

Examine the Residential Property Values in Cul-de-sac: A Case Study of Feng Shui in Harris County, Texas

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Abstract

Feng Shui, known as Chinese geomancy, reflects the relationship between human beings and the natural environment. As an essential component of culture and tradition in China and East Asian countries, it has played an important role in shaping society and personal life. However, the effects of *Feng Shui* have been rarely quantified in rigorous studies. This research intends to explore the relationship between *Feng Shui* and residential properties in North American settings. It employs the hedonic pricing models with spatial and statistical analysis functions to examine the impacts of *Feng Shui* concepts, especially the cul-de-sac (dead-end), on residential property values. In this paper, the researchers explore the correlation between the location of residential properties and property values in the Greater Houston, Texas region. It is found that houses located at the optimal location in a cul-de-sac have the highest value while those located at the T-Junction have lower values. The empirical study reports that the effects of the spatial arrangement of properties are consistent with the *Feng Shui* theory.

Introduction

Feng Shui, or "wind water," means two of earth's flowing elements. It represents the process of maximizing the flow of energy to achieve harmony between people, buildings and nature. The concepts of *Feng Shui* have deeply rooted in the minds of many Chinese people and influenced traditional architecture, designs, and planning in China and many East Asian communities for thousands of years. The principles and practices of *Feng Shui* aim to develop a harmonized built environment for people to live in. It aims to select favorable locations, as well as a theory for designing cities and buildings (Lee, 1986).

The relationship between humans and their environment guided by the concepts of *Feng Shui* dominates personal life in all aspects, including fate, luck, virtue, and education, etc. It is considered as the art of living in harmony with the land, and deriving the greatest benefit, peace, and prosperity from being in the right place at the right time (Skinner 1982). Therefore, the spatial arrangement of the properties in a community may generate different benefits to the households, which may be reflected in their property values.

The energy has the physical form of natural energy or breath of life with both the physical and the invisible types known as "Qi" (natural energy or breath of life), which is carried by air flows. Figure 1 illustrates the relative superiority of houses in a cul-de-sac in terms of the "Qi" strength. The arrows show the direction of air flows in and out of the cul-de-sac. The houses in position 4 and position 5 are located in the inferior places because the "Qi" is too strong at position 4 and too weak at position 5. According to Feng-Shui, Position 3 is the worst location because it is literally at a T-junction and facing the incoming traffics into the cul-de-sac. Therefore, its houses should have the lowest values. Position 1 is the best

because its “Qi” is mild, not too strong and not too weak, which achieves a harmony. Position 2 is better than Positions 3, 4, and 5. But it is slightly worse than Position 1 because its “Qi” is weaker.

The Compass School and the Form School are the two major schools of thought and practice in *Feng Shui*. Mat and Ge (2016) summarized the five key concepts of *Feng Shui* for environmental design as the Unity between Heaven and Human, the Five Elements Cycles, Yin and Yang Harmony, the Form School Model, and the Balance between Interior and Exterior Spaces.

The Unity between Heaven and Human refers to the harmony between the universe, earth, and human energy. The energy has the physical form of natural energy or breath of life with both the physical and the invisible types known as “Qi” (natural energy or breath of life). The five elements in the cycles are fire, water, metal, wood, and earth. Yin and Yang represent two opposing parts of everything, which achieve harmony within a space designed to balance the users' life when engaging in the space (Feuchtwang, 1974). The Form School Model includes the scientific bases for analyzing the built environment. It is based on the verification of the physical configuration of mountains and watercourses surrounding sites and buildings. The so-called “Five Geographical Secrets” as the basic factors of the form school model include dragon, sand, water, cave, and direction (Lip, 1979). The Interior Spaces or the “Inner Form” includes the layout of the building, the elevations of the building, and the elements of the building. The Exterior Spaces or the “Outer Form” refers to the location of the site, conditions surrounding the site, and the topographical conditions of the site and its shape.

