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Historic Buildings and Historic Areas, Central Axes and City Walls

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Contents

About the Author

Fang Wang Ph.D. is Associate Professor, Director of Sino-German Joint Laboratory on Urbanization and Locality Research at College of Architecture and Landscape Architecture, Peking University. Dr. Wang is also a registered urban planner. After receiving a Ph.D. in Architectural Design and Theory from Tsinghua University, Dr. Wang completed her postdoctoral research in geography, with a concentration in urban planning, at Peking University. From 2011 to 2012, Dr. Wang was a visiting scholar at the Harvard University Graduate School of Design.

Dr. Wang's research concentrates on introducing geographical philosophy, methods and techniques into the traditionally engineering-dominated fields of urban planning and architectural design. Her focus is also known as "geographical planning and design", i.e. research on the influence of geography upon urban planning and design and reflexively, urban planning and design responses to geography. She is interested in the following research, including the preservation and renewal of cultural landscapes and historical districts and planning and design of sightseeing districts and geo-architecture. She has published over 70 academic papers and seven books (five in Springer) and has translated nine books from English to Chinese for publication. She has piloted one project subsidized by the National Natural Science Foundation of China (NSFC, No. 51078003), co-hosted three Sino–German Center projects (No. GZ1086, GZ1156, GZ1201) jointly subsidized by the National Natural Science Foundation of China (NSFC) and German Science Foundation (DFG), and six other projects of provincial and ministry-level funding. As the team leader, she won the Second Prize of Land Resources Science and Technology Award in 2015, sponsored by the Ministry of Land and Resources of the People's Republic of China.

Related Years and Emperors in Chinese History

17th Yongle year (1419) of the Ming Dynasty
18th Yongle year (1420) of the Ming Dynasty
31th Guangxu year (1905) of the Qing Dynasty
32nd Jiajing year (1553) of the Ming Dynasty
33th Guangxu year (1907) of the Qing Dynasty
4th Zhiyuan year (1267) of the Yuan Dynasty
8th Shunzhi year (1651) of the Qing Dynasty
Contemporary China (1949–)
Eastern Jin Dynasty (317–420)
Han Dynasty (202 BC–220 AD)
Jin Kingdom (1115–1234)
Kublai Khan (1215–1294)
Liao Kingdom (916–1125)
Ming (1368–1644) and Qing (1644–1911) Dynasties
Ming Dynasty (1368–1644)
Ming Dynasty Emperor Jiajing (reign 1522–1566)
Ming Dynasty Emperor Yongle (reign 1403–1424)
Modern and contemporary China (1840–)
Modern China (1840–1949)
Neolithic Age
Northern Wei Dynasty (386–534)
Paleolithic Age
Qin Dynasty (221–207 BC)
Qing Dynasty (1644–1911)
Qing Dynasty Emperor Shunzhi (reign 1644–1661)
Republic Era (1912–1949 in Mainland China)
Song Dynasty (960–1279)
Sui Dynasty (581–618)
Tang Dynasty (618–907)

Warring States Period (475–221 BC)
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Western Zhou Dynasty (the eleventh century–771 BC)
Yuan Dynasty (1271–1368)

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Changping District
Chaoyang District
Daxing District
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Fangshan District
Fengtai District
Former Chongwen District
Former Dongcheng District
Former Xicheng District
Former Xuanwu District
Haidian District
Huairou District
Mentougou District
Miyun District
Pinggu District
Shijingshan District
Shunyi District
Tongzhou District
Xicheng District
Yanqing District

All–China Federation of Trade Unions
All–China Women's Federation
Altar of Land and Grain
Ancient City Walls
Ancient Observatory
Anding Gate
Anhua Bridge on the North Third Ring Road
Anhui Guild Hall
Anzhen Bridge
Anzhen Gate

Architectures of Tsinghua University in modern time
Asian Sports Village
Babaoshan Revolutionary Cemetery
Badaling Residual Great Wall
Bajiao Bridge on the West Fifth Ring road
Bali Bridge
Baohe Palace
Beichen Bridge on the North Forth Ring Road
Beichen Road
Beijing APM Plaza
Beijing Birds Park
Beijing Books Building
Beijing Capital International Airport Terminal
Beijing Concert Hall
Beijing Friendship Store
Beijing Hotel
Beijing International Hotel
Beijing International Sculpture Park
Beijing Railway Museum
Beijing Railway Station
Beijing South Station
Beijing Telegraph Office Building
Beijing TV Center (Jianguo Road)
Beijing URBAN–RURAL Trade Centre
Beijing Wanda Plaza
Beijing Workers' Sports Complex
Beijing–Hangzhou Grand Canal
Beishang Gate
Beitucheng
Beitucheng Park
Bell Tower
Building of Foreign Language Teaching and Research Press
Capital Library of China
Capital Museum
Capital Times Square
Central Axis
Central TV Tower
Chadao City Wall
Chairman Mao Memorial Hall
Chang'an Avenue
Chang'an Gate
Chang'an Left Gate
Chang'an Right Gate
Chang'an Theatre
Changpu River Park

Chaoyang Gate
Chengtian Gate
China Central Place
China Central Television (CCTV)
China Development Bank
China Education Television
China International Exhibition Centre
China Merchants Building
China Millennium Monument
China Museum of Science and Technology
China National Arts and Crafts Museum
China Radio International
China World Trade Center
Chinese Ethnic Cultural Park
Chinese PLA General Hospital
Chinese Theater
Chongren Gate
Chongwen Gate
Chongzhi Gate
Citibank Site
COFCO Plaza
Confucian Temple
Cuandixia Village Ancient Buildings
Cuiwei Department Store
Cultural Palace of Nationalities
Daguanyuan Garden
Dahongmen
Dahongmen Bridge on the South Forth Ring Road
Dahongmen Clothing Trade City
Daqing Gate
Dashilar Commercial Area
Dashilar Commercial Buildings
Dashilar Historical and Cultural Conservatory Area
Dawang Road
Desheng Gate
Deyunshe Theater
Di'an Gate
Di'anmen Inner Street
Di'anmen Outer Street
Diaoyutai State Guesthouse
Dong'an Gate
Dongbian Gate
Dongdan Archway
Dongdan Park
Dongsishitiao Station of Beijing Metro

Dongzhi Gate
Drum Tower
Drum Tower Bridge on the North Second Ring Road
Drum Tower Outer Street
Duanli Gate
Early Architectures of Tsinghua University
East Chang'an Avenue
East Liulichang Historical and Cultural Conservatory Area
East Prosperity Gate (Donghua Gate)
East–west axis
Embassy Group of Beijing Legation Street
Fayuan Temple
Fengyi Gate
Forbidden City (Palace Museum)
Former International Financial Hotel (now China Merchants International Financial Centre)
Former Ministry of Foreign Trade and Economic Cooperation
Former Ministry of Railways Building
Former Residence of Chen Duxiu
Former Residence of Guo Moruo
Former Residence of Lao She
Former Residence of Mao Dun
Former Residence of Mei Lanfang
Former Residence of Soong Ching–ling
Former Residence of Tian Han
Former Site of the Duan Qirui Government
Fucheng Gate
Fuxing Gate
Fuxing Road
Fuxingmen Bridge on the West Second Ring Road
Fuxingmen Inner Street
Fuxingmen Outer Street
Gate of Divine Prowess (Shenwu Gate)
Gemdale Plaza
Glorious World Trade Mall
Gongzhufen
Great Hall of the People
Great Wall at Badaling
Great Wall Hotel
Greenhouse of Beijing Botanic Garden
Guang'an Gate
Guangqu Gate
Guangtai Gate
Guangxi Gate
Guiyou Store

Guomao Bridge on the East Third Ring Road
Haohua Gate
Headquarter for the Bank of China
Henderson Center
Heping Gate
Heyi Gate
Historic and Cultural Conservatory Area of Beijing Legation Street
History Museum
Huguang Guild Hall
Huguo Temple
Huicheng Gate
Huitong Times Square
Imperial Ancestral Temple
Imperial Archives
Imperial College
Imperial College Historic and Cultural Conservatory Area
Imperial City Wall Relics Park
International Financial Center of China Merchants
International Trade Building
Jiande Gate
Jianguo Gate
Jianguo Road
Jianguomen Bridge on the East Second Ring Road
Jianguomen Green Square
Jianguomen Inner Street
Jianguomen Outer Street
Jianwai SOHO
Jinding Bridge
Jingfeng Gate
Jingshan Hill
Jingtong Expressway
Jingwen Clothing Market
Jishuitan Lake
Juyongguan Pass Great Wall
Kuijun Mansion
Lama Palace
Laoshan Velodrome
Linglong Tower
Liu Laogen Big Stage
Liuyin Park
Lize Gate
Lizheng Gate
Lotus Market
Luogu Lane
Luoguo Lane

Luster International Center
Meridian Gate (Wumen Gate)
Metro Line 1
Metro Line 8
Military Museum of the Chinese People's Revolution
Ming Dynasty Dongbian Gate Relics Park
Ministry of Commerce
Ministry of Public Security
Minzu Hotel
Modern architecture area in 798 Art Zone
Modern Architectures of Beijing Hotel
Monument to the People's Heroes
Museum of Natural History
Museum of the War of Chinese People's Resistance Against Japanese Aggression
Muxiyuan
Muxiyuan Bridge on the South Third Ring Road
Nanluogu Lane
Nanyuan
Nanyuan Road
National Agriculture Exhibition Center
National Aquatics Center (Water Cube)
National Centre for the Performing Arts
National Conference Center's Fencing Gymnasium
National Gymnasium
National Library of China
National Museum of China
National Olympic Sports Center
National Stadium (Bird's Nest)
New courtyard house of Ju'er Hutong
New Otani Changfugong Hotel
New Poly Plaza
New section of Tsinghua University Library
New World Beijing Center
Niujie Mosque
No.5 courtyard house of Mao'er Hutong
North–south axis
Olympic Forest Park
Olympic Park
Oriental Plaza
Palace of Heavenly Purity
Pingguoyuan
Pingjinshang Waterlock Relics of Tonghui River
Pingze Gate
Prime Hotel Beijing
Prince Chun Mansion

Prince Kung Mansion
Prince Li Mansion
Princess Hejing Mansion
Princess Mansion
Qian Gate
Qianmen Street
Qihua Gate
Qingfeng Park
Rending Lake Park
Scitech Plaza
Shengjin Tianqiao Market
Shichahai
Shichahai Historic and Cultural Conservatory Area
Shijingshan Amusement Park
Shijingshan Gymnasium
Shijingshan Road
Shiren Gate
Shoes Mall of Northern World Trade
Shougang Group
Shougang Pine Forest Park
Shuiguan Gate
Shuncheng Gate
Shuntianfu School
Sihui
Sihui Bridge on the East Forth Ring Road
Silk Street
Site of France Post Office
SOHO New Town
State Seismological Bureau
Summer Palace
Summer Palace Relics Park
Suqing Gate
Taihe Palace
Tanzhe Temple
Telegraph Tower
Temple of Agriculture
Temple of Earth
Temple of Heaven
Temple of Mountain and River
Temples of Heaven and Earth
Terminal 3 of Beijing Capital International Airport
Thirteen Ming Tombs
Tian'an Gate
Tian'an Gate Tower
Tian'an Men

Tian'anmen Square
Tianqiao Department Store
Tianqiao South Bridge
Tieshuxie Street
Tonghui River
Tongxuan Gate
Towers of Bell and Drum
Twins Mall
Wen Tianxiang Shrine
Wenming Gate
West Chang'an Avenue
West Prosperity Gate (Xihua Gate)
Working People's Cultural Palace
Wukesong
Wukesong Bridge on the West Forth Ring Road
Wukesong Gymnasium
Xi'an Gate
Xianyukou
Xibian Gate
Xidan Archway
Xidan Cultural Plaza
Xiluoyuan Park
Xinhua Gate
Xinxing Bridge on the West Third Ring Road
Xishenku Church
Xizhi Gate
Xuanwu Gate
Xuanyao Gate
Yandaixie Street
Yangchun Gate
Yangmeizhuxie Street
Yanyuan architecture group around Weiming Lake at Peking University
Yinding Bridge
Yintai Centre
Yongding Gate
Yongdingmen Bridge on the South Second Ring Road
Yongdingmen Inner Street
Yongdingmen Outer Street
YongdingmenYandun Beacon
You'an Gate
Youth Lake Park
Yuan Chonghuan Shrine
Yuan Dynasty Capital City Wall Relics Park
Yuanmingyuan Relics Park
Yuquan Road

Zhangyi Gate
Zhegyang Gate
Zhongfu Building
Zhonghua Gate
Zhonglou North Bridge
Zhonglouwan Hutong
Zhongnanhai
Zhongshan Hall
Zhongshan Park
Zhushikou Church
Zuo'an Gate

Introduction

It has taken China 30 years to complete an urbanization project that may require more than 100 years in other countries. The highly concentrated development path on such a large scale and high speed can surely bring great challenges to the sustainable development of urbanization. China's future urbanization will maintain its rapid development momentum but with a gradually slowing growth rate (Li 2013), entering a phase in which various problems that accumulated in the initial stage of urbanization break out centrally (Wang et al. 2014). That how to make the local culture preserved and lasting becomes the most urgent problem at present. A city is like a human being and it has a spirit and character that must be developed over a long period of time (Xiao 2009). China's famous writer Jicai Feng (2005) once mentioned that just like a person, every city has its own memory, which is stored within the city itself. However, the present development, which is rapid, thorough and similar, introduces the city to a crisis of amnesia, paramnesia, the lapse of memory and the loss of memory. In such an age when historical amnesia prevails and the world is changing rapidly, how to preserve a city's own features and urban memory has become a main issue among urbanists (Liang 2010). Memory must be reassessed, and memory sites must be found and established (Huyssen 1995).

In the process of formation, change and development, the city, serving as a place of collective memory (Rossi 1982), inscribes the interaction process over time between the subject and object of its memory (Wang et al. 2010). It is urban memory that turns a purely physical space into a place with environmental and cultural significance, temporal and spatial meaning and human cognition—a place that gives priority to convey inherent meaning contained within the external manifestations (Tu 2005). Preserving urban memory can not only pass on urban history and features but also strengthen citizens' sense of identity and cohesiveness, thus shaping the spirit and culture of the city.

In recent years, the preservation of urban memory has received wide attention in society. Under the initiative of the State Archives Administration of China, the Urban Memory Project has become the record and rescuer of urban memory by following the government's guidance. In the field of urban planning, the urbanists

can not only conserve fragments of the city's past but also expand the urban context into the future by seeking the living urban memory. By doing so, the urban memory can be recorded and passed on in the spatial dimension and, more importantly, can be continued and expanded in the temporal dimension.

In this study, Beijing is taken as the study case for the following reasons: (1) as the capital of China, Beijing is one of the most important historical and cultural cities in the world. It was regarded as a brilliant work of urban planning in ancient China (Liang 2001). American urban planner Bacon (1967, p. 232) has described Beijing as "possibly the greatest single work of man on the face of the earth." Local residents have a strong perception of Beijing urban memory, and outsiders have a distinctive feeling toward the city's images. (2) During the process of urbanization, Beijing has made brilliant achievements, but at the same time, it is faced with many urban diseases, such as a large population, heavy traffic and haze pollution. The urban heritage has also suffered as many objects and cultural icons with significant meanings, such as hutong, are disappearing rapidly, which challenges the inheritance of urban memory. (3) Beijing is facing an important opportunity for development in the process of new urbanization, and its urban function and layout are calling for adjustment. The construction of Beijing will not pursue the pie-style development disorderly but will turn to define the city's distinctive functions, especially its cultural functions, rather than an overall perfection of all types of functions. Study of the Beijing urban memory will offer an important addition to the cultural function of Beijing.

In the specific study, a research object system that consists of points, lines and planes in space is established. Based on Beijing's historical and modern development, the research objects are sifted in terms of some aspects, such as time, space, function, scale and degree of protection. The point spaces include 345 historical buildings in the inner city; the plane spaces include 367 historical areas; and the linear spaces refer to the north–south axes, the east–west axes and ancient city walls in Beijing. Based on conventional spatial planning, temporal dimension and subjective cognition are applied to explore the perception and application of urban memory. The temporal dimension emphasized the unity of the synchrony and diachrony of urban memory, providing ideas on how to achieve harmony during urban transformation while the subjective cognition focused on people's initiative, recognition and response during the formation of urban memory, thus offering insights into the research on the harmony between man and the environment (Wang et al. 2010).

It is worth noting that this study was launched in 2009. During this period, our thoughts have constantly been developed. At the same time, our research objects, including the historic buildings, historic areas, central axes and ancient city walls, possess various characteristics. Although our research followed an approach of Object–Subject–Time (OST) during the whole research process, we applied slightly different and specific approaches to each object. The difference can be seen in this book, especially clearly in our earliest work on the historic buildings in Chap. 2.

Chapter 1
Theory Study of Urban Memory

1.1 Concept of Urban Memory[1]

The dictionary definition of "memory" is the faculty by which the mind stores and remembers information. Memory is naturally place–oriented or at least place–supported (Casey 2000). Human memory is embodied in living personal memories and embedded in social frames and external cultural symbols (Assmann 2011). Burke (1989) argued that memory is viewed as the subjective experience of a social group that essentially sustains a relationship of power. Confino (1997) noted that the notion of "memory", more practiced than theorized, has been used to denote the manners in which people construct a sense of the past. Memories help us to preserve past events (Boyer 2009). Memory itself has a long evolution that is as long as human consciousness. Memory is the mental capacity through which events are stored, preserved, and recalled by the mind; it is in permanent evolution, open to the dialectic of remembering and forgetting (Nora 1989).

The individual is the subject of memories, and individual memory processes are derived from social interaction. Contemporary usages of the term "collective memory" are largely traceable to Maurice Halbwachs, who published a landmark study entitled *On Collective Memory* (1992). The French sociologist laid the foundation for research into the relationship between memory and society and developed the concept of collective memory. In this landmark publication mentioned above, Halbwachs (1992) emphasized the influence of society on individual memory. He was the first author to propose the idea that there is memory at the collective level, and he used the term "collective memory" to express the social contextualization of all individual memories. In a series of studies, Halbwachs argued that every memory is carried by a specific social group limited in space and

[1]Partial contents of the present section were published in the following: Wang, F., Li, W., Liu, Y. and Cai, H.R. The Measurement and Application of Urban Memory of historic areas in Beijing // Wang, F., Prominski, M. Urbanization and Locality: Strengthening Identity and Sustainability by Site–specific Planning and Design. Heidelberg: Springer–Verlag GmbH, 2015: 27–54.

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time (Confino 1997). While Halbwachs was not the only writer thinking of collective memory, Aby Warburg, the European scholar, was the first to use the concept of social memory (Confino 1997). These two persons independently developed theories of "collective memory" or "social memory" (Assmann and Czaplicka 1995). Young (1993) advocated a collected memory of many discrete memories that are gathered into common memorial spaces and assigned a common meaning. Identity is intimately tied to memory: both our personal memories and the collective and social memories (Hayden 1997).

French historian Pierre Nora, the true heir to Halbwachs, has documented all of the places of memory in French society and has noted the passing of memory into history as being akin to losing a living relative to the past. Nora's multivolume project *Les Lieux de Mémoire* (Nora 1989) underpins further spatial treatments of memory for its emphasis upon the realms and physical sites or places of modern, collective memory (Legg 2005). Along with the classic studies of Halbwachs and Nora, Olick and Robbins (1998) offered a similar argument and referred to distinct sets of mnemonic practices in various social sites, rather than to collective memory as a phenomenon. Bélanger (2002) understood collective memory as a social process, surpassing the understanding of memory simply as the accumulated recollections of actual historical events. Huyssen (1995) mentioned that humans search for and build places of memory that can provide a sense of temporal anchoring in a world of up–to–the–minute media saturation and information overload.

Recent research in different disciplines has explored the political, cultural, spiritual, and socio–economic dynamics of what Crinson (2005) called "urban memory." This term can be regarded as an expression of collective memory shaped within a particular space and time; thus, it expresses relationships between the past and the present of a particular place (Ringas et al. 2011). As Srinivas (2001, p. xxv) suggested, urban memory provides a "means of accessing how various strata of society and different communities construct the metropolitan world." For Crinson, "modernism in architecture often seem[s] to erase memory from the city" (Crinson 2005, p. i); they chastised planners and developers for using memory "to aestheticize and co–opt the past into new forms of place–making" (Crinson 2005, p. 50). Ekici (2007) analyzed the complex relationships between the urban manifestations of collective memory and contemporary architecture in Berlin. Jenks' article about Little Tokyo in Los Angeles addressed issues of ethnic identity, urban space, and the politics of collective memory (Rose–Redwood et al. 2008). Matten (2011) addressed the issues of national and cultural identity in China by applying Pierre Nora's "places of memory" (*lieux de mémoire*) approach to the Chinese context, focusing on the most significant places of memory in modern and contemporary China (1840–). Blunt and Bonnerjee (2013) followed Srinivas' argument that different groups in a city create different landscapes of memory, emphasizing the manner in which members of two minority communities living in London and Toronto remember Calcutta as their home. Ringas and Christopoulou (2013) applied urban computing to the three constituents of urban memory, namely place, community, and infrastructure, in Corfu and Oulu, and they presented a survey of

applications aimed to capture, preserve, and exploit urban memory, as well as maintain and to strengthen urban memory.

In the process of urban development, memory has been constantly formed and preserved, while each individual and each event create new memories and, at the same time, are remembered (re–remembered). When personal memories are melded into collective memories attached to the physical space to which they refer, they form an ambient, collective city memory (Ringas et al. 2011). Of all of these memories, only those with preservation value for urban formation, change and development and those that record the collective memory of the urban history can be incorporated into the urban memory. At the same time, the development of the city has an influence on the collective memory, leading to the loss of old memories mainly due to increasingly rapid industrialization and urbanization (Olick and Robbins 1998).

In this study, urban memory is defined as the collective memory recorded during urban formation, change and development, which, with people as the principal part, dynamically and continuously reconstructs the cognition and memory of the city's history and its present, as well as a process of interaction between the urban subject and object over time (Wang et al. 2010).

1.2 Research Perspectives

Currently, the related research has focused on the relationship between urban memory and architectural landscapes, cultural heritage and sense of place.

1.2.1 Urban Memory and Cultural Landscape

As a carrier of human culture, the architectural landscape, endowed with a memory–storage function, is a refraction of human civilization in different historical periods, demonstrating a city's evolution and development (Zhou and Zhu 2015). Lowenthal (1975), a British geographer, proposed the concept of nostalgia when studying the relationship between landscape and memory. He believed that historic culture must exist in the present landscape; through awareness of the past, we learn and remake ourselves, while through awareness of our own experience, we also refashion the past and replace what is constantly being altered and lost. Viollet–le–Duc and Wethered (2015) argued that people could begin the actual restoration work of historical buildings only when the purpose of everything in all the debris has been determined, and everything has been put into its proper logical place. Srinivas (2001) argued that historic buildings and cultural landscapes, possessing diachronic and synchronic characteristics, act as a type of signifier of the urban memory, vividly embodying cultural identity and the cultural taste of a city with a sense of cultural continuity. Zhu (2004) held that visible architectures, landscapes, streets,

cultural relic sites and historic areas, as well as the invisible historical context, constitute the important part of urban memory. Based on "harmony without uniformity", a regional culture idea advocated in the *Charter of Beijing*, Shu (2004) studied the material and social value of historic buildings in evoking urban memory and restoring old buildings. He proposed that urban memory contains the cognitive image, the spirit of place and the living environment connoted by the perspective of visual perception and the behavior of people. Zhou (2009) argued that the landmarks of a city could strengthen the city's cultural memory. In addition, the study of non–material cultural heritage also constitutes an important part of exploring the relationship between urban memory and cultural landscape. The American urban theorists Mumford et al. (1961) suggested that people's spiritual values are the most important parts of a city, undertaking the fundamental mission of storing, spreading and creating culture. By emphasizing the city's ability to blend various cultures, Mumford et al. claimed to rehabilitate urban and regional cultural heritage, rendering the city as a significant carrier of excellent traditional concepts and ideal states of living. Wang (2007) proposed that modern development is increasingly out of touch with the tradition underlying the strong impact of modern commercial civilization, resulting in a phenomenon that Hobsbawm and Ranger (1983) defined as mass production of the traditional. In Wang's opinion, the ever–severe cultural crisis indicates the urgent need to conserve and rehabilitate traditional cultural and festival heritage.

1.2.2 Urban Memory and Local Characteristics

As a local phenomenon, urban memory takes root deeply in the local and social history so that it is constituted by personal emotions and the social environment, finally serving as a strong bond for places and people. In the evolution of urban construction and cultural landscapes, the delivery, change and loss of local information prompt the urban subject to form a particular perception, thus constructing urban memory with a specific spirit of the place (Zhou and Zhu 2015). Heidegger once said that it is in people's memories and emotions that the place is constructed after repeated encounters and complex relationships (Zou 2006). According to Cloke et al. (2005), the space of urban memory is not measured by the geometric space of latitude and longitude, but it is affected by our perception of space in the world. When analyzing the special schema of city memory, Bell (2003) understood memory to be a socially framed property of individual minds. Lewicka (2008) investigated collective memory among the inhabitants of two twin cities, Lviv (Ukraine, previously Lwow, Poland) and Wroclaw (Poland, previously Breslau, Germany), and he also explored the memory of residence place and its relationships with place identity and place attachment. Othman et al. (2013) argued that sense of place is rooted in occurrences between people and the place where they are, as well as the correlation between one and the other in a specific space; this correlation involves physiology, sense and emotion. Zhao and Zhou (2002) held that urban

space is the projection of personal involvement, embodying the significance of cultural icons and, even more, the sense of place that the humanistic geography emphasizes.

1.2.3 Urban Memory and Urban Space

The breadth of the literature on collective memory is expanding each year. In contrast, there is one specific thematic concern involving the relationship between memory and urban space, called city memory (Othman et al. 2013). Memories are built as a city is built (Hebbert 2005), and cities serve as powerful symbols and repositories of memory (Ladd 1998). The city is the locus of social memory, and city memory can be considered one type of collective memory; individuals in a society create a strong image while experiencing the city (Rossi 1982). Halbwachs (1992) laid the foundation for identifying the role that space plays in shaping collective memory; every collective memory unfolds within a spatial pattern. Urban spaces as lived spaces shape collective imaginations (Huyssen 2003), and the collective memory of a city participates in the actual transformation of space in the works of the collective (Rossi 1982). Le Goff (1992) identified five distinct periods in the history of memory; he noted that city structures emerge in the second stage, following the emergence of mnemonic practices. Ferguson (1994) and Hayden (1997) proved by cognitive mapping that there exist some correlations between collective memory and the morphological evolution of a city. As Casey (2004, p. 38) bluntly asserted, "public memory needs a place of enactment, a scene of instantiation"; public places as a component of public memory are designed to be long–lasting structures that assure continued remembrance. Hebbert (2005) focused on streets and explained how a public space can be a locus of collective memory. Many studies of collective memory and urban space have focused primarily on monumental landscapes because monuments, memorials, and museums have proved to be fertile grounds for investigating places of memory (Till 2003; Jordan 2006; Henneberg and Clara 2004; Forest and Johnson 2002; Johnson 2002; Withers 1996). Stangl (2008) exerted an alternative focus by considering the relationship between vernacular architecture and cultural memory. He argued that the vernacular and monumental are intertwined in urban space, sharing an ambiguous and fluid borderline. This distinction is significant in the analysis of how some vernacular places become memorialized and some monumental places become vernacularized.

1.3 Properties of Urban Memory

Based on the existing research, the properties of urban memory can be concluded to be integrity, dynamism and continuity (Wang et al. 2010).

Integrity: In this research, different from previous research that only focused on the material elements of the city, we hold that compositions of urban memory contain material and non–material elements, and a full sense of urban space environments should be considered in the study of the historical and cultural development of the city. This belief indicates that urban memory has a typical integrity.

Dynamism: The dynamism of urban memory depends on the carrier to which the memory is attached, that is, urban space, the development of which is dynamic. In the study of the component elements of the city, Rossi (1982) emphasized the importance that role time parameters play in urban compositions, and he held that it is the greatest fallacy in urban science to regard turban compositions as a type of work associated with a particular historical period; in this belief, he reveals the significance of urban dynamism. Tu (2005) divided urban memory into three types: permanent urban memory, developing urban memory and fading urban memory. According to Zhang (2008), in the process of a city's form, change and development, various coordinate points, such as the buildings, streets, cultural and historic sites built at different times, also come into being.

Continuity: Urban memory is closely connected to the time dimension so that the forming and developing of urban memory are continuous in the axis of time. There exist symbols, normally the typical buildings or other structures, representing the continuity of urban memory in the city. Chen et al. (2010) held that the forming and developing of a city are processes accumulated at different times, and these processes are reflected by urban memory.

1.4 Component Elements[2]

The elements of urban memory have differed according to different scholars. Rossi (1982) based his view on the physical forms of cities, seeking urban memory not in buildings but in the voids between them: architecture, streets, squares, and monuments (large–scale architecture) are important content embodying urban memory. Halbwachs ([1925] 1992) paid attention to the double nature of collective memory: first, the physical, pertaining to items in material reality, such as statues, monuments, and places in space; and second, the symbolic, or objects of spiritual significance, including intangible resources shared by a group that adhere to and are superimposed upon the physical reality. Similar to Halbwachs, Nora's (1989) conception of *lieux de mémoire* (places of memory) emphasizes both material sites of memory, including burial places, cathedrals, battlefields, and prisons, and non–material sites of celebrations, spectacles, and rituals. Zhu (2005) added the elements

[2]Partial contents of the present section were published in the following: Wang, F., Li, W., Liu, Y. and Cai, H.R. The Measurement and Application of Urban Memory of historic areas in Beijing // Wang, F., Prominski, M. Urbanization and Locality: Strengthening Identity and Sustainability by Site–specific Planning and Design. Heidelberg: Springer–Verlag GmbH, 2015: 27–54.

of subjective experience and time to urban memory, divided into corporal (participations in action), field and scenery (ambient and mental sensations of object characters), and symbolic elements (homonyms, types, and landmarks that emphasize the cultural experience of subjects). De Alba (2012) considered Mexico City as a case study, using Halbwachs's notion of collective memory as a theoretical framework and summarizing the factors of urban memory: time [personal (life stages) and historical (the city's past)], space (cities, neighborhoods, areas or specific places), and groups (family and community contexts; education and job trajectories).

Other multi–disciplinary studies have explored the varied influences of urban memory. Kansteiner (2002) mentioned three factors of collective memory: the intellectual and cultural traditions, memory makers, and memory consumers; his work provided a temporal dimension to collective memory. Bélanger (2002) and Mowla (2004) proposed the idea that products of urban memory usually favor a small minority of elites; in other words, privileged groups are typically in a better position than others to propose their memory as being the predominant urban memory. Postalcy et al. (2006) considered the experiences of both inhabitants and observers regarding their effects on urban memory; they concluded that major changes in the physical or social environment can cause discontinuities and urban memory loss. After examining 200 sites in the greater Berlin area, Jordan (2006) reported that land use, land ownership, memorial entrepreneurs, and the broader public resonance are deterministic factors in the emergence of a memorable place. Lahiri (2011) adopted a multi–sensory approach to studying trans–local urban memories, finding that the sensory factors influencing urban memory encompass vision, smell, sound, and taste. Based on traditional symbols suggested by Mowla (2004), Othman et al. (2013) proposed that the factors influencing memory toward place making can be divided into three components: individual or group, physical (demographic, socioeconomic status, location, and scale [spatial attributes]), and social factors (geographical perspectives, place experiences).

Based on the urban memory system (subject of memory—carrier of memory—effect factors of memory) built by the research team (Wang et al. 2010), this study divides elements of urban memory into three categories: the subjective elements centered on the rememberer, the objective elements centered on carriers of memory, and the temporal elements. In this system, the subject (rememberer) acts as the producer of urban memory, the object (carrier of memory) acts as the memory elements to be remembered, and time acts as the effect factor (Fig. 1.1).

1.4.1 Subjective Elements

As a type of collective memory, urban memory, the subject of which, in a broad sense, refers to the urban collective, consists of the memories of rememberers that participate and act in social activities. Study of the subject of urban memory can be carried out as follows: first, by establishing subjective evaluations, based on the

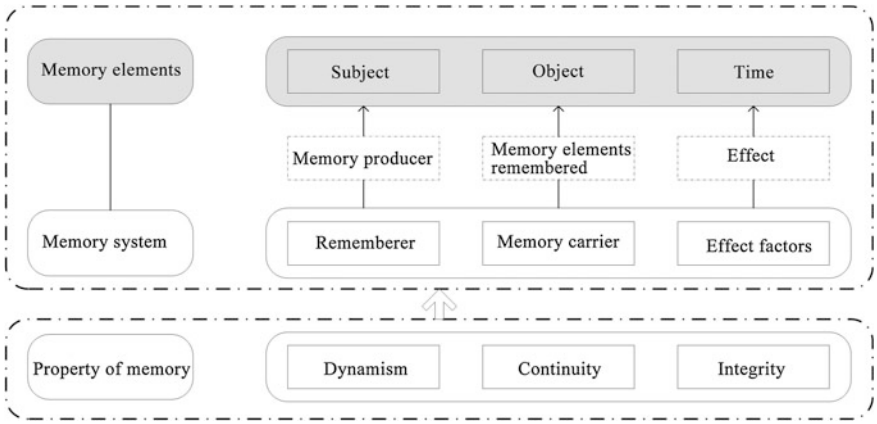

Fig. 1.1 Measurement elements of urban memory (*Source* Drawing by Yang Liu)

cognition of objective elements; and second, by researching the property of an individual person, who also acts as a subject. The subjective evaluation refers to the subject's comprehensive evaluation of objective facts after considering the individual's basic cognition of the objective facts and his or her judgments, value orientations, and ideology, as well as other outside interference factors; thus, the substance of subjective evaluation is the subject's understanding and evaluation of objects.

Based on the cognition of urban objects, subject cognition is affected by the following factors: (1) the urban memory of different components of the city formed in the subject's (or rememberer's) cognition is different for the subject, truly developing varied memories and cognitions regarding various characteristics and properties of the city; and (2) cognitions or memories of the same components of the city in different subjects are also different. From these two points of view, the subject's cognition of Beijing urban memory will have different types.

1.4.2 Objective Elements

Because the object of urban memory is the basis of urban memory, the construction of objective elements should consider integrity, dynamism and continuity. For integrity, the objective elements comprise tangible entity elements and intangible cultural elements; the tangible entity elements include cultural relic sites, building styles, spatial patterns, city wall structures, colors, volumes, materials, surroundings and so on, while the intangible cultural elements include cultural deposits, historical allusions, changed names, anecdotes, etc. Urban memory is rooted in urban three–dimensional space, which is subject to a dynamic process, indicating that urban

memory is changing along, with the development and evolution of urban space over time. In this process, urban memory shows its dynamism and continuity.

1.4.3 Temporal Elements

Temporal elements play key roles in reflecting urban memory's integrity, dynamism, and continuity. Study of the time dimension, to a certain extent, links the subjective elements and the objective elements together by exploring the information about objects from cross–section of times and combining the subject's cognition. It is a synchronic study of urban memory. According to the research results, the information about objects, which can represent the characteristics of development and evolution in longitudinal sections of time, can be further filtered out and further reflected in the cross–section of current and future time.

From the diachronic point of view, urban memory experiences a number of historical stages, evolving and precipitating before finally being established. According to the diachronic characteristics of urban memory and the general characteristics of the object, this study divides the temporal elements into point–in–time (events), time period and time axis.

1.5 OST Measurement Model

According to the classifications of memory by purpose and function in psychological theory, Freud was the first theorist to classify memory into field memory and observer memory; in his opinion, regarding the event to be remembered, we sense it only as a field initially, and the observer memory is what we want to see as outside observers, so it must consists of variations in the memories of the original event (Schacter 1997). Therefore, field memory is more vivid, like copies of the original event, while observer memory focuses on the emotions caused by or interpreted from the event. Connerton (1989) divided memory into unconscious memory and cognitive memory: the former is related to behavior, involving customs and norms, while the latter depends on people's cognitive systems, featuring "iconicity", which encodes on the basis of the visualization of things, and "symbol", which encodes semantic symbols on the basis of meaning. Atkinson and Shiffrin proposed a multi–store model, which asserts that human memory has three separate components: sensory memory, short–term memory and long–term memory (Jia 2007).

In the mentioned multi–store model, it studies how human beings bestow different meanings on the physical environment, how they identify the environment, how they form a representation of the environment in their minds and how they are influenced by the representation (Yu et al. 2000). Previous memory theories suggested that memory is an organic combination of spatial patterns, places and people's cognitive experiences. This study of urban memory, inspired by the

psychological theories above, constructs a theoretical framework known as Object–Subject–Time (OST) (Wang et al. 2010). Time and space form the basic framework for people to experience places. Moreover, the study of time actually explores the process of urban growth, development, decline and rehabilitation. The OST model is adapted to urban memory study, providing a macro–perspective for analyzing sustainable urban development and revealing a unified process between phasing and integrity, diachronic and synchronic, and continuity and diversity. It offers an important way of thinking about exploring the dynamic process and law of urban development.

Previous studies of urban memory included qualitative evaluation and quantitative evaluation. The qualitative evaluation focused on specific cases, exploring a district's or region's historical value, urban fabric and landscape features (Bai 2007). Regarding quantitative evaluation study, Shen et al. (2005) constructed an evaluation system with conservation of the current state, peripheral environment, historic context, architectural features and integrated spectacle as scoring indices. Li et al. (2010) studied the urban memory of the cultural landscape in Foshan City of Guangdong Province, in the southeast of China. By referring to the PPGIS concept and VBA language development, he constructed a database, queried for statistical analysis and conducted a visualization study. Taking Xiaoying Lane in Hanghzou City as a case study, Li et al. (2010) applied the level of urban memory to explore the rules of the group's urban memory. Regarding the memories embodied in a carrier, he measured the percentage of the number of persons who have such memories among the respondents; Lewicka (2008) studied the place attachment, place identity and place memory of Lviv and Wroclaw, both of which were impacted by World War II. He applied a five–point scale and interviews to measure the level of memory of residents' cognition toward major historical events and their attachment to the construction age, original names, famous events and relevant history of streets, houses and apartments.

Based on the previous research into quantitative measurement, which concluded with both index systems and subjective assessments, this study devises an Object–Subject–Time (OST) measurement system. The basic idea consists of the following steps: establishing an OST measurement model; using a five–point scale—questionnaire surveying and field interviewing in line with the measurement model; analyzing the memory level of the acquired memory information; and summarizing the rules of memory.

Chapter 2
Point Space: Measurement of the Urban Memory of Historic Buildings

Rapid and large-scale urban construction results in the increasingly similar appearance of urban landscapes and the demolition of many historic buildings that once existed in people's memories but that now are making way for commercial development. At the same time, lifestyles, scenes, sounds and fragments with which people are familiar are everywhere disappearing and are being replaced by similar modern constructions, leading to urban amnesia. As a major material carrier of urban memory, historical buildings not only constitute urban styles and spatial patterns, but also embody the spiritual connotations and cultural characteristics of the city. In this chapter, historical buildings will be studied as the point space of urban memory.

2.1 Statistical Features

Beijing is a city with a history of more than 3000 years. It has been China's capital for 850 years. From a large number of historical buildings, this study selects 345 in the inner city walls of Beijing for a statistical analysis. According to the ancient capital's features and the historical function of its architecture, these selected buildings are divided into eight categories—the royal buildings, the feudal office buildings, the cultural buildings, the service buildings, the political buildings, the vernacular dwelling buildings, the religious buildings and the landmark buildings—which were further divided into 17 subcategories (Fig. 2.1). The royal buildings, constituting as many as 16 typical buildings, including three subcategories of the imperial palaces, the imperial festival buildings and the imperial living buildings, stand as the unique architecture heritage of the imperial city. The feudal office buildings category, including two subcategories of the imperial mansions and the

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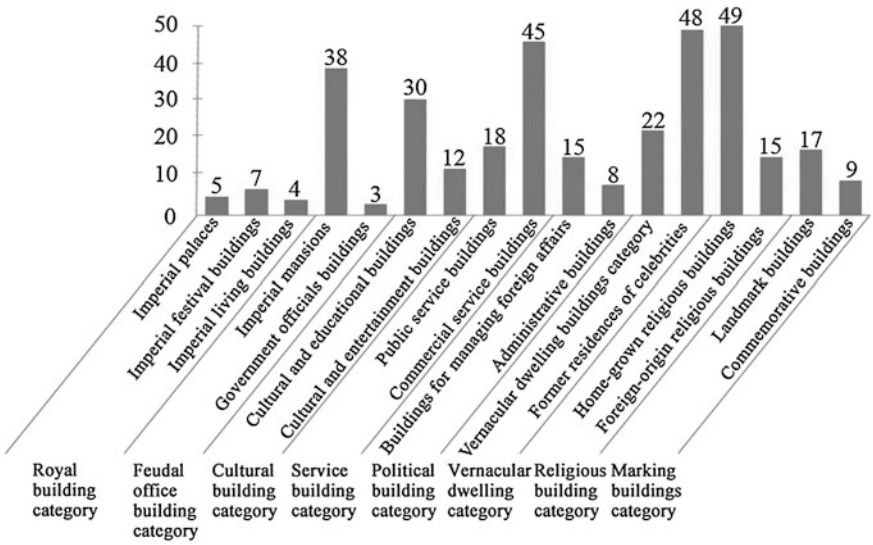

Fig. 2.1 Chart for statistical distributions of historic buildings in Beijing's inner city according to their historical functions (*Source* Drawing by Ming Jiang)

government office buildings with the total number of 41 buildings, refers to buildings erected for the Eight Banners, which were military-administrative organizations of the Manchu nationality in the Qing Dynasty. Because Beijing is the cultural center of China, the amount of cultural buildings here, including two subcategories of the cultural and educational buildings, as well as the cultural and entertainment buildings, numbers as many as 42. The service buildings, including two subcategories of the public service buildings and the commercial service buildings with a total number of 63, suggest the prosperity of Beijing's businesses. The number of the political buildings, including two subcategories of the buildings for managing foreign affairs and the administrative buildings, is 23, and that of the vernacular dwelling buildings, including two subcategories of the common residences and the former residences of celebrities, reaches 70 owing to a large number of celebrities in Beijing's history. The religious buildings, including two subcategories of the home-grown religious buildings and the foreign-origin religious buildings in Beijing, have undergone splendid growth and now number 64. The marking buildings, including two subcategories of the landmark buildings and the commemorative buildings, number 26.

Based on the classifications of buildings, the study carried out a statistical analysis toward spatial characteristics, construction age, historical relic grades and functional changes of historical buildings in Beijing's inner city. The results are as follows.

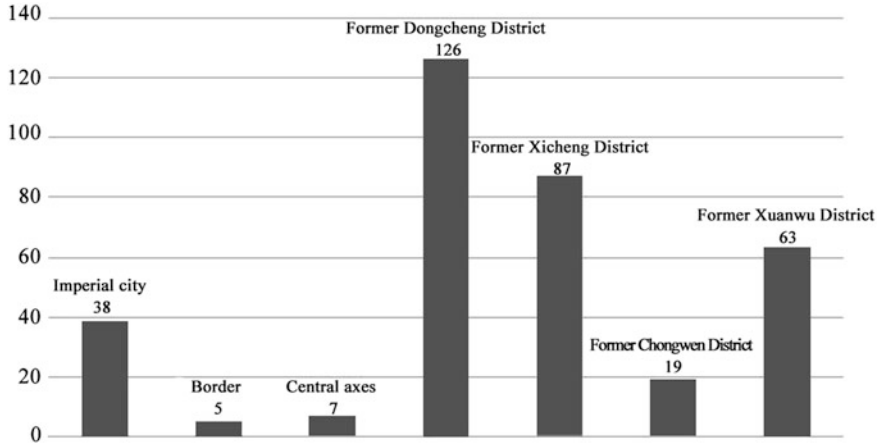

Fig. 2.2 Chart for statistical distributions of historic buildings in Beijing's inner city according to their geographical locations (*Source* Drawing by Ming Jiang)

2.1.1 Spatial Characteristics

The 345 selected historical buildings in the inner city are widely cited in the imperial city, central axes, border and the former Districts of Dongcheng, Xicheng, Chongwen and Xuanwu[1] (Fig. 2.2). In terms of geographical distribution, 126 are distributed in the former Dongcheng District, followed by the former Xicheng District, with 87, the former Xuanwu District with 63, the former Chongwen District with 19, the imperial city with 38, and the border and central axes with 5 and 7, respectively. In terms of distribution density, the largest concentrations of historical buildings are found in the imperial city and the former Dongcheng District.

Among the buildings distributed in the border and the central axes, 75 % are landmark buildings, including city walls, turrets and city gates, and the remainder are service buildings. In terms of the construction age, the ancient buildings, except for those special landmark buildings, are all far from the city walls and central axes, while the modern buildings, such as the cultural and entertainment buildings, as well as the commercial service buildings, are mostly located on the sides of the central axes and on Chang'an Avenue, forming new landmarks.

[1]The Dongcheng District of Beijing is currently merged with the original Chongwen District; Xicheng District is merged with the original Xicheng District, known as Xuanwu District. For the convenience of a clear statement of the investigative situation of this research, considering that the original Xuanwu District is a concentrated area of Beijing's ancient urban historical relics, the administrative division still uses the original names of Dongcheng, Xicheng, Chongwen and Xuanwu.

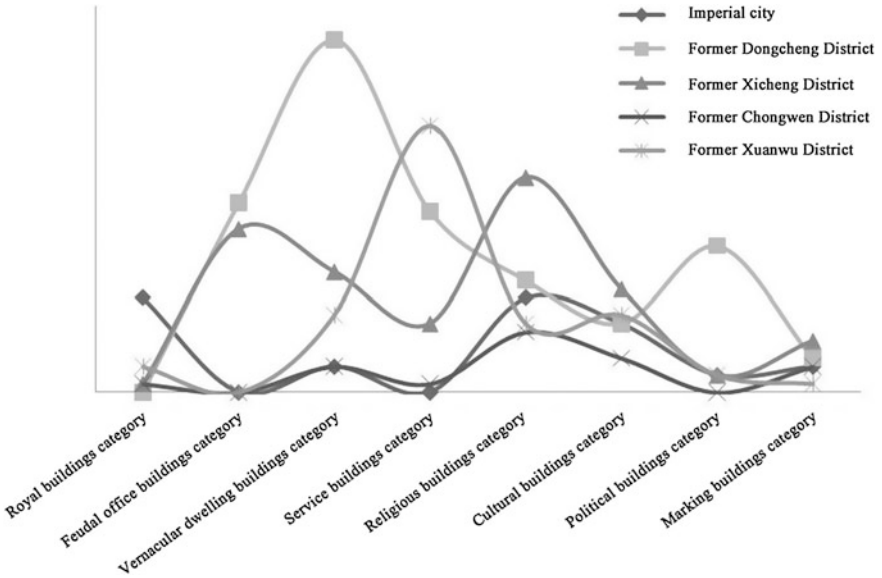

Fig. 2.3 Correlation between the statistical distributions of historic buildings in Beijing's inner city according to their historical functions and geographical locations (*Source* Drawing by Ming Jiang)

In terms of the functions of the historical buildings in the imperial city and the former Districts of Dongcheng, Xicheng, Chongwen and Xuanwu (Fig. 2.3), buildings in the former Dongcheng District mainly serve as the vernacular dwelling buildings; in the former Xicheng District, they serve as the official and religious buildings; in the former Xuanwu District, they are the service buildings; in the former Chongwen District, there are the residential and religious buildings; and in the imperial city, there are the royal and religious buildings. In Beijing, there is an old saying that the rich and the noble live in the east and the west while the poor and the common live in the north and south, which is also in agreement with the distribution rules of these historical buildings. The former Dongcheng District once had rich people living there, and the Xicheng District was for prominent officials and eminent personages, while the former Districts of Chongwen and Xuanwu in the south were the concentration Districts for common people's business and service sectors.

2.1.2 Construction Age

In terms of the construction age (Fig. 2.4), the historical buildings built in the Qing Dynasty account for approximately 47 %, the Republic Era for 28 % and the Ming

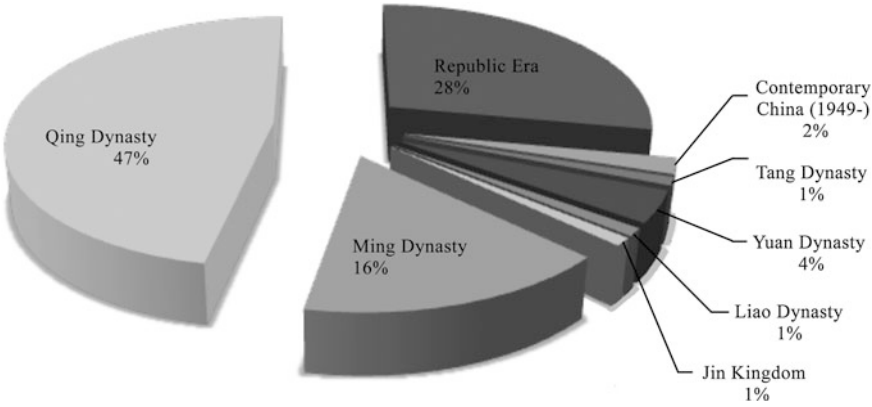

Fig. 2.4 Diagram of construction age statistics of historic buildings in Beijing's inner city (*Source* Drawing by Ming Jiang)

Dynasty for 16 %. These three dynasties, when most of the buildings were built, are the typical periods of Beijing urban memory.

These three periods (Fig. 2.5) show that the existing historical buildings built during the Ming Dynasty are mainly the royal buildings, the religious buildings and the marking buildings. The existing imperial city and the basic urban framework of Beijing were constructed during the Ming Dynasty, demonstrating that the Ming

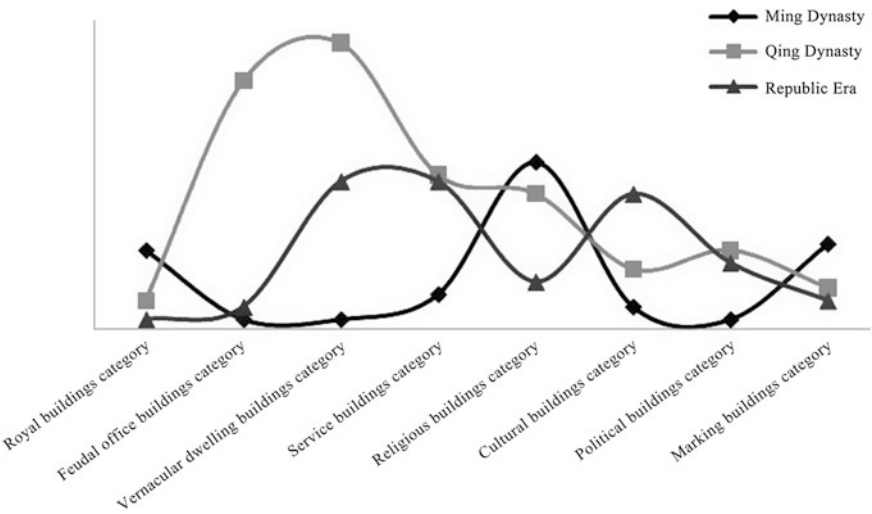

Fig. 2.5 Correlation between the statistical distributions of historic buildings in Beijing's inner city according to their historical functions and construction ages (*Source* Drawing by Ming Jiang)

Dynasty greatly influenced the urban planning and development of Beijing. The existing historical buildings built during the Qing Dynasty are mainly the vernacular dwelling buildings, the feudal office buildings, the service buildings, the cultural buildings and the political buildings. The Qing Dynasty witnessed the development of urban architecture flourishing in Beijing; from the Eight Banners' mansions and imperial mansions in the initial stage of the Qing, to the prosperity of business in the middle stage and further to the emergence of the political buildings for managing foreign affairs in the late Qing Dynasty, this dynasty set the tone for Beijing's urban architecture. Historical buildings from the Republic Era are mainly the vernacular dwelling buildings, the service buildings and the cultural buildings owing to the development of cultural industry triggered by the New Culture Movement in 1919 and the emergence of new ideas.

2.1.3 Historic Relic Grade

The selected historical buildings were rated according to six grades, including World Cultural Heritage, National Heritage Conservative Units, Municipal Heritage Conservative Units, District Heritage Conservative Units, Excellent Architecture in modern China (1840–1949), in accordance with the rating results published on the official Website of the Beijing Municipal Administration of Cultural Heritage (http://www.bjww.gov.cn/index.html). The statistical diagram (Fig. 2.6) shows that the Municipal Heritage Conservative Units account for the greatest proportion, approximately 38 %, followed by unlisted ones at approximately 24 %, the District Heritage Conservative Units at 19 %, the National Heritage Conservative Units at 8 % and the World Cultural Heritages at 1 %. In the inner city, historical buildings with the label of Municipal Heritage Conservative Unit comprise a large proportion so that it is a historical vocation to preserve these buildings and explore memories.

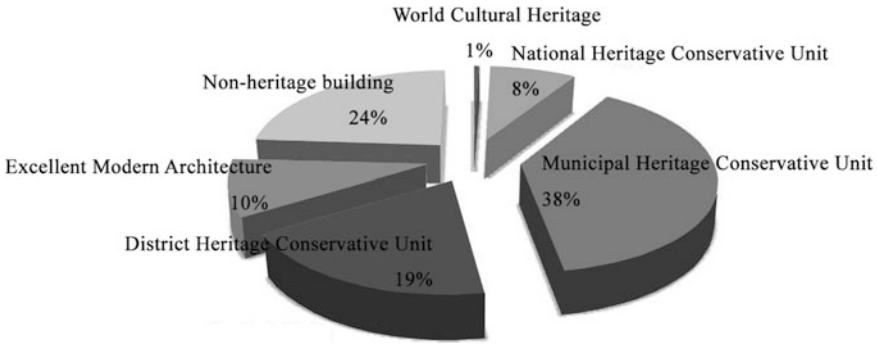

Fig. 2.6 Diagram of historical relic grade statistics of historic buildings in Beijing's inner city (*Source* Drawing by Ming Jiang)

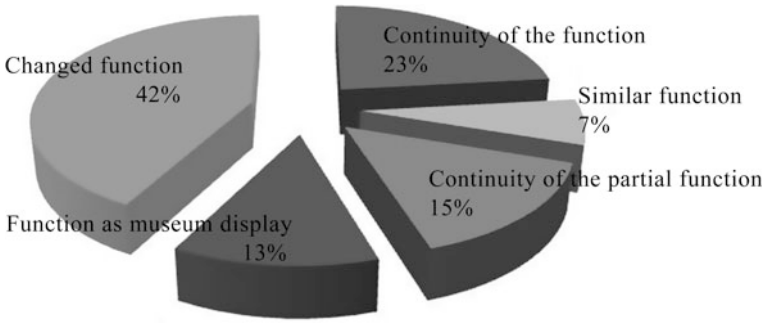

Fig. 2.7 Diagram of function statistics of historic buildings in Beijing's inner city (*Source* Drawing by Ming Jiang)

2.1.4 Functional Change

The functions have changed for most of the historic buildings surviving today in Beijing's inner city (Fig. 2.7). Forty-two percent of them now have totally different functions. Fifteen percent of them, although have abandoned their original functions, bear such characteristics of the past as name and usage; as can be seen in the case of the Gongjian Ice Cellar, once a facility exclusively for the royalty but now having evolved into the Royal Ice Cellar Restaurant. Some clear clues can be found despite the changes in purposes. Seven percent of them have similar functions to those of their past. A case in point is the Ancient Books branch of the National Library of China, which originally was the Beiping Library. There have been no changes for 23 % of the historic buildings in function. Another 13 % have become museums for demonstration and education to preserve their original memories better.

Based on the classification of their historic functions (Fig. 2.8), the memory circulation of religious buildings lasts longest because faith is passed on from generation to generation. Regarding service buildings for commercial and public interests, their fundamental functions will not change because many former and famous enterprises have endured the passing of time. The memory circulation for vernacular dwelling buildings is not very impressive, but some memory segments can always manage to survive by word of mouth for people to recall their past. It is common that memories fade with time, particularly in imperial and prestigious family mansions. Museums are perhaps the most common means of preserving memories. For such distinctive buildings as royal and marking buildings, the establishment of museums can preserve massive amounts of historical materials and, at the same time, provide education and promotion. Beijing's concentrated and dense historic buildings left to function as museums are limited. It is unnecessary

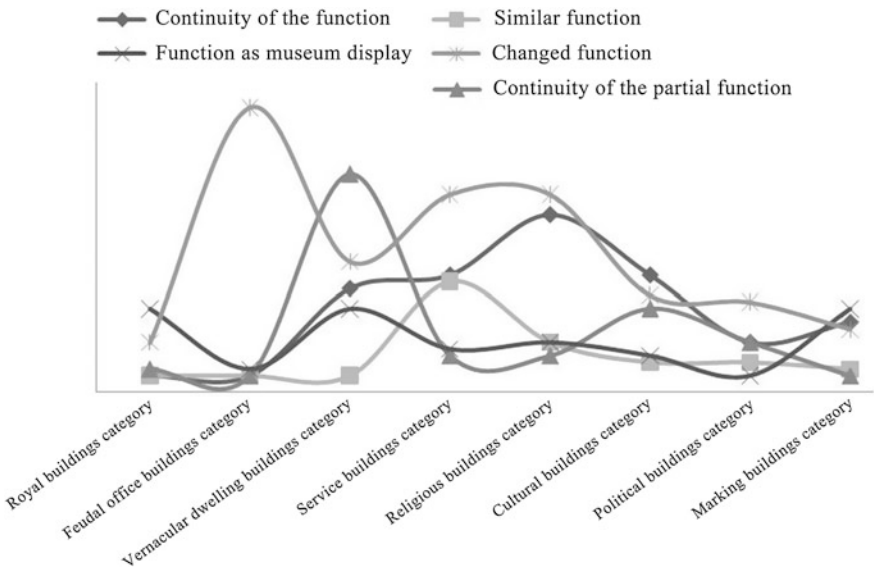

Fig. 2.8 Correlation between the statistical distributions of historic buildings in Beijing's inner city according to their historical functions and changes in function (*Source* Drawing by Ming Jiang)

and not worthwhile to build a museum for every single historical building because the establishment of museums cannot guarantee the preservation of memory. Finding a way for people to connect actively to the past and to promote the historic culture of the cities is an important task for us. Notes are as follows.

① The 345 historic buildings selected cannot represent all of the historic buildings in Beijing's inner city. Every brick can tell a part of history for as ancient a capital as Beijing. The selection of the historic buildings is mainly based on historic preservation lists of Beijing at all levels, books and reference materials on ancient buildings of Beijing and on-site surveys by our group. The selection standard is the existence of the building that bears the historic significance and historic function. Cultural and non-cultural protection buildings are both included.
② The classification method that this research employed might not have universal meaning in scientific and referential nature. However, classification study is not an either-or science: different people might adopt their own classification methods. The focus of this research is not the classification itself but a differential study and comparison of these historic buildings.

2.2 Design Research and Investigation Process

2.2.1 Research Object

The research objects consist of historic buildings in Beijing's inner city. The historic buildings were selected from the following:

① Ancient buildings map of Beijing
② National Heritage Conservative Units
③ Beijing Municipal Heritage Conservative Units
④ Beijing Excellent Architecture in modern China (1840–1949) Units (first batch).

This research selected historic buildings based on proportional sampling of the stratified sampling, combined with the expert screening method. Stratified sampling is an accurate counting method for sample investigation (Gao 2010). It is the process of dividing members of the population into homogeneous subgroups before sampling. The strata should be mutually exclusive: every element in the population must be assigned to only one stratum. Then, simple random sampling or systematic sampling is applied within each stratum (Lin and Wu 2010). The principles of the screening method employed by experts include that the buildings selected can cover every category in spatial characteristics, temporal characteristics and functional features, thus demonstrating typicalness and representativeness. Based on the basic information of the selected 345 historic buildings within the domain of Beijing City, three two-dimensional information tables were drawn as a reference for selection: temporal–spatial characteristics (Table 2.1), function–temporal characteristics (Table 2.2), and functional–spatial characteristics (Table 2.3).

Sample points and the size of every stratified sampling are selected based on proportional sampling of the stratified sampling.

According to the formula of the proportionate sampling, the proportion of the sample capacity (n_i) of every stratified sampling in all of the units (N_i) is equal, that is, equal to the sample capacity (n) in the total size (N) (Sun 1998).

$$\frac{n_1}{N_1} = \frac{n_2}{N_2} = \cdots \frac{n_k}{N_k} = \frac{n}{N}$$

Therefore, we can determine the sample capacity of every stratified sampling:

$$n_i = \frac{N_i}{N} \times n \tag{2.1}$$

Formula 2.1: Calculation of the sample capacity with proportions

We established 24 on-site investigation areas (Table 2.4), and in every area, 20 questionnaires were distributed in line with the formula of the proportionate sampling and the expert screening method, and we made appropriate adjustments according to the complexity of the research, ensuring that the number of the questionnaires covering each category reaches 35, and each subcategory numbers 5.

Table 2.1 Statistical table of the temporal–spatial characteristics of historic buildings in Beijing's inner city

Temporal characteristics	Imperial city/axes/boundary	Xicheng district			Dongcheng district		
		Former Xicheng district	Former Xuangwu district	Total	Former Dongcheng district	Former Chongwen district	Total
Yuan Dynasty and earlier	4	9	3	12	5	1	6
Ming and Qing Dynasties	30	53	39	92	70	14	84
Republic Era	11	15	16	31	40	2	42
Contemporary China (1949–)	5	10	5	15	11	2	13
Sub-total	50	87	63	150	126	19	145
Total	50	150			145		

Table 2.2 Statistical table of the functional–temporal characteristics of historic buildings in Beijing's inner city

Functional features		Temporal characteristics (construction age)					Sub-total	Total
Category	Subcategory	Yuan Dynasty and earlier	Ming Dynasty	Qing Dynasty	Republic Era	Modern		
Royal buildings	Imperial palaces	2	2	1	0	0	5	16
	Imperial festival buildings	0	7	0	0	0	7	
	Imperial living buildings	0	2	2	0	0	4	
	Sub-total	2	11	3	0	0	16	
Feudal office buildings	Imperial mansions	0	0	37	1	0	38	41
	Government office buildings	1	0	1	0	1	3	
	Sub-total	1	0	38	1	1	41	
Cultural buildings	Cultural and educational buildings	2	2	4	17	5	30	42
	Cultural and entertainment buildings	0	0	4	3	5	12	
	Sub-total	2	2	8	20	10	42	
Service buildings	Public service buildings	1	4	8	2	3	18	63
	Commercial service buildings	1	0	15	20	9	45	
	Sub-total	2	4	23	22	12	63	
Political buildings	Buildings for managing foreign affairs	0	0	11	4	0	15	
	Administrative buildings	0	0	0	5	3	8	23
	Sub-total	0	0	11	9	3	23	

(continued)

Table 2.2 (continued)

Functional features		Temporal characteristics (construction age)					Sub-total	Total
Category	Subcategory	Yuan Dynasty and earlier	Ming Dynasty	Qing Dynasty	Republic Era	Modern		
Vernacular dwelling buildings	Common residences	0	0	13	6	3	22	70
	Former residences of celebrities	0	0	31	16	1	48	
	Sub-total	0	0	44	22	4	70	
Religious buildings	Home-grown religious buildings	8	23	17	0	1	49	64
	Foreign-origin religious buildings	3	2	3	6	1	15	
	Sub-total	11	25	20	6	2	64	
Marking buildings	Landmark buildings	3	8	2	2	2	17	26
	Commemorative buildings	1	4	3	1	0	9	
	Subtotal	4	12	5	3	2	26	
Total	Historic buildings	22	54	152	84	33	345	345

Table 2.3 Statistical table of the functional–spatial characteristics of historic buildings within the domain of Beijing

Functional features		Temporal characteristics (construction age)					Sub-total	Total
Category	Subcategory	Imperial city/axes/boundary	Former Xicheng district	Former Xuanwu district	Former Dongcheng district	Former Chongwen district		
Royal buildings	Imperial palaces	4	0	1	0	0	5	16
	Imperial festival buildings	3	1	2	0	1	7	
	Imperial living buildings	4	0	0	0	0	4	
	Sub-total	11	1	3	0	1	16	
Feudal office buildings	Imperial mansions	0	18	0	20	0	38	41
	Government office buildings	0	1	0	2	0	3	
	Sub-total	0	19	0	22	0	41	
Cultural buildings	Cultural and educational buildings	7	9	5	7	2	30	42
	Cultural and entertainment buildings	2	3	4	1	2	12	
	Sub-total	9	12	9	8	4	42	
Service buildings	Public service buildings	0	5	6	6	1	18	63
	Commercial service buildings	2	3	25	15	0	45	
	Sub-total	2	8	31	21	1	63	

(continued)

Table 2.3 (continued)

Functional features		Temporal characteristics (construction age)					Sub-total	Total
Category	Subcategory	Imperial city/axes/boundary	Former Xicheng district	Former Xuanwu district	Former Dongcheng district	Former Chongwen district		
Political buildings	Buildings for managing foreign affairs	0	0	0	15	0	15	
	Administrative buildings	2	2	2	2	0	8	23
	Sub-total	2	2	2	17	0	23	
Vernacular dwelling buildings	Common residences	0	7	1	13	1	22	70
	Former residences of celebrities	3	7	8	28	2	48	
	Sub-total	3	14	9	41	3	70	
Religious buildings	Home-grown religious buildings	10	22	6	6	5	49	64
	Foreign-origin religious buildings	1	3	2	7	2	15	
	Sub-total	11	25	8	13	7	64	
Marking buildings	Landmark buildings	11	3	0	1	2	17	26
	Commemorative buildings	1	3	1	3	1	9	
	Subtotal	12	6	1	4	3	26	
Total	Historic buildings	50	87	63	126	19	345	345

Table 2.4 Classification table of historic buildings in Beijing's inner city

Category	Subcategory	Number of buildings	Number of investigation spots
Royal buildings	Imperial palaces	5	1
	Imperial festival buildings	7	1
	Imperial living buildings	4	0
Feudal office buildings	Imperial mansions	38	3
	Government office buildings	3	0
Cultural buildings	Cultural and educational buildings	30	2
	Cultural and entertainment buildings	12	1
Service buildings	Public service buildings	18	1
	Commercial service buildings	45	3
Political buildings	Buildings for managing foreign affairs	15	1
	Administrative buildings	8	1
Vernacular dwelling buildings	Common residences	22	1
	Former residences of celebrities	48	3
Religious buildings	Home-grown religious buildings	49	3
	Foreign-origin religious buildings	15	1
Marking buildings	Landmark buildings	17	1
	Commemorative buildings	9	1
Total	Historic buildings	345	24

This study has considered the following factors when selecting the buildings. (1) For temporal characteristics, that is, construction age we devised four periods: the Yuan Dynasty and earlier, the Ming Dynasty, the Qing Dynasty, the Republic Era, and contemporary China (1949–). (2) Spatial characteristics, that is, the spatial location: The historic buildings we selected are scattered within the domain of Beijing City. (3) The opinion of the experts was that the buildings we select should be typical and representative. (4) We also considered functional features. The number of imperial living buildings and government office buildings is small so they are not listed as the investigation areas. Finally, we decided on 28 sampling spots for historic buildings (and 10 online investigations), as shown in Table 2.5. In total, the buildings we selected covered almost all 8 categories and 15 of 17 subcategories. Research on the urban memory of historic buildings represented by these 28 buildings within the domain of Beijing City was subsequently undertaken.

