

Entropy and Urban Form: Balancing Order and Disorder in Pettah

Hasini Wijesundara*,
Janaka Wijesundara

University of Moratuwa, Moratuwa, Sri Lanka

Abstract

This paper explores the role of entropy in urban systems, with a focus on the balance between order and disorder in Colombo's Pettah market district. Rooted in thermodynamics, entropy refers to the degree of disorder within a system. In architecture and urbanism, it can be understood as unpredictability, complexity, and adaptability in the built environment. Contemporary urban discourse often equates disorder with informality or chaos; however, this study argues that disorder also reflects adaptability and resilience. The research examines how Pettah's urban form and human activities contribute to an equilibrium of entropy. Built form is analyzed through four parameters street network, block pattern, height variations, and colour palette while human activities are studied through economic, social-cultural, and recreational dimensions, further distinguished as permanent or temporary. Analytical methods include Nolli maps, polar histograms, colour studies, street elevations, photography, and onsite observation. Each parameter is assigned an entropy score to position Pettah along a spectrum ranging from high to low entropy. The research question reframes as, how an urban system achieves balance between order and disorder without going beyond the extreme ends of order and disorder and how the built form, permanent and temporal activities affect this balance. The objective is to develop an analytical framework that reveals the percentage of contribution of built form and human activities for the overall balance of order and disorder in pettah and how it affects adaptive and resilient character of an urban system. Findings indicate that Pettah occupies the middle of this spectrum, reflecting a balance between order and disorder. The paper concludes that entropy, understood as a design principle, enables urban systems to be adaptive, resilient, and responsive to human needs. By learning from Pettah, future urban design can foster this equilibrium, offering pathways toward sustainable urban growth.

Keywords: Entropy, Urban system, Order and Disorder, Pettah Market

Corresponding Author: Hasini Wijesundara:
E mail – hasini.wijesundara2002420@gmail.com

Introduction

The concept of *entropy* was first introduced in the field of thermodynamics, where it denotes the degree of randomness or disorder within a system and its effect on the amount of energy available to perform work. The term was coined in 1868 by German physicist Rudolf Clausius, derived from the Greek prefix *en-* (“within”) and the root *trop-* (“change”), thus meaning “change within (a closed system)” (Merriam-Webster, 2021).

Over time, the theory of entropy has been adapted across diverse disciplines, including information theory, statistical mechanics, architecture, biology, and economics. In 1948, Claude Shannon introduced entropy in information theory as a measure of uncertainty or information content in a communication system, describing it as “a measure of uncertainty or surprise associated with random variables” (Shannon, 1948). Similarly, Ludwig Boltzmann, in 1890, applied statistical mechanics to explain the thermodynamic behavior of matter based on the arrangement of molecules and atoms (Jaynes, 1957, as cited in Cabral et al., 2013).

In architecture, the concept of entropy has been employed to study the balance between order and complexity in spatial configurations. Andrew Borg’s 2015 experimental series at the MIT Media Lab explored how entropy in architectural form generation could be quantitatively assessed through algorithmic parameters. The study concluded that “architectural systems that balance between entropy and order have the highest potential to be both engaging and legible” (Borg Wirth, 2022).

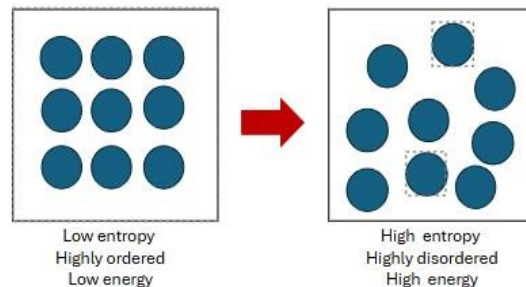


Fig 1: Graphical representation of entropy change
Source: Author

Entropy in an Urban Context

Bentley et al. (1985) define the *urban context* as “the setting within which architectural form gains meaning,” emphasizing that a building’s significance emerges not in isolation but through its relationship to the surrounding environment. Within this framework, *urban entropy* captures the uncertainty, diversity, and dynamism inherent in the interaction between the built environment and the continuously evolving patterns of social, cultural, economic, and human activity.

Kevin Lynch, in *A Theory of Good City Form* (1981), asserts that “the city must be open to disorder and unpredictability, for these are the conditions of vitality and self-renewal.” This perspective closely aligns with the notion of urban entropy, suggesting that a city should resist excessive control and rigid planning, instead remaining flexible, spontaneous, and capable of self-regeneration.

Building on this idea, Rahul Mehrotra (2021), in *The Kinetic City and Other Essays*, introduces the concept of the *kinetic city* to reframe urban order and disorder through the lenses of temporality, informality, and cultural adaptation. The kinetic city embodies higher entropy, challenging the permanence and rigidity of the static city characterized by low entropy. According to Salingeros (2004), “in an organized and symmetric city, entropy is minimized, but this often leads to lifelessness and stagnation because the city does not adapt or respond to the organic needs of its people.” He argues that excessive uniformity and low entropic conditions suppress the complexity essential for human engagement, noting that “monotonous repetition without sub-symmetries represents a minimal pattern on a single level of scale.”

Mehrotra (2021) further observes that “the city is not defined solely by its built fabric but by its patterns of use, adaptation, and ritual,” positioning the kinetic city as a living, evolving urban layer shaped by informality and temporal adaptation. This form of urbanism embraces unpredictability and constant transformation as vital to urban survival and vitality.

Similarly, Salingeros (2004) concludes that “the beauty of organic cities lies in their ability to grow and evolve through human interaction with the built environment, where entropy plays a crucial role in keeping the urban fabric alive and continually adapting.” Thus, the balance between order and disorder in urban systems can be understood through the interplay of built form and human activity, where harmony emerges not from uniformity, but from their dynamic and adaptive coexistence.

Entropy in Built form -Entropy in Street networks

In understanding topological structure in an urban system, the measure of diversity and disorder in streets play a major role. “Recently, scholars have studied street network order and disorder through circuitry” (Boeing, 2019) and orientation entropy Using the space syntax methods polar histograms were produced to study the difference between spread of ordered and disordered street networks in cities.

In the below figure Beijing city with its grid lined street network shows low entropy, streets are oriented in four directions. In contrast Rio de Janeiro's organically grown, angular street network displays high entropy, with streets spreading in multiple directions. Below histograms visually represents this difference, highlighting how the city's entropy has affected by street networks.



Fig 2: Polar histograms of Beijing and Rio de Janeiro (left and center), and Chicago, Sydney, Buenos Aires, Salvador and Istanbul (right).

Entropy in Building Block Patterns

The formation and shape of the building blocks in an urban context contributes to the entropy in its built form. From macro level to the micro levels the segments of the built fabric denote the order and disorder of a city's-built fabric.

