INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES

Vol 15, Issue 4, (2025) E-ISSN: 2222-6990

Integrating Regional Cultures through Visual Semiotics in Shijiazhuang's Metro Signage Design

Zhong Guoying
Mianyang Polytechnic, Shijiazhuang, Hebei Province, China
Email: zhongguoying345@gmail.com

Shaw-Chiang Wong
Faculty of Arts and Design, Raffles University, Johor Bahru, Malaysia
Email: shawchiangwong@raffles-university.edu.my

To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v15-i4/25037 DOI:10.6007/IJARBSS/v15-i4/25037

Published Date: 07 April 2025

Abstract

Shijiazhuang (SJZ) started its metro construction rather late as compared to other cities in China, but at present, it has three metro lines in operation. This study critically evaluates the signage of SJZ's Metro, with a specific focus on embedding regional culture to resonate with the 'New SJZ, New Style, New Metro' ethos. Through participatory action research, six local metro users were deeply involved in the design process. Initial cultural probes and interviews assessed the existing signage system. The collected data was analysed through thematic analysis using NVivo 12 and identified regional cultural aspects deemed significant by the users. The study found that while the metro signage system serves its primary functional purpose, there is considerable scope for cultural enrichment. and identified regional cultures were *Xibaipo*, *Xinbai Plaza*, *Beiguo Commercial Building*, *Zhengding Ancient City*, *Zhaozhou Bridge*, *Hebei Provincial Museum*, and *SJZ Old Railway Station*. These cultures were then extracted and translated to become meaningful visual symbols using a design framework developed based on Morris's semiotic theory. Specific colours, shapes, pictograms, and fonts for the metro signage system were developed, revised, and finalized with the involvement of the users. The reimagined signage system was found to enhance the user experience by fostering a stronger sense of identity and belonging. It also holds the potential to elevate the city's image and competitive edge. In demonstrating the interplay between regional culture and public transit design, the study contributes to the discourse on cultural representation in urban environments. It posits that a metro system that reflects the city's heritage can significantly influence civic pride and the city's cultural narrative. Overall, this research provides a framework for infusing regional culture into metro signage system design, with implications for improving urban identity through transportation infrastructure.

Keywords: Shijiazhuang, Metro Signage Design, Regional Cultures, Visual Semiotics, Users

Introduction

SJZ is the capital and most populous city in China's Hebei Province (SJZ Municipal People's Government, 2017). It is a hub for transportation in China owing to its unique geographical location as well as comprehensive construction and coverage of the metro system in the city (SJZ Municipal People's Government, 2021). The first phase of the metro project began in 2017. As of April 2020, there are three operational lines. It is planned that the metro network of SJZ has eleven regular urban lines and four express urban lines that cover the entire city. SJZ has experienced dramatic growth in population, infrastructure, and economy due to the rapid development of its metro system in the past few years (SJZ Rail Transit Group, 2021).

Signage system is an integral part of the spaces in SJZ metro stations. When taking a metro, users need a comprehensive signage system to meet their wayfinding needs and improve the efficiency of their journey (Xu & Chen, 2021). In general, the signage system generally includes identification, directional, interpretive, regulatory, and warning signs (Calori & Vanden-Eynden, 2015; An et al., 2019; Zhang et al., 2020; De Vries & De Vries, 2021). These signs can be found in various corners of the spaces of SJZ metro stations to guide user movement. According to the SJZ Rail Transit Group (2021), the metro signage system of SJZ meets national construction standards and generally fulfils the functional requirements of its users.

SJZ has rich regional, cultural, humanistic, and historical characteristics (He, 2021). These characteristics can be categorized into urban landmarks (e.g., The TV Tower, the *Hebei* Provincial Museum, the Liberation Monument, *Jizhiguang*, and *City of Victory*), scenic spots (e.g., *Zhangshiyan*, *Taihang* Mountains, *Foguang* Mountain, *Cangyan* Mountain), cultural monuments (e.g., *Zhaozhou* Bridge, *Rongguofu*, *Fuxi* Terrace, and *Xibaipo*), and folk customs (e.g., *SJZ* Silk Strings, *Wuji* Paper Cutting, *Changshan* War Drums) (SJZ Municipal People's Government, 2006, 2012, 2014, 2015, 2017).

As China has become more well-developed, Sheng et al. (2021) claimed that the 'standardization' of urban design has made different cities in China look more alike. Therefore, showcasing the regional cultures in certain areas of a city has received increasing attention in China (Liao, 2019; Wang et al., 2021; Chen et al., 2022). Since metro system is a type of public transport that generally functions in urban areas, Zhou (2020) suggested that metro stations can take on the 'responsibility' of spreading regional cultures and strengthening the cultural image of a city.

Hence, many cities in China have started considering and integrating regional characteristics into the design of their metro signage systems in addition to the general wayfinding functions (Long, 2018; Liao, 2019; Cao et al., 2016). The idea of 'one station, one view' was proposed (Kong, 2007) and reflected in the *Xiushan* Station of *Fuzhou* Metro Line One (Shen & Lian, 2018), *Changchun* Metro Line One (Bian, 2016), and *Beijing* Metro Line Four and Six (Yuan & Feng, 2016). These designs highlighted the distinctive cultural characteristics of a specific city, allowing local users to experience spiritual fulfilment and confidence in the place where they live (Gao, 2021) and foreign visitors to feel and appreciate the historical stories and aesthetic charms of the regions (He, 2021).

Literature Review

SJZ Metro System and Its Current State

The road network in SJZ initially constructed in a 'circular plus' structure, combining six verticals, four horizontals, and two ring roads. However, with the city continues to develop, traffic congestion has slowly become a serious issue. To deal with this, SJZ started its metro construction in 2013 with the intention to form a comprehensive route network structure, which consists of six main lines and three supplementary lines. In the year of 2020, three lines are in operation, including Line One, represented by red; Line Two, represented by champagne; and Line Three, represented by ice blue (SJZ Rail Transit Construction Office, 2020).

SJZ Metro Line One can be considered as the most important lines among all because it is built at the central of SJZ city. This 'east-west' line has 26 metro stations. Two interchange points, which are *Xinbai Square Station* (transfer to Line Three) and *Beiguo Commercial Building Station* (transfer to Line Two) are in operation. The construction of Metro Line One has fastened the expansion and development of SJZ city. According to SJZ Rail Transit Group (2020), it has significantly improved the traffics and logistics of areas such as *Gaoxin* district and *Zhengding* district.

As of 2022, the total user flow of the SJZ metro exceeded 437 million person- times, which equals to 35 percent of the overall urban public transportation usage of the city (SJZ News Network, 2022). In the same year, the overall users of the SJZ Metro have reached 86,876,700, with an average daily user of 243,400 (SJZ Transportation Investment Co, 2020). Since signage system is an integral part of the spaces in SJZ metro stations, the quality of it in the SJZ metro station is essential. To ensure its functionality and consistency, as SJZ Public Railway Transportation Group (2021) stated, the overall SJZ metro signage system is planned, designed, and constructed systematically in terms of the classification of sign information, placement of the signs, use of standardized visual elements on the signs, and so forth. Subsequently, SJZ Public Railway Transportation Group (2022) mentioned that these efforts have allowed the current signage system design of SJZ metro to be highly consistent and functional and fulfil the various navigation needs of the growing number of users.

Nevertheless, as SJZ Public Railway Transportation Group (2022) specifically pointed out, SJZ started constructing its metro system rather late as compared to other cities in China. While the signage system design within SJZ metro station space has 'safely' complied with the national standards to provide easy-to-follow signs and legible directions for the users (SJZ Rail Transit Group, 2021), it does not take its regional cultures into consideration to further strengthen the distinctive identity of the city and instil a sense of belonginess to especially the local users (SJZ Public Railway Transportation Group, 2022).

Regional Cultures of SJZ

Regional cultures refer to the local characteristics and cultural activities that are formed under different regional environment and natural conditions (Burgess & Gold, 2015; Higgins, 2017; Pieterse, 2019). From a sociological point of view, it is an organic whole that is constantly created and developed and is often associated with a group of people who live within the territory (Merlin & Rosinie, 2022). The following subsections elaborate SJZ's regional cultures

from four dimensions: (1.) urban landmarks; (2.) cultural monuments; (3.) scenic spots; and (4.) folk customs (Sun, 2018; Zhao, 2019).

Urban Landmarks refer to those representative and unique buildings, places, or landscapes in a city because of their historical, cultural, artistic, architectural, or natural features (Richter & Winter, 2014). Therefore, these landmarks usually reflect a city's cultural and historical image and the lifestyle of its people. They can serve as tourist attraction and a source of pride for the community (Gavalas et al., 2017). Accordingly, *SJZ TV* Tower, *SJZ Old Railway* Station, *Hebei* Provincial Museum, *SJZ* Liberation Monument, *Jizhiguang, and City of Victory* are a few well-known buildings or architectures that can be categorized as the urban landmarks of SJZ city.

Cultural monuments are prehistoric sites, heritage, cultural landscapes, relics, or other objects that have historical, cultural, artistic or research value. They reflect the civilization, history, culture, and artistic style of a region, a country, or a group of people (Deák et al., 2016). In China, many cultural monuments have also been listed as world heritage sites, becoming common cultural heritages for humankind. Protecting cultural monuments is essential to human civilization (Benhamou, 2020). Based on the above description, a number of famous sites, relics, heritages that can be categorized as the cultural monuments of the SJZ city, such as *Zhaozhou* Bridge, *Rongguofu, Fuxi* Terrace, *Zhengding* Ancient city, and *Xibaipo.*

Scenic spots are beautiful geographic landscapes with high cultural values that are highly appreciated and studied by tourists and cultural enthusiasts (Yang et al., 2020). Scenic spots have not only the tourism value but also played an essential role in understanding nature, history, ecological maintenance, and preservation of cultural diversity. In such a context, the conservation and development of scenic spots is a critical social task and industry, and this is especially the case in China (Sun et al., 2017). *Zhangshiyan, Tiangui* Mountain, *Cangyan* Mountain are the representatives of SJZ City.

