Navigating challenges and psychological engines: case from international communication of Beijing city image

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Abstract As the capital of China, the international city image of Beijing serves not only as a prominent showcase of rich history and cultural heritage but also functions as a crucial window for promoting Chinese international image. However, with the rapid advancement of digital technology and the onset of the VUCA era, the international communication of Beijing city image has encountered numerous nuanced challenges. Applying the Latent Dirichlet Allocation model for content analysis, along with emotion analysis, a large dataset of posts ($N = 1226$) concerning the Beijing city image was examined. The analysis revealed that the inefficient international communication approaches and cultural output, which make it difficult to bridge the cultural gap between high- and low-context communication, were the primary challenges in modeling the international city image of Beijing. In response, the study proposed the construction of an exposure-perception-identification model of international communication with Chinese cultural characteristics, as well as the innovation of a vivid and dynamic city image of Beijing as effective communication strategies to address and navigate these challenges.

Keywords International communication · City image of Beijing · Emotion analysis · LDA · Psychological engine · Exposure-perception-identification (EPI) model

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Introduction

In the realm of international communication, mass media, and online communication are gradually being overtaken by emerging channels such as social media communication and intelligent communication. These mechanisms compete and interact, continuously reshaping the communication landscape. Meanwhile, agenda-setting on international social platforms plays a significant role in shaping the narrative of Chinese cultural communication abroad, contributing to self-representation in the global arena.

In addition, the city image of Beijing the capital serves as a key to unlocking global communication of China, as the city is recognized as the political, cultural, exchange, consumption, and technological center of the nation. Aiello and Tosoni (2016) delineated the tripartite roles of cities in the communication process as context, medium, and content. Presently, Beijing predominantly operates as a medium of domestic and international communication. Not only does it function as a pivotal platform to project international image but also as a favored conduit for foreign audiences to gain insights into China. The multiple attributes of the political center, cultural symbol, and international city play disparate yet seminal roles in shaping Beijing city image. These multifaceted roles place Beijing at the forefront of how China is perceived globally, making it an ideal focal point for understanding the complexities of global communication. In this context, the transmission of information across cultural boundaries is shaped by both objective realities and subjective interpretations. These interpretations are influenced by cultural contexts, which impact how both domestic and global audiences perceive messages.

Nonetheless, the development of digital technology and the VUCA era has posed significant challenges to the agenda-setting of Beijing in shaping its international city image (Dai and Cheng 2022; Zheng and Zompetti 2023). The acronym VUCA was introduced in the 1990s to describe the emerging volatility, uncertainty, complexity, and ambiguity in the post-modern era. The rise of big data and artificial intelligence has allowed fake news to become a powerful tool for political actors (Egelhofer and Lecheler 2019), while disinformation has intensified populist sentiment online (Iosifidis and Nicoli 2020). The algorithm itself, as an inherently imbalanced force, is the scarcest resource in the distribution of algorithmic power. Additionally, with persistent global digital inequality (Barnett et al. 2017), negative portrayals against China dominate international public discourse, driven by cultural hegemony and unilateralism in Western countries. This further emphasizes the need to strategically manage Beijing city image through more effective communication and discourse.

This study focused on how Beijing city image was portrayed and perceived through cultural lenses, leveraging a psychological model to examine the effectiveness of these strategies in navigating diverse international audiences. By exploring the content and emotions of global social media posts, this study sought to uncover the key challenges and opportunities in Chinese intercultural communication efforts. Furthermore, this research adopted a cognitive-emotional

approach, dissecting the interplay between cognitive processing and emotional resonance within cross-cultural communication contexts.

Literature review

Beijing as a strategic epitome for analyzing Chinese international image dynamics

Cities are faced with a tension between crafting their unique urban identity and the identity imposed by being viewed through the external gaze. As Luque-Martínez et al. (2007) and Zhang et al. (2023) suggest, the re-evaluation of a city image involves an ongoing negotiation process between local and international viewpoints. This highlights the need to adapt communication strategies for diverse audiences, which is essential in the international communication process (Lu 2021). The agenda-setting on platforms like Twitter and Meta plays a key role in shaping Chinese cultural communication abroad. As a major political and cultural center, Beijing offers a valuable case study in analyzing how distinct global audiences, with their cultural values, perceive and respond to Chinese international communication efforts. This study intended to explore how these cultural dimensions could be applied to evaluate Beijing city image communication strategies.