Table 2.5 Sample table of historic buildings in Beijing's inner city

Category	Subcategory	Number of buildings	Number of investigation buildings	On-site research spots	Online research spots
Royal buildings	Imperial palaces	5	1	Forbidden City (Palace Museum), Jingshan Mountain	Forbidden City (Palace Museum)
	Imperial festival buildings	7	1	Temple of Heaven, Imperial Ancestral Temple	Temple of Heaven, the Imperial Ancestral Temple
	Imperial living buildings	4	0	0	0
Feudal office buildings	Imperial mansions	38	3	Princess Mansion, Mansion of Princess Hejing, Prince Kung Mansion	Prince Kung Mansion, Kuijun Mansion
	Government office buildings	3	0	0	0
Cultural buildings	Cultural and educational buildings	30	2	Imperial College, Confucian Temple, Shuntianfu School	Confucian Temple, the Imperial College, Beijing National History Museum
	Cultural and entertainment buildings	12	1	National Centre for the Performing Arts	National Centre for the Performing Arts, Daguanyuan Garden
Service buildings	Public service buildings	18	1	Huguang Guild Hall, Site of the French Post Office	Huguang Guild Hall
	Commercial service buildings	45	3	Dashilar Commercial Buildings, Beijing Hotel, Citibank Site	Dashilar Commercial Buildings, Beijing Hotel, Minzu Hotel
Political buildings	Buildings for managing foreign affairs	15	1	Embassy Group of Beijing Legation Street	Embassy Group of Beijing Legation Street
	Administrative buildings	8	1	Former Site of the Duan Qirui Government	Great Hall of the People

(continued)

Table 2.5 (continued)

Category	Subcategory	Number of buildings	Number of investigation buildings	On-site research spots	Online research spots
Vernacular dwelling buildings	Common residences	22	1	New courtyard house of Ju'er Hutong	New courtyard house of Ju'er Hutong
	Former residences of celebrities	48	3	Former Residence of Song Ching-ling, Former Residence of Mao Dun, Former Residence of Chen Duxiu	Former Residence of Song Ching-ling
Religious buildings	Home-grown religious buildings	49	3	Fayuan Temple, Lama Temple	Lama Temple, Fayuan Temple, Huguo Temple
	Foreign-origin religious buildings	15	1	Niujie Mosque	Niujie Mosque, Church of the Saviour
Landmark buildings	Landmark buildings	17	1	Zhengyang Gate, Desheng Gate	Towers of Bell and Drum, Zhengyang Gate, Tian'an Men
	Commemorative buildings	9	1	Wen Tianxiang Shrine	Wen Tianxiang Shrine, Yuan Chonghuan Shrine
Total	Historic buildings	345	24	28 on-site research spots	28 online research spots, 10 additional research spots

2.2.2 Model Construction

Based on the OST model of urban memory in Chap. 1, we performed a deep analysis of the model construction, combined with the research object, i.e., historic buildings.

(1) **Object–Time (O–T)**

About the elements of "Object–Time", outside-of-scene memory is involved. Time and object form a basic framework of site experience and can bring people pictorialized memory about a particular scene.

Memory usually appears in people's mind in scenarized images (Downing 2000). In the book *On Collective Memory*, Halbwachs (1992) reported that memory is scenarized and can surface suddenly by accident through the spatial arrangement of the city and site. Scenarized factors fully embody the impact on subjective memory of the objective materials in the external environment (Boyer 1996).

Based on the scenarized memory theory, we summarize the elements forming outside-of-scene memory into 17 observational variables. Those variables include one regarding external space and its combination of features reflecting historic buildings—geographical location, peripheral environment, style unification, etc.; the variable that reflects the characteristics of the historic buildings—construction age, architectural scales, architectural type, exterior appearance and color, structural and technical designs, construction applications, historical relic grades, historical relic value, historical function, preservation status, etc.; and also includes such aggregative indicators as the overall perception, functional changes, traveling impressions, geographical indications, etc. Object–Time memory reflects deep perception, scenes in sight and comprehensive connections of the people to the objective property of the historic buildings.

(2) **Time–Subject (T–S)**

About the elements of "Time–Subject", symbolic connotation memory is involved. The deepening of memory occurs with time and the processing of people's feelings. Signified memory can offer a process for revaluation and discovery.

Memory and a series of symbol signs are closely interconnected. The image and scene formed in the process of memory can not only recover and pass on information and generate emotion but can also rediscover the meaning of internalized things for people. Marcel Proust (2006) expounded clearly and at length on this idea in his book *Remembrance of Things Past*, that is, the significance of memory does not rely on unconscious recall (in search of the past) and experience alone, and more importantly, on the study of signs (identity).

The elements of Time–Subject place additional emphasis on the memory formed by the existing knowledge and experience about an object, which is the dynamic function of the memory generated by the subject's knowledge and experience with outside information. We summarize the elements of Time–Subject memory as 18 observational variables, which include the marking of symbolization such as

building name replacements and the remaining place names, as well as the stories and clues derived from the historic buildings, such as the literal materials, audio-visual materials, dictated materials, stories and legends and literary works, and the people's feelings and recording modes, such as Travelling notes, photographic records, souvenirs, experience narrations, scenes in sight, knowledge learning, atmosphere feelings and sign interpretations. Iconic identification and cultural features of the historic buildings can help to promote the memory of subject cognition. Time–Subject emphasizes the stories and clues derived from names, identifications and signs, and it also emphasizes people's thinking, methods and the results of coding of the historic buildings.

(3) **Object–Subject (O–S)**

About the elements of "Object–Subject", feeling and experience memory is involved. People integrate a particular site, forming stable behavioral patterns and habits during the experiment after the customary and repeated conduction.

According to the theories of psychology, to allow information in the sensory memory into the short-term memory, the active participation of people is needed (Yang et al. 2012). During the experience, the subject of urban memory can have a more direct and real impact on the object of urban memory. Moreover, the experience can even help the subject to form a stable behavioral pattern and habits and transmit the object of urban memory. In his book *How Societies Remember*, Paul Connerton (1989) demonstrated in detail the two non-textual and non-cognitive styles: physical practices and commemorative ceremonies.

This study views the way that memory results in the experiencing of feelings as one of the factors in evaluating the subject's effect on memory processes toward historic buildings, placing additional emphasis on the importance of the physical actions of the subject. We divide the elements constituting the feeling and experience memory into 18 observational variables, including indictors such as visit and sightseeing, shopping, religious worship, cuisine tasting, leisure and sports, performance watching, activity participation, other activities and activity spaces, and the memory process of evaluating whether there have been colorful athletic events and sufficient activity space to be satisfied with the direct experience. The observational variables also include on-site findings, guider's interpretations, browsing through materials, image association, story association, guide signs and mental feelings, as well as whether the subject can successfully connect the memory object and the way and path of that connection. Memory can deepen by frequent and diversified experience.

The study summarizes the elements of urban memory with three memory composition models—Object–Time memory, Time–Subject memory and Object–Subject memory—and it elaborates the observational variables of every memory model (Table 2.6). These variables are the fundamental assumptions of the questionnaires. Further revision and deletion are needed to obtain more accurate variables forming urban memory through factor analysis.

Table 2.6 Statistical table of the model and observational variables of urban memory

Memory model	Observational variables
Object–Time (O–T)	(1) Geographical location; (2) peripheral environment; (3) style unification; (4) construction age; (5) architectural type; (6) architectural scale; (7) historical relic grade; (8) historical function; (9) preservation; (10) overall perception; (11) exterior appearance and color; (12) structural and technical design; (13) construction application; (14) historical relic value; (15) functional change; (16) impression formation; (17) geographical indication
Time–Subject (T–S)	(1) Name replacement; (2) remaining place name; (3) iconic identification; (4) cultural feature; (5) story and legend; (6) audiovisual materials; (7) literal material; (8) literary works; (9) dictated material; (10) traveling note; (11) photographic record; (12) souvenir; (13) experience narration; (14) scene insight; (15) sign interpretation; (16) knowledge learning; (17) atmosphere feeling
Object–Subject (O–S)	(1) Guide sign; (2) mental feeling; (3) on-site finding; (4) activity participation; (5) guider's interpretation; (6) browsing through materials; (7) visit and sightseeing; (8) shopping; (9) religious worship; (10) cuisine tasting; (11) performance watching; (12) image association; (13) story association; (14) leisure and sports; (15) other activities; (16) activity space

2.2.3 Questionnaire Design and Investigation Methods

(1) **Questionnaire design**

According to the established urban memory component model in the segment above, using the questionnaire on urban memory of historic buildings in Beijing's inner city, research and investigation were performed to collect metrical data. To reduce errors in the questionnaire investigation, the design of the questions was accommodated to popularization to the greatest extent, in an attempt not to cause semantic deviations in its meaning. The overwhelming majority of questions on this questionnaire used a Likert scale (ranging from 1 to 5), with 1 indicating the worst evaluation, 2 a negative evaluation, 3 a moderate evaluation, 4 a positive evaluation, and 5 the best evaluation for the convenience of conducting correlation analysis. The following section is a brief analysis to the questionnaire design.

The question part of this questionnaire mainly included the variable part of the three main bodies—Object–Time, Time–Subject, Object–Subject—as well as a question part to collect information.

(2) **Questionnaire execution**

When the questionnaire was created, ten experts were found to conduct an in-depth interview and meticulous filtration of the investigation cases, as well as the collection of suggestions for the questionnaire design on 22–25 March, 2010 on the basis of which the questionnaire was modified and was greatly approved by others. Thereafter, the questionnaire investigation proceeded in the places where cases

were last chosen. The questionnaire was conducted by two means: field questionnaire and website questionnaire. The field questionnaire was proceeded by stratified sampling, while the website questionnaire used the Sojump Investigation Network (http://www.sojump.com/) as the investigation platform to supplement the investigation.

The questionnaire investigation procedure was divided into three stages: the preliminary investigation stage, formal investigation stage and supplementary investigation stage. The preliminary investigation was launched on 26–29 March 2010, for 3 days; the time of the formal investigation was from 30 March to 10 April. The temporal distribution considered weekends, weekdays and minor vacations, and the site distribution of the paper questionnaires was given priority. The supplementary questionnaire investigation was performed between 11 and 13 April 2010 by the conjunctive means of a website investigation and field research to solve the problem of an insufficient number of questionnaires in certain single case field.

The questionnaires were distributed in a total of 477, among which the paper questionnaires numbered 322, and electronic ones numbered 155. There were a total of 28 field research spots chosen and 10 investigation spots supplemented by e-questionnaires. A total of 454 valid questionnaires were returned in total, for a validity ratio of 95.2 % (Table 2.7).

(3) **Data processing**

The operational data processing softwares used were Excel 2007 and SPSS 13.0 for Windows. The data processing method mainly included: (1) utilizing Excel 2007 to perform descriptive statistics of the historic buildings' features and the population characteristics of the questionnaire samples; (2) conducting modeling construction and calculation, ensuring the quantitative relationships and quantitative classification by means of questionnaire grading; (3) utilizing SPSS software, version 13.0, to perform factor analysis, as well as Pearson's correlation analysis, analysis of variance, and curvilinear regression analysis; and (4) fuzzy evaluation, weighting and constructing matrices by experts and conducting variance operation to obtain fuzzy evaluation characteristic values.

2.3 Survey Results

2.3.1 Descriptive Statistics of the Investigation Data

(1) **The spatial characteristics distribution of questionnaires**

① *The quantitative distribution of questionnaires*: Sample points of 345 historic buildings in Beijing's inner city were selected to distribute questionnaires. Among the 454 valid questionnaires returned, the sample range covered eight representative

Table 2.7 Statistical table on the stratified sampling questionnaire of historic buildings in Beijing's inner city

Category	Subcategory	Number of buildings	Number of investigation buildings	Number of on-site questionnaires	On-site research spots	Number of online questionnaires	Online research spots	Total	Number of effective questionnaires
Royal buildings	Imperial palaces	5	1	6	Forbidden City (Palace Museum), Jingshan Hill	21	Forbidden City (Palace Museum)	27	26
	Imperial festival buildings	7	1	2	Temple of Heaven, Imperial Ancestral Temple	18	Temple of Heaven, Imperial Ancestral Temple	20	20
	Imperial living buildings	4	0	0	0	0	0	0	0
Feudal office buildings	Imperial mansions	38	3	29	Princess Mansion, Mansion of Princess Hejing, Prince Kung Mansion	21	Prince Kung Mansion, Kuijun Mansion	50	47
	Government office buildings	3	0	0	0	0	0	0	0

(continued)

Table 2.7 (continued)

Category	Subcategory	Number of buildings	Number of investigation buildings	Number of on-site questionnaires	On-site research spots	Number of online questionnaires	Online research spots	Total	Number of effective questionnaires
Cultural buildings	Cultural and educational buildings	30	2	39	Imperial College, Confucian Temple, Shuntianfu School	7	Confucian Temple, Imperial College, History Museum	46	45
	Cultural and entertainment buildings	12	1	3	National Centre for the Performing Arts	13	National Centre for the Performing Arts, Daguanyuan Garden	16	16
Service buildings	Public service buildings	18	1	16	Huguang Guild Hall, Site of France Post Office	2	Huguang Guild Hall	18	18
	Commercial service buildings	45	3	35	Dashilar Commercial Buildings, Beijing Hotel, Citibank Site	13	Dashilar Commercial Buildings, Beijing Hotel, Minzu Hotel	48	48
Political buildings	Buildings for managing foreign affairs	15	1	21	Embassy Group of Beijing Legation Street	2	Embassy Group of Beijing Legation Street	23	23
	Administrative buildings	8	1	10	Former Site of the Duan Qirui Government	3	Great Hall of the People	13	13

(continued)

Table 2.7 (continued)

Category	Subcategory	Number of buildings	Number of investigation buildings	Number of on-site questionnaires	On-site research spots	Number of online questionnaires	Online research spots	Total	Number of effective questionnaires
Vernacular dwelling buildings	Common residences	22	1	22	New courtyard house of Ju'er Hutong	1	New courtyard house of Ju'er Hutong	23	22
	Former residences of celebrities	48	3	66	Former Residences of Soong Ching-ling, Mao Dun, and Guo Moruo	5	Former Residence of Soong Ching-ling	71	65
Religious buildings	Home-grown religious buildings	49	3	27	Fayuan Temple, Lama Temple	20	Lama Temple, Fayuan Temple, Huguo Temple	47	44
	Foreign-origin religious buildings	15	1	22	Niujie Mosque	3	Niujie Mosque, Xishiku Church	25	22
Marking buildings	Landmark buildings	17	1	20	Zhegyang Gate, Desheng Gate	20	Towers of Bell and Drum, Zhengyang Gate, Tian'an Men	40	40
	Commemorative buildings	9	1	3	Wen Tianxiang Shrine	2	Wen Tianxiang Shrine, Yuan Chonghuan Shrine	5	5

(continued)

Table 2.7 (continued)

Category	Subcategory	Number of buildings	Number of investigation buildings	Number of on-site questionnaires	On-site research spots	Number of online questionnaires	Online research spots	Total	Number of effective questionnaires
Others	Other buildings	–	–	1	–	5	–	6	0
Total	Historic buildings	345	24	322	On-site research spots 28	155	Online research spots 28, supplementary spots 10	477	454

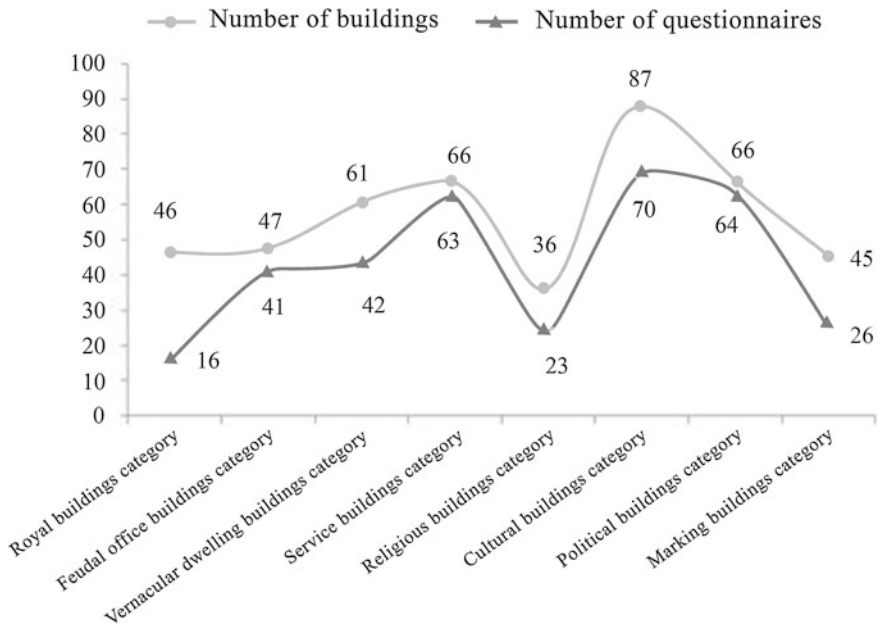

Fig. 2.9 Distribution diagram of the number of samples according to their historical functions (*Source* Drawing by Ming Jiang)

historic building categories of Beijing's inner city, ensuring that the number of buildings classified by function had the same proportional relationship as the number of questionnaires and a very high degree of curve fitting. The number of each type of questionnaires reached the fundamental statistical standard of being greater than 35 (Fig. 2.9).

② *The spatial distribution of samples*: Eight categories, including 28 representative historic buildings, were chosen to be investigated and were researched in the field investigation samples. These historic buildings were equally distributed in four regions: the imperial city, central axes, city walls and inner city. The setting of the investigated points, to the greatest extent, considered rationality, representativeness and accessibility, while ten investigated spots of historic buildings were added through online open-ended questionnaires (Fig. 2.10).

(2) **Population characteristics of questionnaires**

The statistics of the respondents' demographic characteristics were performed first, as well as a brief descriptive analysis to the variable structure of the scale (Table 2.8).

According to the 454 shares of valid sample data attained from the questionnaire survey, the demographic features could be summarized as follows.

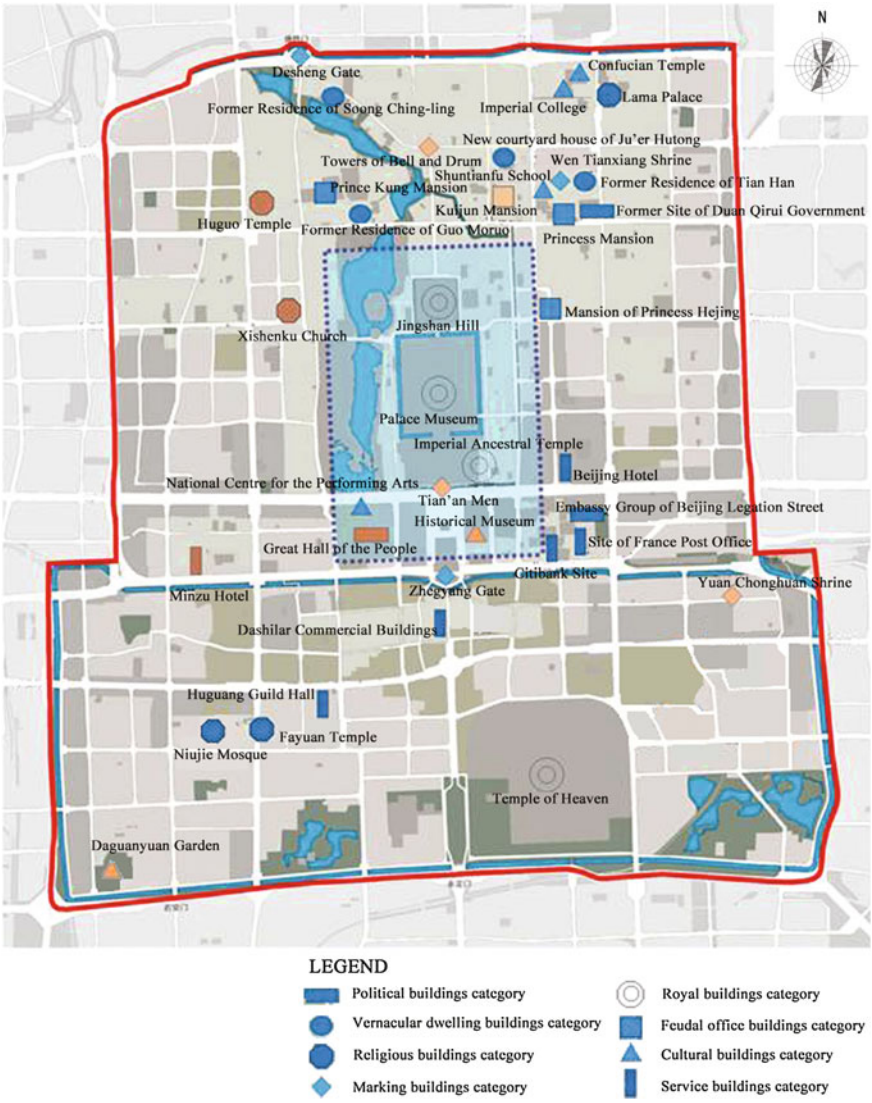

Fig. 2.10 Distribution diagram of the number of investigation spots. The *yellow marks* indicate the supplemented investigated sites online (*Source* Drawing by Ming Jiang)

① *Gender structure*: The gender structure of the samples was basically flat.
② *Age structure*: The age samples were of non-uniform distribution. On the one hand, the distribution of social demographic ages in Beijing was young- and middle-aged-oriented currently; on the other hand, a certain portion of website questionnaires were distributed in this investigation survey, so the young generation was in an absolutely dominant position due to its frequent contact with the internet,

Table 2.8 Analysis of fundamental structural features of the sample data

	Comparative items	Number	%
Gender	1. Male	210	46.3
	2. Female	244	53.7
Age	1. Younger than 20 years old	42	9
	2. 21–30 years old	264	58
	3. 31–40 years old	69	15
	4. 41–50 years old	41	9
	5. 51–60 years old	25	6
	6. 60 years old	13	3
Education status	1. Junior high school or less	25	5
	2. Senior high school or technical secondary school	48	11
	3. Junior college	57	13
	4. Bachelor	186	41
	5. Master	119	26
	6. Doctor or above	19	4
Income	1. Less than 1,000 yuan	159	35
	2. 1,001–3,000 yuan	131	29
	3. 3,001–5,000 yuan	95	21
	4. 5,001–8,000 yuan	46	10
	5. More than 8,000 yuan	23	5
Profession	1. Company employee	110	24
	2. Technician	57	13
	3. Teacher	29	6
	4. Civil servant	28	6
	5. Individual management	24	5
	6. Worker	12	3
	7. Solider	7	2
	8. Peasant	6	1
	9. Student	162	36
	10. Retiree	19	4
Duration of residence in Beijing	1. Less than 1 year	108	24
	2. 1–3 years	84	18
	3. 3–5 years	77	17
	4. 5–10 years	84	19
	5. More than 10 years	102	22

Note The gross sample is 454

which was one of the deficiencies of website investigations and surveys. Young and middle-aged people who played a very significant role in continuing and developing urban memory were the focus group in this urban memory research. Therefore, the age distribution of this sample could be accepted.

③ *Educational structure*: The sampling results showed that the educational background was slightly high, and the people who had bachelor's degree or more education were more than half, which was slightly higher than the actual educational status of today's society. However, considering the research project of historic buildings on which urban memory was borne, the research itself required a certain ability to be understood, so it was normal that the educational status was a slightly high.
④ *Income structure*: The income structure distribution of the samples basically conformed to the pyramid structure of income, showing that people with low and medium income accounted for the great majority, while people with medium and high incomes were fewer. Otherwise, some of the respondents refused to reveal their whole incomes, which might be why the high-income groups were comparatively smaller.
⑤ *Professional structure*: From the aspect of professional structure, students and company employees accounted for the dominant position, which conformed to the age structure as well, while it was relevant to the high degree of compatibility of students.
⑥ *Duration of residence in Beijing*: The samples came from newcomers who had resided in Beijing for less than a year to the old tenants who had resided in Beijing for more than 10 years, so the samples' proportions were uniformly distributed.

2.3.2 Analysis of the Constitutive Elements

To realize the comprehensiveness of the research as much as possible and to achieve the overall measurement of various influential factors of the urban memory of historic buildings, 50 observational variables were established in the stage of research and design, aimed at the constitutive elements of urban memory of historic buildings, but there might have been a strong relationship among individual variables, resulting in the inaccuracy of statistical analysis. Thus, we studied the dependence relationship between these 50 variables through factor analysis, deleted variances and extracted the data structure denoted by several factors to reflect accurately the important information denoted by numerous observational variables.

(1) **Test for the factor elements**

① Test for factor analysis applicability

Before starting factor analysis, KMO and Bartlett's test of sphericity were first conducted. Using SPSS, the KMO numerical value of fifty observational variables was calculated as 0.848 (Table 2.9). On the basis of KMO docimastic theory, when

Table 2.9 KMO and Bartlett's test

Kaiser–Meyer–Olkin measure of sampling Adequacy		0.848
Bartlett's test of sphericity	Approx. Chi-Square	7333.497
	Df	1225
	Sig.	0.000

the numerical value of KMO is less than 0.5, the PCA (principal component analysis) is unfit to be performed; when greater than 0.6, it indicates a "mediocre effect"; when greater than 0.7, it indicates "moderately suitable"; and when greater than 0.8, it indicates "sound effect".[2] Because the KMO numerical value of the current data was greater than 0.8, it was quite suitable for PCA (principal component analysis). According to Bartlett's test results[3] ($P \leq 0$), the test for the applicability of factor analysis was passed.

② The deletion and extraction of factors

Factor analysis was conducted on the basis of 454 pieces of sample data by means of PCA (principal component analysis). Transforming these 50 original variables into another group of irrelevant variables by active transformation, these variables were then ranked in successively diminishing sequences of variance, choosing the principal components with characteristic values equal to or greater than 1 as initial factors and omitting the principal elements with characteristic values less than 1 to guarantee that the retained common factor could at least explain the variance of one variable. From the aspect of characteristic root and accumulated variance contribution rates in Table 2.10, the contribution rate of the first 15 factors was 62.917 %. The Scree plot (Fig. 2.11) also showed that the variation of the first 5 factors' characteristic value was the most obvious, and the first 15 factors represented the basic constitutional tendency of the diagram, while the afterward tendency tended to be stable. It indicates that these 15 factors play significant roles in describing the original variable attributes.

Factor rotation to the original 50 variables was performed by adopting variance maximum methods. We analyzed the loading numerical value in the rotated factor loading matrix, as in Table 2.11, and we extracted the observational variables with factor loadings greater than 0.5. Because the factor loadings of these eight factors, including historical relic grades, the overall perception, audiovisual materials, on-site findings, visit and sightseeing, religious pilgrimage and other activities, were less than 0.5, they were deleted.

Deletion was performed in the same manner six times, after which all of the variables with factor loading absolute values less than 0.5 or with differences between two factors less than 0.02 were all deleted. The KMO numerical value in each time was greater than 0.8, and each observational variable was explained by one factor. From the characteristic root and accumulated variance contribution rates

[2]The value of KMO measurement used to compare the relative sizes of simple correlation coefficient and partial correlation coefficient among the observational variables ranges from 0 to 1. Generally, the nearer it is to 1, the more suitable it is for observational variables to be conducted the factor analysis.

[3]Bartlett's test is a type of statistical test performing by taking the correlation coefficient matrix of variables as the starting point. If the statistical magnitude is greater, and the corresponding concomitant probability value is less than the significant level set by users, it could be decided that the correlation coefficient matrix is possibly not a unit matrix, so it is suitable to conduct factor analysis; otherwise, it is not.

Table 2.10 The characteristic root and accumulated variance contribution rate of factor analysis

	Initial characteristic root			Disjunction of common factor variance			Rotating common factor variance		
Principal component	Characteristic root	Variance (%)	Accumulated variance value (%)	Characteristic root	Variance (%)	Accumulated variance value (%)	Characteristic roots	Variance (%)	Accumulated variances value (%)
1	8.87664	17.7533	17.7533	8.87664	17.7533	17.7533	3.71112	7.42224	7.42224
2	3.0305	6.06101	23.8143	3.0305	6.06101	23.8143	3.69919	7.39838	14.8206
3	2.46695	4.9339	28.7482	2.46695	4.9339	28.7482	3.22073	6.44147	21.2621
4	2.22072	4.44145	33.1896	2.22072	4.44145	33.1896	2.60194	5.20388	26.466
5	1.80431	3.60863	36.7983	1.80431	3.60863	36.7983	2.36401	4.72802	31.194
6	1.65577	3.31154	40.1098	1.65577	3.31154	40.1098	2.14046	4.28091	35.4749
7	1.50228	3.00455	43.1144	1.50228	3.00455	43.1144	2.10116	4.20232	39.6772
8	1.46682	2.93364	46.048	1.46682	2.93364	46.048	1.7317	3.46339	43.1406
9	1.39642	2.79283	48.8408	1.39642	2.79283	48.8408	1.66944	3.33887	46.4795
10	1.34687	2.69375	51.5346	1.34687	2.69375	51.5346	1.55881	3.11763	49.5971
11	1.22026	2.44053	53.9751	1.22026	2.44053	53.9751	1.44698	2.89396	52.4911
12	1.20919	2.41837	56.3935	1.20919	2.41837	56.3935	1.43058	2.86116	55.3522
13	1.15921	2.31842	58.7119	1.15921	2.31842	58.7119	1.34253	2.68505	58.0373
14	1.07237	2.14475	60.8566	1.07237	2.14475	60.8566	1.29003	2.58007	60.6173
15	1.0302	2.0604	62.917	1.0302	2.0604	62.917	1.14985	2.29971	62.917

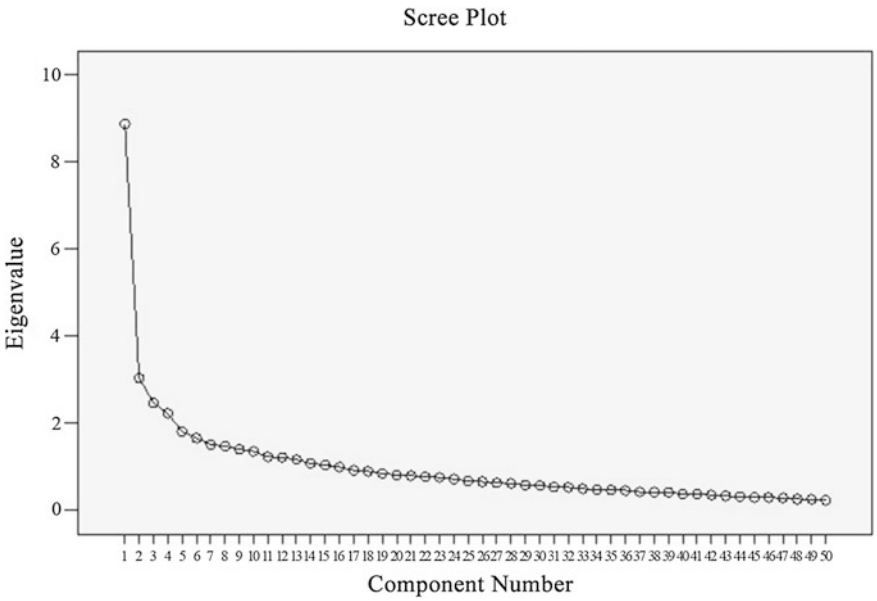

Fig. 2.11 Common factor scree plot of urban memory of historic buildings in Beijing's inner city (characteristic root is greater than 1) (*Source* Drawing by Ming Jiang)

in Table 2.12, the variance contribution rates of the first 9 factors of 29 observational variables remained in the end as high as 63.47 %. The reliability of the 29 variables was obviously enhanced (Table 2.13).

(2) **Model analysis based on factor analysis**

From the factor loading matrix of the 29 rotated observational variables, the meaning of the factors after rotation became clearer, and the unnecessary repeated variables were deleted. In addition, the real meanings of the majority of the variables were taken into account, and the variable models of urban memory were adjusted and amended. The level-two variables of nine principal components were nominated as well; thus, the level-three variables of urban memory models were at last produced (Table 2.14).

① Object–Time memory model

According to the results of factor analysis, Object–Time memory was composed of the first principal component, scene elements, including six observational variables (exterior appearance and color, structural and technical design, construction application, historical relic value, geographical indication, and impression formation), the second principal component, construction elements, including five observational variables (geographical location, construction age, architectural type, architectural scale, and historical function), and the eighth principal component, style elements, including two observational variables (preservation status and style

Table 2.11 Matrix of the factor loading after rotation (50 observational variables before deletion)

Observational variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Geographical location			0.6873												
Peripheral environment				0.5063											
Style unification								0.7695							
Construction age			0.631												
Architectural type			0.7002												
Architectural scale			0.7642												
~~Historic relic grade~~															
Historical function			0.5865												
Preservation status								0.6592							
~~Overall perception~~															
Exterior appearance and color	0.7139														
Structural and technical design	0.7573														
Construction application	0.6423														
Historical relic value	0.6864														
Story and legend	0.5296														
Functional change														0.5029	
Name replacement		0.6169													

(continued)

Table 2.11 (continued)

Observational variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Remaining place name						0.5886									
Iconic identification					0.529										
Cultural feature					0.5831										
Geographical indication						0.6904									
~~Audiovisual material~~															
Literal material		0.8058													
Literary works		0.7591													
Dictated material		0.7152													
Travelling note												0.6824			
~~Photographic record~~															
Souvenir									0.5921						
Experience narration											0.6776				
Scene in sight					0.7404										
Image association					0.6705										
Story association					0.5152										
Guide sign				0.5598											
Mental feeling				0.6365											
Travelling impression				0.6078											

(continued)

Table 2.11 (continued)

Observational variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
~~On-site finding~~															
Activity participation										0.7847					
Guider's interpretation													0.5361		
Sign interpretation							0.5579								
Browsing through material												0.7974			
~~Visit and sightseeing~~															
Shopping									0.7079						
~~Religious worship~~															
Cuisine tasting									0.7621						
Performance watching										0.7752					
Knowledge learning							0.6178								
Atmosphere feeling							0.6345								
Leisure and sports															0.8758
~~Other activities~~															
Activity space				0.5158											

Table 2.12 The characteristic root and accumulated variance contribution rate of factor analysis after deletion

	Initial characteristic root			Extracting common factor variance			Rotating common factor variance		
Principal component	Characteristic root	Variance (%)	Accumulated variance value (%)	Characteristic root	Variance (%)	Accumulated variance value (%)	Characteristic root	Variance (%)	Accumulated variance value (%)
1	6.270429	21.62217	21.62217	6.270429	21.62217	21.62217	3.29941	11.37728	11.37728
2	2.46514	8.500483	30.12265	2.46514	8.500483	30.12265	2.897143	9.99015	21.36743
3	1.814812	6.257972	36.38062	1.814812	6.257972	36.38062	2.560947	8.830852	30.19828
4	1.534899	5.292757	41.67338	1.534899	5.292757	41.67338	1.919352	6.618455	36.81673
5	1.460862	5.037455	46.71084	1.460862	5.037455	46.71084	1.755791	6.054451	42.87118
6	1.362661	4.69883	51.40967	1.362661	4.69883	51.40967	1.737477	5.9913	48.86248
7	1.299071	4.479555	55.88922	1.299071	4.479555	55.88922	1.454765	5.01643	53.87891
8	1.134515	3.91212	59.80134	1.134515	3.91212	59.80134	1.399731	4.826659	58.70557
9	1.065735	3.674948	63.47629	1.065735	3.674948	63.47629	1.383507	4.770714	63.47629

Table 2.13 Matrix of the factor loading after rotation (29 observational variables before deletion)

Observational variables	1	2	3	4	5	6	7	8	9
Exterior appearance and color	0.7562								
Structural and technical design	0.7891								
Construction application	0.7017								
Historical relic value	0.7233								
Geographical indication	0.5528								
Travelling impression	0.5265								
Geographical location		0.7381							
Construction age		0.68							
Architectural type		0.733							
Architectural scale		0.7522							
Historical function		0.5857							
Name replacement			0.587						
Literal material			0.8212						
Literary works			0.8306						
Dictated material			0.6798						
Iconic identification				0.8399					
Cultural feature				0.771					
Travelling note					0.5913				
Sign interpretation					0.6123				
Knowledge learning					0.7155				
Atmosphere feeling					0.6081				
Image association						0.7898			
Story association						0.7548			

(continued)

Table 2.13 (continued)

Observational variables	1	2	3	4	5	6	7	8	9
Activity participation							0.8244		
Performance watching							0.806		
Preservation status								0.7263	
Style unification								0.7659	
Shopping									0.7246
Cuisine tasting									0.8249

Table 2.14 The level-three variables of urban memory models with historic buildings in Beijing's inner city as the object

Memory model	Principal components	Observational variables
Object–Time (O–T)	1. Scene elements	(1) Exterior appearance and color (2) structural and technical design (3) construction application (4) historical relic value (5) geographical sign (6) travelling impression
	2. Construction elements	(1) Geographical location (2) construction age (3) architectural type (4) architectural scale (5) historical function
	8. Style elements	(1) Preservation status (2) style unification
Time–Subject (T–S)	3. Symbol elements	(1) Name replacement (2) literal material (3) literary works (4) dictated material
	4. Distinctive elements	(1) Iconic identification (2) cultural feature
	5. Feeling elements	(1) Traveling note (2) sign interpretation (3) knowledge learning (4) atmosphere feeling
Object–Subject (O–S)	6. Associative elements	(1) Image association (2) story association
	7. Participation elements	(1) Activity participation (2) performance watching
	9. Experience elements	(1) Shopping (2) cuisine tasting

unification). The following paragraphs provide a statistical analysis of the three principal components (thirteen observational variables), and the memory model of construction O–T (Object–Time) is as follows.

$$I_{P-T} = \sum_{n=1}^{6} \frac{A_n}{N_\lambda} + \sum_{k=1}^{5} \frac{B_k}{N_\lambda} + \sum_{r=1}^{2} \frac{C_r}{N_\lambda} \tag{2.2}$$

Formula 2.2: The Object–Time memory model

In this memory model of Formula 2.2, I_{P-T} represents the memory evaluation score; A_n represents the sum of memory scores; B_k represents the sum of memory scores for the construction elements; C_r represents the sum of memory scores for the style elements; n = 1, 2, 3, 4, 5, 6; k = 1, 2, 3, 4, 5; r = 1, 2; N_λ represents the number of questionnaires for certain types of architecture. The specific value of the sum of A_n, B_k, C_r and the number of questionnaires is named as weight. There are altogether 13 variables for I_{P-T}, the total score of which is 65.

Object–Time memory demonstrates people's memory situation for objective characteristics. The eight categories of historic buildings in Beijing's inner city, classified by function, were scored according to the O–T memory model (Fig. 2.12), with the average score being 47.66. As categories, the royal buildings, the feudal office buildings, the cultural buildings, the religious buildings as well as the political buildings exhibit greater-than-average scores, while the service buildings, the marking buildings as well as the vernacular dwelling buildings have scores that are far below the average. Furthermore, the observation can be made that

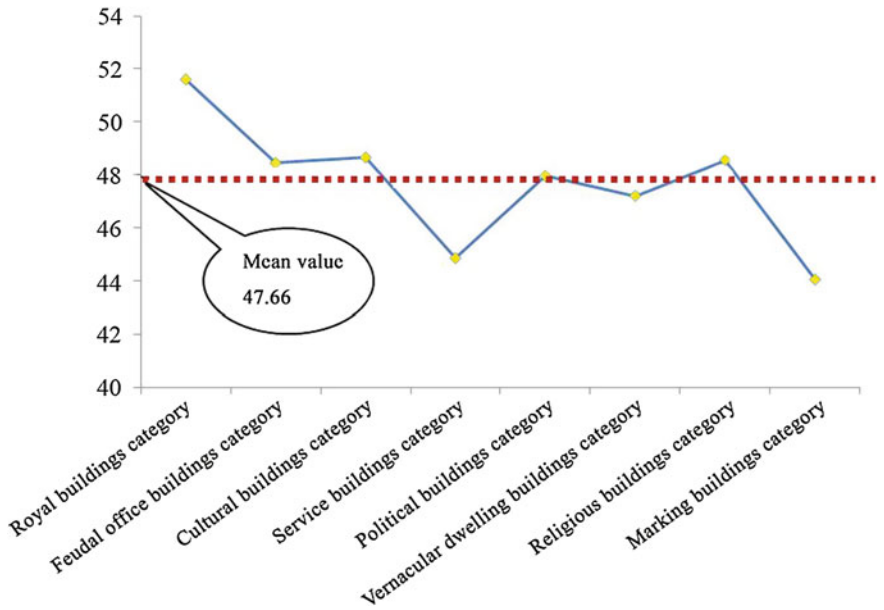

Fig. 2.12 Object–Time memory score (*Source* Drawing by Ming Jiang)

the historic buildings whose scores are above average are generally of great scale and obvious appearance, which leaves people a higher degree of distinctive and impressive scenarized memory. While the architectures of the vernacular dwelling buildings category and the service buildings category, etc. are usually hard to impress people only by its appearance characteristics.

According to Object–Time memory model, taking the memory model scores for different types of historic buildings as the sample data, the three component indexes of Object–Time memory—scene elements, construction elements, and style elements—can be applied as observational variables for a new round of factor analysis. In this factor analysis, the number of setting factors chosen is two, and the factor score coefficient matrix must be displayed by means of orthogonal rotation.

From the factor score coefficient matrix (Table 2.15) and the loading diagram obtained after orthogonal rotation (Fig. 2.13), it is evident that the scene elements and the construction elements consist of the first principal component, while the style elements consists of the second principal component. The factor molecular results are drawn in a coordinate graph (Fig. 2.14), in which the first quadrant contains the architectural types that have positive grades for the scene elements, the construction elements, as well as the style elements. This quadrant includes the subcategories of the imperial festival buildings, the feudal official buildings, the cultural and educational buildings as well as the home-grown religious buildings. However, none of the actual factor scores for these four categories of architecture is beyond 1, which indicates that their characteristics are not distinctive even though

Table 2.15 Factor score coefficient matrix after rotation of Object–Time memory

	Component	
	1	2
Scene elements	0.820	
Construction elements	0.838	
Style elements		0.954

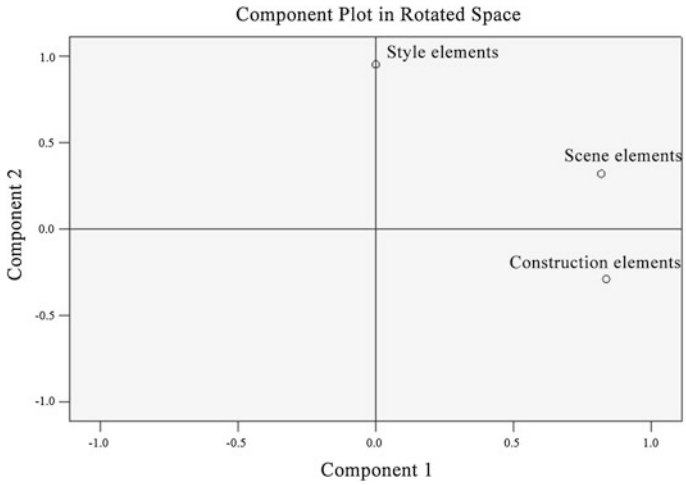

Fig. 2.13 The loading diagram after orthogonal rotation of Object–Time memory (*Source* Drawing by Ming Jiang)

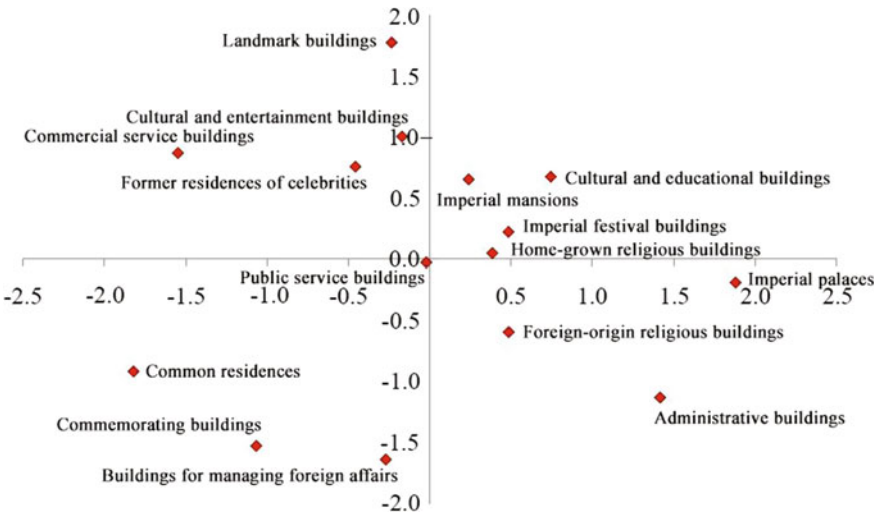

Fig. 2.14 Model factor score coordinate graph of Object–Time memory (*Source* Drawing by Ming Jiang)

they all have positive evaluations. The second quadrant contains the architectural types with negative evaluations for scene elements and construction elements, but positive evaluations for style elements. The style elements in this quadrant include the subcategories of the former residences of celebrities, the commercial service buildings, the landmark buildings, and the cultural and entertainment buildings, which indicate that the preservation status of these four subcategories is better and the styles are comparatively unified, but the overall architectural landscape is not very distinctive. The third quadrant contains the architectural types with negative evaluations for scene elements, construction elements and style elements, including the vernacular dwelling buildings, the commemorative buildings, the buildings for managing foreign affairs as well as the public service buildings. The scores for the commemorative buildings and the vernacular dwelling buildings are negative, indicating that the three characteristics are not very obvious in them. The fourth quadrant contains the architectural types with positive evaluations for the scene elements and construction elements, but negative evaluations for the style elements, which includes the imperial palaces, the foreign-origin religious buildings, the administrative buildings, indicating that their scene characteristics are strong. However, the discrepancies between them and the peripheral buildings are great, and the styles are not quite unified.

② Time–Subject memory model

According to the results of factor analysis, Time–Subject memory is composed of the third principal component, the symbol elements (including the four observational variables of name replacement, literal material, literary works, and dictated material), the fourth principal component, the distinctive elements (including the two observational variables of iconic identification and cultural feature), and the fifth principal component, the feeling elements (including the four observational variables of traveling note, sign interpretation, knowledge learning, and atmosphere feeling). The following paragraphs provide the statistical analysis of these three principal components and ten observational variables, and Time–Subject memory model is as follows.

$$I_{T-P} = \sum_{n=1}^{4} \frac{C_n}{N_\lambda} + \sum_{k=1}^{2} \frac{D_k}{N_\lambda} + \sum_{r=1}^{4} \frac{E_r}{N_\lambda} \tag{2.3}$$

Formula 2.3: The Time–Subject memory model

In this memory model of Formula 2.3, I_{T-P} represents the memory evaluation score; C_n represents the sum of memory scores; D_k represents the sum of memory scores for the distinctive elements; E_r represents the sum of memory scores for the feeling elements, among which, n = 1, 2, 3, 4; k = 1, 2, 3, 4; and N_λ represents the number of questionnaires of a certain type of buildings. The specific value between the sum of C_n, D_k, E_r and the number of questionnaires is used as weight. I_{T-P} has a total of 10 variables, the total scores of which are 50.

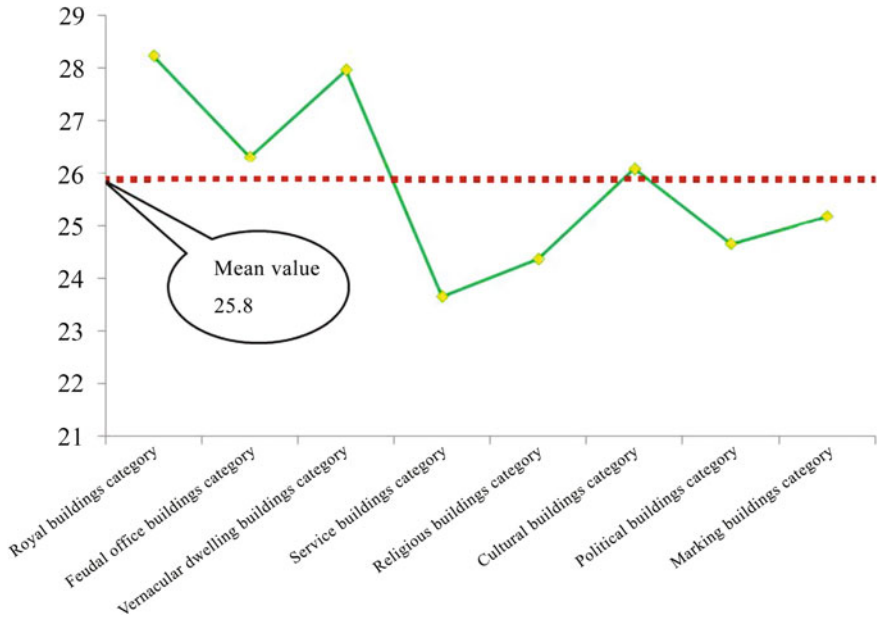

Fig. 2.15 Time–Subject memory score (*Source* Drawing by Ming Jiang)

Time–Subject memory is a summarizing and abstract memory method that people use for evaluating historic buildings and is a type of knowledge memory. The eight categories of historic buildings in Beijing's inner city, classified by functions, were scored according to the T–S memory model (Fig. 2.15). The average score was 25.8. As categories, the royal buildings, the feudal office buildings, the cultural buildings, as well as the vernacular dwelling buildings exhibit above-average scores, while the service buildings, the political buildings, the religious buildings, and the marking buildings are the opposite. These results indicate that people have more knowledge memories on the literary inscriptions of the historic buildings with rich cultural deposits, but people's knowledge memory for the daily life buildings (such as the service buildings and the political buildings) have not yet been aroused.

On the basis of Time–Subject memory model, taking the memory model scores of different types of historic buildings as the sample data, the three component indexes of Time–Subject memory—symbol elements, distinctive elements, and feeling elements—can be applied as observational variables for a new round of factor analysis. In this factor analysis, the number of setting factors chosen is 2, and the factor score coefficient matrix must be displayed by means of orthogonal rotation.

From the factor score coefficient matrix (Table 2.16) and the loading diagram obtained after orthogonal rotation (Fig. 2.16), it is evident that the symbol elements and the feeling elements consist of the first principal component, while the

Table 2.16 Factor score coefficient matrix after rotation of Time–Subject memory

	Component	
	1	2
Symbol elements	0.887	
Distinctive elements		0.988
Feeling elements	0.872	

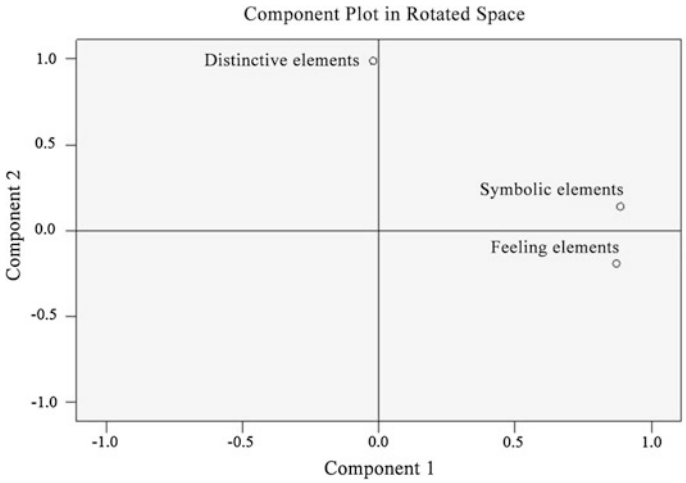

Fig. 2.16 The loading diagram after orthogonal rotation of Time–Subject memory (*Source* Drawing by Ming Jiang)

distinctive elements consists of the second principal component. The factor molecular results are drawn in a coordinate graph (Fig. 2.17), in which the first quadrant contains the architectural types that have positive evaluations for the symbol elements, the feeling elements, as well as the distinctive elements, including the imperial palaces, the cultural and educational buildings, and the administrative buildings. In particular, the results for the imperial palaces, whose actual scores for the two factors are above 1, indicate that people have many memories about the imperial palaces related to literal and symbolic materials. Additionally, they have good knowledge about the characteristics of their cultural images and have learned certain relevant historical knowledge. The second quadrant contains the architectural types with negative evaluations for the symbol elements and the feeling elements, but positive evaluations for the distinctive elements, including the commercial service buildings, the landmark buildings, the foreign-origin religious buildings, the home-grown religious buildings as well as the imperial festival buildings. The characteristics of the commercial service buildings and the landmark buildings are especially obvious, indicating that people have a clear understanding

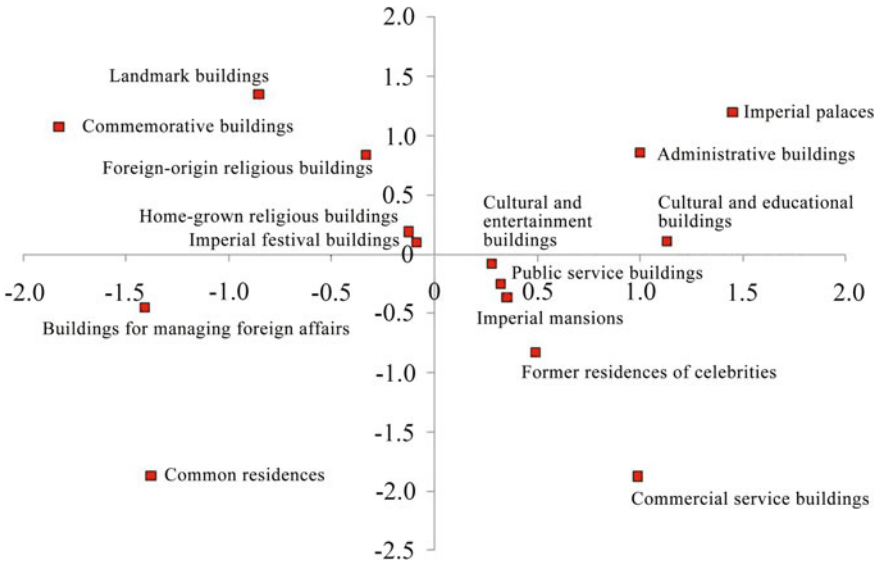

Fig. 2.17 Model factor score coordinate graph of Time–Subject memory (*Source* Drawing by Ming Jiang)

about their images and characteristics, but have less literal–materials and historical knowledge. The third quadrant contains the architectural types with negative evaluations for the symbol elements, the feeling elements and the distinctive elements, including the buildings for managing foreign affairs and the common residences, indicating that the historical records for these two categories of buildings are fewer, and the cultural features are not very distinctive. Additionally, the memory level for the symbol elements is worse. The fourth quadrant contains the architectural types with positive evaluations for the symbol elements and the feeling elements, but negative evaluations for the distinctive elements, including the former residences of celebrities, the commemorative buildings, the cultural and entertainment buildings, the public service buildings and the imperial mansions. The characteristics of the former residences of celebrities and the imperial mansions are comparatively obvious, with greater contrasts, indicating that people's knowledge records and learning activities about them are richer, but people can still not truly master their cultural features.

③ Object–Subject memory model

According to the results of factor analysis, Object–Subject memory is composed of the sixth principal component, the associative elements (including the two observational variables of image association and story association), the seventh principal component, the participation elements (including the two observational variables of activity participation and performance watching), and the ninth principal component, the experience elements (including the two observational variables of

shopping and cuisine tasting). The following paragraphs present the statistical analysis of these three principal components, and Object–Subject memory model is as follows.

$$I_{P-P} = \sum_{i=1}^{4} \frac{F_i}{N_\lambda} + \sum_{i=1}^{4} \frac{M_i}{N_\lambda} + \sum_{i=1}^{4} \frac{G_i}{N_\lambda} \tag{2.4}$$

Formula 2.4: The Object–Subject memory model

In this memory model of Formula 2.4, I_{P-P} represents the memory evaluation score of Object–Subject; F_i represents the sum of memory scores for the associative elements; M_i represents the sum of memory scores for the participation elements; G_i represents the sum of memory scores for the experience elements, among which, n = 1, 2, 3, 4; and N_λ represents the number of questionnaires of a certain type of buildings. The specific value between the sum of F_i, M_i, N_i and the number of questionnaires is used as weight. I_{P-P} has a total of 10 variables, the total scores of which are 30.

Through people's direct and real experiences of the historic buildings, Object–Subject memory was deepened in terms of memory process and developed into stable impressions and habits. The eight categories of historic buildings in Beijing's inner city, classified by function, were scored according to the O–S memory model, with the average score being 9.73 (Fig. 2.18). The scores for the categories of service buildings and religious buildings are the best, indicating that the participatory activities and ceremonies in the service and religious categories are increasing, and the feelings they bring to the buildings are comparatively

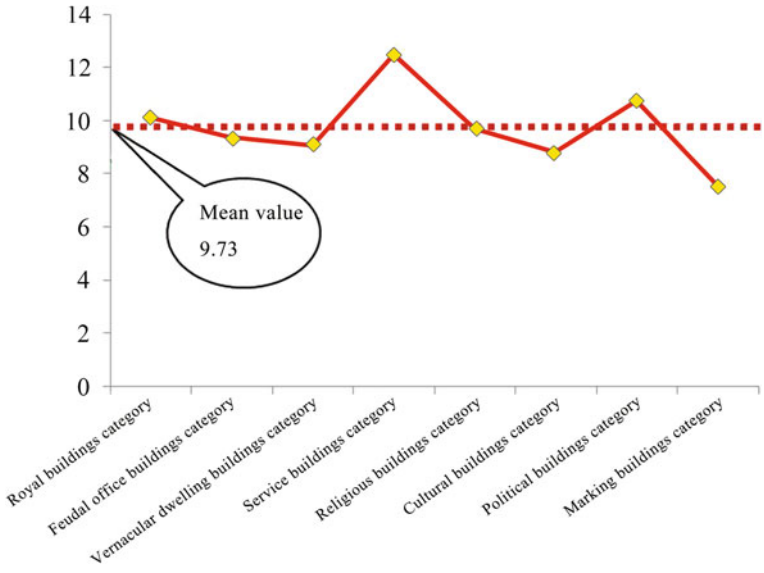

Fig. 2.18 Object–Subject memory score (*Source* Drawing by Ming Jiang)

audio-visual, so people can deepen their memories through the experience and participation process.

On the basis of Object–Subject memory model, taking the memory model scores of different types of historic buildings as the sample data, the three component indexes of Object–Subject memory—the associative elements, the participation elements and the experience elements—can be applied as observational variables for a new round of factor analysis. In this factor analysis, the number of setting factors chosen is 2, and the factor score coefficient matrix must be displayed by means of orthogonal rotation.

From the factor score coefficient matrix (Table 2.17) and the loading diagram obtained after orthogonal rotation (Fig. 2.19), it is evident that the associative elements and the participation elements consist of the first principal component, while the experience elements consists of the second principal component. The factor molecular results are drawn in a coordinate graph (Fig. 2.20), in which the first quadrant contains the architectural types with positive evaluations for the associative elements, the participation elements, as well as the experience elements, including the foreign-origin religious buildings and the public service buildings, indicating that the experiencing activities, the cultural performances and ceremonies of these two

Table 2.17 Factor score coefficient matrix after rotation of Object–Subject memory

	Component	
	1	2
Associative elements	0.864	
Participation elements	0.913	
Experience elements		0.986

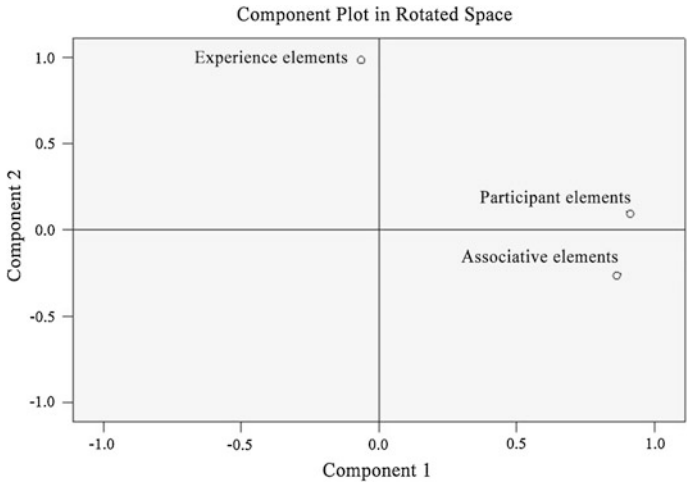

Fig. 2.19 The loading diagram after orthogonal rotation of Object–Subject memory (*Source* Drawing by Ming Jiang)

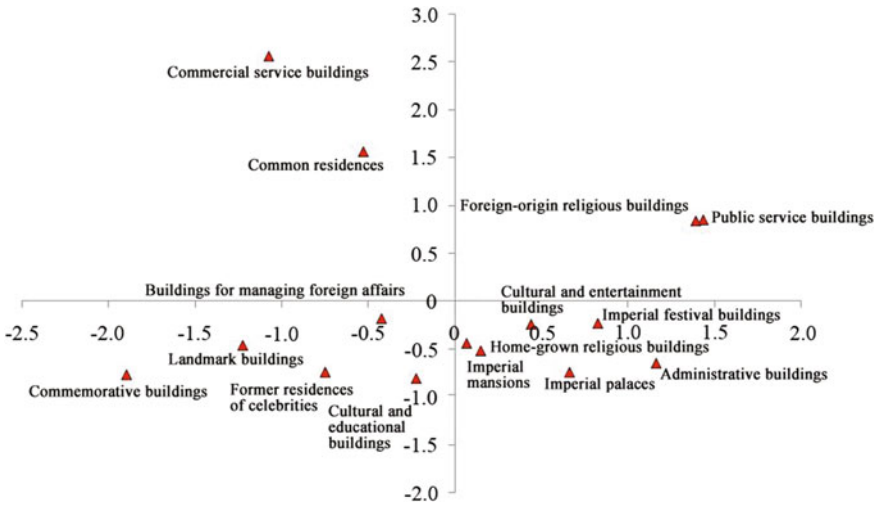

Fig. 2.20 Model factor score coordinate graph of Object–Subject memory (*Source* Drawing by Ming Jiang)

types of buildings, are more numerous, and the property of participation is comparatively better. Additionally, the memorability produced by people's participation in activities is much stronger. The second quadrant contains the architectural types with negative evaluations for the associative elements and the participation elements, but positive evaluations for the experience elements, including the commercial service buildings and the common residences. These results indicate that the activities and performances as well as other performing experiences related to these two types of buildings are fewer, but people's actual experiences from shopping and cuisine tasting are more numerous. The third quadrant contains the architectural types with negative evaluations for the associative elements, the participation elements, as well as the experience elements, including the commemorative buildings, the former residences of celebrities, the cultural and educational buildings, as well as the buildings for managing foreign affairs. These results indicate that the experience and participatory activities related to these types of buildings are fewer; thus, they cannot bring people the associative and experience memorial feelings. The fourth quadrant contains those architectural types with positive evaluations for the associative elements and the participation elements, but negative evaluations for the experience elements, including the imperial palaces, the imperial festival buildings, the administrative buildings, the feudal office buildings, the home-grown religious buildings, as well as the cultural and entertainment buildings. These results indicate that Object–Subject memory related to these buildings are generated from the performing activities and stories, and image association, and people's individual experiences are comparatively less influential.

