

CROSS-CULTURAL COMPARATIVE STUDY OF BURIAL SITES

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ABSTRACT

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Burial grounds, as one of the most important landscape that connect the living and the dead, can often represent culture, tradition and aesthetic evaluation of a local community; therefore, understanding the similarities and differences among the burial sites can help people understand the culture and tradition of places behind the burial sites. This research studies the similarities and differences among different Western and Chinese burial sites, including Pere Lachaise in Paris, three municipal cemeteries in Michigan, USA, three public cemeteries in Shanghai, China, two Chinese imperial tombs in Nanjing, China, and two rural ancestral burial grounds in Jiangsu, China. Cluster Analysis with Principal Component Analysis is applied to this research. Eighty-seven significant variables are used for the calculation of Cluster Analysis. In result, six meaningful principal components are used for further analysis, and the first two principal components are used as primary dimensions for burial site comparisons. The result shows that principal component 1 can be used to compare within culturally, and principal component 2 can be used to compare cross-culturally. And the research further suggests the three public cemeteries in Shanghai are culturally integrated fusion cemeteries that inherit traditional Chinese philosophies and adopt Western influences.

Keywords: Landscape Architecture, Environmental Design, Fengshui, Taoism, Picturesque, Western Culture, Eastern Culture.

ACKNOWLEDGEMENTS

In memory of both of my grandfathers, who passed away years ago and loved me with all their love. Years ago, when they were still around; they were like the magnificent oak trees that can reach the sky, and I was the little squirrel living on the oak tree.

Now they are long gone, and left with carved names on the stones; the love I felt and the inspirations they gave will never fade away.

TABLE OF CONTENTS

| | |
|---|------------|
| LIST OF TABLES | vi |
| LIST OF FIGURES | vii |
| CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW | 1 |
| 1.1 Introduction..... | 1 |
| 1.2 Literature Review of Burial Culture..... | 1 |
| 1.2.1 Burial Ritual and Burial Ground Types | 1 |
| 1.2.1.1 Purpose of Funerary and Burial Ritual | 1 |
| 1.2.1.2 Cemeteries..... | 2 |
| 1.2.1.3 Churchyards, Burial Grounds, and Pantheons | 4 |
| 1.2.2 Western and Chinese Designs..... | 6 |
| 1.2.2.1 Western Picturesque and Chinese Picturesque | 6 |
| 1.2.2.2 Western and Chinese Landscape Design Principles | 9 |
| 1.2.2.3 Fengshui..... | 12 |
| 1.2.2.4 Ancestry Worshipping | 13 |
| 1.3 Literature Review of Western and Chinese Burial Sites..... | 14 |
| 1.3.1 Western Cemeteries | 14 |
| 1.3.1.1 European Cemetery: Pere Lachaise | 14 |
| 1.3.1.2 American Cemeteries..... | 18 |
| 1.3.2 Chinese Burial Sites | 21 |
| 1.3.2.1 Chinese Wealthy and Imperial Tombs..... | 21 |
| 1.3.2.2 Chinese Traditional Hillside Graves..... | 30 |
| 1.3.2.3 Chinese Public Cemetery | 31 |
| 1.4 Integrated Culture of Shanghai, China | 31 |
| 1.5 Conclusion and Purpose of Study..... | 32 |
| CHAPTER 2: METHODOLOGY..... | 34 |
| 2.1 Study Sites | 34 |
| 2.1.1 Michigan Cemeteries | 34 |
| 2.1.2 Chinese Burial Sites | 45 |
| 2.1.2.1 Modern Public Chinese Cemeteries..... | 45 |
| 2.1.2.2 Chinese Rural Burial Grounds | 66 |
| 2.1.3 Conclusion | 72 |
| 2.2 Data Collection..... | 72 |
| 2.3 Analysis Techniques | 74 |
| CHAPTER 3: RESULTS | 78 |
| CHAPTER 4: DISCUSSION | 95 |
| 4.1 Scatter Graph and Distinguishable Variables..... | 95 |
| 4.2 Comparison of Burial Sites and Burial Site Elements..... | 99 |

| | |
|---|------------|
| 4.3 Future Implication..... | 104 |
| 4.4 Limitations and Suggestions for Future Research..... | 105 |
| BIBLIOGRAPHY | 107 |

LIST OF TABLES

| | |
|---|----|
| Table 1: The list of all 91 variables include the four insignificant variables labeled with star symbols. | 73 |
| Table 2: List of burial site elements and existence in eleven burial sites. | 78 |
| Table 3: Means and standard deviation of each variables. | 81 |
| Table 4: Standardized Score of Variables of the Western Cemeteries. | 83 |
| Table 5: Standardized Score of Variables of the Chinese Burial Sites. | 86 |
| Table 6: Principal component Analysis eigenvalues of the covariance matrix from JMP (Version 13; SAS, 2016) software. | 90 |
| Table 7: Principal component Analysis coefficient for each significant variable from JMP (Version 13; SAS, 2016) software. | 90 |
| Table 8: Burial Sites Scores in First Six Principal components. | 93 |
| Table 9: List of distinguishable variables in Principal Component 1. | 97 |
| Table 10: List of distinguishable variables in Principal Component 2. | 98 |

LIST OF FIGURES

| | |
|---|----|
| Figure 1: Location of Pere Lachaise Cemetery in Paris, France..... | 15 |
| Figure 2: The gravesite of Chopin with sculptures, carving portrait of Chopin, fences, and fresh cut flowers from visitors in Pere Lachaise Cemetery, Paris, France. (Copyright ©2005 Jon Bryan Burley all right reserved used by permission). | 16 |
| Figure 3: Gravesite of Joseph Lakanal in Pere Lachaise Cemetery, Paris, France. (Copyright ©2005 Jon Bryan Burley all right reserved used by permission). | 17 |
| Figure 4: Gravesite of James Douglas Morrison with fresh cut flowers from the visitors in Pere Lachaise Cemetery, Paris, France. (Copyright ©2005 Jon Bryan Burley all right reserved used by permission)..... | 18 |
| Figure 5: Location of Ming Xiaoling Tomb in Nanjing, Jiangsu Province, China. | 23 |
| Figure 6: Stone Tablet of Ming Xiaoling Tomb with mythical animal statue in between two archways, and stairs with Chinese dragon carving decoration in Nanjing, China. (Copyright ©2008 Jon Bryan Burley all right reserved used by permission). | 24 |
| Figure 7: Stone paved Sacred Way with mythical animal statues along both sides that creates a rectilinear symmetrical layout with high visual and physical enclosure in Ming Xiaoling Tomb, Nanjing, China. (Copyright ©2008 Jon Bryan Burley all right reserved used by permission). ... | 24 |
| Figure 8: The Dismounting Archway with abstract cloud carving decorations and the uphill stone paved pathway with multiple groups of stairs in Ming Xiaoling Tomb, Nanjing, China. (Copyright ©2008 Jon Bryan Burley all right reserved used by permission). | 25 |
| Figure 9: The three arched bridges connecting to the actual burial site in Ming Xiaoling Tomb, Nanjing, China. (Copyright ©2008 Jon Bryan Burley all right reserved used by permission). ... | 25 |
| Figure 10: Location of Dr. Sun Yat-sen’s Tomb in Nanjing, Jiangsu Province, China. Sun’s Tomb is located approximate to Ming Xiaoling Tomb. | 27 |
| Figure 11: Brick paved plaza area of Sun’s Tomb in rectilinear symmetrical design with water feature, planting beds, and large stairs. (Copyright ©2017 Zhengwei Wu all right reserved used by permission)..... | 28 |
| Figure 12: Sacrifice Hall of Sun Yat-sen’s Tomb with stone plaque on building, and three archway entrances. (Copyright ©2017 Zeran Zhu all right reserved used by permission). | 28 |
| Figure 13: Dr. Sun Yat-sen’s Tomb in rectilinear design with massive stair cases and naturalized landscape. (Copyright ©2017 Zeran Zhu all right reserved used by permission). | 29 |

| | |
|--|----|
| Figure 14: Large stone tablet of Sun Yat-sen’s Tomb with the burial information of Dr. Sun. (Copyright ©2017 Zeran Zhu all right reserved used by permission)..... | 30 |
| Figure 15: Location of the three municipal cemeteries (Mt. Hope Cemetery, Evergreen Cemetery, and North Cemetery) of Lansing in Michigan, USA. | 35 |
| Figure 16: Location of the three municipal cemeteries of Lansing in relationship to Michigan State University..... | 36 |
| Figure 17: Location of Mt. Hope Cemetery and Evergreen Cemetery..... | 36 |
| Figure 18: Lawn graveyard in Mt. Hope Cemetery with information signage and private vehicle accessible driveway, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission)..... | 38 |
| Figure 19: Memorial Garden in Mt. Hope Cemetery with wall niche burial and curved pathway, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission). | 38 |
| Figure 20: Wall niche burial in Memorial Garden of Mt. Hope Cemetery, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission). | 39 |
| Figure 21: Small mausoleum of R. E. Olds with stairs in Mt. Hope Cemetery, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission). | 39 |
| Figure 22: Lawn graveyard with private vehicle accessible driveway in Evergreen Cemetery, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission). | 41 |
| Figure 23: Gravestones with special carving of religious symbol, landscape, and portrait in Evergreen Cemetery, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission)..... | 41 |
| Figure 24: Gravestone with portrait, USA flag carving, and memorable in the Little Arlington Veteran Section in Evergreen Cemetery, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission). | 42 |
| Figure 25: Couple grave and gravestones with decorative carvings. (Copyright ©2017 Haoxuan Xu all right reserved used by permission). | 42 |
| Figure 26: Miller Rd entrance driveway to North Cemetery wining uphill with signage stating hours, rules and regulations of the North Cemetery in Lansing, Michigan, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission). | 43 |
| Figure 27: Large Canopy tree covered lawn graveyard with one one obelisk memorial and city view in the back in the North Cemetery, Lansing, Michigan, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission). | 44 |
| Figure 28: Wining driveways in the hilly lawn graveyards in the North Cemetery, Lansing, Michigan, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission). | 44 |

| | |
|--|----|
| Figure 29: Locations of the three public cemeteries (Binhai Guyuan Cemetery, Haiwanyuan Cemetery, and Yongfu Yuanling Cemetery) in Fengxian, Shanghai, China, along Hangzhou bay in relationship to Yancheng, Jingjiang (near Taizhou), and Nanjing. | 46 |
| Figure 30: Locations of the three public cemeteries in Fengxian, Shanghai. | 47 |
| Figure 31: The entrance archway of Binhai Guyuan Cemetery with flying eaves detail, stone carving decorations and mythical lion statues. (Copyright ©2016 Haoxuan Xu all right reserved used by permission). | 49 |
| Figure 32: The decorative wall with Chinese dragon stone carving details in the entrance to create good Fengshui, and huge vintage cooking vessel made with bronze as symbol of honor and dignity in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission). | 49 |
| Figure 33: Pavilion with flying eaves architectural style and miniature mountains that creates scenic view and recreation area along the pond in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission). | 50 |
| Figure 34: Site map of Binhai Guyuan Cemetery with over twenty graveyard sections and wayfinding signage, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission). | 50 |
| Figure 35: Straight bridge, stone hand railings with stone carving details, miniature rock mountains and artificial river in Binhai Guyuan, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission). | 51 |
| Figure 36: Artificial river, waterfall and decorative wall fencing in distance in Binhai Guyuan, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission). | 51 |
| Figure 37: Fountain water feature and pavilions with flying eaves architectural style and site furniture around artificial pond in Binhai Guyuan, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission). | 52 |
| Figure 38: Graveyard with artistic customizable gravestones, brick paving, and large bonsai in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission). | 52 |
| Figure 39: Artistic couple grave with portrait and platform for oblations (fruit, food, and), censer, and metal bucket for burning fake paper money as part of Chinese traditional ritual in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission). | 53 |
| Figure 40: Uniform traditional style graves with arborvitae trees that creates high visual and physical enclosure in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission). | 53 |

| | |
|--|----|
| Figure 41: Veteran’s Memorial Garden with statues of the veterans in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission)..... | 54 |
| Figure 42: Entrance Fengshui Wall with Chinese Dragon Carving and flying eaves architectural style, potted plants, and large digital screen as information board in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission)..... | 54 |
| Figure 43: Entrance Archway of Haiwanyuan Cemetery with flying eaves, Chinese dragon decorations and mythical animal statues in Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission). | 56 |
| Figure 44: Stone and brick sculpture art installation in planting bed in the entrance plaza of Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission)..... | 56 |
| Figure 45: Fengshui Wall with stone carving of ancient human and horse in the entrance plaza of Haiwanyuan Cemetery with fountain sculpture and large Bonsai in Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission)..... | 57 |
| Figure 46: Curved stone paving pathway in graveyard with sculptures and neatly trimmed plant materials and street trees in Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission)..... | 57 |
| Figure 47: Straight bridge with stone pavement and archway element with plaque linking one section of graveyard to the others in Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission)..... | 58 |
| Figure 48: Covered corridor with red architectural elements, medium size rocks, curved flagstone pathway, and white marble hand railings along the river in Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission). | 58 |
| Figure 49: Police Memorial Garden with wall niches, statue of the victims, large rock miniature mountains and pavilion with flying eaves on the top in Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission). | 59 |
| Figure 50: Couple grave with platform and stone eagle statue decoration and arborvitae trees, pond with dolphin fountains, and miniature mountains on the edge in Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission)..... | 59 |
| Figure 51: Family Grave with stairs and platform, grave and bamboo stone carving decoration and white marble elephant sculpture in Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission)..... | 60 |
| Figure 52: Fengshui Wall with Chinese dragon carving and red roof with flying eaves in the entrance plaza of Yongfu Yuanling Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission). | 61 |

| | |
|---|----|
| Figure 53: Small temple with golden statue of Guanyin on the top, large censer in the front, and the statues of monks along the stone paved straight pathway in Yongfu Yuanling Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission)..... | 62 |
| Figure 54: Stone statues of famous ancient scholars along stone paved straight pathway with golden statue of Guanyin in distance in Yongfu Yuanling Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission). | 62 |
| Figure 55: Multiple arched bridges and hand railings with mythical lion decoration connecting to the entrance archway with red roof and flying eaves of Yongfu Yuanling Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission). | 63 |
| Figure 56: Fountain in the entrance plaza of Yongfu Yuanling Cemetery, Shanghai,China. (Copyright ©2017 Aijing Shi all right reserved used by permission). | 63 |
| Figure 57: Zig Zag bridge with stone pavement, white marble hand railing, stone hand railing, stone carving mythical lion decoration, abstract stone carving lotus flower petal decoration and pavilion with red roof and flying eaves. (Copyright ©2017 Aijing Shi all right reserved used by permission)..... | 64 |
| Figure 58: Pagoda style wall niche with censer and mythical lion decoration, pavilion covered couple grave, and red roofed architecture in the back. (Copyright ©2017 Aijing Shi all right reserved used by permission)..... | 65 |
| Figure 59: Location of Yancheng rural ancestral burial ground in Jiangsu Province, China in relationship to Shanghai, China. | 66 |
| Figure 60: Location of Jingjiang rural ancestral burial ground under the administration of Taizhou in Jiangsu Province, China in relationship to Nanjing, Shanghai, and Yancheng, China. | 67 |
| Figure 61: Rural ancestral burial ground of the Ji's consisting multiple bare dirt mound grave with uniform gravestone and headstones in woodland setting in Yancheng, Jiangsu Province, China. (Copyright ©2017 Ziquan Ji all right reserved used by permission). | 68 |
| Figure 62: Another view of the Ji's ancestral burial ground with fresh cut flowers around one individual grave and agricultural field in the background. (Copyright ©2017 Ziquan Ji all right reserved used by permission)..... | 69 |
| Figure 63: Xu's rural ancestral burial ground consisting group of bare dirt mound graves with arborvitae trees in agricultural field facing river. (Copyright ©2017 Aijing Shi all right reserved used by permission). | 70 |
| Figure 64: Another view of the Xu's ancestral burial ground from the back showing the closer view of the bare dirt mounds with square gravestones and plastic decorative flowers on the top pf each mound in the rapeseed field. (Copyright ©2017 Aijing Shi all right reserved used by permission)..... | 70 |

Figure 65: Detail of one grave of the Xu’s ancestral burial ground during the Grave Sweeping Festival showing oblations (food, drink, and candle), fresh cut flowers, thurifications, and burning of paper fake money as part of traditional Chinese ritual. (Copyright ©2017 Aijing Shi all right reserved used by permission). 71

Figure 66: A scatter graph of the relationships among all eleven selected burial sites based on the scores from principal component 1 (Horizontal Axis: Pavilion, Miniature Mountain, and Bridge Dimension) and principal component 2 (Vertical Axis: Censer, Sacred Way, and Fengshui Dimension)..... 96

CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW

1.1 Introduction

Burial sites are common type of landscape that can be seen in all culture, even though people may practice burial and funerary culture differently, and the idea of burial sites may approve differently. Therefore, burial sites can represent local culture and tradition of places. There are many publications on Western burial sites focusing on landscape, environment, and architecture aspects. There are also many publications about Chinese burial ritual and traditional Chinese imperial burial sites. However, there is little publications about Chinese modern burial sites and Chinese rural burial grounds focusing on landscape, environment. And architecture aspects. In addition, there is little publications that compares the burial sites cross culturally using mathematic research strategies.

Thus, in this research burial sites from both Western and Chinese culture located in rural, sub-urban, and urban settings are selected to represent Western and Chinese design philosophies, high light the contrast between traditional and modern designs, and discover the similarities among them. Furthermore, this research is a combination of quantitative research that uses mathematic research method and qualitative research that includes case studies of each study sites.

1.2 Literature Review of Burial Culture

1.2.1 Burial Ritual and Burial Ground Types

1.2.1.1 Purpose of Funerary and Burial Ritual

No matter how culture and tradition differ, or even individuals have different preference; human as a species all desire to do something meaningful about death through funerary and

burial practice (The North American Review, 1841). Deceased bodies always mean something to the living; it is a universal human nature behavior across most cultural traditions throughout human history. According to Thomas Laqueur, “It matters because almost always, the living need the dead more than the dead need the living” (Laqueur, 2011, p. 799). Humans are species who “care for the dead” (Laqueur, 2011, p. 800).

The fact is the deceased body is going to eventually turn into dirt and go back to nature; but the bereaved tends not to accept the dead is forever gone. The bereaved will give the dead meaning and make sure they are “settled safely into the next” through funerary ritual and burial practices (Laqueur, 2011, p. 802). The dead are forever gone, physically, the bereaved will never be able to reach them again; however, the emotions that connect with the dead will not go away with the deceased body. The bereaved need some place for mourning and other emotions, unfortunately “they cannot be sure that the dead are anywhere”, so marked graves are to ensure the bereaved has some place to go for mourning (Laqueur, 2011, p. 804).

1.2.1.2 Cemeteries

There are different types of burial spaces, and not all burial spaces can be called cemeteries. There are special characteristics which identify cemeteries and separates cemeteries from other burial spaces such as “churchyards”, “burial grounds”, and “pantheons” (Rugg, 2000). Burial spaces are likely to change over time, and the changes include the practice of funeral rituals, the significance of burial spaces, landscapes, and ownerships (Rugg, 2000).

Cemeteries are well planned burial spaces emphasize on memorizing the deceased persons’ individual characteristics, therefore there are four factors of cemeteries: accessibility, public concerns, enclosure, individualism, and ownerships (Rugg, 2000).

Accessibility is the most important physical character of cemeteries. Some cemeteries are in forest setting, some are in arboretum setting, and some are in park setting, however, accessibility and visibility are the keys of cemetery location and development (Harvey, 2006). People want easy access to the cemeteries, on the other hand, people are also concerned about the corpse may bring public health concerns; thus, cemeteries are usually located close to populated developments but not within the developments (Rugg, 2000). In the nineteenth century, cemeteries were considered to have potential to cause public health problems (Harvey, 2006). Another reason for outlying cemeteries is cost and profit. Cemeteries are usually relatively large pieces of land that can provide very little municipal revenue, therefore purchasing cheaper land outside of the dense development becomes a way to eliminate cost (Harvey, 2006).