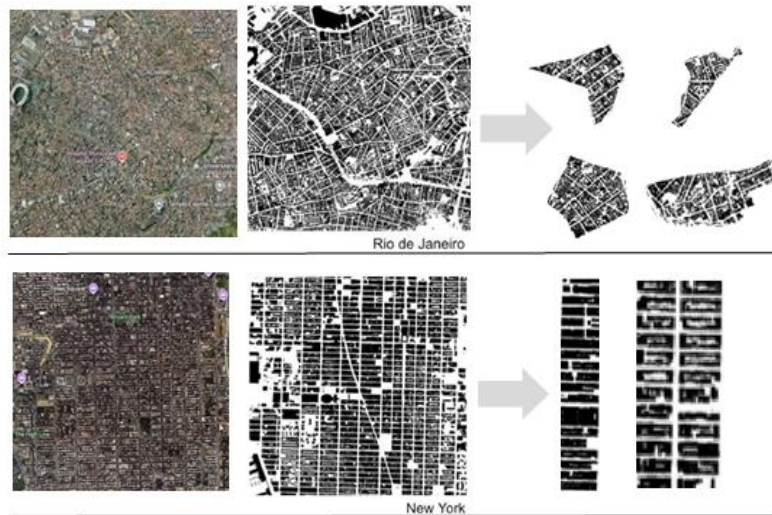


Fig: 3 building block patterns of Rio de Janeiro and New York
Source: (Netto et al., 2022) and google earth

Entropy in urban colour palettes

“A monotonous repetition of modules leads to boredom and ultimately rejection. Human beings need a certain amount of visual complexity to feel comfortable in an environment” (Salingaros, 2004). As mentioned, a colour pallet of a city displays the diversity, spontaneity and culture of a city. A city with monotonous colours tends to be lifeless, boring and less energetic while a city with more colours tends to be more vibrant and stimulate the human activities.



Fig 4: Colour palettes of high and low entropic cities
Source: Rethinking the Future. (n.d.). Cities and their colors: An architectural discourse

Entropy in Building Height Variation

The height variation is a main parameter when considering the entropy in urban form. As Schläpfer, Lee, & Bettencourt, (2021) says "Urban skylines encode information about a city's spatial and economic structure. Variability in building heights reflects both planning practices and organic development patterns". An urban context with a higher fluctuation of heights have a higher entropy while an urban context with a uniform pattern in height have lower entropy.

Identifying human activities that balance order and Disorder

As discussed, built form plays a critical role in shaping a balanced urban system in terms of street network, grid patterns, height variations and colour Palette. However urban balance is not defined by the built form alone. Similarly, it is influenced by the dynamic spectrum of human activities that carries a range of entropy variations. According to experts, "The remarkable link between intrinsic human qualities such as behavior, conduct, and demeanor, and the external environment has been recognized for years."(Haas,et al, 2020)

Permanent activities

Permanent activities provide predictability through spatial permanency and consistent temporal presence. They either are permanently presence in the system, or the temporal presence is made in systematical manner. So those activities help the urban environment to be an ordered, Predictable and structured system. In urbanism designer have adapted the urban form in order to cater these predictable activities of human. Systematic urban design theories such as Functional City / CIAM Principles, Concentric Zone Mode has been introduced to catalyst this systematic human behavior.

Temporal activities

Temporal activities are unpredictable, spontaneous or short-term activities that happens in an urban system. They are not permanently or orderly embedded in the city, but they emerge and disappear based on time, events and community needs. These activities can change according to human needs, their emotions, flexibility and adaptability over time.

In urbanism these temporal activities are taken into consideration to bring the adaptability and transformability into the urban system. Theories like Temporary Urbanism / Tactical Urbanism, Everyday Urbanism.

Achieving balance through built form and human activities

In contemporary urbanism, achieving balance in the urban system involves the correlation between built form and human activities. Experts have said that "In urban planning and design research and practice there is a broad understanding that design of the built environment matters to the life and well-being of communities and individuals"(Haas, Littke, & Elahe, 2020). And also, that both aspects are needed in shaping urban system and while some aspects of human activities are limited by the built form some are encouraged to achieve the balance. Sometime the high ends and low ends of those two aspects meets together to achieve balance. Cities which have high entropic built form can find balance though systematic human behavioural

patterns. Likewise, cities with low entropic built form find its balance through adaptive and temporal human activities.

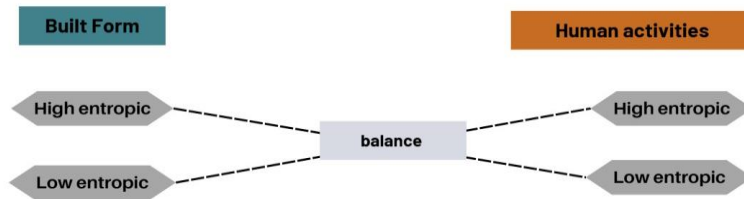


Fig 5: Extreme approaches of entropy balance source: Author

These two approaches are studied in this paper using two cities at the extreme ends. Rome which is an organic city with higher entropy in its built form, and Chicago which is a planned city with low entropic built form have achieved the universal balance with the integration of dynamic human activities.

Case Examples - Chicago & Rome

Human activities – Chicago

	Activity type	Ambiance	My interpretation
Economical activities	Increase economic entropy by introducing spatial and temporal unpredictability, adapting to shifting human needs		
	<ul style="list-style-type: none"> Farmers markets (e.g., Green City Market), food trucks, holiday bazaars, night markets. 		
Social & Cultural activities	Inject cultural vibrancy and social spontaneity, increasing diversity and adaptive urban experiences.		
	<ul style="list-style-type: none"> Parades (e.g., Pride Parade), street theatre in Millennium Park, food festivals, cultural pop-ups. 		
Recreational activities	Promote dynamic use of urban space, generating temporary disorder that rejuvenates the city socially and spatially.		
	<ul style="list-style-type: none"> Seasonal ice-skating rinks, weekend concerts, lakeside film nights, beach festivals. 		

Table 1: Human activity analysis on Chicago
 Source: Author

Human activities - Rome

	Activity type	Ambiance	My interpretation
Economical activities	These long-standing businesses create socio-spatial stability amidst the visual and morphological chaos of historical fabric.		
	<ul style="list-style-type: none"> Family-owned businesses, artisan shops, local produce markets (e.g., Campo de' 		
Social & Cultural activities	These anchor collective memory and cultural identity, functioning as predictable systems that reduce urban entropy.		
	<ul style="list-style-type: none"> Pilgrimage routes, institutionalized festivals (e.g., Easter processions), local neighborhood 		
Recreational activities	These structured and designed spaces enable continuous use, fostering order and well-being.		
	<ul style="list-style-type: none"> Walkable historic plazas (e.g., Piazza Navona), landscaped gardens (Villa Borghese), established parks. 		

