

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

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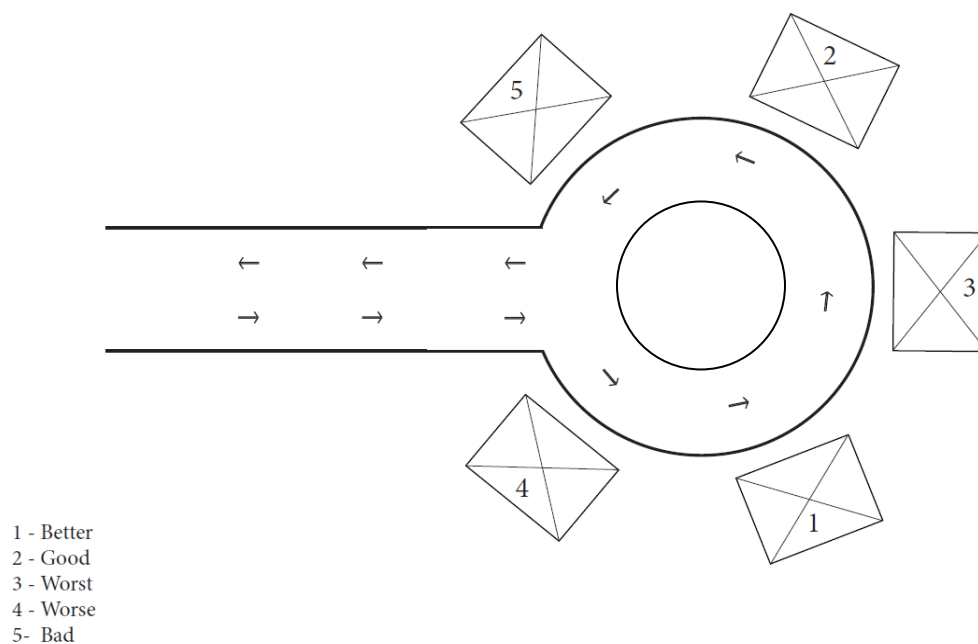
## Introduction

Feng Shui is the traditional Chinese philosophy evolved from Chinese people's observation and understanding of the nature's law. It relies on Yin and Yang that balance the negative and positive energies within a built environment. This concept has huge impacts on people's daily life in China and East Asia. An important practice is on residential properties. However, there are few rigorous studies that explore and quantify the effects of Feng-Shui.

In one of our previous studies, we have examined the underlying connection between Feng Shui settings and residential property values. Our results showed that Feng Shui concepts, especially the Cul-de-sac (dead-end) have significant impacts on residential property values of single-family properties in the Houston region. The effects of the spatial arrangement of properties are mostly consistent with the Feng Shui theory.

One of limitations of the 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. According to the philosophy of Feng Shui, the existence of cul-de-sac island which could potentially change the nature. To further advance our understanding of this topic, the existence of cul-de-sac island is adopted as a new variable in this study. By examining the values of residential property and comparing the patterns with Feng Shui's concepts, this study is to further examine whether the existence of an island in Cul-de-sac has potential impact on residential property values.

From Qi Strength Viewpoint





As a quick review of our previous study, we adopted the hedonic pricing models to investigate whether the impact of property location complies with Feng Shui's concept. As Figure 1 shows, properties were labeled with numbers by their locations within a cul-de-sac. In general, cul-de-sac properties are classified as Position 1 to 5 by order. The one locates closest to the entry is labeled as Position 4 properties, and those locates closet to the cul-de-sac exist is labeled as Position 5 properties. The properties at the T-junction which is in the center of the cul-de-sac, right in the front of the entrance road have Position 3. Those located between Positions 4 and 3 are labeled as Position 1 properties, and the properties located between Positions 5 and 3 are labeled as Position 2 (Figure 1).

In the Feng Shui's concept, the T-junction property at Position 3 usually is unfavorable to home buyers as it constrains more negative energies. Based on our previous findings, it confirmed that property values in Position 3 appears the lowest log value lower than Position 4 and 5. It also indicated that within a cul-de-sac, properties in Position 1 usually have the highest values and properties in Position 2 show the second highest values. Properties at Position 5 have slightly higher average values than homes in Position 4 but lower than Position 2.

