Arts and Design Studies
ISSN 2224-6061 (Paper) ISSN 2225-059X (Online)
Vol 4, 2012
www.iiste.org

Beautiful Things That We Miss in Space Syntax

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Abstract

This Neo-vernacular architecture is often criticized for superfluously introducing local heritage. This mostly results from framing traditional architecture with only few prominent architectural elements. Less attention is given to other beautiful elements that are responsible for knitting all features together to produce a unique physical appearance. Concentrating on street designs, the argument of this study is that the connectivity and forms of the traditional streets encompass certain social rules and perceptional qualities, so that any changes in the street layout leads to changes in its social rules and perceptional impression. To justify this argument, a walled Arab neighborhood was examined through the case study of Sur Lawatyia, Oman. With the replacement of the curvilinear and broken streets of the case study with straight ones, a simplified street layout is obtained that on one hand, is an analogue to the neo-vernacular street layout and on the other hand is a good example to compare with the traditional neighborhood. A comparison of both street layouts is carried out through syntax analysis. The result was that the simple form is far short to represent the space syntax of the traditional street layout and its rich scenic features.

Keywords: integrated spaces, space syntax, connectivity, real given value, social rules

1. Introduction

In The built environment, with its forms, its functions, and relationships among its inner and outer spaces, is intentionally created to accommodate people's daily needs. Every space, in its form and its spatial relationships, is designed or designated to serve a specific activity or activities. This is to say that, forms and their relationships are function signs. In other words, the built environment presents information verbally, nonverbally, and behaviourally to occupants. This information is obtained by reading functions, activities of spaces, and relationships between urban residents, and between residents and non-residents. As Harrison et al (1996) explicitly stated, “space is the opportunity, place is the understood reality”. When such information is understood, the built environment is considered effective and liveable.

The wide belief in the importance of societal heritage has led to continuous attempts to conserve the rich image of Arab traditional buildings and their semiotics. Despite the fact that their approaches are dissimilar, Hassan Fathy, Rassim Badran, and Mohammad Makkiya are the most prominent Arab architects who left their significant input in our architectural vocabularies. There are also a number of non-Arab architects designed neo-vernacular Arab built environments. The most recent settlement design is the Blue City in Oman. It is designed by the international architect, Norman Foster. Keeping the attempts of these famous architects in mind, this paper argues that neo-vernacular architecture has left out beautiful little details that are responsible for knitting the urban fabric and adorning the architectural product as well. Therefore, the contemporary attempts to capture the essence of Arab architectural heritage are incompletely scoped.

This research focuses on the social logic of space while questioning "what if” a traditional street layout is transferred into a simple layout that characterizes the neo-vernacular Arab urban design, would it turn out to have different space syntax from the original layout? It is anticipated that the finding will support the premise of this paper that says there will be differences between both layouts resulting from the little elements and features that contemporary architects miss in the process of the production of neo-vernacular architecture. The methodology of the research implies three means, firstly, the search for a settlement that represents Arab neighbourhoods and comprehends all their various elements and unique features; secondly, the application of the Hillier et al method for value measurement of street connectivity (1984); and lastly, the listing of urban elements that are present in the traditional neighbourhood and not included in the simplified layout.

2. Case Study and Analysis

In order to measure the degrees of connectivity or integration of open spaces of Arab traditional settlement, *Sur Lawatyia* (walled city of *Lawatiya*) is considered. This *Sur* is known as one of the most congested urban areas in Oman. With a size of

100 by 160 meters, *Sur Lawatiya* belongs to the Muscat Governorate in the Sultanate of Oman (Map 1) (Damluji 1998). It has been evolved to ensure a high degree of security, privacy and isolation from surrounding estates while at the same time occupants feel togetherness and belonging. This walled neighborhood is protected by a main northern gate facing the sea. It is worth mentioning that this neighborhood is characterized by narrow streets (ranging from 1-3 meters), short, irregular widths, and its circulations are used mainly by pedestrians. These urban characteristics have social interaction significance on the inhabitants (Ferwati 2010).

For the estate of *Sur Lawatyia*, the space-layout is so complicated that a simple calculation becomes a laborious one. The first step requires the replacement of the streets' layout with their axes. A curved space is represented by broken lines. Then, every line (or space) is assigned an ID (Map 2).

