DISCOVERY OF THE BASIC GEO-SOCIAL GOLDEN-RATIO TRIANGLE IN THE CITY LANDSCAPE OF SHANGHAI

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ABSTRACT

Shanghai [Chinese: 上海] is the largest city by population in the People’s Republic of China, and the largest city proper by population in the world. Located in the Yangtze River Delta in East China, Shanghai sits at the mouth of the Yangtze River in the middle portion of the Chinese coast [1,2]. The nostalgic western bank of Huangpu River [Chinese: 黃浦江, 3], the Bund [Chinese: 外灘, 4, Fig. 1, Fig. 2, Fig. 3] containing places such as the Customs House [Chinese: 江海关, 5] built in 1927, was the generation centre of countless stories. Since modernization of China began in late 1970s, the Oriental Pearl Tower [Chinese: 东方明珠塔, 6, Fig. 1, Fig. 3] stands out as the symbol of modernization drive, located on the Eastern bank of Huangpu River, opposite the Bund, leading a significant development towards the East of the city, even to the seafront where Pudong International Airport is now located. The Peoples’ Square and Peoples’ Park [Chinese: 上海人民广场, 上海人民公园, 8, Fig. 4], which are about 1.5 km to the West of The Bund, are regarded as the prime venue hinging on peoples’ sense of belonging to Shanghai, and inheritance of excellent virtues from the older generations.

Now the permanent China Pavilion which stands since the World Expo 2000, Shanghai, China [Chinese: 世界2000年上海世博會中國館], upholds the strength of sustaining world-wide friendship and leadership, towards world peace and human advancement. The Peoples’ Park and the Peoples’ Square, the Oriental Pearl Tower, The China Pavilion of Expo 2000, all located on both sides of Huangpu River, Shanghai, are therefore Geo-Social icons of the well-esteemed foundation and heritage of people of Shanghai, drive of modernization, and international friendship, harmony, and integration of sustainable development world-wide. Yet it is discovered that these three Geo-Social icons are the three corners of a geo-social basic golden-ratio right-angled triangle of the city of Shanghai, an amazing gift from the heaven, as Chinese people of old would say. What a legend for Shanghai it is, as reported in this paper!

1. INTRODUCTION

Shanghai [Chinese: 上海] is the largest city by population in the People’s Republic of China, and the largest city proper by population in the world. Located in the Yangtze River Delta in East China, Shanghai sits at the mouth of the Yangtze River in the middle portion of the Chinese coast [1,2].

Since the first evidence of settlements in the Shanghai region dated to 5000 B.C. [2], human activities have developed in multi dimensions, through changing of dynasties over thousands of years, and with foreign interactions in the recent centuries, constituting to a unique city of Shanghai. Countless stories have happened, and still are happening, around the central part of the city: the river-bank districts of Huangpu River.

In the old days the western bank of Huangpu River [Chinese: 黃浦江, 3], the Bund [Chinese: 外灘, 4, Fig. 1, Fig. 2, Fig. 3] was the generation centre of stories, evidenced by nostalgic places such as the Customs House [Chinese: 江海关, 5] built in 1927, one of the nostalgic symbols of the Bund and Shanghai. Since modernization of China began in late 1970s, the Oriental Pearl Tower [Chinese: 东方明珠塔, 6, Fig. 1, Fig. 3], a symbol of modernization drive, located on the Eastern bank of Huangpu River, opposite the Bund, has led a significant development towards the East of the city, even to the seafront where Pudong International Airport is now located.