By means of factor analysis, the principal components of the 50 observational variables that exert influence on the level of urban memory for historic buildings

were analyzed using extraction and deletion. Thus, 29 observational variables from the results were reserved, and they were classified and explained on the basis of the 9 factors. Finally, the level-three variables was generated. According to the classification of urban memory indicator system, the Object–Time, the Time–Subject, and Object–Subject memory models were established, and after the second round factor analysis of each type, the factor score coordinate graphs for different functional types of historic buildings were produced. These graphs can be divided into 4 quadrants to illustrate the influence that the level-two observational variables have on the memory level for different types of historic buildings.

2.4 Cognitive Results

2.4.1 Influence of Population Characteristics

This section primarily addresses the correlation and changing rules between the population characteristics of evaluators (including gender, age, income, education, profession, and duration of residence in Beijing) and the variables of urban memory. The Pearson's correlation coefficient is first utilized to explore the existence of simple correlations between specific population characteristics and memory variables. For the variables exhibiting correlations, one-way analysis of variance (ANOVA) is used to examine whether the interaction effect is obvious. For factors with an obvious effect, the S–N–K method can be utilized to compare any two factors, identify the factors with obvious significance and determine the changing rules under different scales.

(1) **Correlation analysis among each element**

This section presents the data analysis conducted by means of Pearson's correlation analysis. Pearson's correlation analysis is not influenced by the variable characteristics, and the resulting values fall between −1 and 1. A negative value generally represents a negative correlation; an absolute value close to 1 usually represents a higher correlation. Generally speaking, if the correlation coefficient's absolute value falls between 0.70 and 0.99, it is considered to be a high correlation; if it falls between 0.40 and 0.69, it is called a moderate correlation; and if it falls between 0.10 and 0.39, it is called a low correlation.

① Correlation analysis of Object–Time memory

Based on the Pearson's correlation analysis, people's duration of residence in Beijing has a significant influence on the construction elements. The correlation coefficient is above 0.01, and the significance level is 0.289, which is regarded as a low correlation. No obvious correlation exists among the scene elements, the style elements and tourists' gender, age, education, profession, the duration of residence in Beijing, etc. (Table 2.18). The inner variables of population characteristics and

Table 2.18 Correlation analysis of Object–Time memory

	Index	Scene elements	Construction elements	Style elements	Gender	Age	Income	Education	Profession	Duration of residence in Beijing
Scene elements	Pearson's correlation									
	Sig. (2-tailed)									
	N									
Construction elements	Pearson's correlation	0.345**								
	Sig. (2-tailed)	0.000								
	N	454								
Style elements	Pearson's correlation	0.301**	0.069							
	Sig. (2-tailed)	0.000	0.141							
	N	454	454							
Gender	Pearson's correlation	0.058	0.003	−0.029						
	Sig. (2-tailed)	0.219	0.948	0.539						
	N	454	454	454						
Age	Pearson's correlation	0.017	0.086	−0.029	−0.126**					
	Sig. (2-tailed)	0.710	0.069	0.538	0.007					
	N	454	454	454	454					
Income	Pearson's correlation	0.066	0.062	−0.014	−0.217**	0.369**				
	Sig. (2-tailed)	0.158	0.186	0.758	0.000	0.000				
	N	454	454	454	454	454				

(continued)

Table 2.18 (continued)

	Index	Scene elements	Construction elements	Style elements	Gender	Age	Income	Education	Profession	Duration of residence in Beijing
Education	Pearson's correlation	0.079	0.066	0.032	−0.013	−0.159**	0.024			
	Sig. (2-tailed)	0.094	0.163	0.493	0.780	0.001	0.606			
	N	454	454	454	454	454	454			
Profession	Pearson's correlation	0.007	−0.042	0.049	0.028	−0.278**	−0.052	0.214**		
	Sig. (2-tailed)	0.878	0.371	0.300	0.545	0.000	0.271	0.000		
	N	454	454	454	454	454	454	454		
Duration of residence in Beijing	Pearson's correlation	0.083	0.289**	−0.077	0.061	0.253**	0.219**	−0.069	−0.061	
	Sig. (2-tailed)	0.078	0.000	0.100	0.192	0.000	0.000	0.141	0.192	
	N	454	454	454	454	454	454	454	454	

Note **Correlation is significant at the 0.01 level (2-tailed)

memory elements will be simultaneously analyzed when other elements are investigated, so here they will not be considered (similarly hereinafter). The construction elements include the intrinsic characteristics of historic buildings, such as the geographical location, the construction age, architectural type, architectural function, historical function and other memories. A positive correlation exists between the duration of residence in Beijing and the construction elements because the residents who lived longer in Beijing have more accesses to this type of information and acquisition opportunities are more frequent, which aids in the memorization of this type of simple, objective information.

② Correlation relationships for Time–Subject memory

Based on the Pearson's correlation analysis (Table 2.19), people's age has a significant influence on the symbol elements. The correlation coefficient is above 0.05, and the significance level is 0.1, which is regarded as a low correlation. Residents' age, income, and duration of residence in Beijing have an obvious influence on the distinctive elements; the correlation coefficient for age is above 0.01, and significance level is 0.124, which is regarded as a low correlation; the correlation coefficient for income is above 0.01, and the significance level is 0.150, which is regarded as a low correlation. Meanwhile, the correlation coefficient for duration of residence in Beijing is above 0.01, and the significance level is 0.200, which is regarded as a low correlation. The residents' educational status has significant significance in relation to the feeling elements, with a correlation coefficient above 0.01 and significance level of 0.148, which is also regarded as a low correlation. The residents' professions have a significant influence on the feeling elements, with a correlation coefficient above 0.01 and significance level close to 0.1, which is also regarded as a low correlation.

The symbol elements include the memory of the name replacements of historic buildings, the literal materials, the literary works, as well as the stories and legends. The symbol elements usually exhibits a positive correlation with age, indicating that people have more chances of gaining knowledge with the increase in age, the richer experiences, as well as the inheritance from the previous generations; therefore, the symbolized memories have been gradually accumulated. Much of the intangible cultural heritage of historic buildings is passed on by word of mouth, but with passing away of the elderly people, this intangible information is easily lost; this becomes one of the reasons why Time–Subject memories disappear.

The distinctive elements include iconic identification and cultural feature, and these two variables are usually regarded as a group of comparatively symbolized variables that require certain accumulation and generalization. The age of residents and the duration of residence in Beijing exhibit positive correlations with these variables, indicating that people's cultural experiences are deepening with the passing of time. Furthermore, people's sense of protection for self-cultural features are becoming increasingly distinctive with improvements in income, which can also indicate that the poverty-stricken areas are short of capital for the protection and repair of historic buildings; therefore, their own culture is becoming more susceptible to cultural invasion. The developed areas have enough capital for the

Table 2.19 Correlation analysis of Time–Subject memory

Correlations										
	Index	Symbol elements	Distinctive elements	Feeling elements	Gender	Age	Income	Education	Profession	Duration of residence in Beijing
Symbol elements	Pearson's correlation									
	Sig. (2-tailed)									
	N									
Distinctive elements	Pearson's correlation	0.799**								
	Sig. (2-tailed)	0.000								
	N	454								
Feeling elements	Pearson's correlation	0.068	0.044							
	Sig. (2-tailed)	0.148	0.347							
	N	454	454							
Gender	Pearson's correlation	0.026	0.001	0.082						
	Sig. (2-tailed)	0.584	0.979	0.082						
	N	454	454	454						
Age	Pearson's correlation	0.099*	0.124**	−0.019	−0.126**					
	Sig. (2-tailed)	0.036	0.008	0.692	0.007					
	N	454	454	454	454					

(continued)

Table 2.19 (continued)

Correlations										
	Index	Symbol elements	Distinctive elements	Feeling elements	Gender	Age	Income	Education	Profession	Duration of residence in Beijing
Income	Pearson's correlation	0.074	0.150**	0.039	−0.217**	0.369**				
	Sig. (2-tailed)	0.114	0.001	0.412	0.000	0.000				
	N	454	454	454	454	454				
Education	Pearson's correlation	0.042	−0.055	0.148**	−0.013	−0.159**	0.024			
	Sig. (2-tailed)	0.369	0.244	0.002	0.780	0.001	0.606			
	N	454	454	454	454	454	454			
Profession	Pearson's correlation	−0.075	−0.085	0.097*	0.028	−0.278**	−0.052	0.214**		
	Sig. (2-tailed)	0.109	0.071	0.039	0.545	0.000	0.271	0.000		
	N	454	454	454	454	454	454	454		
Duration of residence in Beijing	Pearson's correlation	0.069	0.200**	−0.034	0.061	0.253**	0.219**	−0.069	−0.061	
	Sig. (2-tailed)	0.144	0.000	0.465	0.192	0.000	0.000	0.141	0.192	
	N	454	454	454	454	454	454	454	454	

Note *Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)

protection of historic buildings, and they also pay more attention to the protection of cultural features as well as the reshaping of iconic identification.

The feeling elements, including sign interpretation, travelling notes, knowledge learning and other variables, deepen residents' memory processes by means of initiative learning. Educational status exhibits a positive correlation with the feeling elements, indicating that people with a higher educational status are better at learning and deepening their Time–Subject memories through initiative study. In the category of profession, the scores of professions that require a higher degree of knowledge, such as teachers, civil servants, technicians, and students are higher, demonstrating a similar correlation with educational status.

③ Correlation analysis of Object–Subject memory

Based on the Pearson's correlation analysis, residents' educational status and profession have significant influences on the associative elements. The correlation coefficient for the former is above 0.01, and the significance level is 0.182, which is regarded as a low correlation; meanwhile, the correlation coefficient for the latter is above 0.05, and the significance level is 0.104, which is also regarded as a low correlation. Residents' income and educational status have obvious influences on the participation elements. The correlation coefficient for income is above 0.01, and the significance level is 0.149, which is regarded as a low correlation; the correlation coefficient for educational status is above 0.01, and the significance level is 0.143, which is regarded as a low correlation. The correlation coefficient for residents' educational status and duration of residence in Beijing has significant influences on the participation elements. The correlation coefficient for educational status is above 0.05, and the significance level is 0.111, which is regarded as low a correlation. The correlation coefficient for the duration of residence in Beijing is above 0.01, and the significance level is 0.157, which is also regarded as a low correlation. The details are shown in Table 2.20.

The associative elements include residents' competence for remembering the historic buildings by looking at pictures and listening to stories and legends. With increases in educational status, people's field of vision is broadened, and thus their relevant associative memories are enriched accordingly. Meanwhile, the profession elements also demonstrates a relationship that is similar to educational status.

The participation elements include the opportunities for people to participate in activities and watch performances in the historic buildings. Higher incomes generally indicate greater ability to pay for such performances; the higher people's educational status, the higher their enthusiasm becomes, and the greater their chances of watching and participating in performances; in this way, the degree of Object–Subject memory is deepened.

The experience elements include shopping, cuisine tasting and other activities with which the educational status has weak correlation. This weak correlation indicates that the higher people's educational status is, the more their requirements for experiences will become. Meanwhile, the longer their duration of residence in Beijing, the more frequent their experiences will be, and thus their memories can deepen accordingly.

Table 2.20 Correlation analysis of Object–Subject memory

Correlations										
	Index	Associative elements	Participation elements	Experience elements	Gender	Age	Income	Education	Profession	Duration of residence in Beijing
Associative elements	Pearson's correlation									
	Sig. (2-tailed)									
	N									
Participation elements	Pearson's correlation	0.636**								
	Sig. (2-tailed)	0.000								
	N	454								
Experience elements	Pearson's correlation	0.135**	0.354**							
	Sig. (2-tailed)	0.004	0.000							
	N	454	454							
Gender	Pearson's correlation	−0.030	0.054	0.086						
	Sig. (2-tailed)	0.526	0.254	0.069						
	N	454	454	454						
Age	Pearson's correlation	−0.006	0.069	−0.013	−0.126**					
	Sig. (2-tailed)	0.898	0.143	0.785	0.007					
	N	454	454	454	454					

(continued)

Table 2.20 (continued)

Correlations										
	Index	Associative elements	Participation elements	Experience elements	Gender	Age	Income	Education	Profession	Duration of residence in Beijing
Income	Pearson's correlation	0.046	0.149**	0.014	−0.217**	0.369**				
	Sig. (2-tailed)	0.328	0.001	0.771	0.000	0.000				
	N	454	454	454	454	454				
Education	Pearson's correlation	0.182**	0.143**	0.111*	−0.013	−0.159**	0.024			
	Sig. (2-tailed)	0.000	0.002	0.018	0.780	0.001	0.606			
	N	454	454	454	454	454	454			
Profession	Pearson's correlation	0.104*	0.045	−0.020	0.028	−0.278**	−0.052	0.214**		
	Sig. (2-tailed)	0.027	0.341	0.671	0.545	0.000	0.271	0.000		
	N	454	454	454	454	454	454	454		
Duration of residence in Beijing	Pearson's correlation	0.003	0.076	0.157**	0.061	0.253**	0.219**	−0.069	−0.061	
	Sig. (2-tailed)	0.941	0.104	0.001	0.192	0.000	0.000	0.141	0.192	
	N	454	454	454	454	454	454	454	454	

Note *Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)

In this section, the six elements of residents' population characteristics (gender, age, income, educational degree, profession, and duration of residence in Beijing) are taken as independent variables, while the nine elements including the scene elements, construction elements, style elements, symbol elements, distinctive elements, feeling elements, associative elements, participation elements and experience elements are taken as dependent variables to carry out the Pearson's correlation analysis. By contrast, the influence that population characteristics have on Object–Time memory is comparatively small; thus, Object–Time memory belongs to the superficial layer of memory, for which discrepancies are not large among different types of people. Meanwhile, Time–Subject memory belongs to a higher layer of knowledge memory, for which the discrepancies among population characteristics such as different ages, incomes, educational statuses and professions are relatively distinct. The memory method of participating and experiencing is considered to be more suitable to the people who have higher incomes and educational statuses. The detailed correlation relationships for respective element are shown in Fig. 2.21. The correlations in this research are generally characterized as low correlations because each individual's understanding competence and memory method is unique. Only some weak general characteristics and correlation relationships can be found in it, and they cannot be considered definitive.

(2) **Analysis of variance of the influence factors**

The basic correlation relationships between the population characteristics and the urban memory elements are obtained through the correlation analysis presented in the previous section. Obviously, correlations with the element "gender" can be neglected, so the other five variables with existing correlation relationships can be utilized to examine whether the influence of the following groups of variables is obvious through one-way analysis of variance (ANOVA) (Table 2.21). The S–N–K

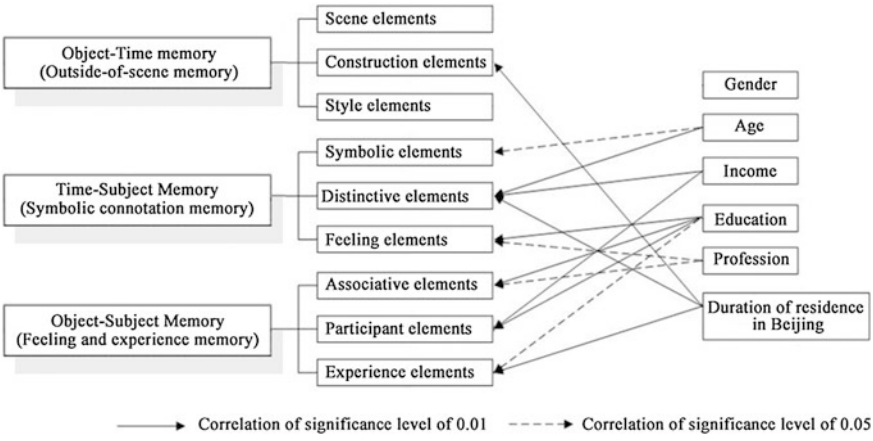

Fig. 2.21 Correlation between population characteristics and urban memory elements (*Source* Drawing by Ming Jiang)

Table 2.21 The variable grouping for one-way analysis of variance (ANOVA)

Independent variables	Dependent variables
Age	Symbol elements, Distinctive elements
Income	Distinctive elements, Participation elements
Education	Feeling elements, Associative elements, Participation elements, Experience elements
Profession	Feeling elements, Associative elements
Duration of residence in Beijing	Construction elements, Distinctive elements, Experience elements

method can be used to compare any two factors with obvious influences to determine which factor has the strongest influence.

① Age

To study whether obvious differences exist between the symbol elements and the distinctive elements among different age groups, one-way analysis of variance (ANOVA) is conducted according to the normalized factor score; if the significance is less than 0.05, significant differences exist. The results are shown in Table 2.22. The significance of the symbol elements is greater than 0.05, indicating that no obvious differences exist; the significance of the symbol elements being less than 0.05, age has an obvious influence on the distinctive elements. To further analyze the influences and differences changing rules of different age groups have on the distinctive elements, the S–N–K comparison and the mean value graph analysis are required.

As is evident from the S–N–K comparison (Table 2.23), the distinctive elements can be divided into two groups that exhibit significant differences in terms of age; ≤20 years old belongs to a group by itself, while 21–30, 31–40, 41–50, 51–60 and >60 belong to another group. From the mean value graph of the distinctive elements (Fig. 2.22), we can see that people's memory level can become more clearly correlated with the characteristics element with the increase in age. The older you become, the more you are able to clearly understand the iconic identification and cultural features of a place. The so-called nostalgia, fallen leaves

Table 2.22 The one-way analysis of variance (ANOVA) for age and urban memory

		Sum of squares	Df	Mean square	F	Sig.
Symbol elements	Between groups	117.772	5	23.554	1.875	0.097
	Within groups	5,629.268	448	12.565		
	Total	5,747.040	453			
Distinctive elements	Between groups	49.915	5	9.983	3.223	0.007
	Within groups	1,387.671	448	3.097		
	Total	1,437.586	453			

Table 2.23 The S–N–K comparison for the distinctive elements

Age	N	Subset for alpha = 0.05	
		1	2
≤20 years old	42	6.43	
21–30 years old	261		7.29
31–40 years old	73		7.49
41–50 years old	41		7.59
51–60 years old	24		7.63
>60 years old	13		8.15
Sig.		1.000	0.279

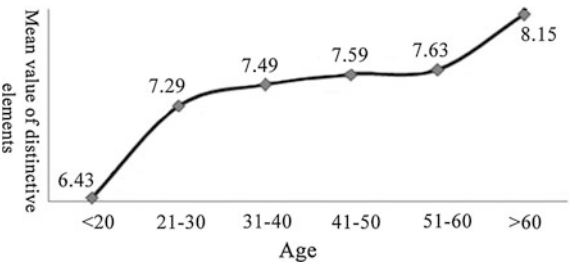

Fig. 2.22 The mean value graph for age and the distinctive elements (*Source* Drawing by Ming Jiang)

returning to the roots, and other descriptions rightly indicate that the older you become, the more distinctive your feelings will become on the emotional characteristics of a place.

② Income

To study whether significant differences exist between the distinctive elements and the participation elements among different income groups, one-way analysis of variance (ANOVA) is conducted on the basis of the normalized factor score; a significance less than 0.05 is usually regarded as indicating significant differences. The results are shown in Table 2.24. The significance for the distinctive elements are greater than 0.05, indicating that no obvious differences exist; the significance of the participation elements being less than 0.05, income has an obvious influence on the participation elements. To further analyze the influences and differences changing rules of different income groups have on the distinctive elements, the S–N–K comparison and the mean value graph analysis are required.

As is evident from the S–N–K comparison (Table 2.25), the memory level of the participation elements becomes more distinctive with an increase in income level. When income reaches a certain level, this correlation tends to stabilize (Fig. 2.23). For the group of people whose incomes are between 5001–8000 and more than 8000, participation preferences and requirements tend to convergence, and no significant differences exist.

Table 2.24 The one-way analysis of variance (ANOVA) for income and urban memory

		Sum of squares	Df	Mean square	F	Sig.
Participation elements	Between groups	40.062	4	10.015	3.218	0.013
	Within groups	1,397.524	449	3.113		
	Total	1,437.586	453			
Distinctive elements	Between groups	46.431	4	10.608	2.264	0.061
	Within groups	2,302.027	449	5.127		
	Total	2,348.458	453			

Table 2.25 The S–N–K comparison for the participation elements

Income	N	Subset for alpha = 0.05
		1
≤1,000	163	6.43
1,001–3,000	129	7.50
3,001–5,000	101	7.50
>8,000	22	7.64
5,001–8,000	39	7.64
Sig.		0.223

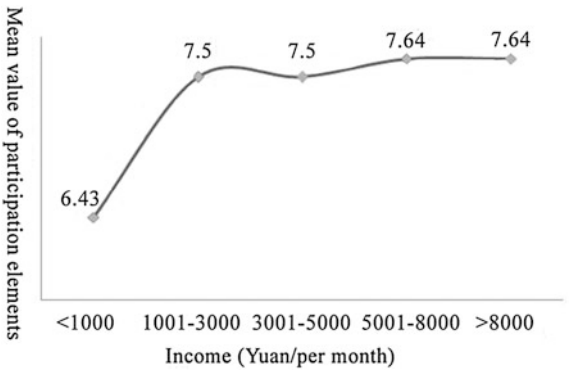

Fig. 2.23 The mean value graph for income and the distinctive elements (*Source* Drawing by Ming Jiang)

③ Education

To study whether obvious differences exist between the feeling elements, the associative elements, the participation elements and the experience elements in different educational statuses, one-way analysis of variance (ANOVA) is conducted according to the normalized factor score. If the significance is less than 0.05, the elements have obvious differences in educational status. Based on the result presented in Table 2.26, the significances of the participation elements and the experience elements are greater than 0.05, indicating that no obvious differences exist. Meanwhile, the significances of the feeling elements and the associative elements are less than 0.05, indicating that educational status has an obvious

Table 2.26 The one-way analysis of variance (ANOVA) for education and urban memory

		Sum of squares	Df	Mean square	F	Sig.
Feeling elements	Between groups	863.317	5	172.663	5.155	0.000
	Within groups	15,006.121	448	33.496		
	Total	15,869.438	453			
Associative elements	Between groups	32.664	5	6.533	2.462	0.032
	Within groups	1,188.913	448	2.654		
	Total	1,221.577	453			
Participation elements	Between groups	25.960	5	5.192	1.002	0.416
	Within groups	2,322.498	448	5.184		
	Total	2,348.458	453			
Experience elements	Between groups	31.194	5	6.239	0.974	0.433
	Within groups	2,868.145	448	6.402		
	Total	2,899.339	453			

Table 2.27 The S–N–K comparison for the feeling elements

Educational status	N	Subset for alpha = 0.05	
		1	2
Junior high school or less	26	3.65	
Senior high school or technical secondary school	46	4.24	
Junior college	73	5.68	
Master	109		6.88
Bachelor	182		7.83
Doctor or above	18		8.06
Sig.		0.055	0.243

influence on the two elements. Thus, for these elements, the S–N–K comparison and the mean value graph analysis are required.

According to the S–N–K comparison (Table 2.27), in terms of the feeling elements, people with different educational statuses can be divided into two groups: those with lower education (Junior high school or less, senior high school or technical secondary school, and junior college) form one group; and those with higher education (bachelor, master and doctoral education) form another. Figure 2.24 shows that the less educated people perform worse in learning-oriented memory, including word recording and sign interpretation, while the higher educated people are more interested in such learning-oriented feeling memory.

In terms of the associative elements, people with different educational statuses can also be divided into two groups: those with the educational statuses of Junior high school or less, senior high school or technical secondary school, junior college and bachelor belong to a group, while those with the educational statuses of master

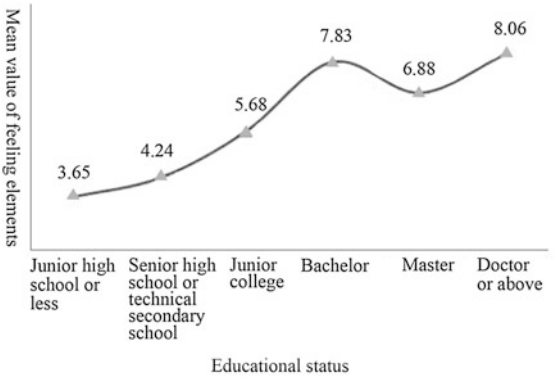

Fig. 2.24 The mean value graph for educational status and the feeling elements (*Source* Drawing by Ming Jiang)

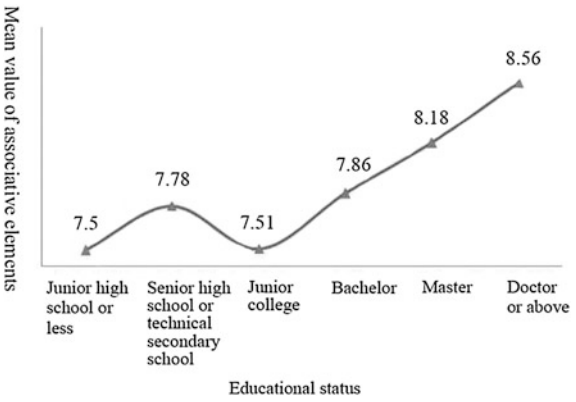

Fig. 2.25 The mean value graph for educational status and the associative elements (*Source* Drawing by Ming Jiang)

and doctoral education belong to another. The associative elements do not imply that the less educated people have poor imaginations but show that the higher educated people are better at connecting different historic buildings with their cultural forms, stories and legends to aid their memorization (Table 2.28, Fig. 2.25).

④ Profession

To study whether obvious differences exist between the feeling elements and the associative elements among different professions, one-way analysis of variance (ANOVA) is conducted according to the normalized factor score; if the significance is less than 0.05, obvious differences exist. The results are shown in Table 2.29. The significance of the associative elements is greater than 0.05, indicating that no obvious differences exist; the significance of the feeling elements being less than 0.05, profession has an obvious influence on the feeling elements. To further analyze the influences and differences of various professions in relation to the

Table 2.28 The S–N–K comparison for the associative elements

Educational status	N	Subset for alpha = 0.05	
		1	2
Junior high school or less	26	7.50	
Junior college	73	7.51	
Senior high school or technical secondary school	46	7.78	
Bachelor	182	7.86	
Master	109		8.81
Doctor or above	18		8.56
Sig.		0.311	0.135

Table 2.29 The one-way analysis of variance (ANOVA) for profession and urban memory

		Sum of squares	df	Mean square	F	Sig.
Feeling elements	Between groups	976.376	9	108.468	3.234	0.001
	Within groups	14,893.062	444	33.543		
	Total	15,869.438	453			
Associative elements	Between groups	24.211	9	2.690	0.998	0.441
	Within groups	1,197.366	444	2.697		
	Total	1,221.577	453			

feeling elements, the S–N–K comparison and the mean value graph analysis are required.

According to the S–N–K comparison (Table 2.30), in terms of the feeling elements, people with different professions can also be divided into two groups: civil servants, students, technicians, company employees and teachers belong to one

Table 2.30 The S–N–K comparison for the feeling elements

Profession	**N**	Subset for alpha = 0.05	
		1	2
Worker	12	2.08	
Farmer	7	2.14	
Retiree	18	3.89	
Self-employed businessman	24	4.17	
Soldier	6	5.00	
Teacher	58		5.95
Company employee	76		7.11
Technician	80		7.19
Student	135		7.41
Civil servant	38		8.55
Sig.		0.140	0.248

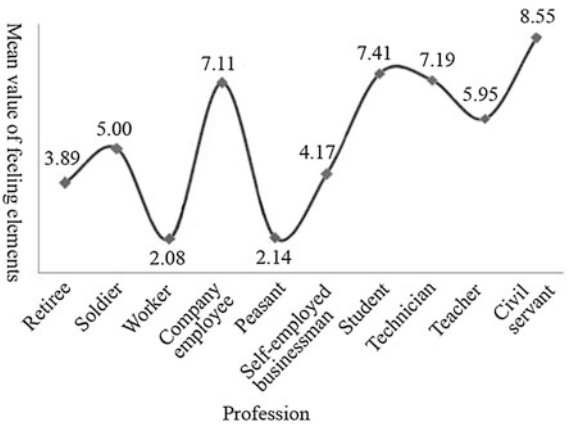

Fig. 2.26 The mean value graph for profession and the feeling elements (*Source* Drawing by Ming Jiang)

group; workers, farmers, self-employed businessmen, solders and retirees belong to another. From Fig. 2.26, the associative elements indicate that people with the professions requiring more cultural education perform well in learning-oriented and feeling-oriented memory such as word recording and sign interpretation, and the reverse is true of professions requiring less cultural education.

⑤ Duration of residence in Beijing

To study whether obvious differences exist between the duration of residence in Beijing and the construction elements, the distinctive elements and the experience elements, one-way analysis of variance (ANOVA) is conducted according to the normalized factor score; if the significance is less than 0.05, significant differences exist. The results are shown in Table 2.31. The significances of the distinctive elements and the experience elements are greater than 0.05, indicating that no obvious differences exist; the significance of the construction elements being less than 0.05, duration of residence in Beijing has an obvious influence on the

Table 2.31 The one-way analysis of variance (ANOVA) of duration for residence in Beijing and urban memory

		Sum of squares	df	Mean square	F	Sig.
Construction elements	Between groups	542.953	4	135.738	10.645	0.000
	Within groups	5,725.099	449	12.751		
	Total	6,268.053	453			
Distinctive elements	Between groups	13.316	4	3.329	1.049	0.381
	Within groups	1,424.270	449	3.172		
	Total	1,437.586	453			
Experience elements	Between groups	41.341	4	10.335	1.624	0.167
	Within groups	2,857.999	449	6.365		
	Total	2,899.339	453			

Table 2.32 The S–N–K comparison of the construction elements

Duration of residence in Beijing	N	Subset for alpha = 0.05		
		1	2	3
<1 year	109	16.23		
1–3 years	82		17.09	
3–5 years	77		17.49	
5–10 years	81			18.81
>10 years	105			18.98
Sig.		0.111	0.446	0.757

construction elements. To further analyze the influences and differences of the duration of residence in Beijing in relation to the construction elements, the S–N–K comparison and the mean value graph analysis are required.

Based on the S–N–K comparison (Table 2.32), the construction elements can be divided into three groups with differences based on the duration of residence in Beijing: those living in Beijing for less than 1 year belong to a group by themselves; residents for 1–3 and 3–5 years belong to a group; while residents for 5–10 years and more than 10 years belong to another group. A positive correlation exists between the duration of residence in Beijing and the construction elements. The longer people stay in Beijing, the more they are able to understand construction features such as geographical location, construction age and the historical function of the historic buildings. The slopes for the categories of 5–10 years and more than 10 years change little, which indicates that when the duration of residence reaches a certain number of years, the ability to build memory tends to stabilize (Fig. 2.27).

Above all, population characteristics influence the urban memory level for historic buildings: (1) A correlation exists between age and both symbol elements and distinctive elements, with age having an obvious influence on the distinctive elements. The older people become, the more accurately they understand the distinctive elements and the higher the memory level becomes. (2) A correlation exists between income and both distinctive elements and participation elements, with income having an obvious influence on the distinctive elements. The sense of participation will strengthen with an increase in income level, but when income

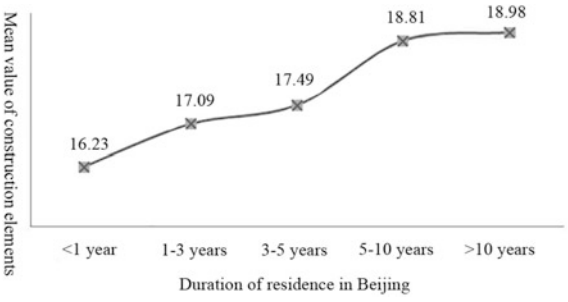

Fig. 2.27 The mean value graph for duration of residence in Beijing and the construction elements (*Source* Drawing by Ming Jiang)

reaches a certain level, this correlation tends to stabilize. (3) A correlation exists between educational status and the feeling elements, associative elements, distinctive elements and participation elements, with educational status having an obvious influence on both the feeling elements and the associative elements. More highly educated people are more interested in the learning-oriented feeling memory and are better at connecting different historic buildings with their cultural forms to aid their memorization. (4) A correlation exists between profession and both the feeling elements and the associative elements. Profession has an obvious influence on the feeling elements, which also demonstrates that people with the professions requiring more cultural education perform well in learning-oriented feeling memory. (5) A correlation exists between the duration of residence in Beijing and all three of the construction elements, the distinctive elements and experience elements, with duration of residence in Beijing having an obvious influence on the construction elements.

2.4.2 *Analysis of Memory Level and Memory Temporal Characteristics*

This section addresses the relationship between the memory level and the memory temporal characteristics. The concept and the grading of memory level was presented initially. The memory level was calculated by adding the 29 observational variables forming memories, and the sum of the mean values minus the standard deviations was taken as the grading standard. Next, analysis of the scores for three variables (visiting times, visiting date and retention time) was conducted by means of the fuzzy evaluation method to obtain the evaluation values for the temporal characteristics of memory. Finally, the memory level–memory time curve model was built using regression analysis to demonstrate the changing rules between them.

(1) **The memory level grading of Object–Time memory model**

The selected results of the evaluation model for memory level include 29 observational variables. The scores, which were obtained using a 5-point Likert scale, reflect each individual's memory level with regard to the historic buildings. The formula is as follows.

$$S_{cog} = \sum_{i=1}^{29} a_i \quad i = 1, 2, 3, \ldots, 29 \tag{2.5}$$

Formula 2.5: Scores of urban memory level

In Formula 2.5, S_{cog} represents scores of the urban memory level for historic buildings. a_i represents scores of the urban memory variables for historic buildings in every questionnaire. There are 29 score variables and the total score is 145. Based on the formula above, the mean memory level for historic buildings is 82.46 and the standard deviation is 13.77.

Referring to the study by Yan (2009) about the cognitive grading of urban memory, the research classified the memory levels of the sample into three types: memory scores higher than the mean value plus 0.5 standard deviation belong to the third level, called the high memory level; memory scores lower than the mean value minus 0.5 standard deviation belong to the first level, called the low memory level; and memory scores between the other two groups belong to the medium memory level. The formula is as follows.

$$\begin{aligned}
&\text{If } S_{cog} > 82.46 + 0.5 \times 13.77 = 89,\ R_{cog} = 3 \\
&\text{If } 76 = 82.46 - 0.5 \times 13.77 \le S_{cog} \le 82.46 + 0.5 \times 13.77 = 89,\ R_{cog} = 2 \\
&\text{If } S_{cog} < 82.46 - 0.5 \times 13.77 = 76,\ R_{cog} = 1
\end{aligned} \tag{2.6}$$

Formula 2.6: Grading of urban memory level

Based on Formula 2.6, scores of the memory level of 17 varieties of historic buildings show that the mean values for the imperial palaces and the administrative buildings fit into the high memory level; values for the buildings for managing foreign affairs, the common residences and the commemorative buildings fit into the low memory level; and values for other historic buildings fit into the medium memory level (Fig. 2.28).

Based on the subdivision of the urban memory levels of different historic buildings (Fig. 2.29), more than half of the samples of the imperial palaces, the cultural and educational buildings and the administrative buildings belong to the high memory level, demonstrating that people have the deepest memories regarding these types of buildings, which also conforms to the whole impression of "royal city," "capital" and "political center" that Beijing usually gives to people. In the samples of the categories of the commercial service buildings, the buildings for managing foreign affairs, the common residences and the commemorative buildings, the low memory level accounts for more than a half because these types of buildings do not have distinguishing features and can not leave deep impressions on people. In particular, the sample area for the commercial service buildings category is located in the Dashilar commercial area at Qianmen Gate, but people have no deep impressions and do not think highly of the reconstructed Qianmen Street.

(2) **The fuzzy evaluation of memory temporal characteristics**

The German psychologist H. Ebbinghaus found that information is lost immediately after learning and the forgetting process is not even. The sharpest increase in information loss occurs after the first recall attempt and the rate then gradually

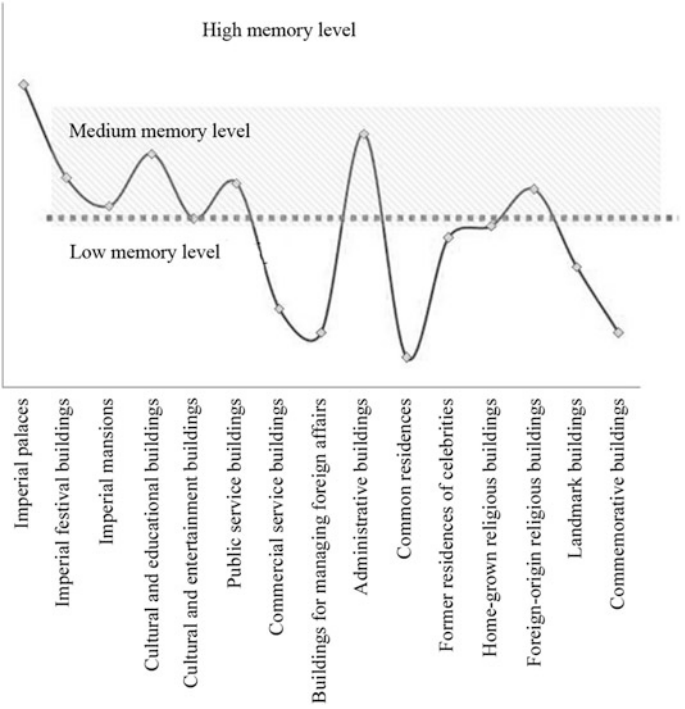

Fig. 2.28 Grading of the urban memory levels of different historic buildings (*Source* Drawing by Ming Jiang)

stabilizes. He thought that the retention and forgetting are the time function, and he draw the curve to describe the forgetting process based on his study result. This curve has become well-known as the Ebbinghaus forgetting curve (Tan 2008) (Fig. 2.30). Based on the retention time, he divided retention memory into two types: short-term memory and long-term memory. According to the forgetting curve, forgetting usually happens following the law of "fast at first and slow later". Therefore, constant review and repetition can lead to permanent and long-term memory (Fig. 2.31).

Urban memory is a collection of individual memories. The urban memory of historic buildings is part of the long-term memory that has been handed down and also follows the basic memory method of people. In the research, the temporal characteristics of urban memory are classified into three types: visiting times, visiting date and retention time. Visiting times are relevant to the review process, and the more times people visit a place, the more easily a permanent memory can form; visiting date is relevant to the time that has passed since acquiring the memory information, and the more distant the visiting date, the more information is lost; retention time is relevant to the duration of the memory process, and the longer people stay, the more easily a deep memory can form. Based on the three variables

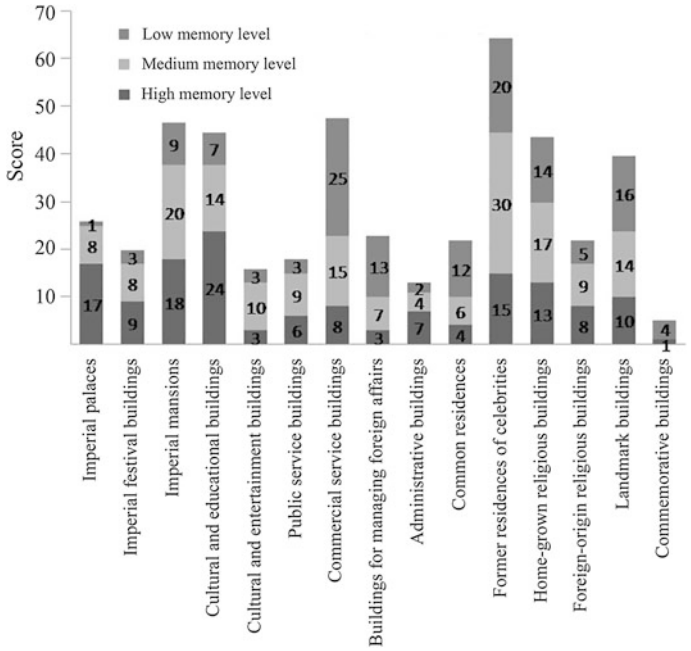

Fig. 2.29 Scores of the urban memory levels of different historic buildings (*Source* Drawing by Ming Jiang)

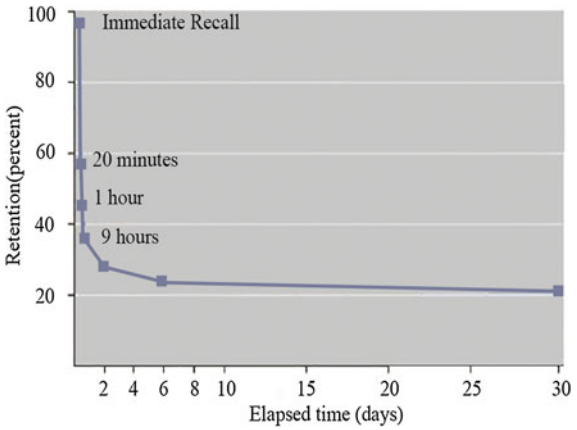

Fig. 2.30 The Ebbinghaus forgetting curve (*Source* Drawing by Hermann 1964)

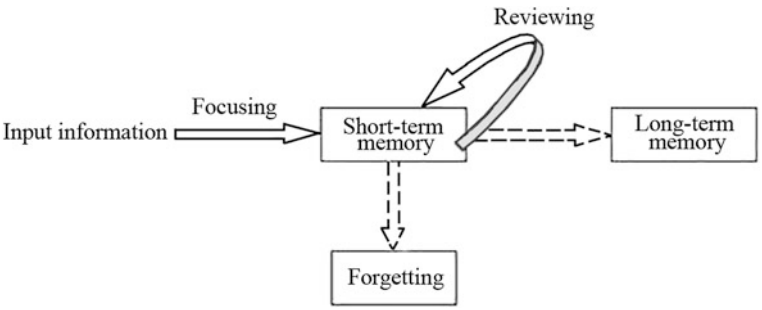

Fig. 2.31 Short-term and long-term memory (*Source* Picture redrawn by Jian Liu based on the original by Hermann 1964)

above, the fuzzy evaluation method is applied to evaluate the temporal characteristics of urban memory.

First, adopting the expert assessment method, weights for visiting times, visiting date and retention time are assigned as 0.35, 0.3 and 0.35. The assessment levels are determined, and by default, more visiting times, a closer visiting date and longer retention time can be associated with a clearer memory and higher scores (Table 2.33).

According to the assessment level, the scores for single variables of different historic buildings are presented in Table 2.34.

Table 2.33 The assignment scale of temporal variables in urban memory

Visiting times	Visiting date	Length of stay	Score
Perennial living	Within 1 month	More than 1 day	5
More than 5 times	1–3 months	1 day	4
4–5 times	3–6 months	Half a day	3
2–3 times	6–12 months	2–4 h	2
1 time	More than 1 year	Less than 2 h	1

Table 2.34 The assessment form for temporal variables of imperial palaces in urban memory

Assessment variable set (U)		Visiting times (U1)	Visiting date (U2)	Length of stay (U2)
Weight (W)		0.35	0.3	0.35
Assessment level	5	0	1	0
	4	1	0	9
	3	5	5	14
	2	7	3	3
	1	13	17	6

The fuzzy evaluation matrix of historic buildings to assessment level equals the weight of the variable multiplied by the membership grade of each variable in its assessment level.

$$\mathrm{R}_1 = \begin{pmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{pmatrix} = \begin{Bmatrix} \frac{U15}{N} & \frac{U14}{N} & \frac{U13}{N} & \frac{U12}{N} & \frac{U11}{N} \\ \frac{U25}{N} & \frac{U24}{N} & \frac{U23}{N} & \frac{U22}{N} & \frac{U21}{N} \\ \frac{U35}{N} & \frac{U34}{N} & \frac{U33}{N} & \frac{U32}{N} & \frac{U31}{N} \end{Bmatrix} = \begin{Bmatrix} \frac{0}{26} & \frac{1}{26} & \frac{5}{26} & \frac{7}{26} & \frac{13}{26} \\ \frac{1}{26} & \frac{0}{26} & \frac{5}{26} & \frac{3}{26} & \frac{17}{26} \\ \frac{0}{26} & \frac{9}{26} & \frac{14}{26} & \frac{3}{26} & \frac{6}{26} \end{Bmatrix}$$

$$S_1 = WR_1 = (w_1 \quad w_2 \quad \cdots \quad w_n) \circ \begin{pmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{pmatrix} = (s_1 \quad s_2 \quad \cdots \quad s_m)$$

$$= (0.35 \quad 0.3 \quad 0.35) \begin{Bmatrix} 0 & 0.04 & 0.19 & 0.27 & 0.5 \\ 0.04 & 0 & 0.19 & 0.12 & 0.65 \\ 0 & 0.35 & 0.54 & 0.12 & 0.23 \end{Bmatrix}$$

$$= (0.012 \quad 0.135 \quad 0.131 \quad 0.169 \quad 0.371)$$

The fuzzy evaluation value for the memory time of imperial palaces category $\mathrm{N_I}$ is calculated and the "weighted average method" is used to collect vector statistics for the assessment level membership grade.

$$N_1 = S_1 E^T = (0.012 \quad 0.135 \quad 0.313 \quad 0.169 \quad 0.371) \begin{pmatrix} 5 \\ 4 \\ 3 \\ 2 \\ 1 \end{pmatrix} = 2.25 \qquad (2.7)$$

Formula 2.7: Formula for the fuzzy evaluation method

In Formula 2.7, R_1 represents the membership grade matrix, S_1 represents the fuzzy evaluation matrix, W represents the weight of the variable, N_1 represents the fuzzy evaluation value, and E^T represents the assessment level priority.

By adopting the same method, the evaluation values for the temporal characteristics of different buildings are calculated (Table 2.35).

The fuzzy evaluation results for the temporal characteristics of different buildings show that the temporal characteristics value and the memory level present the same changing trend, which indicates that more visiting times to the historic buildings, closer visiting date and longer retention time lead to a more permanent memory.

Further explanation is required on some special points: the imperial palaces category presents a low evaluation value for temporal characteristics but a high

Table 2.35 The fuzzy evaluation values for temporal characteristics of different buildings

Building category	Mean value of the memory level	Evaluation value of the temporal characteristics
Imperial palaces	93.58	2.25
Imperial festival buildings	86.30	2.16
Imperial mansions	84.11	2.46
Cultural and educational buildings	88.22	2.47
Cultural and entertainment buildings	83.13	2.15
Public service buildings	85.89	2.67
Commercial service buildings	76.10	2.43
Buildings for managing foreign affairs	74.26	1.96
Administrative buildings	89.77	3.35
Common residences	72.27	2.70
Former residences of celebrities	81.63	2.14
Home-grown religious buildings	82.55	2.57
Foreign-origin religious buildings	85.41	2.84
Landmark buildings	79.38	2.30
Commemorative buildings	74.20	1.87

memory level, which indicates that people use less time to memorize but have deeper impressions. Buildings in the imperial palaces category are famous landmarks and tourist attractions, which people do not often visit in daily life, but because of their distinguishing features and the many opportunities to transfer information concerning them, they leave a deep impression on people in a short time.

Meanwhile, the common residences work in the opposite way. This category presents a high evaluation value for temporal characteristics but a low memory level, which indicates that people spend more time in such buildings but do not form deep memories. The common residences are buildings where people live and pay visits to relatives and friends, but because they have fewer characteristics and have no cultural features and rules to follow, people can not form conscious memories about them (Fig. 2.32).

(3) **Regression analysis of memory level and memory time**

Based on the relationship between memory level and memory time introduced in the previous section, a regression analysis can be conducted to build the memory level–memory time curve model and predict the rule that memory level changes with the temporal characteristics of memory.

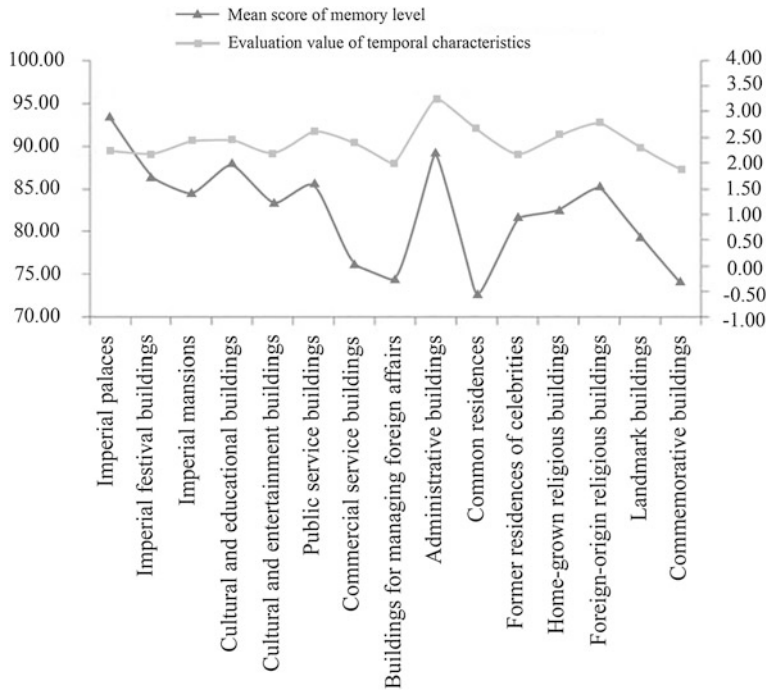

Fig. 2.32 Mean values of memory level and evaluation values for the temporal characteristics of memory (*Source* Drawing by Ming Jiang)

Based on the analysis in the previous section, the two special cases of imperial palaces and common residences were deleted, and the remaining 13 sets of data were analyzed using curvilinear regression analysis. The SPSS curvilinear evaluation method was adopted. The application of the fitting quadratic curve achieved the best effect. When R = 0.721, the fitting degree is good and Sig. = 0.025 < 0.05; thus, the variation test is passed.

The memory level–memory time model is as follows.

$$Y = 32.770 + 31.227X - 4.313X^2$$

Formula 2.8: Memory level–Memory time model

In Formula 2.8, *X* represents the evaluation value for temporal characteristics of memory, *Y* represents memory level.

As is evident from the memory level–memory time model (Fig. 2.33), urban memory level strengthens with the significance of the temporal characteristics of memory. When the memory time that people spend reaches a certain amount, the memory level will not continue to strengthen. In other words, the memory level–memory time curve reflects the same laws as the Ebbinghaus forgetting curve. The process of urban memory also presents a rule of changing fast at first and slowly

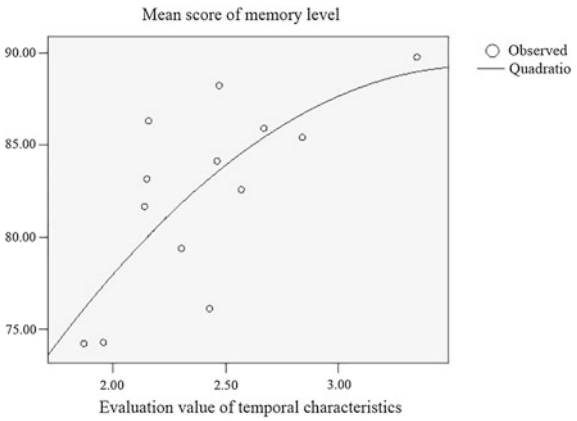

Fig. 2.33 The memory level–memory time model fitting curve (*Source* Drawing by Ming Jiang)

later. The initial memory, which is called the first impression, can be obtained quickly, and then, with the mind filled up with memories, the ability to remember also declines.

The memory level–memory time curve shows a basic fitting development trend, but there are also some special cases, such as very distinguishing features and very impressive experiences, that may change people's memory ability and memory speed related to urban historic buildings.

This section added together 29 variables for urban memory to establish the concept of urban memory level and divided it into three types: high, medium and low memory levels. The historic buildings in the inner city of Beijing were classified to obtain the memory level for different types of buildings. The imperial palaces and the administrative buildings fit into the high memory level; the buildings for managing foreign affairs, the common residences and the commemorative buildings fit into the low memory level; and other types of historic buildings fit into the medium memory level, demonstrating the differences in people's memories of different historic buildings. Next, the fuzzy evaluation method was adopted to score the three variables of visiting times, visiting date and retention time and to obtain the evaluation value for the temporal characteristics of memory, which shows the time people spend memorizing different historic buildings. Finally, the memory level–memory time model was built, which fit with the quadratic curve, demonstrating the rule that memory level changes in relation to memory time, decreasing fast at first and slowly later; the initial memory can be quickly obtained, but when the memory time reaches a certain amount, the memory level will not continue to strengthen.

Chapter 3
Plane Space: Measurement of the Urban Memory of Historic Areas

Historic areas, as the typical areas to carry, record and present the urban memory, reflect the diversity of social life and culture and also contain urban historical and landscape characteristics in many respects of the natural, artificial and humanistic environments (Zhang 2008). The existence of historic areas can help us more clearly know the past, present and future of the city in the process of understanding, interpreting and touching it (Lv and Lu 2003). In this study, historic areas will be studied as urban memory "plane spaces".

In China, the concept of "historic areas" originated in the protection of national historical and cultural cities. When the concept of a "Historical and Cultural Conservatory Area" was put forward with the announcement of the second wave of national historical and cultural cities in 1986, the corresponding concept of "historic areas" was formally announced in conjunction. Then, during 20 years of the historical and cultural heritage protection activities, China gradually formed similar concepts, such as "historic areas", "historical and cultural blocks", and "historic cities". In 2005, the published and enforced *Regulations of Conservation and Planning of Historical Cultural City* (GB 50357–2005) defined the concepts of these terms and determined that the meaning of "historic areas" was the areas with a certain scale that have rich heritages, so as to fully and truly reflect the traditional scenes and ethnic local characteristics of a certain historical period and to preserve a large number of cultural relics, historic buildings, and historic sites in modern times.

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F. Wang, *Beijing Urban Memory*, DOI 10.1007/978-981-10-0678-4_3

3.1 Statistical Features

3.1.1 Research Object

The historic areas in Beijing are the most important carriers of the city's memory. The selection of specific historical locations is determined via initial collection, secondary screening, and case sampling.

(1) **Initial collection**

The initial collection aims to list all of the historic areas within the scope of Beijing after collecting information from government departments, including the Beijing Municipal Administration of Cultural Heritage, Beijing Municipal Commission of Urban Planning, and Beijing Municipal Commission of Tourism Development. The list of historic areas is as follows: (1) World Cultural Heritage[1]; (2) National Heritage Conservative Units in Beijing (see Footnote 1); (3) Municipal Heritage Conservative Units in Beijing (see Footnote 1); (4) Beijing Excellent Architecture in modern China (1840–1949) Units (batch one)[2]; (5) Beijing Historical and Cultural Conservatory Areas (batch one; batch two)[3]; (6) Beijing A–Class Tourist Attractions.[4]

(2) **Secondary screening**

Historic areas in Beijing are not only numerous but also featured by multi-functions, according to the initial collection. Historic areas were built in different times, thus bearing different characteristics of functions and locations; therefore, 367 historic areas will be chosen during the secondary selection based on the following five criteria.

① *Screening criterion 1*: spatial characteristics. The scope of this study is not only bound to historic areas in old Beijing city but also reaches to the outer suburb. For example, modern building groups in Peking University and Summer Palace Relics Park, which were located in the suburb and now are in an urban area, along with the historical and Cultural Conservatory Areas of Yulinpu and Gubeikou, which are located in the outer suburb, are contained in the scope of the study.
② *Screening criterion 2*: temporal characteristics. The screening focuses not only on the historic areas remaining in the 800 years when Beijing was the capital but also on areas that were shaped in the 3000-year-old history of Beijing's formation. Therefore, the span of time explored ranges from the Paleolithic Age and the Neolithic Age in ancient times to the Northern Wei, Sui, and Tang Dynasties, and

[1]The directory date resources of World Cultural Heritages, National Heritage Conservative Units as well as Municipal Heritage Conservative Units: Beijing Municipal Administration of Cultural Heritage, http://www.bjww.gov.cn/.

[2]Data resources: Beijing Municipal Commission of Urban Planning, http://www.bjghw.gov.cn/.

[3]Data resources: Window of Beijing–Beijing Government Affairs web site, http://www.beijing.gov.cn/.

[4]Data resources: Beijing Municipal Commission of Urban Planning, http://www.bjta.gov.cn/.

then to the Yuan, Ming and Qing Dynasties, keeping continuous integrity on the axis of time. In addition, some areas with typical meanings in modern time, such as Modern architecture area in 798 Art Zone, are also on the list.
③ *Screening criterion 3*: degree of heritage protection. Given that historic areas within the domain of Beijing City are numerous in quantity, the study prefers those areas of municipal level and above, such as World Cultural Heritage and National- or Municipal-level Heritage Conservative Units; additionally, Historical and Cultural Conservatory Area, Excellent Architecture in modern China (1840–1949) Units and A–class tourist attractions are also included.
④ *Screening criterion 4*: functional features. Historic areas are built in different times; thus, they have different functions. To make screening easier, functional features of historic areas will be classified.

After screening, 367 historical locations were chosen, and their basic properties, including spatial characteristics (geographic location), temporal characteristics (construction age), degree of heritage protection, and functional features, were quantified to form a basic information database.

3.1.2 Spatial Characteristics

According to the spatial structure of urban development in Beijing, the municipal area is divided into core area (Dongcheng District, Xicheng District), expansion area (Haidian District, Chaoyang District, Shijingshan District, Fengtai District), and outer suburb (Mentougou District, Fangshan District, Tongzhou District, Shunyi District, Changping District, Daxing District, Huairou District, Pinggu District, Yanqing District, Miyun District). Spatial characteristics of the 367 historic locations are shown in Fig. 3.1. As shown, even though they are densely distributed in core area (220 locations) and density decreases from the city center to the peripheral area, locations are widely distributed in the expansion area (84 locations) and outer suburb (63 locations).

3.1.3 Construction Age

As shown in Fig. 3.2, the historic areas were mostly built in the Ming Dynasty (23 %), the Qing Dynasty (38 %) and the Republic Era (13 %); in addition, many other dynasties in both ancient and modern times, such as the Paleolithic and Neolithic Ages; the Western Zhou Dynasty; the Warring States Period; the Han Dynasty; the Eastern Jin Dynasty; the Northern Wei, Sui, Tang, and Song Dynasties; the Liao and Jin Kingdoms; the Yuan, Ming and Qing Dynasties and the Republic Era as well as contemporary China (1949–), all witnessed the building of historic areas.

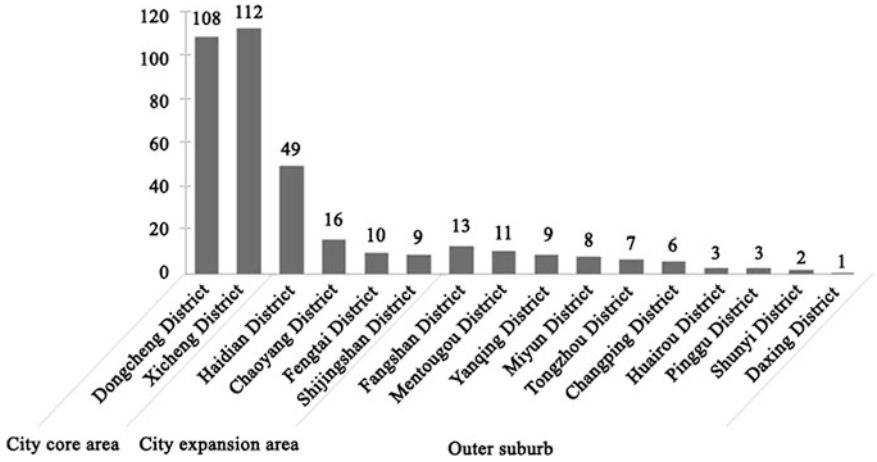

Fig. 3.1 Chart for statistical distributions of historic areas within the domain of Beijing City according to their geographical locations (*Source* Drawing by Yang Liu)

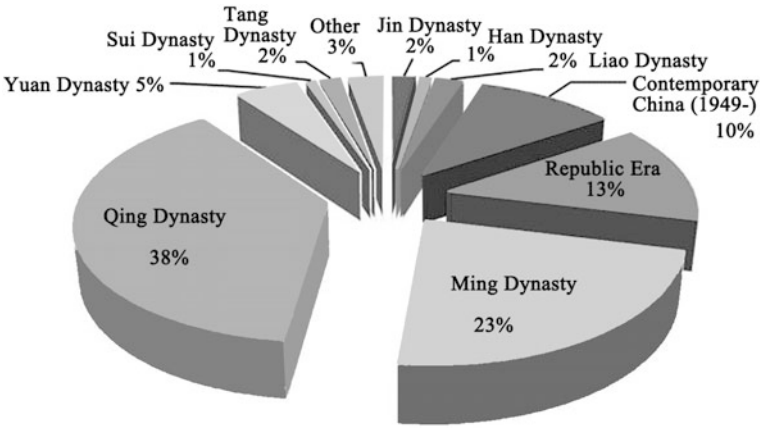

Fig. 3.2 Diagram of construction age statistics of historic areas within the domain of Beijing City (*Source* Drawing by Yang Liu)

3.1.4 Historic Relic Grade

The historic areas chosen include six types, among which are World Cultural Heritage, National Heritage Conservative Units in Beijing, Municipal Heritage Conservative Units in Beijing, Beijing Excellent Architecture in modern China (1840–1949) Units (batch one), Beijing Historical and Cultural Conservatory Areas (batch one; batch two) and Beijing A–Class Tourist Attractions (Fig. 3.3). A area that bears characteristics of any two types will be labeled with higher-level types,

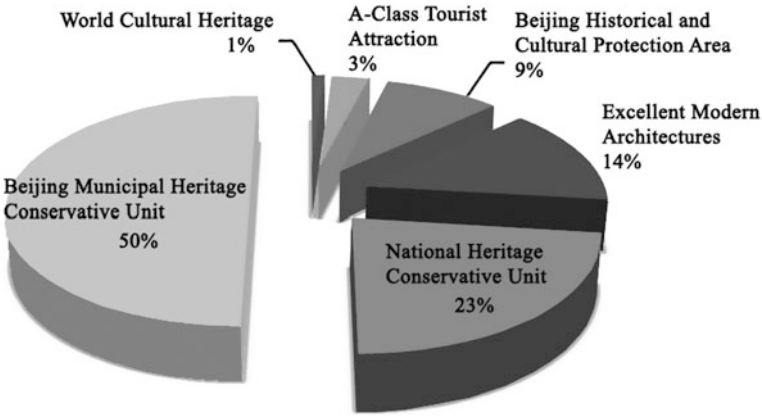

Fig. 3.3 Diagram of historic relic grades statistics of historic areas within the domain of Beijing City (*Source* Drawing by Yang Liu)

among which Municipal Heritage Conservative Units occupy 50 %, followed by National Heritage Conservative Units with 23 %; in contrast, A–Class Tourist Attractions and World Cultural Heritage occupy the lowest percentage, at 3 and 2 %, respectively.

3.1.5 Functional Features

Based on functional features, historic areas will be divided into four major categories and sixteen subcategories (Table 3.1), including the royal areas, cultural areas, manufacturing areas, and residential areas. (1) Providing places for royal governing, life, rituals and logistical services, which include royal palace areas, royal ritual sites, royal mausoleum sites and royal service areas. (2) Reflecting commemoration significance, cultural areas carrying symbolic meaning mainly include cultural relic sites, cultural landmark sites, cultural-memorial sites and cultural-religious sites. (3) Providing places for residents' daily life, social interaction and education, manufacturing areas include daily service areas, administration and governance areas, industry and manufacturing areas, and education and research areas. (4) Lastly, residential areas include common residence areas, former residences of celebrity areas, ancient towns and villages, and officials and nobles' mansion areas.

Figures 3.4 and 3.5 show the proportion and spatial distribution of 367 historic areas in four major categories and sixteen subcategories (royal areas with 31, cultural areas with 137, manufacturing areas with 85, and residential areas with 114). Specifically, cultural-religious sites (73) and common residence areas (49) occupy

Table 3.1 Classification table of historic areas within the domain of Beijing City

Category	Subcategory	Conception definition	Representing historic areas
Royal areas	Royal palace areas	Exclusively for the royal palace areas and royal garden	Zhongnanhai, Summer Palace
	Royal mausoleum sites	For tombs of emperors and empresses	Thirteen Ming Tombs
	Royal ritual sites	For royal worship of heaven, temple sacrifice, and worship of ancestors	Temple of Heaven, Emperor Temple in previous dynasties
	Royal service areas	For royal governing, life, rituals and logistical services	Imperial Archives, Imperial College
Cultural areas	Cultural relic sites	Remains of residences, village, capital, palace, office, temple and workshop, etc.	Summer Palace Relics Park, Yuan Dynasty Capital City Wall Relics Park
	Cultural landmark sites	Areas possessing uniqueness in geographical location and symbolic meaning in culture	Great Wall at Badaling, Tian'an Men
	Cultural-memorial sites	Occasions representing memorial meaning such as tombs, temples and cemeteries	Wen Tianxiang Shrine
	Cultural-religious sites	Temples and churches for religious ceremonies-sacrifice, worship, pray and celebrate	Tanzhe Temple, Lama Palace
Manufacturing areas	Daily service areas	For public servicessuch as businesses, entertainment and medical care	Dashilar Historical and Cultural Conservatory Area, Anhui Guild Hall
	Administration and governance areas	Exclusively for administrative office and foreign exchanges	Historic and Cultural Conservatory Area of Beijing Legation Street
	Industry and manufacturing areas	For industry and manufacturing areas	Modern architecture area in 798 Art Zone
	Education and research areas	For advanced education and scientific research	Early architecture area in Tsinghua University

(continued)

Table 3.1 (continued)

Category	Subcategory	Conception definition	Representing historic areas
Residential areas	Common residence areas	Alley and quadrangle for common people to live	No. 5 courtyard house of Mao'er Hutong
	Former residences of celebrity areas	Residence where celebrities in political and cultural circles lived	Former Residence of Chong Li, Former Residence of Soong Chingling
	Officials and nobles' mansion areas	Mansions where the kings and princes of the Qing Dynasty lived	Prince Chun Mansion, Prince Li Mansion
	Ancient towns and villages	Well-preserved towns and villages representing various characteristics of Beijing	Cuandixia Village, Chadao City Wall

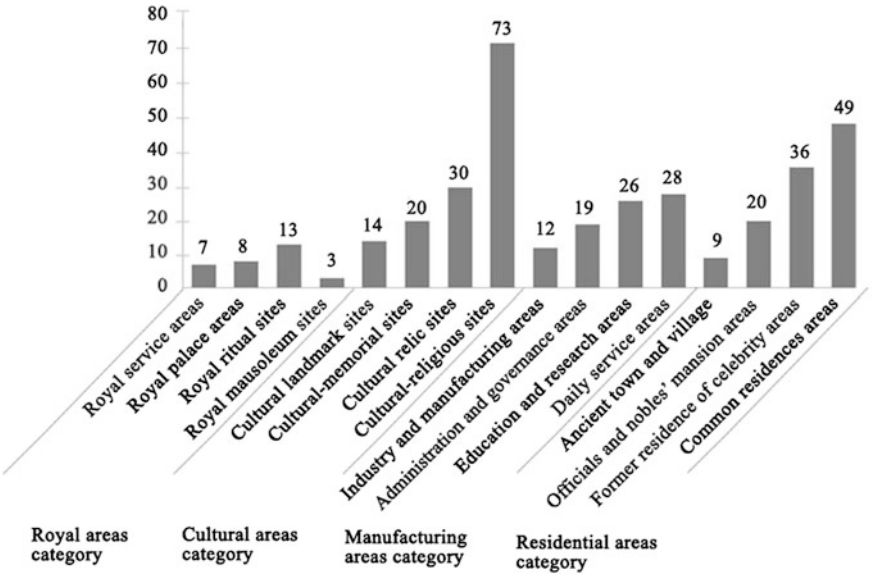

Fig. 3.4 The proportion of historic areas by four major categories within the domain of Beijing City (*Source* Drawing by Yang Liu)

the highest percentage; by contrast, royal ritual sites and ancient towns and villages make up the lowest proportion. The discrepancies of occupations by major types lead to the non-balanced distribution of specific types.