To carry on in the objective of this study, the second step requires the redrawing of *Sur Lawatyia*'s street map in a simplified layout by replacing all broken and curved spaces with straight lines. The result is presented in Map 3 where, for example, the broken street with the segment spaces 2, 10, 11, and 12 are combined in one straight street and replaced with the number 2, the first segment space of this broken street. This will later help in the comparison between both maps 2 and 3. Also, all dead end-streets became straight since they are single broken spaces.

According to many researchers such as Newman (1972), the street network has up to three zones: public, semipublic, and semi-private zones. In this classification, space connectivity forms a hierarchical order that totally ignores the degree of accessibility in respect to the overall neighborhood spaces. Therefore, the third step in this research requires the calculation of the Degree of Integration (DI) for each space. The result demonstrates the distribution of different social zones of both maps.

2.1. Measurement of the Degree of Integration (DI)

In respect to both residents and outside users, a space serves its designated function if it has proper connections with the other spaces of the neighborhood. On one hand, a private space is properly connected if it has indirect links with crowded spaces to reduce the probability of being used by non-residents. On the other hand, the main street is well connected with the same or lower-ordered spaces if this connection is sufficiently direct, to make the movement through spaces easy for both residents and strangers.

The Degree of Integration (DI) of any space is the measurement of the degree of connectivity of a space with other open-spaces in the neighborhood. It varies according to the number of turns needed to move from place X1 to place X2. If a space is connected immediately with other spaces, then the Degree of Integration is 0 (maximum integration) (Figure 1). On the other hand, for a space that is connected in a linear pattern with other spaces, the Degree of Integration is 1 (minimum integration) (Figure 2). The formula that is used to calculate the degree of Integration for X in both cases of Figures 1 and 2 will be explained in the following section.

2.2. Degree of Integration (DI) and Real Degree of Integration (RDI)

For each map the Degree of Integration is calculated as follows: firstly, an ID number was given to each space that mentioned previously. Secondly, the Degree of Depth (DDx) was calculated by counting the minimum numbers of intervening spaces between space x and every other space in the area. Thirdly, the Mean Value (MV) of DDx for space x was calculated by dividing its DDx by the number of spaces (K) less than 1; for space x, this is shown by the equation:

$$MV = \frac{DDx}{K - 1}$$

Where: DDx Degree of Depth for space x
MV Mean of the DDx for space x
K Number of spaces

Finally, the Degree of Integration (DI) for space x with respect to every other space was calculated as follows:

$$DI = \frac{2\,(MV - 1)}{K - 2}$$

Where: DI Degree of Integration for space x
MV Mean of the integration Value for space x
K number of spaces

Route space in every neighbourhood represents a set of social rules that are related to the degree of inhabitant-stranger contact. Social rules (such as privacy, security, protection, non-interference, inaccessibility, encounter and aggregation) are considered in this section on the global level when calculating the Degree of Integration. MV and DI are calculated for every space. A low value (close to 0) means the space is "integrated", while a high value (close to 1) means that the space tends to be "segregated" from the other spaces in the neighborhood.

Since we are concerned with the comparison of two neighborhoods with different numbers of spaces, "According to Hiller and Hanson (1984:109-113), to eliminate the size effect, one should look at spaces of the neighborhood from 'Y'. 'Y' is defined as the carrier of all spaces or the outer spaces that form the border of the neighborhood. Then one can calculate RDI, the Real Degree of Integration, for any space from Y root."

The Real Degree of Integration is calculated using the following equation:

$$RDI = \frac{DI}{D_k}$$

Where: RDI Real Degree of Integration for any space from Y root
DI Degree of Integration
D_k a constant for k spaces

The calculations of the Real Degree of Integration Values is produced by the same software that generates two maps one for the original street layout and the other for the simplified one, showing streets with a range of colors that represents the levels of integration, ranging from red-yellow for high RDI, green set for moderated RDI, to the light blue-Blue for low RDI. These steps were carried out on maps 2 and 3 with the application of UCL Syntax Space Software.