Folk custom refers to the traditional culture and lifestyle of a region, usually including literature, music, dance, handicrafts, arts, customs, traditional festivals, religious rituals, and so on. They are essential to national or regional culture, representing a particular cultural heritage and traditional values (Dundes, 2019). Therefore, protecting, and inheriting folklore helps people better understand and maintain their cultural traditions. It also helps promoting cultural exchange, understanding of different regions, deepening cultural identity, and enhancing mutual respect among people (Fang, 2021). Based on the above description, traditionally sound handicrafts, arts, and traditional festival can be categorized as the folk customs of the SJZ city, for example *SJZ Silk String, Wuji Paper Cutting Changshan War Drum,* and *Jinzhou* Official Umbrella.

Metro Signage System Design: An Overview

According to Romanovich and Simankina (2016), the metro station space is composed of three important components: users or users, navigation or any related activities, and the space itself. To design anything in the metro station must take these three components into account (Sun, 2018). In the metro station space, there are various types of users or users (e.g., elderly people, working adults, students, pregnant women, etc.) carry on different activities, such as finding ways, waiting trains, get on and off the trains, walking towards a destination, and so

on. They should be able to move around the space efficiently and intuitively without any hesitation (Jian, 2021; Cui et al., 2021; Bai, 2022). Any design in the metro station space should keep 'inclusiveness' as one of the key points to allow its different users to have a pleasant and safe visiting or using experience and to fulfil the needs of them (Grodach et al., 2014; Ren et al., 2020; Lü, 2020).

One of the important components within the metro station space is the signage system (Gong, 2020). Signage system design consists of highly 'easy-to-understand' and consistent visual-oriented information such as maps, typographic elements, arrows, graphics, pictograms or symbols, colours, and so on to communicate meaningful information to an audience (Calori & Vanden-Eynden, 2015; Zhang, 2022). Such information may be used to promote, identify, provide direction or to raise safety awareness. More than often, signage system may also contain audio and interactive elements that can guide and affect users' navigating experiences within the space. It carries interactive information in a space and assists users in spatial orientation (Schrag, 2014; Guo, 2019; Dong et al., 2021).

More specifically, the metro signage system is a visual information system formed based on the systematic analysis of the characteristics of the metro station space and the needs as well as activities that are carried out by the users within the space (Calori & Vanden-Eynden, 2015). On the one hand, it is a channel to communicate information about the metro space, assisting users or users in realizing their behavioural needs, ensuring the recognizability of the space, and facilitating their wayfinding intention (Zhou, 2020). On the other hand, as Cao and Cui (2016) highlighted, the metro signage system can be used to reflect the cultural image and spiritual connotation of a city and strengthen the sense of belonginess of users with the place. The distinctive cultural characteristics of a specific city can be highlighted through metro signage system design, allowing local users to experience spiritual fulfilment and confidence in the place where they live (Wang et al., 2021) and foreign visitors to feel and appreciate the historical stories and aesthetic charms of the regions (Xu, 2019). Therefore, in the context of China, a nation that has many historical and cultural cities, the idea of integrating regional cultures into the metro signage system design has received growing attention (Sun, 2017; Long, 2018; Gao, 2021; Huang, 2021).

In short, the functions possessed by the metro signage system are firstly, to undertake functional tasks such as conveying information, guiding paths and determining locations, and assisting users in improving the efficiency and shortening the travel time of the ride (Sheng et al., 2022). According to Tang (2014) and Yan (2022), these considered as the 'extrinsic needs' of the metro users. Secondly, in an era where regional cultures are increasingly valued (Huang, 2021), the metro signage system can also become an essential window for spreading unique culture and civilization of a region (Cao, 2015; Bi, 2017; Zhou, 2017). These can be viewed as the 'intrinsic needs' of the metro users (Tang, 2014; Yan, 2022).

According to its different functions as mentioned above, the metro signage system can be classified into several types, they are: (1.) directional signs; (2.) identification signs; (3.) interpretive signs; (4.) regulatory signs; and (5.) warning signs. In general, different types of signs differ in the information that they intend to communicate to the users within the space (Calori & Vanden-Eynden, 2015; An et al., 2019; Zhang et al., 2020; De Vries & De Vries, 2021).

Most of the time, the user flow in the metro stations is large and intricate. If users are lacking guidance, they will quickly get lost or deviate from the targeted destination (Sun, 2018). Therefore, scientific, reasonable, and strategic placement of the signs is key to ensure the users are able to find their ways especially when they are in a hurry (Zhou, 2020). In addition, signs should also be displayed or mounted suitably. Metro signs can be mounted in several ways: freestanding, ceiling-hung, projecting, flush-mounted. The mounting or support structure for each sign can be either concealed or visibly expressed, resulting in the various overall sign forms (Schrag, 2014; Calori & Vanden-Eynden, 2015; Motamedi et al., 2017).

Metro signage system carries visual-oriented information (Yang & Tang, 2022; Liu, 2019). Sign information is expressed visually through the creative manipulation and meticulous arrangement of design elements, including colours, pictograms, shapes, and fonts. Each element has its own distinctive functions and characteristics that can be used to shape user's perception, influence behaviours, or assist navigation in the metro station space (Tang, 2014; Wang, 2015; Cao, 2015; Yan, 2021).

The Concept of Semiotics for Development of Visual Symbols

Semiotics is the systematic study of sign processes and the formation of meaning (Eco, 1979). There is no agreed upon definition of 'signs' but the most widely accepted one was made by Barthes (1957, 1971, 1979). He elaborated signs from three perspectives: (1.) a sign is an organism, a stimulus, or a non-real stimulus, such as language, smell, pictures, words, etc., that the receivers (e.g., human being or animals) can understand; (2.) a sign is a medium between two entities acting as a function of transferring information; and (3.) a sign represents a specific meaning, such as traffic signs, gestures, etc. In short, signs should be easily recognized and comprehended while they are used to convey information to the receivers (Barthes, 1957, 1971, 1979).

Morris (1938) proposed a theory of signs that comprises three parts, namely semantics, syntactic, and pragmatics. Semantics involves the investigation of relationships between symbols and the objects they denote, including the exploration of symbol meanings and the relations between the denoted objects. Syntactic refers to the study of relationships between symbols, abstracting from their associations with objects or interpreters. Pragmatics studies the nature of symbol interpreters and the origin, usage, and impact of symbols on interpreters (Mertz, 1985; Yelle, 2011). Zhao (2016) deepened the exploration of signs from the perspectives of their form, meaning, and usage. In addition, Roberts (1955) applied the three levels of semiotics by Morris (1938) extensively in aesthetic and linguistic areas, providing crucial references for research in relevant fields.

In design practice, 'semantics' mainly applied to ensure the effective communication and interpretation of information among the receivers. Designers, by understanding and applying principles of semantics, can make the design communicate more effectively with users, thereby enhancing user experience. 'Syntactics' involves the structure and organization of design elements, focusing on how various design elements can be organically combined to construct a meaningful whole. Lastly, 'pragmatics' is used to emphasize the actual application of design and user interaction, mainly considering how to link the design, services, or systems with its actual usage environment and the behaviour, needs, and scenarios of the users (Roberts, 1955; Zhao, 2016; Zhang et al., 2015; Li et al., 2021).

Regional cultural symbols are visual elements or signs focus on representing regional cultures (Huang, 2021). These symbols embody the characteristics of specific regional cultures and therefore to develop them need to understand the specific features of regional culture, meaning of signs, relationship in between signs and human perception and behaviours (Rapoport, 1980; Šifta & Chromý, 2017). The essence of regional cultural symbols is to convey regional cultures through symbolic representation, endowing them with both intension and extension meanings (Sepe & Pitt, 2014). Regional cultural symbols encompass various fields, such as geography, semiotics, design, etc. They can be called as 'cultural symbols' from theoretical perspective while in creative practice, they are usually named as 'design symbols' (Barakat, 2017). Cultural symbols serve as tangible evidence of human activities, whereas design symbols maintain regional cultural features after being refined by designers. Design symbols rely on their cultural symbols as design foundation (Chwalkowski, 2016). Cultural symbols serve as abstract embodiments of the unique culture associated with specific regions, ethnic groups, or nations, acting as crucial carriers of cultural meanings (Lotman, 1988; Baldwin & McCracken, 2014). When regional culture emerges, it usually becomes evident in different aspects of people's lives and works and is manifested as cultural symbols. In other words, cultural symbols can be also referred to as the 'representative images' of regional culture (Lizardo, 2016).

Design symbols in regional culture are visual symbols created by designers after summarizing, categorizing, and refining cultural elements (Kress & Van Leeuwen, 2022). The application of regional symbolic design and extraction in the metro signage system is prominently manifested in metro station signages and the shapes of metro signages (Tang, 2014; Cao, 2015). The transformation of cultural symbol to design symbol is drawing inspiration from regional culture, developed by reinterpreting, and reshaping regional culture (Anderson-Levitt, 2017). In general, there are three basic methods for extracting design symbols for regional culture: preservation of 'original' symbols (directly extract regional cultures while producing the visual symbols); extraction of 'typical' symbols (refining the regional cultures to create highly recognizable visual symbols; and abstraction of 'symbolic' elements (refining regional cultures to deliver their meanings into more concise, powerful, or symbolically rich visual representations).