As residential properties are sold in different years, to take inflation into consideration, our previous study applied consumer price index from the Bureau of Labor Statistics (LBS). The results showed that the situation has slightly changed. Properties locate in Position 1 still have the highest values and properties in Position 2 have the second highest values. However, properties in Position 3 (T-junction house) have a higher value than those in Position 4, which seems not exact the same to those expected by Feng-Shui theory (Figure 2). The possible reason is that Figure 1 may not reflects all the space arrangement of properties 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 properties located at this position no longer T-junction properties. In this case, Position 3 is expected to improve its preference and have a better situation than Position 4.

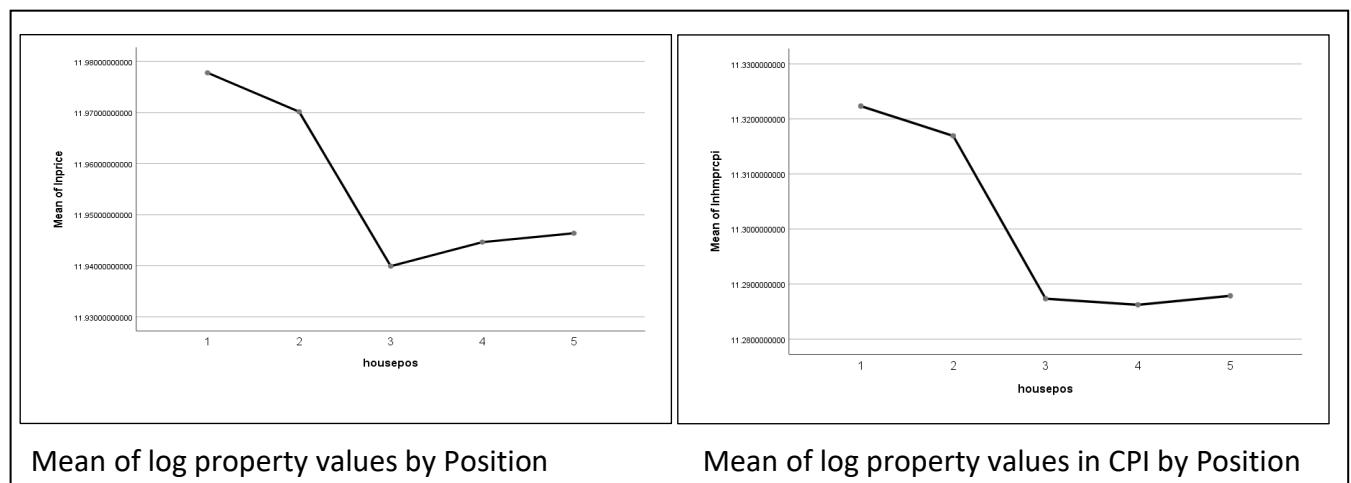


Figure 2. Mean of Log Property Values in Cul De Sac

## Empirical Study

In this study, we identified properties in all the cul-de-sacs with island. We selected Harris county, Texas as our empirical cause. A majority portion of City of Houston, Texas resides in Harris county. According to 2018 U.S. Census, Harris county contains over 4.6 million population and more than 1.6 million households. Among all the working-class population, over 97% has at least one vehicle at home. Among all the housing units, 54.1% are owner occupied. As one of the fastest growing cities within the U.S., Houston has a high demand for jobs and housing units within this region. Our study provides an insight for policy makers to understand the customers' preference for housing in the local housing market.

## Data

Housing data is acquired from 2017 InfoGroup database, which contains past real home sale prices and physical characteristics of residential properties, including home size, home age, owners' income, household financial status, home location, and etc. However, each time a home is sold there may be more than one records. The InfoGroup dataset contains very detailed home sales information recorded since the early 60s. One home could be owned by several owners and sold for several times. This causes duplicate records in the dataset. To clean up the database, we had to create a unique ID for each home contains consisted by home site ID and family ID. For example, if a three-member household, contains the parents and a kid, owns a home. There would be three records in the dataset showing owners' information for each owner. By creating a unique, we were able to eliminate the duplicate home sales information.

