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A Comprehensive Mathematical Ming Tang Model for Evaluating Shopping Mall Entrances with Case Studies

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Abstract: The main entrance and its associated pavement area, which is called *ming tang* in the traditional Chinese architectural theory, that is, *feng shui*, of a shopping mall, could affect the attraction of customers, but quantitative assessment methods for evaluating a *ming tang* remain nonexistent. This paper's main contribution is to present a novel approach to combine traditional *feng shui* principles with a mathematical model for more quantitative evaluation on the design of a shopping mall's *ming tang*. The paper first studies modern theories related to *ming tang* and then adopts traditional *feng shui* principles to identify three main criteria for evaluating shopping mall entrances. The use of a novel and comprehensive mathematical model for assessing *ming tang* is demonstrated by five shopping malls in southern China with data collected from online maps, business reports, and rankings. The criteria of *distance ratio, angle*, and *relative size* are considered feasible for the assessment of *ming tangs* in the aspect of customer attraction. The model presented may shed light on further study of the *feng shui* theory and the impact of *ming tang* design on business performance when more commercial data is available.

Keywords: shopping mall, ming tang, mathematical model, feng shui

1. Introduction

Shopping malls are important components of sustainable cities as they provide space for business, investment, and social activities. What are the elements that contribute to shopping malls' attractiveness? A variety of elements of shopping mall attractiveness have been investigated, and the main ones are identified [1–3]. However, scarce literature specifically investigates the design of the shopping mall entrance where people perceive the first impression of malls. For example, Han et al. [2] study the factors that provoke shoppers toward shopping malls, and a group of items related to built environments is explored, but the design of the shopping mall entrance is not included.

The first impression that attracts customers certainly is the shopping mall entrance. Different constructions of space can create different effects influencing human behavior [4]. Modern urban planning research shows that people tend to be attracted by the presence of other people as well as human activities, and a properly designed frontage of a shopping mall can boost relevant elements to attract pedestrians [5].

It is noted that shopping malls that have adequate open space in front of their entrances usually possess a higher customer traffic density than their counterparts with limited space. The mentioned spatial open space in front of the main entrance is called "*ming tang*" in ancient Chinese architecture or *feng shui* [6]. It originated from the observation of astronomical constellations, natural phenomena, and human behavior [7]. In *feng shui* theories, there is a technical term especially for this space – *ming tang*, one of the significant elements in an ideal *feng shui* model, and this model yields no perpetual difference between the western and eastern architects on preferred surrounding environments [6].

Modern academic researchers opine that some *feng shui* theories are scientific [8] and compatible with modern assessment in modern house design [9], landscape ecological perspectives of urban planning and landscape management [10], and built environment analysis [11]. Therefore, besides modern architectural theories, it is also worth looking at *feng shui* theories to analyze this open space in front of shopping malls.

Ming tang is believed to be relevant to shopping malls' customer attraction, which contributes to sales income. There was a pilot study based on a primitive quantitative model [12]. However, the criteria for evaluating *ming tang* need to be more comprehensive, which calls for a quantitative model of it for scientific evaluation. This is the major goal of this research. Also, research on the spatial system of a shopping mall has been largely focused on the

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interior-built environment to create a comfortable ambience inside to increase the shopping mall's attractiveness. Yet, how to create an open space outside a shopping mall that can amplify customer traffic is also significant.

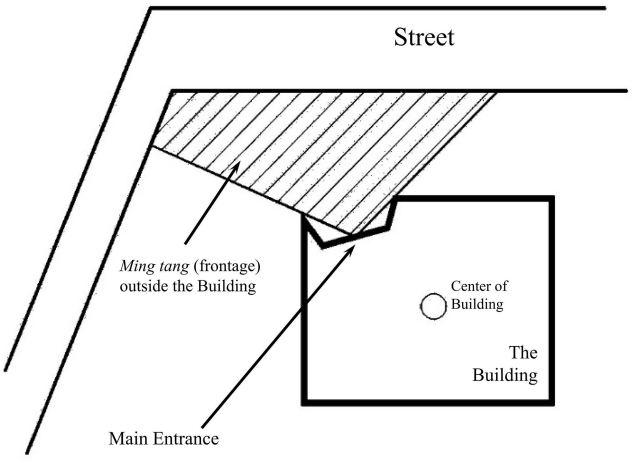
Subjective judgment is a common method applied to explain a *feng shui* phenomenon. How to judge a shopping mall's *ming tang* quantitatively based on *feng shui*? There is no measurable method available in the literature on *ming tang* in traditional *feng shui* theories. To address this gap, this research presents a novel approach to combine traditional *feng shui* with a mathematical model for more quantitative analysis of *feng shui*-based shopping mall evaluation. The novelty of this paper is that the measurable distance *ratio, relative size,* and *angle* of *ming tang* are derived so that the effect of *ming tang* on shopping malls can be studied quantitatively when commercial data is adequately available. The main contribution of this research is a comprehensive mathematical *ming tang* model for evaluation developed based on traditional *feng shui* principles but under a modern approach. Building on the primitive *yin-yang* mathematical model of *distance ratio* developed by Zhang et al. [12], we further investigate how the design of *angle* and the overall *relative size* of the shopping mall's *ming tang* may attract more shoppers and propose this comprehensive model to evaluate these criteria.

In the next section, modern research and the theories related to *ming tang* from a *feng shui* perspective will be reviewed, and then three criteria that should be considered in assessing the open space in front of a shopping mall will be discussed. A comprehensive mathematical model will be developed to quantitatively evaluate the grade of a *ming tang*. Finally, five shopping mall cases in Guangzhou, the capital city of Guangdong province in China, will be analyzed by this new model for illustration.

2. Modern Research Related to *Ming Tang*

In modern architectural terminology, an open area in front of a building or inside is named a *Concourse* where many people gather [13]. This concept could be referred to as *ming tang* in the traditional *feng shui* model. *Ming tang* represents the open space in front of the "*Cave*," which is the *feng shui* spot or the best location [6]. In practical application, *ming tang* mainly refers to the open space in front of the entrance of a building or a site. Entrance is defined as an opening, such as a door, passage, or gate, that allows access to a place (retrieved from Bing.com, data from Oxford Languages). As for shopping malls, *ming tang* refers to a certain open space in front of a shopping mall entrance [12]. Considering the context of the shopping mall, this open space or frontage [5, 14] is exactly in front of a shopping mall's main entrance in modern architectural terms. Figure 1 depicts the *ming tang* area in front of a building with a shaded area. It extends from the entrance of the building to the edge of the street, occupying part of the frontage space.

Figure 1
The open space in front of a shopping mall, called *ming tang* in ancient Chinese terminology (Source: Drawn by authors)



Ming tang, from the perspective of spatial order [15], can be considered a transition space in modern architectural terms, as such a frontal open space connects the street and the building. Transition space is an in-between area linking two different domains, for example, interior and exterior, public and private, and affects human behavior [16]. In the shopping mall context, the surrounding streets belong to exterior space, and the shopping mall itself is an interior space. Hence, the shopping mall's *ming tang* functions as a "transitional buffer" between them. Streets and shopping malls are two types of spaces with a great difference in spatial ambience and structure. The former is an exterior open space with fast-walking pedestrians and fast-moving vehicles, while the latter is an interior enclosed space with slowly walking shoppers. Providing the frontage with a semi-exterior space, open or covered, between the streets and the shopping malls establishes a continuous and definite spatial order, from the exterior through the semi-exterior to the interior and vice versa. This composition of spatial order is regarded as effective in stimulating pedestrians [15].

The physical qualities of streets have an impact on people's outdoor activities [17]. To convince customers to walk into a shopping mall, it is necessary to bring them to *ming tang* first. The activity of taking a walk in a certain open place is influenced by the quality of the outdoor built environment [5]. An active frontage is one of the main design characteristics to increase the customer traffic of shops and retail stores [18]. The *ming tang* in the shopping mall frontage plays a pivotal role in attracting customers. A well-designed frontage has the function of gathering people as human beings tend to be attracted by people and human activities [5]. As the width of the frontage is important to people's activities [19], the size of the *ming tang* is thus a key physical factor in increasing footfalls. While Gehl [5] notes the use of narrow frontage to enhance street life, Farahani and Beynon [19] promote the importance of a wider frontage to boost activities for street cafés. Therefore, there should be a proper size for the *ming tang*, and the secret of a successful frontal open space in customer attraction lies in measuring the proper size, which remains a gap in contemporary studies. Zhang et al. [12] propose the criterion of *distance ratio* by measuring the distance between the entrance to the center of the building and the distance between the outer boundary of the *ming tang* to the same center for evaluating the *ming tang*. However, distance is only one dimension to calculate the size, and in order to build up a comprehensive model for *ming tang* evaluation, more criteria should be considered.

3. *Feng Shui* Theories about *Ming Tang*

Feng shui in ancient China was a collective wisdom on architecture, planning, and the built environment. It is increasingly believed to be scientific, thus drawing modern researchers' attention [8]. Also, the agreement between *feng shui* principles and modern architectural design theories has been gradually uncovered [6]. To grasp the mechanism of *ming tang*, it is worth taking a closer look at it from the perspective of *feng shui*, as the long-term studies and practice of *ming tang* in *feng shui* could contribute to the discovery of criteria for establishing a comprehensive theoretical model of *ming tang*.