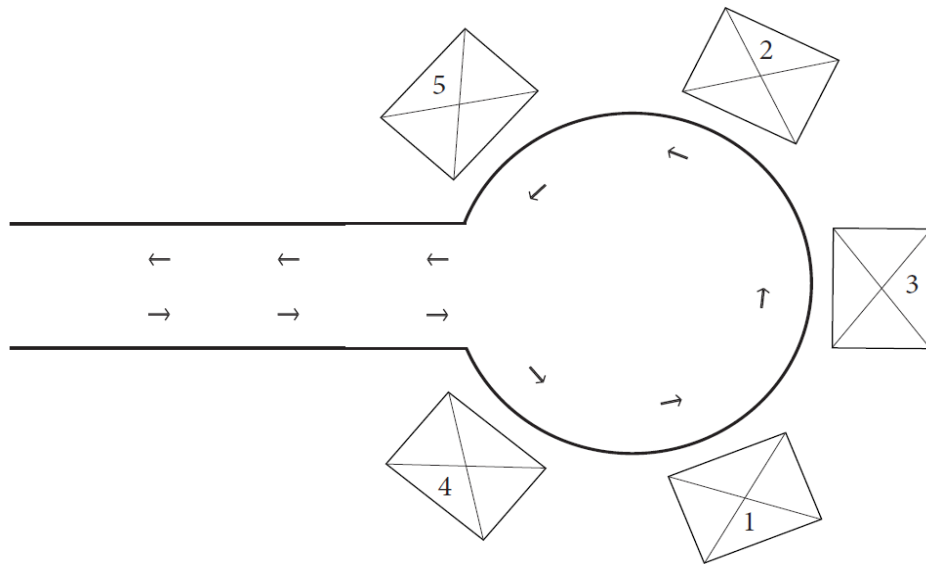
Kevin Lynch (1960) pointed out two features of *Feng Shui*, including an open-ended analysis of the environment where it is possible to generate new meanings, new poetry, and more developments, and the use and control of outside forms and their impacts where it emphasizes that foresight and energy of people rule the universe. The scientific context of Fengshui was discussed by Needham (1959).

In the context of the western contemporary architecture, the interactions with the natural and man-made environment are called Sustainable or Green Design, which share some common concepts with *Feng Shui* in design and architecture. Since the late 1960s, many western scholars have started to recognize the similarities between modern science and eastern philosophy after they realized the limitations of modern scientific paradigms, which are difficult in explaining the whole realm of natural phenomena (Capra, 1975). The fundamental concept of modern, sustainable or green building highlights a holistic method to reduce the negative environmental impact of man-made structure, which is consistent with *Feng Shui* that intends to develop harmony between heaven, earth, and human.

Though *Feng Shui* continues to play an important role in the contemporary Chinese world, many people argued that Feng Shui lacks scientific explanation and evidence (Chen 2007). Few rigorous studies explore and quantify the effects of Feng Shui in the literature. It is also an interesting question if *Feng Shui* has effects in a society completely different from Chinese culture and history.

This research intends to examine the relationship between *Feng Shui* and residential properties in North American settings. It selects the Greater Houston area in Texas as an empirical case to explore the impacts of *Feng Shui* concepts on residential property values. In this study, we select Cul-de-sac, or so-called dead-end, as a representative component of *Feng Shui's* concept. One of our research questions is whether the *Feng Shui* concept, like Cul-de-sac (dead-end), has significant impacts on residential property values in North American settings. The second one is whether the spatial arrangement of properties has significantly different effects on residential property values, which is consistent with the *Feng Shui* theory.

From Qi Strength Viewpoint



- 1 - Better
- 2 - Good
- 3 - Worst
- 4 - Worse
- 5 - Bad

a) 2-D layouts



- 1 - Better
- 2 - Good
- 3 - Worst
- 4 - Worse
- 5 - Bad

b) 3-D layouts

Figure 1. The illustration of the relative superiority of houses from the viewpoint of the “Qi” strength

Literature Review

There were studies on the relevant topics of *Feng Shui* from multiple perspectives. Most of them adopted qualitative methods. As a kind of qualitative studies, March et al. (1968) intended to deliberate whether the Chinese superstition is absurd and how the *Feng Shui* knowledge withstood for thousands of years. Their research was placed on the study of ancient literature. Ogilvie et al. (2018) conducted qualitative studies on Chinese restaurants to explore their associated business behaviors and perceived value of uses. The 20 phenomenological interviews in this study across four different Asian communities highlighted the core elements of the ritualistic practice. The results favored the argument that these practices have a significant impact on managing the service-scape, and, influence the decisions and behaviors of proprietors. This study showed that the knowledge of *Feng Shui* practice provides value for business proprietors.

