

**CROSS-CULTURAL INFLUENCES ON CONSUMERS' PERCEPTIONS  
OF SMART HOMES: A THEMATIC ANALYSIS OF UGC**

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**ABSTRACT**

This study conducts a thematic analysis of user-generated content on smart homes from the United States and China using topic modeling. It investigates cross-cultural influences on consumer perceptions by integrating two of Hofstede's cultural dimensions with the technology acceptance model. The findings provide valuable insights for tailoring marketing strategies to different cultural contexts.

**Introduction**

Smart homes, although regarded as a product of the Fourth Industrial Revolution, their conceptual foundations predate the digital era (e.g., Kamel & Memari, 2019; Mshali et al., 2018; Pal et al., 2018). A smart home refers to a residential environment equipped with advanced technologies, where interconnected devices communicate via the Internet. This integrated system enables remote monitoring, management, and automation of essential household functions, including but not limited to lighting, heating, ventilation, and air conditioning (HVAC) systems, and air quality control (Mocrii et al., 2018; Almusaylim & Zaman, 2019). As AI-powered innovations proliferate and become more deeply embedded in household products (Barrington-Leigh et al., 2019), the integration of multifunctional capabilities within smart home technologies has grown progressively more sophisticated (Sabit, 2025). For instance, these advancements include health condition monitoring and reporting (Facchinetti et al., 2023), as well as the storage and retrieval of multimedia and surveillance data (Irugalbandara et al., 2023).

As smart homes become increasingly popular, discussions about them are widespread on social media, which has become an essential platform for individuals to share opinions and experiences (Bashir et al., 2017; Kumar et al., 2021). As defined by Roberts and Candi (2014), social media refers to "virtual platforms on which people can asynchronously or synchronously create, share, modify, or react to various forms of electronic content." The real-time, large-scale data from social media serves as a valuable source of user-generated content (UGC), capturing authentic personal attitudes (Zhuang et al., 2023) and providing researchers with a rich and reliable dataset (Luca, 2015). The substantial volume of UGC on smart homes can be accumulated and analyzed freely and spontaneously (Zhan et al., 2021). Data-driven approaches are increasingly employed to explore smart home adoption and user engagement. Organizations need also to be able to rapidly comprehend user-generated data and transform it into relevant information (Davenport, 2013). Social media platforms from different countries, such as Twitter from the USA and Weibo from China, not only reflect diverse user perspectives but also serve as invaluable tools for cross-

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cultural comparisons between the two nations (Matassi & Boczkowski, 2021). Posts and tweets about smart homes provide valuable data for analyzing consumers' perceptions (Tang et al., 2014).

Hofstede's (2011) cultural framework identifies significant differences exist between American and Chinese individuals (Tsai & Men, 2012). Among these, uncertainty avoidance (UA) (Lu et al., 2017; Abbasi et al., 2015) is considered particularly relevant to the technology acceptance model (TAM) (Davis, 1989), which is used to explain and predict how users accept and utilize new technologies. The core idea of TAM is that consumers' acceptance of new technologies is primarily determined by two factors: perceived usefulness (PU) and perceived ease of use (PEOU). This model provides a framework for understanding how consumers interact with smart home technologies (Zhou et al., 2024). Moreover, the dimension of individualism vs. collectivism (IC)—plays a crucial role in shaping consumers' perceptions of household products, including smart home technologies (Chen et al., 2020). Individualistic cultures tend to emphasize personal benefits and autonomous decision-making, leading consumers to focus on how smart home products enhance convenience and personal efficiency (Chang et al., 2017). Collectivist cultures prioritize family and social harmony, which may result in a greater emphasis on security, shared benefits, and the integration of smart home devices into family life (Huang et al., 2019).

This research builds on the concepts of UA, IC, and the TAM, aiming to explore how cultural differences shape the two key TAM factors—PU and PEOU—which reflect consumers' perceptions of smart homes. Through the analysis of UGC from Twitter and Weibo using topic modeling—an unsupervised machine learning technique implemented in Python to identify latent topics in text—this study investigates how UA and IC influence PU and PEOU among American and Chinese consumers in the context of smart home technologies. The research question is: How do cultural differences influence the PU and PEOU of smart homes among American and Chinese consumers?