Qi is considered a type of energy and one of the most fundamental concepts in *feng shui.* There are two basic types of *qi*, namely, *sheng qi* (nourishing energy) and *sha qi* (destructive energy) [12]. *Water* is one of the five geographical factors in a classical *feng shui* model for built environment analysis [8]. Mak and Ng [6] further interpret that roads and streets carrying traffic can be treated as a flow of water. Watercourses, roads, bridges, and streets share the same nature: flow. Therefore, the essence of *water* in *feng shui* is flowing, which means that the *qi* carried by *water* comes from flowing instead of real water molecules. According to the *Water Dragon Classic* by *Jiang Dahong* (1620–1714), the *qi* carried by *water* is significantly affected by the flowing speed of the *water*; a slow flow of *water* brings *sheng qi*, while a fast flow carries *sha qi*. Therefore, the flow speed of customer traffic distinguishes *sheng qi* and *sha qi.*

In *feng shui*, *qi* is considered the energy that shapes the form of the landscape [20]. Paraphrased in modern architectural terms, *qi* can be viewed as the element that constructs the space characteristics, and thus, flow is considered of great importance in shaping the characteristics. A space of *sha qi* refers to an environment of fast-moving elements such as pedestrians and vehicles in haste, and a space of *sheng qi* refers to an environment with a slowly moving flow such as shoppers and visitors taking a stroll. In this regard, the interior space of shopping malls requires *sheng qi*, but the exterior space is usually full of s*ha qi*. Therefore, the two different domains require a space in between to provide a transition as well as a link to achieve a continuous spatial order [15].

Ming tang can turn *sha qi* into *sheng qi* and thus deserves attention [12]. In other words, *ming tang* can provide a transition between the exterior space and the interior space, which benefits customer attraction. Also, *ming tang* is regarded as a place where *qi* gathers and *water* is collected, according to *Dragon Seeking Classic* and *Dragon Distinction Classic* by *Yang Junsong* (834–900). Hence, *ming tang* has an impact on customer traffic, and a good *ming tang* is supposed to gather customers. The method of applying traditional Chinese practices to modern architectural design or planning has been adopted in many studies [6]. Yet like modern studies on the open space outside the main entrance of a building, in *feng shui*, the theories of *ming tang* are mainly descriptive in nature. To measure a proper *ming tang* to obtain levels for comparison, a quantitative model should be built up.

4. Criteria for Ming Tang Evaluation

Ancient Chinese scholars tended to generalize both abstract and concrete things into a duality system, namely, *yin* and *yang*, and they are the fundamental elements embodied in *feng shui* [21], so the key to constructing the model for *ming tang* evaluation lies in what *yin* and *yang* represent and how they affect customer traffic. Generally, in a conceptual dimension, *yang* means active, and *yin* means passive [8]. Xu [22] interprets that "solid is *yin"* and "void is *yang"* with respect to space. Based on this principle, empty space is considered *yang* and occupied space *yin*, concretely. The specification of *yin* and *yang* facilitates the scientific application of *feng shui* theories. Traditionally, *ming tang* is included in the Form School approach, known as the five geographical elements, that is, *"Dragon – Sand – Water – Cave – Direction"* [23] and scoped as the open area in front of *cave.* This is quite abstract in nature and cannot be measured quantitatively. Based on the parallel concept of frontage found in Western research and the requirement to specify empty and occupied space, methods for analyzing floor plans could be applied. The widely practiced nine-square thus could be considered for measurement. The employment of the nine-square is merely to facilitate measurement. The whole process is not related to the Compass School, such as the application of the "*Nine Palace Flying Stars*" method.

Zhang et al. [12] propose a model of a *yin-yang* setting to analyze the built environment for a target building based on the proportion of open space and occupied space. According to the proportion of *yin* and *yang*, this model applies the notions of "*tai yin*" (greater yin), "*tai yang*" (greater *yang*), "*shao yin*" (lesser *yin*), and "*shao yang*" (lesser *yang*) from the book *Yijing* to judge the space characteristics of tightness and exposedness of a built environment. The four *yin-yang* settings descriptively indicate the general division of four types of *yin-yang* situations (refer to Figure 2). An extremely tight built environment is considered *tai yin*, an extremely exposed one *tai yang*, a slightly tight but overall balanced one *shao yin*, and a slightly exposed but overall balanced one *shao yang*. A balanced *yin-yang* setting or a slightly more *yang* setting is preferable for shopping malls that emphasize business performance due to the activeness required in commercial buildings, which should be appropriately tight and exposed, or slightly exposed. In this case, *ming tang*, a proper open space in between the building and its surroundings right outside the main entrance, is of great importance. This result is in line with the findings in modern research [17, 18].

Based on the above, three criteria are put forward to form a theoretical model for *ming tang* evaluation: *distance*, *angle*, and *area*. The variable *distance* is the ratio of the length from the center of the building to the boundaries of the *tai yin* and *tai yang* of the building. According to Zhang et al. [12], the *distance* ratio between 1.5 and 2.5 indicates a balance of *yin* and *yang*. The *distance ratio* of *ming tang* is a significant aspect of keeping the balance of *yin* and *yang* (tightness and exposedness) between a shopping mall and its surroundings in *feng shui.* The importance of the *distance ratio* of *ming tang* has also been noticed in modern research on the influence of frontage on people's activities [19].

The second variable is the *angle* of *ming tang*, which is the shape of the entrance of a building, a place of *qi* collection. The *angle* mentioned in classical *feng shui* literature refers to proper embrace, not exactly the geometrical angle to be measured. It is also believed that a proper *angle* is beneficial for *ming tang* to better connect the interior and exterior space. Once the *angle* is identified, the side boundary of *ming tang* can be established. Along with the edges of frontages/streets, the whole boundary of *ming tang* can be scoped.

The third variable to evaluate *ming tang* is the *area*, and a proper frontal space is indeed significant to a shopping mall [18]. According to the *yin-yang* setting model [12], a proper area of *ming tang* is in proportion to the area of the building it belongs to. It is suggested that the concept of *area ratio* should be applied to the use of these criteria, and in this way, a better evaluation of *ming tang* can be achieved.

5. Research Methodology and Methods

In this study, three mathematical elements regarding *ming tang* have been selected as they are the crucial elements in designing a *yin-yang* balanced *ming tang*. Any changes in the three variables can lead to changes in *yin* or *yang*. Through conventional *feng shui* theories, how *ming tang* can contribute to customer attraction from different perspectives can be found and compared, and how *ming tang* can be measured by different criteria is also proposed.

A mathematical model for *ming tang* was developed. The first step of model development was to derive a benchmark of the three *ming tang* elements that are measurable, that is, *distance (ratio)*, *angle*, and *area*. Five shopping malls with desirable locations,

accessibility [1], population [24], and similar retail structures but different in the *ming tang* layout were used to verify the *ming tang* criteria proposed. The next step was to calculate the three measurements of the five buildings and analyze them against the benchmark. The final step was to classify the buildings as good, average, or poor according to the benchmark developed. Comparing and ranking the studied buildings was the last step. The shopping malls' data was collected from open-access online maps, business reports, and rankings of sales. Baidu Maps is one of the most authoritative online maps in China, and the data collected from this map for the case study is reliable. The use of AutoCAD ensures the reliability in the measurement of the buildings of shopping malls. The number of shopping malls within a one-kilometer radius is also calculated from Baidu Maps, as shown in Table 4. The data of permanent residents within the one-kilometer radius zone was gathered by Winshang, which is an authoritative institute specializing in commercial real properties, being shown in the case study of each shopping mall and also grouped in Table 4. The source of the data from Wingshang was footnoted in each case. As precise sales income is confidential data of shopping malls, sales rankings in public were adopted as an alternative, considering that the differences in sales volume can be reflected in rankings. Also, since sales somehow indicate customer attraction, the effect of *ming tang* and the feasibility of our quantitative criteria can be demonstrated by comparing the variables and the sales rankings.

5.1. Mathematical model of shopping malls' *Ming Tang*

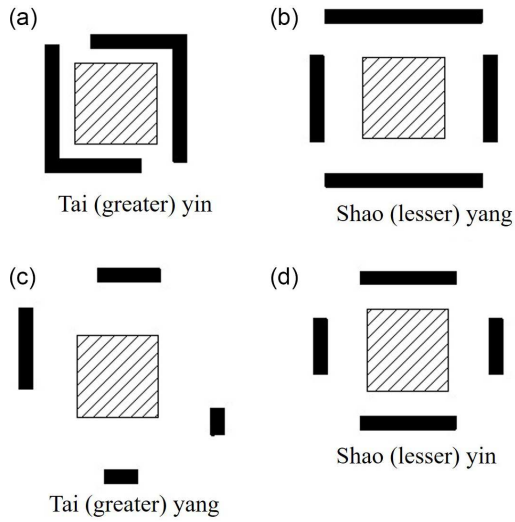
Our comprehensive mathematical model was developed from a primitive one that calculates the characteristics of a *ming tang* based on the *yin-yang* setting model [12].

5.1.1. Deriving distance ratio formulae

The *yin-yang* setting model was built upon four *yin-yang* aggregates as shown in Figure 2. The shaded square refers to the targeted building, and the thick black lines represent either surrounding buildings or streets. In Figure 2(a), the targeted building is tightly surrounded by neighboring buildings, thus called "*tai yin*." Figure 2(c) is too exposed, thus called "*tai yang*." Figure 2(b) and (d) are appropriately tight or exposed. Figure 2(d) is preferable for a shopping mall because it is a bit more *yang*, or less *yin*, that is, a relatively larger proportion of empty space than "*shao yang*." As the space between the black lines and shaded square is the transition space, the proper size of *ming tang* can be measured based on this model.