Previous Studies

Several scholars have conducted relevant studies on the design of metro signage system in the context of China (e.g., Long, 2018; Xiang et al., 2019; Hu & Guo, 2020; Li et al, 2022; Sheng et al., 2022). One of the key scholars, Tang (2014), developed a framework for metro signage design based on regional and cultural symbols. The framework comprises information planning, symbol recognition, and semantic styles. She used semiotic theory to signify the signs in metro stations as 'cultural symbols' made up of information from the environment, local culture, and city spirit. On the other hand, Wang (2015) used the metro signage system of *Harbin* as a research site to demonstrate how regional and cultural characteristics can be used in the design of the metro signage system. He conducted practice-based research by: (1.) identifying the flaws in the current *Harbin* metro signage system design; (2.) extracting colours, pictograms, shapes, and other visual elements from the regional cultures of the city through referring to the design strategies, ideas, and principles of previous studies; and (3.) applying the elements to design the metro signage of *Harbin*.

In addition, Zhang (2021) used the observation method to explore her understanding of *Lanzhou* metro signage system design. She discussed why and how the metro signage system should use *Lanzhou*'s regional cultures and actualized it at the end of the study. Furthermore, Li et al. (2010) conducted a preliminary investigation on the public space of SJZ metro station and found out that suitability of signage information, distinctiveness of the usage of colours, and design of the pictogram are the three important factors that can affect the navigating experiences of the users. These studies are believed to have laid a valuable foundation for the present study.

This study believes there is room for improvement in SJZ metro signage design, especially in reflecting and integrating its regional cultures into it. Regional cultures are characterized by distinct traits and cultural practices that originating from diverse environmental and natural conditions in various locations (Burgess & Gold, 2015; Higgins, 2017; Pieterse, 2019). From a sociological perspective, these cultures are viewed as evolving collectives intrinsically connected to the inhabitants of the region (Mei & Luo, 2022). While the signage within the SJZ metro complies with national standards, providing clear guidance to users (SJZ Rail Transit Group, 2019, 2020, 2021), and the metro actively seeks to refine its signage and services for improved user satisfaction, it is noteworthy that such efforts still fall short in embracing regional cultures (SJZ Metro, 2020, 2021). Additionally, Zhang (2021) pointed out that the SJZ metro has not yet to harness the power of regional culture in its design strategy, which could greatly enhance the city's distinctive character and instil a stronger sense of belonging among its residents (Casais & Monteiro, 2019).

With the rapid development of the economy and the improvement of living standards, the intrinsic needs for spiritual and cultural aspects of lives among Chinese people are also increasing (Kang et al., 2021; Sheng, 2022). Therefore, the roles of SJZ metro signage system design must be expanded to meet the tagline of 'New SJZ, New Style, New Metro' envisioned by SJZ Rail Transit Group (2022) and to take the intrinsic needs of the metro users into serious account. Just like some cities in China, such as Xi'an (Yan, 2022) and Chengdu (Zhou & Dong, 2020), which have incorporated regional cultural elements into their metro signage systems, other major cities—such as Beijing, Shanghai, Shenzhen, and Guangzhou—have also made their metro networks pivotal in showcasing local culture. Subway posters and signage in these cities often highlight geographical features and promote local traditions, effectively transforming transit spaces into cultural showcases. This approach not only educates passengers about regional heritage but also strengthens community identity (Yuan & Yuan, 2019). SJZ, a city with rich regional cultural, should not be an exception. The present study argues that how to optimize the current design of the SJZ metro signage system to reflect the idea of 'one station, one view' (Xu, 2020; Sheng, 2022) is an important research direction that is worth tackling.

The primary function of metro signage system design is to serve people. Integrating regional cultures into the metro signage system adds individuality to the commonality of the metro space to better serve people (Zhang, 2017). However, in the context of this study, which regional cultures would be more meaningful to be included in the design of the SJZ metro signage system from the perspectives of the users to serve them better and bring out their pride of them is also another issue that worth to be examined further.

As highlighted by the SJZ Rail Transit Group (2022), the metro signage system has gradually become a tool or window to showcase the image, stories, and civilization of a city. As previously mentioned, Chinese scholars have initiated several attempts to investigate the integration of regional cultures into the colours, fonts, shapes, and pictograms design of the metro signage systems in particular cities, such as *Beijing* (Huang, 2021; Wu, 2022), *Xi'an* (Zhang & Ding, 2017; Sun, 2018), *Harbin* (Gong, 2020), *Nanchang* (Huang, 2020; Liu, 2019; Jian, 2021), and so forth. However, there is limited studies on relevant areas in the context of SJZ. Thus far, only one study by Li et al. (2010) was found. China is a large nation, and each city has unique regional and cultural characteristics. This study shares the same opinion with Xie and Jiang (2015) that the design of the metro sign system should be meaningfully used to showcase the unique cultural aspects of a city while still meeting its fundamental role of wayfinding. Therefore, this study aims to identify, extract, and integrate regional cultures of SJZ into its metro signage system design. Accordingly, the research questions addressed in this study are as follows:

1. What are the key opinions of the current SJZ metro signage system design as perceived by selected users?
2. What are the regional cultures within SJZ that hold significant meaning for its users?
3. How can identified regional cultures be translated into visual symbols, i.e., colours, shapes, pictograms, and fonts for SJZ Metro Line One signage system design?

Figure 1 depicts the conceptual framework of the study, which is built on the foundation of semiotic theory proposed by Morris (1938). The conceptual framework illustrates how semiotic theory is applied in considering the intricate relationship of three important concepts of the study, namely the users, regional cultures, and metro signage system in the context of SJZ.

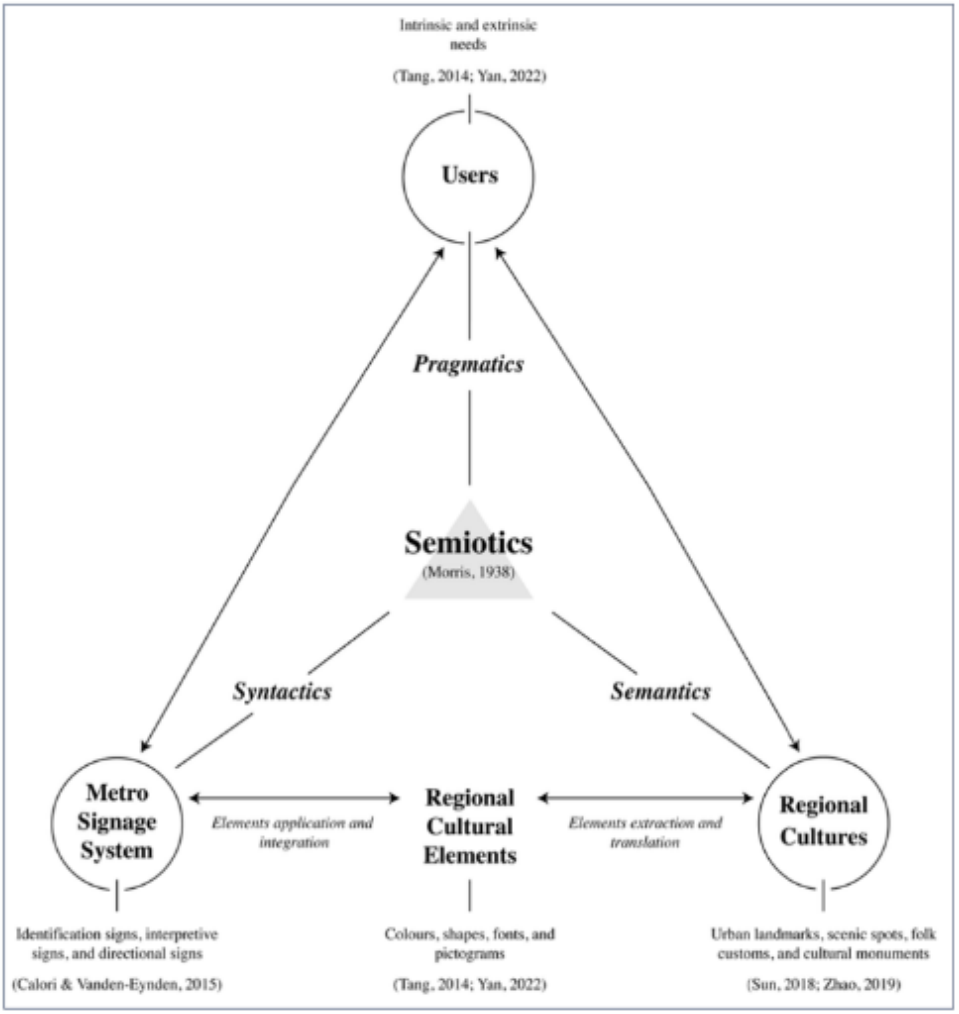


Figure 1 Conceptual Framework of the Study

Methodology

Research Design

Qualitative action research was employed to answer the research questions posed in this study. Action research focuses on improving practices (Hinchey, 2008). It gives practitioners a chance to investigate and evaluate their own work (Cardno, 2003). Davison et al. (2016) stated that the key starting point for action research is to identify a general idea, problem, dilemma, or ambiguity in the existing practice that can be further improved, and the researchers then refines things from there.

According to Swann (2002), action research is a spiral process of both action and research in four important steps: planning, action, observation, and reflection. Specifically, 'planning' includes analysing the problem and determining how to solve it. 'Action' is the process of putting the plan into action. 'Observation' is evaluating the action using the proper methods and techniques. Finally, 'reflection' considers the evaluation results, actions, and research processes. A cycle of each of these steps can lead the researchers to detect new or more interrelated problems and start a new cycle of planning, doing, observing, and reflecting to overcome them systematically and effectively (Zuber- Skerritt, 2016).

When action research is applied to a design study, the researchers and participants usually work together to discover more practical answers or solutions for the problems undertaken in the cyclical process (McNiff & Whitehead, 2012). In other words, action research can often be 'participatory' in nature when it comes to data collection (Koshy, 2005). Chevalier et al. (2012) suggested that participatory action research (PAR) actively engages various stakeholders who might be affected by the proposed solution. This study therefore believes that using PAR in the research process could provide a deeper and more contextualized understanding of the demands of users while designing the metro signage system.