## **Related Work and Theoretical Concepts**

### *Research on Smart Homes*

Research on smart home technologies encompasses various aspects. Wilson et al. (2017) indicate that the smart home industry needs to enhance measurements to build consumer confidence in data security and privacy. As smart homes evolve alongside the deployment of smart surveillance cameras and voice assistants, the latest advancements in AI for voice and image recognition and processing (Khna & Zualkernan, 2018) continue to raise concerns about consumer privacy in smart homes, such as data breaches (Dong et al., 2021; Strielkowski, 2019; Sadowski et al., 2024). While some may argue about the privacy issues related to such data collection, over time, this issue may become more of a lifestyle acceptance question (De Silva et al., 2012). Besides, more recent scholarly inquiries into individuals' topics with smart home technologies focus on aspects, such as, the actual functionality of smart homes and their transformative effects on lifestyles (Basarir-Ozel et al., 2022); the environmental impact of smart homes (Pohl et al., 2021) in relation to sustainability (Huda et al., 2024) and energy efficiency (Hu et al., 2024). Hong et al. (2020) discussed that price is also one of the perceived risks affected by technology uncertainty. As AI-powered smart home technologies improve, an increasing number of individuals

seek personalized and customized smart home solutions to better meet their needs (Zargham et al., 2022). For example, technologies enable real-time multi-level activity monitoring (Parihar et al., 2024), minimize human intervention, and enhance safety and usability (Bringhenti et al., 2021).

#### *Technology Acceptance Model*

The TAM, which was introduced by Davis (1989), includes two concepts—PU and PEOU. PU is the extent to which using a technology is perceived as helpful to job performance, while PEOU is the extent to which a technology is perceived as not requiring much effort. PU and PEOU influence a person's behavioral intention or intention to use the technology and the actual usage of the technology. The TAM has been integrated into research on AI-powered smart homes, demonstrating that PU and PEOU positively influence consumers' intention to use smart home technology (Daruwala & Oberst, 2022) and consumers' attitudes toward using smart homes (Zhou et al., 2024). The attitude toward different aspects of AI-powered smart home products is shaped by various factors related to PU and PEOU. For example, in the case of medical health, entertainment, learning, and social communication technologies, PU is the most critical factor. However, for monitoring and alarm technologies, PEOU is the most crucial factor (Zheng & Shan, 2021).

#### *Hofstede's Cultural Dimensions*

Studies have demonstrated that Hofstede's cultural dimensions exert direct, moderating, and mediating effects on TAM (Jan et al., 2024). Extensive research has examined the influence of Hofstede's six cultural dimensions on the TAM (Al-Gahtani et al., 2007; Anandarajan et al., 2002; Calantone et al., 2006; Hasan & Ditsa, 1999; Park et al., 2007; Srite, 2006; Veiga et al., 2001), with UA being particularly relevant to technology adoption. Additionally, UA has been widely applied in cross-cultural studies between China and the United States (Merkin, 2006; Shi & Wang, 2011; Driskill & Rankin, 2020).

UA significantly influences consumers' perceptions of products. Consumers in low-UA cultures tend to favor seamless, user-friendly interactions over complex systems that require extensive learning and adaptation (Balta-Ozkan et al., 2013). For example, in the United States, where UA is relatively low, consumers exhibit a stronger preference for technologies that are intuitive, easy to use, and require minimal learning or adaptation (Martins et al., 2014). When adopting emerging technologies, American consumers prioritize intuitiveness and ease of operation over concerns about initial uncertainty or complexity. As a result, they are more likely to emphasize PEOU over PU (Venkatesh et al., 2003). In contrast, consumers in high-UA countries tend to be more influenced by PU compared to those in low-UA countries (Anne et al., 2007). Consumers from high-UA cultures, such as China, prioritize minimizing ambiguity and uncertainty, preferring solutions that are stable and familiar (Choi et al., 2014). When evaluating the adoption of new technologies, Chinese consumers place greater emphasis on PU, anticipating that the technology will deliver clear, tangible benefits that mitigate uncertainty and rationalize its adoption (Hwang & Lee, 2012; Sun & Zhang, 2006). As a result, consumers in high-UA cultures require technologies that exhibit high reliability, well-defined value propositions, and concrete use cases to justify their adoption (Straub et al., 1997).