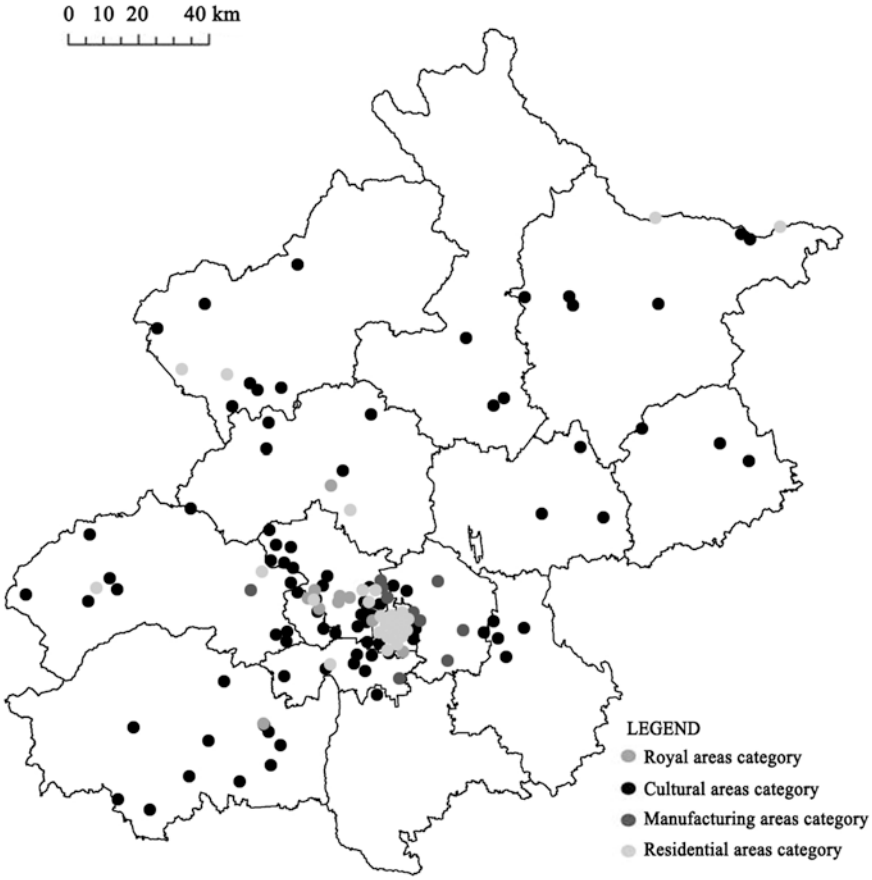

Fig. 3.5 Spatial distribution of historical areas within the domain of Beijing City (*Source* Drawing by Yicai Zhu)

3.2 Design Research and Investigation Process

3.2.1 Sampling

This study adopted stratification sampling, medium-scale sampling and the Delhi method to screen historic areas. Stratified sampling has been mentioned in "2.2.1 Research object". The Delphi method is a systematic, effective and direct method for making judgments and evaluations after achieving a consensus from experts via several rounds of questionnaires (Liu et al. 2009).

Adopting the stratification sampling method, this study manages to follow the principle that the historic areas chosen are typical and represent all types of categories, including spatial characteristics, temporal characteristics, and functional features.

Table 3.2 Temporal-spatial characteristics of historic areas within the domain of Beijing City

Temporal characteristics	Spatial characteristics			Subtotal	Total
	Core area[a]	Expansion area[b]	Outer suburb[c]		
Yuan Dynasty and earlier	14	12	29	55	367
Ming and Qing Dynasties	157	38	29	224	
Republic Era	32	13	4	49	
Contemporary China (1949–)	17	21	1	39	
Subtotal	220	84	63	367	

Note [a]Core area: Dongcheng District and Xicheng District
[b]Expansion area: Haidian District, Shijingshan District, Fengtai District and Chaoyang District
[c]Outer suburb: Yanqing District, Huairou District, Miyun District, Pinggu District, Changping District, Shunyi District, Mentougou District, Fangshan District, Daxing District, Tongzhou District

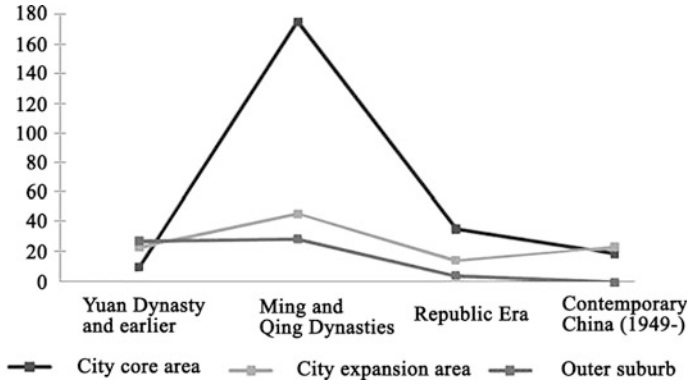

Fig. 3.6 Temporal-spatial characteristic of historic areas within the domain of Beijing City (*Source* Drawing by Yang Liu)

Considering the characteristics of 367 historic areas within the domain of Beijing City, three 2-dimensional information charts represent temporal-spatial characteristics (Table 3.2, Fig. 3.6), functional-temporal characteristics (Table 3.3, Fig. 3.7), and functional-spatial characteristics (Table 3.4, Figs. 3.8, 3.9).

Based on Formula 2.1, sampling of historic areas is performed in accordance with temporal-spatial characteristics, taking 18 as a unit and numbering those the areas that are less than 18 as 1 to ensure that historic areas are distributed in each temporal-spatial dimension, leading to the confirmation of 19 sampling areas as study areas (Table 3.5).

The Delhi method was also used when choosing sampling points selected from historic areas. After three rounds of feedback from 15 professional research fellows and 5 local people with specialized knowledge, a consensus was achieved, and 10 areas were selected from four major types (Table 3.6).

Table 3.3 Functional-temporal characteristic of historic areas within the domain of Beijing City

Functional characteristics		Temporal characteristics (construction age)				Subtotal	Total
Category	Subcategory	Yuan Dynasty and earlier	Ming and Qing Dynasties	Republic Era	Contemporary China		
Royal areas	Royal palace areas	2	6	0	0	8	31
	Royal mausoleum sites	1	2	0	0	3	
	Royal ritual sites	1	12	0	0	13	
	Royal service areas	1	6	0	0	7	
	Subtotal	5	26	0	0	31	
Cultural areas	Cultural relic sites	21	5	4	0	30	137
	Cultural landmark sites	0	14	0	0	14	
	Cultural-memorial sites	0	11	7	2	20	
	Cultural-religious sites	26	47	0	0	73	
	Subtotal	47	77	11	2	137	
Manufacturing areas	Daily service areas	0	9	7	12	28	85
	Administration and governance areas	0	7	6	6	19	
	Industry and manufacturing areas	0	4	5	3	12	
	Education and research areas	0	8	8	10	26	
	Total	0	28	26	31	85	
Residential areas	Common residence areas	3	36	5	5	49	114
	Former residences of celebrity areas	0	28	7	1	36	
	Officials and nobles' mansion areas	0	20	0	0	20	
	Ancient towns and villages	0	9	0	0	9	
	Subtotal	3	93	12	6	114	
Total	Historic areas	55	224	49	39	367	367

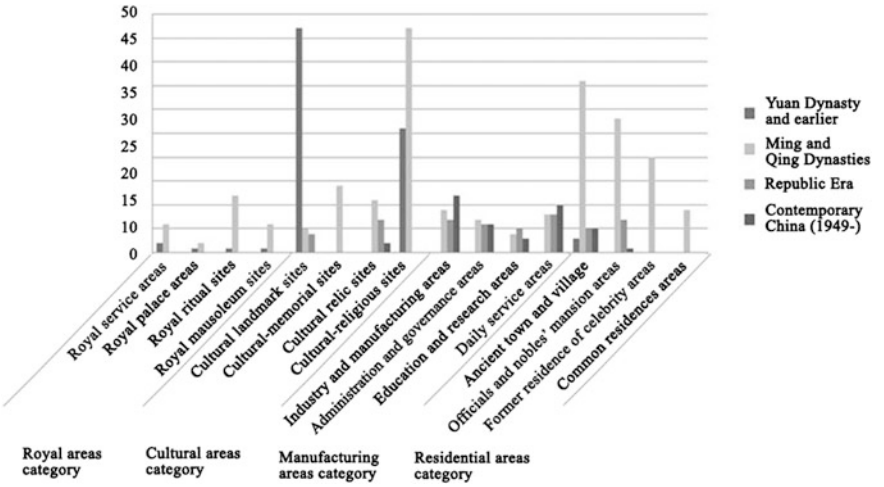

Fig. 3.7 Functional-temporal characteristic of historic areas within the domain of Beijing City (*Source* Drawing by Yang Liu)

Table 3.4 Functional-spatial characteristic of historic areas within the domain of Beijing City

Functional characteristics		Spatial characteristics			Subtotal	Total
Category	Subcategory	Core area	Expansion area	Outer suburb		
Royal areas	Royal palace areas	4	4	0	8	31
	Royal tombs	0	1	2	3	
	Royal ritual sites	12	1	0	13	
	Royal service areas	4	3	0	7	
	Subtotal	20	9	2	31	
Cultural areas	Cultural relic sites	5	10	15	30	137
	Cultural landmark sites	3	1	10	14	
	Cultural-memorial sites	6	9	5	20	
	Cultural-religious sites	29	23	21	73	
	Subtotal	43	43	51	137	
Manufacturing areas	Daily service areas	23	5	0	28	85
	Administration and governance areas	16	3	0	19	
	Industry and manufacturing areas	7	4	1	12	
	Education and research areas	13	11	2	26	
	Subtotal	59	23	3	85	

(continued)

Table 3.4 (continued)

Functional characteristics		Spatial characteristics			Subtotal	Total
Category	Subcategory	Core area	Expansion area	Outer suburb		
Residential areas	Common residence areas	45	4	0	49	114
	Former residences of celebrity areas	33	3	0	36	
	Officials and nobles' mansion areas	20	0	0	20	
	Ancient towns and villages	0	2	7	9	
	Subtotal	98	9	7	114	
Total	Historic areas	220	84	63	367	367

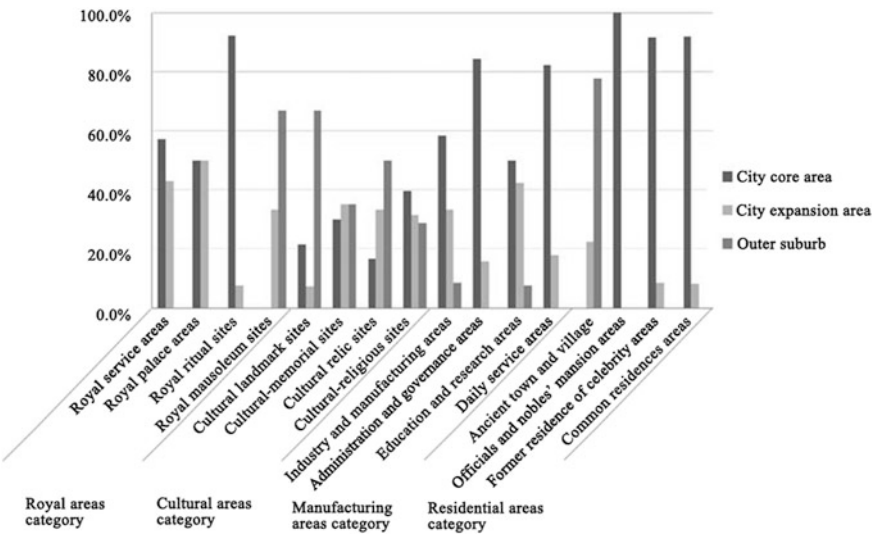

Fig. 3.8 Functional-spatial characteristic of historic areas within the domain of Beijing City (*Source* Drawing by Yang Liu)

Further consideration of screening areas includes four major factors: (1) temporal characteristics, which mean the areas were built throughout four periods in history: the Yuan Dynasty and earlier, the Ming and Qing Dynasties, the Republic Era, and contemporary China (1949–); (2) spatial characteristics, which mean the areas are distributed within the domain of Beijing City; (3) responses from experts, which mean that historical areas are representative and typical; (4) functional features, which require chosen areas to bear functions of those four categories and 16 subcategories. Eventually, a sample of 19 historic areas was chosen (Table 3.7) as the major focus in the further study on urban memory of historic areas.

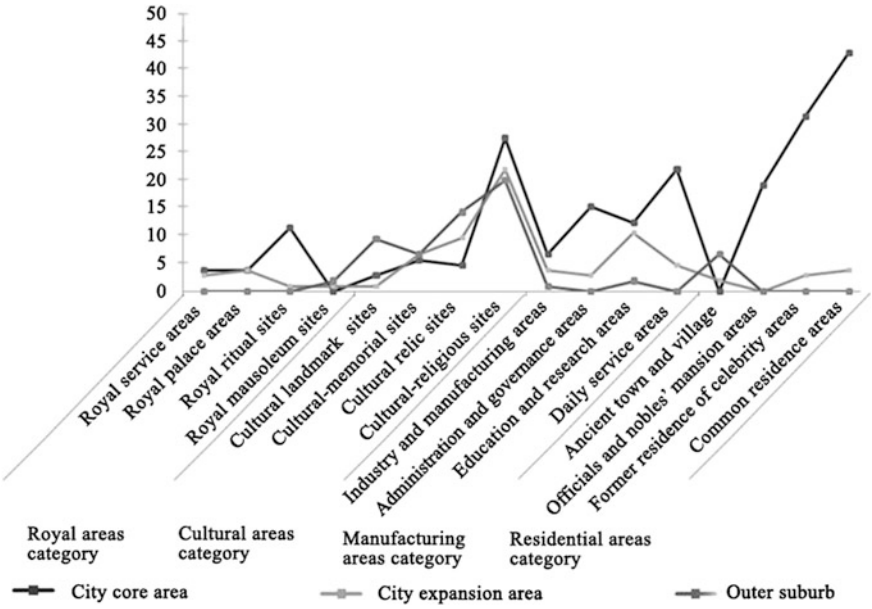

Fig. 3.9 Functional-spatial characteristics of historic areas within the domain of Beijing City (*Source* Drawing by Yang Liu)

Table 3.5 Result of proportional probability sampling of historic areas within the domain of Beijing City (based on temporal-spatial characteristic)

Temporal characteristics	Core area		Expansion area		Outer suburb	
	Total	Selection	Total	Selection	Total	Selection
Yuan Dynasty and earlier	14	1	12	2	29	1
Ming and Qing Dynasties	157	8	38		29	1
Republic Era	32	2	13	1	4	1
Contemporary China (1949–)	17	1	21	1	1	
Subtotal	220	12	84	5	63	3

3.2.2 Measurement Elements

(1) **Subjective elements**

Subjective urban memory on the basis of objective historic areas is a general evaluation of the carrier of memory made by a rememberer and disaffected by the following elements: (1) different elements of historic areas form various urban memories, for the urban memory cognition (UMC) of various aspects of areas including distinctive elements and updated evaluation differs dramatically between rememberers; (2) the same elements of historic areas in different subjects form

Table 3.6 Historic areas selected within the domain of Beijing City through the Delhi method

	Royal areas	Cultural areas	Manufacturing areas	Residential areas
1	Forbidden City (Palace Museum)	Great Wall at Badaling	Yanyuan architecture group around Weiming Lake at Peking University	Prince Kung Mansion and Garden
2	Summer Palace	Summer Palace Relics Park	Modern architecture area in 798 Art Zone	Nanluogu Lane
3	Temple of Heaven	Lama Palace	Early architecture area in Tsinghua University	Imperial College Historic and Cultural Conservatory Area
4	Thirteen Ming Tombs	Tian'an Men	Dashilar Historical and Cultural Conservatory Area	Dashilar Historical and Cultural Conservatory Area
5	Towers of Bell and Drum	Beijing's city walls in the Ming Dynasty	Historic and Cultural Conservatory Area of Beijing Legation Street	Shichahai Historic and Cultural Conservatory Area
6	Zhongnanhai	Tanzhe Temple	East Liulichang Historical and Cultural Conservatory Area	Cuandixia Village Ancient Buildings
7	Imperial College	Beijing–Hangzhou Grand Canal	Cultural Palace of the Nationalities	Former Residence of Lao She
8	Temple of Earth	Juyongguan Pass Great Wall	Modern architecture area in Tsinghua University	Former Residence of Soong Chingling
9	Imperial Ancestral Temple	Badaling Residual Great Wall	Former Site of Duan Qirui Government	Former Residence of Chen Duxiu
10	Jingshan Hill	Babaoshan Revolutionary Cemetery	Modern Architectures of Beijing Hotel	Former Residence of Mei Lanfang

different cognition and memories. Accordingly, urban memory of historic areas made by rememberers is divided into three categories: the memories of the inheritance elements, the distinctive elements and the renewal elements.

Memory of inheritance elements is highly related to the value and cognitive evaluation of historic areas, for memory level reflects evaluation of historic areas from the perspective of historical value, development contributions and the necessity of preservation. Assessment factors forming such memories include the general impression of historic areas, conservation value of historic areas, and the effect on the landscape and urban development of Beijing.

Memory of the distinctive elements is formed on the basis of integrated characteristic factors of historic areas, and memory level reflects the intensity of collective memory. Through investigating the subject's evaluation on the importance of historic areas, acceptance of characteristics and contributions to a further understanding of Beijing local culture, the study quantifies the rememberer's cognition and evaluation of characteristics of the carrier of memory.

Table 3.7 Sampling of selected historic areas

Temporal characteristics	Spatial characteristics					
	Core area	Function	Expansion area	Function	Outer suburb	Function
Yuan Dynasty and earlier	Nanluogu Lane	Common residence areas			Tanzhe Temple	Cultural-religious sites
Ming and Qing Dynasties	Forbidden City (Palace Museum)	Royal palace areas	Summer Palace	Royal palace areas	Thirteen Ming Tombs	Royal mausoleum sites
	Towers of Bell and Drum	Royal service areas	Babaoshan Revolutionary Cemetery	Cultural-memorial sites	Cuandixia Village Ancient Buildings	Ancient towns and villages
	Shichahai Historic and Cultural Conservatory Area	Common residence areas				
	Temple of Heaven	Royal ritual sites				
	Tian'an Men	Cultural landmark sites				
	Dashilar Historical and Cultural Conservatory Area	Daily service areas				
	Prince Kung Mansion and Garden	Officials and nobles' mansion areas				
	Beijing's city walls in the Ming Dynasty	Cultural relic sites				
Republic Era	Former Site of Duan Qirui Government	Administration and governance areas	Yanyuan architecture group around Weiming Lake at Peking University	Education and research areas		
Contemporary China (1949–)	Former Residence of Chen Duxiu	Former residences of celebrity areas	Modern architecture area in 798 Art Zone	Industry and manufacturing areas		
	Cultural Palace of the Nationalities	Daily service areas				

Memory of the renewal elements focuses on protection as well as renewal of historic areas, demonstrating whether the historic areas are in close relationship with carrying on local urban culture when they were changed at various times. The degree of this type of memory shows intensity of rememberer's memory level of historic areas as a whole, such as whether the reconstructed historic areas keep the previous features and keep the memory, carry on traditional culture or maintain features of the ancient city.

According to the study on the formation mechanism and system structure of urban memory and under the guidance of the perception of probability theory (Lens Theory) in environmental psychology and the significance of environmental space theory proposed by Amos Rapoport, the formation of urban memory is mainly affected by the rememberer (subjective) attribute along with temporal characteristics. Thus, any study on a subject's urban memory cannot omit the subjective attributes; likewise, this study regards duration of residence, information access, etc. as major characteristics of rememberers.

(2) **Objective elements**

Because an object of urban memory is the foundation carrying urban memory, the construction of objective elements should fully reflect the characteristics of integrity, dynamism and continuity of urban memory. In terms of integrity, the objective elements of historic areas in Beijing is divided into the objective existence of elements (such as cultural relics, representative architectures, traditional layout, color, volume, materials, peripheral environment) and intangible cultural elements (such as cultural deposits, historic stories, changing of names and anecdotes). In terms of the characteristics of dynamism and continuity, the urban memory of historic areas is formed within a certain street space with a long history, with constant changes in terms of street names, reconstruction, street patterns and businesses. According to the temporal characteristic of objective elements, another carrier of memory of historic areas, the objective elements of urban memory are divided into three categories: memory of the permanent elements, the evolutionary elements, and the temporary elements.

Memory of the permanent elements refers to the memory of elements that exist for a long time and are well preserved in the history of the development of historic areas. Such type of memory relies on the following factors: location of historic areas, representative and renowned cultural architectures; traditional spatial patterns (fish bone shaped in Nanluogu Lane); famous landscape pieces (Yindian Bridge in the Shichahai Historic and Cultural Conservatory Area); and typical forms of buildings (the courtyard house). Remarkable features of such elements change during different periods yet preserve their basic characteristics in certain times.

Memory of the evolutionary elements is memory formed on the basis of the ever-changing elements of historic areas, relying on the change of function, names and the overall features of historic areas. For example, Dashilar Historical and Cultural Conservatory Area was prosperous in the Qing Dynasty but suffered a fire

in 1900 and was reconstructed in the Western style in 2008, regaining its original characteristics during the Republic Era. As observed, these characteristics, as the major composition of Beijing urban memory, demonstrate the obvious changes in historic areas.

Memory of the temporal elements is the memory of temporal events and changes (celebrities and anecdotes related to historic areas), temporal historical function (Tian'anmen Square holding the foundation ceremony), historical events and historic stories (the demolition of the Beijing's city walls in the Ming Dynasty in 1958 and 1969, respectively), previous names of historical areas (Nanluogu Lane was once called Luoguo Lane and Huihuang Street in different periods). Such elements show an obvious periodic characteristic.

(3) **Temporal elements**

As mentioned above, from a diachronic perspective, the study of historic areas includes the Paleolithic and Neolithic Ages; the Western Zhou Dynasty; the Warring States Period; the Han Dynasty; the Eastern Jin Dynasty; the Northern Wei, Sui, Tang, Song Dynasties; and the Liao and the Jin Kingdoms; the Yuan, Ming and Qing Dynasties and the Republic Era as well as contemporary China (1949–) on the axis of time. Historic areas in various periods differ in construction age, remarkable periods and declining periods as well as historical events. Different point-in-time of memory, time period and time axis form different objective elements, exerting various subjective cognitions and evaluations. Accordingly, in diachronic order from short to long, urban memory taking on historic areas in Beijing as its object includes three parts: point-in-time, time period and time axis.

Point-in-time is a transitional period when temporal events with dramatic impact happen, so the main characteristic lasts for a short period of time. Time-significant events held in historic areas (the flag-rising ceremony or military parade in Tian'anmen Square), and the time when some historic areas were panned and reconstructed (reconstruction of Ju'er Hutong) are included.

Time period is a type of temporal elements with long period of history, reflecting the representing period's historic areas' experience, including the most prosperous and most turbulent period witnessed in the historic areas. For example, the Great Wall in the Ming Dynasty experienced its prosperity during the Ming Dynasty and a decline in the contemporary time between the 1950s and 1960s when it was demolished twice, causing great damage to the historic areas; however, modern architecture groups in the 798 Art Zone have seen its prosperity in contemporary time after the founding of the People's Republic of China. Therefore, the objective elements' urban memory of the same historic area at various periods differs, and the objective elements' urban memory of different historic areas during the same period differs as well; thus, the subjective cognition of objects are different. As observed, it is of great necessity to analyze urban memory with temporal elements, which are in contact with the objective elements and subjective elements.

3.2.3 Measurement Methods

(1) **Content and method measuring the subjective elements**

Measurement of the subjective elements of urban memory, which uses historic areas as its object, not only focuses on the rememberer's general evaluation of characteristics of historic areas but also adds the measurement of elements affecting the formation of memory, namely the subjective attribute characteristics. Adopting relevant mathematical analysis methods on the basis of these two measurements, this study obtains the following results: subjective evaluation values (EV), statistical information of subjective attributes, and a relationship between subjective evaluation and subjective attributes.

Level-three variables are concluded through a literature review and expert interviews, such as the collection of relevant materials of 19 typical and representative study objects in terms of temporal, spatial and functional characteristics. In addition, through consultation of planning related to historic areas, such as, the *Conservation Planning of Historical and Cultural City of Beijing* (Beijing Municipal Commission of Urban Planning 2002), the *Conservation Planning of 25 Historical and Cultural Districts in Old Beijing City* (Beijing Municipal Commission of Urban Planning 2002); and the related books such as, *City Records* (Wang 2003), the study obtains level-three variables (Table 3.8) corresponding to such level-two variables as the memory of the inheritance elements, the distinctive elements and the renewal elements.

According to the constructed three-level measurement scale of object elements in urban memory of Beijing's historic areas, memory level can be measured through following steps.

Using a Likert scale with five grades as measurement system, the study introduces subjective evaluation values (EV). Subjective EV is used to measure the degree of recognition of the subject towards the object condition, through which the subject EV can help analyze the judgement on the object on the basis of the perception of the subject (rememberer) oneself and his/her own value orientation. The interval of the subjective EV is set up as 0–1 and the greater value demonstrates a higher evaluation. The subject EV is divided into three levels: $0 \leq EV < 0.4$ is low, $0.4 \leq EV < 0.7$ is medium, and $0.7 \leq EV \leq 1$ is high. The range of the low level is broader than that of the medium and high levels, aiming to agree with the objective grading. This classification serves as a simple standard rather than strict standard for the subjective EV grading. In accordance with the Likert scale, the scale is classified into five levels from low to high (points from 1 to 5): totally disagree, partially disagree, neither disagree nor agree, partially agree, and totally agree. The specific calculation of the subjective EV is shown in Formula 3.1.

Table 3.8 Measurement scale of subjective elements in urban memory of Beijing's historic areas

Subjective evaluative elements	Level-three variables
Inheritance elements	1. General evaluation of historic areas 2. Protection value of historic areas 3. Historic areas exerting a positive impact on the features of Beijing city 4. Historic areas impeding modernization development in Beijing 5. Demolishing historic areas exerting a positive effect on Beijing's development
Distinctive elements	1. Historic areas are important parts of Beijing 2. Historic areas carry profound traditional culture in Beijing 3. Historic areas are important characteristics of Beijing city 4. Historic areas deepen the understanding of Beijing 5. Historic areas help to convey traditional culture in Beijing 6. Whether it is necessary to reconstruct Beijing's historic areas
Renewal elements	1. Preservation and repair, overall impression after renewal 2. Preservation and repair, whether the area is the embodiment of original appearance after renewal 3. Preservation and repair, whether the area bears the original culture after renewal 4. Preservation and repair, whether the area is the continuation of the original function after renewal 5. Preservation and repair, whether the area improves urbanstyle 6. Preservation and repair, whether the area exerts a positive effect on urban development

$$EV = \sum_{i=1}^{n} \frac{a_i - 1}{4n} \tag{3.1}$$

Formula 3.1: Subjective evaluation value (EV)

In Formula 3.1, n represents the number of questions in each type, and a is the sample score (using 0–5 points).

Then the subjective attribute characteristics are in the statistical description. The content of the subjective attributes measurement includes duration of residence, gender, age, profession, education, etc. The methods of measurement are subjective self-reported and mathematical statistics.

On the basis of the subjective evaluation value (EV) and subjective attributes, it is required to standardize the two groups of data, respectively, to further carry out correlation tests. The Standardized transformation of Formula 3.2 is as follows.

$$x_{ij}^{*} = \frac{x_{ij} - \overline{x_j}}{\sigma_j}, (i = 1, 2, 3 \ldots, n; j = 1, 2, 3 \ldots m) \tag{3.2}$$

Formula 3.2: Standardized transformation formula

In Formula 3.2, σ_{j} is the standard deviation of the sample.

After the standardized value is calculated by the subjective evaluation value (EV) and subjective attributes, Pearson's correlation tests will be conducted, which identifies the characteristics of judgments of people from different backgrounds, as shown in Formula 3.3.

$$r_{jk} = \frac{\sum_{i=1}^{n} (x_{ij} - \overline{x_j})(x_{ik} - \overline{x_k})}{\sqrt{\sum_{i=1}^{n} (x_{ij} - \overline{x_j})^2 \sum_{i=1}^{n} (x_{ik} - \overline{x_k})^2}} \tag{3.3}$$

Formula 3.3: Pearson's correlation test

In Formula 3.3, r_{jk} is the Pearson's correlation coefficient between the jth variable and kth variable, and n is the number of samples.

(2) **Content and methods of objective elements measurement**

With Beijing's historic areas as the important spatial patterns carrying Beijing's urban memory, the measurement of objective urban memory purports to determine the objective urban memory cognition (UMC), the correlations between subjective and objective urban memories and between objective evaluation and subjective attributes (Table 3.9).

According to the constructed three-level measurement scale of object elements in urban memory of Beijing's historic areas, how historic areas exert influence on Beijing's urban memory can be measured through following steps.

During the measurement of the objective elements cognition, the urban memory cognition (UMC) was introduced to measure the cognitive degree of the objective

Table 3.9 Evaluative measurement scale of objective elements in urban memory of Beijing's historic areas

Objective evaluative elements	Level-three measurement variables
Permanent elements	1. Location (relative to the Forbidden city) 2. Peripheral environment (natural landscape element) 3. Architectural style 4. Traditional spatial pattern 5. Representative architecture 6. Cultural relic sites 7. Honor of protection level
Evolutionary elements	1. Name replacement of historic areas 2. Function evolution 3. Reconstruction 4. Style changes
Temporary elements	1. Celebrities and historical events 2. Historical allusions and anecdotes 3. Historical function 4. Previous name 5. Name origin

elements and to determine the cognitive difference of the objective elements of different types. The range of UMC was 0–1, with a larger UMC indicating a higher level of cognition. In this study, the UMC values were divided into three categories as follows: $0 \le \text{UMC} < 0.4$ is low, $0.4 \le \text{UMC} < 0.7$ is medium, and $0.7 \le \text{UMC} \le 1$ is high. The reason the range of the low value is greater than the medium and high values is to decrease the influence of multiple choice and single choice. This classification is simple and cannot be use as a strict standard to divide the UMC. The UMC model was defined by Formula 3.4.

$$UMC = \sum_{i=1}^{n} \frac{b_i - 1}{4N}$$

$$Single-Choice : b_i = a_i$$

$$Multiple-Choice : b_i = \sum_{i=1}^{k} \frac{2a_i}{iK} + 3 \quad UMC = 0\,(Null)$$

Formula 3.4: Objective urban memory cognition (UMC)

In Formula 3.4, N is the number of sampling, n = 1, 2, 3, …, N; a is the points given by the individuals in the sample (using 0–5 points); and K is the number of multiple–choice items.

The relationship between subjective attributes and the objective elements of urban memory (including the permanent elements, the evolutionary elements and the temporary elements) as well as the relationship between urban memory cognition (UMC) and the inheritance elements, the distinctive elements and the renewal elements is discussed (Formula 3.3).

(3) **Content and methods of temporal elements measurement**

The measurement and evaluation of urban memory carried by historic areas can be confirmed from the perspective of point-in-time (significant events), time period and time axis. With regard to the diachronic characteristic of the development and evolution of historic areas, level-three variables are obtained and shown in Table 3.10.

Table 3.10 Evaluative measurement scale of the temporal elements in urban memory of Beijing's historic areas

Temporal measurement elements	Level-three measurement variables
Point-in-time	1. Time of significant events 2. Time of festive activities 3. Time of reconstruction
Time period	1. Remarkable periods witnessed by historic areas 2. Declining periods witnessed by historic areas
Time axis	1. Building age 2. Dynasties that survived

According to the constructed level-three measurement scale of temporal elements in urban memory of Beijing's historic areas, how historic areas exert influence on Beijing's urban memory can be measured through following steps.

Similar to the measurement of objective elements in urban memory cognition, the UMC indicator is used to measure the temporal elements, as shown in Formula 3.5.

$$UMC = \sum_{i=1}^{n} \frac{a_i}{N}$$
$$UMC_{sum} = \sum_{i=1}^{n} \frac{UMC_j}{K} \tag{3.5}$$

Formula 3.5: Temporal urban memory cognition (UMC)

In Formula 3.5, n is the number of samples, and a is the points given by the sample.

How subjective attributes are related to temporal elements (point-in-time, time period and time axis) in urban memory are explored, as well as the inheritance elements, the distinctive elements and the renewal elements and objective urban memory (Formula 3.3).

3.2.4 Data Acquisition and Analysis Methods

A formal survey was conducted from April 21 to May 9, 2011, and included field research and an internet survey. A total of 419 questionnaires (including 103 online questionnaires) were distributed; 382 of those collected were valid, accounting for a 91.1 % validity ratio.

Two hundred twenty-nine questionnaires were distributed in fieldwork, 203 of which were effective surveys; thus, the validity ratio was 88.6 %. This study focuses on residents who have a certain duration of residence in Beijing and attempts to expand the locations, covering historic areas throughout the whole city. Accordingly, the questionnaires were distributed in 13 locations, ranging from the core area and expansion area to the outer suburb.

With the help of the survey platform www.sjump.com, an online survey was conducted with a validity ratio of 94.2 % by distributing 190 questionnaires, 179 of which were returned. In the concrete operation, 10 evaluators were chosen according to their occupation to help distribute the questionnaires and explain the questions, after which they conducted the study. Among those 10 evaluators were 3 students, 1 research faculty member, 2 state-owned enterprise employees, 2 foreign enterprise employees and 2 private enterprise employees.

By utilizing both field and online research, the survey reached a relative balance in the properties of rememberers studied. Field survey respondents were mainly the elderly in residential areas with relatively low education and were recategorized

under the long–term memory group; the online survey respondents were those able to use a computer, of a relatively younger age and with higher education, including a certain number of students. The two programs complemented each other in ensuring the diversity and balance of respondents' backgrounds in age, education, income, duration of residence, information access, and other aspects.

After the questionnaires were returned, a statistics process of the data was carried out using Excel 2007 and SPSS 16.0 for Windows. The data processing methods include descriptive statistics, modeling calculations, and correlation analysis (Pearson).

3.3 Research Results

3.3.1 Measurement of the Subjective Elements

The analysis of the subjective elements in the urban memory of historic areas included three aspects. First, the degree of urban memory was measured through a subjective evaluation value (EV) formula. Second, a statistical analysis of rememberers' demographic attributes, including age, period of residence and duration of residence, was conducted. Last, the subjective evaluative elements and subjective attributes were tested and their relationship with the Pearson's correlation analysis method was evaluated to discuss the rules of Beijing's urban memory related to subjective attributes with historic areas as the object.

(1) **Analysis of the subjective elements**

① Level-one elements

The rememberers' overall degree of urban memory of historic areas was measured through subjective evaluation values (EV). According to Formula 3.1, the overall evaluation value of Beijing's historic areas is 0.71, and $0.7 \leq EV \leq 1$ is a high evaluation.

② Level-two elements

Level-two elements represent three main aspects of urban memory carried by historic areas: the memory of the inheritance elements, the distinctive elements and the renewal elements. The EV of level-two variables in terms of three aspects are shown in Table 3.11.

Analysis of rules of level-two elements in urban memory is as follows.

(1) Memory of the inheritance elements represents the evaluation of recognition of Beijing's historic areas made by rememberers, and the EV shows that historic areas are highly recognized, which means they have deep memory of Beijing's historic areas from the perspective of general impression, protection value, positive effect on Beijing's urban features, and inheritance of traditional culture.

Table 3.11 The subjective evaluation value (EV) of level-two variables of Beijing's historic areas

Variables	Inheritance elements	Distinctive elements	Renewal elements
EV	0.77	0.71	0.62
Level	High	High	Medium

Note $0 \leq EV < 0.4$ is low, $0.4 \leq EV < 0.7$ is medium, and $0.7 \leq EV \leq 1$ is high

The high recognization fully illustrates that Beijing's historic areas are important parts and inheritances of Beijing's urban memory.

(2) The EV of the distinctive elements is at 0.71, and $0.7 \leq EV \leq 1$ implies a high level, which demonstrates that rememberers have a high recognition of the characteristics of historic areas and high acceptance of the fact that historic areas could deepen Beijing's urban memory. Specifically, subjects hold a high acceptance evaluation, believing that historic areas are important parts of Beijing, which deepen the understanding of Beijing and aid in a better understanding of Beijing's traditional culture.

(3) Renewal elements memory represents the denial of rememberers that historic areas maintain a close relation with Beijing cultural deposits in the process of change throughout different time periods. Such evaluation mainly focuses on artificial transformations and reconstruction of historic areas in the process of development and evolution, studying subjective evaluation of whether historic areas maintain their original appearance, carry on traditional culture, and continue their original function after renewal. The EV of the renewal elements is at a medium level at 0.62, showing that rememberers do not have a high recognition of reconstruction of historic areas, and both positive and negative responses are included.

③ Level-three elements

The level-three variables of subjective evaluation value (EV) is shown in Table 3.12.

Analysis of rules of level-three elements in urban memory is as follows.

(1) Rememberers have a high recognition of "protection value of historic areas" at 0.82, illustrating that they have a consensus of recognition of the protection of historic areas; additionally, rememberers generally believe that historic areas "have a positive Impact on Beijing's urban landscape", "carry on profound Beijing's traditional culture", "deepen the understanding of Beijing" and "aid in understanding Beijing's traditional culture". The EV is between 0.76 and 0.79, showing that in subjective recognition, historic areas are important parts of Beijing's traditional culture and important carriers of Beijing's urban memory. Thus, a higher EV further proves that historic areas exert a clear positive effect on strengthening and inheriting Beijing's urban memory.

Table 3.12 The subjective evaluation value (EV) of level-three variables of Beijing's historic areas

Variables	Overall impression	Protection value	Impact on Beijing's urban landscape	Promoting Beijing's modernization development
EV	0.69	0.82	0.78	0.76
Level	Medium	High	High	High
Variables	Negative impact of demolishing on Beijing's development	Carrying on profound Beijing's traditional culture	Important parts	One of the significant characteristics
EV	0.79	0.76	0.76	0.77
Level	High	High	High	High
Variables	Deepening the understanding of Beijing	Aiding in understanding of Beijing's traditional culture	Necessity of reconstruction	Overall impression after renewal
EV	0.76	0.77	0.49	0.62
Level	High	High	Low	Medium
Variables	Carrying on original culture after renewal	Continuation of original function after renewal	Conducive to Beijing's development after renewal	
EV	0.64	0.58	0.64	
Level	Medium	Medium	Medium	

Note The reverse questions have been addressed with reverse treatment; $0 \le EV < 0.4$ is low, $0.4 \le EV < 0.7$ is medium, and $0.7 \le EV \le 1$ is high

(2) Rememberers have the lowest recognition of "necessity of reconstruction" with an EV of 0.49, showing that they fail to reach a consensus on the reconstruction of Beijing's historic areas, which to some extent is related to the negative effect of the large-scale demolition of historic areas and construction of antique architecture, leading to the correlation of reconstruction and damage when referring to historic areas. In addition, the EV of the reconstruction of historic areas is at a medium level between 0.58 and 0.64, indicating that subjects do not strongly recognize that historic areas maintain their original features and continue the traditional culture as well as their original function, and that the reconstruction of historic areas fails to exert correctional effects on Beijing's urban memory.

(2) **Subjective attribute characteristics**

Subjective attribute characteristics are important elements of the process of urban memory formation; a statistical description of subjective attributes on the basis of 382 questionnaires was conducted.

① **Distribution characteristics of age and gender**

According to Figs. 3.10, 3.11 and 3.12, characteristics of rememberers' age distribution are as follows: the average age is 30.1, with a focus on middle-aged adults

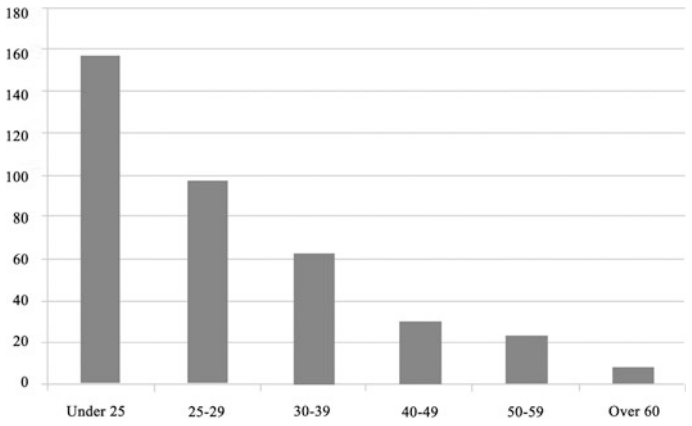

Fig. 3.10 Subjective age distribution of urban memory of Beijing's historic areas (*Source* Drawing by Yang Liu)

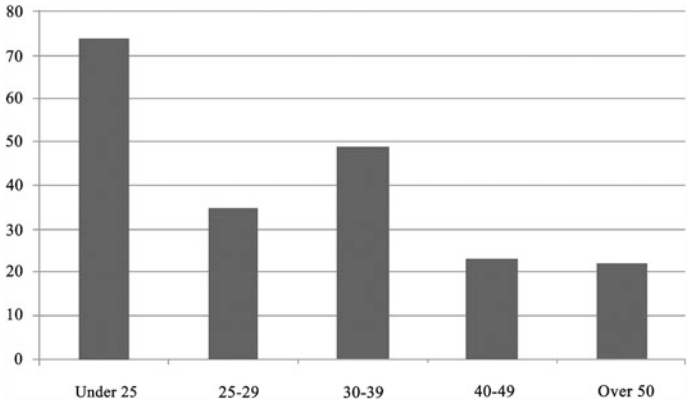

Fig. 3.11 Subjective age distribution in the field research of urban memory of Beijing's historic areas (*Source* Drawing by Yang Liu)

of 25–39. In the field interview, the age distribution of rememberers was balanced. Because the online research used questionnaires, the rememberers were mainly adults between 20 and 29.

According to Fig. 3.13, despite the non-balanced gender distribution of rememberers in the survey in each age group, gender ratio is balanced on the whole.

② Duration of residence and information access

The rememberers chosen were people with an average duration of residence of 16.1 years in Beijing who accounted for 92.2 % of the 351 people in total, and there were 190 total who have lived in Beijing for more than 10 years, comprising

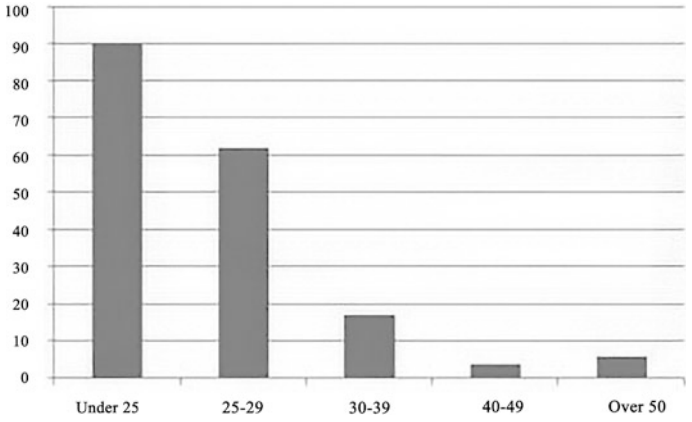

Fig. 3.12 Subjective age distribution in the online research of urban memory of Beijing's historic areas (*Source* Drawing by Yang Liu)

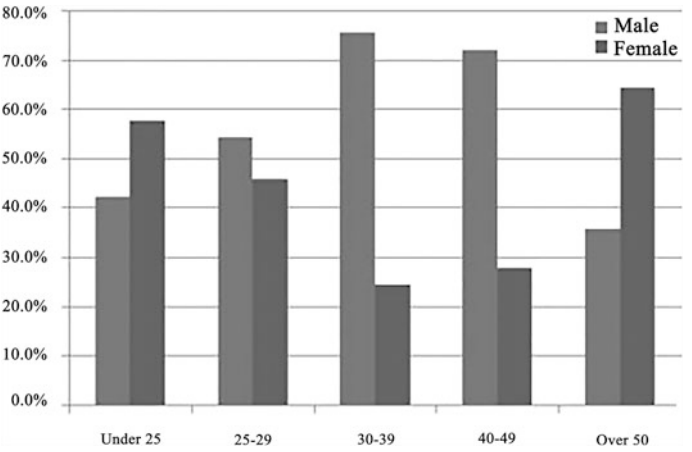

Fig. 3.13 Gender-age distribution of subjects in the survey with Beijing's historic areas as the object (*Source* Drawing by Yang Liu)

49.8 % of the total as well as 114 who have lived in Beijing for their entire lives, comprising 29.9 % (Fig. 3.14).

Using a search for duration of residence, counties and districts that rememberers are familiar with were studied, as shown in Table 3.13. In Beijing many colleges and universities are distributed in Haidian District. As the main group college students were chosen through online questionnaires. So Haidian District is known by most people.

The results of the study on the information access of historic areas is shown in the following table: the main access is life experience, relevant books, broadcasting and

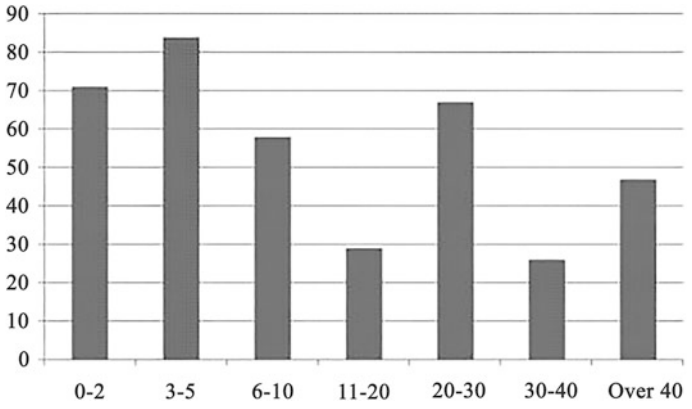

Fig. 3.14 Duration of residence of subjects with Beijing's historic areas as the object (*Source* Drawing by Yang Liu)

the internet. Life experience occupies the largest proportion, which is also related to the experience of 92.2 % of respondents living in Beijing, which is shown in Table 3.14.

③ Educational status and income

As shown in Fig. 3.15, this survey used online questionnaires. Respondents generally have a high educational status, and 218 have a bachelor or junior college degree, comprising 57 % of respondents, along with 92 who have a master degree or above, comprising 24 % of respondents.

A survey of income uses monthly income per person as the standard and is divided into four levels: below 2,000 yuan; 2,000–5,000 yuan; 5,000–10,000 yuan and above 10,000 yuan. The results are as follows (Fig. 3.16).

(3) **Correlation analysis of the subjective evaluative elements and subjective attributes**

The results of the correlation analysis of the subjective evaluative elements and subjective attributes are shown in Table 3.15.

Conclusions are as follows.

① Subjective memory of the inheritance elements is not strongly related to age, duration of residence, familiarity with Beijing, information accesses, educational status, or income, meaning that overall evaluation, protection value, and the positive effect on promoting urban style and carrying on the traditional culture of historic areas differs among people and has no correlation with duration of residence, age, education, and income because that is a type of memory with consensus. The EV of the inheritance elements reaches its maximum at 0.77, and the EV of the other level-three variables is above 0.7, meaning that rememberers have

Table 3.13 Degree of subjective familiarity with Beijing with historic areas as the object

Districts	Former Dongcheng District	Former Xicheng District	Former Chongwen District	Former Xuanwu District	Chaoyang District	Haidian District	Fengtai District	Shijingshan District	Outer suburb
Number of respondents familiar with the district	69	86	55	50	102	207	45	20	40

Table 3.14 Subjective information accesses in urban memory of Beijing's historic areas

Districts	Life experience	Introduction by relatives and friends	Internet	Broadcasting	Newspaper and magazine	Relevant books	Academic study	Travel agency	Explanation board
Information access	238	68	109	115	89	119	40	15	45

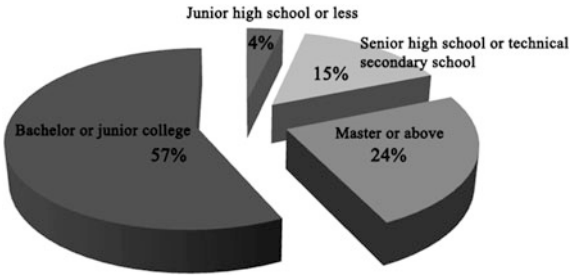

Fig. 3.15 Subjective educational status distribution with Beijing's historic areas as the object. (*Source* Drawing by Yang Liu)

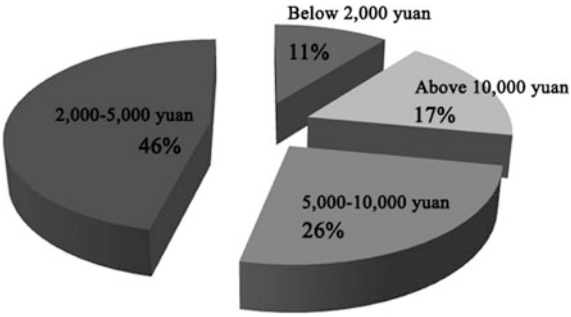

Fig. 3.16 Subjective income with Beijing's historic areas as the object (*Source* Drawing by Yang Liu)

reached a consensus on the recognition of historic areas exerting a positive effect on carrying on Beijing's traditional culture and urban memory.

② Subjective memory of the distinctive elements has a positive correlation with age at the test capacity at 0.05; no relation with duration of residence, degree of familiarity, information accesses, educational status or income; and a weak correlation with subjective evaluation and subjective attributes. This illustrates that distinctive elements memory is consensus oriented, and the EV is 0.71 at a high level, meaning that rememberers universally reached a consensus rather than partly believing that historic areas are important parts of Beijing and aid in understanding Beijing's traditional culture; however, the positive correlation with age indicates that the older rememberers are, the higher their degree of memory of the characteristics of historic areas is.

③ Subjective memory of the renewal elements has a positive correlation with subjective educational status, and every per capita income was at the test level of 0.05. Rememberers with higher education and higher incomes tended to have a higher evaluation of historic areas in terms of reflecting the original appearance and carrying on original functions after renewal, proving that the protection and renewal of historic areas to some extent is the continuation of Beijing's urban memory. However, subjects with low educational status did not hold a positive attitude towards the reconstruction of historic areas. Groups with lower educational status

Table 3.15 Correlation between subjective evaluation value (EV) and subjective attributes with Beijing's historic areas as the object

Level-two variables	Index	Age	Duration of residence	Familiarity degree	Information access	Educational status	Per capita income
Inheritance elements	Pearson's correlation	0.087	−0.039	−0.017	0.055	0.113	−0.024
	Sig. (2–tailed)	0.199	0.562	0.802	0.418	0.098	0.725
	N	382	382	382	382	382	382
Distinctive elements	Pearson's correlation	0.159*	0.024	0.106	0.048	−0.004	−0.076
	Sig. (2–tailed)	0.019	0.723	0.119	0.477	0.951	0.262
	N	382	382	382	382	382	382
Renewal elements	Pearson's correlation	0.107	0.020	0.048	0.020	−0.143*	−0.165*
	Sig. (2–tailed)	0.114	0.770	0.479	0.771	0.035	0.015
	N	218	218	218	218	218	218

Note *Correlation is significant at the 0.05 level (2–tailed)

are usually older people who have lived in Beijing for a longer period. Specifically, those with a junior high school education or less were, on average, 45 years old and had lived Beijing for 32.5 years; those with a senior high school education were, on average, 37 years old and had lived in Beijing for 26.5 years; accordingly, an understanding of Beijing's historic areas stems from average duration of residence, which affects the respondents' attitudes towards the reconstruction of historic areas.

3.3.2 Measurement of the Objective Elements

The analysis of the objective elements of urban memory of Beijing's historic areas includes three aspects: (1) a calculation based on the establishment of urban memory cognition (UMC); (2) employing the Pearson's correlation analysis model to test the subjective evaluative elements and the objective elements and to induce their correlation; (3) employing the Pearson model to test the objective elements and subjective attributes and thus to induce the objective features based on different subjective attributes.

(1) **Analysis of the objective elements**

① Level-one elements

Using the calculation of Formula 3.4, the UMC of the level-one objective elements of urban memory is 0.47, which constitutes a level of medium cognition.

② Level-two elements

The level-two variables of the objective elements of memory of Beijing's historic areas objective elements include the permanent elements, the evolutionary elements and the temporary elements. The UMC of level-two elements are as follows (Table 3.16).

Table 3.16 Level-two objective elements in urban memory cognition (UMC) with Beijing's historic areas as the object

Variables	Permanent elements	Evolutionary elements	Temporary elements
UMC	0.57	0.40	0.47
Level	Medium	Medium	Medium

Note $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

Analysis of rules of level-two elements of urban memory is as follows.

(1) The permanent elements are those elements of historic areas that have not dramatically changed during the process of the development of Beijing. This type of element is characterized by a long preservation time, a long existence and high continuity and exerts a great influence on rememberers to build a permanent urban memory of historic areas, including the cognition of the geographical location of those historic areas, street patterns, cultural relic sites and representative buildings. The UMC of this type of element is 0.57, which is a medium level but is the highest among the three types of objective elements. The Table 3.16 shows that the permanent elements are the most memorable elements, which are of great significance in building an urban memory of historic areas.

(2) The evolutionary elements of memory are formed during the development and evolution of the historic areas of Beijing. This type of element is often related to major events concerning historic areas, such as functional transition and name replacement of historic areas, and so on. The UMC of this type of element is 0.4, which is low and shows the low level of rememberers' cognition upon the objective evolutionary elements and weak urban memory characterized by the evolutionary elements. This is primarily because the cognition of the evolutionary elements usually has a close link to the development of the historical areas. For instance, the functional evolution of some areas could proceed throughout a long historical period. However, the respondents' information access is mainly based on their life experience, the urban memory produced by which is related to their age and duration of residence in Beijing. Therefore, there is a limitation on respondents' cognition of the evolutionary elements of the historic areas over a long period of time or the axis of time, and their cognition is likely to focus more on the experience of the present situation of the historic areas rather than the development and evolution information of the areas.

(3) The temporary elements are memories based on temporary events and change that have happened in Beijing's historic areas, such as celebrities and historical events associated with historic areas, historical function, historical allusions and anecdotes about the areas. The UMC of this type of element is only 0.33, which is very low. Because the temporary elements are insignificant in the present moment, the rememberers' way of obtaining information about historic areas, which is mainly based on their life experience, would hardly enable them to have cognition on the temporary information of the historic areas, which explains the low UMC.

③ Level-three elements

Analysis of the rules of level-three elements of urban memory (Table 3.17):

(1) As a whole, the UMC of the objective elements of the rememberers is between 0.26 and 0.61, which falls into the category of medium-low. Elements of the highest UMC are location (0.61), surroundings (0.60) and the

Table 3.17 Level-three objective elements in urban memory cognition (UMC) with Beijing's historic areas as the object

Variables	Location	Surrounding	Name origin	Architectural style
UMC	0.61	0.60	0.50	0.57
Level	Medium	Medium	Medium	Medium
Variables	Spatial pattern	Representative architecture	Cultural relic site	Honor
UMC	0.54	0.60	0.54	0.58
Level	Medium	Medium	Medium	Medium
Variables	Name replacement	Functional evolution	Reconstruction	Style change
UMC	0.36	0.44	0.38	0.45
Level	Low	Medium	Low	Medium
Variables	Celebrities and historical events	Historical allusions and anecdotes	Historical function	Previous name
UMC	0.35	0.33	0.36	0.26
Level	Low	Low	Low	Low

Note The reverse questions have been addressed with reverse treatment; $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

representative architecture (0.60) of the historic areas; elements of the lowest UMC are the previous name (0.26), historical allusions and anecdotes (0.33) of the historic areas and the celebrities and historical events related to the historic areas (0.35). The UMCs reveal the division of the degree of cognition: the cognition of the objective reality observed up until now is relatively higher, such as is the cognition of the representative architectures, cultural relic sites and street spatial patterns of the areas. The cognition of the evolutionary and the temporary elements during the historical development of the areas is relatively lower, for there is almost no reality observed.

(2) The highest UMC of the objective elements of the rememberers is at a medium level, 0.6, which shows the average level of cognition and memory of the entity's space related to the historic areas. This has a possible association with the fact that subjects obtain information about the entity's space of historic areas through a single method, which is their experience, but lack further knowledge.

(3) The highest UMC of the objective elements of the rememberers is only 0.26. The related elements, such as the previous name of the historic areas, historic allusions and anecdotes, and the celebrities and historical events, contain a great quantity and variety of information, which requires a profound cultural foundation. For this reason, the UMC is the lowest.

Table 3.18 Correlation between objective urban memory cognition (UMC) and subjective evaluation value (EV) with Beijing's historic areas as the object

Level-two variables	Index	Permanent elements	Evolutionary elements	Temporary elements
Inheritance elements memory	Pearson's correlation	0.302**	0.020	0.117
	Sig. (2–tailed)	0.000	0.764	0.084
	N	382	382	382
Distinctive elements memory	Pearson's correlation	0.318**	0.165*	0.213**
	Sig. (2–tailed)	0.000	0.014	0.002
	N	382	382	382
Renewal elements memory	Pearson's correlation	0.360**	0.299**	0.314**
	Sig. (2–tailed)	0.000	0.000	0.000
	N	382	382	382

Note *Correlation is significant at the 0.05 level (2–tailed)
**Correlation is significant at the 0.01 level (2–tailed)

(2) Correlation analysis of the objective elements and subjective evaluative elements

The correlation analysis of objective elements and subjective evaluative elements has a guiding significance for the following decisions: the type of objective elements that should be constructed based on the subjective evaluation and how to pay selective attention to the permanent, evolutionary and temporary elements to build a complete urban memory of Beijing in the future planning and reconstruction of the historic areas. The test result is shown in Table 3.18.

According to the correlation coefficients, the following conclusions can be drawn:

① The inheritance elements of memory and the permanent objective urban memory cognition (UMC) pass at the 0.01 level, which demonstrates that subjects who have a high UMC of the permanent elements have high subjective evaluation on the inheritance elements of memory. Therefore, the permanent objective elements are directly linked to the inheritance of Beijing's urban memory, which means strengthening rememberers' cognition of an entity's space in historic areas, such as geographical environment, cultural relic resources, traditional street patterns and representative architectures. To some extent, this promotes the inheritance of urban memory of Beijing's historic areas.

② The distinctive elements of memory and evolutionary objective urban memory cognition (UMC) pass at the 0.05 level, and the former also passes at the 0.01 level with the permanent objective elements and the temporary objective elements. This demonstrates that rememberers who have a high UMC of permanent, evolutionary and temporary elements of the historic areas have a high subjective evaluation on the distinctive elements of memory, which means that rememberers' cognition of an entity's space and the evolutionary history of the

historic areas is strengthened and in some degree can promote urban memory of Beijing's historic areas.

③ The renewal elements of memory and the UMC of all of the three types of objective elements (the permanent, evolutionary and temporary elements) pass at the 0.01 level, which proves that the urban memory of Beijing's historic areas is directly related to rememberers' high cognition of an entity's space and the evolutionary history of the historic areas. Based on the above, during the process of the planning and reconstruction of historic areas, the opportunities for public participation should be increased to meet the renewal expectations. Thus, the historic areas' role in enhancing Beijing's urban memory will be reinforced by increasing the subjective evaluation value of the evolutionary elements of historic areas.

(3) **Correlation analysis of objective elements and subjective attributes**

Correlation analysis (Formula 3.3) of the urban memory of the objective elements and subjective attributes was conducted (Table 3.19) to discuss the differences of the objective elements of memory of rememberers with different properties.

The correlation analysis of urban memory of objective elements and subjective attributes is as follows.

① The permanent objective urban memory cognition (UMC) passes the test with the age, duration of residence in Beijing and the degree of familiarity of the respondents at the 0.01 level and has a positive correlation, showing that for rememberers, the older they are, the longer they have lived in Beijing and the more familiar they are with Beijing, the deeper their cognition of the permanent elements, the spatial entity of historic areas. This conforms to the general cognitive rule.

② The evolutionary objective urban memory cognition (UMC) passes the test with the age, duration of residence in Beijing and the degree of familiarity of the respondents at the 0.01 level and shows a positive correlation. This means that rememberers who are older and have a longer duration of residence in Beijing and a higher degree of familiarity have a more thorough cognition of the historical evolution rule of historic areas. The Evolutionary elements contain a great quantity and variety information, and the respondents' information access is mainly based on their life experience. Therefore, it is easier for older people, who have a longer and richer life experience, to possess a more profound understanding of this type of element.

③ The temporary objective urban memory cognition (UMC) is notable, with age at a 0.05 level, and there is a notable correlation with the degree of familiarity at the 0.01 level. The older rememberers are and the more familiar they are with Beijing, the more cognition of the temporary objective elements of Beijing's historic areas, due to their richer life experience.

④ Educational status, a special subjective property, has a significant negative correlation with the permanent and evolutionary elements UMC at the 0.05 level; and it has a significant negative correlation with the temporary elements UMC at the 0.01 level. This indicates that educational status has no significant effect on rememberers to learn objects. Indeed, rememberers with more education are more likely to have less cognition of elements that no longer exist.

Table 3.19 Correlation between objective urban memory cognition (UMC) and subjective attributes with Beijing's historic areas as the object

Level-two variables	Index	Age	Duration of residence	Degree of familiarity	Information access	Educational status	Per capita income
Permanent elements	Pearson's correlation	0.174**	0.200**	0.252**	0.067	−0.166*	−0.020
	Sig. (2–tailed)	0.010	0.003	0.000	0.324	0.014	0.767
	N	382	382	382	382	382	382
Evolutionary elements	Pearson's correlation	0.181**	0.222**	0.264**	0.016	−0.168*	−0.037
	Sig. (2–tailed)	0.007	0.001	0.000	0.811	0.013	0.586
	N	382	382	382	382	382	382
Temporary elements	Pearson's correlation	0.136*	0.162*	0.206**	−0.036	−0.175**	0.024
	Sig. (2–tailed)	0.044	0.017	0.002	0.592	0.010	0.726
	N	382	382	382	382	382	382

Note *Correlation is significant at the 0.05 level (2–tailed)

**Correlation is significant at the 0.01 level (2–tailed)

3.3.3 Measurement of the Temporal Elements

Analysis of the temporal elements of urban memory of Beijing's historic areas includes three aspects: (1) to test the degree of cognition of all three levels of temporal variables through the establishment of the formula of the temporal elements in urban memory cognition (UMC); (2) to test the subjective elements of urban memory and the temporal elements with the Pearson model to sum up the correlation between them; (3) to test the objective elements of urban memory and the temporal elements with the Pearson model to sum up different influences exerted by different objective properties on temporal elements; and (4) to test temporal elements and properties of rememberers with the Pearson model to sum up the features of the temporal elements based on different properties of the rememberers.

(1) **Analysis of the temporal elements**

① **Level-one elements**

According to Formula 3.5, the comprehensive level of the temporal elements of urban memory cognition of historic areas in Beijing is 0.59, which is medium.

② **Level-two elements**

Based on the above analysis, the level-two elements of the temporal elements are point-in-time (significant events), time period and time axis, investigating subjective cognition and the memory level of historic areas in different temporal dimensions, respectively (Table 3.20).

Analysis of the rules of the level-two temporal elements of urban memory is as follows.