Some studies also explored the implementation of *Feng Shui* concepts in architecture and design. Hwangbo (2002) investigated the knowledge of *Feng Shui* as an alternative institution in architecture within the intellectual tradition of ancient China. He studied the literature and the drawings of *Feng Shui* schools, namely compass school, and form school. He pointed out that it is worth to conduct further study of *Feng Shui* to outline human consciousness. Otherwise, this knowledge may lose at the modernism.

ŠpelaKryžanowski (2015) brought the spiritual dimension to the design of the built environment by employing Chinese *Feng Shui*, as an example of design approach, which uses the manipulation of life force Qi for a more supportive living environment. The project of the Vital house is shown as an example of a successful combination of contemporary and traditional approaches. It is based on the field work of a researcher who engaged with the Sedona experience by talking with visitors, agents and service providers, consumer products and services to evaluate the environmental psychology recommendations (importance of light, the presence of nature) that can influence human behavior.

Xu (1998) investigated the spatial form of the Beijing courtyard dwellings, including their orientations, positions, and the floor plan arrangement. He also examined the *Feng Shui* model of arranging Qi, from the I Ching diagrams, the Nine Chamber Diagram, and the Later Heaven Sequence to learn the influence of *Feng Shui* models on the design of traditional Beijing courtyard houses from a historic-cultural perspective. His study exhibits that customary beliefs hold great significance and power in the design of vernacular houses.

Hong et al. (2007) explained that the traditional land use practices based on 'Fengshui' have significantly contributed to human-mediated patterns of landscape changes, and the role of the socioeconomic development and other activities in Seoul. They discussed recent concepts and methods of landscape ecology and urban planning from the perspectives of Fengshui and the traditional land use patterns in Seoul. They argued that it is important to integrate landscape ecology principles and the traditional concepts of Fengshui to develop a new urban planning framework for regional development to maintain the sustainability of the urban landscape.

Mark (2019) examined the patterns of *Feng Shui* in his case study of Tai Fu, Tai Mansion in San Tin region, Northern part of the New Territories in Hong Kong. This study explored the patterns of *Feng Shui* in Hong Kong. A survey of architects in Sydney and Hong Kong was taken to evaluate the fundamental concepts of the Form School approach and the developmental structure of the conceptual framework using the knowledge-based expert systems approach and the artificial intelligence techniques, which have a high potential to deal with intuitive expertise. The results of the survey demonstrated that architects accept the fundamental concepts and the conceptual framework.

Mat and Ge (2016) conducted a cross-cultural study by comparing the sustainability concepts and characteristics with the theories and applications of *Feng Shui* knowledge. They developed a simplified *Feng Shui* scoring system in the urban contexts for the Sustainable Office Buildings. They found that the

higher Green Star rated of modern, sustainable office buildings achieved higher similarities with Feng Shui concepts.

The relevance of and relationship between *Feng Shui* and facility management (FM) principles was studied by Pheng et. al. (2018) in a questionnaire with three groups of experts – the *Feng Shui* practitioners, Facilities Managers, and *Feng Shui* practitioners who are also building professionals to verify the assimilation of the two disciplines with a view to draw new perspectives for better understanding. The results of this study confirmed the validity of the assimilated relationships between the two disciplines to improve sustainable building design.

Azizi et. Al (2019) studied the effect of *Feng Shui* on the cultural sensitivity by adopting the Peranakan style architecture of Cheong Fatt Tze Mansion as a case study. Their findings demonstrated a strong interrelationship between the architecture and the environment.

In an attempt to find the cultural identity and belonging in the residential space, Fan et Al. (2019) examined the deficiencies by examining the residential culture in urban regeneration. They found that the cultural characteristics of Henan Province were promising in favor of *Feng Shui*.