3. Discussion

Maps 4 and 5 give an interpretation of the social logic of spaces. They show a hierarchical order from the most highly integrated streets (public streets) down to the least integrated ones (semiprivate streets) in respect to the law of global accessibility. In close comparison between both maps, one can conclude the following findings:

- The traditional map has spaces with high levels of RDI (red and yellow) clustered in the core with a direct link to the main entrance. On the contrary, the simplified map has one main public space found in the center from which the lower RDI order streets branch away. Another yellow street lays parallel to this street on the southern deep side. Both streets are linked on the western side with another yellow street. As a result, the simplified pattern sends a confusing message to the beholder who expects to move onto the settlement in a hierarchical order, from the highest to the lowest RDI streets.
- In the simplified case, the highly integrated spaces stand only for the inhabitants since they are approached by lower levels of RDI spaces. While in the traditional layout, connections are set smoothly right from the main gate up to the dead-end and peripheral streets.

- The scatter gram in Figure 3 shows the correlation of the RDI values of both the simplified and the traditional layouts. All simplified RDI values are scattered between the RDI values of 0.8 to 2 while the traditional RDI values exceed this range up to 2.6 by 11 % of its spaces. It is evident that the strength of RDI Values is not matched in both maps.
- Overall, these results suggest that both traditional and simplified layouts cannot claim similarity, as both have different space integrity. To confirm this finding, the test of significance of the difference between both layouts is carried out. Due to the difference of space numbers (traditional layouts have 78 spaces, while simplified layouts have 37 spaces), interval data was looked at as ranked data, and the Mann-Whitney Test was applied using the RDI values. The result is that at a confidence level of 99 per cent there are significant differences between both cases. In conclusion the result shows that open spaces of traditional and simplified layouts are governed by social rules at different degrees from each other.

As the result confirms dissimilarity, the last step of the study is to find out the missing elements. The following Table 1 lists the traditional elements that are missed in the simplified map. Furthermore, the table shows the social, essence, and perceptional qualities for each element. For example, the simplified layout lacks curvilinear spaces, sharp turns, and broken lines resulting in the reduction or absence of the beholder's curiosity and attraction to the spaces.

4. Observation in Modern Neighborhoods

The traditional neighborhood has its urban elements suitably stitched together to comply with the users' multi-folded needs. The simplified layout, on the other hand, has some elements missing or being presented in less intensity than the traditional layout. This explains the differences in space syntax discussed above and adds to the confirmation of the promise of the research. The validity of this research is also counted on the daily observation of the use and misuse of modern neighborhoods. Table 1 shows four leading differences between traditional and simplified layouts:

- Accessibility: When strangers notice the social meaning of street location and shape such as dead-end streets which are low-integrated-spaces, the space serves its function properly, keeping outsiders away; otherwise, it will be questioned. However, highly-integrated spaces may attract wanderers to the place for a short cut; this reduces the ability of inhabitants to be secluded, feel privacy and protection from the unwanted intruders. These places, thus, are likely to become governed by public interference rules. Squares are used by families and neighborhoods for occasional gatherings and strangers are expected to be encountered.
- Misuse of Spaces: Street landscapers and urban designers modify some open-space features to prevent their misuse, or to encourage proper use. They provide signs indicating permitted vehicles; or put flower beds or steel/wooden poles to prevent all types of vehicles from entering the route space. One of the reasons for misuse of space is the common tendency to minimize effort when moving from X1 to X2. This is observed every day when some people step on grass or trespass on private property.
- Similarities Among Street Characteristics: When the characteristics of different street arteries are alike, it is difficult for a stranger to distinguish between them. To avoid confusion for those who are unfamiliar with the area, written 'dead-end' signs are usually found at the entrances of these streets. The use of written signs is a way to reinforce streetscape evidence or to correct the weakness of the streetscape to reveal a critical social distinction of the urban street space, whether private or public. An effective urban street space informs people denotively and connotively of significant social meanings of the space.

5. Conclusion

Spatial urban elements are perceived and cognitively understood by the social rules governing space accessibility and characteristics. This produces a coherent spatial and semiotic arrangement. The study determines the importance of some urban elements that exist in traditional Arabic cities and are neglected while laying out neo-vernacular architecture. The study was carried out on Sur Lawatiya, an example of an Arab walled city. Its simplified layout presumably has similarity to neo-vernacular urban areas, which are appropriate for comparison with the original plan of Sur Lawatiya. The syntactic analysis produced two maps that showed the relationships of outer-spaces at the global level; this helped in the understanding of the social rules that govern the logic of space integration. It looks at the relationship between the given

space and every other space in the neighboring areas. The study focuses on streets' spatial distributions besides strength and correlation of their real integration values. The result suggests that both traditional and simplified layouts cannot claim similarity, as both have different space connectivities. In the finding, the curved and broken streets were not only physical entities, but also carried social values, perceptional qualities and semiotic messages.

