The Mall Equation

Balancing Space, Strategy, and Shoppers

by

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Abstract

Economic function is accepted as a significant building function in architectural discourses, but the economic potential of spatial configuration has not been adequately explored in real estate decision making. The basic objective of this research is to understand the economic rationale of spatial configuration, and this is attempted through the tenanting decision making in shopping malls. A shopping mall is an agglomeration of different stores managed as a sole property and can be conceptualized as a miniature urban setting. In shopping malls, profit maximization is the objective of the developer as well as of the individual tenant stores and this is achieved through tenanting decision making. In practice, tenanting decision making is mostly prescriptive, case specific and taken mostly on a rule of thumb basis. The tenanting decisions (location and area allocation of stores) are essentially spatial but have economic implications. This research attempts to bridge the gap between retail management practices and architectural design.

Gate counts or customer footfall at a particular location within the spatial configuration has been identified as a potential factor in retail management literature for achieving profitability of individual tenant stores located there and this has been explained through bid rent analysis.

Movement has been widely studied in the field of architecture and urban design. Movement depends on the accessibility of a particular location which in turn is influenced by configuration of the spatial structure and is measured through syntactic properties.

Gate counts, therefore, have been explained in terms of spatial configurational variables by conducting VGA and agent-based simulation of virtual layouts of comparable mall typologies. Combining both the findings, profitability of a tenant store can, therefore, be explained in terms of visuo spatial parameters. This research integrates retail research wisdom and the knowledge of spatial configuration to illustrate the efficacy of space design as a strategic decision-making tool, instead of just an accommodator of functions.

To account for the impact of personal factors on navigational behaviour, a hypothetical model of navigational intentions to explore paths with high visibility is tested with AMOS 18, administering a Structural Equation Modelling (SEM), to establish the influence of achievement orientation and exploratory shopping behaviour on customers' attitude towards moving to highly visible areas, which in turn influences their intentions to explore those areas. Exploratory shopping behaviour is influenced by novelty seeking behaviour. Behavioural intention of shoppers is further confirmed through the recorded navigational preferences (from mall intercept survey) and agent-based simulations. The difference in the impact of signage or visual cues is evaluated for various categories of shoppers for the corresponding navigational preferences exercised by them, and it is found that impulse shoppers are not influenced by visual cues during navigation, while utilitarian shoppers are highly influenced.

These findings are synthesized for proposing a tenanting decision-making framework. This framework provides a direction support system for allocating stores for profit maximization within a given spatial arrangement and it also lends direction to appropriate

alteration / modification decisions with regard to spatial design, for example, in terms of introducing new entry points, opening up some areas for better visibility and functional utility, etc. This framework can also be used as an evaluation tool for selecting the most suitable spatial design for profit maximization from among alternatives. Thus, it is not only form and function that are closely related but also form and finance.

1. An Architect in a Shopping Mall

Space matters

Before getting into the depth of things, it is always better to start with an anecdote. And what could have been the best anecdote for the opening paragraph of a book on the importance of spatial configuration on strategic decision making than the birth of most widely quoted adage on space-behaviour duality. In October 1943, after the destruction of the Commons Chamber of the British Parliament by incendiary bombs during the *Blitz*, the commons debated the issue of re-constructing the parliament building. Sir Winston Churchill argued for the rectangular shape of the chamber against changing it to a semi-circular or horse-shoe type design, common to legislative assemblies. Churchill's logic for supporting the shape was his belief that the rectangular shape of the old chamber handled the *two-party system* which is the essence of British Parliamentary Democracy.

The widely quoted assertion: *"We shape our buildings, and afterwards our buildings shape us"* was, attributed to Sir Winston Churchill in the context of this incident. He (Churchill, 1943) is, reported to have used this famous statement twice: first in 1924 at the Architectural Association of London and then in 1943, requesting to re-construct the bombed-out British Parliament exactly as before (the incident described above). The statement may have already become a cliché through repeated reference, but a comparable belief about the influence of buildings, or, more specifically built environment on human behaviour is quite common in architecture and urban design literature.

Modernist architects of the twentieth century perceived themselves not only as designers of buildings but also of utopian societies. They believed in the potential of spatial design as a tool for changing societies and instilled the belief in architects of future generation. *The Fountainhead*, a 1943 (note the coincidence with the famous quotation by Churchill during the re-construction of the British Parliament) novel by Russian American author Ayn Rand, followed by a Garry Cooper and Patricia Neal starrer motion picture (1949) of the same name was a tribute to that utopian concept. It was freethinker against the status quo. On the other hand, majority of the early twentieth century literature sometimes criticizes modern buildings as impersonal, alienating, mechanistic and sometimes socially disruptive. Literary works like *Women in love* by D.H Lawrence, *The Magic mountains* by Thomas Mann or *The waste land* by T.S. Elliot reflected similar philosophies.