Other than public health concerns, there are also other public concerns and solutions that are established through each community's own acceptances and expectations. For example, the sacredness of the cemeteries is evaluated by each community to meet the agreement of the way people practice funerary and burial rituals and the purpose people in the community give to the cemeteries other than burial spaces (Rugg, 2000). Cemeteries belong to the whole community and belong to individual, because cemeteries offer free choice and individuals can buy pieces of freehold properties in the cemeteries and become partial owner of the cemetery (Laqueur, 2011).

Enclosure gives the sense of place and protection of the spaces. Cemeteries usually have marked boundaries and gateways to establish the size and the edges, which protects the dead from disturbance, separates the dead from the living, and give the space a clear understanding of its unique purposes (Rugg, 2000).

Individualism is greatly manifested in cemeteries. Many physical features are used to enhance the sense of individualism in cemeteries (Rugg, 2000), such as special monuments, designed gravestone, designed landscape, individual information and even wayfinding system to help locate one particular grave. Cemeteries are meant to serve the “complete community” (Rugg, 2000), therefore different individuals share the ownerships of the cemeteries. In general, cemeteries also reveal the community’s expectations on civic pride and spirit; thus, the community will form its own degree of sacredness and acceptance to regulate appropriate ritual practices, activities, and behaviors on the site (Rugg, 2000).

Cemeteries are arts itself (Laqueur, 2011). Other than the four factors of cemeteries, they are, on the other hand, well designed park like landscapes based on the various design principles such as picturesque and naturalness. Other than the burial purpose, cemeteries also serve as “amenity landscape” in cities through their “historic, scenic, and ecological values” (Harvey, 2006). The Oregon Historic Cemetery Association argued that cemeteries are critical spaces for wildlife habitat and refuges for wild and semi wild life; and when cemeteries are well established, they are pleasant spaces for human view corridors and recreation activities such as “coming in and walking, enjoying the grounds, being in a secure area” just like an active greenspace (Harvey, 2006, p. 302).

1.2.1.3 Churchyards, Burial Grounds, and Pantheons

Other forms of burial spaces have their own features and characteristics which distinguish from cemeteries. Churchyards are enclosed area with entrance to demonstrate their purposes and identities, but they are usually located at the center of the developments and settlements instead of just outside the boundaries of dense developments (Rugg, 2000). Churchyards are also smaller in sizes (Rugg, 2000). Other than sizes, compare to cemeteries, another significant physical

difference is that even though churchyards also express social status through locations and special monuments, however, individuality is not obviously celebrated in churchyards (Rugg, 2000). Individual cannot buy pieces of freehold property in churchyards, the church usually retains the “customary right” to the graves, therefore actually churchyards are not places that anyone belong to (Laqueur, 2011). On the other hand, the sacredness of churchyards is usually because of their historical and religious background (Rugg, 2000). One famous churchyard in the USA is the Trinity Church Cemetery in New York, it consists three burial grounds (Trinity Church Wall Street, n.d.). One is the original churchyard located at Wall Street and Broadway; another one is Trinity Church Cemetery and Mausoleum located at upper Manhattan between Broadway and Riverside Drive; the third one is the churchyard of St. Paul’s Chapel (Trinity Church Wall Street, n.d.). They are the only active burial grounds, cemeteries, and mausoleums in Manhattan (Trinity Church Wall Street, n.d.).

Burial grounds have three distinguish characteristics, smaller, a lot more informal, and special distinctive memorials and funerary rituals; in many cases, burial grounds are sacred only to the specific group of people whose family and friends are buried on the site (Rugg, 2000). An example of famous burial ground is the Egyptian Pyramids.

Pantheons are burial spaces with famous people or heroes; and the sacredness of pantheons are only based on the presences of these famous or significant dead (Rugg, 2000). Pantheons attracts many visitors not because of the sorrow for the dead but more for respect and admiring (Rugg, 2000). One of the most famous pantheons in the world is the Panthéon in Paris, France (The Pantheon Paris, n.d.). The façade of the building mimics the Pantheon in Rome, and the dome of the building has similar style as the dome of St. Paul’s Cathedral (The Pantheon

Paris, n.d.). The Panthéon now operates as a secular mausoleum, and Victor Hugo is buried in it (The Pantheon Paris, n.d.).

1.2.2 Western and Chinese Designs

1.2.2.1 Western Picturesque and Chinese Picturesque

The concept of “Picturesque aesthetic” is first suggested by Sir Uvedale Price, who was born in 1747 and died in 1829 (Ballantyne, 1992). There are two schools of thoughts on picturesque. Price and some other artists and scholars believed beauty is something within the object itself (Ballantyne, 1992). On the other hand, another group of poets, artists, and scholars such as Hume and Francis Jeffrey believed that beauty is the perception of human emotion, therefore things are beautiful because people feel they are (Ballantyne, 1992). According to William Gilpin, picturesque is “expressive of that peculiar kind of beauty, which is agreeable in a picture” (Barbier, 1963, p. 98), which means if something can remind someone the work of painter, then it can be understood as picturesque (Ballantyne, 1992). Gilpin believed that picturesque is a “type of beauty” (Ballantyne, 1992).

Even though the term picturesque is used to describe architecture, art, and landscape; and picturesque had significant influence on American architecture in the nineteenth century, the term is more widely used in describing landscape (Maynard, 1997). The idea of picturesque and the rustic scene of picturesque from England are adopted in the United States (Maynard, 1997). The fundamental key principles of picturesque are “irregularity, variety, intricacy, movement, and roughness” (Pierson, 1978, p. 10).

When the concept of picturesque first arrived in the United States, it presented the idea that people can “coexist” with the nature (Maynard, 1997). “Embowerment” is then brought to the American culture under the influence “of the Picturesque and of Romanticism” (Maynard,

1997). The perfect “Picturesque-embowerment” requires the flourish of shrub, vines, and tree canopy to create an irregular rustic vintage looking (Maynard, 1997). There has a strong relationship between the plant material that are used in the picturesque landscape and the people who planted them (Maynard, 1997).

The representative person in the American picturesque landscape is Frederick Law Olmsted, the founder of American Landscape Architecture (FrederickLawOlmsted.com, 2011). Olmsted believed sub-urban and rural picturesque natural landscape can serve the urban population a healthier way of living (FrederickLawOlmsted.com, 2011). He also believed the picturesque landscape can ease the nostalgia people have for the pastoral life before they came to the cities (FrederickLawOlmsted.com, 2011). In order to benefit urban population, Olmsted tried to bring natural landscape as close to people as possible with his picturesque landscape designs (FrederickLawOlmsted.com, 2011).

In China, where Daoism, Buddhism, Taoism and Confucian have significant influence on human behavior which also influences and guides the relationship of human and nature. Confucian tradition believes that human can over dominant nature. However, traditional Daoist and Buddhist teaching believe that human are part of nature; and different from Confucian tradition, Taoism also perceive human and nature are “inseparable”, which have successfully raise the awareness of environmental issue and sustainable development in China (Ellison, 2014).

By comparing and analyzing the traditional landscape paintings of the United States and China, it is obvious to discover the similarity between the American sense of picturesque beauty and Chinese sense of picturesque (Ellison, 2014). Because the underlying concept of picturesque beauty are similar, both two countries are actually preserving the similar natural landscapes

emphasizing the aesthetic and scenic value of the natural landscape instead of their economic values on “ecosystem services” (Ellison, 2014). There is significant “aesthetic appreciation” of landscapes that have picturesque quality in the United States. In the nineteenth century, picturesque beauty was understood as landscape that are “sublime”, “capricious”, and “uncaring natural”, which is undisturbed by human intervention (Ellison, 2014).

Both Western and Chinese traditional landscape paintings are trying to express the “sense of sublime” through natural landscape features such as water, rocks, mountains, extreme weather condition, and wild plant materials (Ellison, 2014). The painters explain the harmony between human and nature by locating human figure or other human development in the sublime looking landscape; in such way, the artists can show the landscape they wish to see and show the relationship between human and nature they wish to have instead of being super realistic (Ellison, 2014). Thomas Cole painted an oil painting in 1836 describes the beauty of natural picturesque landscape, called *View from Mount Holyoke, Northampton, Massachusetts, after A Thunderstorm – The Oxbow* (Ellison, 2014). Thomas Moran also did a painting describing the sublime beauty of landscape in 1872, called *Grand Canyon of the Yellowstone* (Ellison, 2014). In China, where traditional paintings focus on illustrating the picturesque idea of landscapes instead of the realistic scene of the landscape, many paintings present the picturesque quality of mountains and the water (Ellison, 2014). For example, the famous painting called *Nymph of the Luo River* by Gu Kaizhi in the Song Dynasty shows the harmony of between the nymph (human) and the nature landscape (Ellison, 2014).

The idea of picturesque landscape also derived from poetry (Matlock, 2008). In the Western world, there were several poets contributed in the picturesque movement towards landscape architecture, Alexander Pope was one of them (Matlock, 2008). The traditional

Chinese landscape architecture picturesque design principles can also be seen in some ancient Chinese literature; for example, the very famous “peach blossom spring” written by the famous ancient Chinese poet, Yuanming Tao about 1,500 years ago (Chen & Wu, 2009); the literature described a sublime utopian landscape with peach trees along a spring where people live in the village near the spring with their peaceful life.

1.2.2.2 Western and Chinese Landscape Design Principles

Even though there are different design principles and guidelines based on the philosophy of Western culture and Chinese culture, the common approach is towards sustainable development (Chen & Wu, 2009). On the other hand, the idea of capturing picturesque beauty is similar in both Western and Chinese landscape design principles throughout the history, however there are also other differences.

The Western culture, especially American culture often see human has the power to over dominant nature and “have the right and even responsibility” to make nature provide ecosystem services for human (Gu, 1994, p. 1). In other words, the traditional Western sense, human can use “technology and policy” to alter nature for the good of human development (Chen & Wu, 2009). For example, the Western culture often prefer more permanent material for landscape and architecture development, such as stone, brick and marble monuments (Chen & Wu, 2009). Where Chinese culture tends to use materials that can blend with the nature, such as bamboo and wood to demonstrate the sense of harmony between human and nature (Chen & Wu, 2009). However, the Western culture has started to adopt the “Eastern philosophies” on human is part of nature and human must “blend” in the nature (Gu, 1994).

There is a list of major landscape design principle for each culture (Western culture and Chinese culture). The Western design principle list includes: “unity”, “emphasis”

(“focalization”), “balance”, “scale” (“proportion”), “rhythm”, “simplicity” (Motloch, 1991), “time”, “space division” (Crowe, 1981), “contrast” and “variety” (Gu, 1994). “unity” means the sense of “harmony”, which can be expressed by using the same concept repetitively; “emphasis” means the design has “a focal point”; “scale” refers to the size of object in relation to human; “rhythm” can be achieved by “repetition” or “unifies a composition through the recurrence of similar items”; “simplicity” represent the idea of less is more (Gu, 1994); “time” is “a principle unique to landscape design”; “space division” is characterized by “pattern” (Crowe, 1981); “contrast” means “comparing two or more objects or elements so as to show their differences” and “variety” means diversity (Gu, 1994, p. 25).

The Chinese design principles are derived from the three major school of philosophies, which are Taoism, Confucianism, and Buddhism. Taoism and Confucianism arose about the same time around 5th and 6th B.C., and then Buddhism came to China during the Han Dynasty during the first century; despite that Buddhism came from India, both Taoism and Confucianism had significant influence on the Chinese Buddhism culture and philosophy (Gu, 1994).

Confucianism establishes the social norms and responsibilities between individual, family, and society; where Taoism emphasizes the natural, “carefree”, and “romantic” relationship between people and nature (Gu, 1994). The key theory of Taoism is Tao and Yin-yang. Tao literally means the “way of nature and of life” (Gu, 1994, p. 8), and can be concluded as “the law of nature” (Watts, 1975), which is “letting Nature take its own course” (Chan, 1963). The Yin-yang theory explains the world is developed and can be categorized into the “receptive Yin and the creative Yang”; but two parts blends together to reach a stage of equilibrium, which is “unity” and “harmony” (Gu, 1994). Based on the Tao and Yin-yang theories, Taoism philosophy really believes in the “harmony” between human and nature (Gu, 1994).

Chinese landscape and garden was evolved from the ancient “natural hunting grounds for the Imperial family” around two thousand years ago (Gu, 1994, p. 11), however there is no “written theory” on landscape design strategies or principles until the Ming Dynasty around six hundred years ago (Gu, 1994). By analyzing the ancient “written theory” and the Yin-yang theory, modern scholars are able to develop a list of Chinese landscape design principles (Gu, 1994), which are “real and false”, “setting off”, “assembling and spreading”, “unevenness and neatness”, “connecting and separating”, “open and close”, “level and solid”, “ratio and distance of sight”, “directional orientation” and “exposing and concealing” (Chen & Yu, 1986).

In “real and false”, “real” represents the original object, and “false” represents its reflection; “setting off” means the special arrangement of two objects that can enhance the aesthetic of both objects; “assembling and spreading” refers to use the same or similar objects respectively to create a group and continue to spread the same objects into a “horizontal feature”; “unevenness and neatness” means to create both “rustic” or sublime features and “refined” features in order to get the result of harmony; “connecting and separating” means to purposely create some visual access while limit the physical access or vice versa; “open and close” means open bright spaces and enclosed shaded spaces with vertical or overhead structures; “level and solid” means the use of both horizontal wide open plain and vertical elements to reach visual balance and harmony; “ratio and distance of sight” means the enclosure view angle created by vertical elements; “directional orientation” means the garden scene is located at the north of the main building for best quality of view during day time; and “exposing and concealing” means borrowed scene from exterior space or creating mystery by allowing to see part of the next garden scene through some small opening in the current garden scene (Gu, 1994).

Both the West and Chinese design principles share some similarities and differences at the same time. “Unity” and “harmony” are the most common universal design principle in both culture (Gu, 1994). The universal favorite landscape design element in both Western and Chinese culture is water features, and rock features that are favored by Chinese culture are not preferred in Western culture (Gu, 1994).

1.2.2.3 Fengshui

Fengshui is also called geomancy, in Chinese it is derived from two characters, “feng” (wind) and “shui” (water). According to Poulston and Bennet, “Feng shui considers the earth as a living organism”, therefore the earth has its breath (Poulston & Bennett, 2012, p. 24), which is called “qi (气)” in Chinese. The goal of Fengshui is to find the spots in the landscape that has the breath (March, 1968). By Fengshui theory, a place with good Fengshui must be “lively and changeable”, and it does not mean the actual landscape form change in a period of time, but means the diverse experiences people can feel by moving through the place (March, 1968). Fengshui is widely used as guidelines to locate and design “comfortable, attractive, clutter-free and safe buildings...for both practical and aesthetic reasons (Poulston & Bennett, 2012, p. 25). There are many handbooks of Fengshui; and the handbooks are mainly for used for selecting good Fengshui locations for “graves, houses, and smaller sites rather than whole cities” (Meyer, 1978, p. 139). Chinese urban planning is also based on the philosophy of Fengshui, the history of using Fengshui for city planning can be dated back to Changan (Xi’an), the capital of Tang dynasty during 618 to 907 AD as well as the Forbidden City in Beijing (Meyer, 1978).

Fengshui was unaccepted and considered pseudo-science by the Westerners (March, 1968), but now Fengshui is becoming more and more widely accepted by many different cultures other than Chinese culture. For example, the architecture programs in Oregon State University,

Ealing, Hammersmith, and West London College and universities in Singapore offer courses about Fengshui (Poulston & Bennett, 2012). And the design principle of Fengshui can be seen in some western architecture designs, such as the very famous Falling Water in Pennsylvania by Frank Lloyd Wright (Poulston & Bennett, 2012).

Fengshui was initially used for selecting a good location for grave site (Poulston & Bennett, 2012), it is believed that the ancestor buried in a site with good Fengshui can bring protect the descendant from bad or evil spirit and misfortune (March, 1968). The recording of finding good sites for burial using Fengshui principle can be dated back to the Qin dynasty around 210 B.C. in an ancient Chinese book called Zangshu (The Burial Book) (March, 1968).

1.2.2.4 Ancestry Worshiping

The Taoist philosophy advocates the harmonious relationship between human and the nature, while the Confucian philosophy emphasize on the relationship among individual, family and society; therefore, Confucius philosophy and culture “provided a blueprint for honoring ancestors” (Burley, Machemer, & Liu, 2016, p. 41), which becomes the foundation for ancestor worshiping. According to Liu, “Ancestor worship has been a dominant religious form in ancient as well as modern China” (Liu, 1999, p. 602).

Ancestor worship did not derive from the fear of the dead, in fact it arose from respecting life, the dead, and “devotion to human undertaking” for the good of descendants themselves by building up good virtue (March, 1968, p. 264) or like “karma” in Buddhist tradition.

Ancestor worship can be traced back to one of the earliest civilization group in China, the Yangshao culture from 4500 to 4200 B.C. during the Neolithic period (Liu, 1999). One of the most influential ancient mystic ancestor is the Yellow Emperor (Huangdi 黄帝); he is believed as

the common ancestor of all Chinese, and he was worshiped during ancient times and even now (Liu, 1999). People built mausoleum for the Yellow Emperor back in 422 B.C. during the Warring State period, and the mausoleum standing on Mount Qiao is still being maintained today (Liu, 1999).

1.3 Literature Review of Western and Chinese Burial Sites

1.3.1 Western Cemeteries

1.3.1.1 European Cemetery: Pere Lachaise

One of the most famous cemeteries in the world is Pere Lachaise Cemetery in Paris, France. Pere Lachaise, formerly Cimetiere de l'Est, was designed by architect Alexandre Theodore Brongniart (Masson, 1993). He designed the site based on romantic, natural gardens of eighteenth-century design principles of picturesque that can make the most out the location to get the best view overlooking Paris (Masson, 1993). Brongniart planned out major straight allees accompany with large number of curved pathways (Masson, 1993). By doing so, he is able to divide the whole site into sections, which becomes much more manageable to situate each grave or tomb on the grids (Masson, 1993).

According to Thomas Laqueur, Père-Lachaise “very quickly became the symbol of – almost a name for – a kind of burial place that triumphed whatever the new bourgeois civilization of the nineteenth century triumphed or hoped to triumph” (Laqueur, 2011, p. 811). Pere Lachaise became a popular place for visitors, because it was fascinating to see the huge contrast between Pere Lachaise and old-style western burial custom that existed prior to Pere Lachaise in Paris and other European Countries (Masson, 1993). Every other place wants a burial space like Pere-Lachaise, but the cemeteries are not meant to be the exact copy of Pere-Lachaise

instead they are all supposed to have their own unique identities based on the different local context of each place (Laqueur, 2011).

Pere La Chaise is the “predecessor” of Parisian style American cemeteries such as Mount Auburn in Boston established in 1831 and Greenwood Cemetery in Philadelphia established in 1838 (Masson, 1993). Even though the number of monument has increased dramatically in Pere Lachaise, making the cemetery over crowded with monuments, and not much effort has been put on maintaining the picturesque quality of the cemetery (Masson, 1993). Pere Lachaise is in fact always the start of modern rural cemeteries that gives many other English and American cemeteries inspirations on how to design and develop picturesque, nature-oriented environments (Masson, 1993).

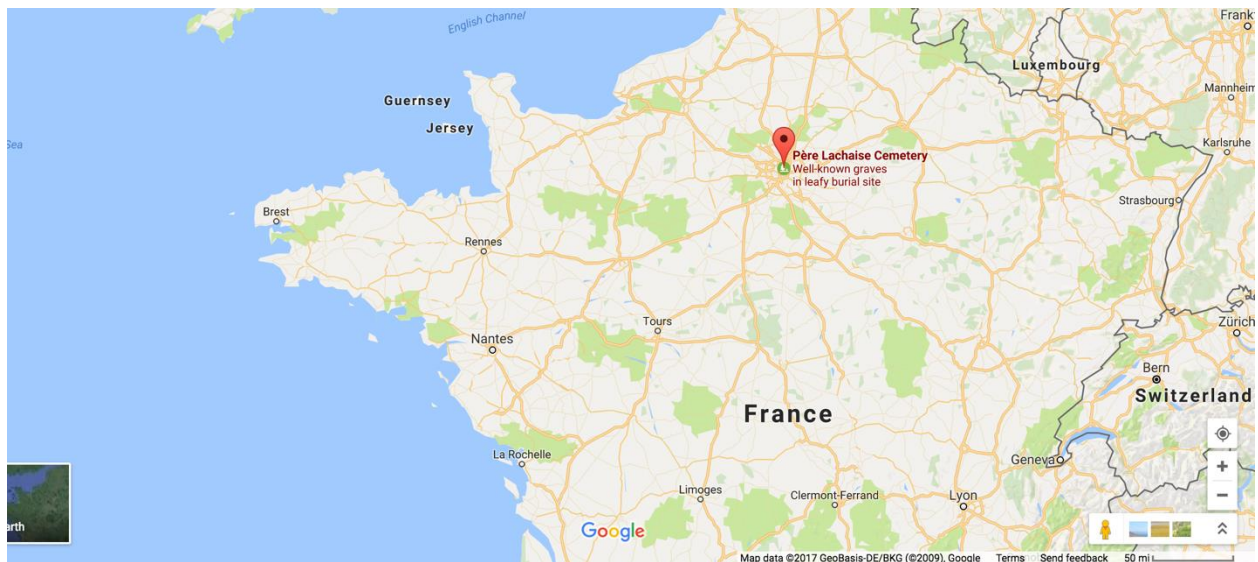


Figure 1: Location of Pere Lachaise Cemetery in Paris, France. (Map data ©2017 GeoBasis-DE/BKG, Google).