Our primitive model [12] originates from the conventional nine-square layout, which has long been widely used by *feng shui* practitioners [25]. The nine-square layout with one central block and eight surrounding blocks is a theoretically simplified plan of a square-sized building. This method has been applied to analyze single houses and courtyard houses [26] and offices [25] for a long time by *feng shui* masters. This paper has nothing to do with the Compass School and applies to the Form School only, that is, *yin* and *yang* principle. The detailed discussion of the two schools is beyond the scope of this paper. The adoption of the nine-square here is merely to facilitate space measurement, that is, dividing a certain building unit into subdivisions of the same size, unlike the one adopted in the Compass School to determine which orientation is auspicious or not. The Form School of *feng shui* works with *qi* energy based on the core concept that "form" defines energy flow. The key point in "form" is the arrangement/layout of a space and the shapes of the components in that setting [27]. In this paper, the nine-square

Figure 2
Layout of residential buildings in four aggregates [12]



model is applied to divide the area where a shopping mall is located into several equal sub-areas. Hence, our nine-square is employed in Form School research for space measurement. Actually, many *feng shui* masters did use this nine-square model in real practice for space measurement and compartmentalization in floor plan design [28]. With this model, the layout of a space and the shapes of the components in the analyzed setting can be clearly evaluated geometrically. As *ming tang* is regarded as a type of space in a building, the nine-square model can be applied to identify, analyze, and measure it. This does not contradict the classical five geographical models "Dragon-Sand-Water-Cave-Direction" in the Form School but is instead a supplement to its quantification. As shown in Figure 3, the shaded square represents the targeted building at the center, surrounded by eight neighboring squared spaces, and the dotted lines

Figure 3
Nine-square model adopted by *feng shui* practitioners [25] p. 21 with add-on by authors

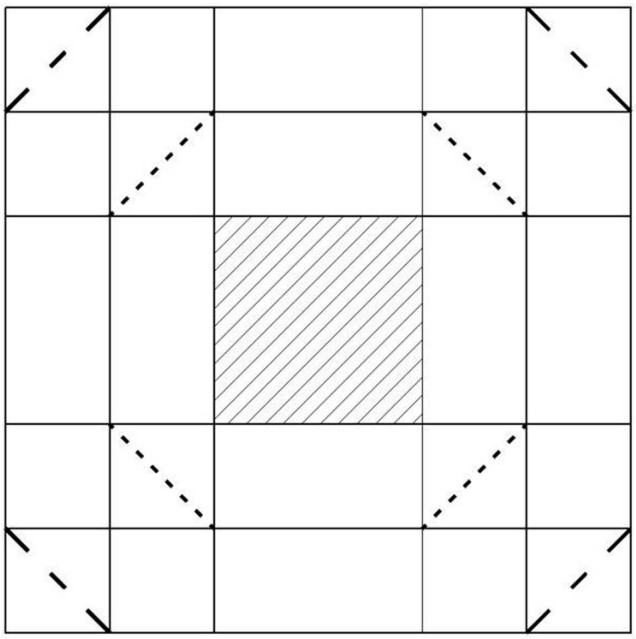
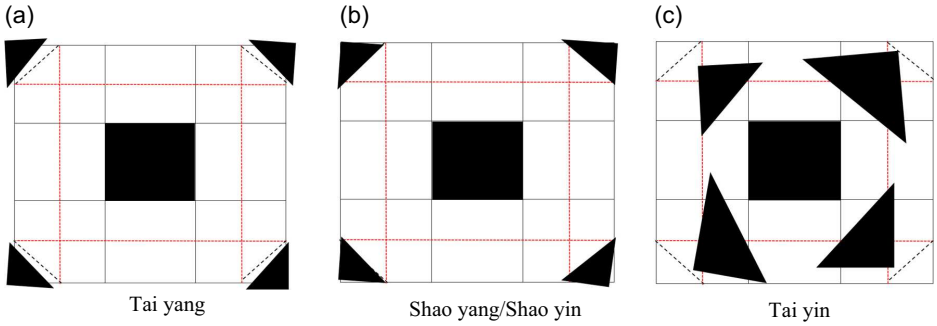


Figure 4
Location of external buildings based on the nine-square model (Source: Drawn by authors)



are added by us to mark the boundaries of *tai yin* and *tai yang*. Reference is then made to Figure 4. If all external buildings are totally beyond the outer dotted lines, the situation is considered "*tai yang*" (Figure 4(a)); if they are all within the inner dotted lines, the situation is considered "*tai yin*" (Figure 4(c)); if they are between the two dotted lines, it is considered auspicious, either "*shao yang*" or "*shao yin*" (Figure 4(b)). Here, "*shao yin*" means buildings nearby are relatively far away from the central building, while "*shao yang*" is closer to the central building. As mentioned before, shopping malls look for a "*shao yin*" layout for a more dynamic property.

Referring to Figure 5(a), by measuring the distances between the center, O, of the targeted building, its main entrance, at point A_1, and the two dotted lines, at points B and C, some calculations can be done. Again, the shaded central square represents the shopping mall. Suppose the width of the building represented by $A_1A_2 = 2$, half the diagonal of the central square, OA_1, is then of length $\sqrt{2}$, and it can be further shown that $OB = 1.5\sqrt{2}$ and $OC = 2.5\sqrt{2}$. Therefore, two magic ratios, OB and OC, to half of the building diagonal, OA_1, as given by "1.5" and "2.5," are formulated. Such ratios can be similarly extended to the remaining four-sided squares, that is, OE and OD, in Figure 5(a). It can also be shown that $OD/(A_1A_2/2) = 2.5$ and $OE/(A_1A_2/2) = 1.5$. In other words, the ratio of the distance of an external building to the distance of the building envelope, both from the center of the targeted building, should obey the magic ratios of "1.5" and "2.5." Such a concept could be applied to buildings of hexagonal (Figure 5(b)) or even irregular (Figure 5(c)) shapes. As discussed before, shopping malls tend to welcome a little bit more *yang* setting, and therefore, it is all right if the ratio is slightly larger than 2.5, but certainly not smaller than 1.5.

As mentioned before, the entrances or *ming tangs*, in particular the main entrance of a shopping mall, are of the utmost importance as they allow a connection between the exterior spatial order and the interior one [15]. Hence, the mathematical model should first be applied to all main entrances, but not to small and side entrances. The distinction between main entrances and side entrances is based on space, facade, and people flow. Space refers to the opening of the entrance, and facade means the board and decoration around the entrance, while the people flow is the number of people moving in and out of the entrance. The main entrance usually has a larger space with an obvious facade, and a much larger people flow than the side entrance. Customers either prefer or are guided to enter a mall via the main entrance. For shopping malls, main entrances are commonly opened on the side facing one or two main roads, which can be taken as an important criterion in judging which one is the main entrance.

By checking the main roads and conducting a field trip to a shopping mall, the main entrances and side entrances can be distinguished. The ones with the largest opening, where most people flow, and obvious main door facades are considered main entrances. Based on the above criteria, usually there are up to two main entrances in a shopping mall, but in some cases, there is only one. An example of shopping mall entrances can be found in Figure 8(a) where the north entrance and south entrance of the Tee Mall are the main entrances as they face the main roads, that is, Tianhe Road and Tianhenanyi Road. The size and façade of these main entrances are relatively larger than those of the east and west entrances. Due to easy access, around twice the customer traffic per minute was observed through these two entrances as compared to the other two entrances.

5.1.2. Deriving angle measurement

Figure 6 shows the main entrance of a typical shopping mall with an open frontage on the upper-left side where the boundary of the frontage meets the street. The boundary is the border of the whole property, that is, the land lot. A straight line is drawn from the building center to the midpoint of the main entrance and further to the boundary between the frontage and the street. The ratio A/B is to be measured to see whether it is within the ratios of "1.5" and "2.5" as discussed in the previous section. The angle of the fan-shaped shaded region, measured from the midpoint of the main entrance, defines the *angle.*

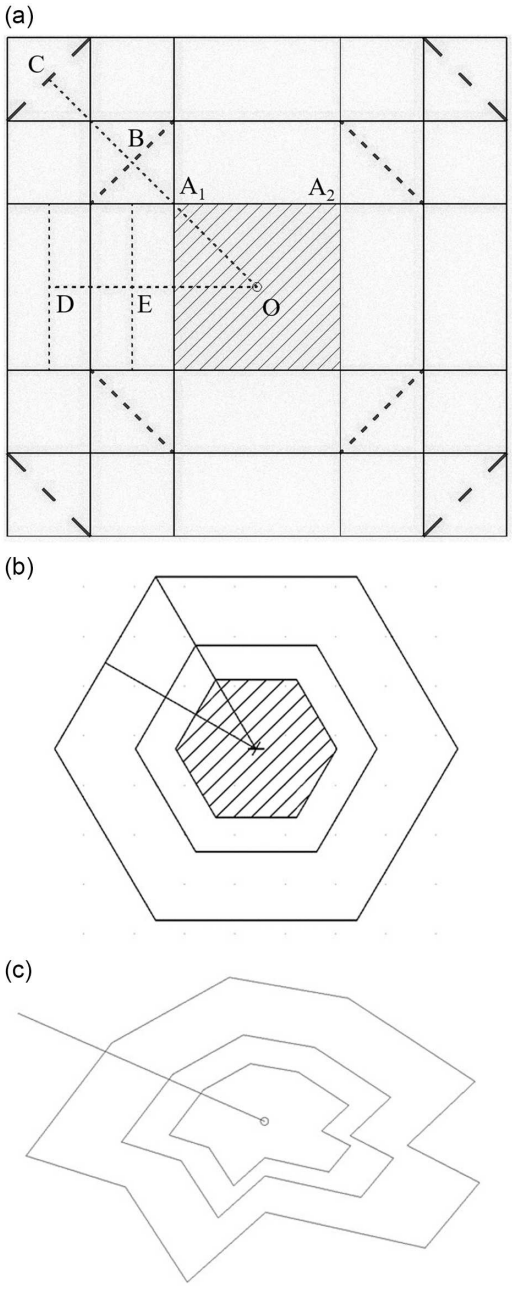
It is proposed that two additional straight lines be drawn from the midpoint of the main entrance to the two widest unblocked edges of the building and further to the frontage/street boundary, forming a sector. It is known that a concave design for the shape of *ming tang* is beneficial [12]. The *angle* of the sector formed by these two lines should be at least 90° to make sure a *ming tang* is concave enough, as shown in Figure 7.

The rationale for setting 90° is based on the balance of *yin* and *yang* in *feng shui* theory. The Form School requires a balance between *yin* and *yang*, which is also the foundation of the four *yin-yang* aggregates mentioned above. The entrance should be wide enough to collect and defuse *qi*, so it should at least transcend the balance point of *yin* and *yang*. The surface is 180°, which means the maximum angle of a main entrance is 180°. When the opening is 90° or above, it can be considered reaching the balancing point of *yin* and *yang* and thus be wide enough. Hence, the frontage with at least such an angle is considered spacious enough to gather, collect, and defuse *qi*. Furthermore, when the side squares are considered, the angle faced by the main entrance is naturally 180°. Therefore, a range between 90° and 180° sounds reasonable.