As the capital city, Beijing serves as the political center of China. Its political significance dates back to ancient times, particularly during the Ming and Qing dynasties when it symbolized supreme imperial power through its distinctive urban planning and architectural layout. Since the establishment of the People's Republic of China, the civic status as the capital has continued to underscore its political importance. The hosting of major international events such as the 2008 Beijing Olympics and the 2022 Beijing Winter Olympics has further enhanced its international image (Gong 2012; Zhan et al. 2023).

However, this has also led to it being utilized as a surrogate for China in Western media and social platforms, often resulting in insinuations and defamation against the city image. Research indicates that its international city image is susceptible to national events, particularly contentious ones that can rapidly alter global perceptions of the city (Zhang et al. 2022). Consequently, the connotation and identity of Beijing as a capital city have been diluted and exploited by Western nations as a means to undermine the international image in global communication (Peng et al. 2020).

Moreover, aside from the emphasis on its political connotations, Beijing remains an enchanting hub for cultural, international exchange, and technological innovation deeply rooted in history. Boasting over three millennia of heritage, it stands as a modern metropolis harmonizing ancient traditions with contemporary advancements. Its diverse urban landscapes juxtaposed with suburban scenery offer a dynamic blend of tradition and modernity while its renowned culinary delights such as Peking duck and dumplings have garnered widespread acclaim among foreign audiences across various social media platforms including Twitter, Meta, Instagram (Zhan et al. 2023), Tictok and vlog. This multifaceted portrayal underscores the

complexity of the international image of Beijing. Therefore, we proposed our first research questions:

RQ1 What are the main themes of the city image of Beijing in the global vision?

The psychological engine of intercultural communication

Intercultural communication can be understood through three progressive stages: first, message exposure where the message is visible and catches the audience's attention, allowing them to notice it; second, message perception where the audience engages with the content, ensuring they remain interested and continue interacting with it; third, message internalization and identification where the audience not only understands but also identifies with the message, aligning it with their perspectives. At the highest level, intercultural identification enables individuals to embrace cultural differences and navigate diverse environments effectively. Despite its importance, this level of intercultural identification is often overlooked in research (He et al. 2023).

In the current study, we encapsulated this process within the exposure-perception-identification (EPI) model. From a cognitive processing perspective, the EPI model interacts with the psychological engine, facilitating adaptation and adjustment to different cultural contexts. The psychological engine of intercultural adjustment emphasizes four core components essentially when navigating cultural differences: emotion regulation, critical thinking, openness, and flexibility (Matsumoto et al. 2007). These internal psychological processes, deeply rooted in emotional responses, drive an ability to adapt. The success of intercultural communication in attracting individuals and fostering identification, or encountering cultural resistance, depends on how personal psychological mechanisms operate and how effectively media messages engage and influence these mechanisms.

International public opinion milieu and emerging digital technological challenges

In addition, digital technologies are reshaping and reproducing virtual spatial environments and enhancing the portrayal of city images by evoking emotional resonance (Kitchin and Dodge 2014; Bruno 2018). However, in international communication, social bots leveraging big data and artificial intelligence technology have been found to significantly contribute to the massive generation, retweeting, and dissemination from low-credibility sources of misinformation or disinformation (Bessi and Ferrara 2016; Shao et al. 2018). Moreover, the human brain has a finite capacity for processing; these limited cognitive resources are further depleted with increased task demands (Franconeri et al. 2013). If misinformation concerning the city spreads on social media, it not only captures the audiences' attention but also engages their memories, emotions, and other deep cognitive resources, influencing the construction of the city image. Therefore, it is imperative to revamp its city image construction in response to the challenges posed by the digital era.

RQ2 Shaped by AI-driven technologies, what are the primary emotions associated with the different topics of the city image of Beijing?