Figure 2: The gravesite of Chopin with sculptures, carving portrait of Chopin, fences, and fresh cut flowers from visitors in Pere Lachaise Cemetery, Paris, France. (Copyright ©2005 Jon Bryan Burley all right reserved used by permission).



Figure 3: Gravesite of Joseph Lakanal in Pere Lachaise Cemetery, Paris, France.
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Figure 4: Gravesite of James Douglas Morrison with fresh cut flowers from the visitors in Pere Lachaise Cemetery, Paris, France. (Copyright ©2005 Jon Bryan Burley all right reserved used by permission).

1.3.1.2 American Cemeteries

There were two environmental thoughts in the nineteenth century on whether the existence of open green spaces is the need for utilitarian function or simply nostalgia from rural pastoral life before industrial revolution (Sachs, 2010). The term “cemetery” was not really a common phrase by 1830s (Sachs, 2010). Before cemeteries were well established, people used churchyards as their burial spaces (Sachs, 2010). Eventually, people had a choice to be buried in a well maintained public landscape, which is supposed to be both good for the dead and the

living (Sachs, 2010). In the nineteenth century, “rural cemetery” referred to the type of burial space “located on the outskirts of a city”, that are designed and developed based on picturesque design principles evolved from English gardens, and inspired by the famous Pere-Lachaise in Paris (Bender, 1974). Cemeteries were once viewed as the most characterized “cultural repository”; compare to the old graveyards, cemeteries provide more pleasant welcoming open green spaces, magnificent monuments, and inspirations, which make cemeteries not only places for burial spaces but also active green parks (Masson, 1993). In the burial tradition context, people spend far more money in contemporary funerary and burial ritual and practices than necessary “for the sake of pride, prestige, and vainglory” and it has become some kind of “cemetery art” that become very popular in both Europe and United States (McDowell, 1982, p. 10). In those “empty or nearly empty” cemeteries, many middle-class Americans spend their leisure time and “resorting for pleasure”; this is due to the establishment of the new relationship between “cityscape and landscape” in the accelerating urbanizing America (Bender, 1974).

Mount Auburn, the first rural cemetery in the United States (Bender, 1974), established in 1831 expresses the rural romantic style by using curved pathways and graveyard layouts instead of the straight avenues in Pere Lachaise (Laqueur, 2011). As the first garden style urban cemetery; the cemetery really pushed urban public green space movement and pushed the new way of expressing care to the dead by planting garden materials around the graves (Sachs, 2010). Mount Auburn is designed and developed based on the principle and guidelines of picturesque from European gardens instead of sublime from American wildness (Sachs, 2010). Mount Auburn Cemetery propose the idea that rural cemeteries are much “more comforting” to the bereaved compare to the stuffy environment in city churchyards (Bender, 1974). Mount Auburn became a major tourist attraction during the late 1830s, people came to the cemetery not only to

relax or grief, but also to re-experience their possible new routines on the site such as joy and active behavior (Sachs, 2010).

After Mount Auburn became so successful, people started to build similar cemeteries across the whole country; then the rural park style cemeteries really start the revolution of city public parks, which leads to public concerns such as public health, aesthetics, and equal access to green spaces (Sachs, 2010). Laurel Hill Cemetery was established in 1836 in Philadelphia; Greenwood Cemetery was established in 1838 by New York City in Brooklyn; and several similar rural park style cemeteries were established by 1842 in New England (Sachs, 2010).

In New Orleans, where above ground burial is preferred because of high water table, Parisian style monuments similar to Pere Lachaise are widely used unlike cemeteries in other northern and eastern cities, where underground burial with simpler markers rural park like setting are more widely used (Masson, 1993). There is large amount of high architectural stylized cemeteries in New Orleans (McDowell, 1982). The architecture style of above ground burial attracts large number of visitors through “tombs, monuments, and mausoleums”, which expresses the unique characteristic of “form, function, and artistic tastes” (McDowell, 1982).

Green-Wood Cemetery with its beautiful rural park style in Brooklyn established in 1838 has become a non-profit public institution that preserves the scenic and historical value of the magnificent hillsides (Sachs, 2010) and provides peaceful land for the dead, wonderful green space for the living, and suitable habitat for wildlife.

Even though all the early American rural park style cemeteries are evoked from Pere-Lachaise, they in fact has two different understanding of the relationship between human establishment and nature (Bender, 1974). Pere-Lachaise was built as a garden and given the function of cemetery; the American rural cemeteries are intended to preserve the natural beauty

of the landscape and incorporate the function of cemetery (Bender, 1974). Pere Lachaise is now over crowded with monuments along all the narrow pathways, in such case, the original picturesque beauty has been taken over; the same is true with other Parisian style cemeteries in United States, such as St. Louis cemeteries in New Orleans (Masson, 1993). Many other cemeteries are still being maintained to reach the picturesque beauty, because people continue to “romanticize nature” mimicking the “European romantic convention” under the rapidly urbanizing living environment (Bender, 1974).

1.3.2 Chinese Burial Sites

1.3.2.1 Chinese Wealthy and Imperial Tombs

There is the “archetype” format of all Ming Dynasty and Qing Dynasty Imperial Tombs or Mausoleums, which is a sequence of archway, entrance gates, stone tablet, a bridge, long sacred walkway with mythical creature statues, pillars, a courtyard, main hall, and the actual burial site (Lai, 2007). It was very common for the royalty and the wealthy people to have a long sacred walkway with stone mythical creature statues for their burial grounds before the arrival of the gate to the actual burial spot. There are many old sacred walkways preserved from different dynasties; for example, there is a shared sacred walkway leading to Ming and Qing imperial tombs outside Beijing (Burley, Machemer, & Liu, 2016).

The gravesite of Yellow Emperor located on Mount Qiao was first built during the Han dynasty during 206 B.C. to 220 A.D., then the mausoleum was built during the Tang dynasty during 766 to 779 A.D. also has the similar elements in design. There is an entrance archway, a sacred walkway leads to the actual mausoleum with a few stone steps along with stone mythical creature statues such as the lion like “kirin” (supposed to be one of the sons of the Chinese Dragon), and a stone tablet (Liu, 1999).

The Ming Xiaoling Tomb in the tomb complex was built in the Ming dynasty during 1381 to 1431 AD at the base of Purple & Golden Mountain in Nanjing; it is the tomb of “the first Ming Emperor Zhu Yuanzhang and his Empress Ma.” (Burley, Machemer, & Liu, 2016). The design of the tomb is very “experiential” (Burley, Machemer, & Liu, 2016); there is a series of gateways, buildings, sculptures and walkways to go through before the arrival of the actual burial site. It first comes the “Dismounting Archway”, then “Great Golden Gate”, then “Square City”, then “Sacred Way”, then “Stone Beasts” sculptures, then “Stone Human Figures” statues, then “Stone Watching Pillar”, then “Tablet Hall”, then “Treasure City”, and finally the actual burial site (Burley, Machemer, & Liu, 2016). All these elements are located along the continuous long pathway with formal symmetrical design landscape plant materials on the side. On the top of the “Dismounting Archway”, there are carved ancient Chinese character informing all officials and visitors must dismount at this point to show great respect to the Emperor and the Empress (Burley, Machemer, & Liu, 2016). The “Square City” is an a few stairs raised courtyard area with a tablet listing the achievements and the “virtues” of the Emperor (Burley, Machemer, & Liu, 2016). The “Sacred Way” is a pathway continues about one mile with stone mythical creature statues that can represent the Emperor (Burley, Machemer, & Liu, 2016). During the Ming dynasty, the tomb was guarded by 5,600 soldiers all the time (Burley, Machemer, & Liu, 2016).



Figure 6: Stone Tablet of Ming Xiaoling Tomb with mythical animal statue in between two archways, and stairs with Chinese dragon carving decoration in Nanjing, China. (Copyright ©2008 Jon Bryan Burley all right reserved used by permission).



Figure 7: Stone paved Sacred Way with mythical animal statues along both sides that creates a rectilinear symmetrical layout with high visual and physical enclosure in Ming Xiaoling Tomb, Nanjing, China. (Copyright ©2008 Jon Bryan Burley all right reserved used by permission).



Figure 8: The Dismounting Archway with abstract cloud carving decorations and the uphill stone paved pathway with multiple groups of stairs in Ming Xiaoling Tomb, Nanjing, China. (Copyright ©2008 Jon Bryan Burley all right reserved used by permission).



Figure 9: The three arched bridges connecting to the actual burial site in Ming Xiaoling Tomb, Nanjing, China. (Copyright ©2008 Jon Bryan Burley all right reserved used by permission).

Yuan Shikai's (the first president of the Republic of China) grave adopts the similar design layout pattern of Qing Imperial Mausoleums, which includes a sequence of "stone bridge, ornamental columns, and an epitaph pavilion along the spiritual road, flanked by sculptures of immortal animals and figures, which led to the sacrifice hall and the tomb behind" (Lai, 2007).

Sun Yat-Sen's (the Father of Modern China) Mausoleum located at the Purple Mountain in Nanjing, where the first Ming Emperor (Yuanzhang Zhu) was also buried, was built in the spring of 1929. The two Mausoleums are only one miles apart, and Sun's Mausoleum is 90 yards higher than Ming Mausoleum (Xiaoling Tomb) (Lai, 2007). Sun's Mausoleum used both western modern architecture style and traditional Chinese architecture style, which incorporated both Chinese history and the contemporary modern world (Lai, 2007). Even though Sun's Mausoleum is a modern burial site, it also followed the principle and guidelines of Fengshui, therefore the Mausoleum is built facing south on a hillside (Lai, 2007). Sun's Mausoleum also partially adopts the form of Ming Xiaoling Tomb, which is the sequence of "the archway, the tripartite gate, the pillars, the hall, and even the long stairway that is analogous to the spirit road of an imperial tomb" (Lai, 2007). However, for Sun's Mausoleum, the architect Lu Yanzhi did not use the mythical animal statues and traditional Chinese dragon ornaments because it was considered to be the old Chinese superstition tradition, which does not meet with Sun's modern China wish (Lai, 2007).

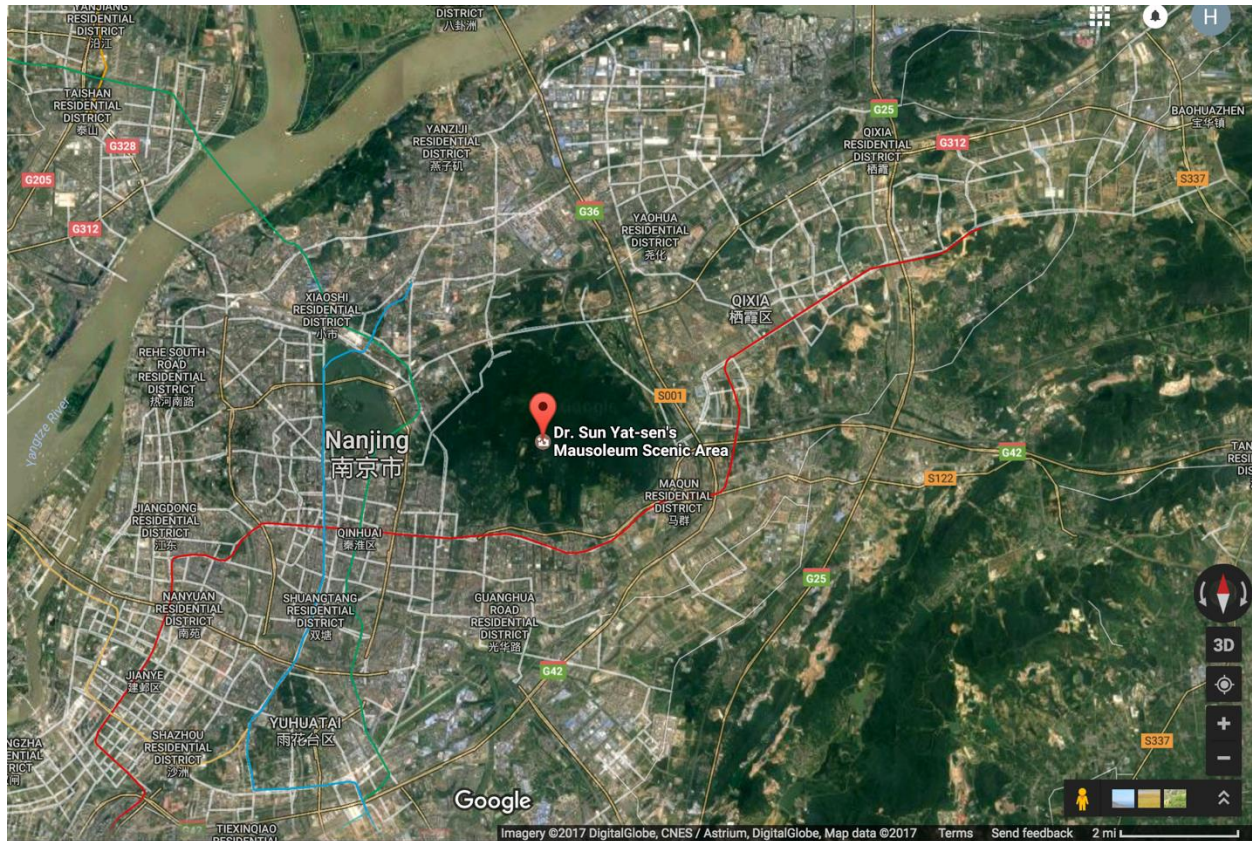


Figure 10: Location of Dr. Sun Yat-sen's Tomb in Nanjing, Jiangsu Province, China. Sun's Tomb is located approximate to Ming Xiaoling Tomb. (Imagery ©2017 DigitalGlobe, CNES / Astrium, DigitalGlobe, Map data ©2017).



Figure 11: Brick paved plaza area of Sun's Tomb in rectilinear symmetrical design with water feature, planting beds, and large stairs. (Copyright ©2017 Zhengwei Wu all right reserved used by permission).



Figure 12: Sacrifice Hall of Sun Yat-sen's Tomb with stone plaque on building, and three archway entrances. (Copyright ©2017 Zeran Zhu all right reserved used by permission).



Figure 13: Dr. Sun Yat-sen's Tomb in rectilinear design with massive stair cases and naturalized landscape. (Copyright ©2017 Zeran Zhu all right reserved used by permission).



Figure 14: Large stone tablet of Sun Yat-sen's Tomb with the burial information of Dr. Sun. (Copyright ©2017 Zeran Zhu all right reserved used by permission).

1.3.2.2 Chinese Traditional Hillside Graves

In the Chinese tradition, it is very important to maintain the ancestral grave sites, (Eng, 1999), which is a burial site with many mount shape graves in family order on hillsides. Even the

traditional rural Chinese graves in the mountain villages try to follow the principle of Fengshui if possible. According to Li, a graveyard with good Fengshui should be located by a mountain, near rivers and with an open view, because good Fengshui will bring good luck to the dead in his or her after life and next life (Li, 1993). In addition, the location or Fengshui of a graveyard determines the fate of the deceased's offspring (Li, 1993).

The people live in the rural villages feel comfortable to leave the ancestral grave sites on the hillsides with no vegetation such as tall grasses to hide them, because they maintained the graves neat and clean to show pride, dignity, and respect (Eng, 1999). The size of the ancestral grave sites can vary depends on the size of the family group.

1.3.2.3 Chinese Public Cemetery

As land becomes scarcer in many Asian cities; cremation has been largely encouraged, and other more sustainable “eco-friendly” form of burials have been evolved, such as “sea and woodland burials” after cremation (Kong, 2012).

Even though cremation is especially encouraged, many people still want grave burial for the urn if they are wealthy enough to afford the cost of the piece of private landscape “as status symbol” (Kong, 2012). At the same time, the practice of Fengshui and other traditional funerary and burial rituals and festivals such as the grave sweeping ceremonies of Qingming Festival (around April 4th), Chongyang Festival (around October 16th) (Kong, 2012), and the Winter Solstice Festival (around December 22nd) are still continuing.

1.4 Integrated Culture of Shanghai, China

Shanghai as one of the most unique city in China was once controlled and colonized by Westerners during late nineteenth century to early twentieth century, therefore the city has adopted complex western integrated culture from Britain, France, United States (Schantz, 2014),

and Germany. The settlement started with British and French, and later the Americans also becomes part of the settlement, and eventually, it evolved into a diverse Shanghai International Settlement operated by Shanghai Municipal Council (Schantz, 2014). Shanghai then became the fifth largest city in the world and “the center of a cosmopolitan cultural space” in 1930’s (Schantz, 2014). The British had the largest influence among all the foreign settlements from both the western world and the eastern world.

As the city grows, the boundaries between Chinese and the westerns disappeared quickly, the “neighborhoods were mixed”, and the “segregation” between all different country residents was weak (Schantz, 2014). A form of cultural, life, and architectural style must be developed to meet the expectation of people with different nationality, different utilitarian purposes, and different aesthetic taste (Schantz, 2014). The unique fusion style quickly evolved in Shanghai to represent its many contrast and harmony between foreign and Chinese, modern and traditional (Schantz, 2014).

1.5 Conclusion and Purpose of Study

The literature reviews the different types of burial sites of both Western World and China, present the brief history of the burial sites, names the famous examples of different burial sites, elaborates the Western and Chinese design principles and philosophies, and describes the uniqueness of Shanghai in its history and culture. However, most of the studies of burial sites are case studies of individual burial site or comparative studies within the similar culture, very little cross cultural quantitative comparative studies are done in this field of study. Besides, most of the studies in the field focus on the funerary and burial ritual instead of the environmental aspects.

Thus, this research will compare the environment, landscape, and architecture aspects of the burial sites cross culturally and find the similarities and differences among them by using a mathematic method called Cluster Analysis. The study sites include four Western cemeteries in Paris and Michigan, three modern public Chinese cemeteries in Shanghai, two traditional Chinese Imperial burial sites in Nanjing, and two rural Chinese ancestral burial grounds in Yancheng and Jingjiang. By comparing these eleven burial sites using Cluster Analysis, the research will be able to identify the measurable variables of these four types of burial sites. Therefore, the study intent of this research is to compare the Western and Chinese burial sites in order to provide understanding of modern Chinese public cemetery designs, especially reveal its relationship with Chinese burial culture and western influence.

The hypothesis of this research is that the modern Chinese public cemeteries in Shanghai are fusion cemeteries that integrates the traditional Chinese design principles, traditional Chinese burial culture, and Western influences, due to the unique local context of Shanghai.

CHAPTER 2: METHODOLOGY

2.1 Study Sites

In this investigation, there are total of eleven sites selected for comparison study; they are Pere Lachaise in Paris, France, three cemeteries (Mt. Hope Cemetery, Evergreen Cemetery, and North Cemetery) in Michigan, USA, three modern Chinese public cemeteries (Binhai Guyuan Cemetery, Haiwanyuan Cemetery, and Yongfu Yuanling Cemetery) in Shanghai, China, two Chinese Imperial burial sites (Ming Xiaoling Tomb, and Sun's Tomb) in Nanjing, China, and two group of rural Chinese burial grounds (Ji's Ancestral graves, and Xu's Ancestral Graves) in Jiangsu Province, China. The comparative analysis uses both secondary information and primary information. The study uses secondary information from literature review for three of the eleven sites, and uses primary field study information for the rest of the eight sites. The information for Pere Lachaise and the two Chinese Imperial burial sites is secondary information learned from published documents. The information of these three sites have been presented in the literature review section. The information of three cemeteries in Michigan, three cemeteries in Shanghai, and the two rural ancestral burial grounds in Jiangsu is primary information collected from field study. In the methodology section below presents the primary information of the eight sites collected from field study.