About 1.5 km to the West of the Bund, is located Peoples’ Square and Peoples’ Park [Chinese: 上海人民广场, 上海人民公园, 8, Fig. 4] which are regarded as the prime venue hinging on peoples’ belonging to Shanghai, and are enjoyed by local people and visitors for many generations and in various forms, carrying various activities, even part of which was once a race course [8, Fig. 5, Fig. 6] in the days of British concession more than 100 years ago, now turned into a park.
Fig. 1: Northern section of the Bund [4] as viewed from the Customs House [5] bell tower towards North, City Centre of Shanghai, with the Bund located at the west side of Huangpu River [3], and the Oriental Pearl Tower [6] located at the east side of Huangpu River, i.e. right hand side of the photo. (Photo: Courtesy of Wikipedia.org)

Fig. 2: Southern section of the Bund [4] as viewed from the Customs House [5] bell tower, viewing towards South, City Centre of Shanghai, with the Bund located at the west side of Huangpu River [3], and the Oriental Pearl Tower [hidden down left bottom of this Figure] located at the East side of Huangpu River, i.e. left hand side of the photo. (Photo: Courtesy of Wikipedia.org)

Going 6 km further South along Huangpu River from the Bund district and from the Oriental Pearl Tower [Fig. 2, Fig. 3] is located the World Expo Site of 2000 [Fig. 7]. World Expo 2000, Shanghai, China, demonstrates the integrated ever-growing strength of modern China, built upon international harmony, friendship, sustainability, and cultural riches. The China Pavilion [Fig. 7, Fig. 8], a permanent pavilion, signifies the Chinese commitment to sustainably uphold the ideals of World Expo 2000, Shanghai, China.

Fig. 3: The city centre model of Shanghai, viewing towards South [7], with the Bund located at the west side of Huangpu River [3], at the right hand side opposite the Oriental Pearl Tower [6], which is located at the East side of Huangpu River, i.e. left hand side of Huangpu River [3]. The Red colour building at the left top is the China Pavilion of World Expo 2010. The green patch near the middle right edge of the photo is the Peoples’ Square and Peoples’ Park of Shanghai. (Image: Courtesy of http://touch.shio.gov.cn)

Fig. 4: The Peoples’ Park [8], inter-connected with Peoples’ Square, enjoyed by local people and visitors, was once a race course [8, Fig. 5, Fig. 6] in the days of British concession around 100 years ago. Photo shows The Hundred-Grass Circle of The Peoples’ Park taken on 17 July, 2013, Wed., afternoon.

The Peoples’ Park and the Peoples’ Square, the Oriental Pearl Tower, The China Pavilion of Expo 2000, all located on both sides of Huangpu River, Shanghai, are therefore Geo-Social icons of well-esteemed foundation and heritage of people of Shanghai, drive of modernization, and the courage on pursuing international friendship, harmony, and sustainable integration.
Fig. 5: Once a race course in the days of British concession around 100 years ago, now The Peoples’ Park [8, Fig. 4] is connected to Peoples’ Square. (Image: Courtesy of Wikipedia.org)

Fig. 6: The Club Building of the old race course in the days of British concession around 100 years ago, now The Peoples’ Park [8, Fig. 4, Fig. 5], inter-connected with Peoples’ Square. The names of the Architects, the engineers and the management team members can be seen at the right bottom corner of the front façade of the building. Photo was taken on 17 July, 2013, Wed., afternoon.

Fig. 7: The World Expo Site of 2000. China Pavilion, a permanent pavilion [Fig. 8], is the Red Square Building around the middle of the site. The Oriental Pearl Tower can be seen at the small map at the right bottom of this figure. The Peoples’ Park is at the left side of the Tower on the same small map, across Huangpu River, at about 1.5 km from the Bund. (Image: Courtesy of organizer of Expo 2000, Shanghai, China)
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Fig. 8: China Pavilion of The World Expo of 2000, now a permanent pavilion, sustains the ideals of World Expo 2000, Shanghai, China. Photo was taken from the roof of Saudi Arabia Pavilion, World Expo 2000 site, 19 July, 2013, Fri., afternoon.