The dimension of IC (Hofstede, 2001) has also been widely applied in cross-cultural analyses of consumers' perceptions of technological household products (Steenkamp &

Geyskens, 2006; Chen et al., 2020). It relates to the extent to which individuals in a society are connected to one another. Individualist societies have loose ties and emphasize self-interest and an “I” consciousness, whereas collectivist societies have strong social bonds and emphasize group harmony and a “We” consciousness. Individualist cultures prevail in Western and developed countries, while collectivist cultures prevail in Eastern and less developed countries (Jackson & Wang, 2013). The individualistic culture of the United States prioritizes fulfilling personal needs and customized features (Chang et al., 2017). American consumers’ PEOU is more closely associated with personal convenience (Aldossari & Sidorova, 2018). In contrast, China, as a collectivist culture, emphasizes products that enhance family and collective well-being (Huang et al., 2019). Chinese consumers’ PU of smart home products is often linked to the needs of other family members.

### **Methodology**

This study utilizes Python for topic modeling to extract the primary themes surrounding smart homes from UGC on Twitter and Weibo. Topic modeling enables efficient clustering of textual data and facilitates the identification of key themes within large corpora. The analytical process, spanning from data collection to thematic analysis, includes the following steps:

1) Data Collection. We retrieved 5,000 tweets related to smart homes and 5,000 Weibo posts from January to February 2025 using the Twitter API and Weibo’s public API. The keywords “smart homes” and its corresponding Chinese translation (智能家居) were used to ensure relevance. To refine the datasets, tweets were filtered to include only those from U.S. users, while Weibo posts were restricted to Chinese users based on user metadata. Additionally, query parameters were applied to exclude advertisements, resulting in two language-specific datasets: an English dataset and a Chinese dataset.

2) Data Preprocessing. Initially, the source field was examined to remove duplicate entries from both datasets. Then, Natural Language Processing (NLP) techniques were applied. For the English dataset, preprocessing steps included stopword removal, expansion of contractions, and lemmatization using the NLTK library. For the Chinese dataset, stopwords were removed using a Chinese stopwords lexicon, and tokenization was performed using the Jieba tool. Furthermore, punctuation, special characters, URLs, @mentions, and hashtags were removed via regular expressions in both datasets.

3) Data Vectorization. After data cleaning, the Bag-of-Words (BoW) approach was applied using the CountVectorizer tool to extract unigrams from both the English and Chinese datasets (Qi et al., 2010).

4) Topic Modeling. Latent Dirichlet Allocation (LDA) was used to identify the topics within both datasets. LDA, a Bayesian inference-based method, determines word significance by analyzing co-occurrence patterns. To optimize model performance, we tested topic numbers ranging from 2 to 10 for each dataset and compared perplexity and coherence scores. The optimal number of topics was determined to be five for both datasets, balancing coherence and perplexity. To further analyze the similarity of themes between the two datasets, we extracted the top 15 keywords for each of the five identified themes

from both the English and Chinese datasets. We then traced the tweets and posts containing these keywords for semantic comparison to assess whether these topics belong to the same conceptual categories. Through this evaluation, we inferred that discussions on smart homes on Twitter and Weibo exhibit similar thematic structures, while cultural differences lead to differing focal points in consumer perceptions.

5) Thematic Analysis. The extracted topics from Twitter and Weibo were systematically compared to identify the theme titles and examine the differing perceptions of smart homes across the two platforms. This comparison revealed that the same five topics were present, but each had distinct aspects. The keywords associated with each theme were then identified, and an in-depth thematic analysis was conducted using the theoretical framework of the TAM, with a specific focus on the constructs of PEOU and PU. To more accurately assess the differences in perceptions due to cultural disparities, we also revisited the individual tweets and posts containing the relevant keywords, analyzing them at the tweet and post level.

### **Findings**

Topic modeling results reveal five themes (Table 1) related to smart homes: (a) home convenience, (b) technological innovation and new features, (c) price, (d) personalization and customization, and (e) privacy and security. The comparison of the aspects within each theme revealed notable differences in how each cultural group perceives these aspects, shaped by the distinct levels of UA and IC in the USA and China. These cultural dimensions influence how consumers prioritize and evaluate smart home technologies.