Table 2: Human activity analysis in Rome
 Source: Author

Built form– Chicago

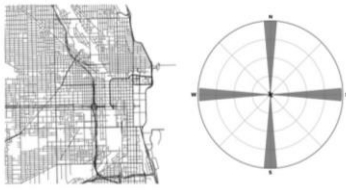


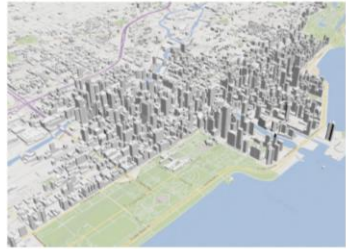
Street network	<ul style="list-style-type: none"> cardinal orientation streets aligned almost exactly to north- south and east-west. takes the Madison street as zero - zero point and extends in a mathematically precise pattern. 	
Grid patterns	<ul style="list-style-type: none"> closest approximation of a single perfect grid score 0.9 on a scale where 1 represent a perfect grid with each section measuring one square mile and subdivided in to rectangular 330x660-foot blocks. 	
Colour palette	<ul style="list-style-type: none"> low entropic character historical architecture features shades of white, beige and grey modern Chicago maintains blue from Michigan lake, grey shades and terra cotta tones from historic buildings 	
Height variation	<ul style="list-style-type: none"> topography supports the systematic development of grid system creates predictable height progressions from the central business district outward. 	

Table 3: Built form analysis in Chicago
 Source: *Author*

Built form– Rome

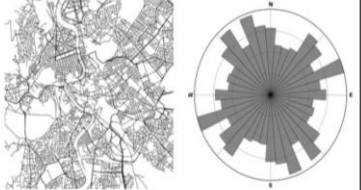



Street network	<ul style="list-style-type: none"> medieval and renaissance interventions adding complexity streets are imposed on existing fabric without a systematic geometric logic layered development 	
Grid patterns	<ul style="list-style-type: none"> shaped with existing pattern. developed through organic accretion over millennia creating complexities. 	
Colour palette	<ul style="list-style-type: none"> colour layers through historical layers. ancient roman buildings are brightly painted medieval additions are with earthy tones a synthesis between gold and red that emerges from the historical layering 	
Height variation	<ul style="list-style-type: none"> height variation because of the construction technology and different historical periods residential buildings with 6 stories monumental buildings like colosseum reaching 157ft creates a irregular sky line. 	

Table 4: Built form analysis in Rome
 Source: *Author*

Comparative analysis of the Chicago and Rome

As mentioned in the above analysis on built form and human activities in the both cities, following conclusions can be made.

- Chicago has a low entropic built form with a grid patterned, perfectly planned city blocks, a monotonous colour Palette and a building height variation where commercial zone has higher buildings and height reduces when it comes to the residential area.
- With the low entropic built form Chicago has integrated its temporary activities to bring the city's entropic level in to a balance.
- Rome has a high entropic built form with an organically grown street pattern, organic shaped building blocks, few layers of colour palettes in the built fabric and a differentiated building height pattern where all the residential buildings are at a same height, but prominent buildings are elevated.
- Rome has achieved its balance in entropy through the routine activity patterns that are generated over time.

	Aspect	Activity	Entropy level	
Chicago	Built form	street network	low	balance achieved
		block pattern	low	
		colour palette	low	
		building height	moderate	
	Human activities	economical activities	high	
		social and cultural	high	
		recreational activities	moderate	
Rome	Built form	street network	high	balance achieved
		block pattern	high	
		colour palette	moderate	
		building height	high	
	Human activities	economical activities	moderate	
		social and cultural	low	
		recreational activities	low	

Table 5: Entropy analysis of Chicago and Rome
 Source: Author

Development of a framework for urban entropy analysis

Considering the two aspects, built form and human activities that interplays in entropy in an urban system, a framework has been developed to cater the case study in Pettah Market district.

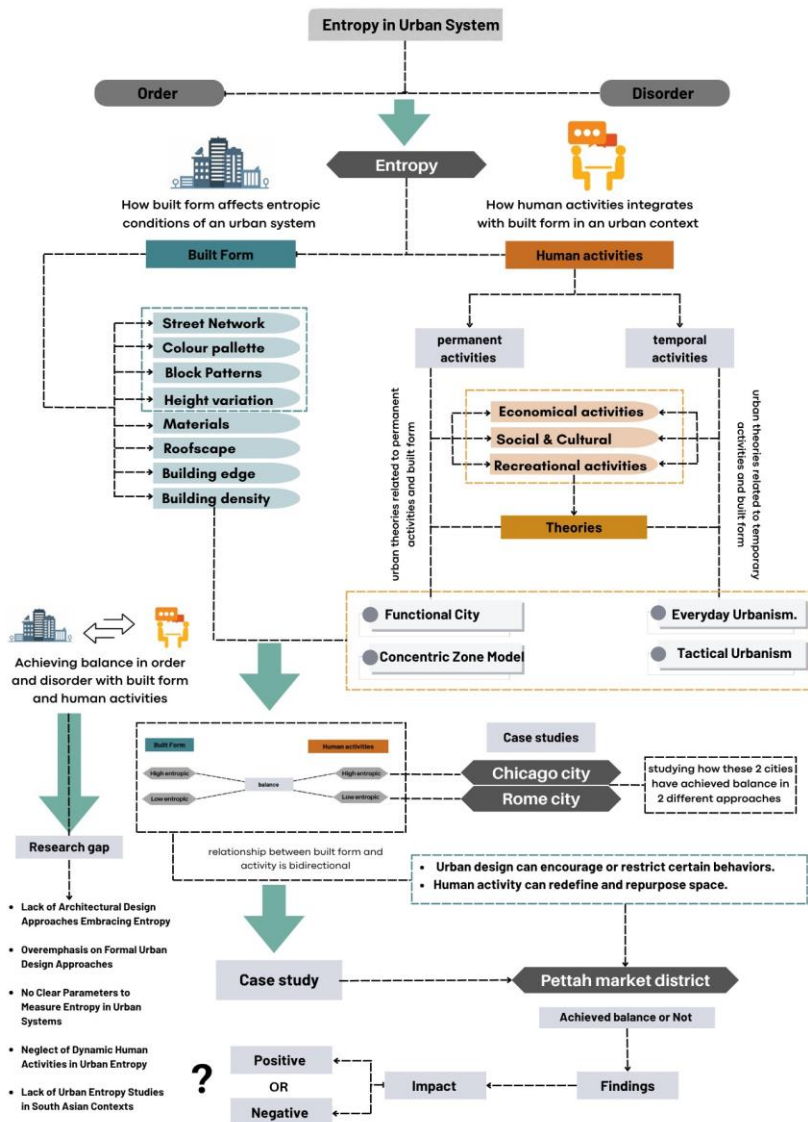


Fig 6: framework of the case study Source: Author

Case study of Pettah Market

This section will take the pettah market district as the case study to study the built form that was discussed in chapter 1 and the human activities that was discussed in chapter 2. And the study will reveal how the pettah market has achieved the balance in order and disorder.