5.1.3. Deriving the relative size of ming tang

Besides the *angle*, the *relative size* of the *ming tang* is also of the utmost importance. The shaded fan-shaped region in Figure 6

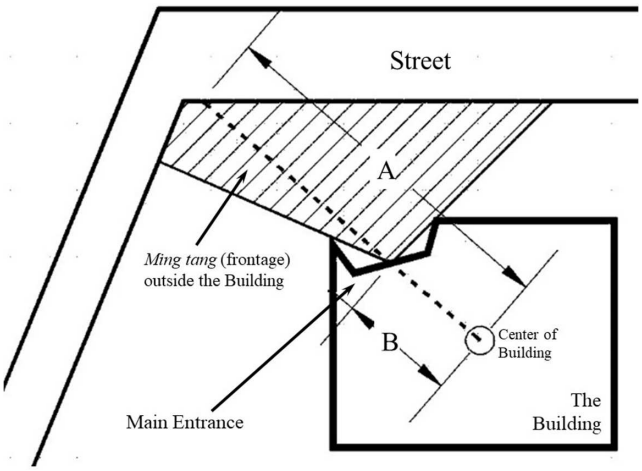
Figure 5
(a) Mathematical model of four aggregates of building surrounding [12]. (b) Model of hexagonal building [12]. (c) Model of irregular building [12]



is the *area* of the *ming tang*, and its *relative size* (*MTRS)* is to be measured.

As mentioned above, shopping malls require *sheng qi*. If the building is huge while the *ming tang* is exceptionally small, it is not spacious enough to defuse sufficient *sha qi* into *sheng qi* to meet the requirements of the whole entity, which can also be understood as *yin-yang* imbalance. Hence, another mathematical feature is proposed, as shown in Figure 7, where the *ming tang* in the upper-left block is considered, without loss of generality, with an associated main entrance in the upper-left corner of the central building. The distance from the center of the building to the main entrance is similarly given by *B*. The *ming tang relative size (MTRS)* is defined as

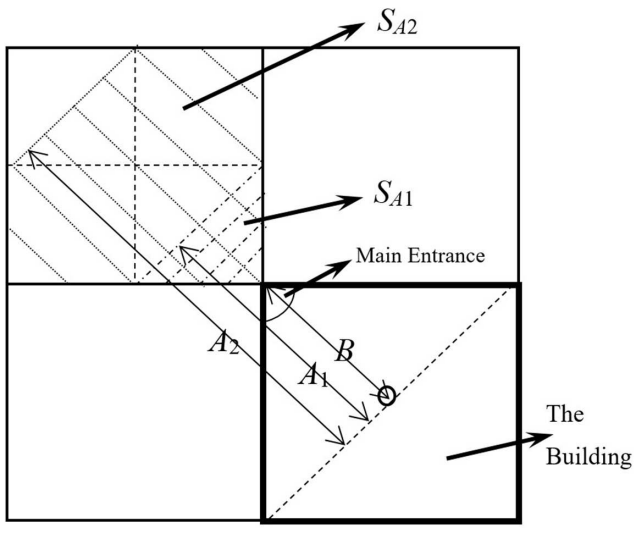
Figure 6
Application of the mathematical model to the main entrance of a typical shopping mall, the *ming tang* (Source: Drawn by authors)



the ratio of the total area, S_A, of the *ming tang* to the square of *B*. Such S_A is actually the area of the fan-shaped shaded region shown in Figure 6. This division process is necessary for normalization to make sure the size is relative to the apparent size of the building itself. The reason why the actual size of the building is not used as the denominator is the consideration of buildings of irregular shapes. For example, a rather rectangular building may not be large in actual size but may need a bigger *ming tang* if it has an exceptionally big length or width. Therefore, the square of *B* is used instead of the actual area of the building to give the apparent size of the building. Moreover, in the definition of the first element, *distance ratio*, above, half the diagonal of the building, that is, OA_1 in Figure 5(a) being equivalent to *B* in Figure 7, is used. Hence, the use of *B* here in the third element is in line with the concept of the first element.

Since there are two limits of *A* in Figure 7, with *A*2 representing the limit of the "*tai yang"* scenario and *A*1 representing the limit of "*tai yin*," their associated sector areas are correspondingly given by S_{A2} and S_{A1}, respectively. Following the same approach before, the

Figure 7
Definition of *MTRS* of a *ming tang* (Source: Drawn by authors)



two limiting values of the *MTRS* become S_{A2}/B^2 and S_{A1}/B^2. From Figure 7, it can be shown that $S_{A1}/B^2 = 0.25$ while $S_{A2}/B^2 = 1.75$. In other words, the *MTRS* should desirably fall within this new magic range as well. Again, shopping malls should be more dynamic and welcome "*yang qi*" a bit more. Therefore, it is all right if the *MTRS* is slightly larger than 1.75 but certainly not smaller than 0.25.

When the side squares are considered, reference is made to Figure 5(a), where the shaded region outside an entrance but up to point "E" has an area equal to 0.5*2 = 1, while the distance from the center of the building to the entrance is given as equal to 1. Hence, the *MTRS* = 1/(1*1) = 1. The shaded region outside the entrance but up to point "D" has an area equal to 1.5*2 = 3, while the distance from the center of the building to the entrance is also given by 1. Hence, the *MTRS* = 3/(1*1) = 3. With a view to the differences between the limiting ratios of corner and side squares, a conservatively desirable choice is a range between "1" and "1.75" for main entrances. Yet it has been mentioned several times before that the *MTRS* could be slightly larger than the upper limit to achieve a bit more "*yang*."

The assessment is based on the following criteria as proposed:

1) For *distance ratio*, based on the above definitions, the desirable lower and higher values for the main entrances based on the mathematical model are 1.5–2.5. So, when the ratio is within 1.5–2.5, it is classified "good." Since the minimum value is 1, we divide it into two categories, with 1.25–1.5 marked "average"; when the ratio is either below 1.25 or beyond 2.5, it can be considered "poor." There is also one exception. It has been argued that a slightly larger value, that is, a bit more "yang," is also favorable. Therefore, though the upper limit is now set at 2.5, in some cases, the ratio over 2.5 can also be "good."
2) For *angle*, the desirable range of 90º–180º is considered "good." Again, the region below 90º is divided into two categories: 45º–90º for "average" and below 45º for "poor." If the shape is not concave, it is also considered "poor," which is in the range 180º–360º.
3) For *MTRS*, as 1–1.75 is a strictly desirable range by derivation, it is certainly "good." Given that the bottom threshold, as discussed before, is 0.25, a range of 0.25–1 is regarded as "average," and any value below 0.25 or above 1.75 can be considered "poor." There is also an exception. Since a little bit more "yang" for MTRS is also favorable, a value slightly above 1.75 is also regarded as "good" in some cases.
4) The overall score is the sum of all three individual scores. When the overall score is larger than or equal to 2, this *ming tang* is considered "good" as equivalently two of the three criteria meet the standard of "good." If the overall score is more than 0.5 but less than 2, this *ming tang* is considered "average" as equivalently two of the three criteria meet the standard of "average." If the overall score is smaller than or equal to 0.5, the *ming tang* is considered "poor," as equivalently two of the three criteria meet the standard of "poor." The mathematical benchmarks of *ming tang* are summarized in Table 1.

It should be noted that Table 1 is a new proposal by the authors based on limited data and knowledge. When a bigger database is available in the future by studying more shopping malls, not only in China but around the world, the benchmarking values may need to be revised, but the methodology could be kept.

6. Case Study

Five shopping malls have been selected as a pilot study to demonstrate this mathematical model. The reasons are as follows. First, these five shopping malls well represent the high, medium, and low levels of business performance in the city of Guangzhou according to the reviews and rankings. Second, they are all located in busy commercial areas in the same city with similar accessibility and population, all falling within the category of comprehensive shopping malls with a similar retail structure, but their *ming tangs* differ significantly in terms of *distance ratio*, *angle*, and *relative size* (*MTRS*). Table 2 shows the rankings of the top ten shopping malls in Guangzhou. Their sales income is ranked, so the ability to attract customers is thus inferred. It should be noted that these five cases are for illustrative purposes rather than for validating the strong relationship between *ming tang* design and the shopping mall's business performance.

The case study begins by describing the location, transportation facility, and local population surrounding the shopping malls. The shopping mall maps were downloaded from publicly available online resources, and the *area* of *ming tangs* was measured directly on the map using AutoCAD. The three *ming tang* criteria were then calculated according to the developed model, with the results provided in Table 3. The calculation methods are based on the benchmarks in Table 1. The results of the three *ming tang* benchmarking elements and their business performances were compared and analyzed.

6.1. Tee Mall

Tee Mall is in the center of Tianhe District, connected with metro station Tiyuxilu, which is an interchange station on Metro

Table 1
Benchmark of *ming tang* for the main entrances of the shopping mall

Ming tang measurement	Desirable ranges based on mathematical model		Assessment of the main entrance by authors		
	Lower value	Higher value	Good	Average	Poor
Distance (ratio)	1.5	2.5	"1" when 1.5–2.5	"0.5" when 1.25 – <1.5	"0" when <1.25 or >2.5
Angle (degree)	90º	180º	"1" when 90º–180º	"0.5" when <90º and ≥45º	"0" when <45º or >180º
Area (ratio)	1	1.75	"1" when 1–1.75	"0.5" when ≥0.25 and <1	"0" when <0.25 or >1.75
Overall score	"Good" when ≥2; "Average" when >0.5–<2; "Poor" when ≤0.5				
Exception	In some cases, distance ratio that is close to 2.5 but above that can be categorized as "good," and area (ratio) that is close to 1.75 but above that can be categorized as "good."				

