factors—such as the domain of robot deployment (e.g., healthcare, public safety, education)—influence trust and user acceptance. Understanding how trust develops in everyday, real-world interactions is crucial for designing socially intelligent robots with culturally coherent and user-responsive designs.

In conclusion, although the current literature has made some progress in investigating the relationship between trust and culture in HRI, significant gaps remain. Future research should delve deeper into not only the psychological and cultural factors influencing trust, but also the contextual variables that shape human–robot dynamics in real-world and diverse application domains. Addressing these aspects will be essential for developing robots that are not only functionally effective but also culturally adaptable and socially acceptable.

CRediT authorship contribution statement

Carla Cirasa: Writing – original draft, Methodology, Data curation, Conceptualization. **Daniela Conti:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare the following potential competing interests: Daniela Conti reports financial support and employment from the Department of Humanities, University of Catania. Carla Cirasa declares no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

This study has been supported by the “START to Aid” (209564) project (PIACERI - PIAno di inCEntivi per la RIcerca di Ateneo) of the Department of Humanities, University of Catania, Italy.

Data availability

No data was used for the research described in the article.

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