The use of the surrounding streets of Sur Lawatiya for commercial purposes has resulted in intense crowdedness of strangers. However, its walls and single gate, besides its street characteristics (short, curvilinear, and broken), have insured security, seclusion, and belonging for the residents who continuously insist on peace and privacy. As residence repel strangers, control over the urban spaces by locals becomes possible. One can conclude that the urban sign elements are the determinants of the social logic of neighborhood urban spaces.

Factors are disregarded in the research

1- There is an important factor that is not considered in this study: the time that is needed to move from X to Xn. This factor is left out because the neighborhood is within a walking distance of around 10-15 minutes.

2- Width of streets that may be perceived as private or public.

3- Geographical direction and the effect of perception of space.

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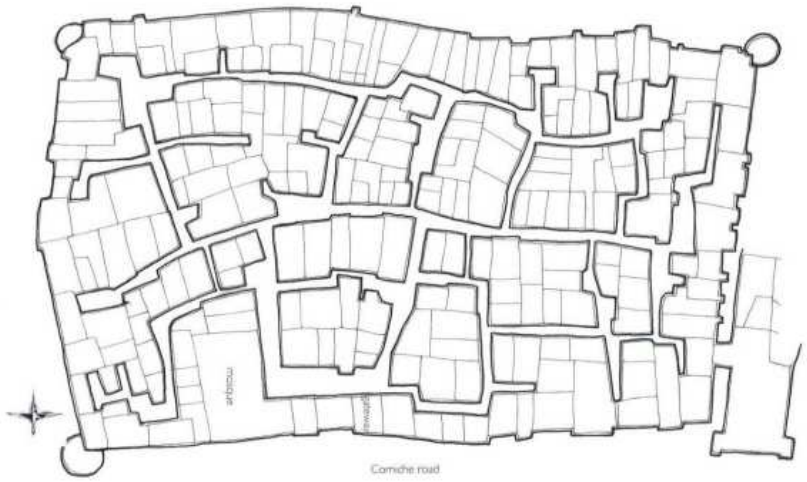
Narrative Statement

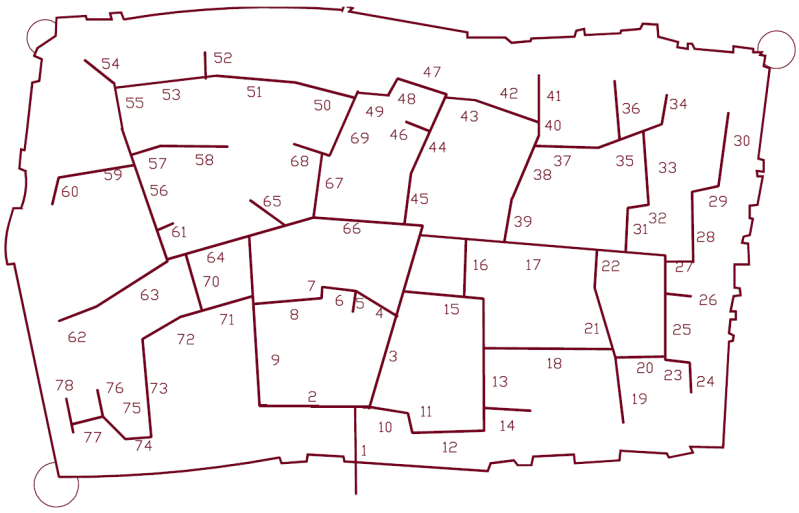
Born in Damascus, Syrian in 1958, M. Salim Ferwati obtained a Bachelor degree in Architectural Engineering from the Architectural Faculty at the University of Damascus, Syria in 1982. In 1988, He obtained a Master's Degree with Honors in Urban Design from the University of Kansas, Lawrence, Kansas, USA; and he received in 1993 a Ph.D. degree in Cultural /Behavioral Geography at the University of Western Ontario, London, Ontario, Canada. Between 1996 and 1999 he was active in three areas: teaching, architectural documentation (measured drawings) of 80 historical buildings, and running his own architectural firm. In 1999, he moved to Saudi Arabia, to work at the Architecture Department, College of Architecture and Planning at King Faisal University as a lecturer. In August 2005, he joined the department of Civil and Architectural Engineering at Sultan Qaboos University as an assistant professor to teach and help in establishing the new architectural engineering program there. He currently hold an assistant professor position at the Department of Architectural and Urban Planning, Qatar University, Qatar. His research interests are related to spatial behavior as generator of spatial pattern, space perception, and urban semiotics.