Table 2
2023 Shopping malls' sales income ranking in Guangzhou

Name of Malls in Guangzhou	Ranking
Tee Mall	1
Grandview Mall	2
Tai Koo Hui	3
Popark	4
Parc Central	5
Metropolitan Plaza	6
Mall of the World	7
K11	8
Fashion Tianhe Plaza	9
Tee Mall (Beijing Road) (Yuehai Yangzhonghui Square)	10

Source: https://www.91ruanzhu.com/news/20776.html

Table 3
***Ming tangs* of all five cases of study**

Shopping mall name	Shopping mall entrance	*Distance* (ratio)	*Points*	*Angle* (degree)	*points*	*ming tang relative size MTRS* (ratio)	*Points*	*Total points*	*Assessment*
Tee Mall	Main entrance (north)	2.5	1	78	0.5	1.93	1	2.5	Good
	Main entrance (south)	1.7	1	128	1	0.95	0.5	2.5	Good
Grandview Mall	Main entrance (northwest)	1.8	1	45	0.5	0.21	0	1.5	Average
	Main entrance (northeast)	1.9	1	34	0	0.19	0	1	Average
	Main entrance (southeast)	1.9	1	53	0.5	0.28	0.5	2	Good
Great Plaza (Haizhu Xinduhui Square)	Main entrance (southeast)	1.2	0.5	159	1	0.15	0	1.5	Average
Taikoo Hui	Main entrance (north)	2.3	1	89	0.5	1.77	1	2.5	Good
	Main entrance (south)	1.4	0.5	172	1	1.69	1	2.5	Good
Tee Mall (Beijing Road)	Main entrance (north)	1.4	0.5	58	0.5	0.09	0	1	Average
	Main entrance (south)	1.3	0.5	118	1	0.14	0	1.5	Average

Lines 1 and 3, and close to major roads where the traffic is busy all day long, thus full of s*ha qi*. It has spacious *ming tangs* at various entrances, particularly the main entrances facing north and south. The concave design of the entrances enables the *ming tangs* to amplify the transition function of turning *sha qi* into *sheng qi*. Surrounding Tee Mall, the district has a permanent resident population of 117,105 within a one-kilometer radius zone[1].

Figure 8(a) shows the layout plan of Tee Mall as extracted from Baidu Maps. Figure 8(b) shows the same plan with our comprehensive mathematical model applied. The Baidu Maps typically displays with north at the top and south at the bottom. The drawing was further edited by AutoCAD with a proper scaling factor to show the exact length of each measurement. The function, geometric center, of AutoCAD was used to locate the building center accurately as shown in Figure 8(b), represented by a circle. Then, polylines are projected from the center of the building to the midpoint of every entrance and further to the frontage/street boundary. Finally, the *angle* of the *ming tang* facing each entrance and its area is measured. The same method is applied to another four cases, and Table 3 documents the results of all five cases.

It is shown that the *distance* ratios of the two main entrances of Tee Mall are within the range of magic numbers, "1.5" and "2.5," respectively. In particular, the northern main entrance has a ratio of 2.5, indicating a more *yang* characteristic. At the same time, the *angle* of each *ming tang* is close to or more than 90º. Regarding the *MTRS*, the northern main entrance has a value of 1.93, slightly larger than the magic number "1.75," which shows that it is between "*shao yin"* and "*tai yang*," good for a shopping mall as commercial areas require activeness. Overall, Tee Mall's *ming tangs* basically meet all the given criteria about the *yin-yang* setting, and the northern main entrance tends to be slightly more *yang* in terms of the *MTRS* (refer to Table 3). The *ming tangs* of Tee Mall are quite strong at attracting customers and make Tee Mall ranked No.1 in the rankings (refer to Table 2).

6.2. Grandview Mall

Figure 9(a) shows the layout plan of Grandview Mall and its surrounding streets. It resembles Tee Mall as it is surrounded by four main roads, bringing in a significant amount of *sha qi*. The two malls are rather close to each other, within around 300 meters, so they can be considered having the same location and accessibility. It has three main entrances and two side entrances, but the *ming tang* of each main entrance is much smaller than those of Tee Mall. In this case, the *sha qi* from the busy roads cannot be well diffused and not enough *sheng qi* is collected and transitioned for the shopping mall due to the small size of *ming tangs*. Though it is located close to the Tee Mall, its performance is considered interior.

[1]Source: http://www.winshangdata.com/projectDetail?projectId=7988).

Figure 8

(a) The layout plan of Tee Mall. (b) The comprehensive mathematical model applied to the layout plan of Tee Mall

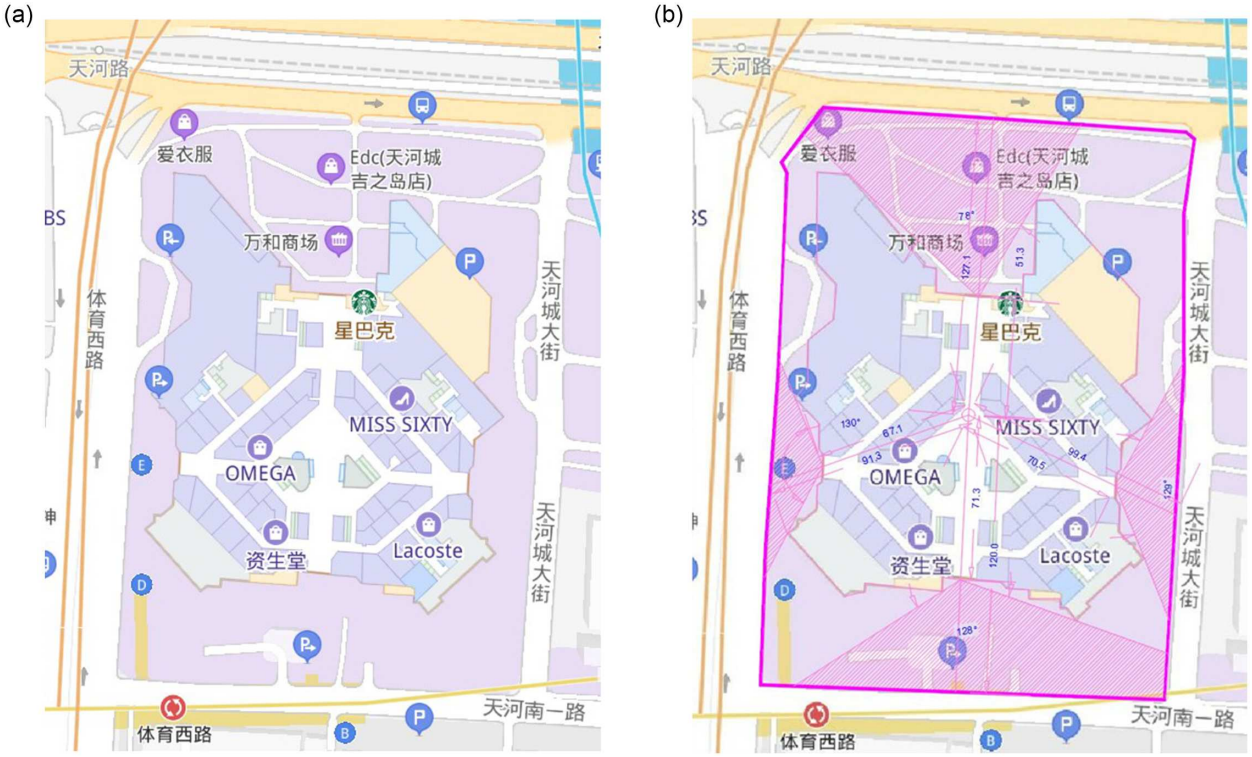
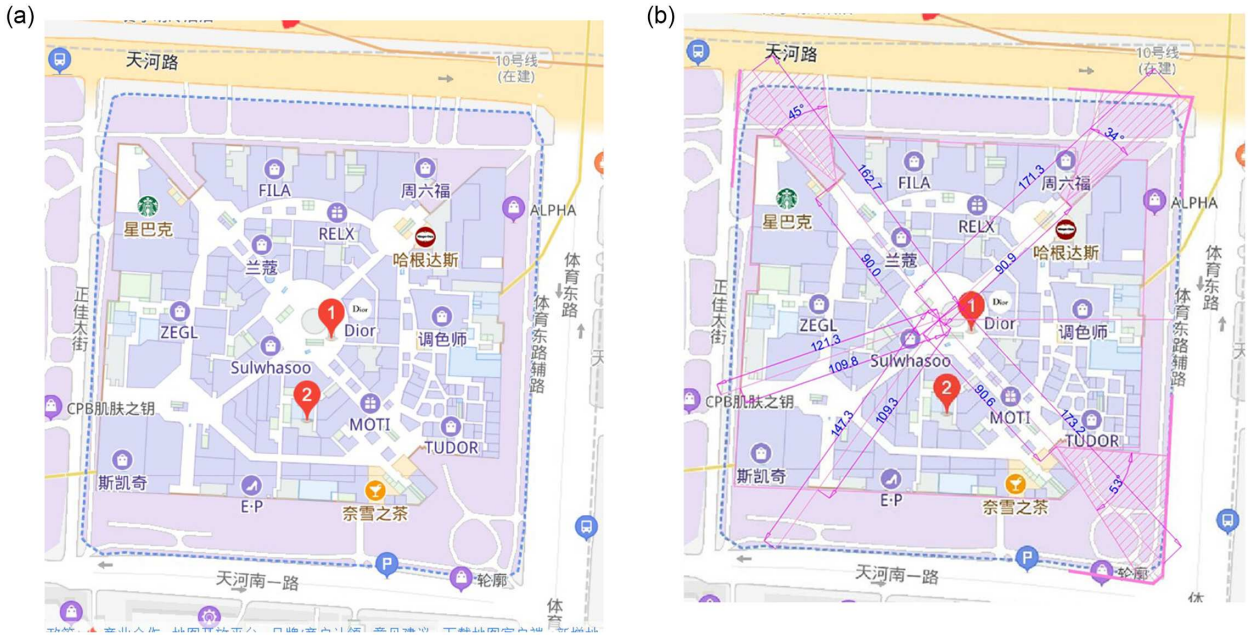