2.1.1 Michigan Cemeteries

The cemeteries in Michigan established during the nineteenth and twentieth century also follows the basic design principles and meet the standard aesthetic requirements of American rural park style cemeteries. Lansing, as the capital of Michigan has three municipal cemeteries: Mount Hope Cemetery, Evergreen Cemetery, and North Cemetery. These three cemeteries are

selected as study sites due to their easy access for data collection, which can be used to represent the general characteristics of Americans rural park like cemeteries for this particular research.

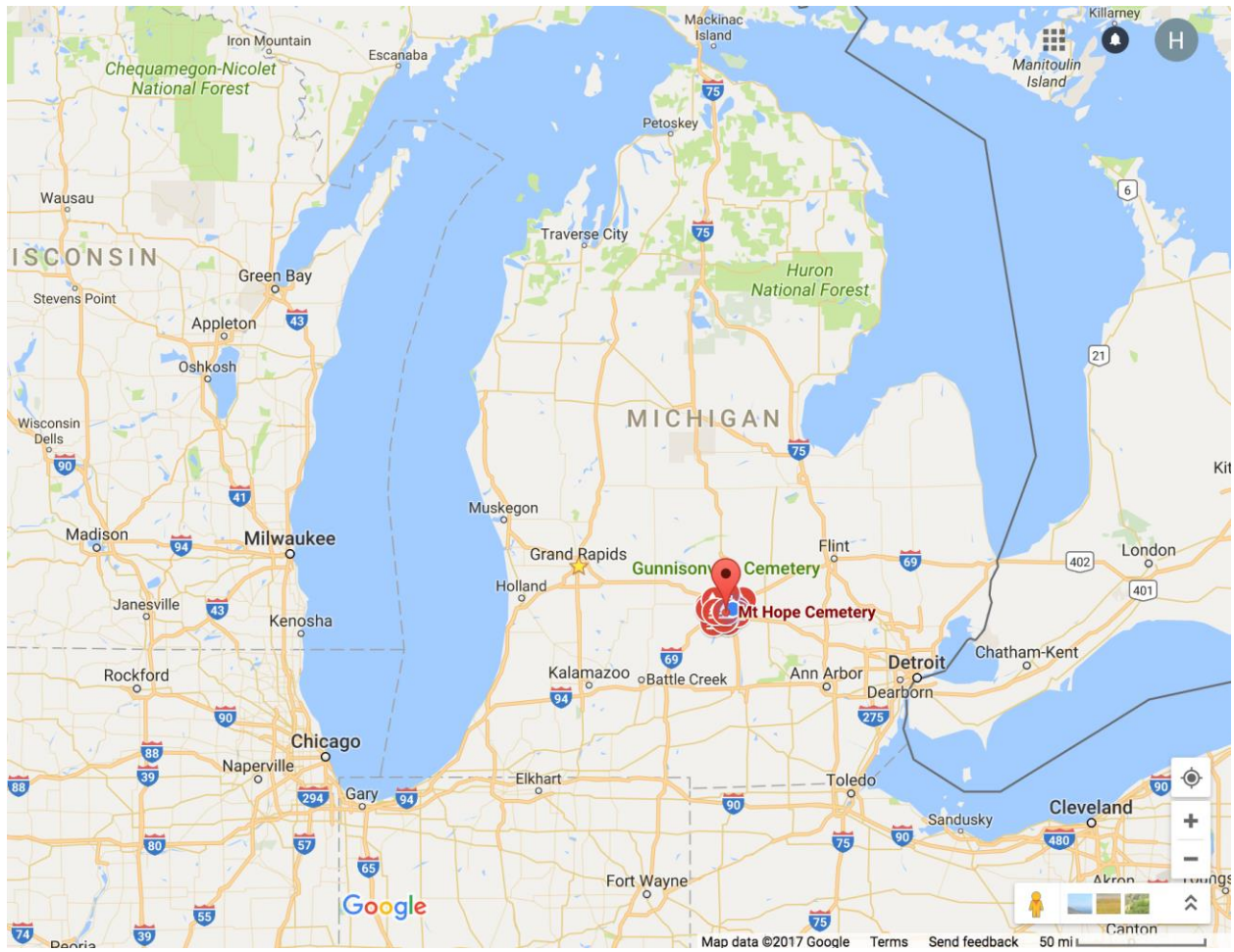


Figure 15: Location of the three municipal cemeteries (Mt. Hope Cemetery, Evergreen Cemetery, and North Cemetery) of Lansing in Michigan, USA. (Map data ©2017 Google).

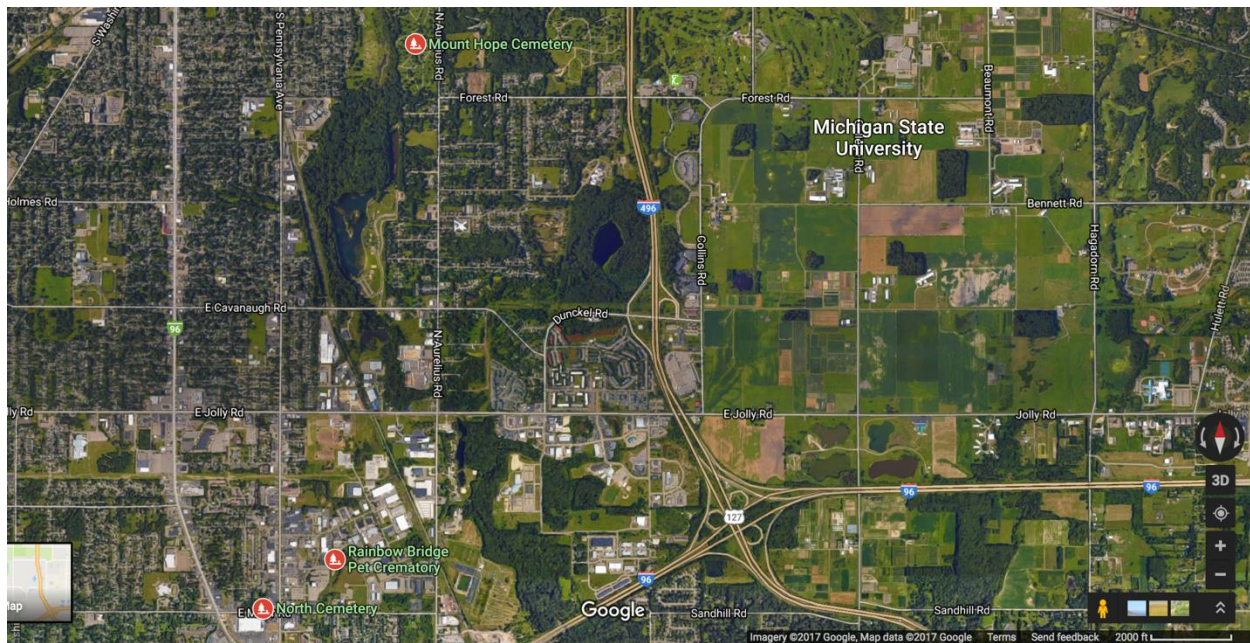


Figure 16: Location of the three municipal cemeteries of Lansing in relationship to Michigan State University. (Imagery ©2017 Google, Map data ©2017 Google).

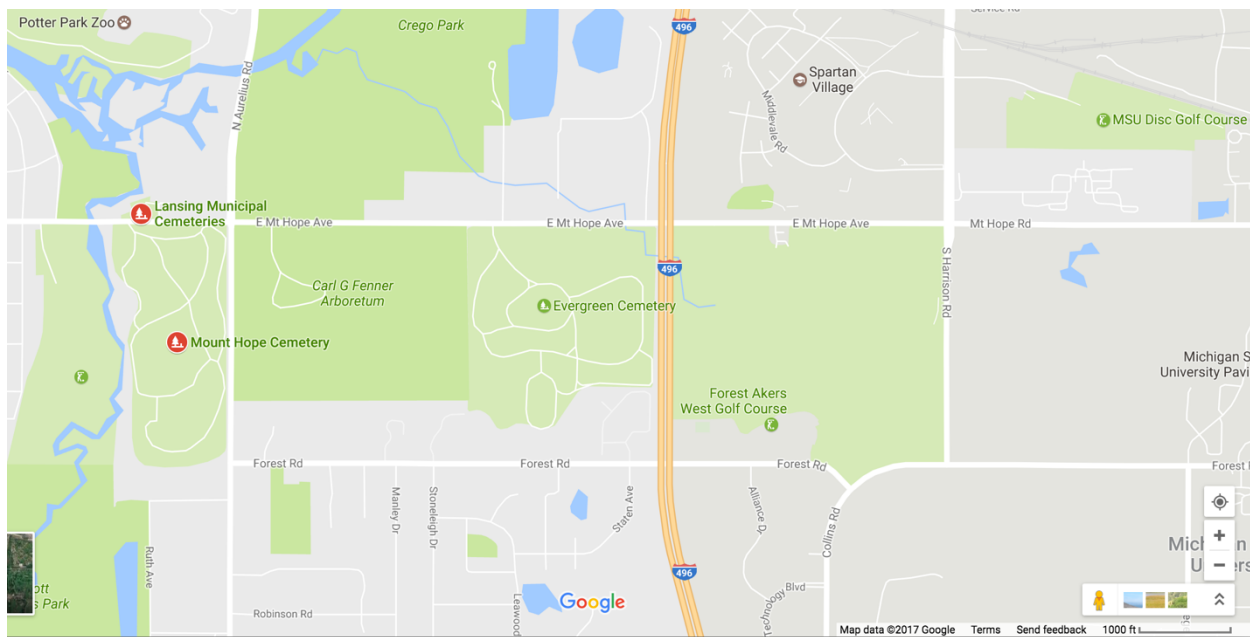


Figure 17: Location of Mt. Hope Cemetery and Evergreen Cemetery. (Map data ©2017 Google).

Mount Hope Cemetery is a medium size cemetery that contains approximately 82 acres of land, and as a municipal cemetery, it is maintained by the city of Lansing (Lindemann, Mt. Hope Cemetery Lansing, Ingham County, 2017). The piece of land was named Millar Farm, and it was purchased from the previous owners John and Rebecca Miller for the cost of \$8,000 on April 3rd, 1871 (Lindemann, Mt. Hope Cemetery Lansing, Ingham County, 2017). On November 28th, 1873, the Cemetery was officially named Mount Hope Cemetery after a cemetery in New York, where many of the pioneers originally came from (Lindemann, Mt. Hope Cemetery Lansing, Ingham County, 2017). The cemetery was opened in 1874, and it is one of the cemeteries that follows the nineteenth century American picturesque design principle. Some gravestones have date information prior to 1874, which means some bodies may be moved and re-buried in Mount Hope Cemetery (Houghtaling, 2006). The cemetery is well maintained to keep its picturesque romantic rural park style. There are many interesting and historical interments, monuments and special sites in the cemetery, for example, the R.E. Olds Mausoleum, the Spanish American and World War I Veteran Memorial garden (Lindemann, Mt. Hope Cemetery Lansing, Ingham County, 2017). The cemetery is fenced, and the only entrance is the white archway entrance gate. There are both winding driveways and small pathways in the cemetery through the hilly lawn burial grounds, which divides the whole site into A-Z twenty-four section. Among all twenty-four sections, section U is the only section that has grave sites available for sale (Lansing Parks & Recreation, n.d.).



Figure 18: Lawn graveyard in Mt. Hope Cemetery with information signage and private vehicle accessible driveway, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission).



Figure 19: Memorial Garden in Mt. Hope Cemetery with wall niche burial and curved pathway, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission).



Figure 20: Wall niche burial in Memorial Garden of Mt. Hope Cemetery, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission).



Figure 21: Small mausoleum of R. E. Olds with stairs in Mt. Hope Cemetery, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission).

Evergreen Cemetery, used to be Tobias Farm, was once owned by Mr. C. Tobias (Lindemann, Evergreen Cemetery Lansing, Ingham County, 2017). However, Mr. Tobias did not have any children, so he deeded the land to his foster son, a young man named Edward (Lindemann, Evergreen Cemetery Lansing, Ingham County, 2017). Edward Banks later sold the land to the City of Lansing in 1922 (Lindemann, Evergreen Cemetery Lansing, Ingham County, 2017). The cemetery has A-P sixteen sections, which is about 104 acres total. Bruce Mckim is the first person who started with the development of Evergreen Cemetery during the first season o 1928 (Lindemann, Evergreen Cemetery Lansing, Ingham County, 2017). Then the development was passed on to Harold Leavitt on April 7, 1928 to finish some of the previous work such as seeding, staking of lots and laying out of water lines for the initial two sections, Section A and Section B (Lindemann, Evergreen Cemetery Lansing, Ingham County, 2017). One of the most noticeable piece in the cemetery is the Little Arlington Memorial established on May 30, 1950. Civilian and military services are conducted starting at 12:00 noon on the Saturday prior to Memorial Day, in order to honor those people who served the country in times of wars (Lindemann, Evergreen Cemetery Lansing, Ingham County, 2017). There are 126 graves in Little Arlington, and 30 marker spaces for Missing in Action memorials or burials of ashes (Lindemann, Evergreen Cemetery Lansing, Ingham County, 2017). The military markers identifying the individual graves reflect a cross-section of service branches, religious faiths and ethnic heritage. There are also both curvy driveway and smaller walkways in the cemetery to create the sense of rural romantic park like layout; however, compare to Mount Hope Cemetery, Evergreen Cemetery is relatively flat instead of hilly.



Figure 22: Lawn graveyard with private vehicle accessible driveway in Evergreen Cemetery, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission).



Figure 23: Gravestones with special carving of religious symbol, landscape, and portrait in Evergreen Cemetery, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission).



Figure 24: Gravestone with portrait, USA flag carving, and memorable in the Little Arlington Veteran Section in Evergreen Cemetery, Lansing, MI, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission).



Figure 25: Couple grave and gravestones with decorative carvings. (Copyright ©2017 Haoxuan Xu all right reserved used by permission).

North Cemetery has only 3.24 acres, which makes it the smallest of three municipal cemeteries in Lansing; however, it is considered the oldest (Lindemann, North Cemetery Lansing, Ingham County, 2017). The cemetery was previously called North Delhi Cemetery before the City of Lansing own the partnership and became the maintenance guardian of the cemetery in 1960, and then it was renamed as North Cemetery (Lindemann, North Cemetery Lansing, Ingham County, 2017). The piece of land was owned by Joshua North, and the original tract of the land was sold to the Delhi Township for \$55 on May 17th, 1852 (Lindemann, North Cemetery Lansing, Ingham County, 2017). The older part located at the south end of the site was limited to the public and only available for the North family and close friends (Lindemann, North Cemetery Lansing, Ingham County, 2017). Today, there no gravesites available for sale to the public and is limited to the persons who already have acquired burial rights privileges through inheritance or transfers of ownership (Lindemann, North Cemetery Lansing, Ingham County, 2017). There are only two curved driveways loop around and couple small driveway in between in the site, but the cemetery is more covered by tree canopy compare to the other two cemeteries discussed earlier.



Figure 26: Miller Rd entrance driveway to North Cemetery wining uphill with signage stating hours, rules and regulations of the North Cemetery in Lansing, Michigan, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission).



Figure 27: Large Canopy tree covered lawn graveyard with one one obelisk memorial and city view in the back in the North Cemetery, Lansing, Michigan, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission).



Figure 28: Wining driveways in the hilly lawn graveyards in the North Cemetery, Lansing, Michigan, USA. (Copyright ©2017 Haoxuan Xu all right reserved used by permission).

2.1.2 Chinese Burial Sites

2.1.2.1 Modern Public Chinese Cemeteries

As discussed earlier in the article, Shanghai is one of the most unique cities in China that incorporated both traditional Chinese culture and Western culture. Shanghai as one of the first cities that absorbed Western influences, has the longest history of using modern philosophies, adapting modern life style, and developing modern aesthetic and utilitarian standards. Therefore, the three newly developed public cemeteries located near the coast of Hangzhou Bay in Fengxian District, Shanghai are selected as study sites, which are Binhai Guyuan Cemetery, Haiwanyuan Cemetery, and Yongfu Yuanling Cemetery. The field trip to the three cemeteries was during December and April which are the times for Chinese traditional Grave Sweeping festivals, therefore there are oblations such as food, drink, flowers, fake paper money, etc. in the front of many graves. And people were practicing thurification and burning fake paper money for the dead as part of traditional Chinese burial and funerary culture.

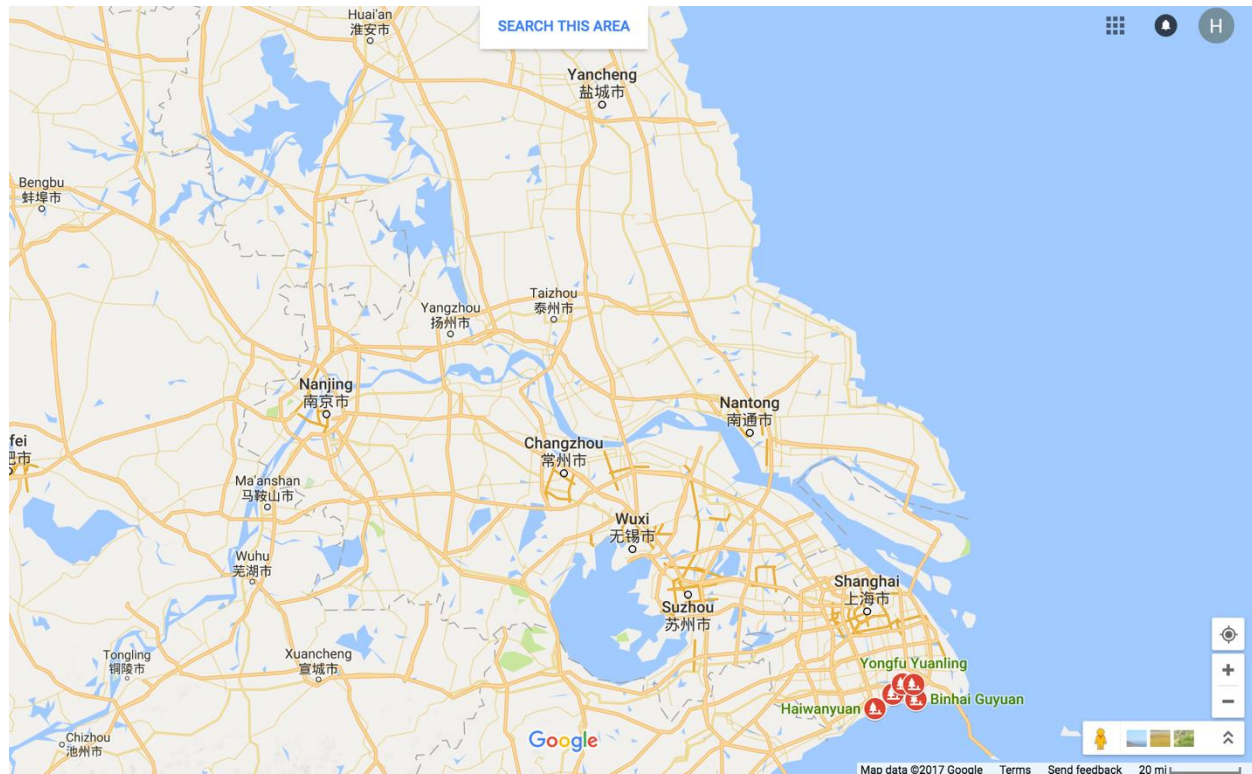


Figure 29: Locations of the three public cemeteries (Binhai Guyuan Cemetery, Haiwanyuan Cemetery, and Yongfu Yuanling Cemetery) in Fengxian, Shanghai, China, along Hangzhou bay in relationship to Yancheng, Jingjiang (near Taizhou), and Nanjing. (Map data ©2017 Google).

