

# Examining the Functionality and Usability of Interactive Wayfinding Design within Cities in China

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**Abstract.** In recent years, wayfinding is one of the aspects in urban city design that emerge with digital technologies in the *smart city* [1] development in China. However, before building a smart city, some issues need to be solved in the wayfinding system within cities in China such as misleading signs, irrational roadway design in transportation. This field study report is part of my research project, in which examples of three prime cities (Beijing, Shanghai, Hong Kong) and two 2<sup>nd</sup> tier cities (Suzhou, Nanjing) are discussed to examine the functionality and usability of interactive wayfinding design. The findings of this report showed that emerging new technologies with wayfinding concept and theory that is based on user experience makes wayfinding more effective and functional. Some alternative guidelines and solutions of usable wayfinding design are provided to help people live in a safe environment rather than live in just a fully digitalized city.

**Keywords:** interactive wayfinding, wayfinding design, user experience, urban infrastructure, mobile internet.

## 1 Introduction

In China, over a hundred cities have planned to transform themselves into smart cities.[2] Wayfinding design in transportation is one of the important aspects in urban city infrastructure [1]. The question now is what role could “wayfinding” play in the planning and development of smart cities in China? Wayfinding is a kind of systematic *communication* [3] which helps people find their way. Basically, the purpose of wayfinding is to help people obtain quick and accurate communication and information in terms of legibility, readability and convenience. It can be applied broadly in urban informatics, infrastructure service, transportation, city planning, travel spots, and more. Traditionally, graphical elements and tools like graphs, diagrams, data, charts, colors, typography, images, sound tracks, via maps, symbols, signs or billboards, information kiosks are used for wayfinding.

With the rapid development of new technologies in recent decades, the definition of wayfinding became broader. An experienced architect, Kelly C. Brandon, explained how wayfinding could contribute to the urban design process: “*Wayfinding design is the*

*process of organizing spatial and environmental information to help users find their way. It should not be considered different activity from traditional signage design, but rather a broader, more inclusive way of accessing all the environmental issues.*" [4] He also quoted Kevin Lynch's city elements (ie. Paths, Edges, Nodes, Landmarks and Districts) in urban design [5], the idea of which is used for mapping information easily.

Nowadays, ubiquitous digital technologies are integrating with wayfinding design, and are making both more interactive and dynamic. Technology is changing the traditional form of wayfinding design via different digital means, such as touch screen, sensor system, smart card, media facades, digital signage, internet system, GPS, automation and so on. In addition to the convergence of pervasive, interactive and digitalized tools for wayfinding, the functionality has become more globalized, locative and informative in real time mode to let people find their way much easier.

According to China Daily (13-8-2013), "*The smart city program aims to create an innovation network, optimizing the use of technology in the design and operation of infrastructure and buildings in a way that meets the city's current and future demands.*" [6] However, smart city development cannot just rely on digital hardware and should avoid excessive emphasis on emerging IT technologies while neglecting the basics of urban design. To this end, the method that can deliver a clear guideline and alternative solutions on wayfinding design which integrates with cultural elements, user experience design and emerging IT technologies, such as GPS mapping, touch screen and voice control technology, internet or mobile user platforms, etc., in urbanization should be applied.

This paper is part of the research report of "*Examining the functionality and usability of interactive wayfinding design within cities in China*" which will take about two more years to complete. The field study, which forms the backbone of the research report, had taken six months and involved three prime cities (Beijing, Shanghai, Hong Kong) and two 2nd tier cities (Suzhou and Nanjing) in China. Those cities were used as examples to examine the functionality and usability of interactive wayfinding design. The report will consist of case studies and analysis and is divided into five major parts: 1. Introduction; 2. Overview of Interactive Wayfinding; 3. Digital Platform Wayfinding Solutions; 4. Wayfinding Concept and Theory Application; and 5. Human Factors in Wayfinding Design. During the research process, it is found that mobile internet and voice control technology would become a very important tool to emerge in interactive wayfinding in the future.

In the coming 18 months, ongoing research including survey will be continued. Municipal authorities, design participants and general public in China are the targets. The objective is to give an overview with comparison of the merits and drawbacks in the existing wayfinding design in aforesaid cities, and highlighting the potential obstacles / problems envisaged in order to providing solutions with practical alternatives and strategies for future development.

Furthermore, the report will also discuss how to motivate people in China to use the wayfinding design and enforce the execution of the design, especially in the view

point of municipal governments. Because different provinces are using different standard for implementation of the system in urbanization, some fundamental issues and problems in the current wayfinding design therefore need to be addressed and discussed before building a smart city.