2. THE BASIC GEO-SOCIAL GOLDEN-RATIO TRIANGLE IN THE CITY LANDSCAPE OF SHANGHAI

These Geo-Social icons of Shanghai, namely, the Peoples’ Park and the Peoples’ Square, the Oriental Pearl Tower, The China Pavilion of Expo 2000, can be connected by straight lines on the map to form a right-angled triangle with the basic sides at 2:1 ratio, what an amazing discovery! [Fig. 9, Appendix A]

A right-angled triangle with the basic sides at 2:1 ratio is the basic right-angled triangle for constructing golden ratio geometries in 2-dimensional form and 3-dimensional form [9-11, Fig. 10]. When this triangle is placed to scale onto the map of Shanghai [Fig. 11], the basic Geo-Social right-angled triangle formed by Peoples’ Park, Oriental Pearl Tower, and China Pavilion, is in fact the basic right-angled triangle of a golden-ratio rectangle [Fig. 11].

Fig. 9: The Geo-Social icons of Shanghai, namely, the Peoples’ Park and the Peoples’ Square, the Oriental Pearl Tower, The China Pavilion of Expo 2000, form a right-angled triangle on the map, with the basic sides at 2:1 ratio. (Background map: Courtesy of google.com)
This Geo-Social golden-ratio right-angled triangle [Fig. 11] can be further developed into a Geo-Social golden-ratio rectangle [Fig. 12]. This will further lead to a variety of applications on the techniques of construction of golden-ration geometries, such as a golden-ratio spiral [Fig. 13], which will cover certain districts of Shanghai, leading to various possible interpretations relating to historical, economic and social developments of the district, and the related variety of schemes on treatments on landscape of urban scale and city scale, based on Geo-Social golden-ratio geometries. This opens up a new perspective on landscape innovation and research, a big scope of discussion in future papers. Furthermore, because the established spiral geometry construction methods [12] allow the spiral to grow over a large geographical region far beyond the basic Geo-social golden ratio rectangle from which the spiral originates, even to grow over half of China, and the neighbouring countries, and sea and ocean surfaces, further discussions should raise world-wide interests.

Fig. 10: A right-angled triangle with the basic sides at 2:1 ratio, or 1:½ ratio, is the basic right-angled triangle for constructing golden ratio geometries in 2-dimensional form and 3-dimensional form. The √5/2 diagonal [i.e. the hypotenuse of the right-angled triangle having sides of 1:½ ratio] of a half square forms the basis for the geometrical construction of a golden-ratio rectangle [9,10, Fig. 11, Fig. 12]. (Image: Courtesy of Wikipedia.org)

Fig. 11: The basic Geo-Social right-angled triangle formed by joining Peoples’ Park, Oriental Pearl Tower, and China Pavilion [Fig. 9, Appendix] is in fact the basic right-angled triangle of a golden-ratio rectangle, as compared with the golden-ratio rectangle inserted at top-left of figure [Fig. 10]. A golden-ratio rectangle illustrating the construction of a golden-ratio spiral is also inserted at bottom-left of figure for comparison [12]. (Background map: Courtesy of google.com)
Fig. 12: The basic Geo-Social right-angled triangle formed by connecting Peoples’ Park, Oriental Pearl Tower, and China Pavilion, Shanghai, China, using straight lines [Fig. 9, Appendix] can be further developed into a Geo-Social golden-ratio rectangle. (Background map: Courtesy of google.com)

Fig. 13: The basic Geo-Social golden-ratio rectangle [Fig. 12] formed from the basic points in Peoples’ Park, Oriental Pearl Tower, and China Pavilion, using golden ratio geometry construction methods [9-12] can be further developed into a Geo-Social golden-ratio Spiral [12]. (Background map: Courtesy of google.com)
Golden Ratio in fact has fascinated Western intellectuals of diverse interests for at least 2,400 years in aesthetics, architecture, painting, design, music, many discoveries in nature, mathematical pyramids and triangles, relationship to Fibonacci sequence [11], illustrated by construction of Egyptian pyramids, famous paintings of Da Vinci [13,14], researched and used in architecture designs by the renowned master of architecture Le Corbusier (1887-1965) [15], who designed with, and published on, golden ratio geometric principle in architecture design [15-21].