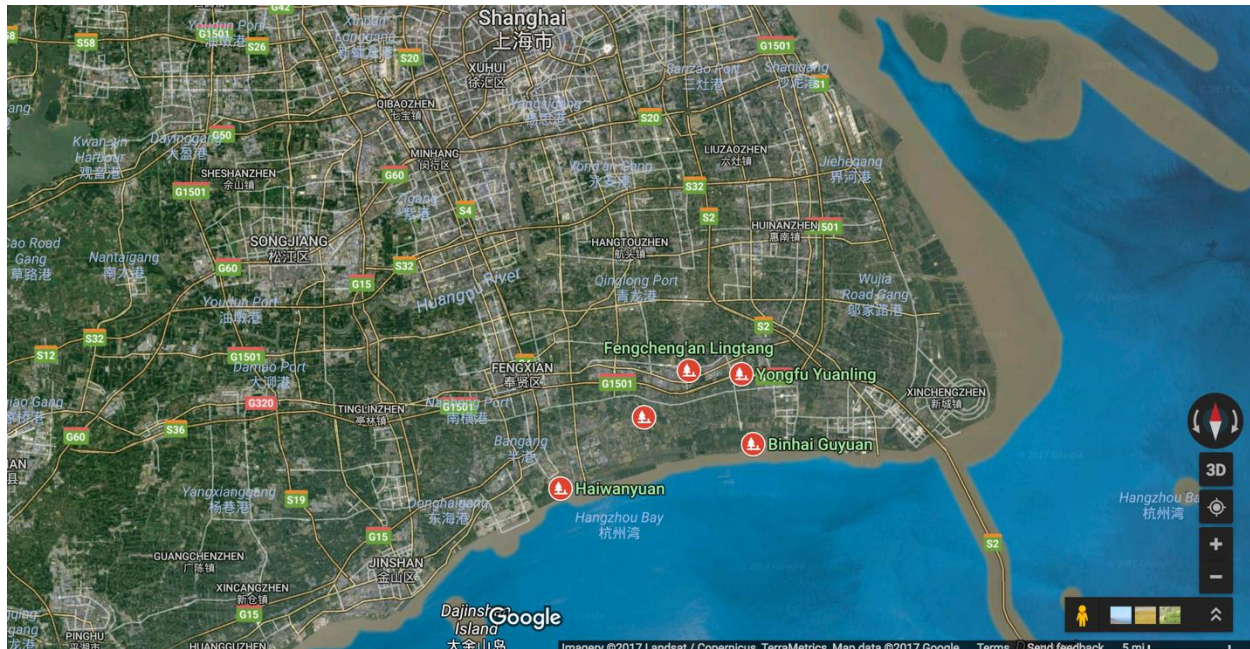


Figure 30: Locations of the three public cemeteries in Fengxian, Shanghai. (Imagery ©2017 Landsat / Copernicus, TerraMetrics, Map data ©2017 Google).

Binhai Guyuan Cemetery, established in March, 1985, is the first national public cemetery in Shanghai; is categorized as Class I Cemetery in Shanghai; is the top ten cemetery in China. The size of the cemetery is about 198 acres; containing 66 acres of parking lots and functional facilities, and 132 acres of burial grounds with designed landscapes. It is located at what is previously Five Four Farm, is ranked as Class I Cemetery in Shanghai. Five Four Farm, established on October 10th, 1954, was the first state-operated farm in Shanghai, which changed underutilized land along the coast of Hangzhou Bay into profitable farming lands. Five Four Farm was named Fengxian Municipal Farm because it is located in Fengxian District; later it was renamed as Five Four Farm after its year of establishment by the Bureau of Agricultural Reclamation of Shanghai in October 1963. The farm was re-developed into Binhai Guyuan Public Cemetery in March 1985. The location of Binhai Guyuan Cemetery has good Fengshui based on Fengshui theory, because it faces south towards Hangzhou Bay with the cityscape in

the back, which use the metaphor of facing a lake with mountains in the back. The famous Shanghai Haiwan National Forest Park is to the west of the cemetery.

The cemetery is divided into multiple section by straight avenue grid forms and curvy winding pathways; each section has its unique emphasis and characteristics. There are more than twenty-five sections in the cemetery, that cover diverse religious beliefs, planting material style, discipline, and function. For example, there is a section of Christian grave yards, Rose Garden section for artists, Wave Garden section for famous people and celebrities, sea-burial memorial section, Purple Bamboo Garden section for teachers and doctors, etc. There are also scenic landscape designs for aesthetic and recreation purposes, such as artificial waterfall, artificial ponds, artificial fountains, bridges, large rocks as sculptures, gazebos, memorial sculptures, etc.

The slogan of Binhai Guyuan Cemetery is “Make the cemetery satisfying for both the dead and the living”; therefore, there are a lot of cultural festival and ceremonies in the cemetery to encourage and promote new sustainable funeral and burial rituals, such as live music ceremony for woodland and sea burial. Customize artistic gravestones and customize landscaping around the gravestone are available for people who are interested in expressing personal identity.



Figure 31: The entrance archway of Binhai Guyuan Cemetery with flying eaves detail, stone carving decorations and mythical lion statues. (Copyright ©2016 Haoxuan Xu all right reserved used by permission).



Figure 32: The decorative wall with Chinese dragon stone carving details in the entrance to create good Fengshui, and huge vintage cooking vessel made with bronze as symbol of honor and dignity in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission).



Figure 33: Pavilion with flying eaves architectural style and miniature mountains that creates scenic view and recreation area along the pond in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission).



Figure 34: Site map of Binhai Guyuan Cemetery with over twenty graveyard sections and wayfinding signage, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission).



Figure 35: Straight bridge, stone hand railings with stone carving details, miniature rock mountains and artificial river in Binhai Guyuan, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission).



Figure 36: Artificial river, waterfall and decorative wall fencing in distance in Binhai Guyuan, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission).



Figure 37: Fountain water feature and pavilions with flying eaves architectural style and site furniture around artificial pond in Binhai Guyuan, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission).



Figure 38: Graveyard with artistic customizable gravestones, brick paving, and large bonsai in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission).



Figure 39: Artistic couple grave with portrait and platform for oblations (fruit, food, and), censer, and metal bucket for burning fake paper money as part of Chinese traditional ritual in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission).



Figure 40: Uniform traditional style graves with arborvitae trees that creates high visual and physical enclosure in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission).



Figure 41: Veteran's Memorial Garden with statues of the veterans in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission).



Figure 42: Entrance Fengshui Wall with Chinese Dragon Carving and flying eaves architectural style, potted plants, and large digital screen as information board in Binhai Guyuan Cemetery, Shanghai, China. (Copyright ©2016 Haoxuan Xu all right reserved used by permission).

Haiwanyuan Cemetery, was originally named as Fengxin Cemetery, it is a profitable public cemetery, established in 1985 and it is also categorized as Class I cemetery in Shanghai. Haiwanyuan Cemetery is located in the Shanghai Fengxian Tourism Development Zone near the Golden Beach with easy public transportation access; it has about 165 acres, consisting service facility, landscaping, various sections of burial grounds, and raw gravestone material factory.

Haiwanyuan Cemetery is a sustainable ecological modern cemetery that consists many rare plant materials and park elements to make pleasant environment and enjoyable experiences. The slogan of Haiwanyuan Cemetery is “Heaven for the Dead, Outdoor Classroom for the Living”. There are fountains, artificial ponds, sculptures, decorative large pillars, and picnic areas.

The different sections of burial grounds have different price ranges and different aesthetic and landscaping styles, can offer diverse choices to people and meet with all different customer’s expectations. There are twelve pre-designed sections with different styles, and one customizable section available for individual customized designs. The major tourist attraction of this cemetery is there are many famous people buried in the cemetery, for example, famous writers Moruo Guo and Lao She, famous artist Mosheng Yao, several famous businessmen and politicians.



Figure 43: Entrance Archway of Haiwanyuan Cemetery with flying eaves, Chinese dragon decorations and mythical animal statues in Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 44: Stone and brick sculpture art installation in planting bed in the entrance plaza of Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 45: Fengshui Wall with stone carving of ancient human and horse in the entrance plaza of Haiwanyuan Cemetery with fountain sculpture and large Bonsai in Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 46: Curved stone paving pathway in graveyard with sculptures and neatly trimmed plant materials and street trees in Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 47: Straight bridge with stone pavement and archway element with plaque linking one section of graveyard to the others in Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 48: Covered corridor with red architectural elements, medium size rocks, curved flagstone pathway, and white marble hand railings along the river in Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 49: Police Memorial Garden with wall niches, statue of the victims, large rock miniature mountains and pavilion with flying eaves on the top in Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 50: Couple grave with platform and stone eagle statue decoration and arborvitae trees, pond with dolphin fountains, and miniature mountains on the edge in Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 51: Family Grave with stairs and platform, grave and bamboo stone carving decoration and white marble elephant sculpture in Haiwanyuan Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).

Yongfu Yuanling Cemetery, established in 1998, is relatively small compare to the other two cemeteries discussed earlier in the article. It has about 82 acres. It is categorized as Class 1 public cemetery as well in Shanghai. The cemetery is proximate to a famous and influential Buddhist temple called Hongfu Temple initially established in 1766 during the Qing Dynasty. Hongfu Temple was relocated in the current location in 1995, and new design kept the original architectures style to mimic the original buildings. During the early stage of the cemetery development, Fengshui was greatly concerned. The developer of Yongfu Yuanling Cemetery invited extremely well respected Fengshui Masters from Taiwan to the site and hired them for involving in the master plan design; therefore, Yongfu Yuanling Cemetery is perfectly designed based on Fengshui theory.

The slogan of Yongfu Cemetery is “Peaceful afterlife for the Decedent, Thriving life for the Descendant”. The landscape design of the cemetery is based on traditional Chinese garden. However, the burial grounds are mainly open lawn with artistic gravestones. There are more than fifteen different sections of burial grounds with distinctive landscape designs; among all the sections, there is also a section called Heaven Garden for Christians. The grave sizes vary from individual grave, couple grave, to large family grave. Some of the graves have vertical built elements to express the owner’s high social statues. The site masterplan also shows general grid form with curvilinear designs in the center landscape garden area. The designed landscape also includes archways, gazebos, artificial lakes and ponds, fountains, bridges, sculptures and statues, and large decorative rock miniature mountains.



Figure 52: Fengshui Wall with Chinese dragon carving and red roof with flying eaves in the entrance plaza of Yongfu Yuanling Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 53: Small temple with golden statue of Guanyin on the top, large censer in the front, and the statues of monks along the stone paved straight pathway in Yongfu Yuanling Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 54: Stone statues of famous ancient scholars along stone paved straight pathway with golden statue of Guanyin in distance in Yongfu Yuanling Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 55: Multiple arched bridges and hand railings with mythical lion decoration connecting to the entrance archway with red roof and flying eaves of Yongfu Yuanling Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 56: Fountain in the entrance plaza of Yongfu Yuanling Cemetery, Shanghai, China. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 57: Zig Zag bridge with stone pavement, white marble hand railing, stone hand railing, stone carving mythical lion decoration, abstract stone carving lotus flower petal decoration and pavilion with red roof and flying eaves. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 58: Pagoda style wall niche with censer and mythical lion decoration, pavilion covered couple grave, and red roofed architecture in the back. (Copyright ©2017 Aijing Shi all right reserved used by permission).

2.1.2.2 Chinese Rural Burial Grounds

The Chinese rural burial grounds, which can also be called as ancestral graves, are the most distinctive form of burial site studied in this research; the Chinese folk funerary and burial ritual have been discussed in many researches, however, the appearance, form, and the particular landscape have not been described in detail in other studies. The rural burial grounds are very informal family oriented burial mounds, and these mounds burial style can only be seen in the rural villages now. The bodies are cremated and the ash is put in the urns, and the urns are buried under the dirt mounds. The mounds are located in family owned woods, hillsides, or agricultural fields. In this research, the two groups of rural burial grounds are described and studied in detail. One group is in the rural village in Yancheng, Jiangsu Province. Another one is in the rural field in Jingjiang, Jiangsu Province.

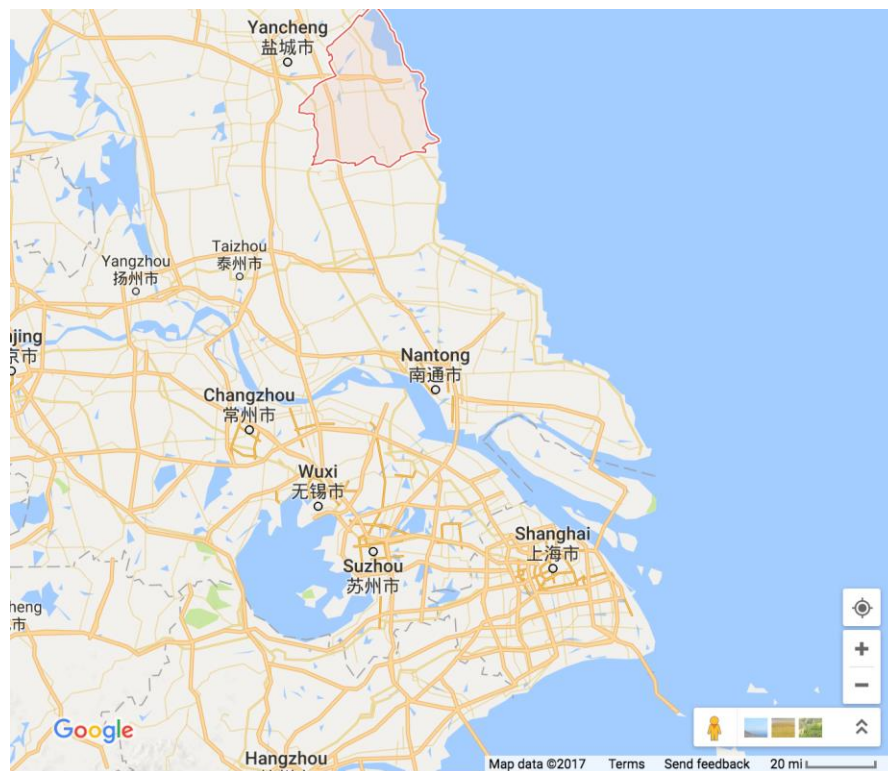


Figure 59: Location of Yancheng rural ancestral burial ground in Jiangsu Province, China in relationship to Shanghai, China. (Map data ©2017 Google).



Figure 60: Location of Jingjiang rural ancestral burial ground under the administration of Taizhou in Jiangsu Province, China in relationship to Nanjing, Shanghai, and Yancheng, China. (Map data ©2017 Google).

The group in Yancheng belongs to the Ji's family, and it is located in woods setting and it is relatively small with about ten small dirt mounds. The mounds rise about three feet tall, and there is a piece of headstone on the top of the mound, and a gravestone in the bottle of each mound. All the headstones and gravestones have the same in appearance with different decedent's' name and dates. There is no planted vegetation around the mounds. People usually bring oblations such as food, drink, flower, fake paper money, etc. to the graves when they visit the graves during the Chinese traditional funerary and burial festivals. However, the time of visiting for this research was not during any of these festivals, so there is no oblation present at the bottom of each mound.

Even though, Fengshui is deeply adopted in Chinese culture, but there is no Fengshui applied in this particular burial site, since it is the only piece of the Ji's family owns, and the fact is unfortunately this piece of land does not meet with the standards of Fengshui. Wealthier families who own more land usually picks a location that has good Fengshui as the family's ancestral burial grounds. However, ordinary peasant family like the Ji's family is not wealthy enough to own many land, therefore, they do not have the opportunity for good Fengshui.



Figure 61: Rural ancestral burial ground of the Ji's consisting multiple bare dirt mound grave with uniform gravestone and headstones in woodland setting in Yancheng, Jiangsu Province, China. (Copyright ©2017 Ziquan Ji all right reserved used by permission).



Figure 62: Another view of the Ji's ancestral burial ground with fresh cut flowers around one individual grave and agricultural field in the background. (Copyright ©2017 Ziquan Ji all right reserved used by permission).

The group in Jingjiang belongs to the Xu's family, and it is in an open agricultural field setting with fields of bright yellow flowering rapeseed (*Brassica napus*). Compare to the Ji's ancestral burial ground, the Xu's is a little bit larger, and it is less hidden. The graves are located along the major pathway in the fields. The graves are still dirt mounds, but they are bigger mounds raised about four to five feet with two cypresses planted on each side of each individual mound. There is a bunch of colorful decorative plastic flower on each mound instead of a piece of headstone. And the gravestones have different styles and have much more formal appearances. The visit to Xu's ancestral graves was during the Grave Sweeping Festival in April, therefore oblations were present at the front of each mound, and people were practicing thurification burning fake paper money for their ancestors.

Fengshui is not strictly applied to Xu's ancestral burial ground either, even though there is small river in front of the Xu's ancestral burial ground and there is a very small local temple

approximate to the site, which brings a little bit of good Fengshui to the graves. The Xu's is wealthier compare to the Ji's, and the Xu's owns a lot more land compare to the Ji's, therefore the Xu's was able to select this particular spot for the ancestral burial ground for its better Fengshui with the water in the front and the temple nearby.



Figure 63: Xu's rural ancestral burial ground consisting group of bare dirt mound graves with arborvitae trees in agricultural field facing river. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 64: Another view of the Xu's ancestral burial ground from the back showing the closer view of the bare dirt mounds with square gravestones and plastic decorative flowers on the top pf each mound in the rapeseed field. (Copyright ©2017 Aijing Shi all right reserved used by permission).



Figure 65: Detail of one grave of the Xu's ancestral burial ground during the Grave Sweeping Festival showing oblations (food, drink, and candle), fresh cut flowers, thurifications, and burning of paper fake money as part of traditional Chinese ritual. (Copyright ©2017 Aijing Shi all right reserved used by permission).

2.1.3 Conclusion

After studying the eleven sites from published documents and on-site field trips, there are many characteristics of the sites are observed. The Western burial sites share many characteristics in common in terms of site layout and design elements, such as the picturesque quality, the site plan, and the memorial types. The three types of Chinese burial sites share some common elements in terms of burial tradition, but overall speaking, the three types are very different in terms of site layout, design principles and site elements. However, the members within the same type are very similar and have many elements in common. Therefore, further statistical analysis is required to compare the eleven selected burials sites, and identify the similarities and differences among them.

2.2 Data Collection

In order to do a cluster analysis for the research to study the sites using mathematical statistical results, the research must generate a data table of elements to be used for statistical analysis. For this research, the elements of all eleven selected cemeteries were chosen based on literature review, site photos, and field study. When reviewing the published documents of Pere Lachaise and the two Chinese imperial burial sites in Nanjing, all the design elements are recorded as candidates of study variables. The same process was done for all the field studies of the other eight sites. Then all the over two hundred candidates are listed in the spread sheet, and categorized into several groups based on their different attributes. The attributes include paving, built structure, plant material, burial element, utility and function, location, design principle and architectural style. Later, in order to eliminate the length of the list to less than one hundred variables, the rare ones and the ones with less noticeable features are excluded from the candidate list.