In order to identify the cul-de-sac, our research team adopted GIS application and local road network acquired from U.S. Census. The end point of a road is generally considered as a potential cul-de-sac. However, if there are no housing unit within a 150 feet buffer of the ending point, it is not considered as a cul-de-sac. This way criteria helps us to eliminate the ending points that are not located in a residential neighborhood. By doing so, we were able to find totally 17,425 cul-de-sacs within entire Harris County, and the total number of single-family housing units reside within a cul-de-sac in the Harris County is 73,007. In average, there are 4 residential properties in each cul-de-sac.

To find out whether a cul-de-sac contains an island, we manually compared cul-de-sacs on GIS map against those on Google Map satellite imagery. We examined each cul-de-sac side by side with google map manually, and we were able to identify 3,099 cul-de-sacs that contain island. The total number of properties within an islanded cul-de-sac is 13,626 (Figure 3). The statistics shows that by average, one island exists in out of every 5.6 cul-de-sacs.



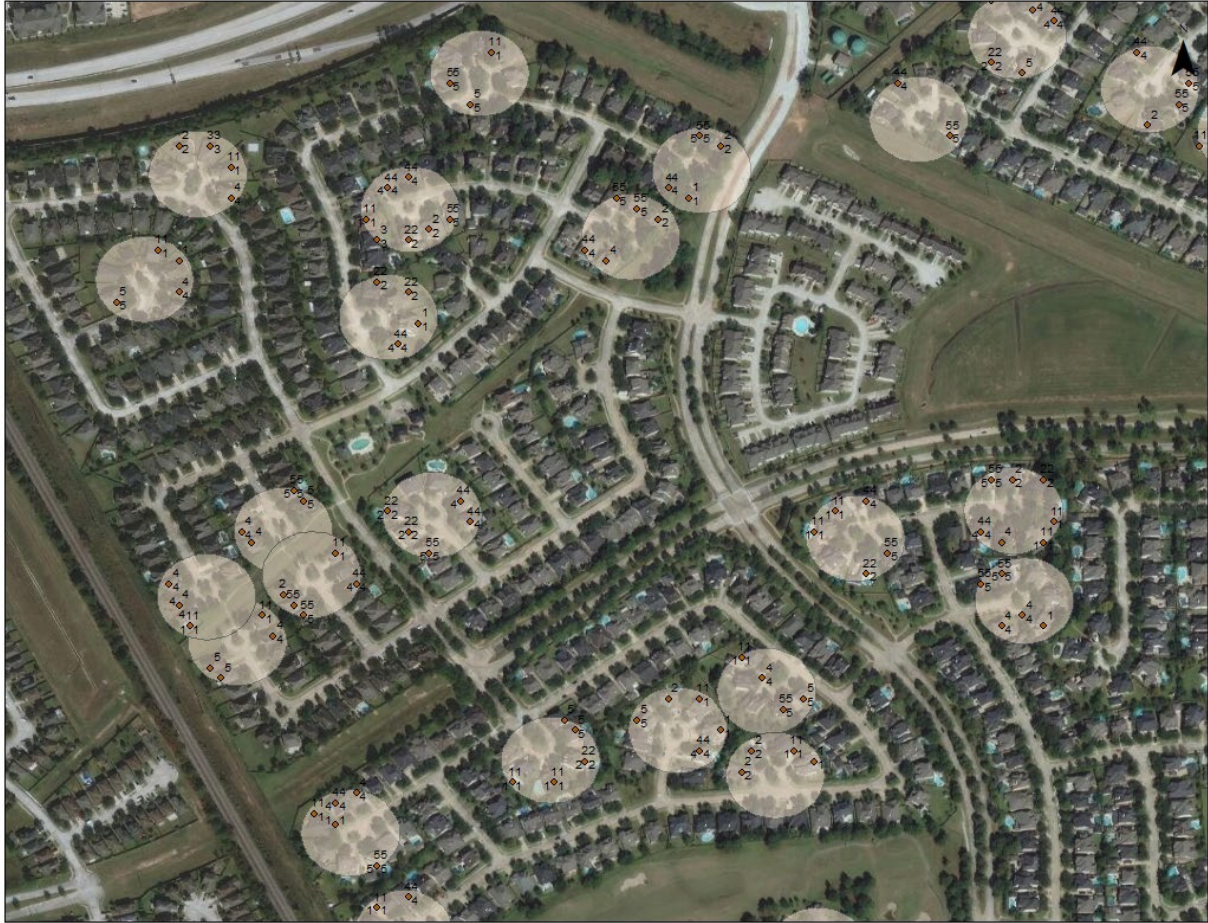


Figure 3. Residential properties in Cul-de-sacs with Island