(1) The highest time cognition is the memory and cognition of the time period of historic areas, and $0.7 \leq \text{UMC} = 0.78 \leq 1$ is high, which indicates that subjects have a strong cognition of the most prosperous and the most declining and turbulent periods of historic areas. As for cognition of time period, there is no fixed answer in the survey set for every historic area according to historical materials. It is assumed in the study that each subject has their own cognition and evaluation of historic areas. As long as the choice of the most turbulent and declining period is in conflict with the objective factors, such as construction age, then the subjective evaluation of historic areas can be regarded as effective.

Table 3.20 Urban memory cognition (UMC) of level-two variables of temporal elements with Beijing's historic areas as the object

Variables	Point-in-time	Time period	Time axis
Time memory UMC	0.50	0.78	0.54
Level	Medium	High	Medium

Note $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

Table 3.21 Urban memory cognition (UMC) of level-three variables of temporal elements with Beijing's historic areas as the object

Variables	Time of significant events	Time of festival activities	Renewal planning implementation time	Remarkable period
UMC	0.40	0.30	0.80	0.81
Level	Medium	Low	High	High
Variables	Declining period	Building age	Dynasties survived	
UMC	0.76	0.66	0.42	
Level	High	Medium	Medium	

Note The reverse questions have been addressed with reverse treatment; $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

(2) Subjects have weak memory cognition of point-in-time (significant events) and time axis of historic areas, the UMC of which is, respectively, 0.5 and 0.54. As there are some objective standards for the cognition of point-in-time (i.e., major events that once happened in historic areas) and time axis (i.e., the age of the area and the surviving dynasties), the cognition is less subjective. In addition, as the information of point-in-time and time axis is very complex, usually, historical material and subjects who are fairly ordinary citizens are unaware of this type of information; thus, memory cognition of these two aspects is very weak.

③ Level-three elements

The UMC of level-three variables, which constitutes every dimension of time, are shown in Table 3.21.

The following can be perceived from the UMC of level-three variables of the temporal elements:

(1) As a whole, urban memory cognition of the relatively subjective temporal elements, that is, cognition of remarkable periods and periods of decline, is higher than that of the relatively objective temporal elements, such as significant events and building age.

(2) Subjects have lower cognition of point-in-time and time axis, which are the temporal elements with objective evaluation standards. The UMC is between 0.30 and 0.66; this indicates that, on the one hand, subjects obtain less information on historic areas. On the other hand, as historic areas are short of information on certain aspects, such as the time of significant events and a low number of festival activities directly linked with historic areas, it is hard for subjects to access information regarding these aspects.

(2) Correlation analysis of the temporal elements and subjective elements

The test results of the correlation analysis of the temporal elements and subjective elements of historic areas' urban memory is shown in Table 3.22.

Table 3.22 Correlation between temporal urban memory cognition (UMC) and subjective evaluation value (EV) with Beijing's historic areas as the object

Level-two variables	Index	Inheritance elements memory	Distinctive elements memory	Renewal elements memory
Point-in-time	Pearson's correlation	−0.050	0.111	0.133*
	Sig. (2–tailed)	0.463	0.101	0.050
	N	382	382	382
Time period	Pearson's correlation	0.152*	0.222**	0.097
	Sig. (2–tailed)	0.025	0.001	0.155
	N	382	382	382
Time axis	Pearson's correlation	0.095	0.154*	0.030
	Sig. (2–tailed)	0.163	0.023	0.661
	N	382	382	382

Note *Correlation is significant at the 0.05 level (2–tailed)
**Correlation is significant at the 0.01 level (2–tailed)

Correlation analysis of the subjective elements and temporal elements of urban memory is as follows.

① The inheritance elements evaluation value of rememberers passes the test with a time period memory cognition at the 0.05 level with a positive correlation. This demonstrates that subjects with a high evaluation value of the inheritance elements of Beijing's historic areas have profound and clear memory of time period, which further indicates that subjective memory of the time period of historic areas can contribute to building the inheritance elements memory of historic areas, which can further promote the inheritance of Beijing's urban memory based on the urban memory of historic areas.

② The distinctive elements evaluation value of rememberers has a positive correlation with both memory cognition of the time period and memory cognition of the time axis. It passes the test with the former at the 0.01 level and the latter at the 0.05 level. This result shows that subjects with a high evaluation value of the distinctive elements of memory of Beijing's historic areas have a high evaluation of time period and time axis, which means that the subjective memory of time period and time axis of historic areas can be conducive to building the distinctive elements of memory of historic areas, which can further strengthen the inheritance of Beijing's urban memory based on the urban memory of historic areas.

③ The renewal elements evaluation value of rememberers has a positive correlation with their point-in-time (significant events) memory cognition and passes the test at the 0.05 level. This indicates that subjects with a high evaluation value of renewal elements memory of Beijing's historic areas have a high memory evaluation of point-in-time (significant events), which means that the rememberer's

Table 3.23 Correlation between objective and temporal urban memory cognitions (UMC) with Beijing's historic areas as the object

Level-two variables	Index	Permanent elements	Evolutionary elements	Temporary elements
Point-in-time	Pearson's correlation	0.321**	0.382**	0.489**
	Sig. (2–tailed)	0.000	0.000	0.000
	N	382	382	382
Time period	Pearson's correlation	0.082	0.045	0.202**
	Sig. (2–tailed)	0.225	0.506	0.003
	N	382	382	382
Time axis	Pearson's correlation	0.050	0.116	0.163*
	Sig. (2–tailed)	0.466	0.087	0.016
	N	382	382	382

Note *Correlation is significant at the 0.05 level (2–tailed)
**Correlation is significant at the 0.01 level (2–tailed)

memory of point-in-time (significant events) of historic areas can be useful in building the renewal elements of memory of historic areas, which can further promote the renewal and inheritance of Beijing's urban memory based on the urban memory of historic areas.

(3) **Correlation analysis of the temporal elements and objective elements**

The correlation of the cognition of the objective and temporal elements of urban memory temporal elements was analyzed by using Formula 3.3. The result of the test is as follows (Table 3.23).

Correlation analysis of temporal elements and objective elements of urban memory is as follows.

① The permanent objective elements of urban memory cognition have a positive correlation with the cognition of point-in-time (significant events), and pass the test at the 0.01 level. This means that rememberers with higher permanent elements of urban memory have profound cognition of point-in-time (significant events) of the temporal elements. As significant events of historic areas, such as important festival activities and district planning and reconstruction, are all based on the physical space of the areas, this result meets the general cognitive rule.

② The evolutionary objective elements of urban memory cognition have a positive correlation with the cognition of point-in-time (significant events), and pass the test at the 0.01 level. This demonstrates that rememberers with higher evolutionary elements of urban memory have profound cognition of point-in-time (significant events) of temporal elements. The Evolutionary elements of historic areas is closely related to significant events, for example, functional change, name

replacement and planning and reconstruction of historic areas. All of these events occurred at various points in time, so the correlation between the evolutionary elements and significant events conforms to general cognitive rule.

③ The temporary objective elements of urban memory cognition have a positive correlation with the cognition of all three time dimensions and pass the test with the cognition of point-in-time (significant events) and time period at the 0.01 level, and also pass the test with the cognition of time axis at the 0.05 level. This shows that rememberers with higher temporary elements cognition have a high cognition of point-in-time (significant events), time period and time axis as well. The formation of the temporal elements of historic areas is linked with a certain period or point-in-time and has obvious and unique temporal characteristics. Strengthening the cognition of the temporary objective elements can strengthen a rememberer's cognition of the temporal elements of Beijing's historic areas, which is helpful to form Beijing's urban memory with regards to the dimension of time.

(4) **Correlation analysis of the temporal elements and subjective attributes**

To analyze the differences of the temporal elements formed by rememberers with different properties, the correlation of the temporal elements of urban memory and subjective attributes was tested (Formula 3.3), the result of which is shown in Table 3.24.

Table 3.24 Correlation between temporal urban memory cognition (UMC) and subjective attributes with Beijing's historic areas as the object

Level-two variables	Index	Age	Duration of residence	Familiarity degree	Information access	Educational status	Per capita income
Point-in-time	Pearson's correlation	0.111	0.163*	0.253**	−0.054	−0.078	0.013
	Sig. (2–tailed)	0.102	0.016	0.000	0.425	0.250	0.844
	N	382	382	382	382	382	382
Time period	Pearson's correlation	−0.095	−0.046	0.021	0.085	0.209**	0.050
	Sig. (2–tailed)	0.161	0.501	0.754	0.209	0.002	0.467
	N	382	382	382	382	382	382
Time axis	Pearson's correlation	−0.061	0.019	0.004	0.080	0.177**	0.135*
	Sig. (2–tailed)	0.373	0.784	0.957	0.240	0.009	0.046
	N	382	382	382	382	382	382

Note *Correlation is significant at the 0.05 level (2–tailed)
**Correlation is significant at the 0.01 level (2–tailed)

The correlation analysis of urban memory temporal elements and subjective attributes is as follows.

① Memory cognition of point-in-time (significant events) has a positive correlation with both the rememberer's duration of residence and their degree of familiarity. It passes the test with the former at the 0.05 level and the latter at the 0.01 level. This indicates that the longer the rememberer has lived in Beijing and the higher degree of familiarity he or she has with Beijing, the deeper he or she learns and memorizes Beijing's significant historical events, which conforms to the general cognitive rule.

② Memory cognition of time period has a positive correlation with the educational status of rememberers and passes the test at the 0.01 level, indicating that the more education they have, the more they learn and memorize the time period element of historic areas.

③ Time axis memory cognition has a positive correlation with both the rememberer's educational status and per capita income and passes the test with the former at the 0.01 level and the latter at the 0.05 level. This shows that rememberers with more education have higher cognition and deeper memory of time axis elements of historic areas.

④ Cognition of time axis elements of historic areas is more objective, which means that the cognition of information, such as construction age and time spent undergoing certain periods of dynasties, requires a good understanding and grasp of complicated information. Due to their rich academic experience, respondents with more education might be able to learn more about this aspect, and it is easier for them to form effective cognition of time axis elements of historic areas.

⑤ Neither age of rememberers nor their information access to historic areas has a significant correlation with the three dimensions of the temporal elements.

3.4 Cognitive Results

3.4.1 Conclusion of Correlation Between Elements

This study is mainly focused on the empirical measurement of urban memory levels in Beijing historic areas. Using SPSS to analyze the urban memory level of 19 historic areas, this research identifies five main factors related to the urban memory of the historic areas under review. According to these main factors, a cluster analysis of the 19 historic areas is conducted, and the historic areas in Beijing are classified into five categories.

Based on the analysis of the overall result and correlation characteristics of Beijing urban memory, a combination of resident demographics and elements that influence urban memory are analyzed (Tables 3.25 and 3.26).

Table 3.25 Summary of the correlation between subjective attributes and memory elements

Relevant elements of the subjective attributes		Secondary attributes
Subjective attributes	Inheritance elements	–
	Distinctive elements	Age
	Renewal elements	Education
		Income
	Permanent elements	Age
		Duration of residence
		Degree of familiarity
		Education
	Evolutionary elements	Age
		Duration of residence
		Degree of familiarity
		Education
	Temporary elements	Age
		Duration of residence
		Degree of familiarity
		Education
	Point-in-time	Duration of residence
		Degree of familiarity
	Time period	Education
	Time axis	Education
		Income

Table 3.26 Summary of the correlation of urban memory elements

Three secondary subjective elements	Objective and temporal elements	Secondary elements
Inheritance elements	Objective elements	Permanent elements
	Temporal elements	Time period
Distinctive elements	Objective elements	Permanent elements
		Evolutionary elements
		Temporary elements
	Temporal elements	Time period
		Time axis
Renewal elements	Objective elements	Permanent elements
		Evolutionary elements
		Temporary elements
	Temporal elements	Point-in-time

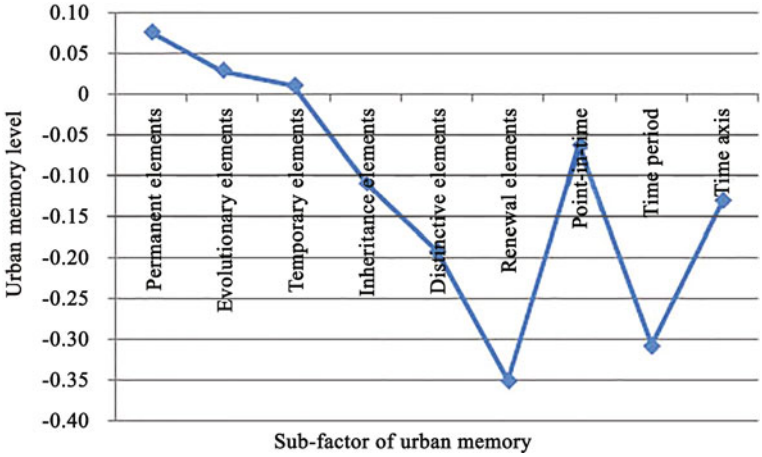

Fig. 3.17 Results in urban memory levels for historic areas with Objective Dynamic Memory (*Source* Drawing by Yang Liu)

3.4.2 Summary of Types

The elements of the urban memory level in the five categories of historic areas are as follows: memories of the inheritance elements, distinctive elements, renewal elements, permanent elements, evolutionary elements, temporal elements, and memory at point-in-time, time period, and time axis. The specific results for these memories are shown in Figs. 3.17, 3.18, 3.19, 3.20 and 3.21 (using standardized data on urban memory level).

(1) **Type I, historic areas with Objective Dynamic Memory**

Historic areas with Objective Dynamic Memory show high memory levels for permanent elements, evolutionary elements and temporary elements but low memory levels of protective renewal evaluation, time period and time axis (Fig. 3.17).

(2) **Type II, historic areas with Integrated Characteristic Memory**

As Fig. 3.18 shows, historic areas with integrated characteristic memories score highest in inheritance elements, distinctive elements and renewal elements but score low in objective elements and temporal elements.

(3) **Type III, historical area with Lasting Retained Memory**

Historical areas with Lasting Retained Memory manifest high urban memory levels for objective elements (permanent elements, evolutionary elements and temporary elements), but show low memory levels for subjective elements and temporal elements, especially for the time period and time axis of historic areas (Fig. 3.19).

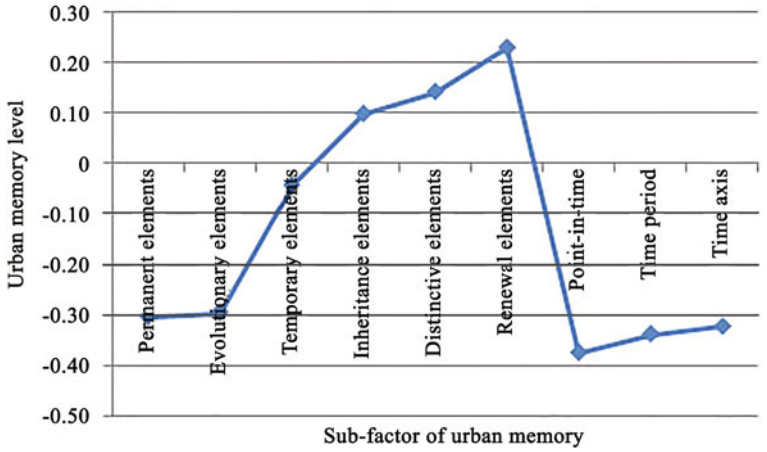

Fig. 3.18 Results in urban memory levels for historic areas with Integrated Characteristic Memory (*Source* Drawing by Yang Liu)

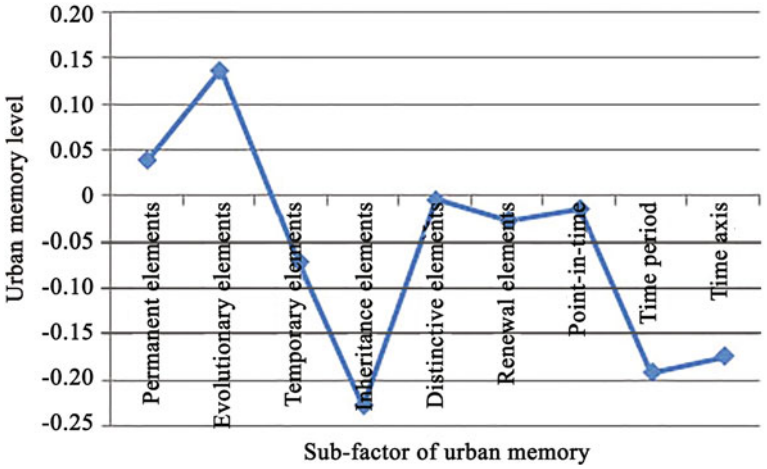

Fig. 3.19 Results in urban memory levels for historic areas with Lasting Retained Memory (*Source* Drawing by Yang Liu)

(4) Type IV, historical area with Protection Renewal Memory

Historical areas with Protection Renewal Memory show balanced urban memory levels for objective, subjective and temporal elements with scores greater than zero, which mean high cognition levels. The highest memory level is seen for permanent elements, inheritance elements and time period (Fig. 3.20).

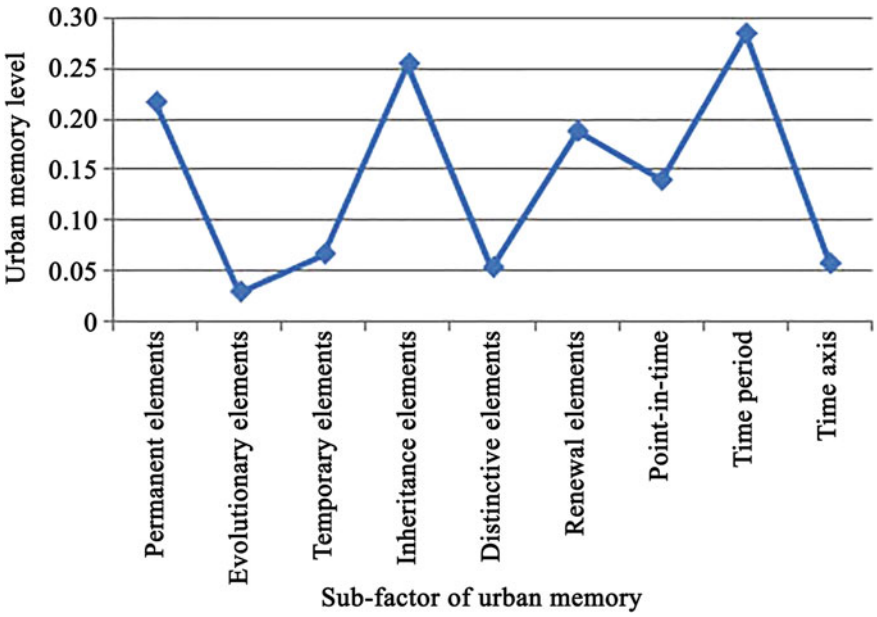

Fig. 3.20 Results in urban memory levels for historic areas with Protection Renewal Memory (*Source* Drawing by Yang Liu)

(5) **Type V, historical area with Continuous Temporal Memory**

Historical areas with Continuous Temporal Memory show evidence of high cognition levels for temporal elements and relatively high cognition levels for time axis and time period but show low memory levels for point-in-time and obviously low levels for objective elements and subjective elements, for which the scores are between −0.2 and −0.6 (Fig. 3.21).

Based on the summary of the memory levels for the above five types of historic areas, the different features that appear in Beijing urban memory can be seen. For historic areas with elements scoring high, medium or low in urban memory levels, different strategies for future protection renewal—with particular emphasis on bearing and inheriting Beijing urban memory—will be proposed.

The applicable results for nine main elements are compared, which yields the following features (Fig. 3.22, Table 3.27).

3.4.3 Summary of Rules

(1) **Overall rule**

From the perspective of the overall level of urban memory, Protection Renewal Memory ranks the highest, with scores generally higher compared to other types of historical districts. Objective Dynamic Memory and Lasting Retained Memory rank the lowest, garnering negative scores for certain items.

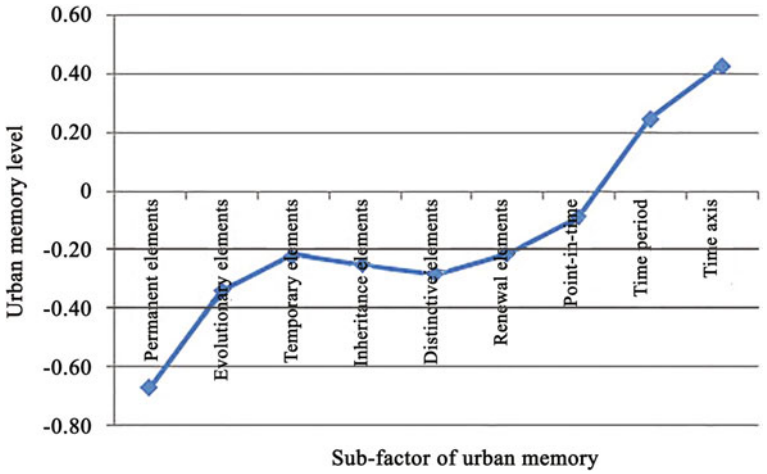

Fig. 3.21 Results in urban memory levels for historic areas with Continuous Temporal Memory (*Source* Drawing by Yang Liu)

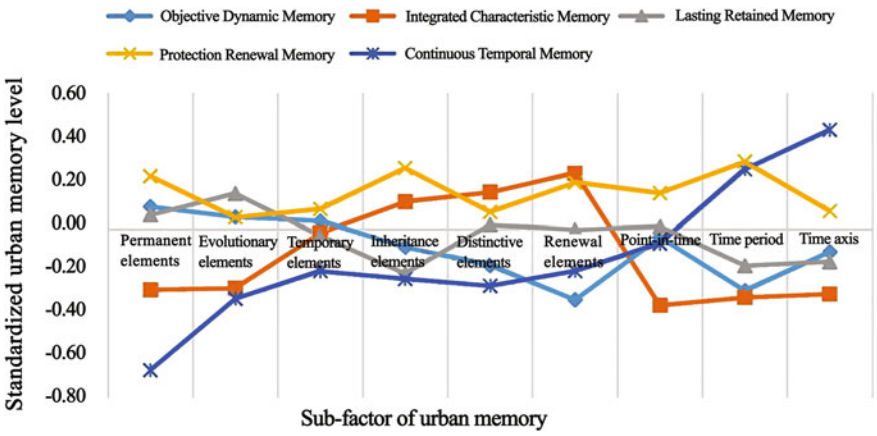

Fig. 3.22 Comparison of urban memory level results for five categories of historic areas (*Source* Drawing by Yang Liu)

(2) **Balanced rule**

From the perspective of even distribution of urban memory scores among the different elements, Protection Renewal Memory and Lasting Retained Memory are relatively balanced in distribution with little fluctuation. Meanwhile, Objective Dynamic Memory, Integrated Characteristic Memory, and Continuous Temporal Memory are not evenly distributed. For example, the Continuous Temporal Memory level for historic areas ranks the highest (0.431) in the time axis elements

Table 3.27 Results of urban memory levels for five categories of historic areas with nine main elements

	Category	Permanent elements	Evolutionary elements	Temporal elements	Inheritance elements	Distinctive elements	Renewal elements	Point-in-time	Time period	Time axis
1	Objective dynamic memory	0.077	0.030	0.011	−0.108	−0.192	−0.350	−0.062	−0.308	−0.130
2	Integrated characteristic memory	−0.304	−0.296	−0.043	0.100	0.143	0.231	−0.376	−0.339	−0.324
3	Lasting retained memory	0.039	0.137	−0.056	−0.229	−0.004	−0.027	−0.014	−0.192	−0.175
4	Protection renewal memory	0.217	0.029	0.066	0.255	0.053	0.188	0.139	0.285	0.057
5	Continuous temporal memory	−0.674	−0.344	−0.218	−0.254	−0.285	−0.217	−0.091	0.249	0.431

but lowest for the Permanent, evolutionary, and Temporal elements (−0.674, −0.344, and −0.218, respectively).

(3) **Rules of each element**

Objective elements: A distinct difference is seen in the high and low points of the urban memory level for five categories of historic areas. Continuous Temporal Memory and Integrated Characteristic Memory score low in the three objective sub-elements objective elements ([−0.674, −0.344, −0.218] and [−0.304, −0.296, −0.043], respectively); the other three categories score higher on the objective elements Memory level, mostly greater than 0. The Objective Dynamic Memory factor scores are 0.077, 0.030, and 0.011, whereas Protection Renewal Memory factor scores are 0.217, 0.029, and 0.066.

Subjective elements: Among the scores for all five categories of historic areas in the three sub-elements of the subjective elements, Integrated Characteristic Memory (0.100, 0.143, 0.231) and Protection Renewal Memory (0.255, 0.053, 0.188) score the highest. Meanwhile, Continuous Temporal Memory scores the lowest (−0.254, −0.285, −0.217).

Temporal elements: The three temporal sub-elements of urban memory show a significant level of difference. Continuous Temporal Memory (−0.091, 0.249, 0.431) and Protection Renewal Memory (0.139, 0.285, 0.057) have the highest scores. Overall, characteristics memory has negative score (s (−0.376, −0.339, −0.324), and the other two also score low, with negative values between −0.014 and −0.308.

3.4.4 Influence Factors

The analysis of five categories of historic areas of memory related to preserving, characteristic, renewal, permanent, evolutionary, and temporal elements, as well as memory at a point-in-time, time period, and time axis, is combined with the residents' demographic information. This process identifies the relevant influential factors toward the major urban memory for different types of historic areas.

(1) **Type I, historic areas with Objective Dynamic Memory**

According to the cluster analysis results, the most salient features (including permanent, evolutionary, and temporal elements) of historic areas with Object Dynamic Memory are chosen for an analysis of the influential factors (Table 3.28). The main factor influencing Objective Dynamic Memory is access to residents' information regarding a historical area, where the permanent elements and information access correlate at a 0.05 level of significance (bilateral), whereas the evolutionary elements and information access are significantly related at a 0.01 level (bilateral). These findings indicate that information from life experiences supports the formation of Objective Dynamic Memory.

Table 3.28 Analysis of the influencing factors on urban memory of historic areas with Objective Dynamic Memory

Objective dynamic memory		Age	Duration of residence in Beijing	Degree of familiarity	Information access	Educational status	Per capita income
Permanent elements	Pearson's correlation	−0.059	0.145	0.032	0.302*	0.197	0.092
	Sig. (bilateral)	0.677	0.304	0.824	0.030	0.161	0.515
	N	52	52	52	52	52	52
Evolutionary elements	Pearson's correlation	−0.102	0.052	0.192	0.367**	−0.002	−0.013
	Sig. (bilateral)	0.473	0.715	0.173	0.007	0.987	0.927
	N	52	52	52	52	52	52
Temporal elements	Pearson's correlation	−0.155	−0.087	−0.014	0.226	0.119	0.050
	Sig. (bilateral)	0.274	0.541	0.922	0.107	0.400	0.727
	N	52	52	52	52	52	52

Note *Correlation is significant at the 0.05 level (2–tailed)

**Correlation is significant at the 0.01 level (2–tailed)

Table 3.29 Analysis of the influencing factors on urban memory of historic areas with Integrated Characteristic Memory

Integrated characteristic memory	Age	Duration of residence in Beijing	Degree of familiarity	Information access	Educational status	Per capita income
Pearson's correlation	0.276*	0.166	0.177	0.049	−0.027	−0.172
Sig. (bilateral)	0.047	0.241	0.208	0.732	0.849	0.223
N	52	52	52	52	52	52

Note *Correlation is significant at the 0.05 level (2–tailed)

(2) Type II, historic areas with Integrated Characteristic Memory

For historic areas with Integrated Characteristic Memory, the most salient features (including the historical and cultural elements, important characteristics, and understanding of Beijing's culture) are used to analyze its influential factors (Table 3.29). The main factors influencing urban memory in these historic areas are the age structure of the population, which is significantly correlated at a 0.05 level (bilateral) with a Pearson's correlation coefficient of 0.276; in other words, the older the residents, the more profound their Integrated Characteristic Memory is.

(3) Type III, historical area with Lasting Retained Memory

For historic areas with Lasting Retained Memory, the most salient features (including whether to retain areas, influence of demolition, and necessity of reconstruction) are chosen to analyze the influential factors (Table 3.30). The main factors influencing the urban memory in these historic areas are mainly the age structure of the residents, which is significantly correlated at a 0.05 level (bilateral) with a Pearson's correlation coefficient of 0.314; that is, the older the residents, the more profound the Lasting Retained Memory is.

(4) Type IV, historical area with Protection Renewal Memory

For historic areas with Protection Renewal Memory, the most salient features (including whether renovations reflect the original appearance, whether the original culture is preserved, and whether the original function is preserved) are chosen to analyze the influential factors (Table 3.31). The main factors influencing the urban

Table 3.30 Analysis of the influencing factors on urban memory of historic areas with Lasting Retained Memory

Lasting retained memory	Age	Duration of residence in Beijing	Degree of familiarity	Information access	Educational status	Per capita income
Pearson's correlation	0.314*	0.157	0.014	0.039	0.052	−0.104
Sig. (bilateral)	0.024	0.266	0.922	0.782	0.715	0.465
N	52	52	52	52	52	52

Note *Correlation is significant at the 0.05 level (2–tailed)

Table 3.31 Analysis of the influencing factors on urban memory of historic areas with Protection Renewal Memory

Protection renewal memory	Age	Duration of residence in Beijing	Degree of familiarity	Information access	Educational status	Per capita income
Pearson's correlation	0.081	−0.027	0.177	0.232	−0.357**	−0.296*
Sig. (bilateral)	0.570	0.847	0.208	0.097	0.009	0.033
N	52	52	52	52	52	52

Note *Correlation is significant at the 0.05 level (2–tailed)
**Correlation is significant at the 0.01 level (2–tailed)

memory in these historic areas are the level of education and average income of residents, which are significantly and negatively correlated at levels of 0.1 and 0.05 (bilateral) with Pearson's correlation coefficients of −0.357 and −0.296, respectively. In other words, low education and average income levels produce less awareness of the memory continuity of protected and renewed historic areas.

(5) Type V, historical area with Continuous Temporal Memory

For historic areas with Continuous Temporal Memory, the most salient features (including point-in-time, time period, and time axis) are chosen for the analysis of influential factors (Table 3.32). The influencing main factors are the level of education and familiarity with Beijing, which are significantly and negatively correlated at levels of 0.1 and 0.05 (bilateral); that is, the more the residents are familiar with Beijing, the greater the understanding of the historic area and urban memory level is.

Table 3.32 Analysis of the influencing factors on urban memory of historic areas with Continuous Temporal Memory

Continuous temporal memory		Age	Duration of residence in Beijing	Degree of familiarity	Information access	Educational status	Per capita income
Point-in-time	Pearson's correlation	−0.133	−0.020	0.303*	0.139	0.235	0.151
	Sig. (bilateral)	0.347	0.887	0.029	0.326	0.093	0.286
	N	52	52	52	52	52	52
Time period	Pearson's correlation	0.031	0.135	0.307*	0.101	0.103	0.087
	Sig. (bilateral)	0.829	0.340	0.027	0.474	0.469	0.539
	N	52	52	52	52	52	52
Time axis	Pearson's correlation	−0.157	0.161	0.099	0.111	0.275*	0.176
	Sig. (bilateral)	0.268	0.254	0.486	0.434	0.049	0.213
	N	52	52	52	52	52	52

Note *Correlation is significant at the 0.05 level (2–tailed)

3.4.5 Protection and Renewal Strategies

Based on the summary of the characteristics of historic areas (Table 3.33), different strategies for the continued, specific, and differential protection schemes in the renewal and regeneration of historic areas are chosen according to the strongest and weakest features and other influential factors at the urban memory level. In the following section, three out of the five categories of historic areas are discussed in detail.

(1) **Type I, historic areas with Objective Dynamic Memory**

Memory Features: Objective Dynamic Memory (permanent, evolutionary, and temporal elements) is the leading factors in the preservation of urban memory.

Table 3.33 Summary of the features and influential factors for the urban memory of Beijing's historic areas

Types		Features of urban memory		Influential factor	Typical area
		Strongest	Weakest		
I	Objective dynamic memory	Permanent elements	Renewal evaluation	Information access	Shichahai Historic and Cultural Conservatory Area
		Evolutionary elements	Time period		
		Temporal elements	Time axis		
II	Integrated characteristic memory	Distinctive elements	Objective elements	Age structure	Tanzhe Temple
		Renewal elements	Temporal elements		
III	Lasting retained memory	Permanent elements	Subjective Elements Temporal elements	Age structure	Nanluogu Lane
		Evolutionary elements			
		Temporal elements			
IV	Protection renewal memory	Permanent elements	Evolutionary elements	Education Income	Yanyuan architecture group around Weiming Lake at Peking University
		Inheritance elements	Distinctive elements		
		Time period	Time axis		
V	Continuous temporal memory	Permanent elements	Point-in-time	Education Familiarity	Beijing's city walls in the Ming Dynasty
		Evolutionary elements	Time period		
		Temporal elements	Time axis		

Protection Strategy: Focusing on the protection of Objective Dynamic Memory, especially protecting weak memory elements, such as time period and time axis, and innovation in differentiated conservation strategies with respect to access to residents' demographic information.

Protection Example: Shichahai Historical and Cultural Conservatory Area

① *Continuing Protection*: Controlling and protecting features of the overall style of historic areas; coordinating between modern businesses and the original cultural atmosphere.
② *Specific Protection*: Combining the new and existing functional features in Shichahai; planning special festival activities; maintaining the original cultural context; staging the "Cool Summer," "Water Village in the North," "Former residences of celebrities," and other themed festival activities; and, based on existing functions, organizing themed festival activities, such as "Music Bar" and "Creative Culture".
③ *Differential Protection*: Enhancing peoples' experiences by organizing festival activities; improving the interpretation system related to the object information and time clues within the historical area to improve the experiences of residents.

(2) **Type II, historic areas with Integrated Characteristic Memory**

Memory features: Integrated Characteristic Memory components (memory of characteristic and renewal elements) as the leading factors of the preservation of urban memory.

Protection strategy: Preserving the Integrated Characteristic Memory, especially protecting weak memory elements, such as objective and temporal elements; implementing differentiated protection based on residents' age levels.

Protection example: The Tanzhe Temple

① *Continuing Protection*: Protecting and maintaining the overall features and important cultural factors within the historic area to continue the citizens' consensus of the Tanzhe Temple as a carrier of urban memory in Beijing.
② *Specific Protection*: Paying special attention to weak memory elements, such as object and time factors, and controlling the overall style of the Tanzhe Temple; through historical interpretation, enhancing people's recognition of objective elements, including permanent, evolutionary, and temporal elements, as well as the recognition of major events in point-in-time, time period, and time axis divisions, such as the overall architectural style and building age (date back to the Western Jin Dynasty of years 265–316), development (relationship with Buddhism, historical events, i.e., Suppression of Buddhism), important characters in history (i.e., the location where Kublai Khan's daughter was married, whose reign was 1215–1294).
③ *Differential Protection*: Protection and renovation should pay attention to the balance between the preferences of people from different age groups.

(3) **Type III, historical area with Lasting Retained Memory**

Memory features: Lasting Retained Memory and Objective Dynamic Memory in good condition (which should be preserved and have a positive influence on the urban style of Beijing) as the leading factors in the preservation of urban memory.

Protection Strategy: Maintain the Integrated Characteristic Memory of the preserved historic area; protect weak memory elements, such as subjective evaluation and temporal elements; carry out differentiated protection based on residents' age structure.

Protection Example: Nanluogu Lane Historical District

① *Continuing Protection*: Maintaining the characteristics of the overall style in the Nanluogu Lane area; strengthening the public's retained synchronic cognition of Nanluogu Lane and memory of Beijing culture preserved by objects.
② *Specific Protection*: According to the weak memory features of the subjective evaluation and the temporal elements, enhancing the overall character of the area and important elements through historical interpretation, as well as improving the interpretation and popularity of the information and major events at point-in-time, time period, and time axis divisions—for example, offering information about the fish skeleton layout of streets and lanes in Nanluogu Lane, the history of "Market in the Back," the story behind the street name (as mentioned before, the lane was called Luoguo Lane before the Qing Dynasty and was renamed as Nanluogu Lane in the Qing Dynasty; and later was called Huihuang Street in the Republic Era and then Luogu Lane again after the founding of the People's Republic of China).
③ *Differential Protection*: Combine the new elements into the business functions; protection and renewal should balance the preferences of people from different age groups.

Chapter 4
Linear Space: Measurement of the Urban Memory of Central Axes

In the city, by spanning different urban areas with different functions, linear space is formed by connecting material heritage and immaterial heritage, both of which contain some historical and cultural evidence. The central axes and city walls in urban spatial structures are typically linear spaces. How significant is it to protect and construct axes and city walls, which are of great importance in city development, to maintain the urban memory of Beijing? Can protection and construction play a useful role in the conservation of the history and culture of Beijing? These questions are extremely important to the future construction of Beijing. The study of urban memory concerning these two types of "linear space" will be discussed the next two chapters.

Urban axes, a typical form of urban linear space with axipetal symmetry and spatial motion characteristics along the axes, order the spatial structure of a city (Wang 2003). The principal urban axes of Beijing are significant parts of the Beijing urban memory. As the urban structure of Beijing is profoundly affected by traditional ritual systems, the central axes are important for spatial organization. Vertically intersecting with one another, the north–south and east–west axes form a cross skeleton in Beijing to support the urban spatial structure, playing a crucial role in displaying the urban landscape. A significant number of archetypical historical buildings unite the time-honored north–south axis, epitomizing the traditional spatial pattern and historical landscape of Beijing; the east–west and north–south axes support each other in the urban pattern, with the former usually labeled as "modern" to distinguish it from the "classical" features of the latter (Wang et al. 2015).

4.1 Transformation Overview

The principal urban axes of Beijing refers to the "two axes" mentioned in the *Master Planning of Beijing (2004–2020)* (Beijing Municipal Commission of Urban Planning 2005), which discusses the building of the urban spatial structure of the

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"two axes—two belts—multicenter." These two axes are the traditional north–south axis of Beijing, and Chang'an Avenue's extending line which is the east–west axis.

4.1.1 Development and Change

Under the influence of traditional ritual and culture, capital cities in Chinese history often had very distinct central axes to organize the city space (Fan 2010). Beijing is a gem in ancient Chinese city construction history, the planning and construction of which was almost completely done according to the ritual requirements in the *Rites of Zhou*[1]*: Kao Gong Ji.*[2] In a sense, the north–south axis can be regarded as an especially unique city central axis that embodies Chinese characteristics. It is the lifeline of Beijing, with special functions and locations (Michael and Chen 2010). There are also many historic buildings, such as the Forbidden City (the Palace Museum), Towers of Bell and Drum and Zhengyang Gate. As the linear space in the city, the north–south axis of Beijing itself is of unique historical value (Sun 2009).

From the perspective of inheritance and development, originating from the building axis, the city axis of ancient China exceeds the scale category for building axes, incorporating the ancient Chinese understanding of cosmic space and social order (Zheng et al. 2008). Based on the "top–down" design procedure, this axis reflects extremely strong political influence. However, in modern urban axis design, it is more important to consider matters like social economy and regional conditions from a people-oriented perspective. Therefore, the result of the structure and growth of traditional axes should conform to guarantee the coordination and integration of the old and new and strengthen the inheritance of the urban context through sensible planning. This bottom–up design idea has a profound significance for us in reexamining the development and inheritance of the traditional city axis (Lin 2005). To further explore the relationship between urban memory and urban axis spaces, the axis evolution should be examined first.

(1) **North–south axis**

The present north–south axis, for which the total length is about 25 km, was developed from the central axis of old Beijing. With a history of 746 years, the foundation for the central axis was built in the fourth year of the 4th Zhiyuan year (1267) of the Yuan Dynasty and was finished in the 32nd Jiajing year (1553) of the Ming Dynasty after expanding the outer city (Wang 2012).

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[1] *Rites of Zhou* (Mandarin: *zhou li*), an ancient ritual text, was supposedly written by the Duke of Zhou in the Western Zhou Dynasty (the 11th century–771 BC).

[2] *Kao Gong Ji*, literally, *The Records of Examination of Craftsman*, was compiled in the Spring and Autumn period (s (770–476 BC). There were originally six parts in the *Rites of Zhou*; however, the sixth part was lost, and later *Kao Gong Ji* was added as a replacement.

The historical development of the north–south axis of Beijing can be traced to the construction of Khanbalik City during the Yuan Dynasty. Its construction was not only done according to the ideas found in the *Rites of Zhou*, in which the "master constructs the state capital (Mandarin: *jiang ren ying guo*, 匠人营国)," but it also evokes new ideas that are closely based on the local distribution of the river system. First, the Central Stage (located in what's now called the Towers of Bell and Drum area) was built on the northeastern bank of Jishuitan Lake. In accordance with the tradition of "an emperor's location always facing south (Mandarin: *mian nan er wang*, 面南而王)," the central axis was designed to trace the pattern of the imperial palaces and the outline of the city walls from the Central Stage on the east bank of Jishuitan Lake to the south (Hou 1997). Heading south to the right south gate of the capital's Lizheng Gate, the central axis begins from the Central Stage and threads Wanning Bridge; Houzai Gate, the north gate of the imperial palaces; Yanchun Pavilion; Daming Palace; Chongtian Gate, the south gate of the imperial palaces; and Lingxing Gate of the imperial city in succession (Zhang 1995).

The Yuan Dynasty was followed by the Ming Dynasty. The former capital of the Ming Dynasty was Nanjing, after which it was moved to Beijing during the Ming Emperor Yongle's reign (1403–1424). As a whole, Beijing during the Ming Dynasty almost duplicates the pattern of the Great Capital of the Yuan Dynasty with changes in some parts of the space. As the south city wall of the Yuan Dynasty was removed in the 17th Yongle year (1419), the new south city wall was built 1 km away from the original wall; thus, the central axis extended southward (Wang 2002). In the capital city, Chengtian Gate and the Square of the Palace were located in the southern part of the Imperial City. In front of the Chengtian Gate is the east–west Chang'an Avenue with a length of 3 km. Covering around 11 hectares, the T-shaped Square of the Palace was the predecessor of Tian'anmen Square (Zheng and Xing 2004). Along each side of the south and north roads used by the emperor were 110 completely symmetrical east–west bungalows. They were called the "Thousand-step Corridor," the centralized offices of the central government with the headquarters for civil officers in the east and military officers in the west (Zhang 2011). With all the principal palaces located on the central axis with an east–west symmetry and price pattern, the Forbidden City was completed in the 18th Yongle year (1420); in the same year, the Towers of Bell and Drum were built in the northern section of the central axis (Wang 2002). After Emperor Yongle moved the capital to Beijing, he had the Imperial Ancestral Temple and Altar of Land and Grain built on the east and west side in front of the imperial palaces in the Nanjing style. The Temples of Heaven and Earth and the Temple of Mountain and River were constructed on the east and west sides of the axis outside of the right south gate of the Imperial City (Zhang 1995). In the Ming Dynasty, to create a pattern of "by the mountain and facing the water," hills were constructed north of the imperial palaces with soil taken from the moat of the Forbidden City and debris from a demolished palace from the Yuan Dynasty called Wansui Hill. Among the five peaks standing side by side, the hill with the highest peak in the middle is located just between the east and west walls of the inner city walls of Beijing, becoming the

commanding height of the north–south axis (Zhang 1995). As the outer city walls of Beijing was completed in the 32nd Jiajing year (1553) of the Ming Dynasty, the central axis extended southward to Yongding Gate, the overall length of which was more than 7 km (Wang 2002). In the Ming Dynasty, the central axis of the Great Capital of the Yuan Dynasty was inherited and transformed. Because the extension of the axis was adjusted slightly to the west when it extended southward, Yongding Gate and the Towers of Bell and Drum are not in the same straight line (Guo 2012).

In 1644, the Qing Dynasty succeeded the Ming Dynasty, and Beijing was designated the capital. In the Qing Dynasty, the city wall, moat, and the location of the central axis were inherited, and finite changes were made, such as the repair, reconstruction and renaming of some buildings on the central axis. For example, in the Qing Emperor Shunzhi's reign (1644–1661), Wansui Hill was renamed Jingshan Hill, and Chengtian Gate was renamed Tian'an Gate. In the 16th Qianlong year (1751) of the Qing Dynasty, a pavilion was built on all five peaks of Jingshan Hill. From west to east, they were named Guanmiao Pavilion, Zhoushang Pavilion, Wanchun Pavilion, Fulan Pavilion and Jifang Pavilion (Zhang 1995). After the subsequent construction, the landscape on the central axis became more diversified.

During the Republic Era, more changes were made along the central axis of Beijing. Some historical buildings were pulled down, like Beizhong Gate, the Thousand-step Corridor, the urn city of Zhengyang Gate and the Imperial City walls. Additionally, the properties and functions of some buildings (or building groups) were changed. The Altar of Land and Grain was changed to the Central Park in 1914 and to Zhongshan Park in 1928. In 1924, the Imperial Ancestral Temple was changed into the Peace Park. The Forbidden City was changed into the Place Museum in 1925. In 1928, Jingshan Hill was changed into a citizen's park.

In 1949, the People's Republic Era was established, and Beijing was designated the capital. The central axis ushered in the most frequent and dramatic changes. On September 30th of that year, the foundation stone-laying ceremony for Monument to the People's Heroes was held at Tian'anmen Square; the founding ceremony, military parade and mass pageant took place on October 1st. The Tian'an Gate Tower served as the rostrum. Since then, Tian'anmen Square has become the center of the political activity in China (Editorial Department of Beijing Construction History Editorial Committee 1989a). From 1949 to 1959, the urn city of Yongding Gate, Left and Chang'an Right Gates, Di'an Gate, Beishang Gate, the gate tower and the embrasured watchtower of Yongding Gate, and Zhonghua Gate on the central axis were demolished in succession. From 1953, the southern part of the central axis, i.e., the street from Yongding Gate to Nanyuan, was constructed and finished in 1959. Therefore, the central axis of Beijing extended further southward (Editorial Department of Beijing Construction History Editorial Committee 1989b).

In September 1959, the reconstruction and extension project was completed. The new rectangular plaza—measuring 500 m wide, 860 m long, and covering more than 400,000 m^2—was able to accommodate 1,000,000 people. The square is flanked by the Museum of the Chinese Revolution and the Museum of Chinese History (changed to the National Museum of China) in the east and the Great Hall

of the People in the west. They are somewhat symmetric. At the center of the square, the Monument to the People's Heroes was built. Breaking the close pattern of imperial capital, the whole project created a new, wide-open space in the central axis. This was complimented by Prof. Renzhi Hou as a monument in the history of the planning and design of Beijing (Hou 2004). In 1969, because of the severe damage and deformation, the Tian'an Gate Tower was demolished and rebuilt according to the original structure. After reconstruction, it was 0.87 m higher than before (Beijing Municipal Commission of Urban Planning, Beijing Urban Planning Society 2004). In 1983, on two sides of the Golden Water Bridge, four green patches of 5,000 m^2 in total were developed to replace the reviewing stand (Editorial Department of Beijing Construction History Editorial Committee 1989a).

In 1990, a north–south traffic artery connecting Zhonglou North Bridge and Beichen Bridge was built and opened to traffic for the Asian Games, which were held in Beijing in September. With Anhua Bridge as the dividing line, the southern part of the artery was called Gulou Outer Street, and the northern part was called Beichen Street. Since the establishment of the city central axis of the Great Capital of Yuan Dynasty, this was the first time that the central axis extended northward.

In 2001, Beijing was chosen to host the 29th Olympic Games of 2008, and engineering and construction related to the Olympic Games again reshaped the spatial pattern of the north–south axis. The central section of Olympic Games was located in the northern part of the central axis. With a "Millennium Footpath" that displayed the history of Chinese civilization, the central section was connected to the previous north–south axis and extended northward to the northern endpoint of Olympic Forest Park. Artificial lakes and hills that symbolized a "dragon" and was coordinated with the landscape of the old city on the central axis from a distance. The overall scene of the north–south axis was significantly changed, not only because of the significant expansion of the spatial scale but also the addition of buildings and landscape elements, such as the National Stadium (Bird's Nest), National Aquatics Center (Water Cube), National Gymnasium, Linglong Tower and Forest Park, etc. In June of 2008, the first-stage project of Metro Line 8—the Olympic subway line—which runs from Beitucheng station to the Forest Park South Gate station, was opened in advance. Since then, the north–south axis ushered in a new era of the development and utilization of underground space. In 2011, construction for the second Beijing Capital Airport began and is expected to be finished in 2017. Some researchers have also recommended or discussed the further southward extension of the north–south axis to the new airport (Shi and Bian 2012). As can be seen, after experiencing times of expansion, the north–south axis still has the potential to continue growing.

On the whole, during the Yuan, Ming, Qing Dynasties and the Republic Era, the spatial scale of the north–south axis changed minimally in terms of frequency and range. In the Yuan Dynasty, the scale of the axis remained almost unchanged, 3.9 km in total length (Wang 2007). In the Ming Dynasty, the north–south axis was extended three times: (1) in the 17th Yongle year (1419) of the Ming Dynasty: with the demolishment of the south city wall of the Great Capital of the Yuan Dynasty

and the construction of the new city wall, the central axis extended from 3.7 to 4.8 km; (2) in the 18th Yongle year (1420), with the completion of the Towers of Bell and Drum, the central axis extended another 190 m northward; (3) during the Ming Emperor Jiajing's reign (1522–1566), due to the construction of the surrounding city in the southern area, the central axis extended southward, reaching 7.8 km in total (Li 2012). In the periods of the Qing Dynasty and the Republic Era, the scale of the axis almost did not change. In addition, from the Yuan Dynasty to the Republic Era, the starting point of the central axis had always been the T-junction on Zhonglou North Street, and after being extended several times, the southern ending point was located at Yongding Gate during the reign of Ming Emperor Jiajing (1522–1566), which had not changed until the middle of the 20th century. Compared with this, in the decades after 1949, the central axis experienced the greatest amount of change, characterized by continuous extension to both the south and north. At present, the length of the north–south axis is triple the length of the traditional central axis of the old city. It is possible that the axis will be further extended in the future.

(2) **East–west axis**

The east–west axis refers to Chang'an Avenue and its extension; the eastern section from Tian'anmen Square is called East Chang'an Avenue, and the western section is called West Chang'an Avenue. The history of the east–west axis began with Chang'an Avenue, which was constructed in front of Chengtian Gate (later changed to Tian'an Gate) in the Ming Dynasty Emperor Yongle's reign (1403–1424) on the former site of the south city wall of the Great Capital of Yuan Dynasty. Chengtian Gate was flanked by the Chang'an Left Gate and Chang'an Right Gate. The area from the Chang'an Left Gate eastward to the Dongdan Archway is called East Chang'an Avenue, and from the Chang'an Right Gate westward to the Xidan Archway is called West Chang'an Avenue. The Chang'an Left Gate and Chang'an Right Gate are separated by a T-shaped square, in which civilians were prohibited to step. In the 8th Shunzhi year (1651) of the Qing Dynasty, Chengtian Gate was renamed Tian'an Men after reconstruction. The Chang'an Left Gate was renamed East Chang'an Gate, and the Chang'an Right Gate was renamed the West Chang'an Gate. The pattern of Chang'an Avenue saw no fundamental change during the Qing Dynasty and Ming Dynasty. In the 31th year (1905) and 33th year (1907) of Qing Dynasty Emperor Guangxu's reign, the dirt roads of East Chang'an Avenue and West Chang'an Avenue were transformed into ballast roads in succession (Editorial Department of Beijing Construction History Editorial Committee 1989b).

After the establishment of the Republican Era, the red walls next to the Chang'an Left Gate and Chang'an Right Gate were demolished to connect East Chang'an Avenue and West Chang'an Avenue (Zheng and Xing 2004). In 1913, the Thousand–step Corridor on the south side of Tian'an Men was torn down; in 1921 and 1928, East Chang'an Avenue and West Chang'an Avenue were transformed into asphalt roads in succession; in 1924, tramcars began running on West Chang'an Avenue (Editorial Department of Beijing Construction History Editorial

Committee 1989b). In August 1937, Beijing (called Beiping at that time) was occupied by invading Japanese troops, and the next year, Qiming Gate was built into the city wall of East Chang'an Avenue, and Chang'an Gate was built into the city wall of West Chang'an Avenue. Later, East Chang'an Avenue was extended to Dawang Road, and West Chang'an Avenue was extended to Yuquan Road (Editorial Department of Beijing Construction History Editorial Committee 1989b). In 1945, Beijing was retaken after the surrender of the Japanese army, after which the Government of the Republic China renamed Qiming Gate to Jianguo Gate and Chang'an Gate to Fuxing Gate.

Since 1949, there has been significant increase in changes to Chang'an Avenue. The Beijing Municipal Government reconstructed and expanded Chang'an Avenue and its extension many times. In the fifties, a number of renovation records showed the following changes: to celebrate the first National Day, September 9th of 1950, a 2.4 km boulevard was built from the entrance of Dongdan Street to the east entrance of Fuyouqian Street. A 15 m–wide road was paved the northern part of east Naheyan and the southern part of west Nanheyan. During this transformation, a tracery wall in the southern part of Chang'an Avenue and two decorated archways named "Luzhong" and "Daohe" were torn down. In August 1952, Chang'an Left Gate and Chang'an Right Gate were torn down for the National Day parade and related traffic dispersion. From March to October 1954, Jianguo Gate was extended to West Dawang Road, and the road was widened from 7 to 10 m. In August of the same year, the East Chang'an Archway and West Chang'an Archway were demolished. In 1955, West Chang'an Avenue was widened. This 1.1–km project stretched from the west end of the southern entrance of Nanchang Street to the entrance of Xidan Road. The narrowest part of the avenue was 32 m wide and the widest part is 55 m. In the construction period, the pagoda of Qingshou Temple across from the Capital Cinema was demolished. From May to November 1956, the road from Chang'an Avenue to the west was opened, and Xidan was reconstructed as Fuxing Gate. More than 2,500 houses owned by citizens were torn down, and a bituminous concrete road of 35 m wide was paved. From May to November 1957, Fuxing Gate was widened to Muxidi. In 1958, the road from Chang'an Avenue to the east was opened up, and Dongdan was reconstructed and renamed Jianguo Road. More than 3,000 houses owned by citizens were torn down, and another bituminous concrete road of 35 m wide was paved. From 1958 to 1959, Jianguo Gate was extended to Bawangfen, and the road was widened from 10 m to 30 m, flanked by two bicycle lanes of 7 to 8 m wide. From May to September 1959, the road from Nanchizi to Nanchang Road was transformed into an 80–metre–wide road for the parade celebrating the tenth anniversary of National Day. From Nanchizi to Dongdan Road, the street was expanded to 44–50 m wide, and the street from Xinhua Gate to Nanchang Road was also expanded. Thus, Chang'an Avenue was reconstructed to measure 35–80 m wide, from Jianguo Gate to Fuxing Gate (Beijing Municipal Commission of Urban Planning, Beijing Urban Planning Society 2004). Apart from the frequent road reconstruction, many new buildings were added along Chang'an Avenue in the 1950s. From 1953, the office buildings

Table 4.1 The top ten buildings of different periods after the founding of the People's Republic of China

Time	Name	Location	Time	Name	Location
1950s	Great Hall of the People	Along the north–south/ east–west axis	1990s	National Olympic Sport Center	Along the north–south axis
	National Museum of China	Along the north–south/ east–west axis		Henderson Center	Along the east–west axis
	Military Museum of the Chinese People's Revolution	Along the east–west axis		Former International Financial Hotel (now China Merchants International Financial Centre)	Along the east–west axis
	Cultural Palace of Nationalities	Along the east–west axis		New World Beijing Center	Other location
	Minzu Hotel	Along the east–west axis		Greenhouse of Beijing Botanic Garden	Other location
	Beijing Railway Station	Along the east–west axis		New section of Tsinghua University Library	Other location
	Prime Hotel Beijing	Other location		Central TV Tower	Other location
	Diaoyutai State Guesthouse	Other location		Building of Foreign Language Teaching and Research Press	Other location
	National Agriculture Exhibition Center	Other location		Beijing APM Plaza	Other location
	Beijing Workers' Sports Complex	Other location		Capital Library of China	Other location
				Asian Sports Village	Other location
1980s	Beijing International Hotel	Along the east–west axis	Beginning of the 21st century	National Stadium (Bird's Nest)	Along the north–south axis
	China Central Television Building	Along the east–west axis		National Aquatics Center (Water Cube)	Along the north–south axis
	China International Exhibition Centre	Other location		National Gymnasium	Along the north–south axis
	Beijing Capital International Airport Terminal	Other location		Capital Museum	Along the east–west axis

(continued)

Table 4.1 (continued)

Time	Name	Location	Time	Name	Location
	National Library of China	Other location		National Centre for the Performing Arts	Along the east–west axis
	Great Wall Hotel	Other location		Beijing TV Center	Along the east–west axis
	Chinese Theater	Other location		Terminal 3 of Beijing Capital International Airport	Along the east–west axis
	Museum of the War of the Chinese People's Resistance Against Japanese Aggression	Other location		Beijing South Station	Other location
	Dongsishitiao Station of Beijing Metro	Other location		New Poly Plaza	Other location
	Daguanyuan Garden	Other location		National Library of China	Other location

for the Ministry of Public Security, Ministry of Textiles, Ministry of Coal Industry and Ministry of Foreign Trade were built in succession. Later, the western building of the Beijing Hotel, Telegraph Building and the Ministry of Fisheries building, among others, were also completed. To celebrate the tenth anniversary of the Chinese state, "The Top Ten Buildings" were added in Beijing, six of which were located on Chang'an Avenue and its extension (Table 4.1).

Chang'an Avenue was constructed in good order in the early 1960s. In April 1964, *the Integrated Planning for Chang'an Avenue* was established (Beijing local chronicles Compilation Committee 2009). From 1966 to 1976, only a few new buildings, such as the East Building of the Beijing Hotel and the Changhua Building, were built along Chang'an Avenue. In June 1966, the second phase of the project, stretching from Yangzha to Tongxian Northern Garden, was finished, forming the east axes of Chang'an Avenue to the east; from 1967 to 1969, the Road Reconstruction Project, from Fuxing Gate to the East gate of the Shou Gang Group, was completed, forming the western axes of Chang'an Avenue to the west. In 1969, the first railway in China ran under Chang'an Avenue. In 1974, on Chang'an Avenue, the first overpass in Beijing, was built and named the "Fuxing Gate Overpass." After several reconstructions, Chang'an Avenue was extended as the east–west axis, traversing the city center at 35–80 m wide and over 40 km long and from a width of over 10 m and a length of 3.7 km at the start (Editorial Department of Beijing Construction History Editorial Committee 1989b).

After the renovations and opening, Chang'an Avenue saw a peak time of construction. To accommodate the increasing traffic flow, newly-built traffic facilities along Chang'an Avenue and its extension included, among others, the Jianguo Gate overpass, Guomao overpass, Muxidi overpass and Gongzhufen overpass. In 1987, extensive construction was launched along this avenue in preparation for the Asian Games. For example, subways for passersby were built under Tian'anmen Square, and other overpasses and subways were built along the line. According to the statistics, in the 1980s, 9 new buildings were added to Chang'an Avenue (from Jianguo Gate to Fuxing Gate) with a total floorage of about 370,000 m^2; in the 1990s, 21 new buildings were built on Chang'an Avenue with the total floorage of about 2.66 million m^2, four times the total construction of first 40 years (Li 2006).

In 1998, for the 50th anniversary of the People's Republic Era, a general reorganization was done on Chang'an Avenue and its extension in Beijing in three aspects: road and traffic, greening and environment, and night lighting (Office of the Beijing Municipal People's Government 1998). The action was performed both horizontally and vertically at the same time within the scope of the red line (Zhao 2001). The overall reorganization widened carriageways, reconstructed sidewalks, and opened up new green spaces measuring 30 m wide and 160 m long on both the east and west sides of Tian'anmen Square. Meanwhile, many facilities, such as advertising boards, shop kiosks and dustbins, were renovated, and seats and green spaces were added.

In March 2009, for the 60th anniversary of the People's Republic Era, Chang'an Avenue had its fourth renovation since the founding in 1949 and broadened the four lanes in each direction to five lanes. In 2010, a project of westward expansion of Chang'an Avenue was completed, in which the western point was extended westward from the east gate of the Shou Gang Group to the Sanshi Road in the Mentougou District. In March 2013, the engineering project of the westward expansion of Chang'an Avenue was approved. The street is to traverse Fengshatie Road and Yongding River, and a brand bridge across Yongding River will be built (Beijing Municipal Commission of Development and Reform 2013). After finishing the project, Chang'an Avenue, at 50 km long, will became the most important urban axis, stretching across the Mentougou, Shijingshan, Haidian, Xicheng, Dongcheng, Chaoyang and Tongzhou Districts.

To sum up, Chang'an Avenue had very small amounts of construction in the Ming and Qing Dynasties, and slightly more construction took place during the Republic Era. Since the People's Republic of China was founded, increasingly frequent reconstructions, extensions and renovations have taken place. On the one hand, the spatial scale continued to extend westward and eastward, and the width of pavement was widened many times; on the other hand, the buildings and landscapes elements increased along the street, and its entire form and function significantly. After expanding many times, Chang'an Avenue and its extension, as the east–west axis, developed at an unprecedented scale. Combined with the north–south axis, a large cross–shaped spatial pattern was built in Beijing.

4.1.2 Typicality of Research Object

(1) **Representing the city's history of development**

Urban axes maintain a very strong time character. Their formation, regardless of how long it takes, always goes through a process of historical development and a time process during the urban development (Wang 2003). Since 1949, the east–west axis of Beijing has undergone tremendous changes in function and form. So to speak, these dramatic changes are the typical epitome of historical culture of the city's development since the establishment of the PRC. The east–west axis vertically interlace with the traditional north–south axis, which forms a large cross–shaped skeleton of the city, unique among other cities around the world. At present, the protection and renovation of this cross–shaped space have been integrated into Beijing's overall development strategy.

(2) **Rich in cultural and historical value**

During the unceasing development process, something in city space goes through inheritance and collection so as to becomes the city's context, and the urban axes are the main veins that inherit and record the city's context (Li 2002). The north–south axis of Beijing are the longest in the world and a unique source of heritage in Beijing (Duan 2003). Along the axes, the Forbidden City (the Palace Museum), Towers of Bell and Drum and Zhengyang Gate, as part of historic buildings featuring Chinese tradition, embody Beijing's traditional spatial pattern and historical outlook and have a very high historical value (Sun 2009). Prof. Sicheng Liang even praised the north–south axis, saying that the construction of the central axes gives birth to a magnificent order in Beijing (Liang 2001). The axes fully reflect the ancient Chinese people's traditional philosophical thoughts while developing the city's planning and construction policy and left a bright example for the construction of the ancient Chinese palace city, acting as the context backbone that supports the 800–year–old capital.

(3) **Unification of real axes and imaginary axes**

Always existing objectively, the urban axes of Beijing strengthen the image of city space through all types of buildings' space sequences and constitute the city's texture. They embody an important function. Meanwhile, the important palace buildings and historical business streets along the north–south axis reflect the fusion of imperial power and civil culture. This fusion reinforces people's psychological cognition of the spiritual axis. That is to say, there is not only an axis constituted by buildings that are seen by people but also a spiritual axis in peoples' hearts (Wang et al. 2014).

To sum up, the cross–shaped axes in Beijing are excellent spaces that reflecting China's traditional philosophical thoughts. They also are partnered well with the construction and development of modern cities and are unique and forward–looking in the construction of urban axes all over the world; the correspondence and different functions of the north–south axis and east–west axis reflect the integrity and richness of the type of axes.

4.2 Design Research and Investigation Process

4.2.1 Research Scope

The *Master Planning of Beijing (2004–2020)* (Beijing Municipal Commission of Urban Planning 2005) has pointed out that the traditional features of central axes in the Ming and Qing Dynasties need to be protected along the 7.8 km–long section from Yongding Gate to the Towers of Bell and Drum; the *Urban Design of the central axes in Beijing* (Beijing Municipal Commission of Urban Planning 2005) and the *Conservation Planning of Historical and Cultural City of Beijing* (Beijing Municipal Commission of Urban Planning 2002), has extended the north–south axis of Beijing. The north point has been extended to the nearby North Fifth Ring Road and the south point to the nearby South Fifth Ring Road.

(1) **Length range of axes**

This research comprehensively considers the current conditions of the north–south axis and east–west axis, on the premise of which this research, as the basis of the study object, makes it clear that the two urban axes' specific spatial scales are as follows.

① *North–south axis*: The axes begin at the Olympic Forest Park in the north to Nanyuan in the south, with a total length of 25 km. During the study, the axes are divided into three sections: the north section, from T-junction Zhonglou North Street to Olympic Forest Park; the central section, from T-junction Zhonglou North Street in the north to Yongding Gate in the south (traditionally the central axes of 7.8 km); and the south section, from Yongding Gate to Nanyuan.
② *East–west axis*: The east–west axis are also named Chang'an Avenue and its extension. The axes begin from the Canal Cultural Square of Tongzhou District in the east to the east gate of Shougang Group in the west, with a total length of 46 km. During the study, the axes are divided into three sections: the east section, from Jianguo Gate to the Canal Cultural Square of Tongzhou District (Chang'an Avenue east and its extension); the central section, from Jianguo Gate in the east to the Fuxing Gate in the west (the central section of 6.7 km); and the west section, from Fuxing Gate to the east gate of Shougang Group (Chang'an Avenue west and its extension).

(2) **Width scope of axes**

Based on the *Conservation Planning of Historical and Cultural City of Beijing* (Beijing Municipal Commission of Urban Planning 2002), the scope of width of the axes in the study is defined as the "road axis as a benchmark, 500 m to the both sides of road as a control boundary, and the 1000–m–wide scope becomes the protected and control scope of the urban axes."