The architects, nonetheless, embarked on an ambitious venture. They tried to replace the popular notion of *God as Architect* (De Luca, 2025) with the myth of *Architect as God* (Zisch & Gage, 2024). Le Corbusier, one of the most prominent architects of that period, believed that a "*building is a machine for living in*" (*une maison est une machine à habiter*) (Le Corbusier, 1923/1986, p. 89) and tried to represent the concept in the buildings and spaces he designed (e.g. *Villa Savoye, Villa Stein, Unite' d'habitation*). This period witnessed a significant shift from client preferences to architectural fashion. The utopia envisaged by Le Corbusier and his followers failed to acknowledge not only the preferences of its inhabitants but also the impact of those built spaces on public users (i.e., Rabaça, 2016; Jacobs, 1961). Few of these projects failed; abandoned and eventually demolished because of the social problems they created. The story of Pruitt Igoe is a classic example in this regard. Pruitt

Igoe was supposed to provide a better environment to the inhabitants through design interventions, but the residents felt ignored and vented their frustration on the environment (this issue is debatable, (i.e., Pinar, 2024) but explains the failure of the project). Architect Minoru Yamasaki designed long communal hallways in that housing project to serve as community gathering places. However, the hallways became isolated, defaced, and unsafe. Most residents stayed locked-up in their rooms and use the corridors only when necessary. The demolition of Pruitt-Igoe (first occupied in 1954 and demolished in 1972) highlighted the necessity of understanding space-behaviour inter-relationship.

Despite the architect's concerns with the form and functions of individual buildings; a building can influence the environment at a much wider scale. Designers recognise the profound influence of built environment on human behaviour, and it had subsequently given rise to ideas aimed at changing the society through design interventions. The most significant and the most ambitious of them are the proposals of *"cites ideales"* by Claude Ledoux in the eighteenth century and the proposals of B. F. Skinner (an American Psychologist) 1960s*: "Reform the environment. Stop trying to reform the people, they will reform themselves if the environment is right."*

Keeping aside such boisterous claims, researchers in the field of human spatial behaviour proved the relationship between the built environments and its human inhabitants in different real-life situations. In studying lunch time behaviour of people in Plazas of New York City, Whyte (1980) (Figure 1) identified two types of plazas: "*Good Plazas*", that attracted people sitting, sunbathing and talking (left side of Figure 1) while other plazas failed to attract people for any kind of activities except only walking across. The

difference in spatial usage despite designed interventions can be, ascribed to the concept of spatial configuration, i.e., integration and segregation with the overall urban fabric which will be, explained later with the adaptation of space syntax methodology. With or without explanation, the problem remained and left to the architects, urban designers, and policy makers to solve.

If the relationship between behavioural patterns and built spaces could be, set up beforehand, the spatial design can support and accommodate the intended behaviours. Predicting human spatial behaviour, thus, is of great consequence to the designers as well as the decision/policy makers. Despite research attention in the field, the attempts to '*quantify*' configuration and '*correlate*' that configurational values with the behavioural outcomes are exceedingly rare. Establishing relationship between spatial configuration and behavioural outcomes (anthropogenic activities), forecasting future usage patterns based on that relationship and optimizing (i.e., maximizing the preferable and minimizing the undesirable) the behavioural outcomes through spatial configuration, therefore, is a challenge for the designers.

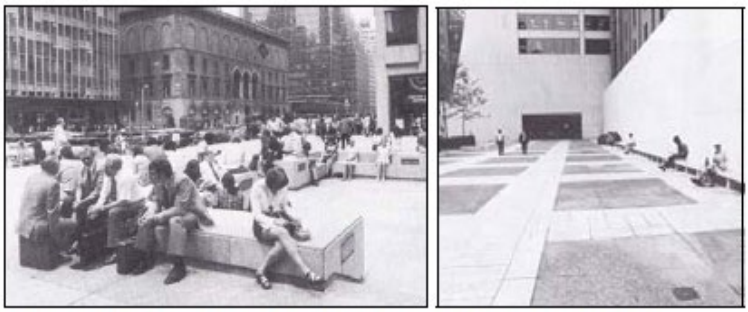

Figure 1: New York City Plazas (The "Good" Plaza and the "Bad" one, Whyte, 1980) and their use during the lunch time; some are full of activities (left) while some are deserted (right)

Why shopping mall?