Justification for the selection of case study

Selecting Pettah Market district as the case study justified as it has a complex spatial, social, cultural and economic dynamics.

1. Co existence of several functions that are formal and informal in a multi-functional urban fabric.
2. There is a planned grid layout and an unregulated spontaneous structure.
3. There are adaptive spaces like pavements, streets and lots of temporal activities are happening through day and night.
4. There is a historical layering over centuries reflecting multiple cultural, political and economic influence.

As of above justifications we can identify Pettah as an urban system with duality of order and disorder in both built form and human activities. It would make the pettah market district ideal for this case study.


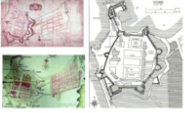


Period		Built form	Human activities
Pre-colonial (before 1505)		<ul style="list-style-type: none"> Built form was organic that was made according to the needs of traders Simple and temporary vernacular structures. 	<ul style="list-style-type: none"> Arab merchants traded here for a long time before Europeans Region was known for its diverse economic activities.
Portuguese period (1505-1656)		<ul style="list-style-type: none"> Fort was built but pettah remained outside the walls, growing organically with narrow lanes Built form was vernacular but there were some masonry buildings. 	<ul style="list-style-type: none"> Local and foreign traders did their economic activities
Dutch period (1656-1796)		<ul style="list-style-type: none"> Restructured pettah introducing a grid-imposed street pattern. Introduced 5 main streets. Bankshal st, Main st, Keyzer st, Prince st, Maliban st. 	<ul style="list-style-type: none"> Over time pettah became a commercial zone with markets and warehouses supporting port and fort. Diverse communities settled bringing their cultural institutions.
British period (1796-1948)		<ul style="list-style-type: none"> Multistorey shop houses, khan clock tower emerged Manning market was established as a major wholesale market. Built form expanded vertically increasing the built density and also people density. 	<ul style="list-style-type: none"> Expanded pettah commercial functions.
Present Colombo (2025)		<ul style="list-style-type: none"> Built form is now dense and modern multistorey buildings are present. New constructions prioritize function over form. Streets are tightly packed with vertical stacking of retail and residential uses. 	<ul style="list-style-type: none"> Market area is vibrant with intense pedestrian flow, street vending and vibrant food cultures.

Table 6: evolution of pettah in built form and human activities
Source: author

Methodology of the study

A point system is introduced to determine following factors.

- To determine whether built form or human activities affects entropy more.
- To determine whether, which parameter has a greater effect on entropy.
- With above parameters identify which streets affect more to the overall entropy.



1. Low entropy
2. Leaning towards low entropy
3. Moderate entropy
4. Leaning towards high entropy
5. High entropy

According to the scale, as there are 7 parameters total points should be 35. (7 parameters × 5 entropy levels).

- If all parameters have high entropy the entropy level should be 35.
- If all parameters have low entropy the entropy level should be 7.
- If the parameters have a moderate effect on entropy, the entropy level should be in between 7 and 35.
- Built form will occupy 20/35 points in overall entropy. (4 parameters × 5 entropy levels)
- Human activities will occupy 15/35 points in overall entropy. (3 parameters × 5 entropy levels)

Entropy levels for each parameter will be assigned, and the conclusion will be arrived from the resulting numbers.

Data was collected through following methodologies.

- **Street Network**- finding the angle of each street from north through maps and producing a polar histogram
- **Block Patterns** – finding the rough area of each block and categorizing them according to area and shape of the block.
- **Colour Pallet**- selecting a random point at each street and analyzing the color palette.
- **Building Height**-producing Street elevation based on the no: of stories and comparing the height fluctuations of each street.
- **Human activities** - studied using photographs taken according to the activity type and the activity maps.

Application of Entropy analysis framework

Built form

Street network

Street network of Pettah Market district has identified and mapped as follows.

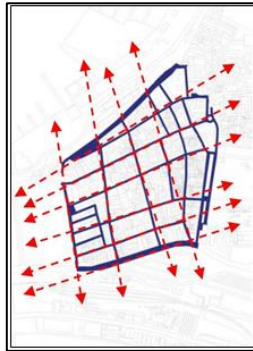


Fig 7: Orientation of streets in pettah
 Source: Author

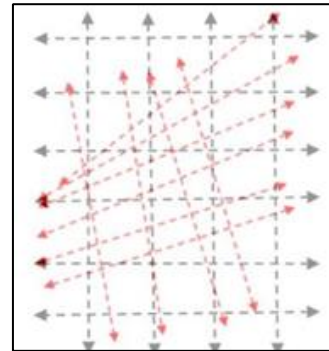


Fig 8: comparison of street networks
 Source: Author

Polar histogram for the pettah street network

Polar histograms are generated using the data collected on the orientation of streets in reference to north- south and east- west axis. If the streets are oriented exactly to North – south and East –west the polar histogram will be as follows.

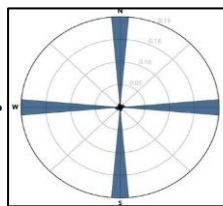
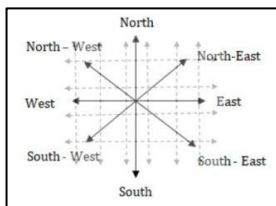


Fig. 9: Polar histogram for a street network to cardinal directions
 Source: Author

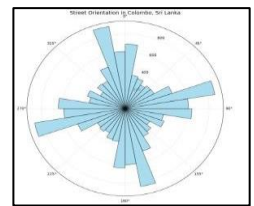
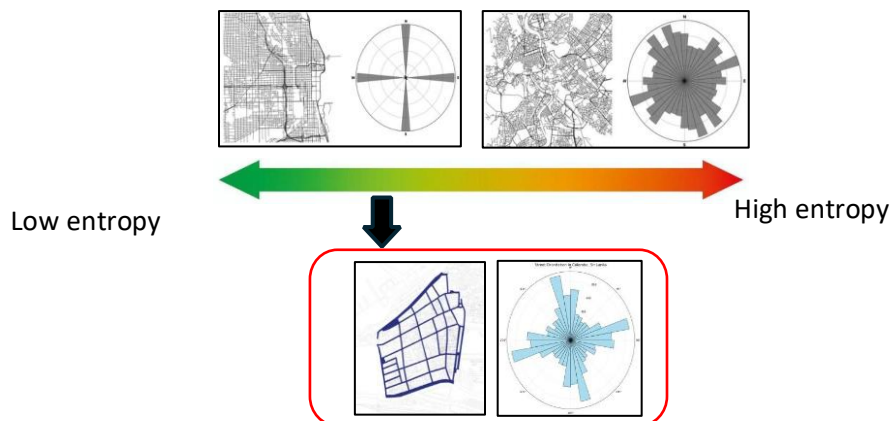


Fig. 10: Polar histogram for pettah market
 Source: Author

Comparison with the previous case studies

Chicago and Rome have been identified as examples for low entropic and high entropic street networks.