There are a few empirical studies that intend to evaluate the effects of *Feng Shui*. Han et al. (1996) argued that *Feng Shui* contains folk wisdom on the site suitable for human habitation and psychological requirements. They also examined whether there are any scientific perspectives in *Feng Shui* on landscape assessment.

Choy et al. (2007) attempted to empirically test whether *Feng Shui* has an impact on property prices in Hong Kong. They found that the lucky number as one of the *Feng Shui* variables was found insignificant, which indicates that it doesn't impose any impact on the property values within the housing estates under investigation. But an unlucky number has been found to be statistically significant. It implies that Hong Kong people try to avoid the bad luck and bad health brought by bad *Feng Shui* when they buy real estate.

Ole (1996) examined the relation between *Feng Shui* and disease etiology, mental disorder, accidents, sex of newborn babies, business affairs and daily affairs by undertaking case studies on villages and Feng Shui specialists. The study concluded that the knowledge of *Feng Shui* helped people with an alternative system of argument to elucidate about people's sickness, the location of the building, and the relation of wealth, etc.

Poulston and Bennett (2012) evaluated the *Feng Shui* of eight hotel foyers and entrances using 20 criteria. They asked the managers to comment on the success of their hotels due to the likelihood of a relationship between good Feng Shui and success. The comment of the managers was examined for possible relationships between Feng Shui and their descriptions of success. This study found similarities between the reported success in six out of eight hotels built with *Feng Shui* principles.

Huang et al. (2013) employed a linear development process with locating system elements and tools to examine the weakness of environmental impact assessment (EIA) systems due to uncertainty and risk. They introduced the concepts of *Feng Shui* and Wu Xing to the systematic interventions of fair utility and equitable allocation in response to the identified weaknesses of the EIA systems. They concluded that the knowledge of *Feng Shui* improved the idealness and effectiveness of the EIA system with a comprehensive assessment technology.

Magli (2019) tried to predict the minimum proportions of buffer areas for taking up excavations at the sites of archaeological relics by adopting cognitive archaeology. This study was successful in combining the aspects of conservation and sustainable development.

Most of the relevant studies in the literature employed qualitative methods and explored the adoption of the *Feng Shui* concepts in architecture and design. Few of them examined the effects of *Feng Shui* with rigorous models. To fill the gap, this study examines the relationship between *Feng Shui* and residential properties using statistical analysis methods. It selects the Greater Houston region in Texas for empirical research.

Methodology

The hedonic pricing models used in the empirical studies employ traditional linear regression methods, i.e., OLS estimation, to examine the effects of *Feng Shui* on residential property values. A general form of the models is shown as follows,

$$Y = a_0 + \sum_{i=1}^l b_{1i}F_i + \varepsilon \quad (1)$$

Where, Y is the dependent variable, i.e. the value of an individual property

F_i refers to the housing characteristics variables according to *Feng Shui*, such as position, direction, and sides of the house, etc.

ε is the residual

a and b are parameters.

As the most popular type of the hedonic price models, the OLS model examines the fixed effects, but ignore spatial differences in property-related variables.

Empirical Study

Houston has received much less attention in planning, research, and practices than many other cities, such as New York, Los Angeles, Chicago, Boston, and San Francisco, etc. As the fourth largest city and the largest American city without zoning, however, Houston has played an essential role in the national and regional economy. The Greater Houston region and the city of Houston have generated a large number of job opportunities that attract people from all over the world to settle down in the area. Houston's booming population growth has made it one of the fastest growing regions in the U.S. The housing market has been quite active to accommodate the newcomers.

Data

The 2017 InfoGroup database provides details of residential properties in this study. The InfoGroup household database archives the values and physical characteristics of residential properties, including home size, home age, the number of bedrooms and bathrooms, and sales prices, etc. The Harris county road network is employed to identify the cul-de-sacs.