In relation to the above, the researchers serve the roles of both the designers and authors of this study. A small number of SJZ metro users were identified as research participants throughout the study. Based on how PAR works (Kindon et al., 2007), the researcher of the study flexibly applies different methods to engage with the users of the SJZ metro for data collection to achieve the research objectives in a meaningful manner. Specifically, by referring to Wang (2015), this action-based study was divided into two phases: (1.) insights exploration phase and (2.) design and integration phases. In each phase, there is a cycle of planning, acting, observing, and reflecting.

Phase One: Insights Exploration

In the preliminary insights exploration phase, the objectives were to explore SJZ metro users' perceptions of existing SJZ metro signage systems and their insights into SJZ regional cultures as SJZ metro users. To achieve these objectives, two data collection methods were used in the first phase of the study: cultural probes and semi-structured interviews.

First, cultural probes were used to learn more about how the users connect themselves with the SJZ metro signage system and their riding experiences, insights, and needs. As pointed out by Gibson (2009), while signage system helps people to navigate the space intuitively, but its design within the built environment is always being taken for granted. To use cultural probes at the beginning of the study is to allow the participants to observe and reflect on the SJZ signage system that they 'see' and 'use' every day. To do this, it is believed that they could be better prepared for the interview and design process in the following phase of the study.

The users (research participants) were tasked with documenting the current state of the SJZ metro signage system using a pre-designed observational checklist. They were required to perform the documentation by taking photos and videos within a week. An observation diary was used to determine what they think about the state of the signage system after they have made the observations and documentations.

Secondly, the researchers 'digs' deeper to know further their perceptions of the existing signage system design of SJZ metro and discover their opinions on integrating the regional cultures of SJZ into its metro signage system by conducting semi-structured interviews. They were also asked to suggest meaningful regional cultures that can best represent SJZ city. The findings were again being reflected to provide initial design resources and materials for the second phase.

The researchers adapted the interview questions asked in previous studies, i.e., Tang (2014), Wang (2015), and Yan (2022) while creating semi-structured interview questions of this study.

In addition, based on the literature review, a preliminary plan for semi-structured interview questions was developed. The scope and content of the interview questions were further narrowed and adjusted based on the analysis of the findings of the observational diary produced by the participants in the earlier stage. In total, eleven questions were finalized in the interview protocol. To ensure the content validity of the instruments used in the cultural probe and semi-structured interview, three experts in the academic field were purposively selected to review and validate the instruments (Pal and Konstan, 2010). These experts were selected based on their prominent educational and work experience in the relevant fields. They were asked to check whether the initially developed instruments were appropriate and relevant to the research objectives (Bell & Bryman, 2007). In addition, experts were also requested to review the accuracy of the wording and grammar used in the instruments. Based on their recommendations, grammatical errors, redundant questions, and poor meanings were revised.

Non-probability convenience sampling method was used to select participants of the study. A few sampling criteria, as stated below, were predetermined by the study: they must be residents of SJZ or highly familiar with SJZ despite not being residents of the region; they started using SJZ metro since its operation in 2019; they are regular users of SJZ metro and take the metro at least 10 times per week; they are SJZ Metro Line One's users.

A mini questionnaire was used to identify suitable research participants for the study. Of the 378 participants who answered the questionnaire, there are eight people who meet the above four criteria. An inform-consent form was sent to them to ensure that they aware of the research purpose and were willing to provide feedback to the researchers at different stages of the study. Subsequently, these eight (8) potential participants all expressed their willingness to participate and committed to providing the necessary support and assistance to the author during the study.

Phase Two: Design and Integration

The objective of the second phase is to develop, refine, optimize, and evaluate the proposed signage system design for SJZ Metro Line One. The findings of cultural probes and semi-structured interviews are the foundation for the study. They lay the foundation in the design stage to refine and transform the confirmed representative regional cultures into meaningful visual symbols.

Before the design and integration process took place, based on the literature review (Morris, 1938; Tang, 2014, 2018; Yan, 2022), the researchers built a design framework. Drawing on Morris's (1938) 'semantics' principle and the practical strategies of Li and Yang (2021), a design theme was determined, and three workable design concepts were developed accordingly. Metro users were consulted, and their feedback was considered in the identification of the most promising design concept. Then, based on Morris's (1938) 'syntactics' principle, representative of SJZ regional cultures were extracted and transformed into four visual elements, including colours, shapes, fonts, and pictograms. Lastly, these elements that carried rich SJZ regional cultural characteristics are combined and integrated to form the proposed signage system design of SJZ Metro Line One. Since Morris's (1938) 'pragmatics' principle focuses on the effective interpretation of the 'signs', in this study, the research participants are engaged closely in providing immediate feedback based on the

design from time to time. In other words, there was also a cycle of planning, acting, observing, and reflecting in the second phase of the study.

Results and Discussion

Phase One: Insights Exploration

Participants Profile

Qualitative action research was employed to answer the research questions posed in this study. Action research focuses on improving practices (Hinchey, 2008). It gives practitioners a chance to investigate and evaluate their own work (Cardno, 2003). Davison et al. (2016) stated that the key starting point for action research is to identify a general idea, problem, dilemma, or ambiguity in the existing practice that can be further improved, and the researchers then refines things from there. The participants consisted of four males and four females. All of them are working adults with ages range from 26 to 44 years old and they started using the SJZ Metro Since its operation in 2019. All of them are the users of SJZ metro line one. At the same time, they take the metro at least 10 times per week. Although Participants E and G are not residents of SJZ, they have been living in the city for more than five years and are highly familiar with SJZ. All of them fulfilled the pre-determined sampling criteria.

Table 1
Participants' Profile

Participant	Gender	Age	Job
A	Female	26	Media Executive
B	Female	28	Veterinarian
C	Male	27	Teacher
D	Female	31	Teacher
E	Male	33	Freelancer
F	Male	44	Architect
G	Male	36	Ceramist
H	Female	42	Accountant

Cultural Probes' Findings

Over a two-week period, eight participants used the toolkit to collect relevant data for the researchers accordingly. However, two participants failed to return the toolkit within the specified time at the end despite two reminders were given. Therefore, the actual number of participants in the cultural probe activity was reduced from eight to six. The initial task required the participants to take random photos or videos according to the observation reference list. Throughout the process, the researchers collected 199 photos and four (4) videos from six participants over a two-week period.

Table 2
Photos and Videos Collected by Participants

Participant	Number of Photos Collected	Number of Video Collected
A	32	1
B	29	0
C	27	1
D	20	0
E	50	2
F	41	0
Total	**199**	**4**

The collected photos and videos were then reviewed and categorized according to the relative themes based on the locations of the signages within SJZ metro stations, including three distinct levels, i.e., entrance or exit level, concourse level, and platform level.

To investigate further their thoughts, the participants were asked to create a observe diary based on their observations of the metro signage system in the second task. There were no restrictions on content or format for the observe diary. As a result, six observation diaries were produced, which are displayed in Figure 2.

Figure 2 Observation Diaries of Participant A - F

In short, drawing from the six participants (A-F), the findings are in concordance with the observational photos. The participants commonly paid attention on during their daily rides include directional signs, identification signs, and interpretive signs. Regulatory signs and warning signs receive relatively less attention; only Participant A, B, and F noticing them. Among these three participants, Participant F provided the most detailed observations of these two types of signs. Additionally, floor stickers were observed to be significant by Participant C and F despite it is not a common mounting method for signage design based on the literature review (Schrag, 2014; Calori & Vanden-Eynden, 2015; Motamedi et al., 2017). Ceiling-Fung and flush-mounted signage installations were prevalent throughout the SJZ

Metro signage system as noted by all six participants. In addition, for facility-related signs, such as toilet, three participants (A, E, F) consistently addressed it in their diaries, which indicates its importance in the metro space too. However, it was also found that some items in the observation reference lists had not been reflected or documented in the diaries of all the participants, such as guiding signs around the metro station, metro operational hours sign, and door position information when riding the metro. These initial findings from the cultural probes were discussed further between the participants and the researchers in the semi-structured interview sessions later on.

Through the cultural probe's activity, the researchers were able to comprehend participants' levels of focus on signage in different areas within metro spaces based on analysis of the photos and diaries documented. These findings, in the researchers' opinion, have not only facilitated a deeper grasp of the relationship between metro signage design and user behaviour but also provided guidance for further exploring users' perceptions on the current state of SJZ's metro signage system. A further reflection on the findings revealed that the participants paid more attention on several areas as stated below:

- The signages that are being placed at the concourse and platform levels. This may be because the participants usually stay longer at these levels and the placement of the signages are more concentrated and therefore they are more likely to catch the attention of the users.
- Ceiling-hung and flush-mounted types of signages have a relatively higher frequency of occurrence in the photos provided by the participants. These two mounting techniques of signage are more frequently seen at the concourse and platform levels. Freestanding and projecting types of signages are mainly placed at the entrance/exit level, and this is because to be the reason why they received relatively less attention from the participants of the study.
- While directional, identification, and interpretive signs are emphasized by the participants, regulatory and warning signs received less attention. The researchers speculated that this may be due to the visual forms of these two types of signs are relatively consistent across stations, causing participants to become accustomed to them and not pay special attention.

Meanwhile, the photos taken by participants mainly focused on SJZ Metro Line One, especially the transfer stations of *Xinbai* Square and the *Beiguo* Commercial Building. SJZ Metro Line One is the first metro line opened in SJZ, connecting the east and west areas of SJZ city and all stations on it runs through are located at densely populated areas. SJZ Metro Line One is busier as compared to another two metro lines that are now in operation (SJZ Rail Transit Construction Office, 2020) and hence why was paid more attention by the participants. This further validate the choice of the researchers to use Metro Line One as example to explore how the regional cultures of SJZ are integrated into the signage system design in the later phase of the study.