As presented above the arrangement of street network in pettah lies neither in high entropic nor low entropic
 Fig. 11: Comparison of polar histograms
 Source: Author

histograms we can see that street networks in pettah have a pattern close to gridiron but has its complications. As a conclusion pettah lies between the middle range of entropy achieving the balance.

Block patterns

Building block pattern of pettah market district has identified and mapped as follows.



Fig. 12: Highlighted building blocks and their areas
Source Author

Comparison with the previous case studies

Chicago and Rome have been identified as examples for low entropic and high entropic block.

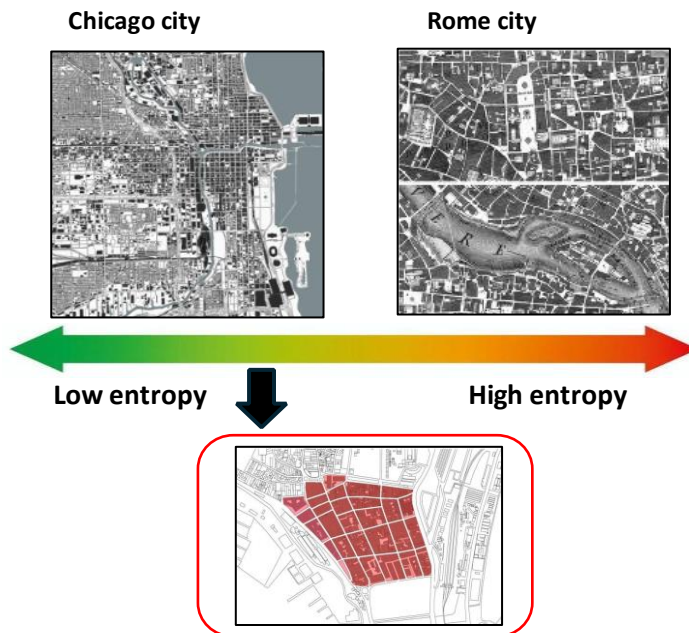


Fig 13: Comparison with building blocks in Rome and Chicago
Source: Author

When considering the areas of the building blocks it has a variation from 1000sqm to 15000sqm. Even though it has an order in means of the shape and the orientation, when it comes to area, they differ. Pettah lies neither at extreme end but at the middle leaning towards the low entropy

not at the extreme end which leads to visual clutter. Pettah has a balanced differentiation of colours but it leans towards the high entropy because of the higher no of variation.

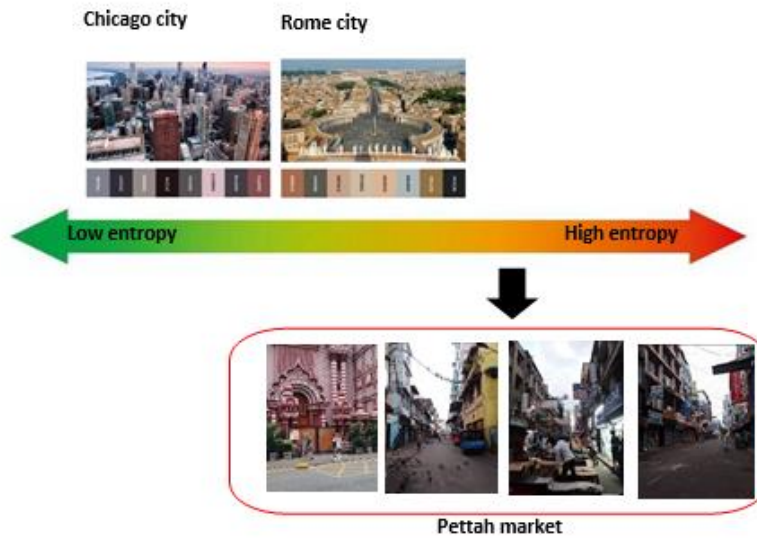


Fig 14: comparison of colour palette of Pettah with Chicago and Rome
Source: Author

Height variations

The building height variation in pettah is varied due to the unpredictable and disorderly vertical development. But some streets like Front Street, 5th Cross Street has a uniform sky line. When comparing with the previous two case studies even though Chicago is a developing city with sky scrapers the height variation is much ordered. The height increases from the residential zone to the commercial zone in an orderly manner. Even though the Rome city has no much variations in skyline there is sudden fluctuations of the skyline that is not arranged in and orderly manner.

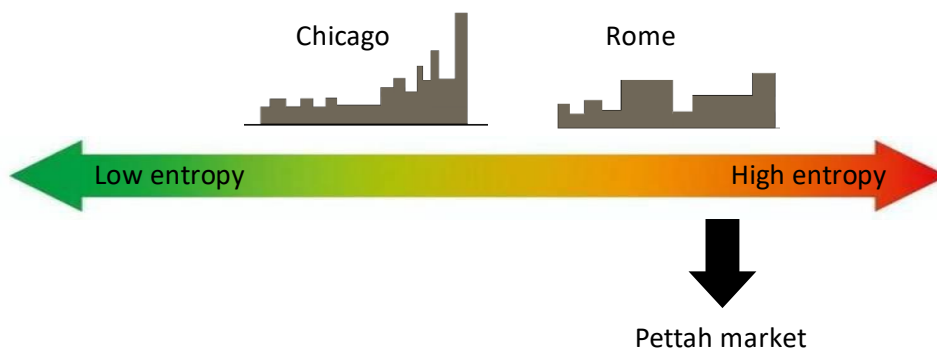


Fig 15: Comparison of building height in pettah with Chicago and Rome
Source: Author