Method

Data collection

This study collected data from January 1, 2023, at 00:00, to December 15, 2023, at 24:00. The focus was on primary posts, articles from foreign media such as *The Voice of America, PR Newswire, BBC News, Sydney News Today, Australian Broadcasting Corporation* and social media like Facebook (Meta) and Twitter. The content and associated comments were gathered using keywords related to the "Four Centers" strategic position of Beijing as the "national political center", "cultural center", "center for international exchanges", and "center for technological innovation", along with the keyword "economic hub", which is presently not listed by the official documents.

After meticulously filtering to eliminate irrelevant data, the study obtained five distinct datasets ($N = 1226$). These included 465 main posts and articles from national media as well as 26 main posts from social media which are related to its "national political center" position; 62 main posts and articles from foreign media as well as 29 main posts from social media which are related to the "cultural center" position; 164 main posts and articles from national media as well as 88 main posts from social media which are related to the "center for international exchanges" position; 203 main posts and articles from foreign media as well as 75 main posts from social media which are related to the "center for technological innovation" position; 332 main posts and articles from foreign media as well as 45 main posts from social media which are related to the "economic hub".

Analytical strategy

To find out whether the national media focuses on the "Four Centers" strategic position of Beijing when constructing the international city image, as described in the literature review, this study analyzed the articles and the text of the posts through LDA analysis. LDA is a three-level hierarchical Bayesian model, in which each item of collection is modeled as a finite mixture over an underlying set of topics. Each topic is, in turn, modeled as an infinite mixture over an underlying set of topic probabilities. LDA analysis provides an overall overview of the themes of the text and allows for the categorization of textual themes (Blei et al. 2003).

In this study, the number of themes (k-values) was first determined using perplexity and coherence (Blei et al. 2003; Stevens et al. 2012). The results showed that both metrics reached an optimal state when the number of themes was 5. Combining these results, it was determined that the number of themes generated by the LDA model in this study was 5. After the most suitable k values were determined, the final model was estimated. On the level of topics, the final model

includes a suggested list of topics. For each topic, LDA provides a list of words that characterize its thematic focus. We further categorized topics into sets of themes, which are larger summarizations of topics.

For sentiment analysis, based on the categorical structure theory of emotions, the sentiment analysis model analyses and measures the text data by analyzing the social media basic emotion thesaurus and combining it with the online text vocabulary matching technology to obtain the intensity distribution of the five basic social emotions: happiness, sadness, anger, fear, and disgust. This study employed *DiVoMiner®* (www.divominer.cn) to calculate social emotions as follows: first, all emotion-related words in the post were identified using the established emotion thesaurus; second, the scores for each emotion category were computed based on the weights of the posts. A higher score indicates a stronger intensity of the corresponding emotion, while a lower score signifies a weaker intensity. By default, the model classifies the emotion expressed in the post according to the category with the highest score.

Results

Thematic distribution

The results of LDA analysis appealed that the five themes in the present study were "*Coordinated Development of the Beijing-Tianjin-Hebei Region*", "*Digital Economy and Technological Innovation*", "*Industrial and Green Development*", "*National Symbols and International Relations*" and "*Tourism Activities and Cultural Exchange*". The five themes corresponded to the city images: theme 1 referred to the political center and center for international exchanges; theme 2 and 3 referred to the present center for technological innovation and former statements economic hub, indicating a more collaborative, innovative, scientific and green development concept; theme 4 referred to the national political center and center for international exchanges; theme 5 referred to the cultural center and center for international exchanges. The results proposed that in the international communication of the city image of Beijing, national media in China did not communicate a single characteristic, but more often, two characteristics are superimposed to deliver comprehensive attributes.

The investigation into the proportional distribution of different themes revealed that there were no significant differences between different themes ($F = 0.446$, $p = 0.775$). The results showed that there was pretty much a balance in themes in the international communication of the city image of Beijing. In terms of quantity, the attributes of Beijing as a national political center and center for international exchanges were mostly mentioned, followed by those of the center for technological innovation and former economic hub (as shown in Table 1). The findings unveiled the primary themes and topics of the city image of Beijing in international communication and answered RQ1.