After the eliminate process, 91 elements (variables) are initially used in the study, later four of the elements were found insignificant for this particular study, therefore was ignored and discarded in the calculation. All these 91 elements have different attributes of different types of pavement, built structures, plants, burial elements, utility and functions, location, design principles, and architectural styles. The following is the list of all 91 variables, and the four with star symbols (Deciduous Tree, Individual Grave, Square Gravestone, and Memorable Element) are the ones discarded:

Table 1: The list of all 91 variables include the four insignificant variables labeled with star symbols.

| | |
|---------------------------------------|----------------------------|
| 1. Brick Pavement | 2. Asphalt |
| 3. Stone Pavement | 4. Special Pattern |
| 5. Compact Soil | 6. Pavilion |
| 7. Gazebo | 8. Main Service Building |
| 9. Ornamental Wall | 10. Metal Sculpture |
| 11. Rock Sculpture | 12. Large Rocks |
| 13. Artificial Miniature Mountain | 14. Waterfalls |
| 15. Pond | 16. Straight Bridge |
| 17. Archway | 18. Entrance Gateway |
| 19. Mythical Animal Statue/Decoration | 20. Zig Zag Bridge |
| 21. Monk/Buddha/Guanyin Statue | 22. Christian Cross |
| 23. Arched Bridge | 24. Stone Tablet |
| 25. Plaque on Building | 26. Sacrifice Hall |
| 27. Public Memorial | 28. Pagoda |
| 29. Bonsai | 30. Street Tree |
| 31. Ornamental Tree | 32. Evergreen Tree |
| 33. Deciduous Tree*** | 34. Flowering Tree |
| 35. Lawn | 36. Bamboo |
| 37. Magnolia | 38. Lotus |
| 39. Boxwood Trimmed Animal Sculpture | 40. Rose |
| 41. Christian Style Graveyard | 42. Bare Dirt Mound |
| 43. Artistic Gravestone | 44. Portrait on Gravestone |
| 45. Individual Grave*** | 46. Family Grave |

Table 1 (cont'd)

| | |
|---|---|
| 47. Couple Grave | 48. Square Gravestone*** |
| 49. Irregular Gravestone | 50. Ornamental Carving/Decoration on Gravestone |
| 51. Grave Sizes Vary with Price | 52. Grave with Platform |
| 53. Stairs to Grave | 54. Pavilion Covered Grave |
| 55. Censer for Thurification | 56. Oblation (Food, Drink, Fake Paper Money) |
| 57. Memorable Elements*** | 58. Headstone |
| 59. Fresh Cut Flower | 60. Obelisk |
| 61. Wall Niche | 62. Small Mausoleum |
| 63. Private Vehicle Access | 64. Electric Trolley Only Driveway |
| 65. Curb and Gutter | 66. Curved Pathway |
| 67. Straight Sacred Pathway | 68. Flower Shop |
| 69. Metal Bucket for Burning | 70. Maintenance Service |
| 71. Public Transportation Access | 72. Wayfinding System |
| 73. Street Light | 74. Flag |
| 75. Graveyard Sections with Different Theme | 76. Sub-urban Location |
| 77. Rural Location | 78. Naturalness |
| 79. High Visual Enclosure | 80. Low Visual Enclosure |
| 81. High Physical Enclosure | 82. Low Physical Enclosure |
| 83. Symmetrical Design | 84. Asymmetrical Design |
| 85. Fengshui | 86. Strict Grid System for Graves |
| 87. Picturesque | 88. Flying Eaves |
| 89. Red Architectural Element | 90. White Marble Hand Railing |
| 91. Stone Carving Architectural Elements | |

2.3 Analysis Techniques

Efficiency is the key to statistical analysis; many analysis techniques are invented to analyze different data with different attributes. Cluster analysis is a simple statistical method usually used to put objects into clusters based on their similarities and differences (Xu, 2015).

For this research, principal component analysis (PCA) must be done prior to cluster analysis. The quintessence of PCA is dimension reduction. Large or high dimension means there

are a lot of variables, elements or features, and it can be very inefficient to study with. Ideally, if the high dimensional data can be represented by fewer dimensional data that has better generalization; then the process of statistical analysis will be a lot more efficient. PCA is an analysis technique that can the goal of transforming high dimensional data into lower dimensional representations of the data. The “smaller set of uncorrelated variables” (Xu, 2015) will show maximum variances.

A statistical analysis software called JMP (Version 13; SAS, 2016) was used for building PCA. By running the data spreadsheet of all the original elements (variables) in JMP (Version 13; SAS, 2016), the report will then show the result table of the PCA of the research consisting the list of principal component (PC) with eigenvalue, corresponding percentage (proportion), cumulative percentage, and differences. The PC with the highest eigenvalue is called first principal component, which shows as PRIN1 in the result table; the PC with the second highest eigenvalue is called second principal component, which shows as PRIN2 in the result table; the rest is sorted by the same manner. Even though the PCA result table will first show the summary plots of all the PCs, however, only the PCs with the eigenvalue greater than 1.0 is considered significant and qualify for further analysis uses. The cumulative percentage shows the percentage of variance that the useful PCs can account for (Xu, 2015).

The JMP (Version 13; SAS, 2016) PCA also presents the table of covariance matrix, which compares the similarity of every two variables. The variables with the closer coefficients are more similar. At the same time, the result also has a table of matrix that shows the relationship between variables and PCs, which are the eigenvector coefficients under each PC that “indicate the correlation” among of the variables in each PC. Again, the similar coefficient means the variables are similar, or vice versa.

Cluster analysis also require means and standard deviations of each variable, in order to calculate standard score of a variable. However, the JMP (Version 13; SAS, 2016) PCA analysis does not show the means and standard deviations, therefore, means and deviations are calculated in Excel spreadsheet. Then there are two equations used for the calculations in cluster analysis. The equations are used by Yiwen Xu (Xu, 2015) for identifying Classical Chinese Gardens verses Modern Chinese Gardens, and are now adopted to exam the Western and Chinese burial sites for this research.

Equation 1:

$$\text{Standard Score of a variable} = \frac{x - x^{\text{mean}}}{SD}$$

Where:

X = Value of Each Variable

x^{mean} = Mean of the Variable

SD = Standard Deviation of the Variable

Equation 2:

$$\text{Cemetery Score} = \left[\left(\frac{x_1 - x_1^{\text{mean}}}{SD_1} \right) k_1 \right] + \left[\left(\frac{x_2 - x_2^{\text{mean}}}{SD_2} \right) k_2 \right] + \dots + \left[\left(\frac{x_{87} - x_{87}^{\text{mean}}}{SD_{87}} \right) k_{87} \right]$$

Where:

X_n = Value of Each Variable

X_n^{mean} = Mean of the Variable

SD_n = Standard Deviation of the Variable

k_n = Principal Component Coefficient of Each Variable

After calculating with Equation 2, each cemetery will have a score under each PC. The final step of cluster analysis is to plot the scatter graph to show the clustering of the cemeteries.

Because PRIN1 and PRIN2 have the highest eigenvalue, so the cemetery scores of principal component one and principal component two are used for plotting graph (Xu, 2015). Scores of principal component one are on horizontal axis, and scores of principal component two are on vertical axis. The two dimensions used for plotting scatter graph can be named after the feature associate variables with the highest absolute value of eigenvector from the PCA results table. The cemeteries can form into several clusters on the scatter graph, and the cemeteries in a cluster means they are more similar compare to the ones in another cluster, or the ones do not belong to any cluster.

CHAPTER 3: RESULTS

In table 2, it displays the existence of the 91 selected elements (variables) in the eleven study burial sites. If the element is present in the burial site; it gets a score of 1; otherwise, it gets a score of 0. Among all the 91 elements (variables), four of them (deciduous Tree, individual grave, square gravestone, and memorable element) are insignificant for this study as discussed earlier, because they are present in all eleven burial sites therefore they all have a score of 1 in the study and is not eligible for PCA.

Table 2: List of burial site elements and existence in eleven burial sites.

| | Western Burial Sites | | | | Chinese Public Cemeteries | | | Chinese Imperial Tombs | | Chinese Rural Burials | |
|-------------------------------|----------------------|----------|-----------|-------|---------------------------|------------|-----------------|------------------------|------------|-----------------------|------------------|
| | Pere Lachaise | Mt. Hope | Evergreen | North | Binhai Guyuan | Haivanyuan | Yongfu Yuanling | Xiaoling Tomb | Sun's Tomb | Yancheng Burial | Jingjiang Burial |
| Brick Pavement | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| Asphalt | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Stone Pavement | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Special Pattern | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| Compact Soil | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| Pavilion | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Gazebo | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Main Service Building | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Ornamental Wall | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| Metal Sculpture | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Rock Sculpture | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Large Rock | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| Artificial Miniature Mountain | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Waterfall | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Pond | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |

Table 2 (cont'd)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Straight Bridge | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| Archway | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Entrance Gateway | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Mythical Animal Statue/Decoration | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Zig Zag Bridge | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Monk/Buddha/Guanyin Statue | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Christian Cross | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Arched Bridge | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Stone Tablet | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Plaque on Building | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Sacrifice Hall | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Public Memorial | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Pagoda | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Bonsai | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Street Tree | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Ornamental Tree | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Evergreen | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| Deciduous | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Flowering Tree | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Lawn | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Bamboo | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Magnolia | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Lotus | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Boxwood Animal Sculpture | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Rose | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Christian Style Graveyard | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Bare Dirt Mound | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Artistic Gravestone | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Portrait on Gravestone | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Individual Grave | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Family Grave | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 |
| Couple Grave | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| Square Gravestone | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Irregular Gravestone | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Ornamental Carving/Decoration on Gravestone | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |

Table 2 (cont'd)

| | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|
| Grave Sizes Vary with Price | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Grave with Platform | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Stairs to Grave | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Pavilion Covered Grave | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Censer | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Oblation (food, drink, fake paper money) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 |
| Memorable Element | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Headstone | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Fresh Cut Flower | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 |
| Obelisk | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wall Niche | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Small Mausoleum | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Private Vehicle Access | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Electric Trolley Only Driveway | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Curb and Gutter | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Curved Pathway | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Straight Sacred Pathway | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Flower shop | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Metal Bucket for Burning | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 |
| Maintenance Service | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Public Transportation Access | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Wayfinding System | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Street Light | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Flag | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Graveyard Sections with Different Theme | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Sub-urban Location | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Rural | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| Naturalness | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| High Visual Enclosure | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| Low Visual Enclosure | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| High Physical Enclosure | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| Low Physical Enclosure | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| Symmetrical Design | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Asymmetrical Design | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 |
| Fengshui | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| Strict Grid System for Graves | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |

Table 2 (cont'd)

| | | | | | | | | | | | |
|--------------------------------------|---|---|---|---|---|---|---|---|---|---|---|
| Picturesque | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 |
| Flying Eaves | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Red Architectural Element | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| White Marble Hand Railings | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Stone Carving Architectural Elements | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |

In order to standardize the variables for running PCA, Equation 1 is used to standardize the variables. First step is to calculate mean and standard deviation of all values using Excel spreadsheet. Second step is to use Equation 1 to calculate the standard score of each variable. The mean and standard deviation of all variables are listed in Table 3, the standard scores of four Western cemeteries are listed in Table 4, and the standard scores of seven Chinese burial sites are listed in Table 5.

Table 3: Means and standard deviation of each variables.

| Variables: | Mean: | Std. Dev. |
|-----------------------------------|-------------|-------------|
| Brick Pavement | 0.454545455 | 0.522232968 |
| Asphalt | 0.454545455 | 0.522232968 |
| Stone Pavement | 0.545454545 | 0.522232968 |
| Special Pattern | 0.363636364 | 0.504524979 |
| Compact Soil | 0.272727273 | 0.467099366 |
| Pavilion | 0.272727273 | 0.467099366 |
| Gazebo | 0.272727273 | 0.467099366 |
| Main Service Building | 0.636363636 | 0.504524979 |
| Ornamental Wall | 0.363636364 | 0.504524979 |
| Metal Sculpture | 0.636363636 | 0.504524979 |
| Rock Sculpture | 0.818181818 | 0.404519917 |
| Large Rock | 0.363636364 | 0.504524979 |
| Artificial Miniature Mountain | 0.272727273 | 0.467099366 |
| Waterfall | 0.272727273 | 0.467099366 |
| Pond | 0.272727273 | 0.467099366 |
| Straight Bridge | 0.363636364 | 0.504524979 |
| Archway | 0.545454545 | 0.522232968 |
| Entrance Gateway | 0.636363636 | 0.504524979 |
| Mythical Animal Statue/Decoration | 0.454545455 | 0.522232968 |

Table 3 (cont'd)

| | | |
|---|-------------|-------------|
| Zig Zag Bridge | 0.272727273 | 0.467099366 |
| Monk/Buddha/Guanyin Statue | 0.272727273 | 0.467099366 |
| Christian Cross | 0.636363636 | 0.504524979 |
| Arched Bridge | 0.272727273 | 0.467099366 |
| Stone Tablet | 0.454545455 | 0.522232968 |
| Plaque on Building | 0.454545455 | 0.522232968 |
| Sacrifice Hall | 0.181818182 | 0.404519917 |
| Public Memorial | 0.545454545 | 0.522232968 |
| Pagoda | 0.181818182 | 0.404519917 |
| Bonsai | 0.272727273 | 0.467099366 |
| Street Tree | 0.818181818 | 0.404519917 |
| Ornamental Tree | 0.818181818 | 0.404519917 |
| Evergreen | 0.636363636 | 0.504524979 |
| Flowering Tree | 0.636363636 | 0.504524979 |
| Lawn | 0.636363636 | 0.504524979 |
| Bamboo | 0.272727273 | 0.467099366 |
| Magnolia | 0.272727273 | 0.467099366 |
| Lotus | 0.272727273 | 0.467099366 |
| Boxwood Animal Sculpture | 0.272727273 | 0.467099366 |
| Rose | 0.363636364 | 0.504524979 |
| Christian Style Graveyard | 0.636363636 | 0.504524979 |
| Bare Dirt Mound | 0.181818182 | 0.404519917 |
| Artistic Gravestone | 0.636363636 | 0.504524979 |
| Portrait on Gravestone | 0.636363636 | 0.504524979 |
| Family Grave | 0.818181818 | 0.404519917 |
| Couple Grave | 0.909090909 | 0.301511345 |
| Irregular Gravestone | 0.636363636 | 0.504524979 |
| Ornamental Carving/Decoration on Gravestone | 0.636363636 | 0.504524979 |
| Grave Sizes Vary with Price | 0.636363636 | 0.504524979 |
| Grave with Platform | 0.636363636 | 0.504524979 |
| Stairs to Grave | 0.727272727 | 0.467099366 |
| Pavilion Covered Grave | 0.636363636 | 0.504524979 |
| Censer | 0.636363636 | 0.504524979 |
| Oblation (food, drink, fake paper money) | 0.454545455 | 0.522232968 |
| Headstone | 0.181818182 | 0.404519917 |
| Fresh Cut Flower | 0.818181818 | 0.404519917 |
| Obelisk | 0.363636364 | 0.504524979 |
| Wall Niche | 0.545454545 | 0.522232968 |
| Small Mausoleum | 0.363636364 | 0.504524979 |

Table 3 (cont'd)

| | | |
|---|-------------|-------------|
| Private Vehicle Access | 0.272727273 | 0.467099366 |
| Electric Trolley Only Driveway | 0.272727273 | 0.467099366 |
| Curb and Gutter | 0.363636364 | 0.504524979 |
| Curved Pathway | 0.636363636 | 0.504524979 |
| Straight Sacred Pathway | 0.454545455 | 0.522232968 |
| Flower Shop | 0.454545455 | 0.522232968 |
| Metal Bucket for Burning | 0.454545455 | 0.522232968 |
| Maintenance Service | 0.818181818 | 0.404519917 |
| Public Transportation Access | 0.545454545 | 0.522232968 |
| Wayfinding System | 0.636363636 | 0.504524979 |
| Street Light | 0.272727273 | 0.467099366 |
| Flag | 0.545454545 | 0.522232968 |
| Graveyard Sections with Different Theme | 0.363636364 | 0.504524979 |
| Sub-urban Location | 0.727272727 | 0.467099366 |
| Rural | 0.363636364 | 0.504524979 |
| Naturalness | 0.454545455 | 0.522232968 |
| High Visual Enclosure | 0.545454545 | 0.522232968 |
| Low Visual Enclosure | 0.909090909 | 0.301511345 |
| High Physical Enclosure | 0.454545455 | 0.522232968 |
| Low Physical Enclosure | 0.909090909 | 0.301511345 |
| Symmetrical Design | 0.545454545 | 0.522232968 |
| Asymmetrical Design | 0.818181818 | 0.404519917 |
| Fengshui | 0.545454545 | 0.522232968 |
| Strict Grid System for Grave | 0.636363636 | 0.504524979 |
| Picturesque | 0.818181818 | 0.404519917 |
| Flying Eave | 0.454545455 | 0.522232968 |
| Red Architectural Element | 0.363636364 | 0.504524979 |
| White Marble Hand Railing | 0.545454545 | 0.522232968 |
| Stone Carving Architectural Element | 0.545454545 | 0.522232968 |

Table 4: Standardized Score of Variables of the Western Cemeteries.

| | Pere Lachaise Cemetery | Mt. Hope Cemetery | Evergreen Cemetery | North Cemetery |
|-----------------|-------------------------------|--------------------------|---------------------------|-----------------------|
| Brick Pavement | 1.04447 | -0.87039 | -0.87039 | -0.87039 |
| Asphalt | -0.87039 | 1.04447 | 1.04447 | 1.04447 |
| Stone Pavement | 0.87039 | -1.04447 | -1.04447 | -1.04447 |
| Special Pattern | -0.72075 | -0.72075 | -0.72075 | -0.72075 |
| Compact Soil | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Pavilion | -0.58387 | -0.58387 | -0.58387 | -0.58387 |

Table 4 (cont'd)

| | | | | |
|-------------------------------------|----------|----------|----------|----------|
| Gazebo | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Main Service Building | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Ornamental Walls | -0.72075 | -0.72075 | -0.72075 | -0.72075 |
| Metal Sculptures | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Rock Sculptures | 0.44947 | 0.44947 | 0.44947 | 0.44947 |
| Large Rocks | -0.72075 | -0.72075 | -0.72075 | -0.72075 |
| Artificial Miniature Mountains | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Waterfalls | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Pond | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Straight Bridge | -0.72075 | -0.72075 | -0.72075 | -0.72075 |
| Archway | 0.87039 | -1.04447 | -1.04447 | -1.04447 |
| Entrance Gateway | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Mythical Animal Statues/Decorations | -0.87039 | -0.87039 | -0.87039 | -0.87039 |
| Zig Zag Bridge | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Monk/Buddha/Guanyin Statue | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Christian Cross | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Arched bridge | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Stone Tablet | -0.87039 | -0.87039 | -0.87039 | -0.87039 |
| Plaque on Building | -0.87039 | -0.87039 | -0.87039 | -0.87039 |
| Sacrifice Hall | -0.44947 | -0.44947 | -0.44947 | -0.44947 |
| Public Memorial | 0.87039 | 0.87039 | 0.87039 | -1.04447 |
| Pagoda | -0.44947 | -0.44947 | -0.44947 | -0.44947 |
| Bonsai | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Street Tree | 0.44947 | 0.44947 | 0.44947 | 0.44947 |
| Ornamental Tree | 0.44947 | 0.44947 | 0.44947 | 0.44947 |
| Evergreens | -1.26131 | 0.72075 | 0.72075 | 0.72075 |
| Flowering Tree | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Lawn | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Bamboo | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Magnolia | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Lotus | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Boxwood Animal Sculpture | 1.55700 | -0.58387 | -0.58387 | -0.58387 |
| Rose | 1.26131 | -0.72075 | -0.72075 | -0.72075 |
| Christian Style Graveyard | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Bare Dirt Mound | -0.44947 | -0.44947 | -0.44947 | -0.44947 |

Table 4 (cont'd)

| | | | | |
|---|----------|----------|----------|----------|
| Artistic Gravestone | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Portrait on Gravestone | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Family Grave | 0.44947 | 0.44947 | 0.44947 | 0.44947 |
| Couple Grave | 0.30151 | 0.30151 | 0.30151 | 0.30151 |
| Irregular Gravestone | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Ornamental Carving/Decoration on Gravestone | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Grave Sizes Vary with Price | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Grave with Platform | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Stairs to Grave | 0.58387 | 0.58387 | 0.58387 | -1.55700 |
| Pavilion Covered Grave | -1.26131 | -1.26131 | 0.72075 | 0.72075 |
| Censer | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Oblation (food, drink, fake paper money) | -0.87039 | -0.87039 | -0.87039 | -0.87039 |
| Headstone | -0.44947 | -0.44947 | -0.44947 | -0.44947 |
| Fresh Cut Flower | 0.44947 | 0.44947 | 0.44947 | 0.44947 |
| Obelisk | 1.26131 | 1.26131 | 1.26131 | 1.26131 |
| Wall Niche | 0.87039 | 0.87039 | 0.87039 | -1.04447 |
| Small Mausoleum | 1.26131 | 1.26131 | 1.26131 | 1.26131 |
| Private Vehicle Access | -0.58387 | 1.55700 | 1.55700 | 1.55700 |
| Electric Trolley Only Driveway | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Curb and Gutter | 1.26131 | -0.72075 | -0.72075 | -0.72075 |
| Curved Pathway | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Straight Sacred Pathway | -0.87039 | -0.87039 | -0.87039 | -0.87039 |
| Flower shop | 1.04447 | -0.87039 | -0.87039 | 1.04447 |
| Metal Bucket for Burning | -0.87039 | -0.87039 | -0.87039 | -0.87039 |
| Maintenance Service | 0.44947 | 0.44947 | 0.44947 | 0.44947 |
| Public Transportation Access | 0.87039 | -1.04447 | -1.04447 | -1.04447 |
| Wayfinding System | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Street Light | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Flag | -1.04447 | 0.87039 | 0.87039 | 0.87039 |
| Graveyard Sections with Different Theme | -0.72075 | -0.72075 | 1.26131 | -0.72075 |
| Sub-urban Location | -1.55700 | 0.58387 | 0.58387 | 0.58387 |
| Rural | -0.72075 | -0.72075 | -0.72075 | -0.72075 |