Semi-Structured Interview Findings

Before the interviews, the researchers verbally asked the six participants if they were willing to continue in the study, and they all agreed. Therefore, a total of six people was interviewed. The researchers used NVivo 12 to analyse the qualitative data collect. The six transcripts were

first imported into the software, then the researchers started familiarizing the data, and after that open coding, axial coding, and selective coding of the data were systematically performed as shown in Table 3. After completing these steps, the researchers refined the themes and conducted in-depth analysis.

Table 3
Interview Data Analysis

Open Coding	Axial Coding	Selective Coding
Guide sign	Finding the way to the metro	**SJZ Metro Signage System Design**
Mobile phone app		
Unclear direction guidance	Hardships faced during metro rides	
Older people have difficulty recognizing		
Not clear enough	Opinions on the existing SJZ Metro signage system	
Complete function		
No need	Opinions on the 'one station, one scene' approach for the metro signage system design	
Available		
One station, one theme		
Quite distinctive	Characteristics of metro signage system in different cities	**The Regionalism of Metro Signage System**
Multilingual text translations		
Positive cultural atmosphere		
High degree of modernization		
Convenient guidance information		
Beiguo Shang Cheng Station	Impressive SJZ metro stations	
Beisong Station		
Bowuyuan Station		
Yuanboyuan Station		
SJZ East Station		
Lieshilingyuan Station		
Changchengqiao Station		
Tiyuguan Station		
Hepingyiyuan Station		
Expectations	SJZ metro signage system integrating regional culture and identity	
Memorable elements		
Recognizability		
Station names	Integrating regional culture into the SJZ metro signage system	
Billboards at the concourse level		
Platform-level cultural wall		

Regarding the understanding of the metro signage system of SJZ, the responses provided by the participants were that it is used to guide and direct users to navigate the metro spaces better. In addition, majority of the participants mentioned that the observation checklist provided by the researchers during the previous cultural probe activity was a good reference, helping them have a more targeted observation process and a more in-depth reflection on SJZ metro signage system that they encountered everyday as they tend to 'take it for granted' for all the signages showed in front of them.

Based on the insights offered by the participants, it could be concluded that: (1.) for those who are taking the metro for the first time, the signage of SJZ metro might be challenging to

comprehend due to the signages are concentrated; (2.) there are issues with the English translation in certain parts of the SJZ metro signage system; (3.) although the current signage system's font complies with design standards, it may pose recognition difficulties for some elderly people and children; (4.) the design of floor signage can still be enhanced; and (5.) the signage for toilet and nursing rooms differs stylistically from the overall signage system.

In the second part of the interview, the researchers specifically asked participants about their understanding of SJZ's regional culture, as well as their impressions of certain metro stations in SJZ. Furthermore, researchers and participants also discussed how to integrate SJZ's regional cultures into the design of metro station signage. Based on the six participants who are regular metro commuters, their impressions of SJZ stations are primarily cantered around the transfer stations at *Xinbai Plaza* and *Beiguo Commercial Building*. Additionally, due to the different workplaces of the six participants, the stations they frequently use vary, resulting in different preferences for memorable stations. Furthermore, it was discovered that the impressive metro stations in SJZ are all located on metro line one

The followed-up interview conducted with the participants reaffirmed the facts from the perspectives of the users that the current SJZ metro signage system of SJZ Metro has successfully met the functional requirements. They noted that the SJZ metro signage system is comprehensive and consistent. This is consistent with the information that the researchers have gathered about the SJZ Metro signage system from the literature review (SJZ Rail Transit Group, 2021). From the feedback given by the participants, there is a continuous effort from the relevant authorities of SJZ to improve and maintain the standards of the signage system. Such effort is important because government assistance will be more beneficial for the development of the SJZ Metro. Despite this, however, there are two distinctive areas that require further optimization and refinement in the opinion of the participants.

First, three participants (A, C, and D) think that certain stations have densely arranged signs at the station hall level, and the information on each sign is overly simplified, making it difficult for users to choose the correct exit. In other words, specific improvement measures include adjusting the sign arrangement distance, changing the sign installation style, verifying the content of information-type signs, and using font size or colour contrast on the layout and design of the signages at that level should be done to increase their functionality in the metro station. Secondly, some participants (A, B, D and F) pointed out that the style of SJZ metro stations is too similar, making it difficult to determine which station they are at, apart from the colour differentiation of different lines and station names. This view aligns with the perspective of the literature review as well as the argument of the present study that although the design of SJZ's metro signage system meets the Chinese metro signage system design standards, it suffers from severe homogenization with other cities' metro signage systems, lacking elements that can truly reflect the local characteristics of SJZ. However, SJZ is a city with rich regional cultures, and this has provided a good background to expand the aesthetical and cultural expression of its metro signage system design. Therefore, the idea of integrating SJZ regional cultures into its metro signage system design was well supported by majority the participants and they thought that not only such idea can present richly connotative signs while meeting basic functional requirements, the city's cultural characteristics and users' sense of identification with the city can also be enhanced. As highlighted by Participant A:

"If that were the case, I would feel proud".

However, Participant B expressed his different opinion regarding to this design concept to be used in SJZ Metro. He thought that it is good for SJZ's metro sign system to continue to be optimized. He proposed the idea of 'one line, one theme' instead 'one station, one scene'. As indicated by previous studies (Tang, 2014; Yan, 2022; Zhang et al., 2022) and related reports (Chengdu Rail Transit Group Co., Ltd., 2017; Shanxi Rail Transit Group Co., Ltd., 2020), China has adopted not only a 'one line, one theme' approach but also a 'one station, one scene' strategy for the visual design of metro signage systems to strengthen the cultural construction of metro systems in various cities. Different lines adopt different theme orientations, and based on this, a more in-depth design is carried out in combination with the characteristics of each station. In this way, an organic connection can be formed between the lines and stations, enabling the metro culture to be refined to every line and station, thus more specifically reflecting the metro culture.

Based on the interview findings, the representative regional cultures of SJZ did not differ significantly from what the researchers had organized in the literature review. But there were minor discrepancies regarding the categorization of *Xinbai* Plaza, *Beiguo* Commercial Building, and *Xibaipo*. Some participants argued that *Xinbai* Plaza and *Beiguo* Commercial Building should not be classified in 'urban landmarks', as they are products under the commercial development of the city. At the same time, *Xibaipo* should not be categorized in 'cultural relic' but should be considered as part of the concept of 'red culture'. Additionally, some participants mentioned additional regional cultures, such as the SJZ city flower, the Chinese rose, and the Chinese Locust tree to be considered further by the study. Therefore, how to classify specific regional culture in the most appropriate category based on its attributes was a challenge faced by the researchers during the research process. Moreover, after further investigation of the unique examples mentioned by the participants, the researchers indeed found separate classifications for commercial culture, red culture, and urban culture (Towse, 2019; Savage et al., 2020; O'Connor & Gu, 2020).

Ultimately, with the inputs from participants, the initial four classifications of SJZ's regional cultures were expanded to seven. In this way, each representative regional culture is more closely aligned with its respective category. This also provides a clearer definition for extracting and converting culture into design elements in later stages. The 'new' classification of SJZ regional cultures is viewed as one of the most interesting discoveries for the study.

Xibaipo is the most frequently mentioned regional culture in SJZ. Participants pointed out that there is a considerable amount of red culture in SJZ, but it is relatively dispersed. For example, the *Jiefang Square* Station, *Martyrs Cemetery* Station, and *Peace Hospital* Station on SJZ Metro Line One were all named with their respective red cultural characteristics in mind. 'Red culture' upholds and enhances the essence of traditional Chinese culture, firmly grounded in the foundations of traditional Chinese culture. It has been developed and advocated by the Communist Party of China throughout the extensive periods of revolution, growth, and reformation (Shen & Lian, 2018; Peng & Jiang, 2021; Shu, 2022).

Phase Two: Design and Integration

Developing Design Framework and Theme

A design framework as shown in Figure 3 was developed based on the review of literature. It combines the analysis of SJZ's regional cultures, the 'syntactics' principle by Morris (1938) semiotic theory, and the symbol extraction and translation method centered around 'imagery' proposed by Yan (2022). A similar design framework was also developed by Tang (2014) in her study. This design framework comprises two components: 'symbol' and 'connotation'. In other words, to successfully integrate regional cultures into SJZ's metro signage system design requires the combination of these two components. By doing so, the visual design of the metro signage system can communicate a deeper meaning and reflect a more accurate representation of SJZ's regional cultures, thus enhancing the cultural identity of SJZ city.

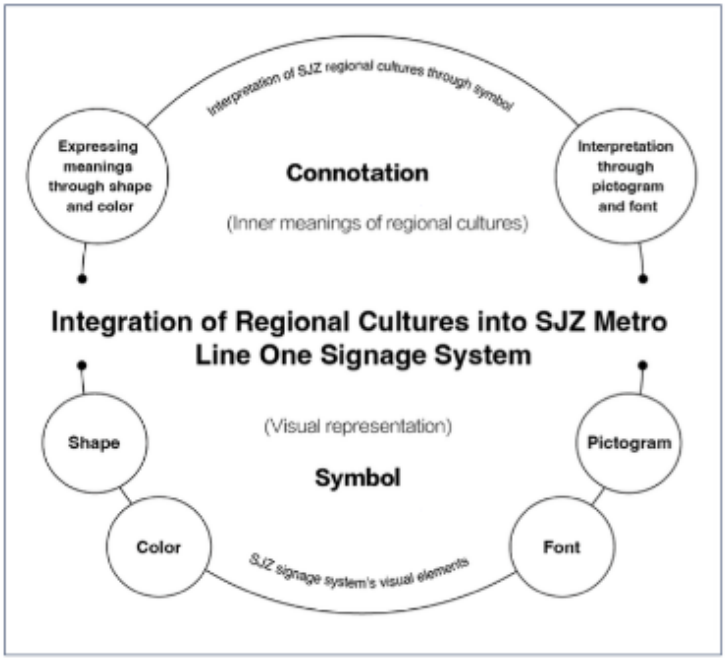


Figure 3 Design Framework of the Study

On the other hand, the study followed the steps employed by Li and Yang (2021) in determining the design theme for SJZ Metro Line One signage system design, i.e., reviewed existing literature (e.g., reports, journal articles, and books), identified relevant vocabularies or attributes, and collected opinions from target audience to filter and define the design theme. Accordingly, the researchers identified vocabularies describing the attributes of SJZ's regional cultures from several books and reports, including SJZ Annals (2010), SJZ General History - Modern volume (2011), and China Folklore Atlas - SJZ Volume (2020). In addition, to enrich the perspectives of collected vocabularies, the SJZ News Network (2014-2022), SJZ official documents (2022), and the SJZ Municipal People's Government (2015-2022) are reviewed.