The concept and theory of “wayfinding” was quite new to people in the past decades in China. Most of the books were targeted only at educators, students and used for curriculum. Theories, case studies, photos were often taken from foreign countries. Only a few of the foreign books on “wayfinding” had been translated into Chinese for local people’s reference [7-9]. To make it more useful for China, it is worth to examine the principles of wayfinding design and to integrate them properly with interactive design, emerging IT technologies and urban infrastructure service in the context of China.

Hopefully, the research at its completion will be beneficial to local governments as well as the general public in China by providing them with a wider perspective of wayfinding design and enhancing their awareness of the possible barriers in effective communications in urban infrastructure service.

## **2 Overview of Interactive Wayfinding**

Hong Kong’s infrastructure design, including interactive wayfinding design, is often used as example and reference for China’s cities. Under the principle of one country, two systems, Hong Kong has become one of the prime cities in China since 1997 [10]. Hong Kong has been awarded numerous international rankings in different aspects [11-13]. Overall its infrastructure is highly ranked among other countries in the world. [14] Its wayfinding design is better than many other cities in mainland China. Because of these merits, its interactive wayfinding designs for its infrastructure, such as airport, subway and roadway, etc. are often taken as example and reference for China’s cities. Similar contemporary design can be found in Beijing and Shanghai. Advanced technologies and applications are also integrated with interactive tools to help people get information easier and faster. For example: information kiosk (with sensor, touch screen, smart card, QR code, internet, GPS, mobile internet for checking real time traffic situation, destination and transport schedules), digital signage and media façade with motion graphics to deliver messages, etc.

Along with the increasing demand for transport service created by both international and local people in China [15-16], the wayfinding systems in transportation are also digitalized, modernized and commercialized, but neglecting the need of considering user experience in applying wayfinding concept and theory. As millions of rural people and foreigners are moving to prime and 2<sup>nd</sup> tier cities for jobs and business opportunities, it is necessary to foster the public to use new wayfinding systems with interactive tools and enforcing execution of applying a correct wayfinding concept and theory. This has become a real challenge to local governments.

### 3 Digital Platform Wayfinding Solutions

#### 3.1 Digital Information Kiosk

Digital information application is popular in wayfinding in transportation, such as free stand information kiosks which are frequently used for people finding information and destinations at new airports, railway and subway stations. Some kiosks are there for checking real time highway traffic conditions to and from airport; others are for checking travel spots, desired destinations nearby, local weather and advertising.



**Fig. 1.** Different forms of interactive information kiosks are emerging in wayfinding Photo by Author - Location: Beijing, Shanghai

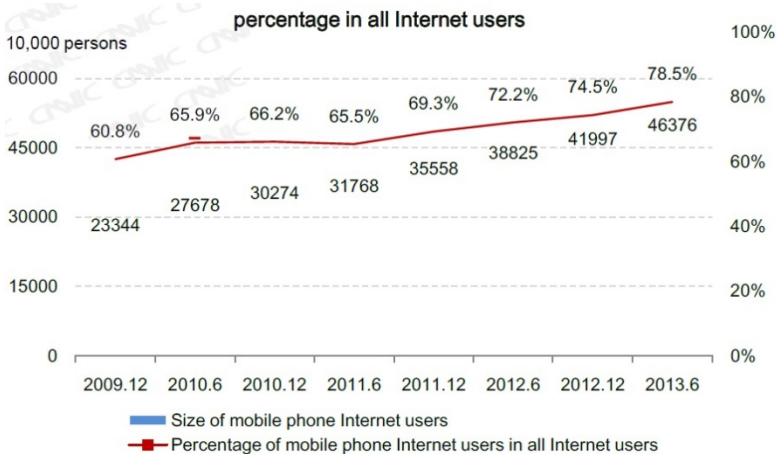
Most interactive information kiosks provide high resolution graphics, text, sounds, maps, GPS system, touch screen buttons and navigation bar. However, the design of most information kiosks still has a lot of room for improvements. For instance, most of the local brands of information kiosks provide information in the Chinese language only. This is a common problem – it is not user friendly for foreign commuters. (See Fig.2) For them, a few foreign brands provide multi-language but are found only at major transport hubs in Beijing and Shanghai, while none can be found in 2<sup>nd</sup> tier cities. From the field observation, each person spent around 3 to 5 minutes in average to complete the searching through clicking different interfaces in applications. That means in average a kiosk is able to serve only 12-15 users hourly. Therefore, information kiosks may not be an efficient means for mass transit wayfinding. It simply cannot cope with the increasing demand of passengers at the transport hubs at peak seasons, such as Lunar New Year and other long public holidays (according to China Daily, there will be more than 3.62 billion trips on roads, via trains, planes and ships during 2014 Lunar New Year) [17]. More alternatives need to be considered.