Table 4 (cont'd)

| | | | | |
|--------------------------------------|----------|----------|----------|----------|
| Naturalness | -0.87039 | 1.04447 | 1.04447 | 1.04447 |
| High Visual Enclosure | 0.87039 | -1.04447 | -1.04447 | -1.04447 |
| Low Visual Enclosure | 0.30151 | 0.30151 | 0.30151 | 0.30151 |
| High Physical Enclosure | 1.04447 | -0.87039 | -0.87039 | -0.87039 |
| Low Physical Enclosure | 0.30151 | 0.30151 | 0.30151 | 0.30151 |
| Symmetrical Design | 0.87039 | -1.04447 | -1.04447 | -1.04447 |
| Asymmetrical Design | 0.44947 | 0.44947 | 0.44947 | 0.44947 |
| Fengshui | -1.04447 | -1.04447 | -1.04447 | -1.04447 |
| Strict Grid System for Graves | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Picturesque | 0.44947 | 0.44947 | 0.44947 | 0.44947 |
| Flying eaves | -0.87039 | -0.87039 | -0.87039 | -0.87039 |
| Red Architectural Element | -0.72075 | -0.72075 | -0.72075 | -0.72075 |
| White Marble Hand Railings | 0.87039 | -1.04447 | -1.04447 | -1.04447 |
| Stone Carving architectural elements | 0.87039 | -1.04447 | -1.04447 | -1.04447 |

Table 5: Standardized Score of Variables of the Chinese Burial Sites.

| | Binhai Guyuan Cemetery | Haivanyuan Cemetery | Yongfu Yuanling Cemetery | Xiaoling Tomb | Sun's Tomb | Yancheng Burial | Jingjiang Burial |
|-----------------------|------------------------|---------------------|--------------------------|---------------|------------|-----------------|------------------|
| Brick Pavement | 1.04447 | 1.04447 | 1.04447 | 1.04447 | -0.87039 | -0.87039 | -0.87039 |
| Asphalt | -0.87039 | 1.04447 | 1.04447 | -0.87039 | -0.87039 | -0.87039 | -0.87039 |
| Stone Pavement | 0.87039 | 0.87039 | 0.87039 | 0.87039 | 0.87039 | -1.04447 | -1.04447 |
| Special Pattern | 1.26131 | 1.26131 | 1.26131 | 1.26131 | -0.72075 | -0.72075 | -0.72075 |
| Compact Soil | -0.58387 | -0.58387 | -0.58387 | 1.55700 | -0.58387 | 1.55700 | 1.55700 |
| Pavilion | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Gazebo | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Main Service Building | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Ornamental Walls | 1.26131 | 1.26131 | 1.26131 | 1.26131 | -0.72075 | -0.72075 | -0.72075 |
| Metal Sculptures | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Rock Sculptures | 0.44947 | 0.44947 | 0.44947 | 0.44947 | 0.44947 | -2.02260 | -2.02260 |
| Large Rocks | 1.26131 | 1.26131 | 1.26131 | 1.26131 | -0.72075 | -0.72075 | -0.72075 |

Table 5 (cont'd)

| | | | | | | | |
|-------------------------------------|----------|----------|----------|----------|----------|----------|----------|
| Artificial Miniature Mountains | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Waterfalls | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Pond | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Straight Bridge | 1.26131 | 1.26131 | 1.26131 | 1.26131 | -0.72075 | -0.72075 | -0.72075 |
| Archway | 0.87039 | 0.87039 | 0.87039 | 0.87039 | 0.87039 | -1.04447 | -1.04447 |
| Entrance Gateway | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Mythical Animal Statues/Decorations | 1.04447 | 1.04447 | 1.04447 | 1.04447 | 1.04447 | -0.87039 | -0.87039 |
| Zig Zag Bridge | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Monk/Buddha/Guan yin Statue | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Christian Cross | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Arched bridge | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Stone Tablet | 1.04447 | 1.04447 | 1.04447 | 1.04447 | 1.04447 | -0.87039 | -0.87039 |
| Plaque on Building | 1.04447 | 1.04447 | 1.04447 | 1.04447 | 1.04447 | -0.87039 | -0.87039 |
| Sacrifice Hall | -0.44947 | -0.44947 | -0.44947 | 2.02260 | 2.02260 | -0.44947 | -0.44947 |
| Public Memorial | 0.87039 | 0.87039 | 0.87039 | -1.04447 | -1.04447 | -1.04447 | -1.04447 |
| Pagoda | -0.44947 | 2.02260 | 2.02260 | -0.44947 | -0.44947 | -0.44947 | -0.44947 |
| Bonsai | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Street Tree | 0.44947 | 0.44947 | 0.44947 | 0.44947 | 0.44947 | -2.02260 | -2.02260 |
| Ornamental Tree | 0.44947 | 0.44947 | 0.44947 | 0.44947 | 0.44947 | -2.02260 | -2.02260 |
| Evergreens | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | 0.72075 |
| Flowering Tree | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Lawn | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Bamboo | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Magnolia | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Lotus | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Boxwood Animal Sculpture | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Rose | 1.26131 | 1.26131 | 1.26131 | -0.72075 | -0.72075 | -0.72075 | -0.72075 |
| Christian Style Graveyard | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Bare Dirt Mound | -0.44947 | -0.44947 | -0.44947 | -0.44947 | -0.44947 | 2.02260 | 2.02260 |
| Artistic Gravestone | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Portrait on Gravestone | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Family Grave | 0.44947 | 0.44947 | 0.44947 | -2.02260 | -2.02260 | 0.44947 | 0.44947 |
| Couple Grave | 0.30151 | 0.30151 | 0.30151 | 0.30151 | -3.01511 | 0.30151 | 0.30151 |
| Irregular Gravestone | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |

Table 5 (cont'd)

| | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|
| Ornamental Carving/Decoration on Gravestone | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Grave Sizes Vary with Price | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Grave with Platform | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Stairs to Grave | 0.58387 | 0.58387 | 0.58387 | 0.58387 | 0.58387 | -1.55700 | -1.55700 |
| Pavilion Covered Grave | 0.72075 | 0.72075 | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 |
| Censer | 0.72075 | 0.72075 | 0.72075 | 0.72075 | 0.72075 | 0.72075 | 0.72075 |
| Oblation (food, drink, fake paper money) | 1.04447 | 1.04447 | 1.04447 | -0.87039 | -0.87039 | 1.04447 | 1.04447 |
| Headstone | -0.44947 | -0.44947 | -0.44947 | -0.44947 | -0.44947 | 2.02260 | 2.02260 |
| Fresh Cut Flower | 0.44947 | 0.44947 | 0.44947 | -2.02260 | -2.02260 | 0.44947 | 0.44947 |
| Obelisk | -0.72075 | -0.72075 | -0.72075 | -0.72075 | -0.72075 | -0.72075 | -0.72075 |
| Wall Niche | 0.87039 | 0.87039 | 0.87039 | -1.04447 | -1.04447 | -1.04447 | -1.04447 |
| Small Mausoleum | -0.72075 | -0.72075 | -0.72075 | -0.72075 | -0.72075 | -0.72075 | -0.72075 |
| Private Vehicle Access | -0.58387 | -0.58387 | -0.58387 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Electric Trolley Only Driveway | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Curb and Gutter | 1.26131 | 1.26131 | 1.26131 | -0.72075 | -0.72075 | -0.72075 | -0.72075 |
| Curved Pathway | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Straight Sacred Pathway | 1.04447 | 1.04447 | 1.04447 | 1.04447 | 1.04447 | -0.87039 | -0.87039 |
| Flower shop | 1.04447 | 1.04447 | 1.04447 | -0.87039 | -0.87039 | -0.87039 | -0.87039 |
| Metal Bucket for Burning | 1.04447 | 1.04447 | 1.04447 | -0.87039 | -0.87039 | 1.04447 | 1.04447 |
| Maintenance Service | 0.44947 | 0.44947 | 0.44947 | 0.44947 | 0.44947 | -2.02260 | -2.02260 |
| Public Transportation Access | 0.87039 | 0.87039 | 0.87039 | 0.87039 | 0.87039 | -1.04447 | -1.04447 |
| Wayfinding System | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Street Light | 1.55700 | 1.55700 | 1.55700 | -0.58387 | -0.58387 | -0.58387 | -0.58387 |
| Flag | 0.87039 | 0.87039 | 0.87039 | -1.04447 | -1.04447 | -1.04447 | -1.04447 |
| Graveyard Sections with Different Theme | 1.26131 | 1.26131 | 1.26131 | -0.72075 | -0.72075 | -0.72075 | -0.72075 |
| Sub-urban Location | 0.58387 | 0.58387 | 0.58387 | 0.58387 | 0.58387 | -1.55700 | -1.55700 |
| Rural | -0.72075 | -0.72075 | -0.72075 | 1.26131 | 1.26131 | 1.26131 | 1.26131 |
| Naturalness | -0.87039 | -0.87039 | -0.87039 | -0.87039 | -0.87039 | 1.04447 | 1.04447 |

Table 5 (cont'd)

| | | | | | | | |
|--------------------------------------|---------|---------|---------|----------|----------|----------|----------|
| High Visual Enclosure | 0.87039 | 0.87039 | 0.87039 | 0.87039 | -1.04447 | 0.87039 | -1.04447 |
| Low Visual Enclosure | 0.30151 | 0.30151 | 0.30151 | -3.01511 | 0.30151 | 0.30151 | 0.30151 |
| High Physical Enclosure | 1.04447 | 1.04447 | 1.04447 | 1.04447 | -0.87039 | -0.87039 | -0.87039 |
| Low Physical Enclosure | 0.30151 | 0.30151 | 0.30151 | -3.01511 | 0.30151 | 0.30151 | 0.30151 |
| Symmetrical Design | 0.87039 | 0.87039 | 0.87039 | 0.87039 | 0.87039 | -1.04447 | -1.04447 |
| Asymmetrical Design | 0.44947 | 0.44947 | 0.44947 | -2.02260 | -2.02260 | 0.44947 | 0.44947 |
| Fengshui | 0.87039 | 0.87039 | 0.87039 | 0.87039 | 0.87039 | -1.04447 | 0.87039 |
| Strict Grid System for Graves | 0.72075 | 0.72075 | 0.72075 | -1.26131 | -1.26131 | -1.26131 | -1.26131 |
| Picturesque | 0.44947 | 0.44947 | 0.44947 | -2.02260 | -2.02260 | 0.44947 | 0.44947 |
| Flying eaves | 1.04447 | 1.04447 | 1.04447 | 1.04447 | 1.04447 | -0.87039 | -0.87039 |
| Red Architectural Element | 1.26131 | 1.26131 | 1.26131 | 1.26131 | -0.72075 | -0.72075 | -0.72075 |
| White Marble Hand Railings | 0.87039 | 0.87039 | 0.87039 | 0.87039 | 0.87039 | -1.04447 | -1.04447 |
| Stone Carving architectural elements | 0.87039 | 0.87039 | 0.87039 | 0.87039 | 0.87039 | -1.04447 | -1.04447 |

After calculating the standard scores of all variables, the data sheet is now ready for running PCA. Then the eigenvalues are listed in Table 6 and the PCA coefficients of all significant variables are listed in Table 7.

Table 6 presents the eigenvalues for the 87 significant elements from the JMP (Version 13; SAS, 2016) software, there are total of ten principal component eigenvalue calculated from the software; however, only the first six have the eigenvalues greater than 1. Therefore, only the first six principal components are eligible for further statistical analysis. The eigenvalues for the first six principal components are later used to calculate principal component coefficient for each variable. The first six principal component makes up 98 percent of the variance; where the first principal component contains 44.982 percent as the primary candidate, and the second principal

component contains 28.559 percent as the secondary candidate for further analysis when plotting cluster analysis scatter graph.

Table 7 presents the coefficients that will be later used in Equation 2 to calculate the standard scores of all eleven burial sites. The variables have the coefficients with the highest absolute values in Principal Component 1 and Principal Component 2 are later used for naming the dimensions used for plotting scatter graph as discussed earlier. And the variables have the coefficients greater than 0.7 and smaller than -0.4 are considered as distinguishable variables, which will be discussed later in the Discussion Chapter.

Table 6: Principal component Analysis eigenvalues of the covariance matrix from JMP (Version 13; SAS, 2016) software.

| Number | Eigenvalue | Percent | Cum Percent | Differences |
|--------|------------|---------|-------------|-------------|
| PRIN1 | 39.1341 | 44.982 | 44.982 | 3715.96 |
| PRIN2 | 24.8467 | 28.559 | 73.541 | 3706.27 |
| PRIN3 | 12.1856 | 14.006 | 87.548 | 3668.22 |
| PRIN4 | 4.8637 | 5.59 | 93.138 | 3605.64 |
| PRIN5 | 3.0877 | 3.549 | 96.687 | 3529.83 |
| PRIN6 | 1.1432 | 1.314 | 98.001 | 3451.23 |
| PRIN7 | 0.7143 | 0.821 | 98.822 | 3370.39 |
| PRIN8 | 0.4983 | 0.573 | 99.395 | 3289.61 |
| PRIN9 | 0.3406 | 0.392 | 99.786 | 3209.25 |
| PRIN10 | 0.1858 | 0.214 | 100 | 3130.07 |

Table 7: Principal component Analysis coefficient for each significant variable from JMP (Version 13; SAS, 2016) software.

| Variables | Prin1 | Prin2 | Prin3 | Prin4 | Prin5 | Prin6 |
|-----------------------|----------|----------|----------|----------|----------|----------|
| Brick Pavement | 0.74751 | -0.39342 | -0.07199 | -0.41937 | 0.31379 | -0.01982 |
| Asphalt | 0.41403 | 0.59595 | -0.07531 | 0.51913 | 0.08559 | 0.00404 |
| Stone Pavement | 0.61274 | -0.62451 | -0.31823 | -0.33708 | -0.12585 | -0.02094 |
| Special Pattern | 0.74705 | -0.53993 | 0.05207 | 0.12321 | 0.36254 | 0.00128 |
| Compact Soil | -0.63589 | -0.47046 | 0.39113 | -0.05125 | 0.46519 | 0.02963 |
| Pavilion | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Gazebo | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Main Service Building | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Ornamental Wall | 0.74705 | -0.53993 | 0.05207 | 0.12321 | 0.36254 | 0.00128 |

Table 7 (cont'd)

| | | | | | | |
|-----------------------------------|----------|----------|----------|----------|----------|----------|
| Metal Sculpture | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Rock Sculpture | 0.62118 | 0.13523 | -0.76737 | 0.07513 | -0.01261 | -0.02618 |
| Large Rock | 0.74705 | -0.53993 | 0.05207 | 0.12321 | 0.36254 | 0.00128 |
| Artificial Miniature Mountain | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Waterfall | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Pond | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Straight Bridge | 0.74705 | -0.53993 | 0.05207 | 0.12321 | 0.36254 | 0.00128 |
| Archway | 0.61274 | -0.62451 | -0.31823 | -0.33708 | -0.12585 | -0.02094 |
| Entrance Gateway | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Mythical Animal Statue/Decoration | 0.58695 | -0.75272 | -0.19594 | 0.20132 | -0.0894 | 0.00012 |
| Zig Zag Bridge | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Monk/Buddha/Guanyin Statue | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Christian Cross | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Arched Bridge | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Stone Tablet | 0.58695 | -0.75272 | -0.19594 | 0.20132 | -0.0894 | 0.00012 |
| Plaque on Building | 0.58695 | -0.75272 | -0.19594 | 0.20132 | -0.0894 | 0.00012 |
| Sacrifice Hall | -0.28707 | -0.70635 | -0.63363 | 0.1222 | -0.04302 | 0.00659 |
| Public Memorial | 0.75706 | 0.41543 | -0.02084 | -0.18474 | -0.02022 | 0.46814 |
| Pagoda | 0.70437 | -0.1721 | 0.25931 | 0.15989 | -0.03938 | 0.00436 |
| Bonsai | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Street Tree | 0.62118 | 0.13523 | -0.76737 | 0.07513 | -0.01261 | -0.02618 |
| Ornamental Tree | 0.62118 | 0.13523 | -0.76737 | 0.07513 | -0.01261 | -0.02618 |
| Evergreen | 0.45402 | 0.48898 | 0.33049 | 0.53918 | 0.04209 | 0.01458 |
| Flowering Tree | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Lawn | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Bamboo | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Magnolia | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Lotus | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Boxwood Animal Sculpture | 0.63238 | -0.01209 | 0.08221 | -0.57921 | -0.09332 | -0.03878 |
| Rose | 0.86442 | -0.08008 | 0.17863 | -0.44688 | -0.09577 | -0.02696 |
| Christian Style Graveyard | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Bare Dirt Mound | -0.62118 | -0.13523 | 0.76737 | -0.07513 | 0.01261 | 0.02618 |
| Artistic Gravestone | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Portrait on Gravestone | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Family Grave | 0.28707 | 0.70635 | 0.63363 | -0.1222 | 0.04302 | -0.00659 |
| Couple Grave | 0.23343 | 0.40026 | 0.42651 | -0.14253 | 0.76148 | 0.00194 |

Table 7 (cont'd)

| | | | | | | |
|---|----------|----------|----------|----------|----------|----------|
| Irregular Gravestone | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Ornamental carving/decoration on Gravestone | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Grave Sizes Vary with Price | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Grave with Platform | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Stairs to Grave | 0.59781 | -0.14726 | -0.57204 | -0.10072 | -0.05986 | 0.5291 |
| Pavilion Covered Grave | 0.51839 | -0.28124 | -0.39163 | 0.52169 | -0.01201 | -0.25609 |
| Censer | 0.10951 | -0.88756 | 0.41245 | 0.14815 | -0.08243 | 0.02111 |
| Oblation (food, drink, fake paper money) | 0.32816 | -0.31032 | 0.88927 | 0.04847 | -0.04631 | 0.01529 |
| Headstone | -0.62118 | -0.13523 | 0.76737 | -0.07513 | 0.01261 | 0.02618 |
| Fresh Cut Flower | 0.28707 | 0.70635 | 0.63363 | -0.1222 | 0.04302 | -0.00659 |
| Obelisk | -0.10951 | 0.88756 | -0.41245 | -0.14815 | 0.08243 | -0.02111 |
| Wall Niche | 0.75706 | 0.41543 | -0.02084 | -0.18474 | -0.02022 | 0.46814 |
| Small Mausoleum | -0.10951 | 0.88756 | -0.41245 | -0.14815 | 0.08243 | -0.02111 |
| Private Vehicle Access | -0.14711 | 0.81533 | -0.30877 | 0.44193 | 0.12979 | 0.00074 |
| Electric Trolley Only Driveway | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Curb and Gutter | 0.86442 | -0.08008 | 0.17863 | -0.44688 | -0.09577 | -0.02696 |
| Curved Pathway | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Straight Sacred Pathway | 0.58695 | -0.75272 | -0.19594 | 0.20132 | -0.0894 | 0.00012 |
| Flower shop | 0.78157 | 0.15909 | 0.08982 | -0.28345 | -0.04875 | -0.51956 |
| Metal Bucket for Burning | 0.32816 | -0.31032 | 0.88927 | 0.04847 | -0.04631 | 0.01529 |
| Maintenance Service | 0.62118 | 0.13523 | -0.76737 | 0.07513 | -0.01261 | -0.02618 |
| Public Transportation Access | 0.61274 | -0.62451 | -0.31823 | -0.33708 | -0.12585 | -0.02094 |
| Wayfinding System | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Street Light | 0.90485 | -0.22984 | 0.32967 | 0.11926 | -0.06269 | -0.00557 |
| Flag | 0.67774 | 0.52368 | 0.0187 | 0.50194 | 0.06001 | -0.00433 |
| Graveyard Sections with Different Theme | 0.80397 | 0.04035 | 0.20206 | 0.27023 | -0.02284 | 0.24946 |
| Sub-urban Location | 0.50913 | -0.02623 | -0.52783 | 0.66702 | 0.02984 | 0.00087 |
| Rural | -0.72822 | -0.67477 | 0.10723 | 0.03774 | -0.02439 | 0.02627 |
| Naturalness | -0.61274 | 0.62451 | 0.31823 | 0.33708 | 0.12585 | 0.02094 |
| High Visual Enclosure | 0.50547 | -0.44689 | 0.22183 | -0.49652 | 0.34291 | -0.01795 |
| Low Visual Enclosure | 0.15172 | 0.54741 | 0.42359 | -0.02141 | -0.70376 | -0.01078 |
| High Physical Enclosure | 0.74751 | -0.39342 | -0.07199 | -0.41937 | 0.31379 | -0.01982 |
| Low Physical Enclosure | 0.15172 | 0.54741 | 0.42359 | -0.02141 | -0.70376 | -0.01078 |
| Symmetrical Design | 0.61274 | -0.62451 | -0.31823 | -0.33708 | -0.12585 | -0.02094 |