Figure 9

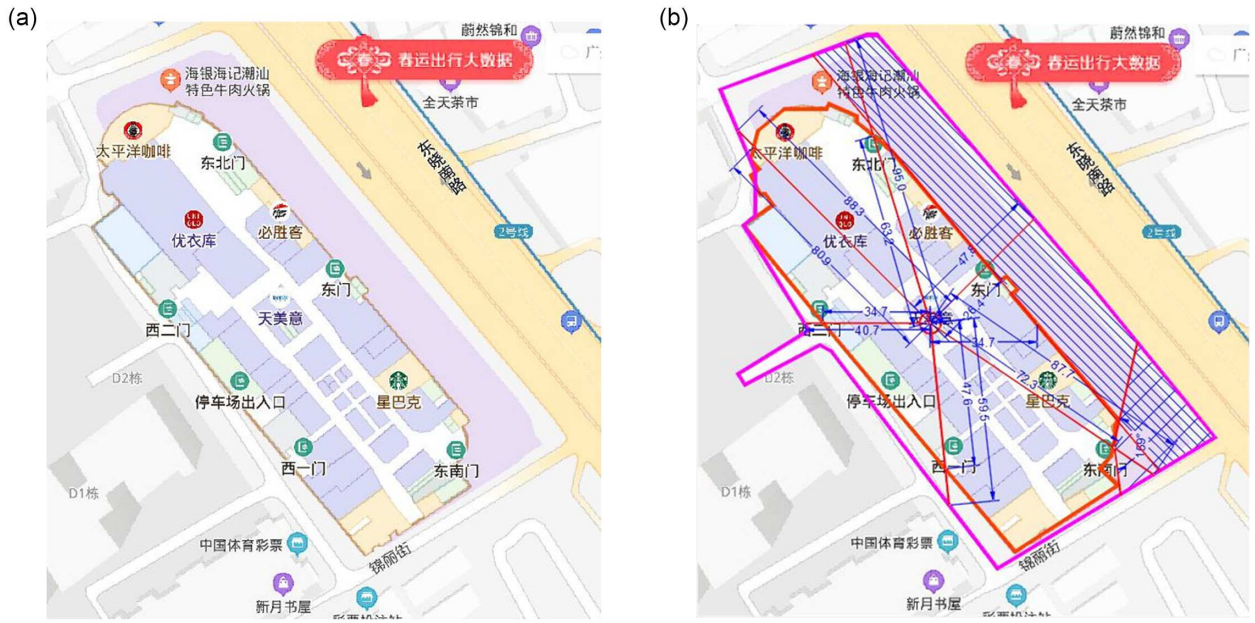
(a) The layout plan of Grandview Mall. (b) The comprehensive mathematical model applied to the layout plan of Grandview Mall



The results of *ming tang* calculation (refer to Figure 9(b)) show that the building envelope to frontage/street boundary ratios of all three main entrances are much smaller than those of Tee Mall. Fortunately, they are still within the magic range between 1.5 and 2.5, meeting the *yin-yang* setting requirements. However, the *angle* of the frontage of the three main entrances is much smaller than 90^{o}, which is considered not spacious enough to collect and defuse the *sha qi*. Regarding the *MTRS*, all three entrances have small values except the southeast entrance, which is marginally acceptable. So, its performance in attracting customers is not as good as that of

Figure 10

(a) The layout plan of the Great Plaza. (b) The comprehensive mathematical model applied to the layout plan of Great Plaza



Tee Mall, though it has a larger number of permanent residents of 126,828 within the one-kilometer radius zone[2] nearby. As shown in Table 2, Grandview Mall has been ranked second.

6.3. Great Plaza (Haizhu Xinduhui Square)

Great Plaza, also named Haizhu Xinduhui Square, is close to busy roads and right next to a subway station, which is less than 100 meters away, but there is an elevated freeway above the main road on the east, southeast, and northeast sides. In this case, the mall is very close to strong *sha qi*, which is extremely difficult to diffuse because it is not at ground level even with a big *ming tang*. This is considered a significantly negative element from the *feng shui* perspective. Furthermore, the *ming tang* is not well provided. Except for the frontage on the northeastern side, the whole building is tightly surrounded by streets and buildings nearby. So, in general, Great Plaza has a "*tai yin*" setting, which is unfavorable for business performance as commercial activities require *yang qi*. The census indicates that the Great Plaza has a population of 240,825 permanent residents within the one-kilometer radius zone[3], even denser than that of the Tee Mall. However, this mall only attracts a limited quantity of customers, and the mall is not even ranked.

Figure 10(a) shows the layout of the Great Plaza and its surrounding streets. Figure 10(b) shows how the mathematical model is applied to the mall. The results show that the ratio of the building center to the road boundary over that to the main entrance is only 1.2, even smaller than the lower limit of 1.5. The *MTRS* of the main entrance is only 0.15 though the angle of its *ming tang* is 159°, much smaller than the lower limit of 0.25. Results much higher than the upper value or below the lower value of the three *ming tang* benchmarks are considered unsatisfactory. By measurement, it has only one average *ming tang* for its main entrance, and the distance ratio is merely 1.2 (refer to Table 3). The unfulfilling *ming tang* measures imply disadvantages in customer attraction.

6.4. Taikoo Hui

Taikoo Hui, shown in Figure 11(a), provides high-end retail, entertainment, and dining options in a busy commercial area. Due to its high-end positioning, Taikoo Hui's customer traffic may not be higher than that of the Tee Mall, but its sales income is also quite outstanding. Within the one-kilometer radius zone of Taikoo Hui, there are 186,885 permanent residents around[4], and it was ranked No. 3 in the ranking[5]. Taikoo Hui has maintained a series of consecutive quarters of growth since opening. There are four entrances, the north and south main entrances, having extensive *ming tangs*.

As shown in Figure 11(b), the two *distance* ratios of the northern and southern main entrances are 2.3 and 1.4, respectively, at the two boundaries of the magic range, indicating that the mall is classified as *yin-yang* balanced. All *angles* are either close to or larger than 90°, indicating a concave design. The *MTRS* of both the northern and southern main entrances are 1.77 and 1.69, respectively, rather satisfactory. Though 1.77 is slightly above 1.75, it matches "a little bit more *yang*," which is favorable, so the area ratio is also considered good. The two main entrances of Taikoo Hui have satisfactory *ming tang*s that are considered good based on our measurements (refer to Table 3) and keep this shopping mall ranked third in sales revenue (refer to Table 2). This indicates that the main entrances can help to balance *yin-yang* for shopping malls, collect *qi*, and defuse *sha qi* to *sheng qi*. The main entrances play a significant role in customer attraction.

6.5. Tee Mall (Beijing Road)

Tee Mall (Beijing Road) was originally named Yuehai Yangzhonghui Square and is now named after Tee Mall as a branch mall. This shopping mall is located in one of the most prosperous shopping streets in Guangzhou, namely Beijing Road. Like the original Tee Mall, Tee Mall (Beijing Road) is also directly connected to

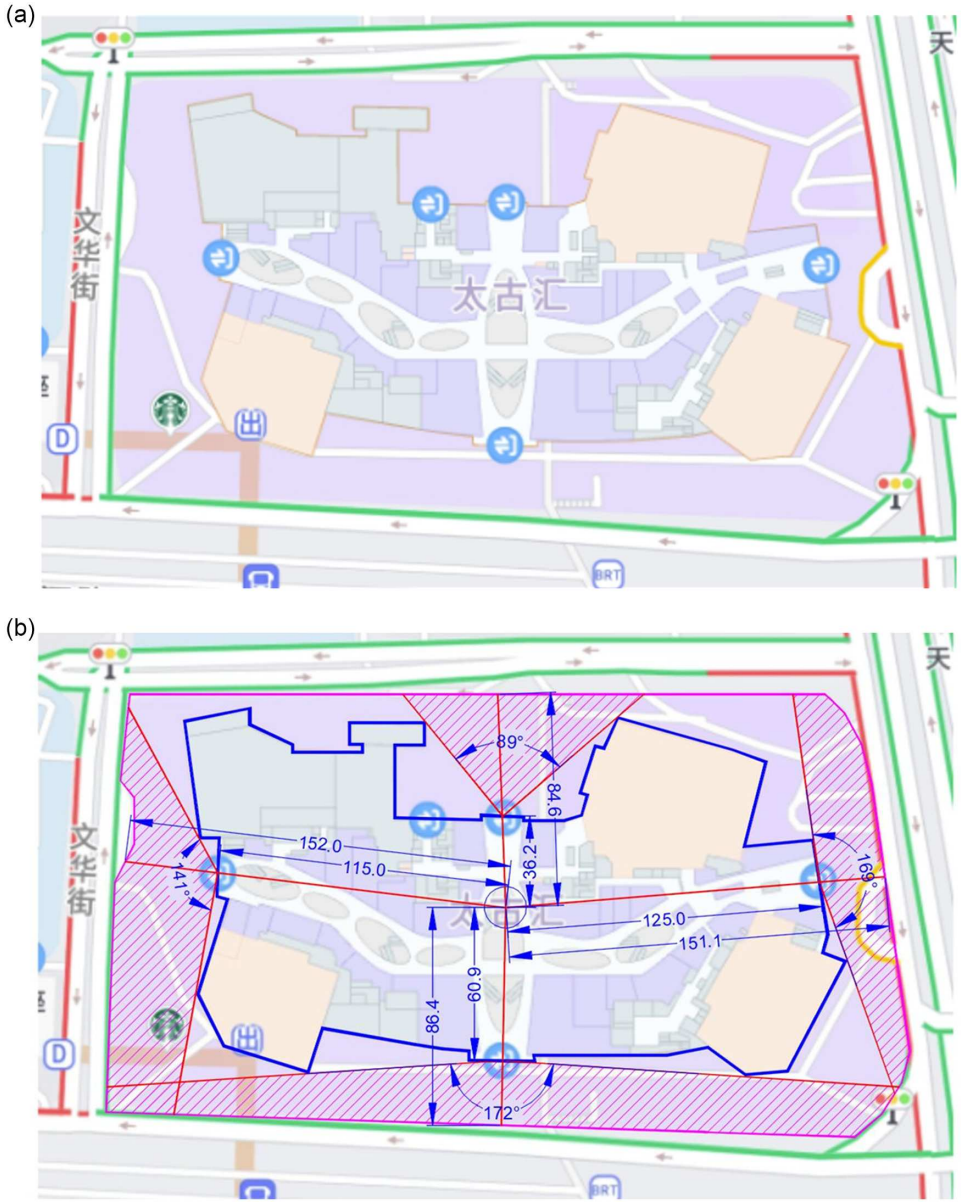
[2]Source: http://www.winshangdata.com/projectDetail?projectId=28081.