Table 1 Themes and topics from LDA results

	Themes	Topics from LDA	Count
1	Coordinated Development of the Beijing-Tianjin-Hebei Region	Jing-Jin-Ji, Two Places, Center, Coordination, New Area, Decentralization	437
2	Digital Economy and Technological Innovation	Digital, Innovation, Economy, Technology, AI (artificial intelligence), Promotion	417
3	Industrial and Green Development	Enterprise, Industry, Brand, Innovation, Green, Project, Opening	302
4	National Symbols and International Relations	China, USA, Climate, Envoy, Global, China-US,	210
5	Tourism Activities and Cultural Exchange	Chaoyang District, Organize, Culture, International, Forum, Huairou District, Bar Street	93

Emotions classification

The results of emotions classification showed that in the international communication about the city image, happiness was the most popular, neutral was the second, and the rest were negative emotions (as shown in Table 2). Moreover, a one-way ANOVA revealed a significant difference between the number of contents of different emotions ($F=13.405$, $p=0.000$), with the happy emotion significantly more than the remaining five emotions. This indicated that the current international communication for city image of Beijing was dominated by positive praise and neutral narratives.

Cross-analysis of LDA and semantic analysis

After exploring the distribution of emotions in posts related to Beijing, to delve more deeply into how articles and posts with different emotions are distributed, we analyzed emotions and themes together. The study found that happy emotion was most prevalent in the themes of "*Digital Economy and Technological Innovation*" ($N=312$), while fear ($N=6$) and disgust ($N=6$) were also shown in theme 2; neutral narratives were most prevalent in the themes of "*Beijing- Tianjin-Hebei Synergy*" ($N=109$), while sadness ($N=11$) and anger ($N=12$) also appeared in this theme 1, indicating that while these two themes are highlighted as positive, they also tend to provoke unease and panic among foreign audiences (as shown in Table 3).

Discussion

This study investigates the themes and emotions in posts related to the city image of Beijing, utilizing a cross-analysis of LDA and semantic analysis. The key findings revealed that the themes of the national political center and center for international exchanges had surpassed other themes. Additionally, the emotions expressed in these posts were primarily characterized by happiness and neutrality. These findings have some implications for intercultural communication, identifying the deficiencies and strategies for enhancing international communication. Based on the results, we can establish an effective communication model from the cognitive to the behavioral level.

Table 2 Emotion classification on social media

Theme	Count
Happiness	998
Neutral	348
Sadness	42
Anger	33
Fear	25
Disgust	13

Table 3 Cross-analysis of emotions and themes

Emotions	Themes	Count
Happiness	2	312
	1	298
	3	213
	4	132
	5	43
Neutral	1	109
	2	82
	3	66
	4	57
	5	34
Sadness	1	11
	2	10
	4	9
	3	6
	5	6
Anger	1	12
	3	10
	5	6
	4	4
	2	1
Fear	2	6
	4	6
	1	5
	3	5
	5	3
Disgust	2	6
	1	2
	3	2
	4	2
	5	1

Internal improvements: the inequality of international communication system

From the internal viewpoint, the reasons affecting the international communication of the international image of Beijing can be attributed to the communication system divided into two dimensions:

First of all, the current discourse system in the new era still relies on traditional narratives. In light of the LDA analysis results, the "national political center" position and the keyword "economic hub" received greater interest in the communication contents. In promoting the city image of Beijing as an international city, the discrepancy in communication should be solved between self-representation and foreign portrayal. For example, although Beijing has been referred to as the "four

centers" by the central authority and publications, foreign media still tend to magnify and overly polarize its only attribute as a political center. Thus, western-defined theories and narrative logic in the process of international communication still prevail in the international public opinion arena, which cause the inequality of the international communication discourse system.

Secondly, it could be of necessity to construct unique cultural symbols that can resonate on a phenomenon level. In the current study, keywords concerning the "cultural center" position received not as much attention compared to others. The urgent issue in cultural communication is to build a city brand and transform the cultural core into communicable elements that can appeal to different audiences, including those with different cognitive attitudes and behaviors, and those in different contextual and cultural backgrounds (McQuail 1997). The international communication of Beijing city image needs to highlight distinctive developmental features rather than encompass a broad culture, differentiating it from other cities. Besides, international communication on social media platforms needs the improvement of posting frequency and content quality, which helps disseminate information to various publics, and the formation of digital diplomacy, which also enables receiving feedback, and reacting to "endogenous incremental shifting" instantly and appropriately (Luqiu and Yang 2020).