Table 7 (cont'd)

| | | | | | | |
|-------------------------------------|---------|----------|----------|----------|----------|----------|
| Asymmetrical Design | 0.28707 | 0.70635 | 0.63363 | -0.1222 | 0.04302 | -0.00659 |
| Fengshui | 0.34784 | -0.80399 | 0.10464 | 0.22028 | -0.10874 | 0.01853 |
| Strict Grid System for Grave | 0.72822 | 0.67477 | -0.10723 | -0.03774 | 0.02439 | -0.02627 |
| Picturesque | 0.28707 | 0.70635 | 0.63363 | -0.1222 | 0.04302 | -0.00659 |
| Flying Eave | 0.58695 | -0.75272 | -0.19594 | 0.20132 | -0.0894 | 0.00012 |
| Red Architectural Element | 0.74705 | -0.53993 | 0.05207 | 0.12321 | 0.36254 | 0.00128 |
| White Marble Hand Railing | 0.61274 | -0.62451 | -0.31823 | -0.33708 | -0.12585 | -0.02094 |
| Stone Carving Architectural Element | 0.61274 | -0.62451 | -0.31823 | -0.33708 | -0.12585 | -0.02094 |

Then, the burial scores of all eleven selected sites can be calculated with Equation 2 explained earlier in the Methodology section of the article, using variable value (0 or 1 from Table 2), means (from Table 3), standard deviations (from Table 3), and principal component coefficients (from Table 7). The scores of all eleven burial sites in principal component 1 to 6 are listed in table 8. The example calculation illustrates how the calculation is done with Equation 2; the score of Pere Lachaise Cemetery in Principal component 1 can be calculated as:

$$\begin{aligned}
 \text{Cemetery Score} &= \left[\left(\frac{x_1 - x_1^{\text{mean}}}{SD_1} \right) k_1 \right] + \left[\left(\frac{x_2 - x_2^{\text{mean}}}{SD_2} \right) k_2 \right] + \dots + \left[\left(\frac{x_{87} - x_{87}^{\text{mean}}}{SD_{87}} \right) k_{87} \right] \\
 &= \left[\left(\frac{1 - 0.45454545}{0.52223} \right) \times 0.7451 \right] + \left[\left(\frac{0 - 0.45454545}{0.52223} \right) \times 0.41403 \right] + \dots + \\
 &\quad \left[\left(\frac{1 - 0.54545454}{0.52223} \right) \times 0.61274 \right] = 5.26977546
 \end{aligned}$$

Table 8: Burial Sites Scores in First Six Principal components.

| | PRIN1 Score | PRIN2 Score | PRIN3 Score | PRIN4 Score | PRIN5 Score | PRIN6 Score |
|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Pere Lachaise Cemetery | 5.270 | 16.636 | -7.782 | -13.675 | -0.588 | -0.126 |
| Mt. Hope Cemetery | -9.286 | 32.211 | -5.966 | 2.352 | 0.618 | 1.482 |
| Evergreen Cemetery | -6.665 | 31.733 | -6.342 | 3.922 | 0.5481 | 1.469 |
| North Cemetery | -10.941 | 30.682 | -5.266 | 3.767 | 0.706 | -2.946 |
| Binhai Guyuan Cemetery | 53.896 | -9.3774 | 5.982 | -0.437 | -0.412 | -0.050 |

Table 8 (cont'd)

| | | | | | | |
|--------------------------|---------|---------|---------|--------|--------|--------|
| Haiwanyuan Cemetery | 56.430 | -8.662 | 6.479 | 0.953 | -0.346 | -0.031 |
| Yongfu Yuanling Cemetery | 55.076 | -8.636 | 6.303 | 2.193 | -0.146 | 0.052 |
| Xiaoling Tomb | -17.902 | -41.010 | -15.563 | 0.314 | 6.552 | 0.037 |
| Sun's Tomb | -27.543 | -29.986 | -15.670 | 2.090 | -7.090 | -0.007 |
| Yancheng Rural Burial | -49.467 | -6.939 | 18.698 | -1.960 | 0.470 | 0.011 |
| Jingjiang Rural Burial | -48.869 | -6.653 | 19.128 | 0.482 | -0.312 | 0.110 |

CHAPTER 4: DISCUSSION

4.1 Scatter Graph and Distinguishable Variables

After all the burial site scores are calculated, the final step of the statistical analysis is to plot scatter graph of the calculation results. Scatter graph is the final step of cluster analysis that plots results into visually identifiable clusters. Since the first two principal component can already account for 73 percent of the variance of the study, the study will use the scores in the first two principal components as representatives for further analysis. Therefore, the scores in principal component 1 and principle 2 are used to plot the scatter graph, where the scores in principal component 1 are plotted on horizontal axis, and the scores in principal component 2 are plotted on vertical axis. As discussed earlier, the two dimensions can be named after the distinguishable variables, which are the variables with the high absolute value of coefficients in Principal Component 1 and Principal Component 2. Therefore, the Principal Component 1 dimension can be named as the “Pavilion, Miniature Mountain, and Bridge Dimension”. Principal Component 2 dimension can be named as the “Censer, Sacred Way, and Fengshui Dimension”. And according to the scatter graph show in figure 62, the result already clearly reveals calculation results in clusters; thus, the study can use the scatter graph of scores in the first two principal components as representatives for further analysis and explanations.

The scatter graph in figure 62 shows that the eleven burial sites can are distributed into four clusters. When looking at the “Pavilion, Miniature Mountain, and Bridge Dimension”, the eleven burial sites can be divided into positive and negative ranges. There are four burial sites in the positive range, which are Pere Lachaise Cemetery, Binhai Guyuan Cemetery, Haiwanyuan Cemetery, and Yongfu Yuanling Cemetery. The rest of the burial sites are all in the negative range, which are Mt. Hope Cemetery, Evergreen Cemetery, North Cemetery, Yancheng Burial,

Jingjiang Burial, Xiaoling Tomb, and Sun's Tomb. Thus, principal component 1 can be used to analyze the relationships among all these burial sites considering the differences and similarities within culture and cross culture. The “Censer, Sacred Way, and Fengshui Dimension” divides the eleven burial sites into two groups. All the Western burial sites are in the positive range of the vertical axis, where all the Chinese burial sites are in the negative range of the vertical axis. Therefore, principal component 2 can be used to identify the differences between the Western burial sites and the Chinese burial sites.



Figure 66: A scatter graph of the relationships among all eleven selected burial sites based on the scores from principal component 1 (Horizontal Axis: Pavilion, Miniature Mountain, and Bridge Dimension) and principal component 2 (Vertical Axis: Censer, Sacred Way, and Fengshui Dimension).

The distinguishable variables that has coefficients greater than 0.7 and smaller than -0.4 in Principal Component 1 are listed in Table 9. The distinguishable variables that has coefficients greater 0.7 and smaller than -0.4 in Principal Component 2 are listed in Table 10. These distinguishable variables are what make the burial sites score very high or very low, which make the burial sites spread into clusters based on the two dimensions.

Table 9: List of distinguishable variables in Principal Component 1.

| Coefficient Greater than 0.7 | Coefficient Smaller than -0.4 |
|-------------------------------|-------------------------------|
| Brick Pavement | Compact Soil |
| Special Pattern Paving | Bare Dirt Mound |
| Pavilion | Headstone |
| Gazebo | Rural Location |
| Main Service Building | Naturalness |
| Ornamental Wall | |
| Metal Sculpture | |
| Large Rock | |
| Artificial Miniature Mountain | |
| Waterfall | |
| Pond | |
| Straight Bridge | |
| Entrance Gateway | |
| Zig Zag Bridge | |
| Monk/Buddha/Guanyin Statue | |
| Christian Cross | |
| Arched Bridge | |
| Public Memorial | |
| Pagoda | |
| Bonsai | |
| Flowering Tree | |
| Lawn | |
| Bamboo | |
| Magnolia | |
| Lotus | |
| Rose | |
| Christian Style Graveyard | |
| Artistic Gravestone | |

Table 9 (cont'd)

| | |
|--|--|
| Portrait on Gravestone Irregular Gravestone Ornamental Carving/Decoration on Gravestone Grave Size Vary with Price Grave with Platform Wall Niche Electric Trolley Only Driveway Curb and Gutter Curved Pathway Flower shop Wayfinding System Street Light Graveyard Sections with Different Theme High Physical Enclosure Strict Grid System for Grave Red Architectural Element | |
|--|--|

Table 10: List of distinguishable variables in Principal Component 2.

| Coefficient Greater than 0.7 | Coefficient Smaller than -0.4 |
|--|---|
| Family Grave Fresh Cut Flower Obelisk Small mausoleum Private Vehicle Access Asymmetrical Design Picturesque | Stone Pavement Special Pattern Paving Compact Soil Ornamental Wall Large Rock Straight Bridge Archway Mythical Animal Statue/Decoration Stone Tablet Plaque on Building Sacrifice Hall Censer Straight Sacred Pathway Public Transportation Access Rural Location High Visual Enclosure Symmetrical Design Fengshui Flying Eave |

4.2 Comparison of Burial Sites and Burial Site Elements

The most obvious differences between Western and Chinese burial sites is that the four Western cemeteries have similar scores, where the Chinese burial sites scored differently and dividing them into three groups. The Western cemeteries scored similarly, meaning they are similar in their environmental, landscape, and architectural style even though they are different in sizes and location. Within the Western Cemetery group, the three American cemeteries in Michigan are clustered relatively closer to each other, showing the three Michigan cemeteries are even more similar and on the other hand, the Pere Lachaise Cemetery in Paris is relatively different. This phenomenon can be explained with previous literature review information. Pere Lachaise is the parent of American rural romantic style cemeteries, which means the American cemeteries adopted the design of Pere Lachaise with some American modifications to suit the American society better with distinguishing American history, culture, taste, preference, and functions. The major differences between Pere Lachaise and the three Michigan cemeteries is that the three Michigan cemeteries are much more simple and open with less design elements and features. For example, the Michigan cemeteries have much simpler pavement style, less architectural elements such as stone archway, and less complex plant material composition.

The Chinese burial sites are divided into three groups; where the three Chinese public cemeteries in Shanghai are clustered very close to each other, the two Chinese rural ancestral graveyards are clustered very close, and the two Chinese imperial tombs are clustered relatively close, but apparently not as close as the members of the other groups. This is an interesting phenomenon because the result shows even though these seven sites are all Chinese burial sites, they are developed and influenced by different historical social and cultural background, school of philosophies, and resource limitations. The three public cemeteries in Shanghai scored very

high in principal component 1 because the three sites had all the positive coefficient and they do not associate with any negative coefficient elements in principal component 1. The two rural ancestral graveyards are the total opposite of the public cemeteries in Shanghai; the rural ancestral graveyards included all the negative coefficient elements but have very little association with the positive coefficient elements in principal component 1. The two Chinese imperial tombs are relatively different. They have the similar structure as imperial tombs, such as the stairs, the symmetrical design, the sacrifice hall, the stone animal statues, and the stone tablet; but they are also significantly influenced by different social context within the particular time frame. The Xiaoling Tomb is a classical example of traditional Chinese imperial tombs for emperors. On the other hand, Sun's Tomb is relatively a modern design for imperial tomb due to the characteristics of Sun. Sun is the founding father of the modern China; so, the design of Sun's Tomb follows the wishes of Sun, which is towards Western-influenced modern design. Therefore, the design of Sun's Tomb still follows the classical structure of an imperial tomb, but it purposely avoided many symbolisms that are used in traditional royal Chinese imperial tomb designs as the representative of rejecting the old feudal society.

After discussing the broader differences and similarities among all these eleven burial sites, the focus of the discussion is to discuss the similarities and differences of the three public cemeteries in Shanghai as compare to the other eight burial sites in the study to provide a better understanding of the design and development of the modern Chinese public cemetery.

The modern Chinese public cemeteries are unique existence; because they are where the Chinese traditional landscape designs and Western influences fuse together. These three cemeteries are very similar, which share the same design layout, design elements, and concepts. Generally speaking, they are carefully designed with Chinese traditional landscape and garden design

principles with various landscape and architecture elements can be seen in traditional Chinese gardens to enhance the beauty of the site and to create a place for not only mourning but also joy, such as miniature mountain and waterfall, decorative walls, gazebos, bonsai, pond, zig zag bridges, etc. The design of the three public cemeteries also strictly follows the principle of Fengshui, which is the primary design principle of the Chinese imperial tombs. The modern design mimic the elements used for Chinese imperial tombs to create good Fengshui and generate the sense of solemnity and respect. For example, they consist the sequence of a long sacred way with stone animal statues along the way, the grand entrance archway with the stone plaque on the top, the large stone tablet right after the archway and the bridges that connect to the actual burial site.

Besides, due to the distinctive historical background of Shanghai as discussed in the literature review, the culture and tradition in Shanghai have been incredibly integrated with Western culture. Therefore, the three public cemeteries also adopt many Western design layouts, principles, functions, and even religious practices regarding environmental, landscape, and architectural style. There are mainly two categories of design that are adopted from the Western and now has become the fusion culture in the three public cemeteries; they are the master plan layout and the evolved graveyard style.

First, the master plan layout of the cemeteries is based on the grid system, which is similar with the four Western cemeteries. The traditional layout for Chinese imperial tombs is linear symmetrical design. However, the three public do not apply such design form throughout the whole site; the only adopted part of the linear symmetrical design is the long sacred way with animal statues. The traditional Chinese landscape and garden design are based on irregular, asymmetrical designs with diverse elements installed in a complex form to create the sense of

mystery and discovering within and through different places. However, the three public cemeteries do not apply such form throughout the site either; the irregular Chinese garden style design can be seen in a very small portion of the cemeteries for the purpose of garden aesthetic and recreation. The fact is that the three public cemeteries use grid form rectangular design incorporate with curvy pathways to distribute the large site into smaller manageable sections, which is the form the Western cemeteries use for cemetery master plan design. The grid form design makes the large site very manageable and also helps locate each grave as part of the wayfinding system that has the purpose of encouraging individualism as discussed earlier in the literature review.

Second, there are plenty of Western-styles built, and design elements throughout the cemeteries and the Western thoughts, philosophies, and religions are percolating into the design and development of the graveyards. Western style design elements include metal sculptures, the use of entrance gate instead of grand archway like the ones in imperial tombs in several places, and the use of open lawn graveyards. Well established wayfinding signage system similar to large park wayfinding system throughout the site is also one design and functional element that has been adopted from the Western culture. The Western philosophy of being unique to express the idea of self and individualism has also influenced the development of the graveyards significantly, especially on the artistic customizable irregular gravestones. These cemeteries offer services to find the type of stone customers want to use, and offers carving and landscaping services; therefore, most of the gravestones are all different in texture, color, shape, and decorative carvings. The decorative carvings are where personality and characteristics took place. Some gravestones have carved portraits or profile of people; some have carved landscape paintings, and many others have carved plants or animals on the gravestones. Some of the graves

even have different landscaping style with the particular types of plant materials they want in the trimming style they like. Also, there is Christian style graveyard sections for people worshipping Christianity. There is the statue of Jesus in the middle of the sections, and the giant sculpture of Christian Crosses throughout the section.

Even though there are plenty of clear traces of Western influences in the three public cemeteries in Shanghai, they kept the Chinese traditions and cultures that derived from the three major schools of philosophy in China, which are Taoism, Buddhism, and Confucianism. There are the statues of the famous ancient Chinese scholars especially in the school of Taoism and Confucianism with their very famous quotes on understanding life and death in different sections of graveyards. There are also many uses of symbolism in the landscape design; for example, there are lotus flowers and koi fishes in the ponds, and sculptures, carvings, and statues of lotus flowers, Buddha, and Guanyin as symbols of Buddhism. The symbol of Yin-yang from Taoism is also used in many details, such as sculptures, arts, and paving patterns. Other than that, the tradition of ancestor worshipping is originated with Taoist traditions and beliefs, which almost all Chinese follows even when they are not aware of. Therefore, there are many ancestor worshipping elements in the cemeteries just as the ones be seen in the Chinese rural ancestor burial grounds, such as metal buckets for burning fake paper money, censor for thurification, and oblations (food, drink, little objects, etc.).

Therefore, the three public cemeteries in Shanghai are really the fusion cemeteries that integrates traditional Chinese civilian worshipping practices, traditional Chinese school of philosophies and design principles of imperial tombs and gardens, and the Western culture and traditions. In the twenty-first century, with the continued rapid growing of cities that brings more global sharing, the simple traditional only designs may not be suitable for people's modern life;

thus, the fusion cemeteries can offer the variety of choices for people who have different interests and expectations.

4.3 Future Implication

The research compares the Western and Chinese burial sites cross-culturally and within culturally, and provides guides of designing burial sites according to the local context of the location in the future. The research result shows the different type of burial sites (cemeteries, imperial tomb, and ancestral graves) in the various area the built in the different period consist different lists of site elements, which makes the burial sites easily identifiable and can be distinguished from one another. Furthermore, the research explores and provides an understanding of the Chinese rural ancestral burial grounds regarding their environment and landscape style in detail instead of funerary and burial ritual, which is not previously discussed very much in other studies. Thus, help ordinary readers and researchers have a better understanding of the role of ancestral worshipping, environment, landscape, and Fengshui in rural China, which is still the majority type of land and lifestyle in China.

Also, the research studies and describes the three fusion cemeteries in great detail, which also provides design concepts and guidelines for culturally integrated cemeteries. The research elaborates the uniqueness of the modern fusion style Chinese public cemeteries in Shanghai. The concept of fusion cemetery is to integrate different culture and tradition with distinctive design elements to celebrate the uniqueness of different culture. This particular concept may perhaps be adopted and evolved by many cultures not only in Shanghai or other large cities in China but also large cities with great diversity around the world. Therefore, the fusion cemeteries in Shanghai may become the parent of future culturally integrated cemeteries around the world, just like how Pere Lachaise has become the parent of all modern picturesque style cemeteries in the

world. Even though, the actual design and design elements of future fusion cemeteries will be based on the local context of their location, the research as case studies of the three fusion cemeteries in Shanghai, can still provide some basic design guidelines of how the integration can be done through various site organizing and site managing strategies in terms of master plan layout.

4.4 Limitations and Suggestions for Future Research

First, the research uses four group of burial sites to elaborate in detail; however, the groups are relatively small with the great local context that may not be able to represent other burial sites. In the result, the selected site in within the same geographic region are very similar with the similar scores and are clustered very closely on the scatter graph. It might be the result of small study groups, due to the time and geographic limitation of the research. However, there are a large number of other burial sites in Michigan, Shanghai, and Jiangsu established during the similar time frame, that can be studied for future research. Even more, the burial sites all over the world can be explored in the future for more comparison studies both horizontally and vertically.

Second, the data and information of eight burial sites are primary information collected in field studies because the lack of literature review secondary information, therefore the primary information are based on personal understanding and experiences that may not be comprehensive and involve personal biases. Especially, there is very little secondary information on the environment, landscape, and architecture style of modern Chinese urban public cemeteries. And all the secondary information on the Chinese rural ancestral burial ground focuses on its religious importance to the community and its ritual practice. However, there is no secondary information describing the environment and landscape aspects of Chinese rural ancestral burial ground other

than its application of Fengshui when possible. The information of these five selected sites (three public cemeteries in Shanghai, and two rural burial grounds in Jiangsu) are significantly dependent on personal observations. Thus, further studies can focus on collecting more information on the modern Chinese public cemeteries and rural burial grounds, and accomplish more data collection research method for these burial sites; to contribute to the literature pool in this field. For example, more sites in various places in China can be studied and documented to discover the commonality among the sites in the different location with relatively different local context.

Finally, future research in the field can also adopt the equations used for this research to test if the equation work for other burial sites among the four group of burial sites studied in this research or even another type of burial sites. Thus, more studies can contribute to the data pool of the field of burial site environment, landscape and architecture style research in the future.

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