Golden ratio leads to construction of various 2-dimensional and 3-dimensional geometric forms such as triangles, pentagons and pentagrams, rhombus, and rhombic triacontahedron, etc. [11], contributing significantly to various disciplines of design, including city design, urban design, landscape design, and architecture design.

The Basic Geo-Social Golden-Ratio Triangle in the City Landscape of Shanghai will open up a generic theme of using golden ratio in an enriched integrated and sustainable geo-social context unique to Shanghai, in reshaping or realigning the urban landscape and city landscape, to be viewed from the river, i.e. water, from the land, the most common way, and from the air, i.e. by people on air crafts and satellites; and enjoyed by people world-wide through broadcast of images and videos taken by satellites.

3. CONCLUSION

Shanghai has a legend: The golden ratio is clearly endowed by heavens to Shanghai, as Chinese people of old would say.

The Peoples’ Square and Peoples’ Park [Chinese: 上海人民广场，上海人民公园], the Oriental Pearl Tower [Chinese: 东方明珠塔], the permanent China Pavilion of World Expo 2000, Shanghai, China [Chinese: 世界2000年上海世博會中國館], respectively symbolizing peoples’ strength and sense of belonging to Shanghai, the modernization drive, the power to sustain world-wide friendship and leadership, towards world peace and human advancement, collectively and amazingly constitute to The Basic Geo-Social Golden-Ratio Triangle in the City Landscape of Shanghai, as discovered and reported in this paper.

This discovery shall contribute significantly to developing a generic theme of using golden ratio in attaining an enriched integrated and sustainable geo-social context unique to Shanghai, in reshaping or realigning the urban landscape and city landscape, to be viewed from the river, i.e. water, from the land, the most common way, and from the air, i.e. by people on air crafts and satellites; and enjoyed by people world-wide through broadcast of images and videos taken by satellites.

Reported in this paper, Shanghai may just be the first city exhibiting Geo-Social Golden-Ratio relationships. There can be many more other cities in the world endowed with similar Geo-Social Golden-Ratio relationships, pending discovery.

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APPENDIX A

Calculation of the right-angled triangle formed by joining on the map the following points by straight lines: The Hundred-Grass Circle [Fig. 4] of Peoples’ Park [representing the integration of the inter-connected Peoples’ Square and Peoples’ Park], the centre of Oriental Pearl Tower, the centre of China Pavilion of Expo 2000 Site [Fig. 9]

The Latitude and Longitude of Peoples’ Park, Oriental Pearl Tower, China Pavilion are obtained as follows by a web identifier: [22]

Point P = The Hundred-Grass Circle of Peoples’ Park [Longitude 121.471897 degree East; Latitude 31.231405 degree North]

Point O = The centre of Oriental Pearl Tower, [Longitude 121.499664 degree East, Latitude 31.239881 degree North]

Point C = The centre of China Pavilion of Expo 2000, [Longitude 121.494093 degree East, Latitude 31.184204 degree North]

The distances between the points P, O, C are obtained as follows, by entering the values of longitude and latitude of each point into a web calculator [23], working with 2 points at one time:

Distance PO = 2801.52 m; Square of Distance PO = 7848514.3104 square m.

Distance CO = 6309.373 m; Square of Distance CO = 3980817.653129 square m.

Distance PC = 5653.289 m; Square of Distance PC = 31959676.517521square m.

Since (Square of Distance PO) + (Square of Distance PC) = (Square of Distance CO), that is, 7,848,514.3104 square m. + 31,959,676.517521 square m. = 39,808,187.653129 square m. in practical sense, therefore, Triangle (POC), is a right-angled triangle, by applying Pythagoras Theorem.

Furthermore, since the ratio of (Distance PC) to (Distance PO) = (5653.289 m) to (2801.52 m) = 2.0178 = 2 in practical sense, therefore Triangle (POC), a right-angled triangle, with its two sides now in the ratio of 2:1, becomes a Basic Golden-Ratio Triangle [9-11].