Form and function are two widely discussed components in architectural discourse with scholastic inclination towards the latter. Hillier et al. (1984) asserted that, *"scientific approaches to architecture usually avoid the issue of building form, preferring to focus on function"* (Hillier et al., 1984 p.61) and attributed this preference for function to the popular belief, that, function is scientifically more tractable than form.

The functions of a building can be categorized as spatial organization of activities, climate regulation, symbolic functions, and economic functions (Hillier & Leaman, 1976), which correspond closely with the functions found by Norberg-Schulz (1965). The functional quality of a building, again, can be explained by the level of assistance provided to the programmed activities through spatial arrangement and determined by the level of support from the latter three functions (climate regulation, symbolic and economic function) on spatial organization of activities. The higher the level of support, the better is the functional quality and *vice-versa*. The relative importance of the latter three functions though can vary across building typologies, but all are present, nonetheless. Van der Voordt & Wegen (2005) also described *'architectonic quality'* as the co-presence of aesthetic, functional, technical, and economic qualities.

Economic function has featured in architectural research literature as a significant building function and should therefore contribute towards achieving architectonic quality. However, there is truly little empirical research on that area (e.g. Hough & Kratz, 1983; Vandell & Lane, 1989; Pearson, 2000, Skripkiūnas & Navickas, 2023

and Worpole, 2023). Climatic and symbolic functions attracted majority of attention. The economic function is one of the key success factors for real estate projects. Roulac (1996) and Abd El-Aziz et at. (2025) felt the need to acknowledge the role of design in real estate decision making while discussing real estate market cycles, but the potential of spatial configuration is not fully explored in real estate decision making because of difference in perspective of the key players. Real estate decision makers operate in a verbal world while designers operate in a visual one (Brown, 1999, p.86) creating a gap between the two domains of research. The challenge is to make both the ends meet.

Investigations into the relationship between the built form and economics (Nobbs, 1935) have ranged from choice of structural systems or materials to corporate identity building and to space branding and stimulating tourism through iconic architecture (e.g. Piatkowska, 2012). These inquiries have traditionally focused more on the optimization of cost aspects (construction and / or operational) or externalities (e.g. Knippers et al., 2021; Yashchenko et al., 2024), and less so on the attributes of the built form. Even where the built form did feature in such inquiries, the query was limited to aesthetics, looking at, for example the influence of architectural quality on rent (e.g. Vandell & Lane, 1989, Cheung & Yiu, 2022; Zhang et al., 2024) or creating corporate identities (Piatkowska, 2012, p.552). Establishing a relationship between *'architectural economics'* and spatial configuration has still been a less explored area of research. There is a need therefore, for scientific investigation into the role of the built form in generating economic benefits.

The shopping mall is an example of a built form where economic sustenance is paramount for its very existence (Ooi et al., 2006 and Salleh, 2023). By definition, a shopping mall is the agglomeration of different retail and other commercial establishments, or tenant stores, managed as a sole property (ICSC, 2004, p.1; Pitt & Musa, 2009 and Leung et al., 2024). Accommodating and locating this group of tenant stores in a shopping mall is the tenant mix (e.g. Kirkup & Rafiq, 1994; Bruwer, 1997; Downie et al., 2002 and Jakom et al., 2024). This mix generates a positive shopping atmosphere (e.g. Burns & Warren, 1995; Wakefield & Baker, 1998; Bone & Ellen, 1999 and Jakom et al., 2024) and leads to increasing returns to scale of operations (e.g. Goldstein & Gronberg, 1984; Fujita, 1989; Fujita & Thisse, 2002 and Kuduvalli et al., 2025). Various categories of tenant stores have different capacities of rental payment (Urban Land Institute, 1977; Xu et al., 2022 and Spasenić et al., 2023). A proper mix of tenant stores is, therefore, necessary for economic success of the mall (e.g. Nicholls et al., 2002, Reimers & Clulow, 2009; Yiu & Xu, 2012; Yuo & Lizieri, 2013; Garg & Steyn, 2014; Kyriazis & Cloete, 2018; Widiyani, 2018 and Jakom et al., 2024). Hence, tenant mix or composition of stores is a strategic mall management decision (e.g. Abratt et al., 1985; Anikeef, 1996; Marona & Wilk, 2016 and Jakom et al., 2024). This tenant mix decision is dependent on certain spatial factors (location and area allocation for different stores) for attracting and distributing customers throughout the mall (Dawson, 1983 and Riaz et al., 2024) and modifying their behaviour when they arrive near different stores by potentially engaging them in shopping behaviours (e.g. Hunter, 2006; Brito, 2009 and Chebat et al., 2010). Rent and area allocation decisions of individual tenant stores are spatial, but have strong economic implications (Riaz et al., 2024).