Home convenience emerged as a key theme in both datasets. American users predominantly focus on how smart home products can enhance personal comfort and overall quality of life. For them, the primary value lies in how these devices integrate into their lifestyles, improving convenience, leisure, and individual well-being. In contrast, Chinese users place greater importance on time-saving and labor reduction, highlighting the efficiency and practicality of smart home technologies in streamlining household tasks. When it comes to technological innovation and new features, American users tend to emphasize compatibility with other devices and systems. They seek products that can seamlessly integrate into their existing technological ecosystems. Conversely, Chinese users demonstrate a stronger preference for practicality, favoring smart home devices that are directly applicable and useful in their daily routines. Their focus is less on novelty and more on the functional benefits that contribute to effective household management. Price sensitivity also differs markedly between the two cultural groups. American consumers are generally more willing to pay a premium for products that offer advanced technological features or superior quality. Chinese users, on the other hand, tend to be more price-conscious, prioritizing affordability and value for money. They are more likely to choose products that deliver reliable performance at a lower cost. In terms of personalization and customization, American users value functional customization and features that support family entertainment and communication—such as devices that enhance home theater experiences, facilitate family interactions, or provide personalized user settings. Their emphasis is on creating an enjoyable and individualized home environment. Chinese users, in contrast, focus more on adapting device functions to meet the specific needs of family members, particularly the elderly and children, reflecting a more family-oriented perspective. Finally, privacy and security concerns reveal distinct cultural orientations

toward data protection. American users place high importance on personal data privacy, emphasizing transparency and individual autonomy in how their data is collected, stored, and used. In contrast, Chinese consumers are more concerned with government regulations and national policies. Their focus is less on individual data control and more on broader issues of governmental oversight and national security.

### **Discussions**

This study conducts a thematic analysis using topic modeling to examine UGC on smart homes from Twitter and Weibo, with the aim of exploring how cultural influences shape PU and PEOU among American and Chinese consumers. The findings indicate that American consumers exhibit a lower level of uncertainty avoidance, which amplifies the influence of PEOU in their decision-making processes. They place significant value on the user-friendliness of technology—for instance, the compatibility of devices, which ensures ease of use and smooth integration across systems—allowing them to more easily personalize and control their experiences. Even when products are priced at a premium, American consumers are willing to make a purchase if the products are perceived to offer high quality. While they do consider the functional benefits of smart home technologies, their primary focus lies in how these products enhance personal comfort, convenience, and family-oriented activities such as entertainment and communication. Moreover, American consumers tend to place a stronger emphasis on individual autonomy and control, particularly in relation to the management of personal data and privacy. These tendencies align with the individualistic nature of American culture.

In contrast, Chinese consumers—characterized by a higher degree of uncertainty avoidance—tend to place greater emphasis on the functionality, usability, and efficiency of smart home products, indicating a stronger influence of PU. Furthermore, shaped by their collectivist cultural orientation, Chinese consumers prioritize the benefits that smart home technologies offer to the family as a unit, such as reducing household chores and accommodating the needs of elderly family members and children. Additionally, instead of focusing on individual control over personal information, they are more concerned with government regulations and national policies. This reflects a collective mindset in which governmental oversight is often perceived as a necessary safeguard for societal and technological stability.

### **Conclusions and Implications**

This research highlights the importance of understanding how cultural dimensions—UA and IC—influence consumer perceptions of smart home technologies among American and Chinese consumers. Through the analysis of UGC on Twitter and Weibo, we identified notable differences in how consumers interact with smart homes across five key themes, viewed through the lens of UA and IC. American consumers, characterized by low UA and a culture of individualism, are more influenced by PEOU, which emphasizes individual usability. In contrast, Chinese consumers are more affected by PU, which centers on the functional benefits for the family. This study underscores the need for businesses in the AI-powered smart home industry to account for cultural nuances when designing and marketing their products. By understanding these diverse consumer perceptions, companies can better tailor their offerings and strategies to meet the specific needs of various markets, thereby enhancing their success in the global marketplace. Future research should examine how these cultural distinctions evolve over time and influence the adoption

of emerging technologies in different regions, or alternatively, employ a larger and more diverse dataset for deeper insights.

**Keywords:** Cross-cultural, Hofstede's Cultural Dimensions, Technology Acceptance Model, Perceptions, Smart Homes, Thematic Analysis

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