Table 1 and Figure 4 shows the mean of log prices and the mean of log prices adjusted by consumer price index (CPI) for properties in cul-de-sac with an island. After adjusting the sale prices with CPI for properties in cul-de-sac with islands, the values of positions have a similar pattern as shown in Figure 2. Basically, the average value of homes with islanded cul-de-sac is higher than other properties. They both indicate that homes locate at Position 3 has the lowest average sale prices, and homes at Position 1 have the highest. Homes at Position 4 and 5 values are higher than those at Position 2, and Position 5 appears as the second highest value following by Position 4. This pattern is close to what we find in our previous study.

Table 1. Descriptive Statistics of Log Housing Values by Position in Cul-de-sac with Island

		<i>Position 1</i>	<i>Position 2</i>	<i>Position 3</i>	<i>Position 4</i>	<i>Position 5</i>	<i>Total</i>
	N	2,903	2,955	677	3,597	3,494	13,626
Descriptive Statistics of Log (Housing Values)	Mean	12.057	12.027	12.012	12.046	12.055	12.045
	Standard Deviation	0.669	0.671	0.669	0.664	0.653	0.664
	Standard Error	0.012	0.012	0.026	0.011	0.011	0.006
	Median	12.106	12.084	12.101	12.09	12.101	12.095
	Minimum	6.908	7.601	9.105	8.294	6.908	6.908
	Maximum	16.118	17.217	13.802	14.989	16.626	17.217
Descriptive Statistics of Log (Housing Values Adjusted by CPI)	Mean	12.248	12.222	12.201	12.232	12.241	12.234
	Standard Deviation	0.635	0.637	0.644	0.630	0.618	0.630
	Standard Error	0.012	0.012	0.025	0.011	0.011	0.005
	Median	12.289	12.269	12.284	12.267	12.273	12.275
	Minimum	7.062	8.126	9.401	8.704	7.433	7.062
	Maximum	16.309	17.347	14.115	15.183	17.131	17.347