**Fig. 2.** Touch screen type of interactive wayfinding – only available in the Chinese language  
 Photo by Author - Location: Shanghai

### 3.2 Emerging Mobile Technology

Mobile phone platform as the tool in wayfinding would become more and more important in future. People can get information quickly and conveniently through the mobile internet. According to the report by (CNNIC) China Internet Network Information Center: “the number of mobile internet users in China had reached 464 million by the end of June 2013, up by 43.79 million over the end of 2012. Amongst all the Internet users, those using mobile phones to access the Internet rose from 74.5% to 78.5%, a higher growth rate than that of the second half of 2012. According to the data released by the Ministry of Industry and Information Technology, the number of users who use mobile phone to access the Internet in China had reached 783 million by May 2013. Despite the difference, the data above indicated that the size of Chinese mobile Internet users is huge, and maintains a momentum of rapid development.”[18]



**Fig. 3.** Size of Mobile Phone Internet Users Source: CNNIC - Statistical Survey on Internet Development in China 2013

This data shows that the mobile internet would be the key tool for searching information in the future, provided that the right application interface is available, and utilization of mobile technology would be one of the effective alternatives for dealing with mass transit wayfinding. According to Phoenix New Media of the 2014-01-31 instant, over 60% passengers have purchased their railway tickets through the mobile internet during the 2014 Luna New Year [19-20]. Mobile phone users can use free Wifi to surf the internet for finding instant traffic schedules, ways of buying tickets, and their destinations in a quick and convenient manner instead of lining up to wait for their turn searching for information in front of the kiosk. It is unlike information kiosks which provide only limited real time mode in wayfinding within the related district. In a way, the information kiosk is only good for those who are not conversant with mobile internet applications, eg. some elderly or illiterate people. For mass transportation, the mobile platform is seemingly the most efficient tool for interactive wayfinding as of today.

### 3.3 Integrated Voice User Interface (VUI) Technology

Integrated with an advanced *voice user interface* [21] would also be a feasible wayfinding solution. According to the book “*Voice User Interface Design*” by Cohen Michael H. James Giangola. Jennifer Balogh: “*VUI would free the user to be far more mobile, as speech input eliminates the need to look at a keyboard...Hand-held devices would be designed with larger, easier-to-view screens, as no keyboard would be required. Touch-screen devices would no longer need to split the display between content and an on-screen keyboard, thus providing full-screen viewing of the content.*”[22], it inspired that when VUI further develops, its voice control elements could be applied and integrated with the interactive wayfinding system. The developed VUI eliminates the cumbersome steps and layers of guiding or directing interfaces, enabling people to communicate directly with the voice responder to retrieve target wayfinding information more efficiently, and could therefore get information more conveniently.

### 3.4 Collaboration between Government and IT Industries

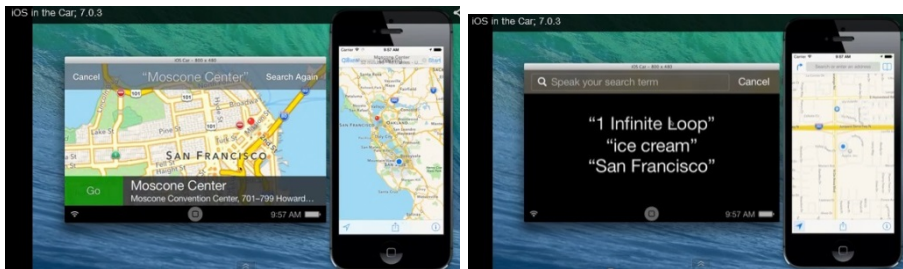
In mainland China, the only internet service provider (the China Internet Network Information Center) and the mobile telecommunication providers (like China Mobile, China Unicom, China Netcom and China Telecom) are all state-owned enterprises under the control of Chinese Government. Therefore, it is crucial to obtain enough support from the Chinese Government for any wayfinding system to be integrated with digital applications for the purposes of large scale usage, eg. the use of mobile technology in transport services, where massive data and high performance speed access at busy locations are carried out through the mobile network to deliver real time information, identify the current location, checking traffic, tickets, or weather. In order to develop the right strategies and solutions for dealing with such, one may need to go even further to collaborate with IT industries and research organizations for leveraging with say, *cloud service, graphical processing unit (GPU), QR codes apps*