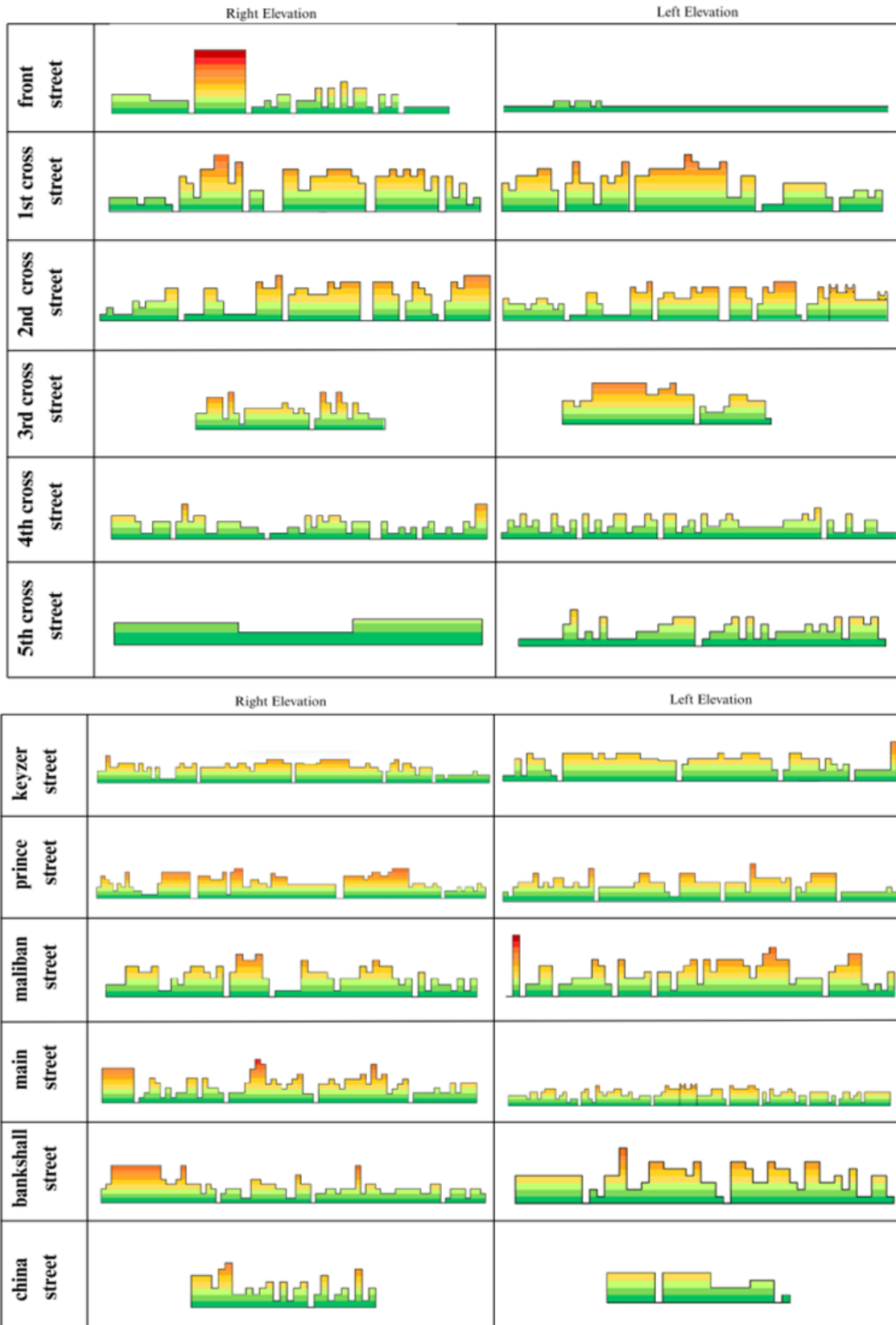


Fig 16: comparison of building heights through street elevations in pettah
 Source: Author

Summary of the built form

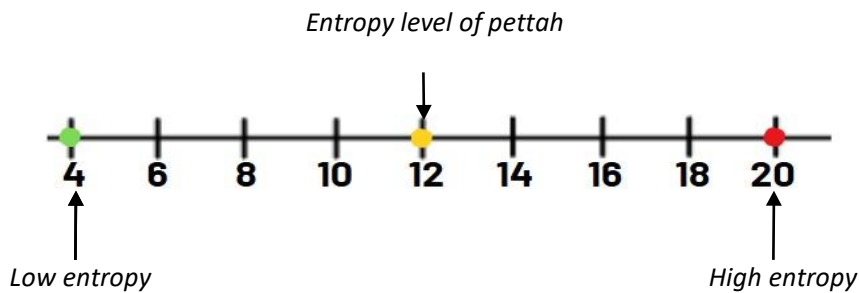
- *Street network - Lies neither at the extreme ends in the scale of entropy but leans towards the less entropic side because of the north- south and east – west oriented street network.*
- *Block patterns -Lies neither in two extreme ends but at the middle leaning more towards the low entropic side because of its grid pattern.*
- *Colour palette- It is not too monotonous or causing visual chaos, but it is having a visual diversity and vibrancy allowing it to lean more towards high entropic level. This visual richness enhances street identity and cultural dynamism*
- *Building height- Shows a much variation because of the rapid vertical growth. It has affected the uneven skyline causing it to be in the middle of the entropic range leaning toward high entropic side.*

Entropy analysis of built form in Pettah

Parameter	Nature	Entropy level	Entropy point	
Street network	middle, leaning low	2	2	Low Entropy
Building block pattern	middle, leaning low	2	2	Low Entropy
Colour palette	middle, leaning high	4	4	High Entropy
Building height	middle, leaning high	4	4	High Entropy

Table 8: Entropy analysis of built form in pettah
 Source: Author

Total entropy points for built form if all the parameters have high entropy = 20 points
 Total entropy points for built form if all the parameters have low entropy = 4 points
 Total entropy points of pettah in the existing built form (E – built) = 2 + 2 + 4 +4 = 12 points



- Entropy level percentage of built form = $12/20 \times 100 = 60\%$
- Pettah has a 60% of an entropy level created by the built form.

Human activities

Pettah can be identified as a commercial hub where mostly economical activities take place. With the economical identity of the place some social, cultural and recreational activities also takes place within the context. These activities help the urban system to balance the urban order and disorder in means of their temporality or permanency.

Economic activities

Introduction to Economic Life in Pettah

Economic activities in Pettah thrives on diversity and informality. The building is zoned according to the items that are selling in the shops. So the concentration of people, activity patterns mostly depend on the economic activities. The blend of formal and informal economies creates high intensity commercial environment that supports a wide range of livelihoods. Pettah’s economic life is defined not only by the trading but also its adaptability, fluidity and entropy mix of order and disorder

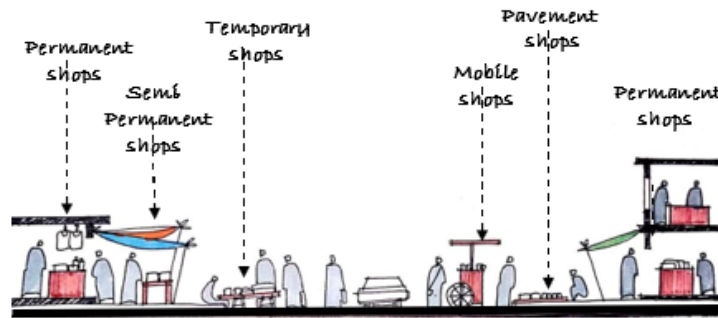


Fig 17: Section through a street in Pettah
 Source:Author

Typologies of Economic Spaces

Pettah's economic activities depends on not only the permanent shop that are regularly functioned but mostly on the temporal and spontaneous selling paces that have been adapted according to the comfortability and space availability of vendors and sellers. these shops are divided in to 5 types and studied under 5 parameters for the configuration of entropy level of human activities interacted with these spaces.