4.2.2 Research Ideas

Here are the main research ideas:

① First, based on the related literature review about urban memory and urban axes, this research organized the reference materials about historical changes and updated conditions of the main axes of Beijing;
② Under the theoretical framework of Object–Subject–Time (OST), this research analyzed and concluded the three main elements of urban memory, which used the main axes of Beijing as its study object: objective elements, subjective evaluative elements and temporal elements;
③ Based on measurement, this research needs to conclude the relevant measuring factors that are classified to three levels: objective elements, subjective evaluative elements and temporal elements are the level-one variables;
④ Based on the spectrum of measuring factor, this research designed the questionnaires;
⑤ This research introduces some concepts, such as urban memory cognition (UMC) and subjective evaluation value (EV), as its measurement standard. According to questionnaires, interviews and data preparation, this research adopted basic statistical methods and Pearson's correlation tests to analyze urban memory's time, objects, and subjective features and also studied the regularity of changes between the time, object and subject.

4.2.3 Research Methods

(1) **Information extraction of study object**

The two main axes of Beijing are in possession of rich information and a wide range of scope. Based on the following thoughts, this research made space division and information selection of the study object.

① *Grid selection method*: While studying the temporal elements of the main axes, this research extracted the representative architectures of different ages on the main axes. Based on the defined scope of the north–south axis and east–west axis, the axes were divided into 500 × 500 grids with a width of 500 m on both sides of the axes. The representative architectures on the main axes were selected by the most representative architectures on one or two small grids derived from the large one.
② *Expert scoring method*: Because numerous representative architectures were selected based on the Grid Selection Method, further selection was necessary. Hence, this research adopted the Expert Scoring Method. Thirty–two experts were invited to complete the questionnaire, which was carried out on 28–31 March, 2011.

In the end, 31 expert scoring questionnaires are available. According to the scoring results, 20 representative architectures on the axes are regarded as the basis of temporal elements measurement of the main axes of Beijing.

(2) **Data collection method**

The method of data collection is mainly the questionnaire, which was classified into the field questionnaire and website research. Having designed the questionnaire, the pre–research was carried on in the middle of April 2011. After numerous modifications regarding the questionnaire, the formal research was implemented. It began from 23 April to 2 May, 2011.

Field research selected 13 places from the Beijing's inner city, suburb and outer suburb to complete questionnaires. Because the study object is a group with urban memory and the time span of urban memory needs to be balanced, what the respondents measured was whether they have the memory of the main axes of Beijing as well as the memory's depth and accuracy. Hence, the research space needs to cover within the domain of Beijing City. Although a larger stream of people gather at the Forbidden City (the Palace Museum)–Jingshan Hill– Towers of Bell and Drum as well as along Chang'an Avenue, it is very difficult to discriminate the respondents. This research employed residential communities to do research. During the field research, 220 questionnaires were issued, including 182 valid questionnaires, with the validity ratio of 82.7 %. Here are the places of field research and condition of the questionnaire issued in Fig. 4.1.

Apart from field research, the directed questionnaire method was adopted and conducted with the assistance of online investigation. According to professional status, 10 researchers were selected to finish the questionnaires and explain questions existing in the questionnaires. They then began their research in their own life circles. The 10 researchers of different vocations included students (three persons), scientific research personnel (one person), workers in state–owned enterprise (two person), workers in a foreign enterprise (two persons) and workers in private enterprise (two persons). The directed questionnaire used a website questionnaire with the Sojump Investigation Network (http://www.sojump.com/) as the website research platform. Finally, 203 questionnaires were issued and 192 collected, with a validity ratio of 94.6 %.

The respondents were mainly middle–aged or aged residents living in residential communities and a few visitors with relatively low education levels and mostly long–term memory, while the respondents of the website questionnaire were those people whose average age was relatively low and educational status was relatively high. A certain number of students were included. Those respondents had short–term memories. Complementing each other, the two types of research means ensured that the group of respondents came from a balanced background.

(3) **Data Processing Method**

After the questionnaires are collected, this study conducted a statistical analysis on the data. The data processing softwares used here were Excel 2007 and SPSS 16.0

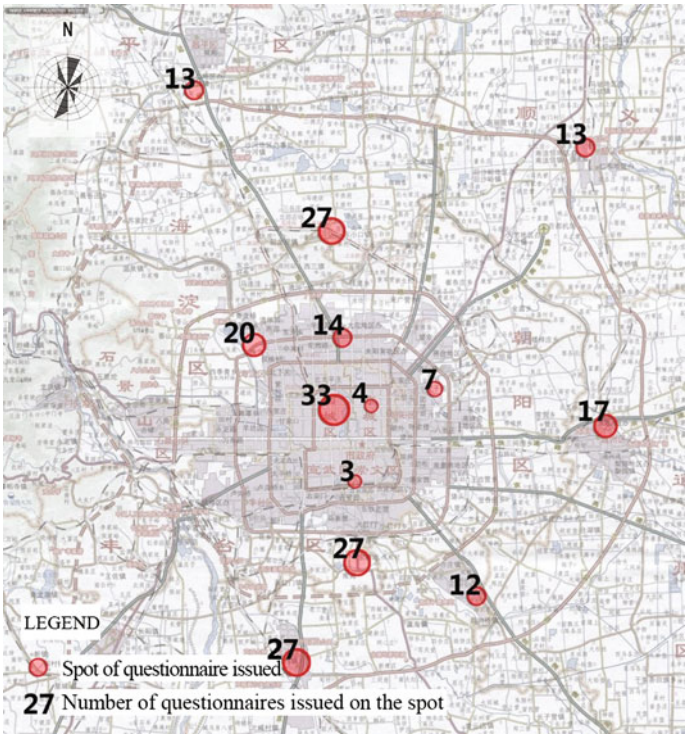

Fig. 4.1 Distribution diagram of the number of investigation spots in the field research of Beijing's central axes (*Source* Drawing by Xiufeng Yu)

for Windows. The data processing method mainly included descriptive statistics, modeling calculations, and the Pearson's correlation analysis.

① *Descriptive statistics*: The statistical contents included subjective evaluative elements, subjective attributes, objective elements and temporal elements. By introducing urban memory cognition (UMC), subjective evaluation value (EV) and other concepts as the measurement standard, this research measured the depth of urban memory on Beijing's main axes.
② *Modeling calculation*: Based on the models, the original data were processed to generate the factors of objective elements, subjective evaluative elements and temporal elements of urban memory on the main axes of Beijing.
③ *Pearson's correlation analysis*: This study performed a Pearson's correlation analysis on subjective evaluative elements, objective elements, temporal elements and subjective attributes factors (Table 4.2).

Table 4.2 Variables of Pearson's correlation analysis

Number	Variable 1	Variable 2	Analysis purpose
1	Objective elements	Subjective evaluative elements	To learn about correlation and rules between objective elements and subjective evaluative elements
2	Objective elements	Subjective attributes	To learn about correlation and rules between objective elements and subjective attributes
3	Temporal elements	Subjective attributes	To learn about correlation and rules between temporal elements and subjective attributes
4	Subjective evaluative elements	Subjective attributes	To learn about correlation and rules between subjective evaluative elements and subjective attributes
5	Temporal elements	Subjective evaluative elements	To learn about relevant factor between subjective evaluative elements and temporal elements
6	Temporal elements	Objective elements	To learn about relevant factor between time cognitive and objective elements

4.3 Research Results

4.3.1 Analysis of Subjective Elements

The subject analysis of urban memory includes three parts: first, examining the evaluation level of the subject regarding the main axes of Beijing by establishing a formula for the subjective evaluation value (EV); second, performing a statistical analysis on the subject's age, duration of residence, residence experience, gender, education, income and so on; last, using the Pearson's correlation to examine the subjective evaluative elements and subjective attributes an analysis d identifying the relationship between subjective evaluative elements and subjective attributes.

(1) **Composition and measurement of the north–south axis**

① Subjective elements of urban memory on main axes

The study on urban memory is carried out in two aspects: on the one hand, establishing a subjective evaluation based on objective elements cognition; on the other hand, studying the subjective attributes when the subjects were considered as individuals.

Based on the subjective cognition of objective fact, subjective evaluation is a comprehensive evaluation to which many factors are added, such as self–judgment, value orientation, ideology and outside intervention. While evaluating urban axes, the core is the object-urban axes. Hence, the classification of the evaluation is based on urban axes' influence on urban memory because the component factors of different urban axes have different effects on urban memory and even the same effect of component factors of the same urban axes on urban memory while being judged by different people. According to the urban axes' influence on urban

memory, the subjective analysis is divided into three types: inheriting/erasing memory, strengthening/weakening memory and correcting/distorting memory. According to their characteristics, they are subdivided into three levels of measuring factors.

Inheriting/erasing memory emphasizes peoples' degree of recognition regarding urban axes. For example, peoples' cognition that urban axes exist in Beijing; peoples' cognition levels for buildings that exist on the axes; peoples' cognition levels of axes' functions for Beijing.

Strengthening/weakening memory emphasizes urban axes' strengthening role in the Beijing urban memory. In other words, it emphasizes Beijing urban memory's dependence on urban axes. For example, peoples' increased understanding of Beijing due to the existence of urban axes; people's cognition of urban axes' role on the division of city space; people's cognition of the relationship between urban axes and urban development.

Correcting/distorting memory emphasizes urban axes' correction and distortion role in the Beijing urban memory—for example, subjects' cognitive degree of durable development of urban axes or distortion of subjective cognition of urban axes.

The study on subjective attributes is an otherness study that classifies the subject based on the difference of the subjective attributes. For example, the subject of urban memory is divided into residents and visitors based on the level of degree of participation and group relationships. Additionally, from the perspective of the relationship between the subject of urban memory and the urban object, the subject of urban memory is divided into presenters and users of the object of urban Memory (Wang et al. 2010). In the study, the main focus is on subject's age, residence experience, duration of residence, information accesses, population property and so on.

② The content and method of the subjective elements measurement on the main axes of Beijing

The subjective measurement of urban memory is divided into two types: measurements of subjective evaluation and subjective attributes.

According to the argument above, on the basis of the study of the literature review, expert interview and study object, the subjective measurement is divided into three types (level-two variables) in light of the influence of the main axes of Beijing on urban memory: inheriting/erasing memory, strengthening/weakening memory and correcting/distorting memory. The factor construction can be seen in Table 4.3.

As mentioned in Chap. 3, the study introduces subjective evaluation values (EV) to measure the degree of recognition of the subject towards the object condition. The specific calculation of the subjective EV is shown in Formula 3.1. Then the subjective attribute characteristics are in the statistical description. To discuss how subjective attributes affect urban memory levels, the Pearson correction analysis method was adopted to standardize subjective evaluation values (EV) and

Table 4.3 The level-three measuring factors of the subjective evaluative elements of Beijing's central axes

Subjective evaluative elements	Level-three measuring factors
Inheriting/erasing memory	(1) The cognition of the axes; (2) The cognition of the buildings on the axes; (3) The cognition of the importance of the axes
Strengthening/weakening memory	(1) The cognition of the axes in terms of their division of Beijing; (2) Whether the existence of the axes deepens the understanding of Beijing; (3) Whether the existence of the axes helps promote urban development.
Correcting/distorting memory	(1) The cognition of axes' continuity; (2) Whether there is a distortion of memory of axes

attribute the value of the subjective attributes before the Pearson's correction test. See Formulas 3.2 and 3.3.

(2) **Subjective elements analysis**

The statistical results of questionnaires show the points of the level-one, level-two and level-three variables of the subjective evaluative elements. The details are as follows.

① Level-one variables

The subjective evaluation of urban memory adds the comprehensive evaluation of its own judgement on the basis of its cognition of the objective elements, and it is measured through subjective evaluation value (EV). In accordance with Formula 3.1, the total evaluation value from the subject of urban memory towards the main axes of Beijing is 0.62, classified as being at a medium level.

② Level-two variables

According to the impacts the main axes of Beijing have on urban memory, the level-two variables of the subjective evaluative elements are classified into three types: inheriting/erasing memory, strengthening/weakening memory and correcting/distorting memory. EV of level-two variables in each type is shown in Table 4.4.

The subjective evaluation value (EV) analysis of level-two variables shows the following.

(1) The type of "inheriting/erasing memory" stands for the recognition degree of people toward the main axes of Beijing. The data show the subject has a

Table 4.4 The subjective evaluation value (EV) of level-two variables of Beijing's central axes

Variables	Inheriting/erasing memory	Strengthening/weakening memory	Correcting/distorting memory
EV	0.61	0.61	0.63
Level	Medium	Medium	Medium

Note $0 \leq EV < 0.4$ is low, $0.4 \leq EV < 0.7$ is medium, and $0.7 \leq EV \leq 1$ is high

moderate recognition degree toward the main axes of Beijing. North–south axis, Chang'an Avenue and its extension are parts of the Beijing urban memory;
(2) The type of "strengthening/weakening memory" represents the memory depth of people toward the main axes of Beijing. Its subjective evaluation value is 0.61, and the level is medium, showing that people have a rough understanding of the main axes;
(3) The type of "correcting/distorting memory" stands for the memory–related accuracy of people regarding the main axes of Beijing. Its subjective evaluation is medium, showing that there are many inaccurate memories by the subjects regarding the main axes of Beijing.

③ Level-three variables

The subjective evaluation value (EV) is shown in Table 4.5.

The subjective evaluation value (EV) analysis of level-three variables shows the following.

(1) The overall points of the subjective evaluation value (EV) are medium and high, showing that the subject has a higher level of evaluation toward the main axes of Beijing;
(2) The subject has the highest recognition level of the variable "the axes strengthen the understanding of Beijing," at 0.72. Because the memory of the axes itself is obtained based on an overall understanding and cognition of the city, it is widely recognized that the axes strengthen the understanding of Beijing;
(3) The subject has the lowest recognition degree of the variable "I learned about the axes of Beijing," at 0.45, showing that people have a low level of understanding of the main axes of Beijing.

(3) **Characteristics of the subjective attributes**

According to 374 valid questionnaires, the following section analyzes the age, gender ratio, residence experience, educational status, income and other information of the respondents.

Table 4.5 The subjective evaluation value (EV) of level-three variables of Beijing's central axes

Variables	Learning about the axes of Beijing	Cognition of the architectures on the axes	Importance of the axes	Role of axes in terms of its division of Beijing
EV	0.45	0.51	0.69	0.60
Level	Medium	Medium	Medium	Medium
Variables	Strengthen the understanding of Beijing	Contribute to the development of the city	Continuity of axes	Distortion degree of the memory
EV	0.72	0.64	0.51	0.55
Level	High	Medium	Medium	Medium

Note The reverse questions have been addressed with reverse treatment: $0 \le EV < 0.4$ is low, $0.4 \le EV < 0.7$ is medium, and $0.7 \le EV \le 1$ is high

① *Age*: The average age of the respondents is 28.82, and the age distribution is shown in Fig. 4.2.

Figure 4.2 shows that young men accounted for a higher proportion of the total respondents, mainly because the directional investigation was carried out in the form of website questionnaires; in addition, the large number of internet survey samples also led to the lower ages of the respondents. Just as Fig. 4.3 shows, the age distribution of field research questionnaires was relatively even. However, the age of the directional investigation was unevenly distributed. Just as in Fig. 4.4, the respondents aged between 20 and 29 comprised the vast majority.

② *Gender ratio*: Among the respondents surveyed, there were 184 males, accounting for 49.2 %; there were 190 females, accounting for 50.8 %. The gender ratio was generally balanced.

③ *Residence experience*: Among the 374 valid questionnaires, a total of 345 once lived in Beijing, comprising 92.2 % of all people surveyed; 93 of these were born in Beijing and accounted for 24.9 % of all respondents. Another 72 have lived in Beijing since birth, comprising 19.3 %. The average duration of residence in Beijing for all respondents was 12.6 years, and 150 people have lived in Beijing for more than 10 years, comprising 40.1 % of all. The statistics in the survey were also conducted in the respondents within the domain of Beijing City, as shown in Table 4.6.

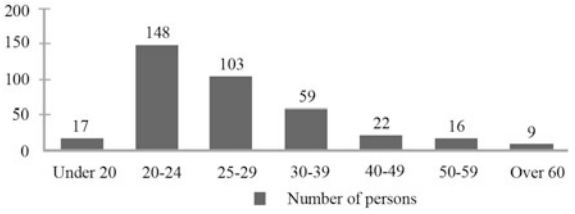

Fig. 4.2 Subjective age structure of urban memory of Beijing's central axes (*Source* Drawing by Xiufeng Yu)

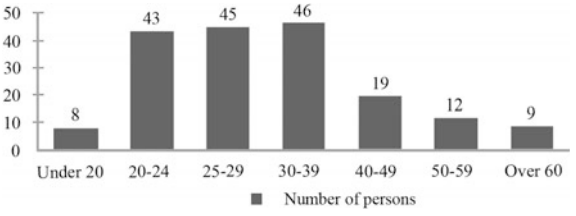

Fig. 4.3 Subjective age distribution in the field research of urban memory of Beijing's central axes (*Source* Drawing by Xiufeng Yu)

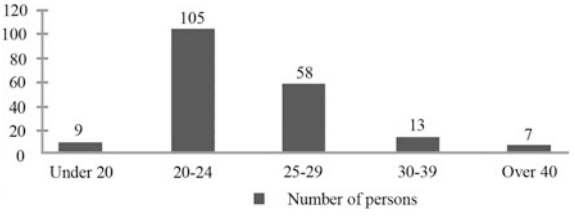

Fig. 4.4 Subjective age distribution in the directional investigation of urban memory of Beijing's central axes (*Source* Drawing by Xiufeng Yu)

Table 4.6 Degree of subjective familiarity with Beijing with Beijing's central axes as the object

Districts	Former Dongcheng District	Former Xicheng District	Former Chongwen District	Former Xuanwu District	Chaoyang District	Haidian District	Fengtai District	Shijingshan District	Outer suburb
Number	63	102	44	40	93	232	61	19	36

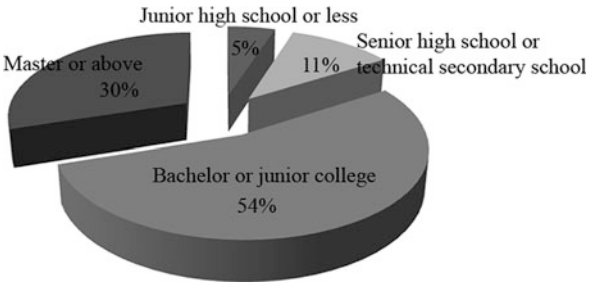

Fig. 4.5 Subjective educational status distribution with Beijing's central axes as the object (*Source* Drawing by Xiufeng Yu)

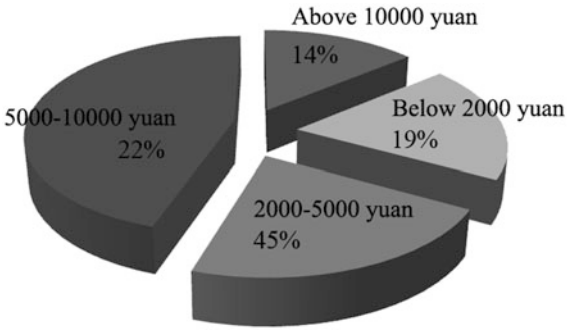

Fig. 4.6 Subjective income with Beijing's central axes as the object (*Source* Drawing by Xiufeng Yu)

As the directional investigation in the survey was conducted in the form of website questionnaires, and as most of the respondents were students, the number of persons familiar with Haidian District was high; the number in other districts and counties was relatively evenly distributed, roughly equal to the number, proportions and occupations of their population.

④ *Educational status*: The educational status structure of the samples surveyed was as follows, in descending order: 112 people with master degree or above accounted for 30 %; 201 with bachelor or junior college degrees, 54 %; 40 with senior high school or technical secondary school, 11 %; and 21 with junior high school education or below, 5 %. The educational degrees of the sample were evenly distributed, and the vast majority had excellent educational backgrounds on the whole, owing to the large internet sample (Fig. 4.5).

⑤ *Income*: The household monthly income per person of the respondents was considered the research standard in terms of income and was divided into four levels: below 2,000 Yuan, 2,000–5,000 Yuan, 5,000–10,000 Yuan and above 10,000 Yuan. The income structure of the sample was as follows, from high to low: 53 respondents with above 10,000 Yuan account for 14 %; 83 respondents with 5,000–10,000 Yuan, 22 %; 174 respondents with 2,000–5,000 Yuan, 45 %, and 75 respondents with 2,000 Yuan, 19 %. The incomes of this sample were evenly distributed (Fig. 4.6).

(4) Correlation analysis of the subjective elements and properties

The Pearson's correlation tests are conducted for the subjective evaluative elements and subjective attributes of urban memory, which can be used to analyze the characteristics of the judgment of people with different backgrounds on the main axes of Beijing (just as Formula 3.2 shows). Before the Pearson's tests, it is required to standardize the two groups of data to further carry out correlation tests (the subsequent analysis is the same as above and will not be repeated here.)

After the standardized value is calculated by the subjective evaluation value (EV) and subjective attributes, Pearson's correlation tests will be conducted, which can determine the characteristics of the judgment of people with different backgrounds on the main axes of Beijing, just as Formula 3.3 shows. The results are displayed in Table 4.7.

The following is the analysis based on the Pearson's correlation coefficient:

① The subjective evaluation of inheriting/erasing memory passes the test at a 0.01 level in terms of age, duration of residence in Beijing, personal experience, and familiarity with Beijing. The result demonstrates that the older the respondents are, the longer their duration of residence in Beijing is, the more familiar they are with Beijing, and the greater their personal experience is, the more they know about the main axes of Beijing. In other words, the subject will regard knowledge of the axes as part of the Beijing urban memory. This point is in conformity with the general result of cognition. However, a correlation is not detected between the educational status and the judgment of inheriting/erasing memory, showing that the cognition of the main axes of Beijing is irrelevant to the level of knowledge; it is a universal recognition without a higher level of knowledge.

② The subjective evaluation of strengthening/weakening memory passes the test at a 0.01 level just in terms of duration of residence, demonstrating that the depth of memory of the main axes of Beijing comes primarily from the personal experience of the subject and has no relationship with age, duration of residence in Beijing, educational status or other factors. To some extent, the channels of deep understanding of the main axes of Beijing at present are few, exclusively personal experience.

③ The subjective evaluation of correcting/distorting memory passes the test at a 0.01 level in terms of the duration of residence in Beijing, the degree of familiarity of Beijing and educational status, and it demonstrates a negative correlation between them. The result demonstrates that the longer they live in Beijing, the more they are familiar with Beijing, and the higher their educational status is, the lower their cognition distortion of the main axes of Beijing is. In other words, they have a more accurate memory of the main axes of Beijing.

The accuracy of memory requires much from the subjects; thus, the subjects are required to be more familiar with Beijing and have a higher level of education. Therefore, when the accuracy of the memory of the main axes of Beijing needs to be improved, the overall cognition of Beijing and the familiarity degree of the subject should be enhanced.

Table 4.7 Correlation between subjective evaluation value (EV) and subjective attributes with Beijing's central axes as the object

Level-two variables	Index	Age	Duration of residence in Beijing	Personal experience	Familiarity with Beijing	Education status
Inheriting/erasing memory	Pearson's correlation	0.191**	0.263**	0.465**	0.299**	−0.044
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.397
	N	374	374	374	374	374
Strengthening/weakening memory	Pearson's correlation	−0.008	0.059	0.349**	0.099	−0.038
	Sig. (2-tailed)	0.880	0.258	0.000	0.056	0.462
	N	374	374	374	374	374
Correcting/distorting memory	Pearson's correlation	−0.06	−0.184**	0.018	−0.134**	−0.135**
	Sig. (2-tailed)	0.249	0.000	0.732	0.010	0.009
	N	374	374	374	374	374

Note **Correlation is significant at the 0.01 level (2-tailed)

4.3.2 Analysis of Objective Elements

The objective analysis of the urban memory of the main axes of Beijing includes the following four aspects: (1) the basic cognition of the subject towards the object, namely, the scope and nature of the main axes of Beijing; (2) the construction of the formula of the urban memory cognition (UMC), which can be used to examine the cognitive level of level-three objective elements; (3) the subjective evaluative elements and objective elements, which are examined using the Pearson's correlation analysis model and their correlation later summarized; and (4) the objective elements and subjective attributes, which are examined using the Pearson model to sort the objective features based on different subjective attributes.

(1) **Constitution and measurement of the objective elements**

① Objective elements of urban memory targeting the main axes of Beijing

Objective elements of urban memory contain both tangible entities and intangible cultural carriers. From all aspects of an urban environment and its form, For example, Guo and Xu (2003) divided objective elements into the geographical environment, natural resource, scenery resource, cultural environment, old city appearance, cultural relic sites, axes feature, urban skyline, urban space joint, urban background buildings, urban typical buildings, important public place, urban structures, urban monument and urban environment sculpture. Xin Tu (2005) concluded that there are seven elements of urban memory: natural element, economic element, political element, cultural element, religious element, existing environmental element, specific persons and events.

The above classification is made from the perspective of the city, whereas for the axes of Beijing as the research object, it is just part of the urban space environment. The classification is made up of tangible elements and functions, such as roads, buildings and open space, and intangible cultural elements such as culture and history. The objective elements of urban axes are all facts that are of objective existence; therefore, the research of urban axis objects is defined as the cognition of the objective elements. In addition, as a research object in a three-dimensional space, urban memory is continuous and dynamic on the time axis. For a better description of the feature, the objective elements of urban memory for the main axes of Beijing are divided into three types: permanent elements, evolutionary elements and temporary elements.

Permanent elements are those that the main axes have preserved from generation to generation and have not undergone fundamental changes during urban development, such as the location of architecture on the axes and the time when they were built. The distinct characteristic of this type is that the elements maintain the original features despite the vicissitudes of dynasties.

Evolutionary elements are those that have experienced replacement and evolution during urban development, such as changes of functions on the axes, renewal

of architectural appearance on the axes, space evolution and historical changes of the axes. These elements are typical of the obvious changes that the axes experienced and exert significant and irreversible impacts on the axes.

Temporary elements are the phasic changes and events that the urban main axes experienced during urban development, such as historical events, former names and the functions of architectures on the axes. These elements are phasic and tend to be featured by events; the impacts they exercise are momentary or phasic and are found nowhere at present.

② The content and methods of the objective elements measurement of the main axes of Beijing

As described above, on the basis of literature review, expert interviews and research objects, the objective elements of urban memory for the main axes of Beijing are divided into three types (level-two variables): permanent elements, evolutionary elements and temporary elements. This section takes the form of level-three single choice and multiple choices.

Through the literature review of the main axes of Beijing and experts' scoring, the elements that constitute the object of urban memory of the main axes of Beijing can be summed, and the represented content is selected as the measuring factor (Table 4.8).

In the objective elements cognition measurement of the main axes of Beijing, the research introduces the concept of urban memory cognition (UMC) (Formula 3.4). This indicator measures the cognitive degree of objective factors of urban memory, and the analysis of cognitive degree can sum the cognitive differences of the various objective elements.

The objective UMC, subjective evaluation value (EV) and subjective attributes must be standardized (Formula 3.2) to further conduct the Pearson's correlation tests (Formula 3.3). The Pearson's correlation can test the correlation between the objective elements cognition of memory and inheriting, strengthening and correcting urban memory.

Table 4.8 level-three measuring factors of objective elements with Beijing's central axes as the object

Objective elements	Level-three measuring factors
Permanent elements	(1) The space location of architecture on the axes; (2) The time when the architecture was built on the axes
Evolutionary elements	(1) The functions of the architecture on the axes; (2) The appearance of the architecture on the axes; (3) The historical evolution of the axes; (4) The space expansion and evolution of the axes
Temporary elements	(1) The historical events that happened on the axes; (2) The names and function evolution of the architecture on the axes

(2) **The analysis of the objective elements**

① Level-one variables

The analysis of objective elements of urban memory is based on objective elements cognition, and urban memory cognition (UMC) is the indicator used to describe this feature. Through the calculation of Formula 3.4, the cognitive degree of the objective elements is 0.52, which is at the medium level.

② Level-two variables

The level-two variables of the objective elements of urban memory are divided into the following types: permanent elements, evolutionary elements, and temporary elements. The urban memory cognition (UMC) of the level-two variables is as shown in Table 4.9.

The analysis of the urban memory cognition (UMC) of the level-two variables: (1) Permanent elements are those that the main axes have preserved from generation to generation and have not undergone fundamental changes during urban development. This type of element has a medium cognitive degree, higher than the other two elements. The result shows that permanent elements most easily impact cognitive memory; (2) Evolutionary elements are those that have experienced irreversible changes during the development of the main axes of Beijing, such as demolition, expansion, and function transformation of the architecture on the axes, as well as the extension of the axes. The cognitive degree of this type is 0.516 at the medium level, showing that the subjects have a general understanding of the evolutionary elements of the object; (3) Temporary elements are phasic changes or events of the main axes of Beijing from in the past, such as the former names of architecture and roads on the axes and past events. The cognitive degree of this type is 0.374, at the low level. Considering that temporary elements cannot leave their marks currently, the cognitive degree is therefore low.

③ Level-three variables

The urban memory cognition (UMC) of the objective elements of the level-three variables is as follows (Table 4.10).

The analysis of the urban memory cognition (UMC) of the level-three variables as follows.

The UMC of the location of existing architecture on the axes is highest, with a value of 0.78, and similarly, the function of existing architecture on the axes is high,

Table 4.9 Urban memory cognition (UMC) of level-two variables of objective elements with Beijing's central axes as the object

Variables	Permanent elements	Evolutionary elements	Temporary elements
UMC	0.674	0.516	0.374
Level	Medium	Medium	Medium

Note $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

Table 4.10 Urban memory cognition (UMC) of level-three variables of objective elements with Beijing's central axes as the object

Variables	Location of architecture on axes	Time of architecture on axes	Function of architecture on axes	Appearance of architecture on axes
UMC	0.78	0.57	0.75	0.47
Level	High	Medium	High	Medium
Variables	Historical evolution of axes	Space evolution of axes	Past events	Name and function evolution of architecture
UMC	0.37	0.50	0.36	0.39
Level	Low	Medium	Low	Low

Note The reverse questions have been addressed with reverse treatment, $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

with a UMC of 0.75. The result shows that relatively permanent elements that are able to survive have higher UMC.

The UMC of the past events on the axes is lowest. The variable contains information of great quantity and variety, and they require profound cultural deposits, so the value is the lowest.

The UMC of the historical evolution of architecture and the axes is also low because the time span is long, and information contained is abundant and is not directly accessible at present.

(3) **Correlation analysis between the objective elements and subjective evaluative elements**

Pearson's correlation tests are conducted for the objective elements and subjective evaluative elements of urban memory to determine the correlation between the objective elements and its inheriting, strengthening and correcting urban memory (Formula 3.3). In some sense, based on the subjective evaluation, it is more important to establish which type of urban memory exists. The results are shown in Table 4.11.

According to the Pearson's correlation tests: (1) The subjective evaluations of inheriting/erasing memory and strengthening/weakening memory and the cognitive degree of the permanent, evolutionary and temporary objective elements pass the test at the 0.01 level. The result shows that people who have a high cognitive degree on the permanent, evolutionary and temporary elements must do the same in inheriting/erasing memory and strengthening/weakening memory. (2) The subjective evaluations of correcting/distorting memory pass the test at the level of 0.01, only in terms of the permanent objective elements. A negative correlation exists between the subjective evaluations and the cognitive degree of the permanent objective elements; however, there is no correlation with the cognitive degree of evolutionary and temporary objective elements. The result shows that people who

Table 4.11 Correlation between objective urban memory cognition (UMC) and subjective evaluation value (EV) with Beijing's central axes as the object

Level-two variables	Index	Permanent	Dynamic	Temporary
Inheriting/erasing memory	Pearson's correlation	0.572**	0.407**	0.591**
	Sig. (2-tailed)	0	0	0
	N	374	374	374
Strengthening/weakening memory	Pearson's correlation	0.173**	0.396**	0.178**
	Sig. (2-tailed)	0.001	0	0.001
	N	374	374	374
Correcting/distorting memory	Pearson's correlation	−0.610**	−0.069	−0.069
	Sig. (2-tailed)	0	0.185	0.18
	N	374	374	374

Note **Correlation is significant at the 0.01 level (2-tailed)

have a high cognitive degree on the sable elements distort least the memory of the axes of Beijing and also have a more accurate understanding of the axes.

(4) **Correlation analysis of the objective elements and subjective attributes**

By applying Pearson's correlation test to the objective elements and subjective attributes of urban memory (Formula 3.3), the cognition differences that different subjects with different attributes have on objective elements is analyzed. The test results are shown in Table 4.12.

According to the Pearson's correlation factors, we obtain the following results.

① The permanent cognition degree of the objective elements passed the test at the 0.01 inspection level and is positively associated with the duration of residence in Beijing, personal experiences, familiarity degree with Beijing, and income, indicating that the more familiar people are with Beijing, the deeper their cognition on permanence will become, which conforms to the general rules of cognition.

② Both the cognition degree of the evolutionary objective elements and originating from personal experiences are obvious at the 0.01 inspection level and are positively associated with each other, but there is no correlation relationship with the other subjective attributes. The evolutionary objective elements appeared in recent years, so people's memories are roughly equal, whereas personal experiences can help to deepen their understanding.

③ The cognition degree of the temporary objective elements is obvious at the 0.01 inspection level, together with age, duration of residence in Beijing, personal experience, familiar degree with Beijing and educational background, among which temporary objective elements are positively associated with age, duration of residence in Beijing, personal experience and familiarity degree with Beijing and are

Table 4.12 Correlation between objective urban memory cognition (UMC) and subjective attributes with Beijing's central axes as the object

Level-two variables	Index	Age	Duration of residence in Beijing	Personal experience	Familiarity with Beijing	Education
Permanent elements	Pearson's correlation	0.107	0.275**	0.309**	0.300**	0.133
	Sig. (2-tailed)	0.039	0	0	0	0.01
	N	374	374	374	374	374
Evolutionary elements	Pearson's correlation	0.015	0.036	0.200**	0.132	−0.076
	Sig. (2-tailed)	0.779	0.492	0	0.011	0.144
	N	374	374	374	374	374
Temporary elements	Pearson's correlation	0.146**	0.152**	0.270**	0.215**	−0.155**
	Sig. (2-tailed)	0.005	0.003	0	0	0.003
	N	374	374	374	374	374

Note **Correlation is significant at the 0.01 level (2-tailed)

negatively associated with educational background. The educational status only has a negative correlation with temporality, indicating that it has no significant influence on subjects' understanding about objects. The higher a person's educational status is, the greater the likelihood of misunderstanding and distorting of information about elements that existed in the past but are nonexistent in the present.

4.3.3 Analysis of Temporal Elements

The time analysis of the urban memory of Beijing city central axes includes three aspects: firstly, to test the cognition level of the level-three objective elements factors by constructing formula of urban memory cognition (UMC); secondly, to test and induce the correlation relationship between the subjective evaluative elements and temporal elements by means of a Pearson model; thirdly, to test the temporal elements and subjective attributes by means of a Pearson model to induce the temporal elements features based on different subjects' background attributes; fourthly, to test the temporal elements and objective attributes by means of a Pearson model to determine the influences that different objective attributes have on temporal elements cognition.

(1) **Temporal elements composing and measuring**

① Temporal elements of urban memory that take the Beijing city central axes as the object

Subjective and objective study of the contents on certain time cross-sections, especially the synchronic contents of the Beijing city central axes, was performed. Because the central axes of Beijing have been significantly changed with time, so the study of the Beijing's central axes from the time dimension is an indispensable part of the study of the urban memory of the Beijing's central axes.

Taking the temporal evolution rule of Beijing's central axes, the historical characteristics of Beijing urban construction and the significant position of short-term memory in the urban memory of Beijing's central axes into account, the temporal elements level-two variables of urban memory can be divided into the following time quanta on the basis of the built-up time on the axes: before modern time (–1840), modern time (1840–1949), after the founding of the People's Republic of China to before the reform and opening-up policy (1949–1978), after the reform and opening–up policy to the end of the 20th century (1978–2000) and since the 21st century (from the year 2000 to the current day). Considering the temporal elements measurement, 20 representative buildings on the central axes are chosen as the point-in-time for measuring the temporal elements.

The architectural characteristics and architectural styles of the north–south central axis are not the same as those of the east–west central axis:

Before modern time (–1840), namely, the Opium War, the western powers had not entered into China, so the traditional Chinese style was widely adopted in the urban construction of Beijing.

During modern time (1840–1949), with the invasion of the Western powers, many Western architectural features were added to the urban construction of Beijing. Buildings on the central axes in this period, such as Qianmen Railway Station, and Zhushikou Church, had distinctive Western building features. At the same time, modern cultural features were added to the urban architectural styles. In this period, the overall urban construction dynamics were comparatively weak, especially the urban construction in the late Qing period, due to the recession of national powers. In the period after the Qing Dynasty fell and before the founding of the People's Republic of China, the urban construction also experienced slow development because Beijing was not the capital of the nation.

After the founding to before the Reform and Opening–up (1949–1978): the period after the founding of the People's Republic of China was a concentrated development period of Beijing urban construction. A large number of buildings on the eastern and western central axes were constructed in this period most and were loaded with special political and cultural functions due to the special historical background at the time. As a result, some unique architectural styles came into being.

After the Reform and Opening-up to the end of 20th century (1978–2000): the economic development became the principal target after the Reform and Opening-up policy, so the new buildings on the Beijing's central axes, whose forms

and functions were completely different from those of the former period, were partial to economic function.

Since the new century (2000 to the present): due to Beijing's successful Olympic bid, Beijing urban construction, especially construction on the north–south central axis, was strongly tied to the 2008 Olympic Games, which led to the protection and development of central axes to a new height.

To measure the temporal elements, specific quantification methods are needed. The urban memory measurement of representative buildings on the central axes from different ages can, to certain degree, demonstrate people's temporal memory of the Beijing's central axes. By choosing 4 buildings in each time quantum established in the corresponding time period, and measuring the total 20 points-in-time in the five time quantum (four points-in-time in each), the temporal memory features were finally obtained.

② Confirmation of the important buildings/open spaces/roads on the central axes

First, the important buildings, open spaces and roads on the central axes were determined according to the self-characteristics of the axes.

The central axes were divided into a 500 × 500 m grid according to the determined scope of the Beijing north–south central axis, as well as the 500 m width beside them, as shown in Fig. 4.7.

One or two representative buildings were selected in each grid, as in Fig. 4.8, to obtain the significant architectures in the east–west and north–south axes.

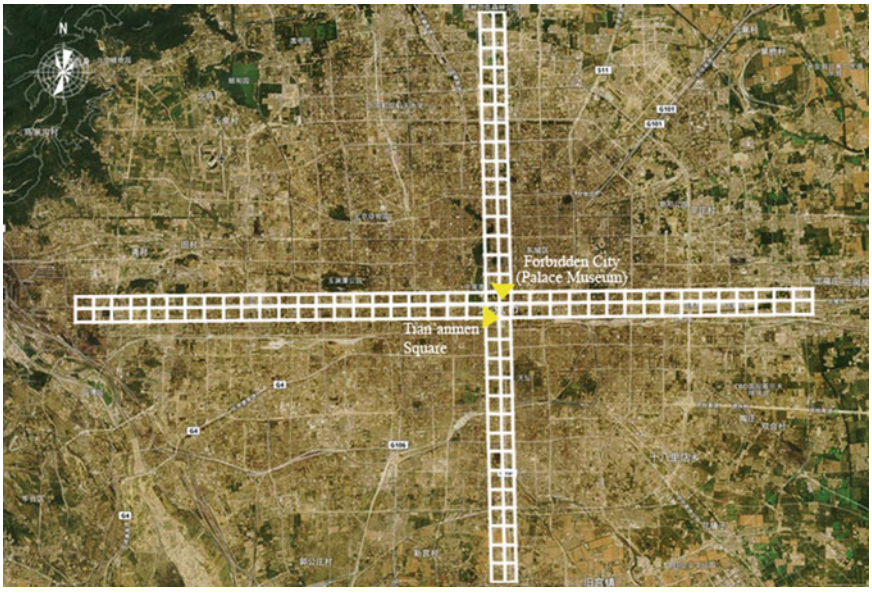

Fig. 4.7 The schematic diagram of the axes division by grid method (*Source* Drawing by Xiufeng Yu)

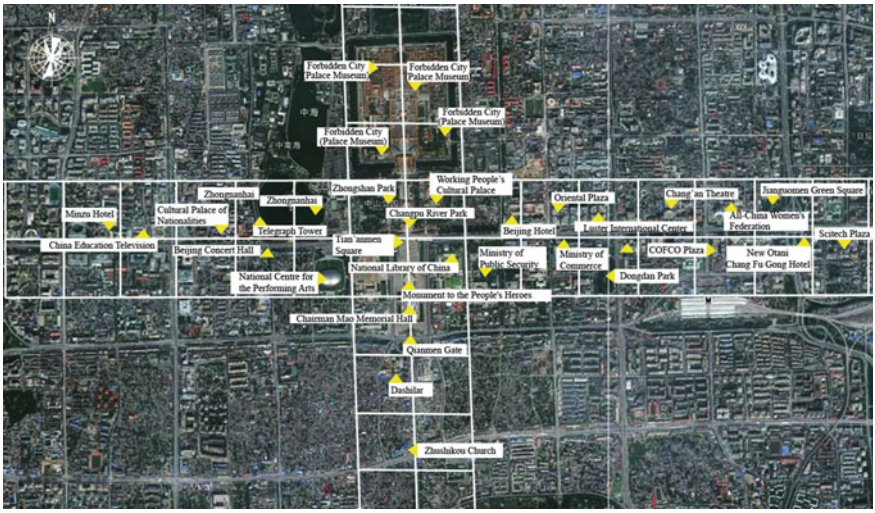

Fig. 4.8 The schematic diagram of selecting representative architectures (*Source* Drawing by Xiufeng Yu)

③ Selection of representative architecture

To select the typical architectures, open space and roads on the east–west and north–south axes in Beijing, this study adopted experts marking and questionnaire methods to ask urban planning experts and Beijing citizens to select the architecture, open space and roads in the main axes according to their memories.

The experts marking questionnaire was conducted from March 28 to March 31; 31 questionnaires were collected. The results are shown in Fig. 4.9.

According to the results of the experts' marking questionnaire and considering the objective elements of key architecture, open space and roads on the axes, to make the representative architecture distributed more evenly based on construction time, location, and function, 20 representative buildings were chosen from the east–west and north–south axes in Beijing, as shown in Tables 4.13, 4.14, and Fig. 4.10.

④ Contents and methods for measuring the temporal elements of the main axes

In this study, OST is introduced to the study of temporal elements. As the study object, the urban axes can be judged through the measurement of the architectures, open space and roads constructed during the different historic periods on the main axes in Beijing. The measuring factors are as follows (Table 4.15).

The arrangement is in chronological order from the past to the present to increase the difficulty for measuring gradually, which could help to validate the measurement effect.

After obtained the temporal urban memory cognition (UMC) (Formula 3.5) of Beijing's central axes, we performed Pearson's correlation analysis on the objective

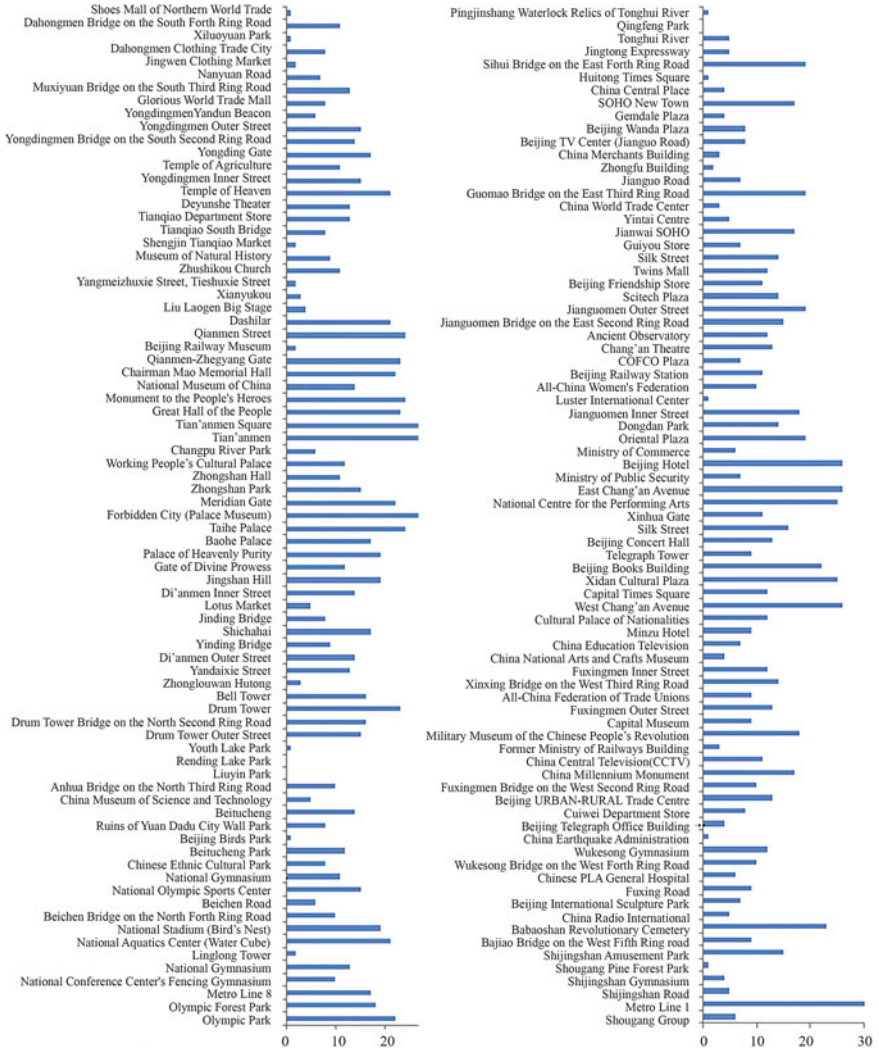

Fig. 4.9 Results of the experts' questionnaire (*Source* Drawing by Xiufeng Yu)

UMC and subjective attributes to analyze the correlation between the objective elements and temporal elements, as well as that between the subjective elements and temporal elements (Formula 3.3).

(2) **Analysis of the temporal elements**

① Level-one variables

The correlation analysis between the subject and object is synchronic, whereas the study of the main axes in Beijing based on temporal dimensions is diachronic.

Table 4.13 Representative architectures selected in the east–west axis

Important architectures	Temporal elements	Location	Types				Functions			
			Feature	Whether in old city	Degree of scenic region	Historic relics grade	Economy	Politics	Religion	Culture
Zhongnanhai	Before 1840	West	Public space	Yes	–	National Heritage Conservative Unit	–	Yes	–	–
Beijing Hotel	1840–1949	East	Landmark	–	–	Municipal Heritage Conservative Unit	Yes	–		
Babaoshan Revolutionary Cemetery	1840–1949	West	Public Space	–	–	–	–	–	–	–
Metro Line 1	1949–1978	All	Road	–	–	–	–	–	–	–
Military Museum	1949–1978	West	Landmark	–	–	–	–	–	–	Yes
Oriental Plaza	1978–2000	East	Landmark	–	–	–	Yes	–	–	–
Xidan Cultural Square	1978–2000	West	Public Space	–	–	–	Yes	–	–	–
Beijing Books Building	1978–2000	West	Landmark	–	–	–	Yes	–	–	Yes
National Grand Theater	2000–	West	Landmark	–	–	–	–	–	–	Yes
Jianwai SOHO	2000–	East	Landmark	–	–	–	Yes	–	–	–

Table 4.14 Representative architectures selected in the north–south axis

Important architectures	Temporal elements	Location	Types				Functions			
			Feature	Whether in old city	Degree of scenic region	Degree of heritage protection	Economy	Politics	Religion	Culture
Tian'an Men	Before 1840	Middle	Landmark	Yes	–	National Heritage Conservative Unit	–	Yes	–	–
Qianmen Street	Before 1840	South	Road	Yes	–	–	–	–	–	–
Forbidden City (Palace Museum)	Before 1840	North	Landmark	Yes	5A	National Heritage Conservative Unit	–	Yes	–	–
Zhongshan Park	1840–1949	North	Public Space	–	4A	–	–	Yes	–	–
Zhushikou Church	1840–1949	South	Landmark	Yes	–	–	–	–	Yes	–
Great Hall of the People	1949–1978	South	Landmark	–	–	–	–	Yes	–	–
Tian'anmen Square	1949–1978	South	Public Space	–	–	–	–	Yes	–	–
National Gymnasium	1978–2000	North	Landmark	–	–	–	–	–	–	Yes
Olympic Park	2000–	North	Public Space	–	5A	–	–	–	–	Yes
National Aquatics Center (Water Cube)	2000–	North	Landmark	–	–	–	–	–	–	Yes

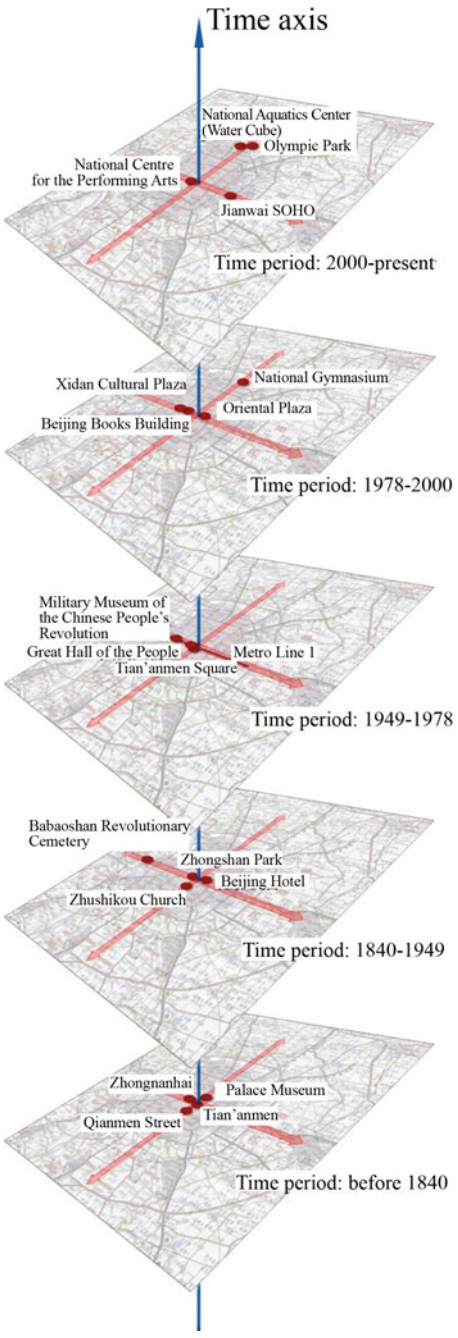

Fig. 4.10 Diagram of the selected time axis—time period—point-in-time (*Source* Drawing by Xiufeng Yu)

Table 4.15 Temporal measurement elements in urban memory of Beijing's central axes

Temporal measurement elements	Level-three measurement variables			
Before 1840	Zhongnanhai	Tian'an Men	Qianmen Street	Forbidden City (Palace Museum)
1840–1949	Zhongshan Park	Beijing Hotel	Babaoshan Revolutionary Cemetery	Zhushikou Church
1949–1978	Metro Line 1	Military Museum of the Chinese People's Revolution	Great Hall of the People	Tian'anmen Square
1978–2000	Oriental Plaza	Xidan Cultural Park	Beijing Books Building	National Gymnasium
2000–	National Centre for the Performing Arts	Olympic Park	National Aquatics Center (Water Cube)	Jianwai SOHO

During the research, temporal elements in the urban memory cognition (UMC) (Formula 3.5) were applied in the calculation. The result indicates that the urban memory cognition is 0.60, which is in the medium level.

② Level-two variables

As mentioned before, the temporal elements level-two variables of urban memory can be divided into the following time periods on the basis of the built-up time on the axes. The urban memory cognition (UMC) of the level-two variables is shown in Table 4.16.

It can be seen from the urban memory cognition (UMC) of the level-two variables that: (1) the highest period of UMC is in 1949–1978, then there are two less high periods before 1840 and after 2000 until the present. Those time are also the peak periods of construction on the east–west and north–south axes: the main architectures —the Forbidden City (the Palace Museum), Yongding Gate, Gate Tower, Bell and Drum Towers on the north–south axis were built before 1840. The main construction and development period on the east–west axis began after the foundation of China and before the Reform and Opening, and the latter period was mainly composed of reconstruction and extension. After 2000, the government conducted massive repair

Table 4.16 Urban memory cognition (UMC) of level-two variables of temporal elements with Beijing's central axes as the object

Variables	Before 1840	1840–1949	1949–1978	1978–2000	2000–
UMC	0.806	0.551	0.816	0.678	0.797
Level	High	Medium	High	Medium	High

Note $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

and construction on the north–south axis because of the Olympic Games. (2) UMC is low in the periods 1840–1949 and 1978–2000, during which most of the architectures that were built have not changed, resulting in low UMC.

③ Level-three variables

The urban memory cognition (UMC) of the level-three variables composing the temporal elements in each period is given in Table 4.17.

Based on the urban memory cognition (UMC) of the level-three variables of the temporal elements.

(1) As a whole, the urban memory cognition on the spatial location and function are in the range of medium–high, much higher than the construction age and deviation degree of time. The cognitive degree of spatial location that could be perceived directly is higher than that of the function, which means that the elements that could be directly perceived have a higher cognitive degree.
(2) During the period from 1840–1949, the cognitive degree of spatial location is lower than that of the function because people had an overall lower cognitive degree in this period. The cognitive degree of the construction age in this period is the lowest, whereas the UMC of the deviation degree is the highest because in this period, the infrastructure on the north–south axis and east–west axis is lower, which resulted in alow cognitive degree.
(3) For the temporal cognition, the buildings constructed after 2000 have the highest UMC. The deviation degree of UMC is only 0.236, suggesting that short-term memory is the highest in UMC.

(3) **Correlation analysis between the subjective evaluation value and temporal elements**

By applying Pearson's correlation analysis to the subjective evaluation and temporal elements of urban memory, we can obtain the cognitive correlation between them (shown in Formula 3.3). The results are as follows (Table 4.18).

According to the Pearson's correlation factor, we can obtain the following results.

① All subjective inheriting/erasing memory evaluation values and temporal elements cognitive degrees pass the test at the level above 0.01, and they have a positive correlation, which means the preserve/vanish memory evaluation is of high value, and people who have urban memory for the main axes also have deep memory on time, which corresponds to the ordinary cognitive rule.

② The correlations between all subjective correcting/distorting memory evaluation values and the temporal elements cognitive pass the test at the level above 0.01, and they have a negative correlation, which means people with a more accurate urban memory about the main axes of Beijing have a deeper temporal memory, which also corresponds to ordinary rules.

③ The correlations between subjective strengthening/weakening memory and temporal elements cognitive during the periods before 1840, from 1949–1978, and from 2000 to the present pass the test at the level above 0.01, and they have a

positive correlation, where as the cognitive degrees towards the temporal elements during 1840–1949 and 1978–2000 show no correlation, which reflects that the respondents involved in this research generally have a lack of deep understanding about temporal memory of the main axes in Beijing during these periods. The reason might be that the infrastructure constructed on the north–south and east–west axes was less extensive in modern time. From the Reform and Open policy (1978–2000) to the end of the 20th century, there were few significant events along with the construction of infrastructure on the north–south and east–west axes, so memory was not strongly impacted.

(4) **Correlation analysis between objective cognitive degree and temporal elements**

By applying Pearson's correlation analysis to the subjective evaluation and temporal elements of urban memory, we can obtain their cognitive correlation (Formula 3.3). The results are as follows (Table 4.19).

According to the Pearson's correlation factor, some conclusions are summarized as follows.

① The correlation between cognition of permanent objective elements and all temporal elements pass the test at the level above 0.01, and they have a positive correlation, which means people who have a higher permanence cognitive degree have a deeper temporal memory, which corresponds to ordinary rules.

② The correlation between cognitive of evolutionary objective elements and all of the temporal elements pass the test at the level above 0.01, and they have a positive correlation, which means people who have a higher variability cognitive have deeper temporal memory, which corresponds to ordinary rules.

Table 4.17 Urban memory cognition (UMC) of Beijing's central axes at different times

Variables	Spatial location	Function	Construction age	Deviation degree of time
UMC before 1840	0.912	0.859	0.647	0.321
Level	High	High	Medium	Low
UMC in 1840–1949	0.649	0.659	0.345	0.543
Level	Medium	Medium	Low	Medium
UMC in 1949–1978	0.944	0.877	0.626	0.299
Level	High	High	Medium	Low
UMC in 1978–2000	0.791	0.746	0.479	0.404
Level	High	High	Medium	Medium
UMC in 2000–	0.845	0.816	0.731	0.236
Level	High	High	High	Low

Note The reverse questions have been addressed with reverse treatment, $0 \le \text{UMC} < 0.4$ is low, $0.4 \le \text{UMC} < 0.7$ is medium, and $0.7 \le \text{UMC} \le 1$ is high

Table 4.18 Correlation between temporal urban memory cognition (UMC) and subjective evaluation value (EV) with Beijing's central axes as the object

Level-two variables	Index	Inheriting/erasing memory	Strengthening/weakening memory	Correcting/distorting memory
Before 1840	Pearson's correlation	0.352**	0.158**	−0.220**
	Sig. (2-tailed)	0	0.002	0
	N	374	374	374
1840–1949	Pearson's correlation	0.448**	0.093	−0.280**
	Sig. (2-tailed)	0	0.072	0
	N	374	374	374
1949–1978	Pearson's correlation	0.254**	0.163**	−0.189**
	Sig. (2-tailed)	0	0.002	0
	N	374	374	374
1978–2000	Pearson's correlation	0.379**	0.1	−0.237**
	Sig. (2-tailed)	0	0.053	0
	N	374	374	374
2000–	Pearson's correlation	0.287**	0.148**	−0.252**
	Sig. (2-tailed)	0	0.004	0
	N	374	374	374

Note **Correlation is significant at the 0.01 level (2-tailed)

③ The correlation between cognitive of temporary objective elements and temporal elements before 1840, during modern time (1840–1949) and from the Reform and Open policy (1978–2000) to the end of 20th century pass the test at the level above 0.01, and they have a positive correlation. No correlations were found from the foundation of China to the Reform and Opening (1949–1978) or in the new century (2000 until present). The reason could be attributed to the development characteristics of the main axes of Beijing from the point-in-time. During the periods from 1949 to 1978 and from 2000 to present, no changes took place in the infrastructure on the axes, which caused the loss of the temporal element, so there was no correlation.

(5) **Correlation analysis between subjective attributes and temporal elements**

By applying Pearson's correlation analysis to the temporal elements of urban memory and the subjective attributes, we can analyze the differences in the temporal elements of subjects with different properties. The results are shown in Table 4.20.

Table 4.19 Correlation between objective and temporal urban memory cognitions (UMC) with Beijing's central axes as the object

Level-two variables	Index	Permanent elements	Evolutionary elements	Temporary elements
Before 1840	Pearson's correlation	0.479**	0.188**	0.157**
	Sig. (2-tailed)	0	0	0.002
	N	374	374	374
1840–1949	Pearson's correlation	0.546**	0.235**	0.317**
	Sig. (2-tailed)	0	0	0
	N	374	374	374
1949–1978	Pearson's correlation	0.406**	0.200**	0.083
	Sig. (2-tailed)	0	0	0.11
	N	374	374	374
1978–2000	Pearson's correlation	0.519**	0.300**	0.224**
	Sig. (2-tailed)	0	0	0
	N	374	374	374
2000–	Pearson's correlation	0.543**	0.237**	0.124
	Sig. (2-tailed)	0	0	0.017
	N	374	374	374

Note **Correlation is significant at the 0.01 level (2-tailed)

According to the Pearson's correlation factor, some conclusions are summarized as follows.

① The correlation between age and temporal elements cognitive degree during the periods of modern time (1840–1949), and from the Reform and Open policy to the end of the 20th century (1978–2000) pass the test at the level above 0.01, and they have a positive correlation. Based on the analysis above, the temporal elements in the periods of 1840–1949 and 1978–2000 are the lowest, suggesting that the older people get, the deeper their memory about Beijing becomes, so that they have temporal memory about these two periods.

② The correlation between the duration of residence in Beijing and temporal elements cognitive degree during the periods before modern time (–1840), modern time (1840–1949), from the foundation of China to the Reform and Open policy (1949–1978), and from the Reform and Open policy to the end of the 20th century pass the test at the level above 0.01, and they have a positive correlation. No correlations are found from the new century (2000 until present). The longer people lived in Beijing, the higher their cognitive degree about temporal elements. The period from 2000 to now belongs to the short–term memory range. The infrastructure on the north–south and east–west axes as well as the Olympic Games

Table 4.20 Correlation between objective urban memory cognition (UMC) and subjective attributes with Beijing's central axes as the object

Level-two variables	Index	Age	Duration of residence in Beijing	Personal experience	Familiarity with Beijing	Education
Before 1840	Pearson's correlation	0.117	0.213**	0.198**	0.181**	0.169**
	Sig. (2-tailed)	0.023	0	0	0	0.001
	N	374	374	374	374	374
1840–1949	Pearson's correlation	0.385**	0.491**	0.162**	0.261**	−0.01
	Sig. (2-tailed)	0	0	0.002	0	0.848
	N	374	374	374	374	374
1949–1978	Pearson's correlation	0.078	0.193**	0.122	0.136**	0.178**
	Sig. (2-tailed)	0.134	0	0.019	0.008	0.001
	N	374	374	374	374	374
1978–2000	Pearson's correlation	0.149**	0.330**	0.141**	0.219**	0.068
	Sig. (2-tailed)	0.004	0	0.006	0	0.188
	N	374	374	374	374	374
2000–	Pearson's correlation	−0.055	0.086	0.138**	0.145**	0.205**
	Sig. (2-tailed)	0.29	0.096	0.007	0.005	0
	N	374	374	374	374	374

Note **Correlation is significant at the 0.01 level (2-tailed)

increased recent memory, so people who have only lived for short time in Beijing also have urban memory about these periods.

③ The correlation between self-experience and temporal elements cognitive degree during the periods before modern time (– 1840), modern time (1840–1949), from the Reform and Open policy to the end of 20th century (1978–2000), and the new century (2000 until present) pass the test at the level above 0.01, and they have a positive correlation, where as no correlation was found during the period from the foundation of China to the Reform and Open policy. In effect, infrastructures built in this period on north–south and east–west axes have high visibility and publicity, for example, the Great Hall of the people, Tian'anmen Square; thus, there is little correlation between self-experience and urban memory of Beijing.

④ The correlation between the degree of familiarity to Beijing and temporal elements cognitive degree pass the test at the level above 0.01, and they have a positive correlation. People who are more familiar with Beijing have a higher cognitive memory of temporal elements, which corresponds to ordinary rules.

⑤ The correlation between the educational status and temporal elements during periods before the modern time (–1840), from the foundation of China to the Reform and Open policy (1949–1978), and the new century until present (2000 till now) pass the test at the level above 0.01, and they have a positive correlation. The cognitive degree of temporal elements was be the highest in these three periods, which shows that the cognitive degree of education of temporal elements corresponds to ordinary rules.

4.4 Cognitive Results

Based on urban memory's basic characteristics of the Beijing's central axes summarized above, comparisons of the characteristics between the east–west axis and the north–south axis are conducted.

4.4.1 Comparisons of Urban Memory's Characteristics of the Two Axes

As previously mentioned, the Beijing's central axes are made up of the Beijing north–south axis and the east–west axis, which organize the urban space in Beijing and in some sense act as a psychological axis. Each individual has different cognition towards the axes; at the same time, the spatial forms of these two axes, for example, starting point, roads that compose the axes, buildings and their functional properties, all changed constantly throughout history. In the following section, the differences of urban memory cognition between these two axes are analyzed from perspectives of space, function and objective elements in urban memory cognition (UMC).

4.4.2 Comparisons of the Spatial Characteristics of the Two Axes

As stated already, in the traditional sense, the Beijing north–south axis starts at Yongdingmen and ends at the Drum Tower, whereas East and West Chang'an Avenues, respectively, starts at Xidan and ends at Dongdan. With the development of Beijing, the north–south axis and East and West Chang'an Avenues have

continued to expand. Although contents, such as the starting point of the Beijing's central axes, have been stipulated in the planning documents, such as the *Master Planning of Beijing (2004–2020)* (Beijing Municipal Commission of Urban Planning 2005), the *Urban Design of the Central Axes in Beijing* (Beijing Municipal Commission of Urban Planning 2005), and the *Conservation Planning of Historical and Cultural City of Beijing* (Beijing Municipal Commission of Urban Planning 2002), these definitions are not necessarily the same as subjective cognition.

In this study, the question "where are the four endpoints of west, east, south and north of Beijing main axis in your mind?" has been proposed. The votes for each endpoint are shown in Fig. 4.11.

The number of votes for each point was divided by the total votes, and the proportion of each is shown in Table 4.21.

According to the position of the endpoints of the axis chosen by respondents, values can be assigned to measure the urban memory cognition (UMC) of every direction of the urban main axes. Five is assigned to endpoints outside the Fourth Ring in Beijing, three is assigned to the endpoints in the Third Ring, and two is assigned to endpoints in the Second Ring. The results are shown in Table 4.22.

In the following, the results are summarized:

For the north–south axis, some believe that the central axis starts from the endpoint of the traditional central axis—the Drum Tower and Yongdingmen, whereas others accept the expanded endpoint of the north–south axis, that is, Nanyuan and the Olympic Forest Park. In general, subjective cognition of the scope of the north–south axis tends more to the north because development in the southern part of Beijing is relatively lacking, whereas the north end of central axis held the Olympics, which strengthened people's memory.

