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The sustainable and harmonious landscape in ancient Chinese philosophy and its parametrization with current GIS models. Characterization of Yin-Yang properties in Geographical Information Systems

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Abstract: The modeling of urban and natural environment is essential for both the landscape design experts and for the general public, as well. Since ancient times the landscape and its beauty has made a great influence on people and their philosophies. This resulted in such prominent examples as the ancient Chinese yin-yang theory which is still used in contemporary architecture and planning not only in China but world-wide as well. The current tendency is to incorporate public participation into the professional planning methodology. The traditional sense of harmony and beauty can be expressed with the modern technology. Since the GIS systems can work with different attributes and parameters of the landscape related entities, it is desired to find models that describe a harmonious or sustainable landscape and find parametrization that can be used to enhance and develop areas of having unfavourable conditions. The traditional GIS softwares were based on the discrete binary logic (yes/no) whereas the yin-yang theory of harmony based on two dynamically changing opposite entities (yin and yang) and uses continuous values that are complementary to each other. The contemporary architecture (Meggyesi 2009) and science also has utilized the yin-yang model to enhance the spatial comfort. As our models get more realistic and interactive, sensor webs promise to animate and constantly update our models to provide a living and adaptive view of our built environments. Sensor inputs can in a sense act as a glue between the different tools because of their ability to inform living models. Sensors would include such inputs as weather, traffic movement, the way that wind affect the built environment, the movement and impact of pollution, as well as the many things that citizens as sensors can inform. The bringing in of these dynamic inputs inform our models, and the need for deep analysis to understand the complexity of these

inputs calls for a whole new level of computing capabilities in order to better inform design and the management of our world.

Keywords: landscape parametrization, dynamic change, GIS

Introduction

The well known yin and yang symbol, the entity of two entwining symmetric black and white semicircles used to describe how seemingly polar and contradictory forces can result in a harmonious state that represents permanent change and constant equilibrium. It has inspired not only philosophers and artists, but it has influenced the modern computational geoscience as well [3].

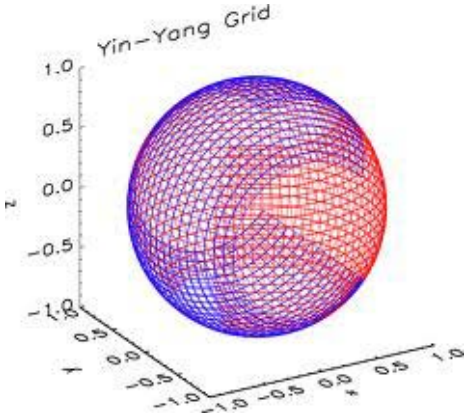

Figure 1:Yin yang grid in geospatial model

In the geoscience model - Yin-Yang grid is composed of two identical component grids that are combined in a complement way to cover a spherical surface with partial overlap on their boundaries. Each component grid is a low-latitude part of the latitude-longitude grid.

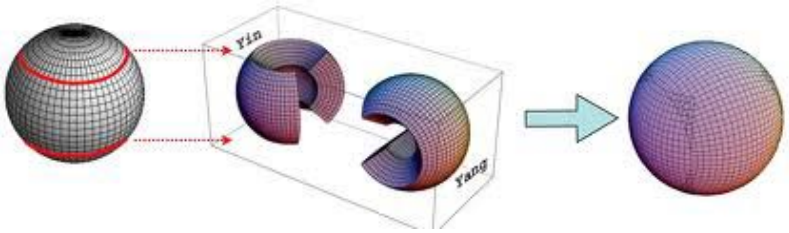

Figure 2: The combination of the two identical components

Figure 3: Taijitsu, the ancient yin yang symbol

The ancient symbol shown on Figure 3. originated from the Chinese culture around 1250 B.C. According to this *yin and yan*g are complementary opposites that interact within a greater whole, as part of a dynamic system. Everything has both *yin and yang* aspects , but as a total they result in the eternal completeness – the whole circle.

There is a perception (especially in the West) that *yin and yang* correspond to evil and good. However, Taoist philosophy generally omits good/bad distinctions and other dichotomous moral judgments, in preference to the idea of balance.