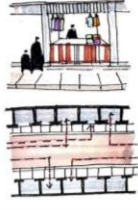
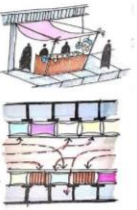


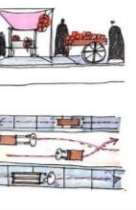
	Permanent shops	Semi permanent shops	Temporary shops	Pavement shops	Mobile shops
					
Mobility of people	Low. Customers move in and out vendor is fixed inside.	Customers over inside the shaded area, cluster movement	High clustering around stalls . Circulation is disturbed	High . Pedestrians pause briefly. Flow obstructed at ground level	Vendor and customer both mobile, constantly moving
Space occupation by human activities	Contained inside walls, minimal spill over	Extended in to pavements via shadings	Extended in to streets flexible boundaries	Overlaps with pedestrian activity	Occupies no fixed spot . Footprint constantly moving
Temporal rhythms of activities	Stable activities in weeks, days, hours, predictable	Varies with sales, times of the day	Strong in peaks, festivals, daily setup and removal	Short term, dismantled easily, quickly	Highly unpredictable presence
Social interactions	Formal transactions, repeat customers, limited bargaining	mix of formal and informal. Bargaining is common	Intense bargaining, dense customer vendor interaction	Highly informal, negotiable pricing	Quick opportunities, minimal relationships
Adaptability of human behavior	Low . Fixed routine , predictable routine	Customers adapted to shaded extensions	Pedestrians divert, crows compress to access stalls	Pedestrians steps off side walks/roads , constant negotiation of spaces	Sellers adjust constantly while moving
Entropy level	1	2	3	4	5

Table 9: shop typologies and their entropy contribution

Source: Author

Spatial Relationships & Layering

When considering the economic activities in pettah it is important how the human activities overlap, layer and negotiate spaces. The variety of layers and the relationships between them have both negatively and positively affected the entropy level in pettah. Across the typical street of pettah we can see the horizontal layering and how the layer are weave together in means of human activities.

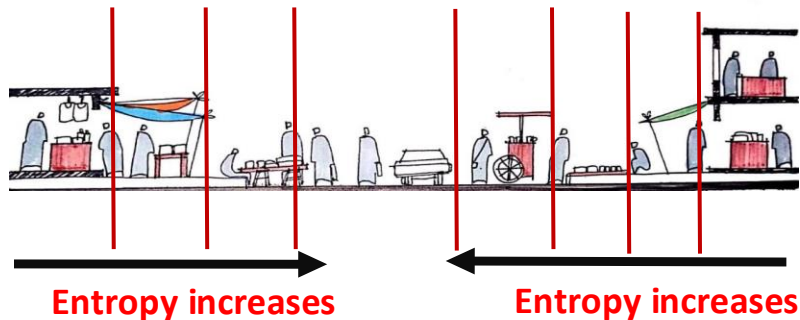


Fig 18: entropy behavior through a street Source: Author

- Permanent shops set the base layer and provide continuity
- The semi-permanent shops extend the layer and claim the space between permanent shops and road. Often keep spaces for pedestrian so the economic activity pattens and pedestrian activities fill the gap between layers
- Temporary structure often colonizes and makes another layer
- Mobile vendors weave between these and fill out the gap in circulation routes
- When you move towards the road the diversity, informality mobility and spontaneous nature of activities increase affecting high entropy.

Transformation of Spaces

In Pettah there is a static, permanent built fabric that defines certain permanent activities. But with the needs of the people and space availability pettah's permanent built layer has extended inward with temporary structures. Because of these the low entropic level has evolved in to high entropic conditions in means odd built form and human activities.

1. Transformation of building corners

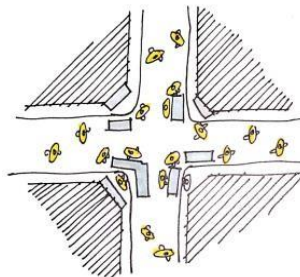


Fig 19: Transformation of building corners
Source: Author

In pettah, the junctions with 4 building corners have transformed in to a diverse and more celebrative space with the temporal economic activities. Because of that the entropy level has increased.

2. Transformation of pavements and roads



Fig 20: Transformation of pavements and roads
Source: Author

Anchoring to the permanent built form temporary structures have been extended from them transforming pavements and roads in to temporary selling spaces. These activities affect high entropic levels in pettah market.

Social and cultural activities

Beyond its role as a commercial hub, Pettah possesses a distinctive social life that is integral to its identity. It serves as a shared arena where diverse social classes, ethnic groups, and communities coexist. The streets are not merely lined with shops but are enlivened by continuous bargaining, negotiation, and spontaneous social interactions. Sidewalks extend beyond their functional purpose to become spaces for rest, conversation, and shared meals, weaving social life seamlessly into the urban fabric. Religious institutions, churches, temples, and mosques, act as cultural anchors, shaping the rhythms of daily life and reinforcing Pettah’s pluralistic character.

Entropy analysis of social and cultural activities in pettah

Activity	Nature of the activity	Entropy level	
	Unpredictable gatherings, occupy circulation spaces	Leaning towards high entropy	4
	Rhythmic but temporal. Creates sudden burst of entropy	Moderate entropy	3
	Breaks formal spatial use, unpredictable in placement	Leaning towards high entropy	4
	Ritualized, ordered in practice, crowd density can change	Leaning towards low entropy	2
	Daily activities as a routine, circular activity that repeats every day	Leaning towards low entropy	2
	Periodic, unpredictable with human needs	Leaning towards high entropy	4

Table 10: Entropy analysis of social and cultural activities in Pettah
 Source: Author

Recreational activities

Pettah is not only just a center of commerce, it is a living organism shaped by interplay of economic, social, and recreational rhythms. Pettah is a recreational arena with diverse communal meetings, practice of traditions and seasonal cycles. Within the constant hustle of pettah, recreational practices emerge informally: pausing for tea, sharing a meal, attending festivals or simply wondering through the vibrant streets

Entropy analysis of recreational activities in Pettah





Activity	Nature of activity		Entropy level
Recreational activities around Dutch fort 	Happening at opening hours, predictable and ordered	Low entropy	1
Wedding photoshoots in pettah 	Happening at morning, slightly ordered	Leaning toward low entropy	2
Tourist activities in pettah 	Spontaneous, concentrated among religious places and museums	Leaning towards high entropy	4
Shopping activities in pettah 	Highly unpredictable, disordered, spontaneous	High entropy	5

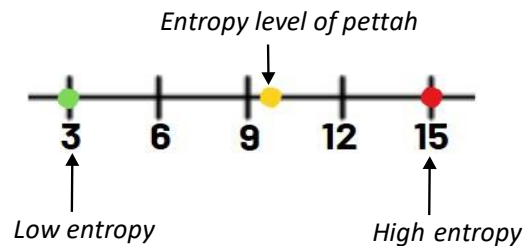
Table 11: Entropy analysis of recreational activities in Pettah
 Source: Author