Note

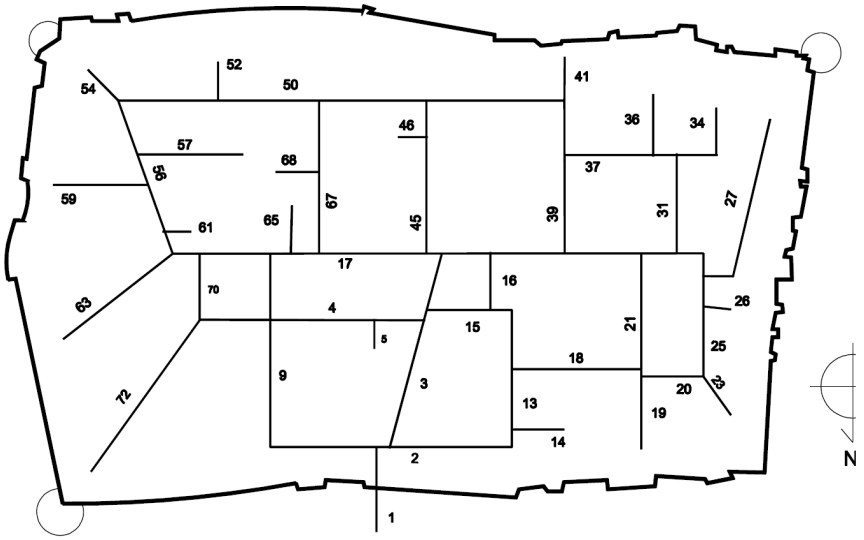
This study is different from a previous research I did in 2011 on Sur Lawatyia under the title, "Construability of Traditional Neighborhood and its Simplified Layout". It looked at the space connectivity on the local level. It was published in IJAR 2011. This paper studies space-syntax on the global level, that is the examination of the degree of connectivity of every space with every other space in the neighborhood.



Map 1: *Sur Lawatiya* (walled *Lawatiya*), an ethnic walled neighborhood beside Mattrah area of the Muscat Governorate in Sultanate of Oman, is protected by walls with a main northern gate facing the sea. (Source: Damluji 1998: 175)



Map 2: Sur Lawatyia with the axial and ID numbers assigned for each street in its road network.



Map 3: The simplified layout with spaces ID numbers

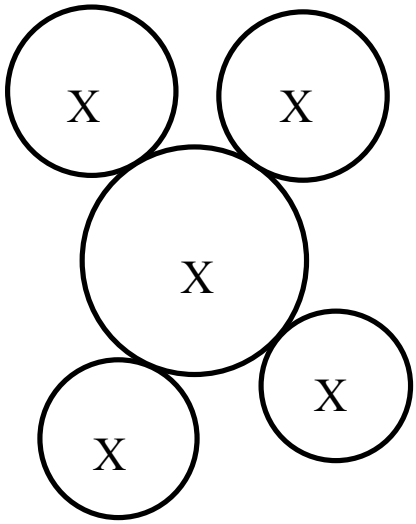


Figure 1: direct connection of space X with spaces X1, X2, X3, and X4. DI is 0.