[3]Source: http://www.winshangdata.com/projectDetail?projectId=12293

[4]Source: http://www.winshangdata.com/projectDetail?projectId=1362

[5]Source: https://www.91ruanzhu.com/news/20776.html

Figure 11
(a) The layout plan of Taikoo Hui. (b) The comprehensive mathematical model applied to the layout plan of Taikoo Hui



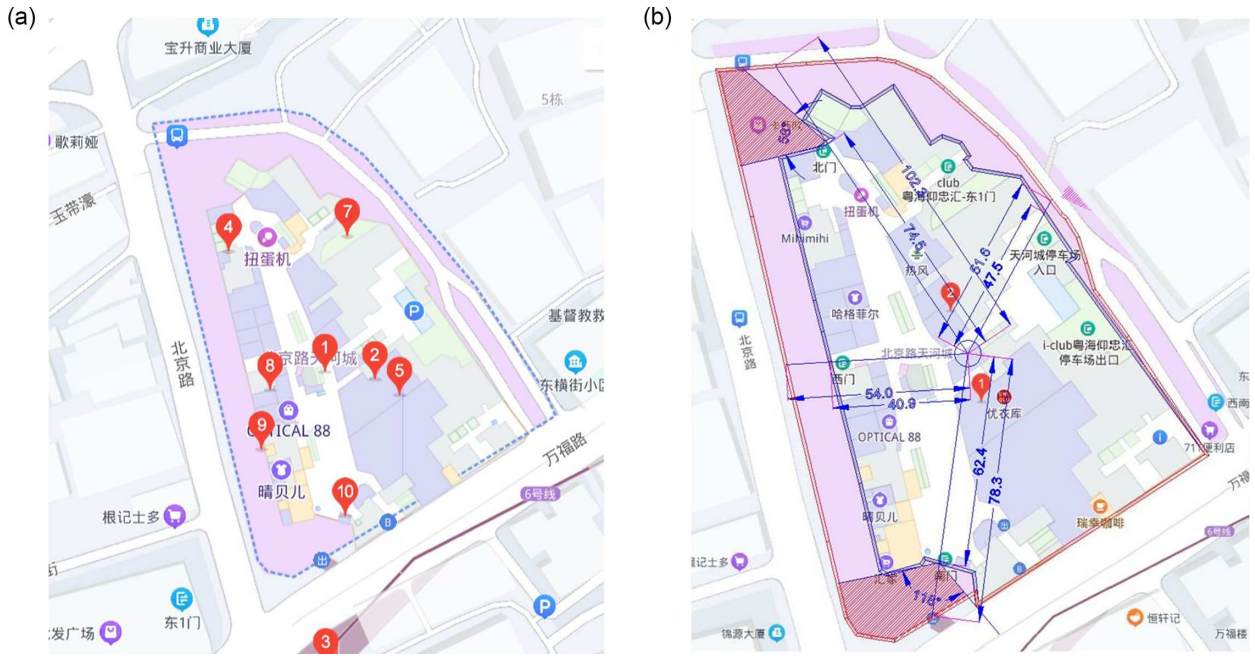
a subway station and is operated by the same company, but its sales income is much lower than that of the original Tee Mall. There are four entrances with the main ones facing north-northwest and south. The *ming tangs* in front of these two main entrances adopt a concave design, but the area is relatively small as shown in Figure 12(b), while the general layout is shown in Figure 12(a). It is suggested that these small *ming tangs* could not provide enough transitional space for a well-connected spatial order between the exterior space and the interior one. In *feng shui*, this case is also regarded as unfavorable for a shopping mall as it cannot sufficiently turn *sha qi* into *sheng qi*.

The *distance ratios* are unsatisfactory except that the *distance ratio* of the northern main entrance, which is 1.4, is close to the lower boundary of the magic range. The *angle* of the northern main entrance is only 58°, very unsatisfactory, though that of the southern main entrance is alright. The *MTRS* for both main entrances is poor. Overall, Tee Mall (Beijing Road) only has a southern entrance that meets the criterion of *angle*, and the northern main entrance is close to the lower value of the criterion. By calculation, it has two average *ming tang*s for its two main entrances (refer to Table 3). Hence, the *ming tang*s of Tee Mall (Beijing Road) are doomed to be weak in attracting customers, and the low business performance of Tee Mall (Beijing Road) is predictable. Tee Mall (Beijing Road) has a population of 209,466 permanent residents within the one-kilometer radius zone[6]. Also, Beijing Road is widely regarded as one of the most prosperous commercial streets in Guangzhou[7]. Unfortunately, though the district is superb, the attraction of customers of Tee Mall (Beijing Road) is unsatisfactory. Tee Mall (Beijing Road) is ranked 10th in Guangzhou (refer to Table 2), worse than those with good

[6]Source: http://www.winshangdata.com/projectDetail?projectId=31657

[7]Source: https://excelguangzhou.net/beijing-road/

Figure 12
(a) The layout plan of Tee Mall (Beijing Road). (b) The comprehensive mathematical model applied to the layout plan of Tee Mall (Beijing Road)



*ming tang*s but better than Great Plaza, which has only one average *ming tang*.

6.6. Comparison and discussion of the results

The cases studied have illustrated our comprehensive mathematical model for evaluating shopping malls' customer attraction. This method could help architects and developers design the *ming tang* of new shopping malls, which will have an impact on urban planning. Having a good *ming tang* for the main entrance is essential to good performance in customer attraction. Based on the calculated *ming tang* results, we found that Tee Mall, Grandview Mall, and Taikoo Hui all have good *ming tangs*, and they are listed in the top 3 on the ranking (refer to Table 2). Tee Mall (Beijing Road) and Great Plaza have average *ming tangs,* so they fall behind. Comparing the two, Tee Mall (Beijing Road) has one more average *ming tang* than the Great Plaza, and so its performance is slightly better. Tee Mall (Beijing Road) is ranked 10th and Great Plaza is not ranked.

Table 4 shows the *ming tang* assessment results against sales rankings for the top ten shopping malls ranked in a 2023 ranking report [29]. Other factors that may influence business performance are also presented, such as population and the number of shopping malls around. Four of the studied cases in this paper were ranked in the top ten shopping malls in terms of sales revenue, and the Great Plaza is not on the list due to its poor performance. The findings from the developed *feng shui* model on *ming tang* are consistent with the shopping center performance as shown in the ranking results (refer to Table 2).

The quantitative criteria for the evaluation of *ming tang* in our mathematical model could help to reveal the quality of *ming tang.* The findings of the three criteria, namely, *distance ratio, MTRS*, and *angle*, are grouped in Table 3. Generally, a shopping mall with a relatively large *ming tang* (defined by a distance ratio between "1.5" and "2.5," *MTRS* between "1.00" and "1.75," and an angle of the sector of the main entrance at least 90°) is beneficial to its business performance. A quantifiable proper size of *ming tang* has filled the gap in the absence of *ming tang* elements [18] and added literature on the size of frontage research [5, 19]. Among all the shopping mall entrances, the main entrances are critical and dominating in *qi* transition. The possible reason is that the main entrances are the key areas to connect the exterior space and the interior space, and they have more customer traffic. The different contributions between main entrances and side entrances could be further explored in future studies.

Location and accessibility play a significant role in shopping mall sales [1]. All five shopping malls are in dense permanent residential areas, busy roads, and nearby subway stations. Traditionally, the permanent resident population around a shopping mall is considered an important factor that affects its business performance [24]. However, our study shows that the factor of the population around a shopping mall is not dominant. A dense population is supposed to yield big customer traffic, but having a large population around does not necessarily mean a large customer volume. This research shows that *ming tang* can be one element that affects shopping mall attraction and a good *ming tang* can contribute to shopping malls' customer attraction in some way. Space structure is one of the most influential design elements for customer experience in shopping malls [30]. The effect of *ming tang* strengthens the claim of the influence of frontage on shopping malls' customer traffic [18], and the effective area in the frontage of a shopping mall is actually the area of *ming tang*.

The developed mathematical model offers detailed references for the design of *ming tang. Distance ratio* and *MTRS* suggest that certain spaces should be left outside the shopping mall envelope, ensuring space to build a properly sized *ming tang*. The criterion of *angle* provides a reference for the design of entrance gates. The overall *yin-yang* balance of architecture may affect human senses of architecture, which is significant to architectural design [31]. There

Table 4
Comparison of the case shopping malls' *ming tang*s (main entrance)

Name of malls	*Ming tang*	Sales income ranking	Permanent residents' no. (1-kilometer radius)	Shopping malls' no. (1-kilometer radius)
Tee Mall	Good	1	117,105	13
Taikoo Hui	Good	3	186,885	13
Grand View	Good	2	126,828	11
Tee Mall (Beijing Road)	Average	10	209,466	15
Great Plaza	Average	Not ranked	240,825	3

is a close relationship between customer behavior and the retail atmosphere [32]. *Sheng qi*, produced by *yin-yang* balance, may create a beneficial atmosphere that impacts the behavior of customer visits.

Our findings may suggest that shopping mall locations could be less restrictive for retail property managers, city planners, and developers. This deepens the understanding of locations for shopping malls in many previous studies [33, 34]. Provided that a good *ming tang* design is fulfilled, the mall could be a bit remote from densely populated districts as long as transportation facilities are convenient. For researchers, this study shows the potential of incorporating scientific and mathematical elements in *feng shui* theories, and more efforts can be put into digging out the notions that are valued in *feng shui* but might be neglected in modern research. Also, the research results reveal that it is feasible to quantify descriptive *feng shui* theories.