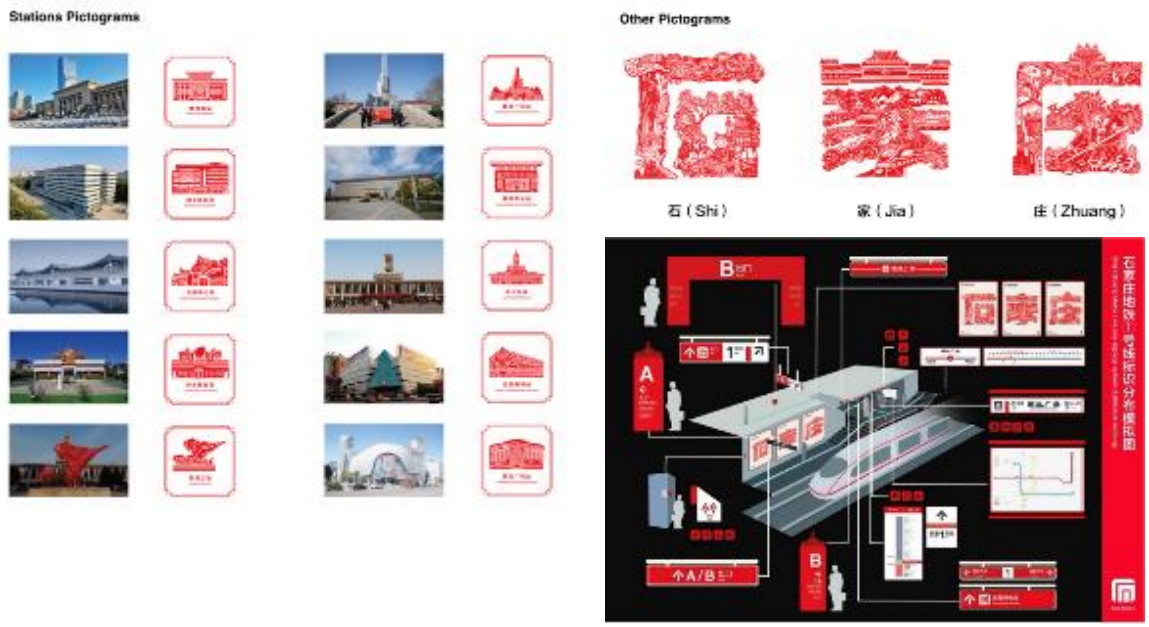
Based on the findings, the top three vocabularies that received 100 percent agreement (six out of six) are: 'beautiful', 'happy' and 'diverse'. During the feedback session, Participant A to F all expressed their happiness living in SJZ and believed that SJZ is a beautiful and dynamic city. Even so, among these three terms, participants generally think that 'diverse' is more

suitable as a theme for design. Participant B elaborated, saying that everyone would find their hometown beautiful, and living in one's own hometown is a form of happiness. 'Beautiful' and 'happy' embody the deep affirmation of citizens towards their hometown. However, other cities can also be described with these two words, a view that was agreed upon by other participants. Participant D further explained that 'diverse' is different because not every city has a diverse developmental path. Some cities might rely on specific industries or characteristics for development. Considering the cultural diversity of Shijiazhuang, therefore, 'diverse' is particularly appropriate as a design theme. In addition, Participant A, C, and F stated that SJZ is a place that combines 'old and new' and connects 'east and west', which also echoes to the vocabulary 'diverse'. Based on the widely acknowledgement of all the participants, the researcher finally decided to use 'diverse' as the theme for SJZ Metro Line One signage system design.

Creative Practice and Output

Initially, three design concepts were proposed. Based on participants' selection and opinions, the researchers decided to develop the first concept further, and this decision has received the agreement from all the participants. Subsequently, specific colors, shapes, pictograms, fonts, and metro signage design were developed thoroughly, with the consistent inputs and involvement of the participants. Figure 4 illustrates the pre-final design of the respective items.

Figure 4 Final Two-dimensional Design



Based on the final feedback from participants, the researchers presented parts of the final design in 3D format.

Figure 5 Final Creative Output

The overall appearance and identity of a metro space is influenced by various social factors, such as politics, economy, technology, and culture (Schrag, 2014; Barnett, 2017;). These factors catalyse the unique regional characteristics of different cities. As an important component of metro spaces, signage systems can be used as an effective medium to showcase a city's spiritual qualities and cultural image (Shu, 2015; Zhang et al., 2022; Zhao, 2022). Taking the SJZ metro as an example, the very important mission of the study is to convey SJZ city's cultural characteristics and humanistic spirits through its metro signage design. To achieve this mission, before starting the design process, the author needs to first establish a design theme. In order to find a suitable theme for the signage design of the SJZ Metro Line One, the author applied the semantic knowledge from Morris (1938) semiotics, collected words describing SJZ from various channels, and constructed a semantic library of SJZ. During this process, the basis for the cultural diversity of SJZ could be found in the stages of literature review, data collection, and data analysis. When determining the final design

theme, the opinions of the participants were also sought. Therefore, the study believes that to use 'diverse' as the design theme is not only 'appropriate' but also 'meaningful'.

Under the guidance of a design framework that combines 'symbol' and 'connotation' (Morris, 1938; Tang, 2014; Yan, 2020), the recognizability of the 'regional identity' and 'cultural meanings' of station name and related graphics created for the signage system of SJZ Metro Line One was enhanced. Since the colours, fonts, and graphics are closely integrated by thoroughly considering the unique features and elements of regional cultures, they form a unified whole visual system that speaks about the same language. In other words, by combining 'symbol' and 'connotation,' the signage design of the metro station can not only play an important role in for identification and wayfinding but also can bring a positive impact on impression and memory of SJZ residents. In addition, the use of *Wuji* paper cutting style was a good way to showcase SJZ regional cultures and this was further verified by the feedback provided by the participants during the design process. Nevertheless, the author encountered a challenge to adequately reflect the 'diverse' theme in the signage design, as some participants highlighted that such theme was not prominent during the early conceptualization stage.

Since the signage system is part of the metro space, the design outcome of this study is believed to have enriched the cultural connotations of SJZ Metro's visual identity. Visual identity refers to the overall 'look and feel' of a brand or organization as conveyed through its visual elements such as typography, colours, imagery, and other design elements (Jiang & Chen, 2016; Zhu & Zhang, 2018; Jie, 2020). With respect to SJZ's unique regional attributes and cultural traditions, relevant symbols and elements are 'organically' integrated with modern design concepts. The artistic and cultural expression of the design gives users a sense of familiarity, localness, and belonging, thereby enhancing their trust in interpreting, and appreciating the information within the metro space. In other words, the specific regional colours, fonts, and graphics extracted or created on signage can potentially be used to enhance the visual identity and values of SJZ Metro and to create a cohesive and recognizable image that can be easily distinguished from other metro brands in China.

Conclusion

In metro signage system design, both standardization and internationalization must be considered thoroughly to make it functional, convenient, and efficient for users from all around different places (Hao et al., 2021; Zhang, 2021). However, with the development of cultural convergence in the digital information age, the inheritance of culture in various aspects of design has become increasingly important (Jenkins, 2014; Borowiecki et al., 2016; Yan, 2022). Hence, the integration of regional cultures into metro signage systems should also be viewed as a potential area to be explored, as if it is properly developed, the sense of belonging of especially the local users to the city can be elicited (Cao, 2014; Sun, 2017; Gao, 2021). This study moved beyond functionality and investigated how the connotations of local cultures from various dimensions of SJZ city can be meaningfully represented in the metro signage system through systematic research and design processes. It is hoped that such efforts will contribute to the development of SJZ city, especially in elevating the quality of its metro space in the future from both functional and spiritual levels. It is believed that this study has provided valuable practical and theoretical references for future research.

In action research, data collection and analysis are intertwined with the design process (Collatto et al., 2018). The research process is similar to the design process, requiring iterative efforts, long-term examination of issues, continuous analysis, and integration of revised options (Shani & Coghlan, 2021). Therefore, the challenge for the researchers in this process was to maintain close engagement with participants and motivate them to stay active throughout the research and design process. In the sampling stage, eight people who met the criteria were first recruited, and all agreed to participate after being briefed. However, during the cultural probe's activity, two individuals failed to complete the tasks for personal reasons, despite frequent reminders. Subsequently, interviews were conducted with only six participants who had completed the cultural probe activity. The reduction in the number of participants limits the richness of the data obtained. In addition, sampling bias, more involvement of different stakeholders in the study, and more comprehensive exploration on the system of the metro signage are also some of the limitations that cannot be overlooked. Hence, multiple data collection methods and stakeholders from local authorities or agencies and users of various age groups or occupations can be included to ensure the representativeness of the findings in the future for similar studies.

In conclusion, more relevant practice-based studies should be conducted in the future to investigate how metro signage system can work hand in hand with the regional cultures to foster a greater sense of pride and belonging among the metro users, enhance the city's charm and competitiveness, and preserve and inherit meaningful cultures of the region.