External challenges: the inefficiency of cultural outputs between high and low contexts

When communicating from a high-context culture to a low-context culture, there is inevitably a challenge of information mismatch and a lack of understanding of cultural outputs (Hall 1976; Kim et al. 1998). Thus, avoiding a simple and rigid cultural output can elevate a thorough understanding of the audience, making it smoother to bridge the cultural divide between high and low contexts and reduce cultural discounts, cognitive biases, and stereotypes caused by cultural and discourse habits.

In the process of international communication of Beijing city image, the "soft communication" of cultural elements may significantly enrich the effectiveness (Mattingly and Yao 2022), showcasing a micro-narrative approach to attract foreign audiences and generate interest and curiosity about the local culture. Meanwhile, "hard communication" emphasizes the economic and technological strengths (Huang and Wang 2019) and is often displayed through conflict-oriented frameworks (Frauen 2021). At this time, supposing the two sorts of communication strategies exist simultaneously, it leads to the dispersion and incoherence of the communicative message, which in turn makes for the blurring of the perception of the city image.

Thus, it is essential to build a connected communication network that involves multiple social actors in shaping Beijing city image. According to the push–pull-mooring (PPM) theory, push factors refer to negative elements that drive people away from the place, such as poverty, natural disasters, lack of opportunities or resources, and social instability, among others; pull factors, on the other hand, represent positive factors that attract people to a destination area, such as better

employment opportunities, improved living conditions, higher quality and equality of life, and access to better education or healthcare resources; and mooring factors encompass personal, cultural, and social factors, such as family connections, cultural identity, language, and community support networks, which influence individuals in their decision whether to stay in one area (Moon 1995). Drawing from PPM theory, the current study constructed an intercultural communication model based on exposure, perception, and identification factors.

Exposure factors: constructing cultural symbol and communication meme

The exposure-perception-identification (EPI) model can play a beneficial role in enhancing international communication and shaping city image by helping to reduce cultural discount through its focus on news exposure, emotional arousal, perception, and identification. The initial step news exposure serves as the foundation for subsequent news perception. For audiences, both incidental news exposure and intentional information-seeking are common ways to access information and engage further with news content. Incidental news exposure is influenced by the characteristics of the news content, typical media usage patterns (Karnowski et al. 2017), and algorithmic mechanisms, with highlighted key factors that drive incidental news exposure and emphasize social media platforms as agenda-setting vehicles (Ahmadi and Wohn 2018). Furthermore, the decision to engage attentively with news content is largely shaped by users' perception of that content (Kümpel 2019). Consequently, the characteristics of the content play a crucial role in attracting attention and fostering deeper perception.

When it comes to building the city image of Beijing, the exposure factors involve utilizing effective promotional techniques to capture the audiences' attention, while emphasizing cultural storytelling. This requires harnessing the communicative power of user-generated content (UGC) and professional user-generated content (PUGC). Unlike official communication that often relies on grand narratives and overall city development, user-generated content tends to highlight the micro-level aspects, capturing the food, scenery, and other appealing elements of the city, thereby shaping a more vivid and lively international city image (Fung and Hu 2022). In terms of soft communication, for instance, the successful inscription of the "Beijing Central Axis" as a World Heritage site has provided a focal point for addressing this issue. In this study, an analysis from a recent year data showed that the theme of central axis inscription received the most widespread and positive discussions. Achieving the breaking of the great symbol requires efforts in content, channels, and audience segmentation, such as incorporating elements of participation in the communication of the "Beijing Central Axis" can transform it from being visibility to a constructible process, nurturing the audience's cognitive map.

Perception factors: urban resilience and encouraging creative culture

Perception factors in the EPI model refer to the cognitive processing of news, which occurs through processes such as compartmentalization, homogenization, and

reconceptualization (Swart and Broersma 2024). Additionally, emotional and affective processes play a crucial role in reconceptualization and internalizing news content. In the current study, the distribution of emotions across news themes, such as happiness, sadness, anger, and fear, further influenced news perception.