To identify possible cul-de-sac, a Geographic Information System (GIS) software – ArcGIS is used to perform spatial analysis. The Feature Vertices to Points function tool is utilized to identify road line dangle points as potential cul-de-sacs. After carefully reviewing the results on an imagery base map, we have found the GIS identified points match very well with the real cul-de-sacs. By testing different buffer distances, including 100 feet, 150 feet, 200 feet, and 250 feet, we have concluded that 150-foot buffer of the cul-de-sac point fits the best to identify homes within a cul-de-sac (Figure 2).

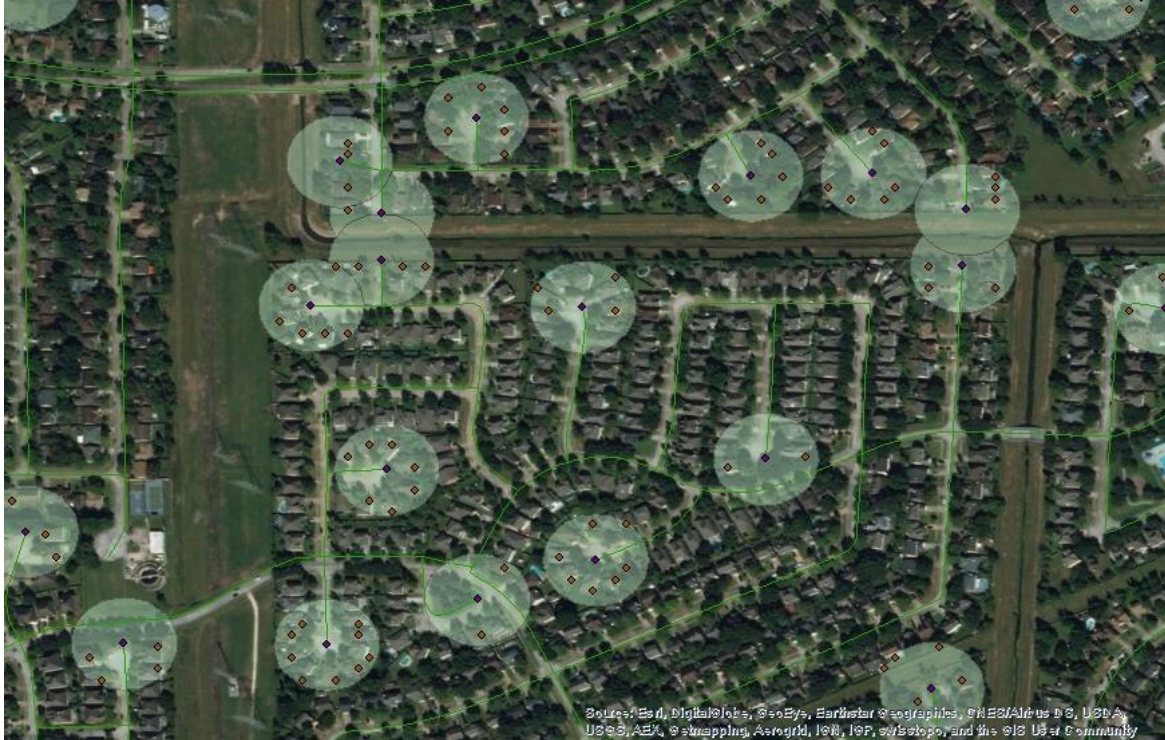


Figure 2. Residential properties in Cul-de-sacs

By examining the InfoGroup Data, we find that many home transactions have been recorded several times due to multiple ownerships. For example, if a couple owns a property, both individuals were registered so that there are two records for the property in the dataset. To remove the duplicate records, we have used family ID as a unique identifier to keep only one record for a given property. The finalized data set contains a total of 640,933 home transactions in Harris County.

Additionally, to test our selection of buffer size, we use a spatial join function to count the number of residential properties fall into the 150-foot buffer. Because only a limited number of houses can be built within a cul-de-sac, we remove those that counts more than ten homes within the 150-foot buffer. The total number of homes has reduced to 637,011 units.

Finally, we have identified a total of 17,426 cul-de-sacs in Harris County. The number of residential properties located within a cul-de-sac is 73,007. There is an average of four (4) residential properties in each cul-de-sac.

Data Analysis

This study develops GIS programs using Visual Basic Script language to identify the relative positions of the 73,007 properties within the 17,426 cul-de-sacs, shown as follows in Figure 3.