and mobile location apps, [23-26], etc. An example of such successful cooperation is ‘Di Di Taxi Calling’ application. This App was developed by private enterprises in China. Basically, it integrates the taxi calling system with a GPS, so that a customer through the mobile network can notify the nearby taxi drivers of his/her request for a taxi service whilst the driver can see the calling customer’s location through the GPS. If a driver decides to take the job, he can reply to the customer and that call order will be deleted on the mobile screen. With this App, the driver can capture much more business opportunities and it offers the customer much more effective way of finding a taxi.



**Fig. 4.** “Di Di Taxi Calling” App in transport wayfinding in China. Screen Source: HKTVB News

In fact, some overseas industries have used mobile voice technology in wayfinding such as the “Apple iOS iCar” in automobiles [27]. (See Fig.5) Mobile voice technology eliminates the cumbersome procedures of going through numerous layers or interfaces using tiny buttons on the touch screen to operate the system [28]. For the mobile voice technology to be successfully adopted in China, it needs the support and collaboration between the Chinese government and private enterprise, particularly, in establishing a common standard or interface that can be shared by all or at least most of the mobile network service providers in order to enhance the usability of the wayfinding system in China.



**Fig. 5.** “Apple iOS iCar”: iPhone mobile voice control system integrated in wayfinding in automobile industry Screen Source: youtube.com



## 4 Applying Wayfinding Design Concept and Theory

During the field study research, there has been found to be misuse of wayfinding design in transportation as illustrated below. This finding reflected that the fundamentals of wayfinding concept and theory such as sign placement, position, typography, colors, size as well as spatial and environmental organization have been neglected. This kind of misuse of design would surely affect the quality and image of a smart city.

### 4.1 Placement, Typography, Colors, Position, Scale

When cities in China took reference of Hong Kong's wayfinding design, some improper designs were also borrowed. (See Fig.6)

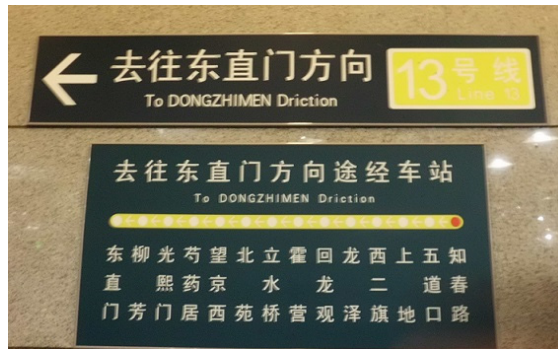


**Fig. 6.** (Left) Confusing and chaotic queue lines in Hong Kong's Mass Transportation Railway System (Right) The confusing sign was adjusted by tapping yellow sign in Suzhou Subway line Photos by Author - Location: Hong Kong and Suzhou

(Fig.6) The design of the queue lines was intended to guide commuters to line up in proper order at the train doors (Left photo). The package consists of 6 lines and 5 arrows. The column in the middle is for commuters leaving the train, while the others are for commuters boarding the train. The problem here is that the total width of the columns is much greater than the width of the train door. It creates chaos, especially during busy hours. The same wayfinding design can also be found in many subway and railway stations in China. In Suzhou, (right photo) the original sign was found to cause confusion and chaos, the design was manually adjusted by using a yellow tap sign on the floor. If the wayfinding design has taken into account the spatial organization effects in terms of user needs and experience, this problem would not have happened.

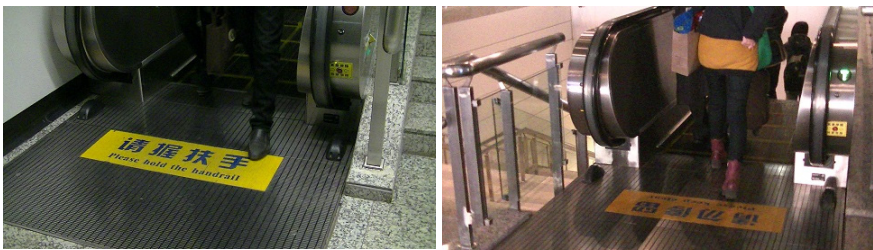
Inconsistent street names and road signs can often be found in cities in China. They are unclear, hard to read or understand, thus creating potential risks for both the drivers and pedestrians. In addition, incorrect signs with misspelled words cause confusion. Some signs show only Simplified Chinese words, while others are using *Pinyin* [29] (using Latin letters to help pronounce the Chinese words), which is the only recognized translation system being enforced in mainland China [30]. If foreigners do not recognize Chinese, what is the use for them to spell the Pinyin, even with correct intonation? They do not know the meaning. It is difficult for them to memorize the strange combination of Pinyin Latin letters of street names and places. Foreign visitors simply cannot find their ways using these types of road signs for wayfinding.