The data revealed that different emotions played a crucial role in news perception, particularly in capturing audience engagement and emotional response. Positive emotions, such as "happiness," appear most frequently in topics like "Digital Economy and Technological Innovation" and "Jing-Jin-Ji" (coordinated development of the Beijing-Tianjin-Hebei region), suggesting that positive emotions enhance audience attention and resonance, increasing receptivity and news dissemination. The high frequency of happiness also indicates that positive emotions support a favorable perception of the city image among international audiences. In contrast, negative emotions like "sadness," "anger," and "fear" are comparatively rare, especially in topics like "National Symbols and International Relations." This low frequency reflects a media tendency to convey positive information, helping to reduce cultural discount and foster international acceptance. However, moderate occurrences of negative emotions can prompt deeper audience engagement with specific issues, encouraging discussion. Therefore, the distribution and thematic alignment of different emotions suggest that emotion is not only essential to news perception but also instrumental in shaping Beijing city image in international communication.

The perception factors include urban resilience and other appealing attributes to evoke an emotional response from the audience. Urban resilience is the ability of urban assets, location, and systems to provide performance, with redundancy, robustness, adaptation, resources, and innovation as its core characteristics (Ribeiro and Gonçalves 2019). It is necessary to coordinate efforts from various stakeholders and utilize diverse communication channels. Official channels such as the website, international summits, cultural exchange activities, and business exhibitions remain the most influential avenues for the external communication of the city image of Beijing, through which the city can make these crucial means to display its culture and achieve value transformation (Qi and Wang 2022). Besides, urban resilience is also evident in the delicate balance between the city labels. This balance allows for the realization of the embodied participation and "Instagrammable" aspects of symbols (Budge 2020), to a connection between people and urban space.

Identification factors: the process of understanding and practicing the city image

The Hofstede (1984; 2011) dimensionality of cultures paradigm emphasizes the diverse cultural impacts on values, behaviors, and organizational structures (Hofstede 2011). Dimensions such as individualism or collectivism, power distance, uncertainty avoidance, masculinity or femininity, and long-term or short-term orientation reveal how cultural contexts shape beliefs, social interactions, and institutional practices, providing a framework to understand how cultural identification involves not only a cognitive process but also a deep connection to specific cultural characteristics. Cultural identification, therefore, is influenced by these

dimensions as individuals internalize cultural norms and values, which in turn affect their worldview, behaviors, and affiliation with social groups.

In the era of post-truth, new technologies such as generative artificial intelligence contribute to personalized and precise niche markets, leading to a "post-city-communication era" that emphasizes cognitive competition, emotional factors, relationship resonance, and the understanding of the majority. It also focuses on segmented audiences and niche markets (Dimmick 2002). The goal is to achieve the process of understanding and practicing regarding the city image. This process shapes the audience's implicit cognition and subconscious to achieve social anchoring, leveraging trends in communication. This is mainly achieved through the dissemination of popular culture, such as film and television, music, novels, and other gamified interactive methods to cultivate the audience and form collective memories in a short period. The repetitive circulation of "hit songs" in short videos also helps reshape new impressions and perceptions of the city image. Besides, media pilgrimage reconnects the abstract nature of the media production system with tangible elements of that process (Couldry 2007), serving as an effective way to help people engage with and understand different cultural symbols. Through media pilgrimage behaviors, these locations gain social legitimacy and visibility, which play a significant role in agenda-setting and intercultural communication.

Conclusion

Drawing from the PPM theory, this study extended this framework within the psychological engine of international communication. Through the LDA content and semantic analysis, it identified the thematic and emotional distribution of the city image of Beijing across specific topics, seeking strategies and solutions for contemporary intercultural communication challenges. This study postulated an EPI model emphasizing the roles of media exposure, message perception, and identification. In conclusion, the city image of Beijing needs to reduce cultural discounts and balance in various aspects within the context of multiple positions and dimensions. This balance is essential for fostering a sustainable influence, addressing audience expectations, and reducing psychological uncertainties. The ultimate goal is to transform the media agenda into the psychological map of the audience, shaping a visible, acceptable, and communicable image of the city.

Code availability   The code used during the current study is available from the corresponding author on reasonable request.

Declarations

Conflict of interest   The authors declare no conflict of interest.

Ethical approval   The authors declare that this research article does not contain any personal information that could lead to the identification of gathered online data.

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