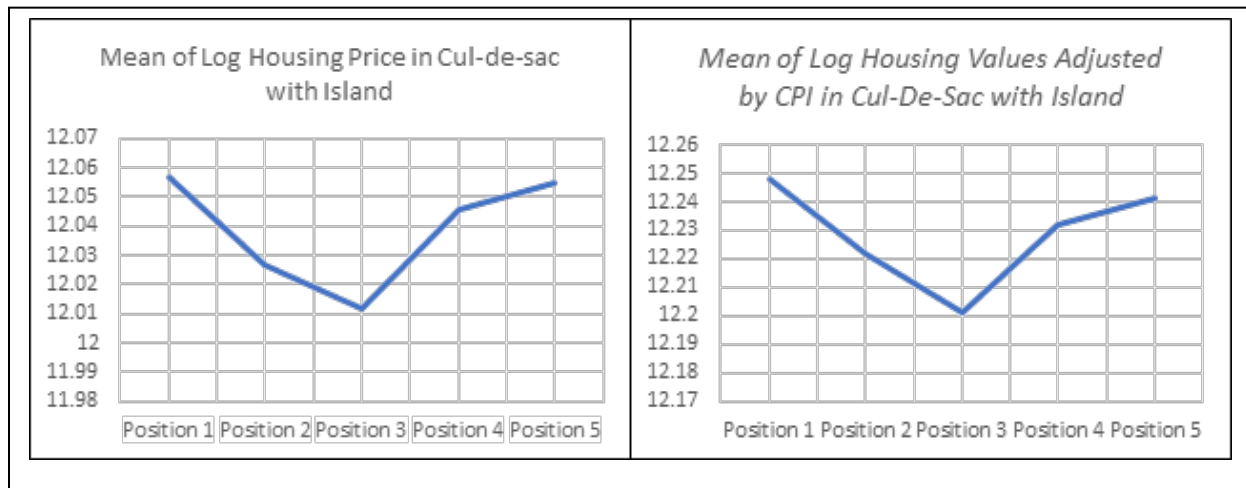


Figure 4: Mean of Log Property Values in Cul De Sac with an Island

## Methodology

Based on our previous research, we have identified the position (1-5) for each single-family housing unit within a cul-de-sac. In this study we further identified the units within a cul-de-sac that share an island. The concept is that the island is considered as an addition to the values of the nearby properties. In the Feng Shui concept, the island mitigates the negative energies within the cul-de-sac.

Hedonic model is adopted using traditional linear regression method, as below:

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

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.

$\varepsilon$  is the residual

$a$  and  $b$  are parameters.

In this study, we also used Geographically Weighted Regression (GWR) method to estimate the impact of cul-de-sac island on properties. The dependent variable is log housing price, and the independent or explanatory variables include the percentage of the total number of cul-de-sacs with an island over the total number of cul-de-sacs on the block group level.

## Results

The regression results for the hedonic model in Equation 1 are shown in Table 2A and Table 2B. They report that an island has positive effect on property values. Position 1 and 2 have significantly positive effects on residential property values (see Table 2B). However, their explanatory powers are much lower than that of the physical structure of the properties.

The GWR regression results in Figure 4 also shows that the model has modest explanatory power for residential property values. The total R square for the GWR regression is 0.1918.

## Conclusions

This research intends to enhance our knowledge of Feng Shui by conducting an empirical study on the effects of the spatial arrangement of properties on their values in Cul-de-sac with Island. We found that . Island has significantly positive effects on the residential property values. The property values are also significantly affected by their spatial positions in Cul-de-sac with Island, which confirms the impacts of Feng Shui concepts. However, the results are not what we expect that the properties at the T-junction which is in the center of the cul-de-sac, have improved



their situation. The properties located in the T-junction position still have the lowest values in comparison to those in other four positions in the cul-de-sac with island. It implies that the current features of the cul-de-sac island may not be good enough to improve the Feng Shui of the properties at the T-junction position. The landscapes of the islands may need to change by planting trees, bushes, or flowers.

Table 2A. Regression results for the hedonic model in Equation 1

<b>N</b>	<b>73,007</b>				
<b>R2</b>	<b>0.386</b>				
<b>Model</b>		<b>B</b>	<b>Sig.</b>	<b>VIF</b>	<b>R2 Change</b>
<b>6</b>	(Constant)	11.141	0.000		
	Home Size X10	0.370	0.000	1.111	0.363
	Home Age X1K	-0.072	0.000	1.100	0.023
	Island	0.038	0.000	1.007	0.000
	Position 1	-0.025	0.000	1.091	0.000
	Position 2	-0.023	0.000	1.090	0.000
	Position 3	-0.047	0.000	1.034	0.000
	Position 4				
	Position 5				

Table 2B. Regression results for the hedonic model in Equation 1 without physical structure variables

<b>N</b>	<b>73,007</b>				
<b>R2</b>	<b>0.004</b>				
<b>Model</b>		<b>B</b>	<b>Sig.</b>	<b>VIF</b>	<b>R2 Change</b>
<b>6</b>	(Constant)	11.926	0.000		
	Island	0.108	0.000	1.000	0.004
	Position 1	0.030	0.000	1.000	0.000
	Position 2	0.022	0.000	1.000	0.000
	Position 3				
	Position 4				
	Position 5				

Figure 4. GWR - Residential properties in Cul-de-sacs with Island