**Fig. 7.** Misused typography and color in one of the signs of a busy subway station Photo by Author - Location: Beijing

(Fig.7) Line No. 13 is one of the busy subway lines in Beijing. The word “Dricition” on the top sign plate is a typo and the correct word should be ‘Direction’. The even more correct translation is ‘To DONGZHIMEN’. Station names are only available in Chinese, without any Pinyin. The yellow and white colors are in weak contrast, thus reducing legibility and readability in wayfinding.



**Fig. 8.** Misplacement of sign plates at escalators in the newly built Nanjing railway station Photo by Author - Location: Nanjing

(Fig.8) The sign label on the escalator floor is wrongly placed. Both the sign label with the text ‘Please hold the handrail’ (left photo) and the sign label with the text ‘Please keep clear’ (right photo) are placed upside down. Although it may not be the designer’s mistake, it has defeated the purpose of the wayfinding design and reflects that there is a lack of wayfinding knowledge or poor management in implementing the wayfinding design.



**Fig. 8.** Large Scale Traffic Signs Photo by Author - Location: Nanjing

(Fig.9) This is a good example of applying a wayfinding concept and theory. The size of the digital traffic timer and arrow signs is much larger than those found in many other cities in China. It is highly visible for both drivers and pedestrians at the road intersection whether at day or nighttime. It helps provide a safe and convenient environment for users in the city. It also reflects that different provinces are using different standards for building their wayfinding system in urban development.

#### 4.2 Urban Planning Design

Urban planning design can also affect the functionality and usability of wayfinding. Some irrational infrastructure design appearing in the new city planning and development in China reveal that there is insufficient application of a wayfinding concept and theory based on a user's need and experience. In Fig.10 below, the bus station (left photo) and the bush fencing (right photo) is constructed in the middle of the zebra crossing. The road crossing function and the bus waiting / loading & unloading function are crashing. This is a representative example of irrational urban planning in wayfinding.



**Fig. 10.** Irrational road design in wayfinding Photo by Author - Location: Shanghai

## 5 Human Factors in Wayfinding Design

No matter how a city is integrated with advanced technologies to improve a citizen's quality life, it would be worthless if people are to abuse the wayfinding system and do not follow the rules in a city. For example, see Fig.11. Zebra crossing is one of the

wayfinding features commonly found in roadway systems. Around the world, pedestrians always have the right of way crossing the road. In China, it is seldom the case. Many drivers violate this code of traffic and challenge pedestrians walking on the zebra crossing, causing chaotic and dangerous situations on the roads. To improve the situation, tighter enforcement of the traffic laws and regulations as well as more advertising and education are advised to foster people, including drivers and pedestrians, to better make use of wayfinding tools.



**Fig. 11.** Chaotic and dangerous scenes at zebra crossing happen frequently in China Photo by Author - Location: Beijing

## 6 Conclusion

In this field study report, it is revealed that though the proposed smart city may emerge with new high-tech applications, a poor wayfinding design in urban infrastructure system would decrease its efficiency and weaken the city image. It needs a proper balance between emerging technologies and wayfinding concept and theory application which is based on user experience. Three prime cities (Beijing, Shanghai, Hong Kong) and two 2<sup>nd</sup> tier cities (Suzhou, Nanjing) were examined to explore the positive and negative scenarios of interactive wayfinding in transportation in China. The report showed that mobile voice control technology is effective digital platform solutions that would be the future wayfinding tools and would be widely applied in smart cities in China. However, it is necessary to obtain enough support and collaboration between the Chinese Government and private enterprises to enhance the effectiveness of the interactive wayfinding platform. As a guide for design practitioners and local government officials who are responsible for the implementation of the wayfinding design, the basic concept and theory of wayfinding must be considered and incorporated with the urban design of the city in order to make it a smart city.

In my ongoing research project, a smart city will be chosen for further in-depth surveying and experiment for wayfinding design. Hopefully, the final paper would be beneficial to local governments and general public in China by providing them with a wider perspective of wayfinding design and enhancing their awareness of the possible barriers in effective communications in urban infrastructure service.

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