References

About SJZ. (2017). SJZ Municipal People's Government. https://www.sjz.gov.cn/col/1596018204061/index.html

An, D., Ye, J., & Ding, W. (2019). Spatial features and elements affecting indoor wayfinding—a case study in a transit hub. In *HCI in Mobility, Transport, and Automotive Systems: First International Conference, MobiTAS 2019, Held as Part of the 21st HCI International Conference, HCII 2019, Orlando, FL, USA, July 26-31, 2019, Proceedings 21* (pp. 357-367). Springer International Publishing.

Bai, K. (2022). Exploration of Artistic Strategies for Improving the Spatial Quality of Tianjin Metro. *Tianjin Academy of Fine Arts*. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202202&filename=1022574046.nh

Barnett, J. (2017). *Redesigning cities: Principles, practice, implementation*. Routledge.

Barthes. (1957). Mythologies. (Lavers, Annette, trans.) New York: The Noonday Press.

Barthes. (1971). From work to text. In: The Rustle of Language. (Howard, Richard, trans.) Berkeley, Los Angeles: University of California Press, 56–64.

Barthes. (1979). S/Z. (Miller, Richard, trans.) London: Blackwell.

Beautiful SJZ. (2021). Shijiazhuang Municipal People's Government. https://www.sjz.gov.cn/col/1596018204061/index.html

Benhamou, F. (2020). Heritage. In *Handbook of Cultural Economics, Third Edition* (pp. 279-286). Edward Elgar Publishing.

Bi, Q. (2017). Spatial deduction of "shape, color, meaning" visual elements - Analysis of graphic design language in subway directional signs. *Modern Decoration (Theory)*, (01), 147.

Bian, Z. (2018). *Research on design symbols of public facilities based on regional culture of*

subway stations (master's thesis, Beijing Jiaotong University). Retrieved from https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201802&filename=1018144536.nh

Borowiecki, K. J., Forbes, N., & Fresa, A. (2016). *Cultural heritage in a changing world* (p. 322). Springer Nature.

Burgess, J., & Gold, J. R. (2015). *Geography, the media and popular culture*. Routledge.

Calori, C., & Vanden-Eynden, D. (2015). Signage and wayfinding design: a complete guide to creating environmental graphic design systems. John Wiley & Sons.

Cao, F. Y., & Cui, C. (2016). Research on the Design of Metro Guide Signs Based on Regional Culture. *Beauty and Times*, 26(11), 77–29. https://doi.org/10.16129/j.cnki.mysds.2016.11.026.

Cao, X. (2014). Research on the Design of Subway Guide Signs Based on Regional Culture. *Beauty and Times*, 10(06), 37–40. https://doi.org/10.19554/j.cnki.1001-3563.2014.06.010.

Cao, Y. (2015). *Study on the design of subway directional signs based on the regional culture of Guangzhou and Foshan* (master's thesis, South China University of Technology). Retrieved from https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201601&filename=1015989700.nh

Changshan War Drum. *(2012).* SJZ Municipal People's Government. https://www.sjz.gov.cn/col/1596018204061/index.html

Cardno, C. (2003). *Action Research: A Developmental Approach*. New Zealand Council for Educational Research, PO Box 3237, Wellington, New Zealand.

Chen, L., & Zhang, T. (2022). Study on the design of public space guidance system under urban context. Design, (17), 79-81. doi:10.20055/j.cnki.1003-0069.000020.

Chengdu rail transit group co., ltd. (2017). *Chengdu Metro Code*. Chengdu Metro. www.cdmetro.cn

Chevalier, J. M., & Buckles, D. J. (2019). *Participatory action research: Theory and methods for engaged inquiry*. Routledge.

Collatto, D. C., Dresch, A., Lacerda, D. P., & Bentz, I. G. (2018). Is action design research indeed necessary? Analysis and synergies between action research and design science research. *Systemic Practice and Action Research*, *31*, 239-267.

Cui, J., Broere, W., & Lin, D. (2021). Underground space utilisation for urban renewal. *Tunnelling and Underground Space Technology*, *108*, 103726.

Davison, R., Martinsons, M. G., & Kock, N. (2004). Principles of canonical action research. *Information systems journal*, *14*(1), 65-86.

Deák, B., Tóthmérész, B., Valkó, O., Sudnik-Wójcikowska, B., Moysiyenko, I. I., Bragina, T. M., ... & Török, P. (2016). Cultural monuments and nature conservation: a review of the role of kurgans in the conservation and restoration of steppe vegetation. *Biodiversity and conservation*, *25*, 2473-2490.

De Vries, Ad., & De Vries, Arthur. (2021). Elsevier's dictionary of symbols and imagery. In *Elsevier's Dictionary of Symbols and Imagery*. Brill.

Dong, Y. H., Peng, F. L., & Guo, T. F. (2021). Quantitative assessment method on urban vitality of metro-led underground space based on multi-source data: A case study of Shanghai Inner Ring area. *Tunnelling and Underground Space Technology*, *116*, 104108.

Dundes, A. (2019). Who is the Folk?. In *Frontiers of folklore* (pp. 17-35). Routledge.

Eco, U. (1979). *A theory of semiotics* (Vol. 217). Indiana University Press.

Fang, Y. (2021). Liquor Making and Folk Customs in Ancient China. *A New Phase of Systematic Development of Scientific Theories in China: History of Science and Technology in China Volume 4*, 175-203.

Gao, Y. (2021). The role of subway cultural identification system in urban cultural communication. *News Research Guide*, (14), 51-53.

Gavalas, D., Kasapakis, V., Konstantopoulos, C., Pantziou, G., & Vathis, N. (2017). Scenic route planning for tourists. *Personal and Ubiquitous Computing*, *21*, 137- 155.

Gibson, D. (2009). *The wayfinding handbook: Information design for public places*. Princeton Architectural Press.

Gong, Y., Lin, Y., & Duan, Z. (2017). Exploring the spatiotemporal structure of dynamic urban space using metro smart card records. *Computers, Environment and Urban Systems*, 64, 169-183.

Gong, R. (2020). *Investigation on the optimization design of Harbin Metro's space visual identification system* (master's thesis, Harbin Normal University). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202101&filename=1020311107.nh.

Grodach, C., Currid-Halkett, E., Foster, N., & Murdoch III, J. (2014). The location patterns of artistic clusters: A metro-and neighborhood-level analysis. *Urban Studies*, *51*(13), 2822-2843.

Guo, X. (2019). Design of subway guidance system and its enhancement of space. In China Architecture Society Interior Design Sub-committee (Eds.), *2019 Interior Design Papers* (pp. 92-94). China Water & Power Press.

Hao, Y., Lei, B., Zhang, Y., & Sun, Y. (2021). Optimization of Subway Guiding Sign Information Based on Pedestrian Cognitive Rules. Traffic Information and Safety, (04), 99-107.

Hebei Provincial Museum. (2015). SJZ Municipal People's Government. https://www.sjz.gov.cn/col/1596018204061/index.html

Higgins, B. (2017). *Regional development theories and their application*. Routledge.

Hinchey, P. H. (2008). *Action research primer* (Vol. 24). Peter Lang.

Hu, Y. Z., & Guo, X. T. (2020). Visual image design of Zhengzhou Metro based on the background of city characteristic culture. Beauty & Times, (11), 11-13. https://doi.org/10.16129/j.cnki.mysds.2020.11.007.

Huang, G. Z. (2021). *Research on the design of high-speed rail station guide system based on regional culture* (master's thesis, Beijing Jiaotong University). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202202&filename=1021873333.nh

Jian, M. L. (2021). Research on Design Strategies for Cultural Identification of Subway Station Public Spaces. *Nanchang University*. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202202&filename=1021798940.nh

Jiang, H., & Chen, Z. (2016). Conversion and Presentation of Wuyi Overseas Chinese Hometown Regional Cultural Symbols in Design. *Packaging Engineering*, (06), 41-44+86. doi:10.19554/j.cnki.1001-3563.2016.06.011.

Jie, C. (2020). Application of Regional Cultural Elements in Cultural and Creative Product Design. *Packaging Engineering*, 41(8), 313-316. doi:10.19554/j.cnki.1001-3563.2020.08.051.

Jizhiguang. (2017). SJZ Municipal People's Government. https://www.sjz.gov.cn/col/1596018204061/index.html

Kang, Z. Y., Shen, F. D., Xu, H. B., Han, T. S., Shen, Q., & Bu, Q. (2021). Determination of Metro Influence Areas Based on Multi-Center City. *Railway Transport and Economy*, *18*(11), 113–119. https://doi.org/10.16668/j.cnki.issn.1003- 1421.2021.11.18.

Kindon, S., Pain, R., & Kesby, M. (Eds.). (2007). Participatory action research approaches and methods: Connecting people, participation and place.

Koshy, V. (2005). *Action research for improving practice: A practical guide*. Sage.

Li, W., Sun, Y., & Gou, R. (2021). Subway station name graphic symbol design based on fuzzy analytic hierarchy process. *Packaging Engineering*, 14, 277-283. doi:10.19554/j.cnki.1001-3563.2021.14.036.

Liao, J. L. (2019). Artistic design and application of subway guidance sign system. Doors and Windows, (21), 143-144.

Liu, Q. (2019). *Application of graphic symbols originated from Liaohe culture in subway station space* (master's thesis, Shenyang Aerospace University). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202001&filename=1019239184.nh

Long, Y. T. (2018). Research on the application of regional graphic language in subway visual guidance system. *Art & Technology*, (11), 49.

Lü, Z. (2020). Research on the design of visual guidance system in urban public spaces in Zhengzhou (Master's thesis, Zhengzhou University). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202101&filename=1020056084.nh.

McNiff, J., & Whitehead, J. (2012). *Action research for teachers: A practical guide*. Routledge.