Brown (1999) was one of the pioneers who tried to correlate spatial configuration with economic benefits through a comparative analysis of two shopping malls—Beau Monde and Tarmac Square—in Denver, Colorado in the USA. The space syntax approach was adopted in this award-winning research (1998 ICSC Research Best Paper Award) to compare the geometrical abstractions of spatial arrangements (space syntax measures like convex spaces, axial lines) of the two malls for identifying their configurational differences. Beau Monde had failed as a mall and was eventually adapted to a church, while Tarmac Square continued its operations as a shopping mall. The study, instead of being a pioneer in highlighting the spatial significance in economic sustenance, remained a diagnostic one and did not lead to a framework for tenanting decision making. But it rightly pointed out the role of the built form in generating economic benefits.

Despite its strategic significance, traditional tenant mix policies do not focus on spatial arrangement of stores in shopping malls from a designer's perspective (Fong, 2005). There are very few empirical studies on the spatial allocation of tenant stores in shopping malls (e.g. Yiu et al., 2008) although researchers have emphasized the importance of spatial planning (Riaz, 2024). Few findings, instead, highlighted the importance of the location of stores in achieving a better pedestrian flow through the mall (e.g. Sim & Cheok, 1989; Alexander & Muhlebach, 1990 and Douglas & Fasintei, 2025). According to Kaylin (2012), the outcome of an ideal tenant mix should be a logical layout of shops. The most significant weakness of design layout studies is the lack of focus on movement and behaviour of shoppers (e.g. McColl, 1989 and Doma et al., 2024), while shoppers' movement affect the performance of the shopping

malls (e.g. Carter & Haloupek, 2002; Chebat et al., 2005; Carter & Vandell, 2005 and Deb & Mitra, 2018).

Architecture is both a process and a product: it deals with design, construction, organization, and conceptualization of space along with the spatial organization itself (e.g. Bertel et al., 2004). These aspects influence how a user perceives a space and navigates through it. Half a century ago, Le Corbusier (1962) emphasized the idea of movement as a central theme in the theory of architectural design, as the built environment is experienced and understood as people engage in movement through it and less from a static viewpoint. Thus, from a user's perspective, several points of environmental ability, that is, legibility (Lynch, 1960), imageability (Passini, 1992), and intelligibility (Hillier, 1996a) are essential for understanding and interpreting building layouts while users move through spaces. Movement has been studied in the fields of architecture and urban design, particularly for public spaces and configuration plays a significant role in generating and influencing movement patterns (Hillier et al., 1987; 1993; Hillier, 1996a; Hillier, 1996b; Hillier & Iida, 2005 and Ramadhani et al., 2024) within a built environment and urban areas.

As the shopping mall recreates the *'urban buzz'* removed from the '*city streets'* (Fong, 2003), it may be argued that the theories of urban spatial structure are applicable in shopping mall environments for explaining movement through it. Movement in turn affect the tenanting decision and economic performance of the mall. The shopping mall is thus an appropriate laboratory for inquiry into the spatial influences on tenanting decision making, which in turn determine the economic sustenance of a mall (e.g. Bellenger et al., 1977; Stoltman et al., 1991 and Finn & Louviere, 1996). The

identification of impact of the built form on economic functionality through development of a tenanting decision-making framework is the focus of this book.

Scholarly context

Studies in the field of retail management (e.g. Yiu & Xu, 2012; Yuo & Lizieri, 2013; Garg & Steyn, 2014 and Jakom et al., 2024) attempted to identify an *'ultimate tenant mix'*, a potentially useful tool for the mall management. The tenant mix decisions within a planned shopping mall involve decision making regarding composition of tenant stores in the spatial envelope along with space and rental allocation for each category of store and positioning them within the mall. These decisions were identified as being extremely important and ought to be considered at an early stage of shopping mall design (e.g. Guy, 1994; Beyard & O' Mara, 1999 and Leung et al., 2024) but, in practice, these are taken using a rule of thumb approach by real estate decision makers (e.g., Brown, 1991; Anikeef, 1996; YimYiu & Xu, 2012).