Figure 3. Positions of residential properties in Cul-de-sacs

This study examines the difference between residential property values in Cul-de-sacs. The simple descriptive statistics report that Position 1 has the highest value; Position 2 has the second highest value; Position 4 has the third highest value. If the CPI has not adjusted the housing prices, Position 5 has the fourth highest value, and Position 3 (T-junction house) has the lowest value (Table1, Figure 4), which is consistent with the hypothesized housing values according to *Feng Shui* theory (Figure 1).

Table 1. Descriptive Statistics of Log (Housing Values) by Position

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1	14464	11.3223	0.6659	0.0055	11.3115	11.3332	6.1938	16.7095
2	14285	11.3169	0.6640	0.0056	11.3060	11.3278	6.4747	16.5211
3	3346	11.2873	0.6888	0.0119	11.2640	11.3107	6.3447	14.2961
4	20580	11.2862	0.6626	0.0046	11.2772	11.2953	6.4149	16.2644
5	20329	11.2879	0.6502	0.0046	11.2789	11.2968	6.1499	16.5531
Total	73004	11.2999	0.6615	0.0024	11.2951	11.3047	6.1499	16.7095

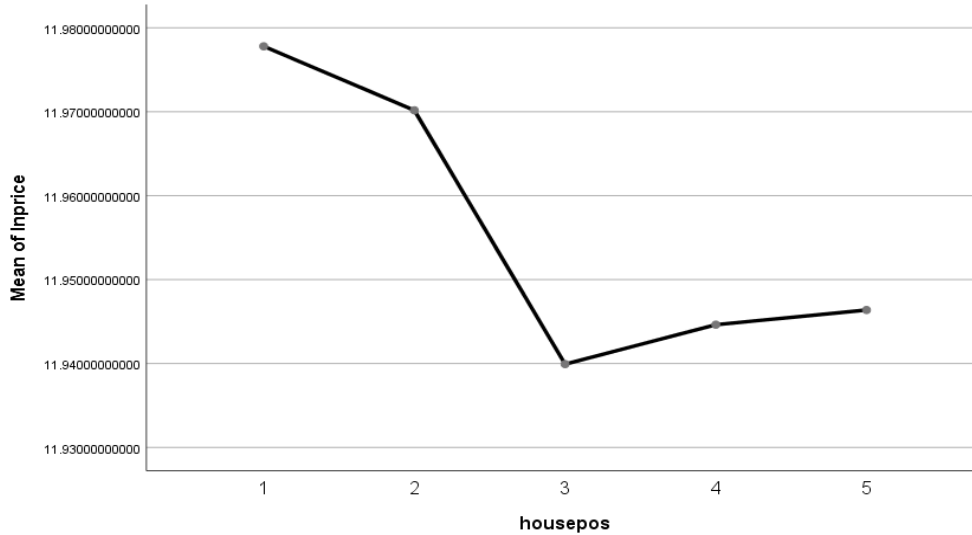


Figure 4. Mean of Log (Housing Values) by Position

When the housing prices are adjusted by Houston's consumer price index (CPI) from the Bureau of Labor Statistics (LBS), the situation has slightly changed, illustrated in Table 2 and Figure 5. Houses in Position 1 have the highest values while houses in Position 2 have the second highest values, which is exactly the same as that in our previous findings. Similarly, houses in Positions 4 and 5 have lower values than houses in Positions 1 and 2, which is also consistent to Feng-Shui theory. However, houses in position 3 (T-junction house) have a higher value than those in Position 4, which seems inconsistent to Feng-Shui theory. The possible reason is that Figure 1 may not reflect all the space arrangement of houses in cul-de-sacs. Some of the cul-de-sacs have island in the middle, which may change the situation of Position 3 and make houses located at this position no longer T-junction houses. In this case, Position 3 may have a better situation than position 4.