On the East and West Chang'an Avenues, as well as its extending line, the endpoints of the east and west exceed the original endpoints of East and West

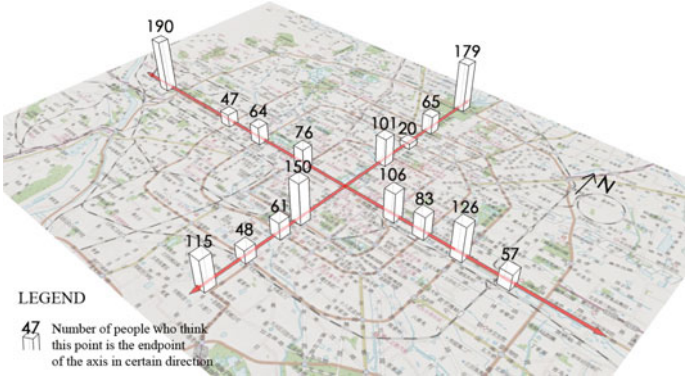

Fig. 4.11 Diagram of subjective cognition of the endpoints of the axes (*Source* Drawing by Xiufeng Yu)

Table 4.21 Subjective endpoint cognition of Beijing's central axes

East endpoint	Bali Bridge	Sihui	Guomao	Jianguomen	Others
Proportion	14.8 %	32.7 %	21.6 %	27.5 %	3.4 %
South endpoint	Nanyuan	Dahongmen	Muxiyuan	Yongdingmen	Others
Proportion	29.9 %	12.5 %	15.8 %	39.0 %	2.9 %
West endpoint	Pingguoyuan/Shougang Group	Wukesong	Gongzhufen	Fuxingmen	Others
Proportion	49.5 %	12.2 %	16.7 %	19.8 %	1.8 %
North endpoint	Olympic Forest Park	Beitucheng	Anhua Bridge	Drum Tower	Others
Proportion	46.6 %	16.9 %	5.2 %	26.3 %	4.9 %

Table 4.22 Subjective direction cognition of Beijing's central axes

Direction	East	South	West	North
Mean value of endpoints	2.86	2.70	3.17	3.03

Chang'an Avenues, that is, Dongdan and Xidan. The endpoint of the west is quite clear, with people agreeing to the endpoint of Metro Line 1, that is, Pingguoyuan/Shougang Group. However, the endpoint of the east is not clear, and subjects have roughly the same urban memory cognition (UMC) of Jianguomen, Guomao and Sihui. Generally speaking, subjective cognition of East and West Chang'an Avenues, as well as its extending line, tends more to the west.

4.4.3 Comparisons of the Attributive Characteristics of the Two Axes

As to functions and positions of the Beijing's central axes, the north–south axis and Chang'an Avenue, as well as its extending line, are regarded as the important components of the "two axes—two belts—multiple centers" urban space structure in the *Master Planning of Beijing (2004–2020)* (Beijing Municipal Commission of Urban Planning 2005), in which it has been pointed out that functions and positions of the central axis as urban cultural axis should be defined.

In this study, respondents' answers about the "functions of Beijing main axis" are shown in Fig. 4.12. Among them, "spatial symmetric axis" and "urban landscape axis" are investigations of the functions played by the axes in urban space, whereas "political axis", "economic axis" and "cultural axis" are investigations of the urban functions of the axes.

As can be seen from Fig. 4.12, respondents' degree of recognition of the north–south axis far exceeds that of the east–west axis in the investigation of the spatial

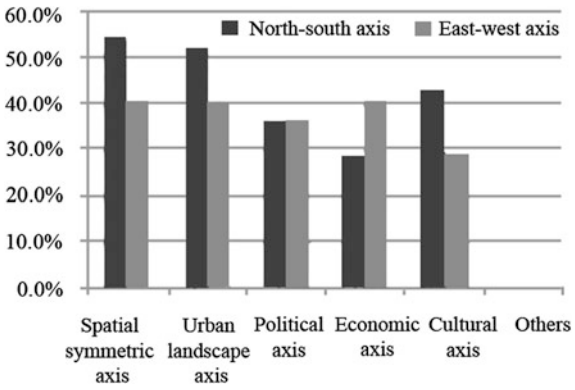

Fig. 4.12 Diagram of subjective cognition of the attributive characteristics of the axes (*Source* Drawing by Xiufeng Yu)

functions of the axes because more than half of the respondents agree that the north–south axis is the symmetric axis of the Beijing urban space.

As for the functions of these two axes, "cultural axis" has the highest recognition degree for the north–south axis, which conforms to the position of the north–south axis in some related plannings.

For the east–west axis, "economic axis" has the highest recognition, whereas" cultural axis" has the lowest. Looking back to the planning and construction of the east–west axis, it has always been defined mainly as the political and cultural axis until in the *Master Planning of Beijing (1991–2010)* (Beijing Municipal Commission of Urban Planning 1993) that appropriately arrange commercial service facilities was proposed. From the founding to the eve of reform and opening up, urban construction on the east–west axis was administrative-based and cultural-based, but in recent years, construction has mainly been commercial service buildings and business finance buildings. Therefore, commercial buildings have the strongest impression on subjects' memory. Subjective cognition about the nature of the east–west axis reflects how short-term memory plays a main role in the urban memory of the Beijing urban axis.

4.4.4 Comparisons of the Cognition Degree of the Objective Elements

As previously stated, the analysis of the objective elements of urban memory is built on the basis of the cognition of the objective elements, and urban memory cognition (UMC) is the indicator to describe this characteristic. From Formulas 3.4 and 3.5, the objective elements cognition degree and the temporal elements cognitive degree of the east–west axis and the north–south axis can be calculated (Table 4.23).

Table 4.23 Urban memory cognition (UMC) of the Beijing's central axes

Variables	Spatial location	Axis function	Construction age	Degree of deviation of temporal memory
UMC of the north–south axis	0.866	0.827	0.641	0.299
Level	High	High	Medium	Low
UMC of the east–west axis	0.790	0.756	0.497	0.422
Level	High	High	Medium	Medium

Note $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

The cognitive degree of spatial location and function far exceeds that of temporal memory. Compared to temporal memory, visible spatial location and function can be more easily perceived.

For the cognition of spatial location, functional and temporal memory, the objective elements cognition degree of the north–south axis exceeds that of the east–west axis; at the same time, the degree of deviation of memory of the north–south axis is also below that of the east–west axis. On the whole, the basic cognitive degree of the north–south axis exceeds that of the east–west axis. Although from our founding to the 1980s, the planning and construction of the east–west axis along Chang'an Avenue exceeded that of the north–south axis. However, the north–south axis has played a significant role in the history of Beijing urban development and construction. In addition, the development and protection of the north–south axis in recent years have also improved the objective elements cognition degree.

Chapter 5
Linear Space: Measurement of the Urban Memory of City Walls

City walls are the general term for the city walls and the city gates. Ancient city walls are typically linear space elements of Beijing that represent the transformation of the urban form over the past 800 years and have greatly influenced the memory of the entire city. Beijing's city walls are part of the urban memory, so the study of their historical changes and updated condition plays an important role.

5.1 Transformation Overview

5.1.1 Historical Transformation

Beijing is a historic city, according to historical records, boasting more than 3,000 years of history. The *History of Chinese Architecture,* written by Sicheng Liang in 1943, was the first book on this topic in China. In this book, Prof. Liang gave high praise to Beijing that Beijing in the Ming and Qing Dynasties was constructed by following the plan of Chang'an during the Sui and Tang Dynasties; Hence, it became the greatest architecture among the existing medieval cities all over the world (Liang 2005).

Beijing was established to be the capital of Yan State during the Spring and Autumn (770 BC–476 BC) and the Warring States (475 BC–221 BC) Periods. It was named Nanjing in the Liao Kingdom. The central position of the Liao and

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F. Wang, *Beijing Urban Memory*, DOI 10.1007/978-981-10-0678-4_5

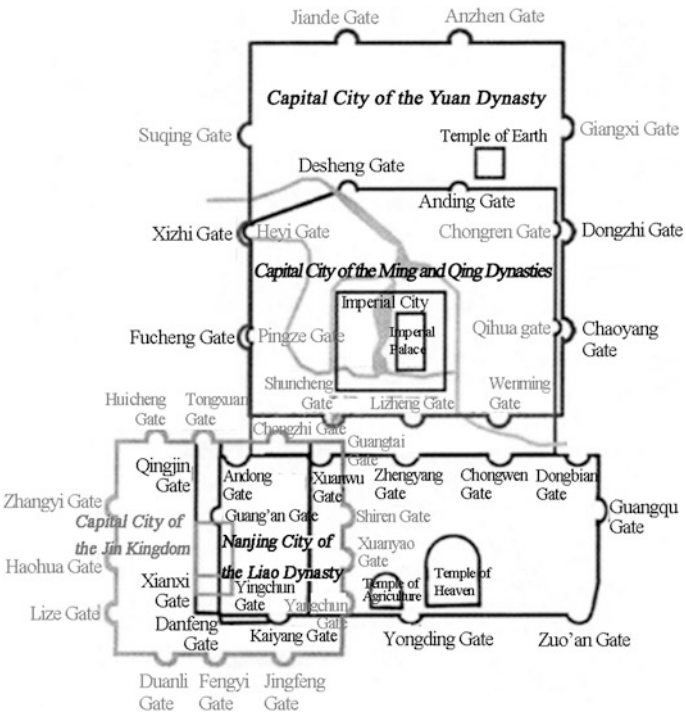

Fig. 5.1 Transformation diagram of Beijing City (*Source* redrawn by Fan Yin based on an original from: Dong 2009)

Yan was in the area of Guang'an Gate. Its city wall was square in plane, covering 27 *li*[1] (approximately 13,000 m) with eight city gates (Fig. 5.1). In the early 12th century, Jin wiped out Liao and changed its name to the Jin Kingdom's capital, which was located in over half of the western area of the former Xuanwu District in Beijing. The whole city was roughly square, with a circumference of 37 km and 13 city gates, covering an area approximately 1.8 times that of the Liao and Yan. In the 13th century, the Yuan Dynasty changed the name of the Jin Kingdom's capital to the Yuan's capital, which was constructed after 26 years. Centered by the Taiye Pool, it covered approximately 30 km and was 6,700 m long in the east and west and 7,600 m long in the south and north. The southern and northern area of the city was roughly rectangular. Today's Chang'an Avenue is located where the southern city wall originally was located. Beitucheng is the northern city wall, extending from Chaoyang Gate in the east to Fucheng Gate in the west. Yuan Dynasty's

[1] ***Li*** is a unit of length; 1 *li* = 1/2 km.

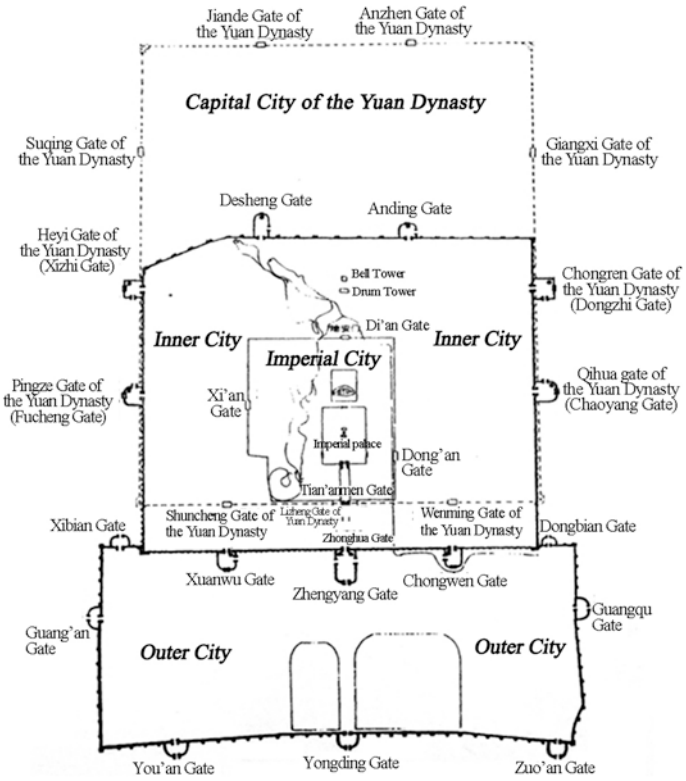

Fig. 5.2 The location of Beijing's city walls of the Yuan, Ming and Qing dynasties (*Source* Beijing News, 2003; errors were corrected by Fan Yin)

capital was 400 m from Jin Kingdom's capital, and both of were called Beicheng. The original Jin Kingdom's capital was called Nancheng, which was on the wane and was abandoned finally in the Ming Dynasty.

The northern city wall and southern city wall were, respectively, moved 2.5 and 1 km towards the south during the Ming Dynasty. The imperial palace and imperial city were constructed on a large scale. To improve fortification, the outer city was constructed. All four city walls, including the imperial palace, imperial city, inner city, and outer city, surrounded Beijing, featuring a convex-shaped city pattern (Fig. 5.2). Large-scale construction of Beijing's city walls in the Ming Dynasty provided an opportunity for the shape of the Beijing's city walls and architectural technology to reach an unprecedented height.

When the Qing army entered into Shanhaiguan and Beijing was established as the capital, the basic appearance of the urban structures was kept, apart from the renovation of palaces and city walls.

5.1.2 Modern Transformation

Beijing's city walls were built in the Liao Kingdom, prevailed in the Yuan Dynasty and prospered in the Ming Dynasty. Until the end of the Qing Dynasty, the walls were preserved very well. When China suffered from the invasion of the imperialist powers, Beijing's city walls were destroyed.

At the end of the Qing Dynasty, the Eight T-Sower Allied Forces invaded Beijing, bombarded Zhengyang Gate and destroyed embrasured watchtower. Beijing's city walls witnessed the prelude of destruction of imperialist powers by force. The ancient Beijing's city walls lost their protective function for the city after encountering the modern weapons of the Western powers. The Qing government was obliged to demolish one section of Yidong City Wall of Yongding Gate, which provided a gap for them to introduce trains into the city. A railway station was built in Zhengyang Gate. The outer city and inner city walls of Beijing were disconnected with three gaps, and the Barbican of Chongwen Gate was demolished. In the early part of the Republic Era, the government started "the event of demolishing Beijing city". According to the record in the *Historical Record of Beijing City* (Madarin: *yan du cong kao)*: "the surroundings of the Imperial City were demolished year by year, and the Left and Right Gate of Chang'an had been taken down since the first year of the Republic Era". The Imperial City, as the symbol of a feudal regime, was firstly dismantled.

In the early days after the foundation of the PRC, the city walls, an important part of the old city of Beijing, were protected, as was the whole old city. In January 1949, the ancient capital was kept intact due to the peaceful liberation of Beijing. In the early 1950s, because the development of Beijing and modern transportation had an increasing contradiction with the city walls, the problem of the preservation of Beijing's city walls has been put on the agenda. Sicheng Liang, the famous Chinese architectural expert, and Chen Zhanxiang, the architectural expert who studied in the UK, proposed "The Plan of Liang and Chen". They proposed that the ancient city walls and city gates should be preserved, the top of city walls should be developed as a resort for visitors, the moat off the wall needed to be renovated, and the both sides of the moat should be planted with green trees. Hence, the surroundings of the old city of Beijing gave rise to a stereoscopic park around the city with unique features. The intention of building a new city in the eastern Beijing is to keep the old city intact as a wonder of ancient civilization. However, for various reasons, this proposal was not adopted, and the city wall of Beijing was gradually demolished. In 1969, the city wall and most of the gate towers were torn down to build a subway around the city of Beijing.

Finally, only a few of the places were reserved, such as the Zhengyang Gate Tower, embrasured watchtower, southeastern corner tower, Ancient Observatory, embrasured watchtower of Desheng Gate, a section of the city wall of the southwestern corner in the inner city and a section of ruins near Chongwen Gate.

5.1.3 Actuality of Protection and Renovation

Over the past 50 years, "Rendering of City Wall Park", the dream of Sicheng Liang, did not come true. During the rapid expansion of the city, Beijing's city walls now only exist in people's memory.

Since entering into the 21st century, there has been an attempt to study the zonal resort space of the remaining city walls (Fig. 5.3). In 2001, the Imperial City Wall Relics Park and the Ming Dynasty Dongbian Gate Relics Park were constructed. The Imperial City Wall Relics Park was built on the ruins of the Imperial City Wall, starting from Eastern Chang'an Avenue in the south to Ping'an Street, for a total length of 2.4 km. The Ming Dynasty Dongbian Gate Relics Park in Beijing starts at the south eastern corner tower in the east and continues to Chongwen Gate in the west, for a total length of 1.5 km. There is only one inner city wall of the Ming and Qing Dynasties preserved in Beijing, and the southeastern corner tower is the biggest existing tower in terms of scale. In 2003, the 9 km Yuan Dynasty Capital City Wall Relics Park was built, followed by Desheng Park and the North Second Ring City Park. The former is located in the southern section of the old Towers of Bell and Drum to Lama Palace Bridge in the North Second Ring of Beijing, covering 54,000 m^2. The two narrowest City Parks in Beijing are the zonal landscape of green lands stretching from east to west. They were built in the location of the old Beijing city wall. In 2004, Yongding Gate, the south point of the central axes of Beijing, was reconstructed 50 years after it was demolished. The remaining Beijing's city walls include Zhangyang Gate and its embrasured watchtower, embrasured watchtower of Desheng Gate and the relics of city walls of the Jin Kingdom's capital outside Guang'an Gate.

In 2002, the *Conservation Planning of Historical and Cultural City of Beijing* (Beijing Municipal Commission of Urban Planning 2002), the first long-term planning for the conservation of the historical city in Beijing, was issued, followed by *the Imperial City Conservation Planning* the following year. The conservation of ancient city walls gradually became legitimate.

5.2 Design Research and Investigation Process

5.2.1 Research Object

For the field survey, we selected three sites to acquire information: the Ming Dynasty Dongbian Gate Relics Park, Imperial City Wall Relics Park, and Yuan Dynasty Capital City Wall Relics Park. These three ruin parks are important public recreation areas for local people and are relatively well preserved. These three ruin parks span the Yuan, Ming and Qing Dynasties. Three types of city walls are included—the Yuan Dynasty inner city walls, the Ming and Qing Dynasties imperial city walls and the Ming and Qing Dynasties outer city walls. We did not

Ming Dynasty Dongbian Gate Relics Park

East Wicket Corner Tower

Zhengyang Gate

Embrasured watchtower of Zhengyang Gate

Imperial City Wall Relics Park

Ancient Beijing Imperial City Map in the Ming and Qing Dynasties Engraved on Stone in the Imperial City Wall Relics Park

Yongding Gate

Yuan Dynasty Capital City Wall Relics Park

Fig. 5.3 Some existing city wall relics (parks) (*Source* Photographs by Fan Yin)

choose the Forbidden City (the Palace Museum) as a site for the investigation because it is the most popular tourist attraction, and tourists were not our main target. The study subject is a group with urban memory of balanced time span. Even though streams of people gather in the Forbidden City (the Palace Museum), the difficulty of discriminating the respondents of subjects arises.

5.2.2 Measurement Elements

Beijing's city walls are regarded as the measurement object, and the measuring process of the urban memory was divided into five steps: first, examine the measuring object and confirm the measuring content; second, look for the theoretical foundation for the measurement method; third, design the measurement method and questionnaires; fourth, perform the measurement and collect data according to the questionnaires and investigation; last, process the data by applying mathematical statistics methods and obtain the related conclusions.

The overall index system of the measurement is shown in Table 5.1.

Table 5.1 The measuring factors of urban memory of Beijing's city walls

Level-one variables (OST)	Level-two variables	Number of level-three variables
Subjective evaluative elements	Inheriting/erasing memory	6
	Strengthening/weakening memory	6
	Correcting/distorting memory	3
Subjective attributes	Life experience	1
	Duration of residence	1
	Age	1
	Education	1
Objective elements	Permanent elements	6
	Evolutionary elements	3
	Temporary elements	3
Temporal elements	Newly-built city walls of the Republic Era	4
	Inner city walls of the Ming and Qing Dynasties	9
	Outer city walls of the Ming and Qing Dynasties	7
	Imperial city walls of the Ming and Qing Dynasties	4
	Imperial palace walls of the Ming and Qing Dynasties	4
	City walls of the Yuan Dynasty	11
	City walls of the Jin Kingdom	13

(1) **Subjective elements**

Because urban memory is a type of collective memory, its subject, broadly speaking, is the urban collective, which is a combination of the individual memories taking part in an activity or social practice. The study of urban memory can be performed from two aspects: first is the motional bonding with Beijing's city walls; second is the subjective attributes.

The subjective evaluative elements of Beijing's city walls, on the basis of subjective cognition of objective facts, are closely related to the factors such as self judgment, value orientation, ideology and outside intervention. Evaluation of the city walls is essentially the evaluation of the object of the city walls. Hence, the classification of the evaluation is founded on the influence of city walls on urban memory because component factors of different city walls have different effects on urban memory and even the same component factors of the same city walls on urban memory when judged by different people. Based on previous research on place bonding, we chose the following three aspects of people's attitudes towards the impact of Beijing's city walls on urban memory: (1) inheriting/erasing memory, (2) strengthening/weakening memory, and (3) correcting/distorting memory.

Inheriting/erasing memory measures whether the walls' memories are passed down, for example, how people choose when there is a contradiction between city walls and city development; and how people choose when there is a contradiction between the preservation of the city walls and the benefit of local residents.

Strengthening/weakening memory measures whether the walls enhance people's memories when they think of Beijing, which can be understood as the dependence of Beijing urban memory on city walls, for example, whether people's cognition is deepened because of the existence of city walls, whether the city walls are atypical city element of Beijing in people's heart; and whether the name of city gates can help people to better remember the place names of Beijing.

Correcting/distorting memory measures whether the walls' transformations are acceptable, for example, whether transformed city walls can keep the original appearance (original memory) and whether the surroundings of the transformed city walls are coordinated and conform to the historical city style of Beijing.

The study of subjective attributes is conducted based on classification of the differences of the subjective attributes. For example, at the levels of the degree of participation and collective relationship, the subject of urban memory can be divided into residents and visitors. From the perspective of the relation between the subject of urban memory and urban objects, the subject of urban memory can be divided into performers and users of memory case reminder (Wang et al. 2010). In this study, the main focuses are on life experience, duration of residence, information access, etc.

(2) **Objective elements—Beijing's city walls**

The object of the city walls is a combination of such substantive factors as the city gate, gate tower, city wall, barbican, as well as structure, color, volume and material of city walls, and also such intangible cultural elements as function, culture and history.

Objective elements of memory—Beijing's city walls are objective facts, so the study of the object of the city walls is defined as the cognition of objective elements. Urban memory, as the study object of three-dimensional space, is continuous and dynamic. To better describe this feature, we select three aspects of Beijing's city walls as the indicators: (1) permanent elements, (2) evolutionary elements, and (3) temporary elements.

Permanent elements refer to things related to Beijing's city walls that are passed down from one generation to another during the development process of Beijing city, such as the name of the city gates, moats surrounding the city walls, architectural structure of the city walls, and classification of the city walls (inner city, Outer City, Imperial City and imperial palaces). The prominent characteristic of this type of element is to keep the original characteristic through the changing of dynasties.

Evolutionary elements refer to things related to Beijing's city walls that are irreversibly changed by social and economic life, not necessarily specific to a particular individual, group, or event, such as functional changes of the city walls, Name replacements of city gates (for example, Yuan Dynasty Heyi gate is now called the Xizhi Gate), and location changes of the city walls. The characteristics of these elements are the obvious changes that the city walls have gone through, and these changes play an important role in city walls and cannot be reversed.

Temporary elements refer to historical events related to Beijing's city walls or a period of time that had an impact on the city walls within only a short period. For example, Zhangyang Gate was destroyed by the Eight-Power Allied Forces, parts of city walls were demolished, and the city gates were used in the special fields in a certain period. This type of element has stage features and event properties and has a short-term or stage influence.

(3) **Temporal elements**

The subjective and objective studies are based on the contents of a certain time period, whereas studying Beijing's city walls on the time dimension connects the subject and object from the time dimension, which is important when studying the urban memory of Beijing. The study on the time dimension can be divided based on the dynasties when the city walls were built, such as the Liao, Yuan, Ming, Qing, the Republic Era and other dynasties. Beijing's city walls of the Ming and Qing Dynasties, the focus of this study, can be divided into inner city, outer city, imperial city and imperial palace.

5.2.3 Measurement Methods

(1) **Measurement contents and method of subjective elements**

There are two types of subjective measurements of urban memory: the motional bonding with Beijing's city walls and the subjective attributes.

Table 5.2 Level-three measuring factors of subjective evaluative elements with Beijing's city walls as the object

Subjective evaluative elements	Level-three measuring factors
Inheriting/erasing memory	(1) Good impression of the city walls; (2) The presence of the walls has a huge influence on the form of Beijing (e.g., layouts, traffic routes); (3) The presence of the walls hinders the city's development; (4) The presence of the walls hinders the development of the traffic system in Beijing; (5) Pulling down the walls did more good than harm; (6) Residential demolition and household relocation is needed if City Wall Ruins Parks are to be built.
Strengthening/weakening memory	(1) The presence of the walls plays a critical role in cultural boundaries; (2) There is a better understanding of the walls than the two axes, i.e., south-north and west-east; (3) The presence of the walls can enhance my understanding of the city; (4) The city walls are a typical element of Beijing; (5) Gate names help me recall place names in the city; (6) The wall transformation has been successful.
Correcting/distorting memory	(1) The wall transformation reflects its authenticity; (2) The gate transformation reflects its authenticity; (3) The wall transformation is in harmony with its surrounding environment.

On the basis of the literature review, expert interviews and research on the study object, we chose the following three aspects of people's attitudes towards the impact of Beijing's city walls on urban memory: (1) inheriting/erasing memory, (2) strengthening/weakening memory, and (3) correcting/distorting memory. See Table 5.2.

As mentioned in Chap. 3, the study introduces subjective evaluation values (EV) to measure the degree of recognition of the subject towards the object condition. The specific calculation of the subjective EV is shown in Formula 3.1. Then the subjective attribute characteristics are in the statistical description. To discuss how subjective attributes affect urban memory levels, the Pearson correction analysis method was adopted to standardize subjective evaluation values (EV) and attribute the value of the subjective attributes before the Pearson's correction test. See Formulas 3.2, 3.3.

(2) **Measuring content and method of the objective elements**

On the basis of the literature review, expert interviews and research on the study object, we select three aspects of Beijing's city walls as the measuring indicators: (1) permanent elements, (2) evolutionary elements, and (3) temporary elements.

According to the literature review on Beijing's city walls, website content analysis and interviews, this study determined the elements of the object of Beijing's urban memory and selected the most representative content as the measuring factor (Table 5.3). The literature we consulted includes such classic books about Beijing's city walls as *The Walls and Gates of Peking* (Siren 1924), *The walls*

Table 5.3 Level-three measuring factors of objective elements with Beijing's city walls as the object

Objective element	Level-three measuring factor
Permanent elements	1. Four city divided in the Ming and Qing Dynasties: imperial palace, imperial city, inner city, and outer city 2. Present site of the city wall ruins 3. Place name that bears the old gates' name 4. Walls surrounded by a huge moat 5. City wall architecture structure 6. City gate architecture structure
Evolutionary elements	1. The function and meaning of the walls 2. Gate name that changes over time 3. Dynasties during which the walls existed 4. Period when the walls changed their position
Temporary elements	1. City walls were pulled down shortly after 1950 2. The functional purpose of each gate in the Qin Dynasty 3. Wars taking place in the wall/gates 4. 2nd Ring Road runs close to where the walls of the inner and outer city once stood

and gates of Beijing in the Ming and Qing Dynasties (Zhang 2003), *The Old City Gates of Beijing* (Fu 2001) and *Beijing Record* (Wang 2003), and 25 literatures on China National Knowledge Internet (CNKI). The key search engine used was Baidu, and dozens of websites were browsed. This study used two interviews from two experts and several elderly people in Beijing.

During the measurement of the objective elements cognition of Beijing's city walls, the objective urban memory cognition (UMC) (Formula 3.4) was introduced to measure the cognitive degree of the objective elements of urban memory and to determine the cognitive difference of the objective elements of different types.

Having acquired the objective UMC, subjective evaluation value (EV) and subjective attributes, this study standardized these three groups of data (Formula 3.2) and performed a Pearson's correlation test (Formula 3.3). All measures show the correlation between the objective elements cognition of memory and inheriting, strengthening and correcting urban memory.

(3) **Measuring content and method of temporal elements**

The framework of OST is introduced to research the perspective of time. City walls can be judged through the cognition of different ages. Because city walls are combined with city gates, this study takes names of city gates as its measuring object and city walls of different ages as its classification standard. Liao Kingdom city walls were in a remote epoch and left no relics. Moreover, the investigating object is ordinary people rather than experts. Thus, this research abandons the cognition of Liao Kingdom city walls. The measuring factors can be seen in Table 5.4 and Fig. 5.4.

Table 5.4 Level-three measuring factors of temporal elements with Beijing's city walls as the object

Temporal measuring factors	Level-three measuring factors				
Newly-built city walls of the Republic Era	Jianguo Gate	Fuxing Gate	Shuiguan Gate	Heping Gate	
Inner city walls of the Ming and Qing Dynasties	Zhengyang Gate	Chongwen Gate	Xuanwu Gate	Dongzhi Gate	Xizhi Gate
	Anding Gate	Desheng Gate	Chaoyang Gate	Fucheng Gate	
Outer city walls of the Ming and Qing Dynasties	Dongbian Gate	Xibian Gate	Guangqu Gate	Guang'an Gate	Zuo'an Gate
	You'an Gate	Yongding Gate			
Imperial city walls of the Ming and Qing Dynasties	Tian'an Gate	Di'an Gate	Dong'an Gate	Xi'an Gate	Daqing Gate
	Chang'an Left Gate	Chang'an Right Gate			
Imperial palace walls of the Ming and Qing Dynasties	Meridian Gate (Wumen Gate)	Gate of Divine Prowess (Shenwu Gate)	East Prosperity Gate (Donghua Gate)	West Prosperity Gate (Xihua Gate)	
City walls of the Yuan Dynasty	Lizheng Gate	Wenming Gate	Shuncheng Gate	Qihua Gate	Pingze Gate
	Chongren Gate	Heyi Gate	Guangxi Gate	Suqing Gate	Anzhen Gate
	Jiande Gate				
City walls of the Jin Kingdom	Lize Gate	Huicheng Gate	Zhangyi Gate	Shiren Gate	Xuanyao Gate
	Yangchun Gate	Jingfeng Gate	Fengyi Gate	Duanli Gate	Haohua Gate
	Tongxuan Gate	Chongzhi Gate	Guangtai Gate		

The presentation is in chronological order from near to the distant to strengthen the difficult degree of measurement step by step, which is useful for the measuring effect.

Having obtained the temporal urban memory cognition (UMC) (Formula 3.5) of Beijing's city walls, this research performs a Pearson's correlation test on the objective UMC and subjective attributes to analyze the correlation between the objective elements and temporal elements, as well as that between the subjective attributes and temporal elements (Formula 3.3).

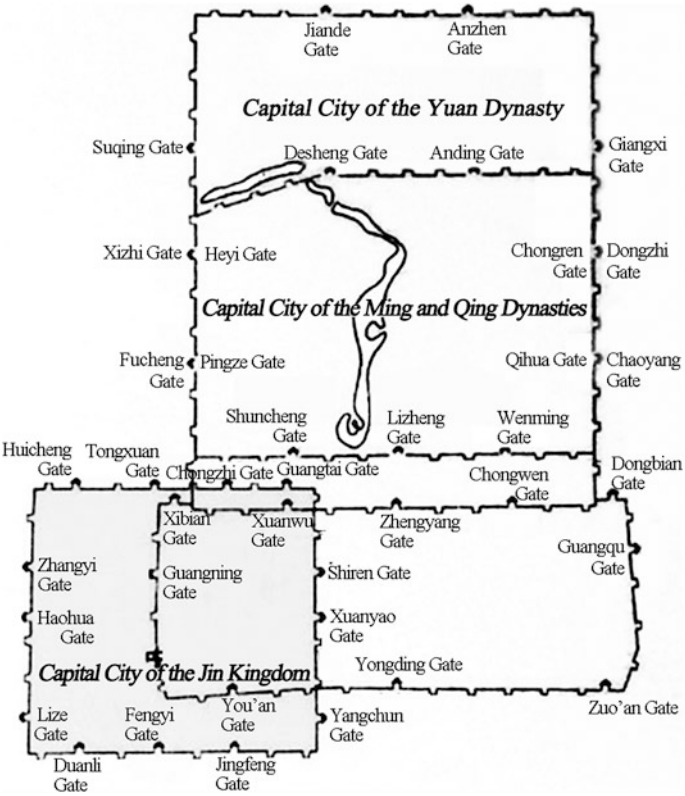

Fig. 5.4 Part of Level-three measuring factors of temporal elements with Beijing's city walls as the object (from the Jin Kingdom to the Qing Dynasty) (*Source* Picture redrawn by Fan Yin based on an original from http://finance.sina.com.cn/roll/20080112/01501926507.shtml, 2008–01–12)

5.2.4 Data Acquisition and Analysis Methods

This research adopted questionnaires to collect the data on Beijing's city walls through field survey and directed questionnaires and used Excel 2007 and SPSS 16.0 for Windows to process the data.

(1) **Questionnaire implementation**

The data collection process was divided into two parts: the pre-field survey and the formal survey. The pre-field survey was conducted in late April 2010. The semi-formal questionnaires were distributed to 11 people, including 5 college students (4 pursuing master's degrees and 1 Bachelor's degree), 5 persons from diverse professions (1 technician, 2 company employees, 1 teacher, and 1 civil servant), and a retired person. After the questionnaire revision step was complete, the distribution of the formal questionnaire was conducted from 27 April 2010 to

8 May 2010. We delivered the questionnaires via two means: a field survey and an online survey.

For the field survey, we selected three sites to acquire information: the Ming Dynasty Dongbian Gate Relics Park, Imperial City Wall Relics Park, and Yuan Dynasty Capital City Wall Relics Park. In total, 239 questionnaires were distributed, and 220 valid ones were retrieved with a 92.1 % effective response rate.

For the online survey, we selected 10 people ranging from students to working people living in Beijing to help collect data in their living environment via the online survey platform—the Sojump Investigation Network (http://www.sojump.com/). The respondents were required to finish their own questionnaires before issuing others to ensure that they clearly understood each question. One hundred sixty questionnaires were returned, and all of them were usable.

Because the respondents in the field survey were mainly local middle-aged and elderly people with a few visitors, they had a relatively high group age and low education and are mainly a group with a long-term urban memory. The respondents in the website research group were people who could use computers to fill out website questionnaires, so they had a relatively low group age and high education, including a certain number of students. They mainly had a short-term urban memory. The complementary of these two groups could practically guarantee that the respondents had a balanced background property.

Generally speaking, the samples in the investigation were selected randomly. The number of samples under 95 % confidence interval can be confirmed by the following Formula (Wu 2006) (Formula 5.1):

$$n = \frac{z^2 * p(1-p)}{e^2} \tag{5.1}$$

Formula 5.1: The sample number formula

In Formula 5.1, n represents the sum of samples; p represents the sample ratio; e is the tolerable error value; and z is the standardizing normal variable value.

Because p is the unknown number and cannot be estimated, this research selects the conservative estimated value of 0.5 and uses the formula to obtain approximately 384 usable samples. In summary, we received 380 usable questionnaires (N = 380) from a total of 399 questionnaires, and the valid returned rate was 95.2 %.

(2) **Data processing method**

The data processing software programs used in this study were Excel 2007 and SPSS 16.0 for Windows. The data processing methods included descriptive statistics, modeling calculations and Pearson's correlation analysis.

① *Descriptive statistics*: The contents of the statistics include level-three variables characteristic of subjective evaluative elements, distribution characteristics of the subjective property, urban memory cognition (UMC) characteristics of level-three variables of the objective elements and the temporal elements.

② *Modeling calculations*: The model that has been set up is used to process the original data with the intent to generate the factors of objective elements, subjective evaluative elements and temporal elements of urban memory of Beijing's city walls, all of which are level-two variables.
③ *Pearson's correlation analysis*: This research uses Pearson's correlation analysis of the above variables and subjective attribute factors of Beijing. The analysis can be seen in Table 5.5.

5.3 Research Results

5.3.1 Measurement of the Subjective Elements

The subject analysis of city walls includes three aspects. The first is to test the subjects' evaluation level of city walls constructing a subjective evaluation value (EV) formula. The second is to conduct statistical analysis of subjects' dwelling experiences, duration of residence in the city, participation, and such population properties as gender, age, profession and educational status. The third is to carry out inspections on subject evaluative elements and subjective attributes to induce the subject evaluation features based on the subject background properties by means of the Pearson model.

(1) **Analysis of subjective evaluative elements**

① Level-one variables

The subjective evaluation of urban memory adds up comprehensive evaluations of self-judgment and carries out measurement by means of a subjective evaluation value (EV) based on subjective cognition of objective elements. According to Formula 3.1, the total evaluation value held by the subjects of urban memory on Beijing's city walls is 0.65, which belongs to the medium rank.

② Level-two variables

The level-two variables of the subjective evaluative elements with Beijing's city walls can be divided into three types in light of the city walls' influences on urban memory: inheriting/erasing memory, strengthening/weakening memory, and correcting/distorting memory. The subjective evaluation values (EV) of level-two variables of these types are shown in Table 5.6.

The subjective evaluation value (EV) analysis of level-two variables shows the following.

(1) Inheriting/erasing memory measures whether the walls' memories are passed down. As the data show, the subjects of urban memory highly endorse the existence of the city walls; that is, they take city walls as one of the inevitable aspects of Beijing urban memory.

Table 5.5 Variables of Pearson's correlation analysis

Number	Variable 1	Variable 2	Analysis purpose
1	Objective elements: (1) permanent elements, (2) evolutionary elements, and (3) temporary elements	Subjective evaluative elements: (1) inheriting/erasing memory, (2) strengthening/weakening memory, and (3) correcting/distorting memory	To learn about the related variables and regulation of the objective elements and subjective evaluative elements
2	Objective elements: (1) permanent elements, (2) evolutionary elements, and (3) temporary elements	Subjective attribute	To learn about related variables and regulation of objective elements and subjective attributes
3	Temporal elements factors: (1) newly built city gates of the Republic Era, (2) inner city walls of the Ming and Qing Dynasties, (3) outer city walls of the Ming and Qing Dynasties, (4) imperial city walls of the Ming and Qing Dynasties, (5) imperial palace city gates of the Ming and Qing Dynasties, (6) the City walls of the Yuan Dynasty, (7) the City walls of the Jin Kingdom	Subjective attribute	To learn about related variables and regulation of temporal elements and subjective attributes
4	Subjective evaluative elements: (1) inheriting/erasing memory, (2) strengthening/weakening memory, and (3) correcting/distorting memory	Subjective attribute	To learn about related variables and regulation of subjective evaluative elements and subjective attributes
5	Temporal elements factors: (1) newly built city gates of the Republic Era, (2) inner city walls of the Ming and Qing Dynasties, (3) outer city walls of the Ming and Qing Dynasties, (4) imperial city walls of the Ming and Qing Dynasties, (5) imperial palace city gates of the Ming and Qing Dynasties, (6) the City walls of the Yuan Dynasty, (7) the City walls of the Jin Kingdom	Subjective evaluative elements: (1) inheriting/erasing memory, (2) strengthening/weakening memory, and (3) correcting/distorting memory	To learn about related variables and regulation of subjective evaluative elements and temporal elements

Table 5.6 Subjective evaluation value (EV) of level-two variables of Beijing's city walls

Variables	Inheriting/erasing memory	Strengthening/weakening memory	Correcting/distorting memory
EV	0.74	0.69	0.46
Level	High	Medium	Medium

Note $0 \leq EV < 0.4$ is low, $0.4 \leq EV < 0.7$ is medium, and $0.7 \leq EV \leq 1$ is high

(2) Strengthening/weakening memory measures whether the walls enhance people's memories when they think of Beijing. The evaluation by subject of urban memory is near the high level regarding the invigorating effects of the city wall on Beijing urban memory, indicating that city walls have become typical representatives of Beijing elements to some degree, and the urban memory of Beijing is dependent on city walls.
(3) Correcting/distorting memory measures whether the walls' transformations are acceptable, to which the subject of urban memory gives a medium-level evaluation, indicating that the continual transformation and renewal of the city walls distorts and rectifies the Beijing urban memory.

③ Level-three variables

The subjective evaluation value EV and change curve of the level-three variables are shown in Table 5.7 and Fig. 5.5, respectively.

The subjective evaluation value (EV) analysis of level-three variables shows the following.

(1) Owing to reversal handing with reverse questions (such as "The presence of the walls hinders the city's development" problem), all values of level-three variables of subjective evaluative elements exceed 0.4—namely, the medium-high level evaluation; thus it is obvious that people have a comparatively good evaluation of city walls on the whole.
(2) "The city walls are a typical element of Beijing" acquired the highest score, 0.85.
(3) "The wall transformation reflects its authenticity" acquired the lowest score, 0.41. This is because the several existing city wall relics parks that actually preserve the city walls include only the Ming Dynasty Dongbian Gate Relics Park, whereas the Yuan Dynasty Capital City Wall Relics Park and the Imperial City Wall Relics Park do not contain city walls in wall form but mostly foundations and symbolic sculptures of city walls. It is very difficult for people to see ancient city walls in their original form; therefore, the authentic evaluation of these city wall relic parks is comparatively low.

Table 5.7 Subjective evaluation value (EV) of level-three variables of Beijing's city walls

Variables	EV	EV Level
Inheriting/erasing memory	**0.74**	**H**
1. Good impression of the city walls	0.75	H
2. The presence of the walls has a huge influence on the form of Beijing (e.g., layout, traffic routes)	0.63	H–M
3. The presence of the walls hinders the city's development	0.83	H
4. The presence of the walls hinders the development of the traffic system in Beijing	0.78	H
5. Pulling down the walls did more good than harm	0.80	H
6. Residential demolition and household relocation is needed if City Wall Ruins Parks are to be built	0.66	H–M
Strengthening/weakening memory	**0.69**	**H–M**
1. The presence of the walls plays a critical role in cultural boundaries	0.60	M
2. There is a better understanding of the walls than the two axes—i.e., south–north and west–east	0.45	L–M
3. The presence of the wall can enhance my understanding of the city	0.81	H
4. The city walls are a typical element of Beijing	0.85	H
5. Gate names help me recall place names in the city	0.84	H
6. The wall transformation has been successful	0.60	H–M
Correcting/distorting memory	**0.46**	**L–M**
1. The wall transformation reflects its authenticity	0.41	L–M
2. The gate transformation reflects its authenticity	0.43	L–M
3. The wall transformation is in harmony with its surrounding environment	0.54	M

Note $0 \le EV < 0.4$ is low, $0.4 \le EV < 0.7$ is medium, and $0.7 \le EV \le 1$ is high
The negatively keyed items (such as "The presence of the walls hinders the city's development")were reverse—scored to ensure that all items are consistent with each other

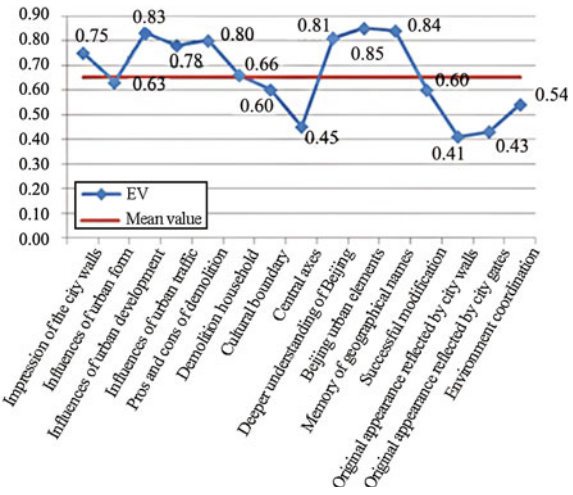

Fig. 5.5 Subjective evaluation value (EV) curve of level-three variables (*Source* Drawing by Fan Yin)

(2) **The characteristics of subjective attributes**

① *Life experience*: The dwelling experiences of respondents are fundamentally consistent with the expectant requests and can be divided into the following parts from high to low: 114 persons working in Beijing account for 31 %, 108 persons studying in Beijing account for 30 %, 105 local residents account for 29 %, 25 persons traveling in Beijing who had been there before account for 7 %, and 10 persons traveling in Beijing for the first time account for 3 % (Fig. 5.6). The respondents who grew up from childhood in Beijing are imputed into the native type regardless of whether they live in Beijing for study or work.
② *Duration of residence*: The respondents' subjective structure of duration of residence can be divided into the following parts from high to low: 145 persons whose duration of residence was 3–10 years account for 38 %, 93 persons whose duration of residence was 10–30 years account for 24 %, 40 persons whose duration of residence was more than 50 years account for 11 %, 35 persons whose duration of residence was 1–3 years account for 9 %, 33 persons whose duration of residence was 30–50 years account for 9 %, and 33 persons whose duration of residence was less than 1 year account for 9 % (Fig. 5.7).
③ *Information access*: The information input is the basis of cognition and evaluation, and different information accesses may produce different cognitions and evaluation results. The urban memory of subjects on city walls mainly comes from life experiences, which was selected by 288 out of 380 persons, accounting for 76 %. Otherwise, the number of respondents for each channel is ranked from high to low: 160 persons who cite relevant books account for 42 %, 133 persons who cite the internet account for 35 %, 124 persons who cite newspaper and magazine account for 33 %, 123 persons who cite television and radio account for 32 %, 77 persons who cite the introduction of friends account for 20 %, 40 persons who cite academic research account for 11 %, and 13 persons who cite a travel agency

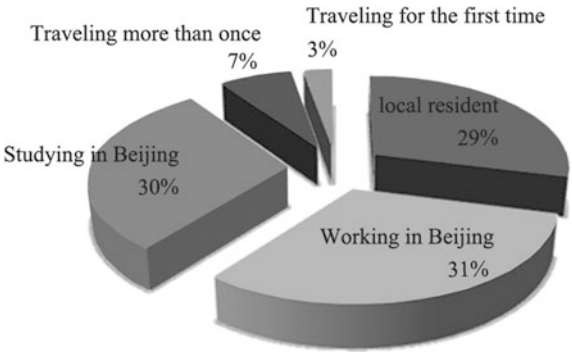

Fig. 5.6 Subjective distribution of life experience with Beijing's historic areas as the object (*Source* Drawing by Fan Yin)

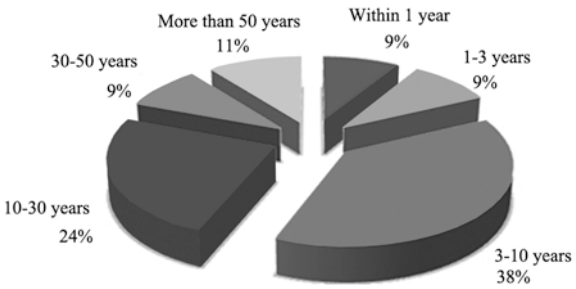

Fig. 5.7 Subjective distribution of duration of residence with Beijing's historic areas as the object (*Source* Drawing by Fan Yin)

account for 3 % (Fig. 5.8). It is worth noting that the explanatory system is always an important means to strengthen urban memory in the process of urban memory shaping. However, as shown in the investigative results, only 17 % of respondents chose the explanatory system to acquire information with regard to city walls, whereas it is widely applied in other mature cultural relic sites; thus, the construction of the explanatory system still must be improved with regard to the city walls.

④ *Gender*: The gender structure of the samples was basically balanced: 192 males accounted for 50.5 %, and 188 females accounted for 49.5 %.

⑤ *Age*: The age structure of the respondents can be divided into the following categories from high to low: 192 persons aged 18–29 account for 50.5 %, 78 persons aged 30–44 account for 20.5 %, 55 persons aged over 60 account for 14.5 %, 45 persons aged 45–60 account for 11.8 %, and 10 persons aged under or

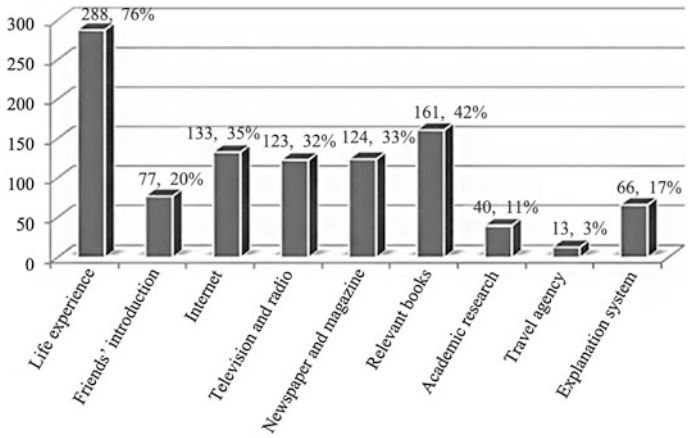

Fig. 5.8 Structure of the number of persons using all types of information accesses (*Sourc* Drawing by Fan Yin)

equal to 18 account for 2.6 % (Fig. 5.9). The high proportion of respondents 18–29 years old has three reasons. First, the directional questionnaire investigation was conducted through a website, so the ages of respondents are highly concentrated in this age level. If we merely consider the onsite investigation results, persons in this age level account for only 22.3 %. Second, the number of website questionnaire samples is comparatively large, accounting for 42.1 % of the total. Third, the division of the age level between 18 and 29 is excessively brief and rough, which is thought to be an unexpected problem from the preliminary stage of the questionnaire design.

⑥ *Education*: The educational structure of respondents can be divided into the following parts from high to low: 166 persons with bachelor or junior college account for 44 %, 131 persons with master or above account for 34 %, 48 persons with senior high school or technical secondary school account for 13 %, and 35 persons with junior high school or less account for 9 % (Fig. 5.10). It is thus clear that the distribution of the sample's educational status is well distributed and slightly high overall, which is caused by the large number of website investigation samples.

⑦ *Profession*: The professional structure of respondents can be divided into the following parts from high to low: 110 company employees account for 29 %, 85 students account for 22 %, 51 retirees account for 13 %, 25 teachers account for 7 %, 24 technicians account for 6 %, 22 civil servants account for 6 %, 21 liberal professions account for 6 %, 14 workers and peasants account for 4 %, 12 businessmen account for 3 %, 7 self-employed businessmen account for 2 %, 4 unemployed account for 1 %, and 3 soldiers account for 1 % (Fig. 5.11). From this professional structure, it is clear that the three professions that compose the majority of the samples are students, company employee and retirees, which reflect the most common occupations from youth to middle age to the aged; thus, the constitution of this professional structure is as expected.

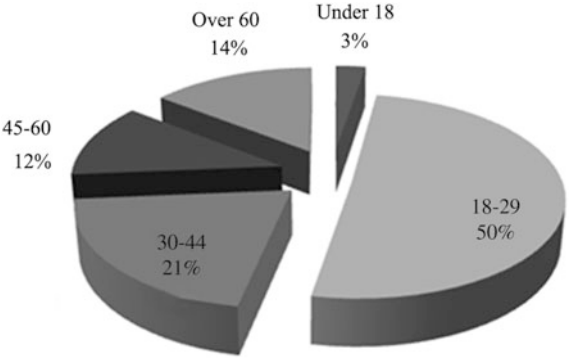

Fig. 5.9 Subjective age distribution of urban memory of Beijing's city walls (*Source* Drawing by Fan Yin)

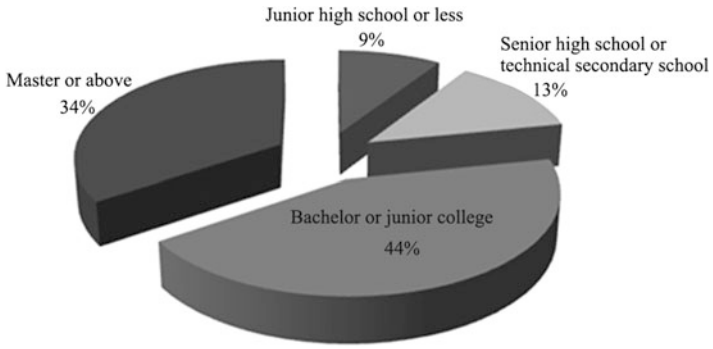

Fig. 5.10 Subjective educational status distribution with Beijing's city walls as the object (*Source* Drawing by Fan Yin)

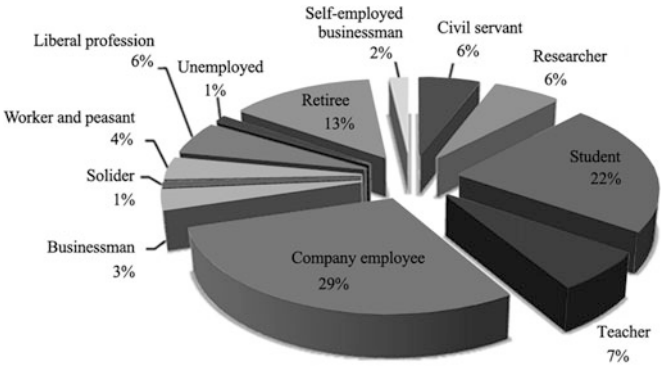

Fig. 5.11 Subjective profession status distribution with Beijing's city walls as the object (*Source* Drawing by Fan Yin)

(3) Correlation analysis of subjective evaluative elements and subjective attributes

Pearson's correlation analysis can be used to test the subjective evaluative elements and subjective attributes of urban memory to analyze the evaluation given by different groups of people with different backgrounds on the city walls. Before conducting the Pearson's test, standardization of the two groups of data is needed for the convenience of further correlation tests (the same as the following analysis, with no need for repetition). The standardizing transition uses Formula 3.2.

Apply the Pearson's correlation test to the standardization values obtained from the subjective evaluation value (EV) and subjective attributes, from which the evaluation features of different groups of people with different backgrounds can be tested via Formula 3.3. The results are shown as Table 5.8.

First, at the significance level of 0.01 ($p < 0.001$, Sig. = 0.147), we conclude that the respondents exhibit a significant linear relationship between their education and

Table 5.8 Correlation between subjective evaluation value (EV) and subjective attributes with Beijing's city walls as the object

Level-two variables	Index	Life experience	Duration of residence	Age	Education
Inheriting/erasing memory	Pearson's correlation	0.006	−0.004	−0.086	0.147**
	Sig. (2-tailed)	0.910	0.943	0.096	0.004
	N	380	380	380	380
Strengthening/weakening memory	Pearson's correlation	0.157**	0.185**	0.174**	−0.055
	Sig. (2-tailed)	0.002	0.000	0.001	0.281
	N	380	380	380	380
Correcting/distorting memory	Pearson's correlation	−0.044	−0.052	0.156**	−0.178**
	Sig. (2-tailed)	0.388	0.316	0.002	0.000
	N	380	380	380	380

Note **Correlation is significant at the 0.01 level (2-tailed)

inheriting/erasing memory. People with higher education have a highly developed sense of the walls' identity. They consider the walls to be an essential part of urban memory and would rather sacrifice other elements (such as transportation) to ensure complete city walls. The result coincides with the planning ideas for Beijing's city walls, as represented by Prof. Sicheng Liang, a well-known Chinese architect and scholar and a leading advocate for keeping the walls in the 1950s.

Second, at the significance level of 0.01 ($p < 0.001$), we conclude that the respondents exhibit a significant linear relationship between strengthening/weakening memory and subjective attributes of life experience, duration of residence, age. The results conform to general laws in which longer life experience, longer duration of residence, and greater age will produce a higher degree of dependence. There is no correlation between education and the strengthening/weakening memory; the correlation coefficient is actually negative. This result can be interpreted as follows: in the respondent population, those who have higher education are mostly young people. During this transitional period into modern Beijing, young people may have placed the National Stadium (Bird's Nest), the National Aquatics Center (Water Cube), 798 Art Zone, or other modern city elements in their memory. The Beijing's city walls may no longer be the most important element in their urban memory.

Third, at the significance level of 0.01 ($p < 0.001$, Sig. = 0.156), we conclude that the respondents exhibit a significant positive linear relationship between the age and correcting/distorting memory. A positive correlation means that older adults are more accepting of the walls' recent transformation. However, at the significance level of 0.01 ($p < 0.001$, Sig. = −0.178), there is a significant negative linear relationship between education and the correcting/distorting memory. A negative correlation means that people with higher education hardly recognize the outcome of

the recent wall relic parks. Older people with richer experience often have a more tolerant attitude toward the walls. Some older adults even participated in the demolition of the city wall when they were young. As the decades have passed, the remaining city walls have become not only reminders of the past but also parks in which to recreate. Therefore, older people show a high regard for the authenticity of wall relic parks. With respect to the highly educated respondents, some of them even have a deep knowledge of the traditional structure of the old city walls. They tend to have a skeptical or negative attitude toward the symbolic and artistic wall relic parks. Furthermore, most of the highly educated population have not seen the Beijing city wall (the Beijing city wall underwent a large-scale demolition in the late 1950s and 1960s) but have acquired knowledge only from books or literature that describe their spectacular qualities. Therefore, when people who imagine the magnificent city walls read the history of the walls' demolition, they feel bitter. That is why they have a pessimistic attitude towards the remaining walls.

5.3.2 Measurement of the Objective Elements

The objective analysis of urban memory based on Beijing's city walls includes three aspects: first, to test the cognition level of three levels objective elements factors by constructing a formula of objective urban memory cognition (UMC); second, to test and induce the correlation between the subjective evaluative elements and objective elements via Pearson modeling; third, to test the objective elements and subjective attributes via Pearson modeling to induce the objective features based on different subjects' background attributes.

(1) **Objective elements analysis**

① **Level-one variables**

According to the former statements, analysis of the objective elements of urban memory is based on objective elements cognition. Urban memory cognition (UMC) is an index used to describe this feature. Through the calculation of Formula 3.4, it is clear that the objective urban memory cognition (UMC) is 0.50, which indicates a medium cognition degree.

② **Level-two variables**

The level-two variables of the objective elements of urban memory can be divided into permanent, evolutionary, and temporary elements. The urban memory cognition (UMC) values of level-two variables are shown in Table 5.9.

The urban memory cognition (UMC) analysis of level-two variables shows the following.

(1) Permanent elements refer to aspects of Beijing's city walls that are passed down from one generation to another during the development of Beijing, such as

Table 5.9 Level-two objective elements in urban memory cognition (UMC) with Beijing's city walls as the object

Variables	Permanent elements	Evolutionary elements	Temporary elements
UMC	0.55	0.40	0.54
Level	Medium	Medium	Medium

Note 0 ≤ UMC < 0.4 is low, 0.4 ≤ UMC < 0.7 is medium, and 0.7 ≤ UMC ≤ 1 is high

the city moat and city wall structure. All of their cognition degrees are medium and rank first among these three types of memories, indicating that permanent elements that can be passed down are easiest to be perceived and memorized.
(2) Evolutionary elements refer to aspects of Beijing's city walls that are irreversibly changed by social and economic life, not necessarily specific to a particular individual, group, or event, such as the functional transformation of ancient city walls, the name replacement of city gates and the location changing of city walls. These are given the lowest cognition degree of 0.4, which approaches the low rank, indicating that it is difficult for people to memorize this type of procession information because it is influenced by transmission and cannot be directly perceived through the senses.
(3) Temporary elements refer to historical events related to Beijing's city walls or a period of time that had an impact on the city walls within only a short period, such as wars. The cognition degree of the elements is 0.54.

③ Level-three variables

The objective urban memory cognition (UMC) of level-three variables and its change curve can be seen in Table 5.10 and Fig. 5.12, respectively.

The urban memory cognition (UMC) analysis of level-three variables shows the following.

(1) The UMC of the city moat is highest at 0.72. The other places with a comparatively high degree of UMC include the current sites of city walls.
(2) Because the city gates' function and significance are easily found in books and media and the Second Ring surrounds the inner and outer cities near their real locations, they gain comparatively high cognition degree.
(3) The cognition degree of the changing names of city gates and the changing positions of city walls is the lowest owing to its long time span and huge amount of information.
(4) The cognition degree of the structure of city walls and city gates is the lowest owing to its reliance on engineering structural knowledge.

(2) Correlation analysis of objective elements and subjective evaluative elements

The Pearson's correlation test was applied to the objective elements and subjective evaluative elements of urban memory, from which the correlation of inheriting,

Table 5.10 Level-three objective elements in urban memory cognition (UMC) with Beijing's city walls as the object

Variables	Ming and Qing Dynasties city walls classification	Current sites of ancient city walls	Geographical names that come from city gates	City moat
UMC	0.62	0.62	0.64	0.72
Level	Medium	Medium	Medium	High
Variables	Structure of city walls	Structure of city gates	Structure of city gates	Structure of city gates
UMC	0.34	0.30	0.69	0.50
Level	Low	Low	Medium	Medium
Variables	Name replacements of city gates	Location change of city walls	Wars that city walls had experienced	Second Ring surrounding inner and outer city
UMC	0.20	0.21	0.50	0.66
Level	Low	Low	Medium	Medium
Variables	Demolition time of city walls	Function of city gates		
UMC	0.58	0.43		
Level	Medium	Medium		

Note The reverse questions have been addressed with reverse treatment; $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

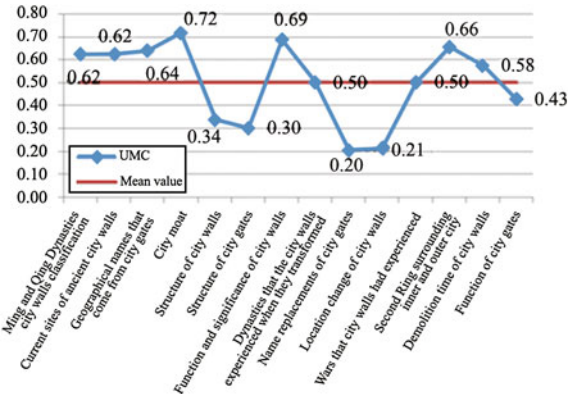

Fig. 5.12 The change curve of urban memory cognition (UMC) of level-three objective elements (*Source* Drawing by Fan Yin)

strengthening and correcting urban memory, and regarding the objective elements can be obtained (Formula 3.3); namely, it is important to determine the type of urban memory on which to build the basis of subjective evaluation. The test results are shown as follows (Table 5.11).

Judging from the Pearson's correlation coefficient, the following conclusions can be reached:

Table 5.11 Correlation between level-two objective elements and subjective evaluative elements with Beijing's city walls as the object

Level-two objective elements	Index	Permanent elements	Evolutionary elements	Temporary elements
Inheriting/erasing memory	Pearson's correlation	0.121*	0.089	0.134**
	Sig. (2-tailed)	0.018	0.083	0.009
	N	380	380	380
Strengthening/weakening memory	Pearson's correlation	0.251**	0.238**	0.241**
	Sig. (2-tailed)	0.000	0.000	0.000
	N	380	380	380
Correcting/distorting memory	Pearson's correlation	−0.135**	−0.083	−0.167**
	Sig. (2-tailed)	0.008	0.105	0.001
	N	380	380	380

Note *Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)

① The subjects' inheriting/erasing type of memory passed the test with permanent and temporary objective elements at the 0.05 and 0.01 significance levels, respectively, which means that people with a higher cognition degree on permanent elements and temporary elements have higher evaluations of the necessity of the city walls' existence.

② The strengthening/weakening type of memory evaluation passed the test with three types of objective elements at the 0.01 significance level, so people with high cognition of city walls usually have high regard for their significance.

③ The correlation coefficient of the correcting/distorting type of memory evaluation with permanent and temporary elements is negative at the 0.01 significance level, which is negative correlation; thus, the higher people's degree of cognition, the lower their evaluation of the authenticity of city walls.

All three foregoing points can be explained by the Client Evaluation Theory: clients' evaluation = clients' experiences − clients' expectancy. Here, the clients can be taken as the subjects of urban memory; the richer a human's experiences, the higher the cognition that they can obtain. When expectancy value remains unchanged, they can acquire higher subjective evaluations, which well explains the positive correlation property of the former two types of subjective evaluative elements and objective elements. As stated in Formula 3.4, the subjects' evaluations not only depend on the rich experiences it offered to them but also rest with subjects' expectancy, which is based on subjects' cognition of products and services. With regard to the permanence of city walls, subjects with high temporality

Table 5.12 Correlation between objective elements and subjective attributes with Beijing's city walls as the object

Variables	Life experience	Duration of residence	Age	Education
Permanent elements	0.332**	0.337**	0.197**	0.116*
	0.000	0.000	0.000	0.023
Evolutionary elements	0.258**	0.226**	0.121*	−0.020
	0.000	0.000	0.018	0.700
Temporary elements	0.347**	0.431**	0.191**	0.149**
	0.000	0.000	0.000	0.004

Note *Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)

cognition usually have a higher cognition of the city walls' original appearance, so they have a higher degree of expectancy but a lower evaluation of the authenticity of the renewed city walls. Subjects whose correlation has not been checked can be explained as follows: owing to the random distribution of the samples, there generally exists such behavior as cognitive dissonance even if it is a rational urban memory subject. For example, when faced with the same things with the same values, people will have totally different degrees of appreciation.

(3) **Correlation analysis on objective elements and subjective attributes**

By applying Pearson's correlation test to the objective elements and subjective attributes of urban memory (Formula 3.3), the cognition differences of subjects with different attributes on objective elements will be analyzed. The test results are shown in Table 5.12.