7. Conclusions and Future Studies

With reference to modern architectural literature, it seems there is some kind of correlation between the *ming tang* design, the effective area of frontage or concourse, based on *feng shui* theories, and the performance of the retail properties in terms of customer attraction. According to traditional *feng shui* theory, how *ming tang* attracts customers lies in its nature to gather pedestrians and the function to reconcile the exterior space and interior space, which are collecting *qi* and turning *sha qi* into *sheng qi*. A novel and comprehensive mathematical model has been developed with three quantitative criteria (*distance ratio, angle, and area*) to evaluate the quality of *ming tang*, and this model looks feasible and applicable based on our case studies. Our approach shows that consolidating different terminologies in modern research and *feng shui* studies is of great value. Then, the solely descriptive *feng shui* theories can become quantitative for more scientific studies.

Our approach has practical applications for architects, urban planners, and retail managers. In designing a shopping mall, the architects can use the mathematical model to calculate the design criteria of *ming tang* to achieve *yin* and *yang* balance. The model also helps urban planners who can apply *feng shui* principles in planning shopping center development at suitable locations. The retail managers would benefit from knowing the *feng shui* criteria when participating in the shopping mall's design stage for customer satisfaction.

The mathematical model is based on the nine-square model, and it is mainly feasible for shopping malls that are approximately square-shaped. Shopping malls in shapes that are greatly different from the square, for example, long and narrow, scattered blocks rather than a single unit, cannot be applied to the model. Further studies can be carried out to solve this limitation and generalize the application.

Currently, the five shopping malls for demonstrating how to use the model are all located in Guangzhou, China, due to the limited resources of the authors. The application of this model to shopping malls in other provinces in China and overseas countries will be a subject of future study. Moreover, when more commercial data of shopping malls is available, validation of the correlation between *ming tang* design and shopping malls' business performance can be enhanced.

In addition, this study mainly focuses on main entrances, as main entrances play a dominating role in collecting and defusing *qi*, according to the traditional *feng shui* principle. Further studies can shed more light on the weights of the main entrances and side ones to arrive at a more comprehensive evaluation including all big and small entrances. This model may be applicable to buildings beyond shopping malls. Any buildings that are commercial and in need of substantial dynamic human flow may fall within our model, such as office buildings, hotels, and supermarkets, but non-commercial buildings may not be applicable. Further investigation can strengthen the generalizability based on the approach developed in our study.

Ethical Statement

This study does not contain any studies with human or animal subjects performed by any of the authors.

Conflicts of Interest

The authors declare that they have no conflicts of interest to this work.

Data Availability Statement

In this paper, most of the data or results were derived from the models (Table 3), and all Figures 1–4 were created by the authors. For the others, only publicly available data were used. Below is the detailed statement. For Table 2, the 2023 shopping malls' sales income ranking in Guangzhou, the data are openly available on the 91ruanzhu website at https://www.91ruanzhu.com/news/20776.html.

The number of permanent residents (Table 4) is openly available in Win Data at http://www.winshangdata.com. For Figures 8–12, the maps were openly available on the Baidu Maps website (in Chinese) at https://map.baidu.com. The measurements on the maps were created by the authors.

Author Contribution Statement

Yucheng Zhang: Conceptualization, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Project administration. **Albert So:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Visualization, Supervision. **Xin Janet Ge:** Conceptualization, Resources, Writing – review & editing, Supervision, Project administration.

References

[1] Kiriri, P. (2019). Determinants of shopping mall attractiveness: The case of shopping malls in Nairobi, Kenya. *European Journal of Economics and Business Studies*, *5*(1), 258–270.

[2] Han, H., Sahito, N., Thi Nguyen, T. V., Hwang, J., & Asif, M. (2019). Exploring the features of sustainable urban form and the factors that provoke shoppers towards shopping malls. *Sustainability*, *11*(17), 4798.

[3] Salleh, N. A., Rahman, N. Y. A., Wahab, M. A., & Ahmad, N. (2023). A review on key determinants factors of successful shopping malls. *International Journal of Business and Technology Management*, *5*(S3), 1–11.

[4] Coburn, A., Weinberger, A., & Chatterjee, A. (2022). How architectural design influences emotions, physiology, and behavior. In M. Skov & M. Nadal (Eds.), *The Routledge international handbook of neuroaesthetics* (pp. 194–217). Routledge.

[5] Gehl, J. (2011). *Life between buildings: Using public space*. Washington DC: Island Press.

[6] Mak, M. Y., & Ng, S. T. (2005). The art and science of Feng Shui—A study on architects' perception. *Building and Environment*, *40*(3), 427–434.

[7] Feuchtwang, S. D. R. (1974). *An anthropological analysis of Chinese geomancy*. Vientiane, Laos Vithagna.

[8] Mak, M. Y., & So, A. T. (2015). *Scientific Feng Shui and the built environment—Theories and applications*. China: University of Hong Kong Press.

[9] Octavia, L., & Gunawan, T. (2014). Feng shui in modern house design search for the rationale and possible impacts assessment. *Journal of Architecture and Built Environment*, *41*(1), 43–50.

[10] Hong, S. K., Song, I. J., & Wu, J. G. (2007). Feng shui theory in urban landscape planning. *Urban Ecosystems*, *10*(3), 221–237.

[11] Ge, X. J., & Mak, M. Y. (2015). Case studies: Feng shui integrated applications for built environment analysis. In M. Y. Mak, & Albert, T. So (Eds.), *Scientific Feng Shui for the built environment: Theories and applications* (pp. 165–176). China: University of Hong Kong.

[12] Zhang, Y., So, A., & Ge, X. J. (2021). A mathematical method to assess the yin-yang balance of commercial complexes' entrances. *International Journal of Real Estate Studies*, *15*(2), 95–102.

[13] Kim, Y., & Kim, T. W. (2019). How do people explore a large concourse in university campus? A computational analysis. *Journal of Computational Design and Engineering*, *6*(4), 666–674.

[14] Law, S., Seresinhe, C. L., Shen, Y., & Gutierrez-Roig, M. (2020). Street-frontage-net: Urban image classification using deep convolutional neural networks. *International Journal of Geographical Information Science*, *34*(4), 681–707.

[15] Ashihara, Y. (1981). *Exterior design in architecture*. New York: Van Nostrand Reinhold Company.

[16] Singh, R. (2015). *Understanding transition spaces*. Bachelor Dissertation. Retrieved from: https://www.academia.edu/19852235/Understanding_Transition_Spaces

[17] Farahani, L. M., & Lozanovska, M. (2014). A framework for exploring the sense of community and social life in residential environments. *Archnet-IJAR: International Journal of Architectural Research*, *8*(3), 223–237.

[18] Jayakody, R. R., Keraminiyage, K., Alston, M., & Dias, N. (2018). Design factors for a successful shared street space (SSS) design. *International Journal of Strategic Property Management*, *22*(4), 278–289.

[19] Farahani, L. M., & Beynon, D. (2015). Pavement cafes as the activity zone in the social life of neighbourhood centres. In *Living and Learning: Research for a Better Built Environment: 49th International Conference of the Architectural Science Association*, 193–202.

[20] Xu, J. (2003). *A framework for site analysis with emphasis on Feng shui and contemporary environmental design principles*. Doctoral Thesis, Virginia Polytechnic Institute and State University.

[21] Xu, P. (2022). Healthy living in the built environment in light of Feng-shui. *International Journal of e-Healthcare Information Systems*, *8*(1), 196–202.

[22] Xu, P. (1990). *Feng shui: A model for landscape analysis*. PhD Thesis, Harvard University.

[23] Guan, R., Chen, Y., & Chen, X. (2024). Scientific evaluation of fengshui from the perspective of geography: Empirical evidence from the site selection of traditional Hakka villages. *Applied Spatial Analysis and Policy*, *17*(4), 1545–1568.

[24] Zhou, R., Wang, C., Bao, D., & Xu, X. (2024). Shopping mall site selection based on consumer behavior changes in the new retail era. *Land*, *13*(6), 855.

[25] Kiel, K. A. (2005). *Feng shui: The use and value of Feng shui in interior design in Northern Ohio*. Thesis, The Graduate Faculty of the University of Akron.

[26] Hassan, M. M., Ahmad, N., & Hashim, A. H. (2021). Homebuyers superstitious belief: Feng shui and housing property. *International Journal of Academic Research in Business and Social Sciences*, *11*(7), 444–462.

[27] Hsu, S. T. (2023). *Form School feng shui*. Blue Mountain Institute. Retrieved from: https://www.bluemountainfengshui.com/form-school/

[28] Weber, K. (2020). How to diagram your two story home. *Red Lotus Letter*. Retrieved from: https://redlotusletter.com/how-to-diagram-your-two-story-home/

[29] Ruanzhu. (2023). *Sales ranking of the shopping malls in Guangzhou (Chinese translation)*. Retrieved from: https://www.91ruanzhu.com/news/20776.html

[30] Yuan, Y., Liu, G., Dang, R., Lau, S. S. Y., & Qu, G. (2021). Architectural design and consumer experience: An investigation of shopping malls throughout the design process. *Asia Pacific Journal of Marketing and Logistics*, *33*(9), 1934–1951.

[31] Spence, C. (2020). Senses of place: Architectural design for the multisensory mind. *Cognitive Research: Principles and Implications*, *5*(1), 46.

[32] Patil, B., Aradhya, G. B., Kumar, T. K., Sateesh, K., & Shiva, S. (2021). Impact of customer behavior based on store atmospherics. *PalArch's Journal of Archaeology of Egypt/ Egyptology*, *18*(9), 480–492.

[33] Thanasi-Boçe, M., Kwiatek, P., & Labadze, L. (2021). The importance of distance and attraction in patronizing a shopping

mall. *Journal of Place Management and Development*, *14*(2), 222–238.

[34] Mok Kim Man, M., & Cai Qian Qiu, R. (2021). An empirical study of factors influencing consumers' purchasing behaviours in shopping malls. *International Journal of Marketing Studies*, *13*(1), 14–25.

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