Table 2. Descriptive Statistics of Log (Housing Values Adjusted by CPI) by Position

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1	14464	11.3223	0.6659	0.0055	11.3115	11.3332	6.1938	16.7095
2	14285	11.3169	0.6640	0.0056	11.3060	11.3278	6.4747	16.5211
3	3346	11.2873	0.6888	0.0119	11.2640	11.3107	6.3447	14.2961
4	20580	11.2862	0.6626	0.0046	11.2772	11.2953	6.4149	16.2644
5	20329	11.2879	0.6502	0.0046	11.2789	11.2968	6.1499	16.5531
Total	73004	11.2999	0.6615	0.0024	11.2951	11.3047	6.1499	16.7095

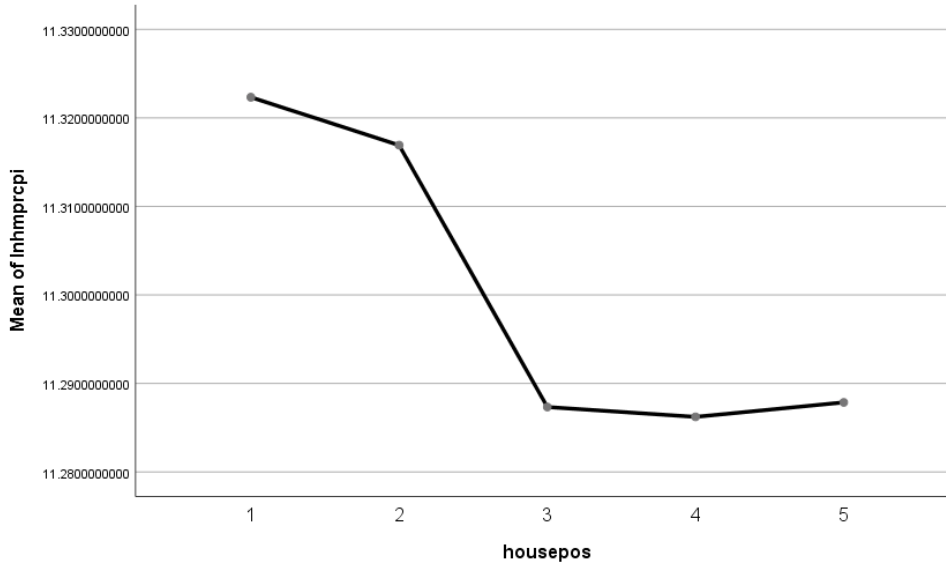


Figure 5. Mean of Log (Housing Values Adjusted by CPI) by Position

A multi-level regression also reports that the housing position has significant effects on property values. Properties located in Position i have significantly higher values than those located in the $i+j$ position, where, $i = 1, 2, 3, 4$ (Table 3).

Table 3. Estimates of Fixed Effects of Housing Position on Property Values

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	11.332841	.005860	42318.139	1933.827	.000	11.321355	11.344328
housepos	-.010485	.001186	59752.596	-8.841	.000	-.012809	-.008161

a. Dependent Variable: Inhmprcpi.

Conclusions and Discussions

To explore the relationship between *Feng Shui* and residential properties in North American settings, this research adopts a hedonic pricing model with spatial and statistical analysis functions to examine the impacts of *Feng Shui* concepts, especially the Cul-de-sac (dead-end), on residential property values. It selects the Greater Houston region in Texas as an empirical case. The analysis results show that the location of residential properties has significant impacts on property values. The houses at the optimal location have the highest prices while those located at the T-Junction have the lowest values without adjustment of the local CPI. The properties located at the T-Junction have lower values than those in the optimal locations, but higher than those in the less favorable locations according to the *Feng Shui* concept. The empirical study reports that the effects of the spatial arrangement of properties are mostly consistent with the *Feng Shui* theory.

A limitation of this study is that we have assumed all the cul-de-sacs have no islands in the middle because we lack capacity to separate the cul-de-sacs with and without islands due to the large number of observations. In the real world, a small portion of cul-de-sacs have islands in the middle, which may change the situation of some T-junction houses and promote their superiority. The results also show that the houses located at T-junction position do not have the lowest values after housing prices are adjusted by the Houston's consumer price index (CPI). This may reflect the situation that some houses at a T-junction may be located in cul-de-sacs with islands.

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