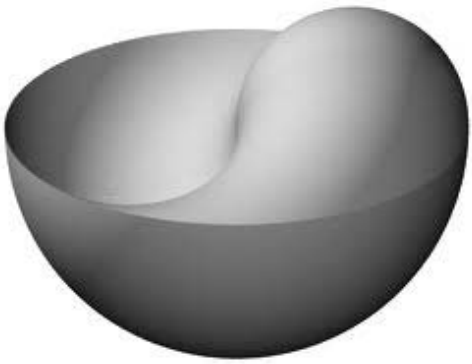

Figure 4: *Yin Yang in 3D*

www.cs.berkeley.edu

Eventhough *yin and yang* are opposites, they never disturb each other, moreover each of them requires its asymmetric pair for existence. They are equal in magnitude, hence are equal in importance as well.

*Figure 5***:** Yin yang mountain

Source: www. travel.webshots.com

According to the ancient Chinese wisdom the following properties represent *yin and yang*:

Yin and yang in nature

Yin and yang can be perceived as:

- Intrinsic natural entities: light and shadow
- Winter or summer
- Cold or warm
- Male and female (that can create an offspring)
- Natural reproduction of plants (i.e. a seed will sprout from the earth and grow upwards towards the sky – an intrinsically yang movement. Then, when it reaches its full potential height, it will fall to complete a dynamic cycle of growth and decay)
- Wave of water in the ocean- high and low point of waves

The concept of yin and yang originates from observing the nature.

Yin originally means the shady, Northern part of the mountain, while *yang* means the sunny (Southern) part.Similarly *yin and yang* can be also related to the sides of a river (*Nota bene*: the river has also two sides , yin and yang). Later these were generalized to arbitrary opposite concepts as well.In Chinese geograhic and place names one can still find ancient words that correspond to yin and yang. In geographical context "*yang*" means southern (sunny) side, while "*yin*" corresponds

to the northern, shady one. Similarly the city called “Louyang” means the city on the southern part of the Lou river.

*Figure 6***:** The yin (water) and yang (mountain)

The traditional Chinese landscape paintings

The beauty of Chinese landscape can be rooted back to BaGua or “eight symbols” system reflecting the dualistic philosophy of ‘*yin*’ and ‘*yang*’, and it goes back to 10th century BCE. This system has been adopted by the Chinese culture and it is still very popular, even in modern days in China (see Figure 8.).

The original meaning of *yang* (Southern, high, sunny) can be associated with elevation, positivity, power and light. The opposite complementary of the prevoius is *yin* (Northern, low, wet, dark) represented by the lakes, water and low points of the landscape.

The traditional Chinese landscape painting , the so called *shansuihua* means water and mountain (yin and yang). Chinese paintings are usually displayed in

faded color, mainly using ink and water, with light coloring. Their strokes are softer, more graceful, and suggestive. Water washes on the existing brush strokes of ink produces softer and subtle effect.

Lake is separated from water, as the mountain is being separated from Earth, showing the special significance of mountains and lakes or rivers.

*Figure 7***:** Chinese Landscape painting *shansuihua*

Yin yang in fractal geometry

The fractals- objects with a self-similar property - (shapes with a rough or fragmented structure that can be split into parts, each of which is approximately a reduced-size copy of the whole), are also related to the *yin and yang*. The following figure shows such a fractal.

Figure 8: yin and yang fractal

www.fractalsoup.net/.../fractals/ying-yang.png

Yin and yang in contemporary arts

Figure 9: Prize winner in 2007, the Chengdu Contemporary Art Centre inSichuan (China). The largest standalone structure

Chinese people have always valued the traditional beauty of *yin and yang* and it is still considered as a contemporary value. *Figure 9*. shows the Chengdu Art Centre in China designed by Zaha Hadid is a 200,000 sq m complex that includes three huge auditoriums, an art museum, an exhibition centre, a conference centre, a learning centre, bars, restaurants and shops, all housed within a single sculptural form.

The building, which Hadid won in a design competition in 2007, is also the largest standalone structure ever designed.