Entropy Analysis of Human Activities in pettah

	Activity	Entropy level	Entropy point	Overall entropy point
Economical activities	Activities related to Permanent shops	1	1	$(1+2+3+5+5)/5$ =16/5 =3.2
	Activities related to semi-permanent activities	2	2	
	Activities related to temporary activities	3	3	
	Activities related to pavement shops	5	5	
	Activities related to mobile shops	5	5	
Social and cultural activities	Social pockets	4	4	$(4+3+4+2+2+4)/6$ =19/6 =3.16
	weekly Sunday “pola”	3	3	
	Informal habitation	4	4	
	Religious and cultural activities	2	2	
	Infrastructure activities	2	2	
	Alms giving	4	4	
Recreational activities	Recreational activities around Dutch fort	1	1	$(1+2+4+5)/4$ =12/4 =3
	Wedding photoshoots in pettah	2	2	
	Tourist activities in pettah	4	4	
	Shopping activities in pettah	5	5	

Table 12: Entropy analysis of human activities in pettah
 Source: Author

Total entropy points for human activities if all the parameters have high entropy = 15 points
 Total entropy points for human activities if all the parameters have low entropy = 3points
 Total entropy points of pettah in the existing human activities (E- activity) = 3.2+3.16+ 3 = 9.36 points



- Entropy level percentage of human activities = $9.36/15 \times 100 = 62.4\%$
- Pettah has a 62.4% of an entropy level created by the human activities.

Entropy analysis of pettah market district

Built form

- Assuming that a city with high entropy created by built form has an entropy percentage of 100%, pettah has achieved 60% of an entropy level through its built form.
- According to the entropy level, built form is neither highly ordered nor chaotic.

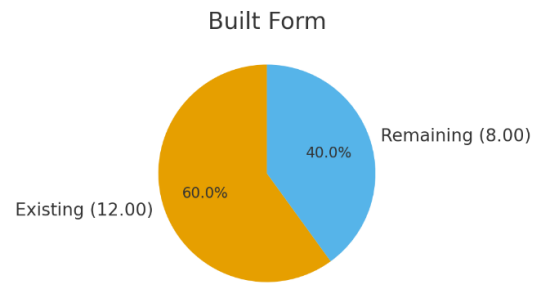


Fig 21: Pie chart for the entropy percentage of built form
 Source: Author

Human activities

- Assuming that a city with high entropy created by human activities has an entropy percentage of 100%, pettah has achieved 62.4% of an entropy level through human activities.
- Human activities are slightly more entropic than built form.

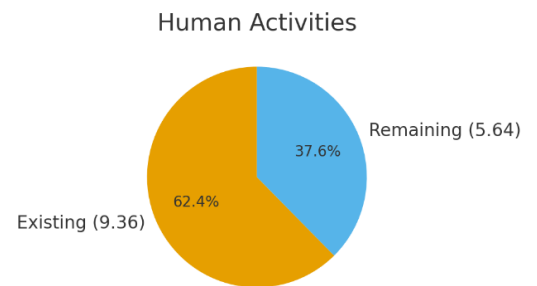


Fig 22: Pie chart for the entropy percentage of human activities
 Source: Author

Overall entropy in pettah

$$\begin{aligned}
 \text{E- overall} &= \text{E – built} + \text{E – activity} \\
 &= 12 + 9.36 \\
 &= 21.36 \\
 \text{Entropy percentage} &= 21.36/35 \times 100 \\
 &= 61\%
 \end{aligned}$$

- Pettah has achieved 61% of its maximum possible entropic level.
- Pettah's entropy level is neither high nor low but lies in between with a balanced order and disorder.
- When considering built form parameters colour palette and building height variations have a higher contribution to the entropy level.
- When considering human activity parameters economic activities has a higher contribution to

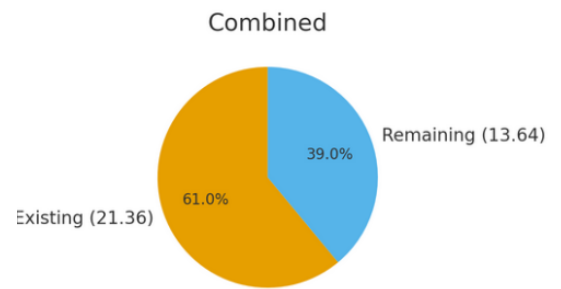


Fig 23: Pie chart for the entropy percentage of pettah Source: Author

entropy level.

Lessons from pettah for future designs

Pettah's built fabric is made of permanent and temporary structures allowing them to be flexible. A city needs to be flexible according to human needs being adaptable for their needs.

- Pettah has a horizontal spatial layering that supports co- existence of different activities. In an urban environment this spatial layering can use to arrange spaces according to spatial hierarchy.
- Pettah has a balance in order and disorder with a structured planning, and it is always open for growth. This allows a city to be well organized and flexible at the same time.
- Pettah has given the priority for human scale. The street level is designed diversely with different economic, cultural and social layers. A city also needs to be responded to human scale in every aspect.
- Even though pettah has a structured plan it has identified the informality within and treated them carefully. In urban planning the designer should identify the informal character and it needs to be treated.
- With the chaotic activity patterns pettah has preserved the cultural rhythms such as weekly markets, festivals and gatherings. In urban planning also these cultural patterns needs to be identified and respond to them.
- Even though pettah has a diverse built form with vibrant colours, different heights, rather than denying it pettah has embraced it by making it the identity of pettah. in designing also this localized character should be identified despite being order or disorder and should embrace it.

Conclusion

The study of the Pettah market through the lens of entropy reveals that a sustainable urban system thrives on a delicate balance between order and disorder. The layered evolution of its built form and the coexistence of diverse human activities make Pettah a living demonstration of how entropy operates within an urban context.

The point-based analysis provided a framework to evaluate the entropic levels of four parameters of built form and three of human activity. The findings indicate that both aspects contribute moderately to Pettah's overall entropy, blending in a way that sustains equilibrium between order and dynamism. Human activities, however, show a slightly higher entropic influence due to their

spontaneity, informality, and unpredictability. Nevertheless, both built form and human behaviour collectively maintain a balanced system.

At present, Pettah functions as a successful urban environment where the built fabric and human activity coexist symbiotically. Morphologically, the market's street networks, building blocks, and spatial organization reflect rhythmic diversity and commercial vitality. While structural parameters such as street layout and block patterns contribute to lower entropy, the variations in colour, scale, and form introduce higher entropic tendencies, together achieving equilibrium within the built environment. Among human activities, economic exchanges exert the greatest impact on overall entropy, with social, cultural, and recreational practices complementing this dynamic balance.

In conclusion, the study demonstrates that both the built form and human activities in Pettah independently achieve balance between order and disorder, while collectively producing an urban system that is adaptive, resilient, and harmoniously entropic.

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