According to Pearson's correlation coefficient, three aspects of people's cognition and three predictors of demographic variables passed the test at the 0.01 and 0.05 significance levels. This result means that people who are older and have more life experiences and longer duration of residence will have a higher cognition of Beijing's city walls, which is coincident with the basic cognition rule.

5.3.3 Measurement of the Temporal Elements

The urban memory temporal analysis of Beijing's city walls includes three aspects: the first is to test the cognition level of level-three time factors by constructing the formula for the temporal elements in urban memory cognition (UMC); the second is to conduct and induce the correlation among subjective evaluative elements and temporal elements via Pearson's model; the third is to induce the temporal elements and subject property based on different subjective attributes and attributes via Pearson's model.

(1) Temporal elements analysis

① Level-one variables

The investigative content of the foregoing analysis of urban subjects and objects is synchronicity; studying Beijing's city walls from the time dimension is to some degree a study of their time synchronicity. By applying Formula 3.5 of the temporal urban memory cognition (UMC) mentioned in the preceding part, the total urban memory cognition degree of Beijing's city walls' temporal elements is found to be 0.56, which indicates a medium class cognition.

② Level-two variables

By dividing the temporal elements in accordance with the built-up dynasty and form of the city walls, the measured variables can be sequenced in chronological order as follows: Newly-built city walls of the Republic Era; walls of inner city, outer city, imperial city, imperial palace of the Ming and Qing Dynasties respectively; city walls of the Yuan Dynasty, and city walls of the Jin Kingdom. The urban memory cognition (UMC) and change curve of level-two variables are shown in Table 5.13 and Fig. 5.13, respectively.

From the urban memory cognition (UMC) degree of temporal elements level-two variables, the following is clear.

(1) Overall, the cognition degree of each type of level-two variable is basically consistent with the time rules; that is, the nearer the age, the higher the cognition degree. Newly-built city walls of the Republic Era, including Shuiguan Gate, have a lower overall cognition degree, which will be demonstrated in detail later.
(2) The variable with the highest cognition degree is the inner city walls of the Ming and Qing Dynasties, whose urban memory cognition (UMC) is 0.86; the variable with the lowest cognition degree is the Jin Kingdom, whose UMC is 0.07.

Table 5.13 Level-two temporal elements in urban memory cognition (UMC) with Beijing's city walls as the object

Variables	Newly-built city walls of the Republic Era	Outer city walls of the Ming and Qing Dynasties	Inner city walls of the Ming and Qing Dynasties	Imperial city walls of the Ming and Qing Dynasties
UMC	0.66	0.86	0.77	0.57
Level	Medium	High	High	Medium
Variables	Imperial palace walls of the Ming and Qing Dynasties	City walls of the Yuan Dynasty	City walls of the Jin Kingdom	
UMC	0.78	0.21	0.07	
Level	High	Low	Low	

Note $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

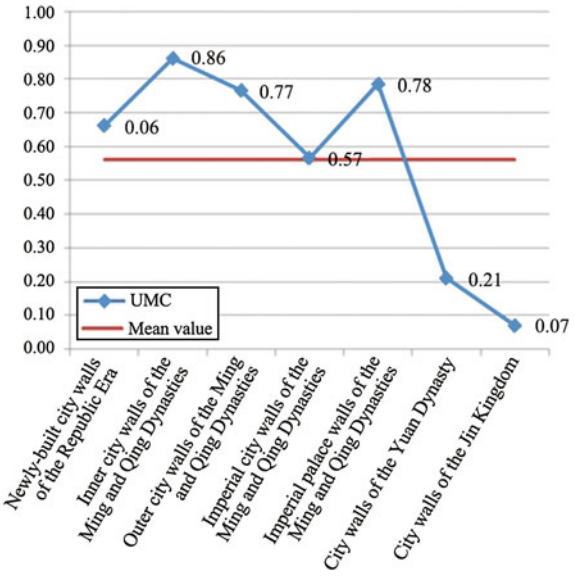

Fig. 5.13 The change curve of urban memory cognition (UMC) of level-two temporal elements (*Source* Drawing by Fan Yin)

(3) The imperial city walls of the Ming and Qing Dynasties received a sub-high UMC and are the only one that has been perfectly preserved.

③ Level-three variables

The urban memory cognition (UMC) degree of level-three variables comprising the temporal elements of different periods and the UMC change curve are shown as follows.

The urban memory cognition (UMC) degree of the newly-built city walls of the Republic Era and the UMC change curve are shown in Table 5.14 and Fig. 5.14, respectively.

(1) The four city gates from the Republic Era have ceased to exist, but there arise some differences among urban memory cognition (UMC); all values are rather higher apart from Shuigun Gate.
(2) Jianguo Gate and Fuxing Gate, which are located in the ends of Chang'an Avenue, are the meeting points of Chang'an Avenue and the inner city. People pay the most attention on them, so their urban memory cognition (UMC) is the highest.
(3) Heping Gate is located between Zhengyang Gate and Xuanwu Gate; Shuiguan Gate is situated between the present Zhengyang Gate and Chongwen Gate, which are symmetrically distributed. These two gates, whose largest difference is that the name Heping Gate continues to be used as local toponymy, were opened during the same period because they were two doorways to be excavated in the original city walls under the threat of large, western powers.

Table 5.14 Urban memory cognition (UMC) degree of the newly-built city walls of the Republic Era

Variables	Total cognition of the newly-built city walls of the Republic Era	Jianguo Gate	Fuxing Gate	Shuiguan Gate	Heping Gate
UMC	0.66	0.89	0.84	0.13	0.78
Compared with totality	–	High	High	Low	High

Note The reverse questions have been addressed with reverse treatment, $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

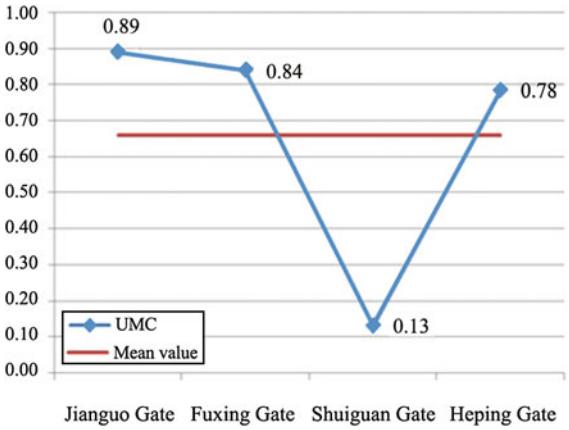

Fig. 5.14 The change curve of urban memory cognition (UMC) of the Republic Era (*Source* Drawing by Fan Yin)

The urban memory cognition (UMC) degree of the Ming and Qing Dynasties inner city walls and the UMC change curve are shown in Table 5.15 and Fig. 5.15, respectively.

(1) The urban memory cognition (UMC) is high overall, which is related to the fact that the names of these city gates continue to be used, and some of them are even bus station and railway station names.
(2) The urban memory cognition (UMC) adopts certain rules: the UMC degrees of the symmetrical two city gates are very close; for example, the UMC degrees of Chongwen Gate and Xuanwu Gate are both 0.91, and Dongzhi Gate and Xizhi Gate differ by 0.01, as do Anding Gate and Desheng Gate. This can be explained as follows: when people memorize these city gate names, they usually adopt a way to pair the memory with entity space, which is thought to be more effective
(3) Suppose that in future urban memory planning, this rule could be applied to other ruined city gates; for example, if the name of Shuiguan Gate is restored to use, it might be established in no time.

Table 5.15 Urban memory cognition (UMC) degree of the inner city walls of the Ming and Qing Dynasties

Variables	Total cognition of the inner city walls of the Ming and Qing Dynasties	Zhengyang Gate	Chongwen Gate	Xuanwu Gate	Dongzhi Gate
UMC	0.86	0.79	0.91	0.91	0.89
Compared with totality	–	High	High	High	High
Variables	Xizhi Gate	Anding Gate	Desheng Gate	Chaoyang Gate	Fucheng Gate
UMC	0.88	0.88	0.87	0.83	0.79
Compared with totality	High	High	High	High	High

Note The reverse questions have been addressed with reverse treatment, 0 ≤ UMC < 0.4 is low, 0.4 ≤ UMC < 0.7 is medium, and 0.7 ≤ UMC ≤ 1 is high

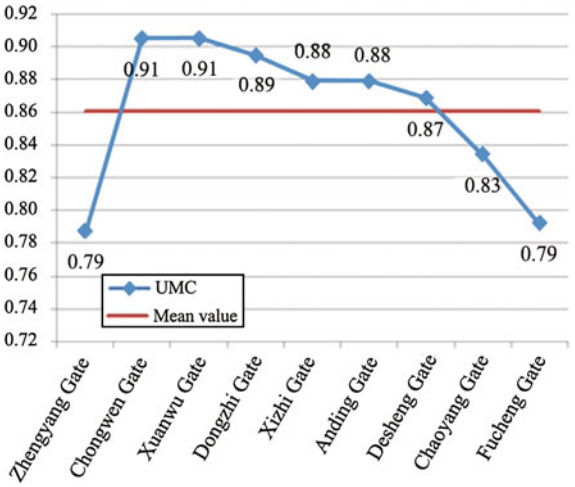

Fig. 5.15 The change curve of urban memory cognition (UMC) of the inner city walls of the Ming and Qing Dynasties (*Source* Drawing by Fan Yin)

(4) The urban memory cognition (UMC) degrees of Chongwen Gate and Xuanwu Gate are relatively higher, which may be related to the fact that some of the entity questionnaires were distributed in Dongbian Gate Ming Dynasty City Wall Relics Park, from which Chongwen Gate is not far. Because Xuanwu Gate is influenced by the above mentioned rules, its UMC is accordingly improved.
(5) The reasons why the urban memory cognition (UMC) of Zhengyang Gate is the lowest among all of those from the Ming and Qing Dynasties inner city gates are that Zhengyang Gate is currently named Qianmen; the railway station also called Qianmen. Meanwhile, the road on which it is located is named Qianmen Street as well, which is considered as an unintentional element in the

questionnaire design. However, this also reflects the great influence of the usable range of city gate names on urban memory from the other side.

The urban memory cognition (UMC) degree of the Ming and Qing Dynasties outer city walls and the UMC change curve are shown in Table 5.16 and Fig. 5.16, respectively.

(1) The urban memory cognition (UMC) rules are the same as those of the inner city; namely, the UMCs can mutually rise and fall in pairs.
(2) The reasons why Dongbian Gate and Xibian Gate have comparatively lower UMCs can be explained as follows: hierarchies exist even in the outer city gates;

Table 5.16 Urban memory cognition (UMC) degree of the outer city walls of the Ming and Qing Dynasties

Variables	Total cognition of the outer city walls of the Ming and Qing Dynasties	Dongbian Gate	Xibian Gate	Guangqu Gate	Guang'an Gate
UMC	0.77	0.73	0.73	0.77	0.81
Compared with totality	–	High	High	High	High
Variables	Zuo'an Gate	You'an Gate	Yongding Gate		
UMC	0.73	0.73	0.85		
Compared with totality	High	High	High		

Note The reverse questions have been addressed with reverse treatment, 0 ≤ UMC < 0.4 is low, 0.4 ≤ UMC < 0.7 is medium, and 0.7 ≤ UMC ≤ 1 is high

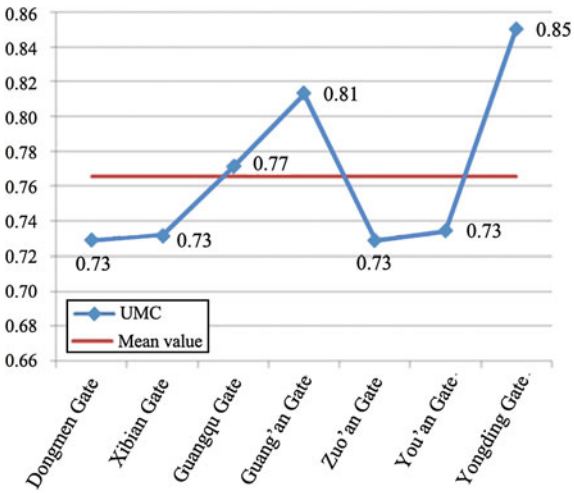

Fig. 5.16 The change curve of urban memory cognition (UMC) of the outer city walls of the Ming and Qing Dynasties (*Source* Drawing by Fan Yin)

they are, in decreasing order, Yongding Gate, Liangguang Gate, Zuo'an Gate, You'an Gate, Dongbian Gate and Xi'an Gate. This rule is basically reflected by UMC.

(3) The reasons why the UMCs of Zuo'an Gate and You'an Gate are lower can be explained as follows: they are located in "South City", where the population density is comparatively lower, traffic accessibility is weaker, and city attractions are fewer, so the possibility of gaining "life experience", which are rightly the most important information access in subjective attributive analysis results, is lower.

(4) In addition to the fact that the form and structure rank of Yongding Gate is the highest, the other important reason why it has the highest UMC is that, as the starting point of the Beijing South central axes, Yongding Gate was rebuilt on its original location in 2004; thus, the recovery of city walls can be seen again, which plays an effective function to promote the city walls' urban memory.

The urban memory cognition (UMC) degree of the Ming and Qing Dynasties imperial city walls and the UMC change curve are shown in Table 5.17 and Fig. 5.17, respectively.

(1) Urban memory cognition (UMC) degrees continue to appear in pairs.

(2) Different city gates have great variation in UMC values, which can be explained as follows: because Tian'anmen Square has unique significance in China, and has even becomes the symbol of our nation, Tian'an Gate obtains the highest UMC; Di'anmen, obtains the second highest UMC because its name corresponds to that of Tian'anmen and Di'anmen Street continues to use the name of the city gate, which brings relatively high experience and more attention.

Table 5.17 Urban memory cognition (UMC) degree of the imperial city walls of the Ming and Qing Dynasties

Variables	Total cognition of imperial city walls of the Ming and Qing Dynasties	Tian'an Gate	Di'an Gate	Dong'an Gate	Xi'an Gate
UMC	0.57	0.98	0.86	0.57	0.55
Compared with totality	–	High	High	Medium	Medium
Variables	Chang'an Left Gate	Chang'an Right Gate	Daqing Gate		
UMC	0.35	0.33	0.32		
Compared with totality	Low	Low	Low		

Note The reverse questions have been addressed with reverse treatment, $0 \leq UMC < 0.4$ is low, $0.4 \leq UMC < 0.7$ is medium, and $0.7 \leq UMC \leq 1$ is high

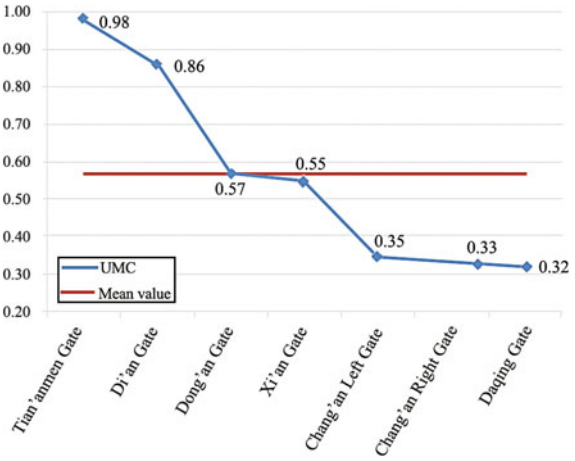

Fig. 5.17 The change curve of urban memory cognition (UMC) of the imperial city walls of the Ming and Qing Dynasties (*Source* Drawing by Fan Yin)

(3) Dong'an Gate and Xi'an Gate share the names of Dong'anmen Street and Xi'anmen Street, respectively; however, they obtain only a medium UMC value owing to the fact that the streets are relatively short without any important city attractions.
(4) With respect to and Chang'an left Gate, Chang'an right Gate and Daqing Gate (it was called Daming Gate in the Ming Dynasty and Zhonghua Gate in the Republic Era), when they were demolished, the former was built at Chang'an Avenue, whereas the latter was constructed at Chairman Mao Memorial Hall in the original location. All information was stored only in the historical data or memories of elderly people aged more than 60 years. Therefore, it has the lowest UMC.

The urban memory cognition (UMC) and its change curve of imperial palace gates from the Ming and Qing Dynasties are shown in Table 5.18 and Fig. 5.18, respectively.

(1) The Meridian Gate (Wumen Gate), which is the main entrance to the Forbidden City, is near Tian'anmen and is located on the central axis. As a result, it has the highest urban memory cognition (UMC).
(2) In the process of the questionnaire survey, the respondents mentioned the concept of "the Meridian Gate beheading" many times. However, this statement is not supported by historical evidence (in fact, it was only a "court beating", a type of punishment, whereas the execution ground is located at Caishikou, outside the Xuanwu Gate). The concept of "the Meridian Gate beheading" is derived from historical novels and traditional operas, but the long-term misinformation indeed deepens people's impression of the Meridian Gate.

The urban memory cognition (UMC) and its change curve of imperial palace gates from the Yuan Dynastyare shown in Table 5.19 and Fig. 5.19, respectively.

Table 5.18 Urban memory cognition (UMC) degree of the imperial palace city walls of the Ming and Qing Dynasties

Variables	Total cognition of the imperial palace city walls of the Ming and Qing Dynasties	Meridian Gate (Wumen Gate)	Gate of Divine Prowess (Shenwu Gate)	East Prosperity Gate (Donghua Gate)	West Prosperity Gate (Xihua Gate)
UMC	0.78	0.90	0.75	0.75	0.74
Compared with totality	–	High	High	High	High

Note The reverse questions have been addressed with reverse treatment, $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

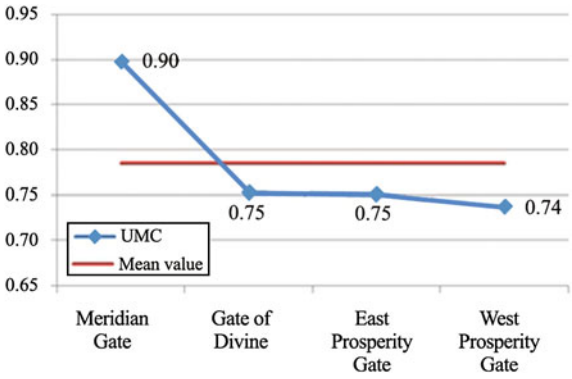

Fig. 5.18 The change curve of urban memory cognition (UMC) of the imperial palace city walls of the Ming and Qing Dynasties (*Source* Drawing by Fan Yin)

Table 5.19 Urban memory cognition (UMC) degree of the city walls of the Yuan Dynasty

Variables	Total cognition of the city walls of Yuan Dynasty	Lizheng Gate	Wenming Gate	Shuncheng Gate	Qihua Gate
UMC	0.21	0.13	0.09	0.16	0.18
Compared with totality	–	Low	Low	Low	Low
Variables	Pingze Gate	Chongren Gate	Heyi Gate	Guangxi Gate	Suqing Gate
UMC	0.10	0.18	0.15	0.30	0.09
Compared with totality	Low	Low	Low	Low	Low
Variables	Anzhen Gate	Jiande Gate			
UMC	0.53	0.41			
Compared with totality	Medium	Medium			

Note Reversal treatment has been given to reverse questions and answers, $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

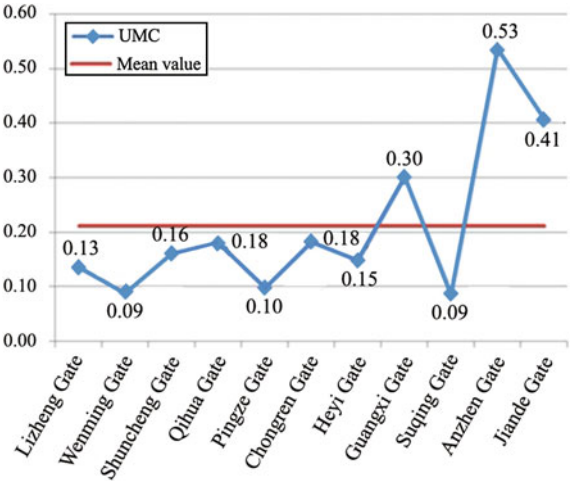

Fig. 5.19 The change curve of urban memory cognition (UMC) of the city walls of the Yuan Dynasty (*Source* Drawing by Fan Yin)

(1) The distribution of the urban memory cognition (UMC) of these gates differs greatly from that in the Ming and Qing Dynasties. The rule that UMC degrees appear in pairs is declining rapidly, with the UMC of symmetrical gates no longer being similar.
(2) The UMC value has no relationship with levels of gates. For example, Lizheng Gate, which ranks at a relatively high level, has a relatively low UMC.
(3) Some of the gates whose names have been in use from the past to the present have relatively high UMC degrees, such as Anzhen Gate, Jiande Gate and Guangxi Gate. Differences among them reflect only pedestrian flow volume and the resulting use of their names: Anzhen Bridge is located in the North Third Ring Road with the largest pedestrian flow volume and longest time of use; Jiande Bridge is situated between the Third Ring Road and the Fourth Ring Road, which is also a station of Metro Line 10 (opened in 2008); and Guangxi Gate has the smallest pedestrian flow volume.
(4) As shown in the UMC data on gates from the Yuan Dynasty, urban memory can be reserved only through the names being used (Table 5.20) for those city walls that cannot be experienced in person.

The urban memory cognition (UMC) and its change curve of imperial palace gates from the Jin Kingdom are shown in Table 5.21 and Fig. 5.20, respectively.

(1) The urban memory cognition (UMC) value has nothing to do with the layoutsor shapes of gates.
(2) The overall UMC value is below that of the Yuan Dynasty, which conforms to the recession law of time.

Table 5.20 Names of the city gates in the Yuan Dynasty and at present respectively

Number	Yuan Dynasty	Present
1	Lizheng Gate	Qianmen Gate
2	Wenming Gate	–
3	Shuncheng Gate	–
4	Qihua Gate	Chaoyang Gate
5	Pingze Gate	Fucheng Gate
6	Chongren Gate	Dongzhi Gate
7	Heyi Gate	Xizhi Gate
8	Guangxi Gate	Guangxi Gate
9	Suqing Gate	–
10	Anzhen Gate	Anzhen Bridge, Anzhen Gate
11	Jiande Gate	Jiande Bridge, Jiande Gate

Table 5.21 Urban memory cognition (UMC) degree of the city walls of the Jin Kingdom

Variables	Total cognition of the city walls of the Jin Kingdom	Lize Gate	Huicheng Gate	Zhangyi Gate	Shiren Gate
UMC	0.07	0.17	0.16	0.08	0.03
Compared with totality	–	Low	Low	Low	Low
Variables	Xuanyao Gate	Yangchun Gate	Jingfeng Gate	Fengyi Gate	Duanli Gate
UMC	0.05	0.05	0.04	0.06	0.06
Compared with totality	Low	Low	Low	Low	Low
Variables	Haohua Gate	Tongxuan Gate	Chongzhi Gate	Guangtai Gate	
UMC	0.04	0.05	0.07	0.05	
Compared with totality	Low	Low	Low	Low	

Note Reversal treatment has been given to reverse questions and answers, $0 \leq \text{UMC} < 0.4$ is low, $0.4 \leq \text{UMC} < 0.7$ is medium, and $0.7 \leq \text{UMC} \leq 1$ is high

(3) Lize Gate and Huicheng Gate have relatively high UMC degrees because their names are still in use. The name of Lize Gate has changed to Lize Bridge, whereas Huicheng Gate maintains its original name.
(4) Although the names of Lize Gate and Huicheng Gate have been used from the past to the present, their UMC values are below that of gates of the same type from the Ming, Qing and Yuan Dynasties. The reason can be explained as follows: with the increasing difficulty of overall memory, respondents' ability (or probability) to make connections between names over a long time span becomes increasingly weaker.

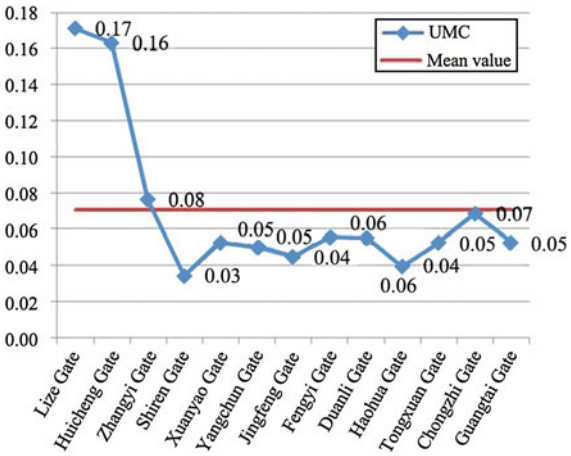

Fig. 5.20 The change curve of urban memory cognition (UMC) of the city walls of the Jin Kingdom (*Source* Drawing by Fan Yin)

(5) Although the name of Zhangyi Gate is not still in use, it still has a UMC above the average value. The explanation is as follows: Zhangyi Gate was built during the Jin Kingdom, located 2 km to the west of today's Guangan Gate. When Beijing's outer city was built in the Ming Dynasty, Zhangyi Gate Street was constructed between Guangning Gate (later changed to Guang'an Gate) and Zhangyi Gate. The name of Zhangyi Gate has been frequently used for a long time. The dual use of the name of "Zhangyi Gate" causes the Zhangyi Gate, which actually exists, to be gradually forgotten; moreover, "Guangning Gate" is regarded as Zhangyi Gate by the public. In the process of the questionnaire investigation, several respondents also mentioned that they had heard some elderly people talking about Zhangyi Gate, which provides evidence for the analysis of the historical data.

(6) The name of Fengyi Gate has also been used from the past to the present and in the name of Fengyi Bridge in the West Third Ring Road now. However, it has a relatively low UMC; its position ranks in the latter part. Owing to the long time span, it is difficult for respondents to connect Fengyi Bridge with Fengyi Gate merely through names. It should be noted from points 3 and 6 that when respondents in the questionnaire investigation are the common public, psychology must be considered into questionnaire design, especially regarding the arrangement of questions and options, to conduct a scientific inquiry.

(2) Correlation analysis of temporal elements and subjective evaluative elements

After conducting the Pearson's test of subjective evaluative elements and temporal elements of urban memory, correlation between them can be analyzed. The test results are shown in Table 5.22.

Table 5.22 Correlation between temporal elements and subjective evaluative elements with Beijing's city walls as the object

Level-two variables	Index	Inheriting/erasing memory	Strengthening/weakening memory	Correcting/distorting memory
Republic Era	Pearson's correlation	0.055	0.122*	−0.010
	Sig. (2-tailed)	0.288	0.017	0.842
	N	380	380	380
Inner city in Ming and Qing Dynasties	Pearson's correlation	0.157**	0.095	−0.140**
	Sig. (2-tailed)	0.002	0.064	0.006
	N	380	380	380
Outer city in Ming and Qing Dynasties	Pearson's correlation	0.137**	0.161**	−0.137**
	Sig. (2-tailed)	0.008	0.002	0.008
	N	380	380	380
Imperial city in Ming and Qing Dynasties	Pearson's correlation	−0.025	0.237**	0.108*
	Sig. (2-tailed)	0.622	0.000	0.035
	N	380	380	380
Palace city in Ming and Qing Dynasties	Pearson's correlation	0.079	0.152**	−0.127*
	Sig. (2-tailed)	0.122	0.003	0.013
	N	380	380	380
Yuan Dynasty	Pearson's correlation	0.000	0.195**	−0.030
	Sig. (2-tailed)	0.997	0.000	0.559
	N	380	380	380
Jin Kingdom	Pearson's correlation	0.042	0.142**	−0.024
	Sig. (2-tailed)	0.414	0.005	0.642
	N	380	380	380.0

Note *Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)

The following can be concluded based on analyses of the judgment of the Pearson's correlation coefficient.

① The evaluation of the subjects' inheriting/erasing memory of cognition of the inner city and outer city in the Ming and Qing Dynasties passes the test at the significant level of 0.01. This means that the higher a person's cognition of names

of gates from the Ming and Qing Dynasties, the deeper his or her understanding of the necessity of city walls' existence. This can be explained as follows: the inner city and outer city walls of the Ming and Qing Dynasties were pulled down in the 1950s and 1960s, which is an era in which some respondents are likely to have had first hand experience. For the city walls pulled down last, the demolition of city walls brings greatly contrasting feeling. As a result, they are more likely to agree with the necessity of the city walls' existence.

② The subjects' strengthening/weakening memory shows certain correlation with the cognition of names of city walls in all periods (although that of the inner city walls of the Ming and Qing Dynasties does not reach the significant level of 95 %, it is very close to this standard at 93.6 %). This shows that the higher a person's cognition of names of gates, the more he or she recognize the importance of the city walls.

③ The evaluation of the subjects' correcting/distorting memory has a negative correlation with the inner city, outer city, imperial city and palatial city of the Ming and Qing Dynasties, which shows that the higher a person's cognition of the historical names of gates, the lower he or she evaluates the correcting/distorting memory of city walls. The above mentioned two points can also be explained using Client Evaluation Theory, so they will not be covered again here.

There may exist collinearity between objective elements—Beijing's city walls and temporal elements—so no Pearson's correlation test is conducted.

(3) **Correlation analysis of temporal elements and subjective attributes**

After conducting the Pearson's test of the objective elements—Beijing's city walls and subjective attributes of urban memory (as in Formula 3.3)—differences in cognition towards temporal elements among subjects with different properties can be analyzed. The test results are shown in Table 5.23.

The analysis of Pearson's correlation is as follows.

① The subjective attributes of life experience and duration of residence both show certain correlation with the cognition of names of gates in all periods. This means that the longer one's life experience and duration of residence, the higher his or her cognition of the city walls' temporal elements.

② Age of subjects is also correlated with the urban memory cognition (UMC) value of names of gates from the Republic Era, outer city walls of the Ming and Qing Dynasties and imperial city walls of the Ming and Qing Dynasties. This means the older a person is, the higher his or her cognition of the city walls' partial temporal elements.

③ With respect to the eras when age is not tested with correlation, and given the phenomenon that correlation between education and temporal elements is irregular sometimes, it can be explained that age and education have no necessary connection with life experience and duration of residence, which results in the irregularity between experience and age and between depth of understanding and age. With respect to the cognition of temporal elements, in addition to first hand experience,

Table 5.23 Correlation between temporal elements and subjective attributes with Beijing's city walls as the object

Level-two variables	Index	Life experience	Duration of residence	Age	Educational status
Newly-built city walls of the Republic Era	Pearson's correlation	0.131*	0.187**	0.111*	0.001
	Sig. (2-tailed)	0.010	0.000	0.030	0.989
	N	380	380	380	380
Inner city walls of the Ming and Qing Dynasties	Pearson's correlation	0.127*	0.189**	0.076	0.128*
	Sig. (2-tailed)	0.013	0.000	0.140	0.013
	N	380	380	380	380
Outer city walls of the Ming and Qing Dynasties	Pearson's correlation	0.267**	0.331**	0.114*	0.055
	Sig. (2-tailed)	0.000	0.000	0.026	0.281
	N	380	380	380	380
Imperial city walls of the Ming and Qing Dynasties	Pearson's correlation	0.284**	0.356**	0.358**	−0.185**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	380	380	380	380
Imperial palace walls of the Ming and Qing Dynasties	Pearson's correlation	0.236**	0.279**	0.055	0.218**
	Sig. (2-tailed)	0.000	0.000	0.281	0.000
	N	380	380	380	380
City walls of the Jin Kingdom	Pearson's correlation	0.235**	0.206**	0.082	−0.172**
	Sig. (2-tailed)	0.000	0.000	0.112	0.001
	N	380	380	380	380
City walls of the Yuan Dynasty	Pearson's correlation	0.186**	0.157**	0.035	−0.095
	Sig. (2-tailed)	0.000	0.002	0.491	0.065
	N	380	380	380	380

Note *Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)

information on the Yuan and Jin Dynasties must be obtained from historical data and books. Therefore, the joint effects of a series of factors result in the irregularity in the cognition of the temporal elements.

5.4 Cognitive Results

Under the theoretical framework of Object-Subject-Time (OST) in the area of urban memory, concepts such as urban memory cognition (UMC) and subjective evaluation value (EV) are established. The Beijing's city walls are analyzed from the perspectives of subjective evaluative elements of the Beijing's city walls themselves, subjective attributes, and objective elements and temporal elements of urban memory. The conclusions are drawn as follows.

First, conclusions drawn from the measurement of evaluation value (EV) and urban memory cognition (UMC) are as follows: subjects of urban memory divide the evaluation of city walls into three categories. In decreasing order, the subjective evaluation value (EV) ranks as follows: inheriting/erasing memory, strengthening/weakening memory, and correcting/distorting memory. All three of them have relatively high EV, which indicates that people tend to have a high degree of recognition of city walls and regard them as indispensable elements of Beijing urban memory. The objective elements—Beijing's city walls of urban memory—are divided into three categories, ranking from high to low as follows according to UMC: permanent, evolutionary and temporary elements. This shows that people tend to have relatively high UMC towards elements preserved but relatively low UMC towards procedural inconstant elements. The cognition of temporal elements of urban memory shows a clear law of decay with time; that is, the closer the period is, the higher the cognition is.

Second, different subjective attributes lead to different assessments of the city walls (Table 5.8). The deeper a person's residential experience, the longer a person lives and the older a person is, the more he or she recognizes the importance of the Beijing's city walls. The seniors tend to hold more tolerant attitudes towards the means by which the city walls are renewed. The higher a person's education, the more he or she recognizes the necessity of the city walls' existence, and the lower he or she estimates the authenticity of the city walls to be.

Third, with respect to the objective elements—Beijing's city walls of urban memory (Table 5.12)—different subjective attributes will have higher cognition with deepening residential experience and increasing duration of residence and age. Similarly, the cognition of the temporal elements also reflects this basic rule. The higher a person's cognition of the permanent elements and temporary elements of the city walls, the higher he or she estimates the necessity of their existence to be (Table 5.11); and the higher a person's cognition of city walls, the higher he or she estimates their importance. However, people with higher cognition of city walls tend to have a lower assessment of their authenticity. This shows that the higher one's cognition is, the more he or she values the necessity and importance of city walls. However, a higher regard for city walls results in a relatively low assessment of authenticity.

Fourth, influenced by the demolition of city walls in the 1950s and 1960s, the more one recognizes the names of gates of the inner and outer cities of the Ming and Qing Dynasties, the deeper he or she recognizes the necessity of the existence

of city walls. Similarly, the more one recognizes the names of gates, the more he or she recognizes their importance; however, as with the cognition of the objects of city walls, the more one recognizes the historical names of gates, the lower regard he or she will have of the authenticity of the city walls.

Fifth, the summarized subjective evaluation value (EV) and objective and temporal urban memory cognition (UMC) levels will contribute to the excavation and shaping of urban memory. For instance, attention should be paid to the excavation of connotation of variables of urban memory with high cognition. For variables of urban memory with low cognition, on the premise of measuring its value of existence, improvements should be made to its existing forms and expressions to awaken urban memory. For urban memory with a relatively low evaluation value, fundamental reasons must be explored to improve the public's assessment.

Sixth, the summarized relationship among temporal, objective and subjective elements will provide some beneficial thoughts to future planning with urban memory as their planning object. For instance, when facing the controversial problem of preservation or demolition, we can promote public cognition of the necessity of protecting permanent elements of cultural heritage. When we must improve people's understating of the necessity of city walls in urban memory, information on all types of city walls in different periods should be spread and publicized to improve public cognition. When we construct rest space at a relic site of ancient city walls for the elderly, consideration of authenticity may not be of primary importance when facing people with high educational status, attention should be paid to this variable.

Chapter 6
The Existence of a City Depends on Memory

In one of the most important books in the study of urban theory, *The City in History*, the famous American urban theorist and sociologist Lewis Mumford (1961) mentioned that the existence of a city depends on memory. Urban memory is the collective impression of the formation, change, and development of a city. Urban memory can maintain the continuity of urban history and culture, strengthen the identity and cohesion of urban residents and shape urban spirit and culture as well. The existence of urban memory enables the evolution and continuation of urban material space structure as well as social and cultural forms to follow certain pathway, which shows unique styles and images that are different from other cities.

Within the context of rapid city renovation and in the face of the problems of "thousands of cities looking the same" as well as "urban memory loss", the protection of urban historic buildings often becomes the breakthrough point for solving these problems. As easily perceived on a spacial scale, historic buildings become the main material carriers of urban memories that constitute city styles and features as well as space characteristics. Seeking the law in which memory elements exist in historic buildings will contribute to the discovery of more internal intangible elements and implications beneath the surface of the material form of historic buildings. Such discovery will build the positive association between the protection of historic buildings and residents' daily lives more effectively in urban planning and will allow historic buildings to "exist" in the overall environment with "people" being the core. In this study, 345 representative historic buildings in Beijing's inner city were selected and divided into 8 categories and 17 subcategories, with urban memory's Object–Subject–Time (OST) as the frame. Object–Time memory reflects the picture memory of people based on specific places at specific instances; Time–Subject memory goes through the new cognition process that is being perceived and processed by people; while Object–Subject memory is the visual and permanent memory method formed after the repeated experiences of people.

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(1) Research on the impacts of different population characteristics on urban memory indicates that age, income, profession, educational status and duration of residence in Beijing have a positive influence on the formation of urban memory. The longer residents live in Beijing, the clearer their outside–of–scene memory is; and with increases in income and educational status, residents' capacity for learning and remembering symbolic connotation memory increases; and increases in residents' income levels are correlated with more salient feeling and experience memory. (2) In the research on the relationship between the degree of memory and memory time, the degree of memory is divided into three levels—high, medium and low—and different degrees of memory related to historic buildings are obtained: imperial palaces and administrative buildings belong to the category with a high degree of memory, buildings for managing foreign affairs, common residences and commemorative buildings belong to the category with a low degree of memory, and other historic buildings belong to the category with a medium degree of memory. These results demonstrate the different memories people have regarding different buildings. At the same time, the changing rule that the degree of memory varies with memory time is that, with the increasing of memory time, the degree of memory slows after the initial fast speed, and the attainment of the initial memory is relatively fast and distinct. When the memory time reaches a certain amount, the degree of memory will not increase clearly.

The measurement of urban memory level was conducted for the study of historic areas, with 19 typical historical areas chosen as cases in this research from 367 historic areas in Beijing. The areas were chosen comprehensively considering these aspects including spatial characteristics (geographic location), temporal characteristics (construction age), degree of heritage protection, and functional features. This research identifies five major categories of urban memory related to historic areas in Beijing, namely, Objective Dynamic Memory, Integrated Characteristic Memory, Lasting Retained Memory, Protection Renewal Memory and Continuous Temporal Memory. Overall cognitive evaluation and recognition for the value of protecting historic areas, which is a type of memory that has reached a consensus, is irrelevant to the rememberers' residential experience, age, educational status and income level. For cognitive levels and the correlation law for elements of Beijing urban memory related to historic areas, the following are obtained: subjective elements of memory are led by preserving and distinctive elements; objective elements memory is led by permanent and evolutionary elements; and the temporal elements of memory is led by time period. Meanwhile, subjective elements of memory that are represented by values of protection, positive influences, cultural inheritance and significant characteristics, boast the highest level of memory; subjective elements of memory represented by representative buildings, architectural style and spatial pattern have a relatively high level of memory; while objective evolutionary elements of memory represented by functional evolution, style changes, and name replacement have a relatively low level of memory. As for elements that have a relatively low level of memory, they can be regarded as important aspects of the renewal and transformation of future historic areas, and then regenerative strategies can be developed.

Through comparisons of the characteristics of urban memory between the north–south axis and the east–west axis, it can be seen that Beijing's main urban axis composed by the two axes not only organizes urban space axes in Beijing, but is also a type of psychological axis. The spatial form of these two axes changes constantly in the process of history, and each individual may have different cognition towards them. (1) From the perspective of the spacial memory of axes, generally speaking, people's cognition of the scope of the north–south axis tends more to the north, which relates to the fact that development in the southern part of Beijing is relatively backward while the northern end of the central axis hosted the Olympics, this great event for strengthening people's memory. In addition, the subjective cognition of East and West Chang'an Avenues as well as its extending line tends more to the west, which is related to the fact that the endpoint of the west side is clear. (2) From the perspective of the nature memory of axes, as for functions of these two axes, the function of cultural axis has the highest degree of recognition for the north–south axis, which conforms to the position of the north–south axis in some related plannings. And as for the east–west axis, the function of economic axis has the highest recognition. (3) From the cognitive perspective of the objective elements, on the whole, the basic cognition of the north–south axis exceeds that of the east–west axis. Regardless of the cognition of spatial location, function or temporal memory, the objective elements cognition of the north–south axis always exceeds that of the east–west axis; at the same time, the degree of deviation of memory of the north–south axis is also below that of the east–west axis. Several plannings in Beijing in recent years, including the *Master Planning of Beijing (2004–2020)* (Beijing Municipal Commission of Urban Planning, 2005), and the *Conservation Planning of Historical and Cultural City of Beijing* (Beijing Municipal Commission of Urban Planning, 2002), involve the protection and construction of the north–south axis and the east–west axis, and specific plannings such as the *Urban Design of the Central Axes in Beijing* (Beijing Municipal Commission of Urban Planning, 2005) have been compiled. It can be seen that the construction of the north–south axis has been strengthened in recent years. The construction greatly improves the memory cognitive of the north–south axis, which has now already exceeded that of the east–west axis. For this reason, related plannings are essential to the protection and development of axes. The north–south axis of Beijing carries profound Beijing urban culture. In fact, Chang'an Avenue and its extending line as the east–west axis also carries the important urban memory of the historical period from the founding of the People's Republic of China until now. Due to the short time interval between this period and now, the strengthening of urban memory for this period is lacking. According to the research results, subjects have relatively low memory cognition and evaluation value for Chang'an Avenue and its extending line as the east–west axis, and the cognition of its function as political and cultural axis also deviated from what has been defined in the *Master Planning of Beijing (2004–2020)* (Beijing Municipal Commission of Urban Planning, 2005); therefore, plannings concerning this aspect need to be strengthened.

Research about Beijing's city walls has revealed the following: (1) People with different subjective attributes have different assessments of city walls. The deeper a

person's residential experience is and the longer a person lives, the more he or she recognizes the importance of Beijing's city walls; older people tend to hold more tolerant attitudes towards the ways that city walls are renewed; the higher a person's education, the more he or she recognizes the necessity for the city walls' existence and the lower he or she estimates the authenticity of city walls; and the higher a person's cognition of the permanent elements and temporary elements of city walls, the higher he or she estimates the necessity for their existence, etc.. (2) As for the objective elements of urban memory, people with different subjective attributes will have higher cognition with the deepening of residential experience and increases in duration of residence and age. Similarly, the cognition of the temporal elements also demonstrates this basic rule. The higher a person's cognition of the permanent and temporary elements of city walls, the higher he or she estimates the necessity for a city walls' existence. In addition, the higher a person's cognition of city walls, the higher he or she estimates their importance. However, people with higher cognition of city walls tend to have lower assessment of the walls' authenticity. This finding shows that the higher a person's cognition, the more he or she values the necessity and importance of city walls. However, the higher expectation of city walls results in the relatively lower assessment of authenticity. (3) Influenced by the tearing down of city walls in the 1950s and 1960s, the more a person recognizes the names of gates of inner city and outer city of the Ming and Qing Dynasties, the deeper he or she recognizes the necessity for the existence of city walls; similarly, the more a person recognizes the names of gates, the more he or she recognizes their importance. However, just as in the cognition regarding city walls, the more one recognizes the historical names of gates, the lower an assessment he or she will have of the authenticity of city walls.

Under the same research framework, analysis of urban memory regarding Beijing's central axes and city walls, which are both associated with linear elements, is conducted. Comparisons of urban memory cognition (UMC) with the subjective evaluation value (EV) of the obtained level–one variables, that is, the subjective evaluative element, the objective element and the temporal element, are shown in Table 6.1.

The following is evident from Table 6.1: (1) For subjective evaluation value (EV), the value of the main axes is below that of city walls. City walls are constantly strengthened by physical forms in spatial terms. From original city walls and city towers to present Second Ring roads and places named after those original city towers, all of these promote a relatively high degree of recognition; however, the cognition of axes requires that people have a grasp of Beijing's overall space structure, which is a type of conceptual cognition that requires more time and longer residential experience. However, in actual urban life, the space of the central axes is intermittent, which cannot be followed consistently from the beginning to the end. Only from the bird's eye view can the central axes be seen completely, which results in a low degree of recognition. (2) For the objective and temporal elements, the value of the main axes exceeds that of city walls. The reason is that city walls have mostly disappeared, whereas Beijing's primary urban axes have been strengthened constantly, leaving a relatively high degree of recognition.

Table 6.1 Comparisons of characteristics of urban memory between the main axes and city walls

Elements	Subjective evaluative element	Objective element	Temporal element
EV/UMC value of the main axes	0.62	0.52	0.60
EV/UMC value of city walls	0.65	0.50	0.56

Note $0 \leq EV < 0.4$ is low, $0.4 \leq EV < 0.7$ is medium, and $0.7 \leq EV \leq 1$ is high
$0 \leq UMC < 0.4$ is low, $0.4 \leq UMC < 0.7$ is medium, and $0.7 \leq UMC \leq 1$ is high

Urban memory reflects the collective memory characteristics of people at some place at sometime, with memory elements, memory degrees and memory time, among others, as its measurement standards. In planning practice, planners cannot plan people's memory; however, they can provide targeted guidance for the planning according to characteristics of urban memory, for example, giving priority to the conservation of elements with rich urban memory information, evaluating whether planning results can leave a deep impression on people, choosing programs according to memory characteristics of different people and choosing the key time period based on memory time characteristics. Such guidance also involves knowing the urban memory embodied in major historic buildings before their demolition and formulating redeeming solutions accordingly.

As a type of collective memory of urban space established on individual subjective judgments and emotional factors, the connotation of collective memory needs to be reflected to a larger extent in the planning of urban memory. Therefore, with regard to urban planning, especially that of historic areas, public participation should be made a legal basic public policy and implemented in the long term. At the same time, with regard to public participation in urban planning, procedures for public participation in urban planning should be perfected, and basic roles for the public need to be brought fully into play.

Only cities with memories can preserve their continuity. Thus, the measurement of urban memory is an essential part of urban planning. In the process of urban planning and management, more consideration needs to be given to elements with immaterial and historical relevance beyond the material planning. Current planning work will have a direct impact on people's memories of cities in the future. To prevent our urban culture from disappearing bit by bit and to allow successors to learn from their ancestors' achievements, people first chose to use written language to record the evolution of civilization. But, how should we record people's memories and emotions regarding city transformation? Data such as words, pictures and files with no emotions can be easily forgotten in the process of repeated renovation. Urban planners and administrators shoulder the historical responsibilities and add memory elements to their work, enabling generations of people to experience cities in person, preserve memories and understand history.

References

Assmann J (2011) Communicative and cultural memory. Springer, Netherlands, Berlin

Assmann J, Czaplicka J (1995) Collective memory and cultural identity. New German Critique 110(65):125–133

Bacon EN (1967) Design of cities. Thames and Hudson, London

Bai L (2007) Landscape planning based on urban memory protection: landscape planning of the riverside of Suzhou canal as a case study. New Architecture (4):71–75 (in Chinese)

Beijing Local Chronicles Compilation Committee (2009) Beijing annals—urban and rural planning volume—planning annals. Beijing Press, Beijing

Beijing Municipal Commission of Development and Reform (2013) Approval on the road project proposal of the Chang'an avenue west extension section (Gucheng Street–Sanshi Road). BDRC. No.502 (in Chinese)

Beijing Municipal Commission of Urban Planning (1993) Master Planning of Beijing (1991–2010) (in Chinese)

Beijing Municipal Commission of Urban Planning (2002) Conservation Planning of Historical and Cultural City of Beijing (in Chinese)

Beijing Municipal Commission of Urban Planning (2002) Conservation Planning of 25 Historical and Cultural Districts in old Beijing City. Yanshan Publishing House, Beijing (in Chinese)

Beijing Municipal Commission of Urban Planning (2005) Master Planning of Beijing (2004–2020) (in Chinese)

Beijing Municipal Commission of Urban Planning (2005) Urban design of the central axes in Beijing. China Machine Press, Beijing (in Chinese)

Beijing Municipal Commission of Urban Planning, Beijing Urban Planning Society (2004) Chang'an avenue: past, present and future. Mechanical Industry Press, Beijing (in Chinese)

Bélanger A (2002) Urban space and collective memory: analyzing the various dimensions of the production of memory. Canadian J Urban Res 11(1):69–92

Bell DS (2003) Mythscapes: memory, mythology, and national identity. British J Sociol 54(1):63–81

Blunt A, Bonnerjee J (2013) Home, city and diaspora: Anglo-Indian and Chinese attachments to Calcutta. Global Netw 13(2):220–240

Boyer MC (1996) The city of collective memory: its historical imagery and architectural entertainments. The MIT Press, MA

Boyer P (2009) What are memories for? Function of recalling cognition and culture. In: Boyer P, Wertsch JW (eds) Memory in mind and culture. Cambridge University Press, New York, pp 3–33

Burke P (1989) History as social memory. Memory: history, culture and the mind

Casey ES (2000) Remembering: a phenomenological study (Second Edition). Indiana University Press, Bloomington

Casey ES (2004) Public memory in place and time. In: Phillips KR, Stephen B, Barbara B (eds) Rhetoric, culture, and social critique: framing public memory. University of Alabama Press, Tuscaloosa, pp 17–44

F. Wang, *Beijing Urban Memory*, DOI 10.1007/978-981-10-0678-4

Chen XL (2013) Comparative study on Beijing North–South Axis and East–West Axis based on the cultural heritage: (Dissertation for Master, Tutor: Wang, F.). Peking University, Beijing (in Chinese)
Chen Y, Lu B, Pei FW (2010) Protection of the continuous code of urban memory: a case study of the planning and design of the fifth white house in Tianjin. In: Planning Innovation: proceedings of 2010 China's urban planning annual meeting (in Chinese)
China Business News (2008) Evolution of Beijing city walls and city gates. http://finance.sina.com.cn/roll/20080112/01501926507.shtml. Accessed 2008–01–12 (in Chinese)
Cloke PJ, Crang P, Goodwin MA (2005) Introducing human geographies. Routledge, New York
Confino A (1997) Collective memory and cultural history: problems of method. Am Hist Rev 102(5):1386–1403
Connerton P (1989) How societies remember. Cambridge University Press, Cambridge
Crinson M (ed) (2005) Urban memory: history and amnesia in the modern city. Routledge, New York
De Alba M (2012) A methodological approach to the study of urban memory: narratives about Mexico City. Forum: Qual Soc Res 13(2)
Dong Y (2009) Studies in the construction of Beijing city wall site park: (Dissertation for Master). Beijing Forestry University, Beijing (in Chinese)
Downing F (2000) Remembrance and the design of place (No. 6). Texas A & M University Press, College Station
Duan JY (2003) On the growth pattern of Beijing axis line: a reflection on the future spatial pattern of Beijing. Planners (10):13–15 (in Chinese)
Editorial Department of Beijing Construction History Editorial Committee (1989a) Construction materials of Beijing City since the founding of the PRC (the 1st Volume, Urban Planning) (in Chinese)
Editorial Department of Beijing Construction History Editorial Committee (1989b) Construction materials of Beijing city since the founding of the PRC (the 3rd Volume, Roads and Traffic) (in Chinese)
Ekici D (2007) The surfaces of memory in Berlin. J Archit Educ 61(2):25–34
Fan SX (2010) Research on spatial structure of the downtown district of Hanzhong city. J Northwest Univ (Natural Science Edition) 40(4):729–733 (in Chinese)
Feng JC (2005) The thinker walking alone. Huashan Literature and Art Publishing House, Shijiazhuang (in Chinese)
Ferguson PP (1994) Paris as revolution: writing the nineteenth–century city. University of California Press, Berkeley
Forest B, Johnson J (2002) Unraveling the threads of history: Soviet-era monuments and post-Soviet national identity in Moscow. Ann Assoc Am Geogr 92(3):524–547
Fu GY (2001) The old city gates of Beijing. Art Photography Press, Beijing (in Chinese)
Gao Y (2010) The project design of multivariate post–stratification sampling based on multi–analyses. Stat Dec (22):8–10 (in Chinese)
Guo C (2012) Research on the evolution of the central axes of Beijing. Academy Press, Beijing (in Chinese)
Guo GP, Xu TL (2003) City calling memory. Chinese Real Estate Business, 2003 November 20 (in Chinese)
Halbwachs M (1992) On collective memory. University of Chicago Press, Chicago
Hayden D (1997) The power of place: urban landscapes as public history. MIT Press, MA
Hebbert M (2005) The street as locus of collective memory. Environ Planning D-Soc Space 23 (4):581–596
Henneberg V, Clara K (2004) Monuments, public space, and the memory of empire in modern Italy. Hist Memory 16(1):37–85
Hermann E (1964) Memory: a contribution to experimental psychology. Dover, New York
Hobsbawm E, Ranger T (1983) The invention of tradition. Cambridge University Press, Cambridge

Hou RZ (1997) The Forbidden City and the central axes of Beijing: opening speech of the second academic seminar on the Chinese association of the forbidden city. Collection of the Chinese Association of the Forbidden City (the 2nd series). Forbidden City Publishing House, Beijing (in Chinese)
Hou RZ (2004) Three milestones in Beijing urban planning and construction. Beijing Planning Rev (3):4–7 (in Chinese)
Huyssen A (1995) Twilight memories: marking time in a culture of amnesia. Routledge, New York
Huyssen A (2003) Present pasts: urban palimpsests and the politics of memory. Stanford University Press, Stanford
Jia LX (2007) Research on the cognitive of symbol processing orientation. J Northwest Normal Univers (Soc Sci) 44(4):52–58 (in Chinese)
Jiang M (2010) Urban memory research on historical architecture of Beijing inner city: (Dissertation for Master, Tutors: Wu, B.H., Wang, F.). Peking University, Beijing (in Chinese)
Johnson NC (2002) Mapping monuments: the shaping of public space and cultural identities. Visual Commun 1(3):293–298
Jordan JA (2006) Structures of memory: understanding urban change in Berlin and beyond. Stanford University Press, Stanford
Kansteiner W (2002) Finding meaning in memory: a methodological critique of collective memory studies. Hist Theory 41(2):179–197
Ladd B (1998) The ghosts of Berlin: confronting German history in the urban landscape. University of Chicago Press, Chicago
Lahiri S (2011) Remembering the city: translocality and the senses. Soc Cult Geogr 12(8):855–869
Le Goff J (1992) History and memory. (trans: Rendall S, Claman E.). Columbia University Press, New York
Legg S (2005) Contesting and surviving memory: space, nation, and nostalgia in LesLieux de mémoire. Environ Planning D: Soc Space 23(4):481–504
Lewicka M (2008) Place attachment, place identity, and place memory: restoring the forgotten city past. J Environ Psychol 28(3):209–231
Li C (2012) The historical change and development trend of the central axes of Beijing. Beijing Planning Rev (2):8–11 (in Chinese)
Li H (2013) International phenomenon observation of urbanization rate exceeding 50% threshold: implications for China. Urban Planning Forum (1):43–50 (in Chinese)
Li HB (2006) Historical change and development trend of Chang'an avenue. Beijing Planning Rev (5):55–58 (in Chinese)
Li JP (2002) Beijing's city landscape and ancient capital culture. J Beijing Union Univ (Natural Science Edition) 16(1):34–39 (in Chinese)
Li WM, Jiang JY, Shen, TT (2010) Measurement and inheritance of urban memory: Xiaoying Street in Hangzhou as a case study. Urban Problems (1):21–26 (in Chinese)
Liang M (2010) Retaining the urban memory space and inheriting the outstanding cultural heritage: planning of the historical and cultural blocks of Ya'an Guanyin Pavilion. Sichuan Archit 30(5):18–20 (in Chinese)
Liang SC (2001) Brilliant work in urban planning. In: Works of Liang Sicheng, vol V. China Architecture & Building Press, Beijing (in Chinese)
Liang SC (2005) History of Chinese architecture. Baihua Literature and Art Publishing House, Tianjin (in Chinese)
Lin J (2005) The changes of the political nature and design thoughts of city axis. http://www.jianzhu114.cn/jzzl/1828.htm. Accessed 2005–04–05, (in Chinese)
Lin XQ, Wu ZX (2010) Analysis of pros and cons of the stratified catalogue sampling and cluster sampling. China Stat (11):40–41 (in Chinese)
Liu FY, Dong BQ, Wang XW, Li JB, Huang MY, Luo D (2009) Using Delphi method to establish the comprehensive evaluation index system of tuberculosis control efficiency. Chinese J Health Stat 26(1):96–97 (in Chinese)

Liu Y (2012) Research of the determination and applied of the memories of the city: historic places in Beijing as an example: (Dissertation for Master, Tutor: Wang, F.). Peking University, Beijing (in Chinese)
Lowenthal D (1975) Past time, present place: Landscape and memory. Geogr Rev 65(1):1–36
Lv XJ, Lu JW (2003) A new pattern for conserving and renewing of lilong residence: conservation and renewal of Xiwangjiashe in Shanghai. New Archit (2):10–12 (in Chinese)
Matten MA (ed) (2011) Places of memory in modern China: history, politics, and identity. Brill, Leiden
Michael D, Chen FF (2010) The square: apolitical anthropology of the built environment of Beijing. Time +Architecture (4):88–101 (in Chinese)
Mowla QA (2004) Memory association in place making: understanding an urban space. Protibesh (9):52–54
Mumford L (1961) The city in history: its origins, its transformations, and its prospects. Harcourt, Brace & World, New York
Nora P (1989) Between memory and history: Les lieux de mémoire. Representations (26):7–24
Office of the Beijing Municipal People's Government. (1998) Notice on the comprehensive rectification of Chang'an avenue and its extension section to greet 50th anniversary of the founding of PRC. OBMP. [1998] No. 42
Olick JK, Robbins J (1998) Social memory studies: from "collective memory" to the historical sociology of mnemonic practices. Ann Rev Sociol (24):105–140
Othman S, Nishimura Y, Kubota A (2013) Memory association in place making: a review. Proc-Soc Behav Sci 85(20):554–563
Postalcy IE, Kuruç Ada A, Özbek Eren I (2006) The new urban memory. In: Proceedings of the 42nd international society of city and regional planners congress, pp 1–5. Istanbul, Turkey
Proust M (2006) Remembrance of things past, vol 2. Wordsworth Editions Ltd, Hertfordshire
Ringas D, Christopoulo E, Stefanidakis M (2011) CLIO: blending the collective memory with the urban landscape. In: Proceedings of the 10th international conference on mobile and ubiquitous multimedia, pp 185–194. ACM
Ringas D, Christopoulou E (2013) Collective city memory: field experience on the effect of urban computing on community. In: Proceedings of the 6th international conference on communities and technologies, pp 157–165. Munich, Germany
Rose-Redwood R, Alderman D, Azaryahu M (2008) Collective memory and the politics of urban space: an introduction. GeoJournal 73(3):161–164
Rossi A (1982) The architecture of the city. (Trans: Ghirardo D, Ockman J). The MIT Press, Cambridge
Schacter DL (1997) Searching for memory: the brain, the mind, and the past. Basic Books, New York
Shen SX, Li CM, Xu H (2005) Landscape characteristics and protective development of former residences of celebrities in Hangzhou. City Planning Rev 29(9):55–59 (in Chinese)
Shi WJ, Bian LC (2012) The future axis: protection and development of Beijing south axis. Beijing Planning Rev (2):30–33 (in Chinese)
Shu T (2004) Revived buildings that evoke memory of city: the research of building–renewal tactic that symbioses with history, reality and future: [Dissertation for Doctorate]. Chongqing University, Chongqing (in Chinese)
Siren O (1924) The walls and gates of Peking. John Lane, London
Srinivas S (2001) Landscapes of urban memory: the sacred and the civic in India's high–tech city. University of Minnesota Press, Minneapolis
Stangl P (2008) The vernacular and the monumental: memory and landscape in post–war Berlin. GeoJournal 73(3):245–253
Sun HM (2009) Research on the new urban spatial structure in Beijing city master planning. Urban Stud 16(3):36–40 (in Chinese)
Sun YJ (1998) The method of defining the sample size of each layer in stratified sampling. Stat Educ (6):16–17 (in Chinese)

Tan Y (2008) Explore the long–term effectiveness of the brand communication based on the Ebbinghaus forgetting curve and the brand core value. Enterp Econ 166(6):33–35 (in Chinese)
The Beijing News (2003) Beijing geography: city gate of ancient capital. Beijing Tourism Press, Beijing (in Chinese)
Till KE (2003) Chapter 19. Places of memory. A companion to political geography. Blackwell Publishers Ltd, Oxford, pp 289–301
Tu X (2005) Management of "urban memory". Sichuan Archit 25(1):13–14 (in Chinese)
Viollet–le–Duc EE, Wethered C (2015) On restoration. Leopold Classic Library
Wang F, Li W, Prominski M (2014) The new conflicts, strategies and explorations of urbanization and locality: overview on the sino–German symposium. Geogr Res 33(11):2205–2214 (in Chinese)
Wang F, Liu J, Chen XL (2015) A planning positioning and media cognition comparison of the North–south Axis and East–west axis of Beijing. Urban Probl 35(7):39–47 (in Chinese)
Wang F, Wu X, Yu XF (2014) A cognitive comparison of the north–south axis and east–west axis of Beijing. Urban Probl (4):37–44 (in Chinese)
Wang F, Yan L, Wu BH (2010) Collective memory of city planning: Xuanwu District's collective memory of city of as a case study. Urban Planning Int 25(1):71–76, 87 (in Chinese)
Wang J (2003) City records. Joint Publishing, Beijing (in Chinese)
Wang JG (2003) Researching on urban traditional spacial axis. Archit J (5):24–27 (in Chinese)
Wang SR (2012) Textual research on the mystery of the ancient Beijing axes. Beijing Planning Rev (2):11–13 (in Chinese)
Wang XB (2007) Festival: a special kind of public cultural space. Henan Soc Sci 15(4):5–8 (in Chinese)
Wang Y (2002) Analysis on the axis of the old city of Beijing. Beijing Planning Rev (1):20–22 (in Chinese)
Withers CWJ (1996) Place, memory, monument: memorializing the past in contemporary highland Scotland. Cult Geographies 3(3):325–344
Wu PC (2006) A Study of exploring planning factors of local industry street based on experiencing marketing: a case of Yingge Pottery Street: (Dissertation for Master). Graduate School of Architecture and Urban Design, Taichung (in Chinese)
Xiao CL (2009) Spirit and flesh of three lanes and seven alleys. National Geographic (2):46–59 (in Chinese)
Yan L (2009) A cognition–based research on urban memory—Beijing South drum lane historic district case study: (Dissertation for Master, Tutors: Wu, B.H., Wang, F.). Peking University, Beijing (in Chinese)
Yang ZL, Sun LR, Tang JH (2012) Psychology of memory. East China Normal University Press, Shanghai (in Chinese)
Yin F (2012) Study on the memory of the city based on the city walls of Beijing: (Dissertation for Master, Tutor: Wang, F.). Peking University, Beijing (in Chinese)
Young JE (1993) The texture of memory: holocaust, memorials and meaning. Yale University Press, New Haven
Yu GL, Wang QL, Yang ZL (2000) Environmental psychology. People's Education Press, Beijing (in Chinese)
Yu XF (2012) Study on the main axis of Beijing based on the memory of the city: (Dissertation for Master, Tutor: Wang, F.). Peking University, Beijing (in Chinese)
Zhang MD (2011) On ten points of Beijing city's axis. J Beijing Union Univ (Human Soc Sci) (3):35–38 (in Chinese)
Zhang N (1995) Historical investigation on the traditional central axes in Beijing. In: Proceedings of the 13th annual conference of Chinese ancient capitals society, pp 210–221. Shanxi People's Publishing House, Taiyuan (in Chinese)
Zhang S (2008) An Introduction to integrated conservation: a way for the protection of cultural heritage and historic environment, 2nd edn. Tongji University Press, Shanghai (in Chinese)

Zhang XD (2003) The walls and gates of Beijing city in the Ming and Qing dynasties. Hebei Education Press, Shijiazhuang (in Chinese)
Zhao XS, Zhou YM (2002) Human brain, desire and city. Shanghai People's Publishing House, Shanghai (in Chinese)
Zhao ZJ (2001) Some comments on the comprehensive regulation of Chang'an avenue and its extension section. Beijing Planning Rev (5):48–49 (in Chinese)
Zheng GZ, Xing GX (2004) Deliberation on planning of Tian'anmen square and Chang'an avenue. Beijing Planning Rev (1):60–64 (in Chinese)
Zheng W, Ding KL, Li JS (2008) A historical investigation on the design of symmetric axes in Chinese ancient cities. The Architect (4):91–96 (in Chinese)
Zhou SY (2009) Interpretation of Beijing landmark landscape culture. Qianxian (3):59–60 (in Chinese)
Zhou W, Zhu YF (2015) A study review of urban memory in the last 20 years. Urban Prob (3):2–10 (in Chinese)
Zhu R (2004) City and memory: continuity and development of urban history in psychological dimension. South Archit (4):65–68 (in Chinese)
Zhu R (2005) Collective memory of city and urban form—Research of history and culture continuity in the perspective of psychology and sociology: (Dissertation for Doctorate). Southeast University, Nanjing (in Chinese)
Zhu YC (2011) Study on the place identity of historic places in Beijing based on Google earth photos: (Dissertation for Master, Tutor: Wang, F.). Peking University, Beijing (in Chinese)
Zou TQ (2006) Study on management models of China tourist attractions. Nankai University Press, Tianjin (in Chinese)