Figure 10: Yin and yang sculpture on the beach

tgffsw.blu.livefilestore.com

Yin Yang – a duality principle and its effect on landscape design

As the world famous French Geographer and Japanologist Augustin Berque (1992) has written: "the notion of landscape in the Asian art could not have been evolved without the principle of duality. This culture is based on the ***yin yang concept*** which describes things and objects **with the use of its opposite form"**.

Since the Chinese phylosophy and landscape art is based on the dinamically changing equilibrium and balance of *yin and yang*, in urban and design and architecture these principles still can be found.

The aesthetics of a city is a combination of many sensory stimuli as well a visual one. The monotonious flat structures and surfaces of buildings and roofs of the same levels can be nicely complemented with high structures (towers, temples, lookout towers, skyscreapers) which can be used as landmarkes to show central location and can be used to accomodate large crowds (city centre towers, Eiffel tower). Currently almost every large city is seeking to build such a specific landmark to be famous and to attract tourists.

This vertical expansion was to symbolize power and to control a territory and space. Every religion (western or Asian cultures) used height to express sacral importance. Gothic churches, pagodas, Indian stupas are also examples of this tradition.The *yin and yang* principle – i.e. making harmonious structures with oppositely changing dynamic entities – inspite of its simplicity and age is still used by contemporary architects. Tamás Meggyesi, one of the most prominent architects in Hungary in his book called *Morphology of Urban Architecture* (*Város ÉPÍTÉSZETI alaktan, 2009)* has analyzed the urban space in structural – morphological context and emphasized the importance of dichotomous, dinamically changing entities (open or closed space, linear or centralized road systems, etc.) which can be considered as an extension of the ancient *yin yang* philosophy.

The yin yang principle and GIS

GIS is a relatively new science and it is used for capturing, storing, checking, integrating, manipulating, analysing and displaying data related to positions on the Earth's surface. Since the original meaning of *yin and yang* has spatial implications (high-low, Southern- Northern, sunny- shady) it is plausible to use current technology and GIS to characterize certain regions in terms of *yin -yang* aspects.

Chinese government has proposed a strategic development plan named as Harmonious Society, which contains the requirement to apply Chinese traditional theory to contemporary urban construction. The first step is to develop the model and define properties which contribute to the yin and yang characteristics. Some geospatial parameters are the following:

Methods:

- Altitude
- Slope
- Exposure
- Average height of the grid cell
- Standard deviation of the heights (variability of the elevation)
- Distance from industrial zone or main road
- Green area proportion
- Soil fertility
- Yearly precipitation
- Air quality
- Existence or closeness to water (see, river, lake, pond, artificial objects, fountains, etc.)
- Cultivated / natural landscape
- Wind
- Earthquake danger
- Flood danger
- Noise levelThese attributes are quite diverse and a careful expert knowledge is necessary to find the appropriate range and scale that can be used for GIS analysis. Furthermore, the weights that correspond to the importance factors have to be determined as well (100 means the highest impact, 0 means no impact at all).

The Chinese research [13] used 24 different parameters and 11 indices. They could divide the downtown of Nanjin city in to three zones: the area of low total score (yin) and a average area (both yin and yang) and a high total score area (yang). This result was a clear indication for the future development programs and plans.

Conclusions:

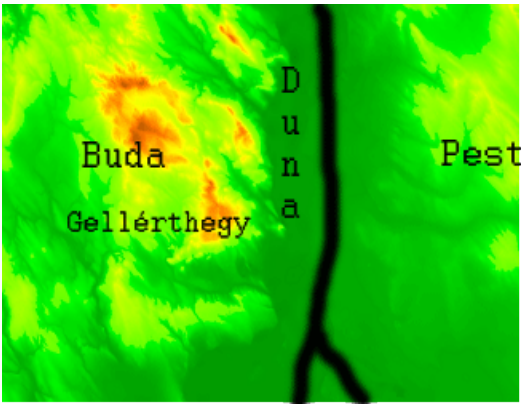

Figure 11: Yin yang distribution of Budapest

Since the object of the project is rather complex, a harmonious area has geospatial and socio economic attributes, so an interdisciplinary approach is necessary to find the appropriate parameters that describe a harmonious space.

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