Tenant mix decisions have been driven by the consideration of inter store externalities since the inception of the format (e.g. Brueckner, 1993; Gatzlaff et al., 1994; Miceli et al., 1998; Pashigian & Gould, 1998; Vitorino 2012 and Leung & Zhou, 2024). During the same period when studies on inter store externality were gaining popularity, some studies focused on circulation or movement of customers within shopping malls for describing tenant mix (e.g. Brown, 1991; Fisher & Yezer, 1993; Sim & Way, 1989; Carter & Haloupek, 2000; Carter & Vandell, 2005; Thaw, 2024 and Jakom et al., 2024). The outcomes of these studies suggest that the profit function of a store in a shopping mall can be expressed as a

function of customer foot fall near it when other things remain constant. The configurational theories on shopping malls (e.g. Vandell & Lane, 1987; Pearson, 1991; Brueckner, 1993; Brown, 1999; Carter & Vandell, 2005; Andi et al., 2021 and Aigbe et al., 2024) were evolved from and relied on the theories of urban spatial structure (e.g. Lösch, 1940; Alonso, 1964; Christaller, 1966 and Hotelling, 1990) for describing profitability of a tenant store in terms of gate counts or foot falls, explained through bid-rent analysis (BDA). Therefore, there are two significant factors guiding tenant mix decisions in a shopping mall: inter store externality (from studies in retail management) and gate counts or foot falls near stores (from studies on configurational analysis).

Gate counts or foot falls in a particular location is a result of pedestrian movement through it. Movement has been studied in the fields of architecture and urban design. Studies on human navigation patterns in indoor environments (e.g. Peponis et al., 1990; Haq & Zimring, 2003; Hölscher et al., 2012; Sailer & Koutsolampros, 2021 and Lan & Yoon, 2023) suggest that human route choices in a built space are influenced by the syntactic properties of space. Space syntax is a configurational type of model which focuses on social encounters and co-presence within a spatial arrangement. Research results have also established that within a built environment, patterns of visibility are stronger predictors of movement (Sailer & Penn, 2007) than others such as convex space and axial line. Many researchers have supported the importance of visibility in explaining movement within an environment (e.g. Stavroulaki & Peponis, 2003; Peponis et al., 2004; Tzortzi, 2004; Markhede & Koch, 2007; Peponis et al., 2007; Omer & Goldblatt, 2007; Churchill et al., 2008; Psarra, 2009; Natapov & Fisher 2016 and Sailer & Koutsolampros, 2021) and this has been

verified for artificial organisms by roboticists (Yeap & Jefferies, 1999). Visuo-spatial properties of spaces are therefore significant for influencing movement. Visibility Graph Analysis (VGA), used to measure geometric visual properties of space, has emerged as a suitable tool for describing visuo- spatial configuration of a built space.

The relationship between the environment (both, natural and synthetic) and behaviour has been recognized for a long time in the field of architecture and urban design. To emphasize the significance, psychologist Kurt Lewin (1951) argued that behaviours *(B)* are not only a function of personal factors *(P)* but also of the environment (E) where it takes place, that is, *B=f (P, E)* (Lewin, 1936). Lewin (1936, p.12) expressed the relationship in a functional form as: *B= f (P, E).* That remains the basic philosophy behind this research. It can be conjectured that, wayfinding and navigation behaviours can be influenced by factors from both the environmental (visuo-spatial configuration) and human individual differences (e.g. Weisman, 1981: 189, 204; Peponis et al., 1990; O' Neil, 1991 and Montello, 2007). In a shopping mall, shopper characteristics are strong predictor of human individual differences (Gu et al., 2023).

As discussed earlier, tenanting decision making is about location, rent and area allocation of individual tenant stores. These decisions are spatial but have economic implications. These decisions depend on behaviour (i.e., movement) which eventually, gets influenced by visuo-spatial configuration (environmental factor) and shopper characteristics (i.e., personal factor). A logical tenanting decision making framework based on the logic of visuo-spatial configuration fine-tuned with personal factors will be of

immense significance for the mall management and real estate decision makers. This framework can use spatial design as a tool for economic decision making.

Why it is at all important?

Death may not be a good starting point for anything, but the death of a mall and the later resurrection of the same space as a church as chronicled in Denver Post (as described in Brown, 1999) is the beginning of understanding the requirement of a good decision-making tool based on the logic of spatial configuration. The *'ultimate tenant mix'* has always been a retailers' *El-dorado* for profit maximization. Two factors contribute significantly as the motivators for this research. The first pertains to the economic performance of shopping malls and the second is the complexity of the design development process. In this study, for explaining economic performance of shopping malls, the Indian market scenario is considered where the modern retail formats are on the rise.

The design development of a shopping mall is complex. Once the strategic decisions like location and format of the shopping mall are finalized, the concept is communicated to the designers in the form of a design brief for accommodating the functional requirements within a spatial envelope and for making the space aesthetically pleasant. The transformation of that enclosure into an operational shopping space is achieved through the input of other players such as retailers, mall management and leasing management professionals (Figure 2). In practice, tenanting decisions are taken by the mall management / real estate professionals long after the spatial design is finalized (sometimes