Merlin, & Rosinie, M. (2022). Systematic Analysis of "Regional Culture and Urban Rural Landscape" and Research on Teaching Strategies. *Geography Teaching*, (01), 7–11.

Morris, C. W. (1938). Foundations of the Theory of Signs. In *International encyclopedia of unified science* (pp. 1-59). Chicago University Press.

Motamedi, A., Wang, Z., Yabuki, N., Fukuda, T., & Michikawa, T. (2017). Signage visibility analysis and optimization system using BIM-enabled virtual reality (VR) environments. *Advanced Engineering Informatics*, *32*, 248-262.

O'Connor, J., & Gu, X. (2020). *Red creative: Culture and modernity in China*. Intellect Books.

Pal, A., & Konstan, J. A. (2010, October). Expert identification in community question answering exploring question selection bias. In *Proceedings of the 19th ACM international conference on Information and knowledge management* (pp. 1505-1508).

Peng, Z., & Jiang, S. (2021). On the Red Gene and Its Inheritance in the New Era. *Hunan Social Sciences*, (01), 12-20.

Pieterse, J. N. (2019). *Globalization and culture: Global mélange*. Rowman & Littlefield.

Ren, S. S., Wang, W. X., Li, H., & Zhao, P. F. (2020). Application and Expression of Regional Culture in Subway Station Space Design. *Architecture and Culture*, (02) , 180–181.

Romanovich, M., & Simankina, T. (2016). Urban planning of underground space: The development of approaches to the formation of underground complexes–metro stations as independent real estate objects. *Procedia Engineering*, *165*, 1587-1594.

Savage, M., Warde, A., & Ward, K. (2020). *Urban sociology, capitalism and modernity*. Bloomsbury Publishing.

Schrag, Z. M. (2014). *The great society subway: A history of the Washington metro*. JHU Press.

Shanxi rail transit group co., ltd. (2020). *Xi'an Metro*. Shaanxi Railway Group. http://shxgdjt.com/index.html

Shen, C., & Lian, W. (2018). On the Connotation, Characteristics and Contemporary Value of

Red Culture. *Teaching and Research*, (01), 97-104.

Sheng, L., Liu, M., Zhu, W., & Wan, M. (2022). Review of the theory and practice of ground space VI identification system at subway stations in China. Central China Architecture, (09), 44-49. doi: 10.13942/j.cnki.hzjz.2022.09.006

Shu, D. (2022). The Relevance of "Red Culture" in Contemporary China. *Open Journal of Social Sciences*, *10*(4), 431-441.

Šifta, M., & Chromý, P. (2017). The importance of symbols in the region formation process. *Norsk Geografisk Tidsskrift-Norwegian Journal of Geography*, *71*(2), 98-113.

SJZ Liberation Monument. (2006). SJZ Municipal People's Government. https://www.sjz.gov.cn/col/1596018204061/index.html

SJZ metro. (2019). SJZ Rail Transit Group. http://www.sjzmetro.cn/cyportal2.3/template/site00_index@gdb.jsp?a1b2dd=7xaac

SJZ metro. (2020, 2021, 2022). SJZ Rail Transit Group. http://www.sjzmetro.cn/cyportal2.3/template/site00_index@gdb.jsp?a1b2dd=7xaac

SJZ metro. (2021). SJZ Rail Transit Group. http://www.sjzmetro.cn/cyportal2.3/template/site00_index@gdb.jsp?a1b2dd=7xaac

SJZ metro development plan. (2020, 2021, 2022). SJZ Public Railway Transportation Group. https://xxgk.mot.gov.cn/2020/jigouapp/741/788/841/list_6699.html

SJZ Metro Project Construction Plan. (2020). SJZ Rail Transit Group. http://www.sjzmetro.cn/cyportal2.3/template/site00_index0305@gdb.jsp?a1b2dd=7xaac

SJZ Metro Project Construction Plan. (2021). SJZ Rail Transit Group. http://www.sjzmetro.cn/cyportal2.3/template/site00_index0305@gdb.jsp?a1b2dd=7xaac

SJZ Rail Transit Line. (2020, August 26). SJZ Rail Transit Construction Office. https://zhuanlan.zhihu.com/p/64820351

SJZ TV Tower. (2014). SJZ Municipal People's Government. https://www.sjz.gov.cn/col/1596018204061/index.html

Smart Travel of SJZ Rail Transit 4. (2022, July). SJZ News Network. http://www.sjzdaily.com.cn/

Shani, A. B., & Coghlan, D. (2021). Action research in business and management: A reflective review. *Action Research*, *19*(3), 518-541.

Sun, B. (2017). *Research on the application of "Jin rhyme culture" in subway space visual design* (master's thesis, Tianjin Polytechnic University). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201702&filename=1017197583.nh

Sun, J. (2018). *Research on the expression of subway station space characteristics based on regional culture* (Doctoral dissertation, Xi'an University of Architecture and Technology). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CDFDLAST2020&filename=1018862208.nh

Sun, Y., Ma, H., & Chan, E. H. (2017). A model to measure tourist preference toward scenic spots based on social media data: A case of Dapeng in China. *Sustainability*, *10*(1), 43.

Swann, C. (2002). Action research and the practice of design. *Design issues*, *18*(1), 49-61.

Tang, Y. (2014). *Research on the regional system of subway station space signage system* (Doctoral dissertation, Xi'an University of Architecture and Technology). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CDFDLAST2016&filename=1015996081.nh

Towse, R. (2019). *A textbook of cultural economics*. Cambridge University Press.

Xiang, C. Q., Liu, C. H., & Wang, L. (2019). The application of calligraphy fonts in subway traffic signs. *Science Consulting (Technology·Management)*, (04), 17.

Xu, J., & Chen, J. (2021). The Unity and Efficiency Awareness of Public Transportation Identification System——Brief into The Function of Public Service from The Status of Domestic Metro Signs. *Design*, 02, 153–155.

Wang, J. (2021). Brief talk on the application of color universal design in subway guide system. Tomorrow's Fashion, (05), 185-186.

Wang, H. (2015). *Study on regional culture in Xi'an subway station signs from the perspective of multimodality* (master's thesis, Shaanxi Normal University). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201601&filename=1015721157.nh

Wang, X., Zeng, M., Wang, H., Lai, J., & Li, Q. (2021). Situation of Guangzhou Shenzhen subway sign system. In National Language Commission, National Language Service and Greater Bay Area Language Research Center (Guangzhou University) (Eds.), *Language life skin book - Greater Bay Area language life situation report (2021)* (pp. 164-179). The Commercial Press.

Wu, X. (2019). *Humanized design of public facilities in Taiyuan subway stations* (master's thesis, Nanjing University of Aeronautics and Astronautics). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202001&filename=1019687996.nh

Yan, W. (2022). *Research on the design of subway station identification system from the perspective of regional culture* (master's thesis, Northwest A&F University). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202301&filename=1022586488.nh

Yang, Y., Yao, C., & Xu, D. (2020). Ecological compensation standards of national scenic spots in western China: A case study of Taibai Mountain. *Tourism management*, *76*, 103950.

Yuan, Y., Yuan, H. (2019). On Poster Design in the Subway Public Space in China Based on the Regional Culture. In: Fukuda, S. (eds) *Advances in Affective and Pleasurable Design.* AHFE 2018. Advances in Intelligent Systems and Computing, vol 774. Springer, Cham. https://doi.org/10.1007/978-3-319-94944-4_7

Zhan, R. T. (2022). From city card to city image shaping: A case study of the construction of Wuhan city card guide system. *Beauty & Time (City Edition)*, 6, 82-84.

Zhang, D. L. (2021). *Study on the design of Lanzhou Metro guidance system under the perspective of regional culture* (master's thesis, Lanzhou University of Technology). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202201&filename=1021713666.nh.

Zhang, L., Li, X., Li, C., & Zhang, T. (2022). Research on visual comfort of color environment based on the eye-tracking method in subway space. *Journal of Building Engineering*, *59*, 105138.

Zhang, Z., Jia, L., & Qin, Y. (2020). Location-allocation model for the design of guidance signage systems for pedestrian wayfinding in public spaces. *IEEE Transactions on Intelligent Transportation Systems*, *22*(12), 7531-7546.

Zhang, Y., & L Lü, J. J. (2021). The Parlor of the City That Eliminates Cultural Distances. *Architectural Journal*, *13*(11), 37–40. https://doi.org/10.19819/j.cnki.ISSN0529-1399.202111013

Zhao, Z. (2022). *Study on Optimization Design of Spatial Wayfinding System for Xi'an Subway*

Transfer Stations (Master's thesis, Xi'an University of Architecture and Technology). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202301&filename=1022817114.nh

Zhao, J. Y. (2019). Inheritance of Regional Culture in the Packaging Design of Local Specialties. *Packaging Engineering*, (16), 298–301. https://doi.org/doi:10.19554/j.cnki.1001-3563.2019.16.050

Zhou, Y. (2020). Research on subway station static waiting signs based on space optimization. *Shanxi Architecture*, (13), 19-20. doi:10.13719/j.cnki.cn14-1279/tu.2020.13.009

Zhou, M. (2017). Review of the regionalization design of the visual image of urban rail transit station area in China. *Art & Technology*, (04), 271-273+275.

Zhou, Q., & Dong, S. (2020). Study on the redesign of graphic symbols in subway platform signs: A case study of Chengdu Jinsha Site Station guidance system. *Design*(01), 45-47.

Zhang, H. (2017). Research on the design method of subway sign guidance system. *Packaging Engineering*, (22), 287-289. doi:10.19554/j.cnki.1001- 3563.2017.22.059.

Zhu, H., Zhang, Q., & Li, H. (2018). Research on the Application of Regional Cultural Elements in Cultural and Creative Product Design. *Industrial Design*, (08), 44-45.

Zuber-Skerritt, O. (2016). The action research planner: Doing critical participatory action research.