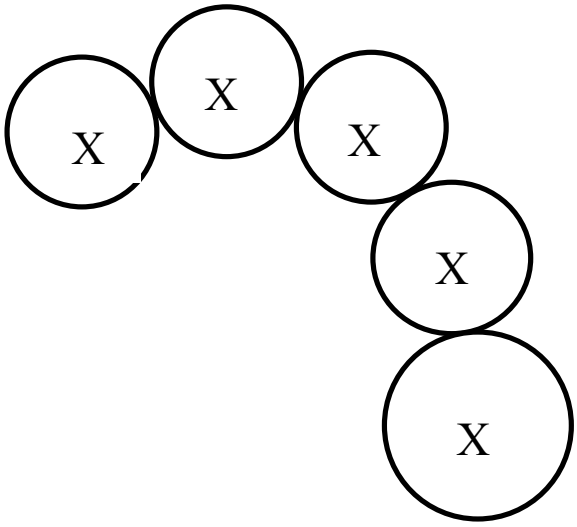
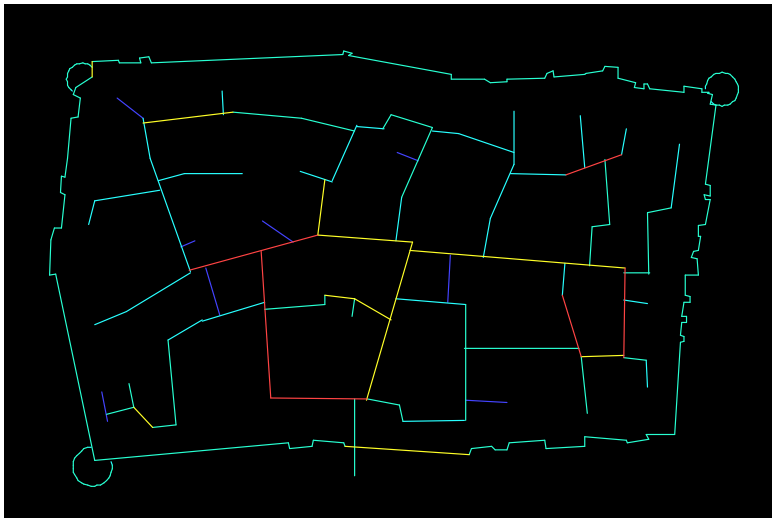
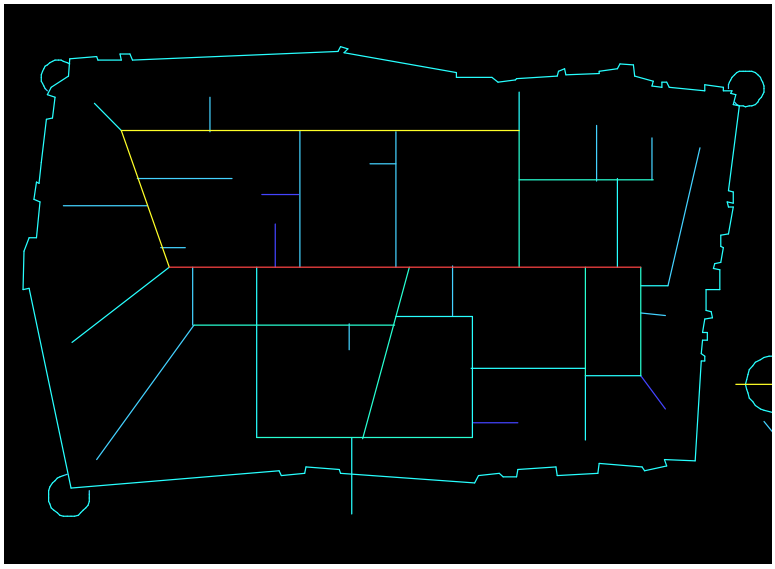


Figure 2: indirect connection of space X with spaces X1, X2, X3, and X4. DI is 1.

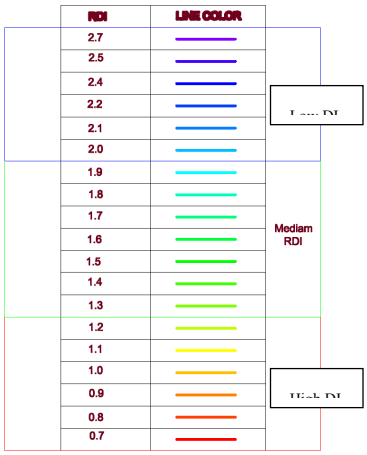


Map 4. Result of the RDI on the traditional neighborhood



Map 5. The RDI for the simplified layout

Legend



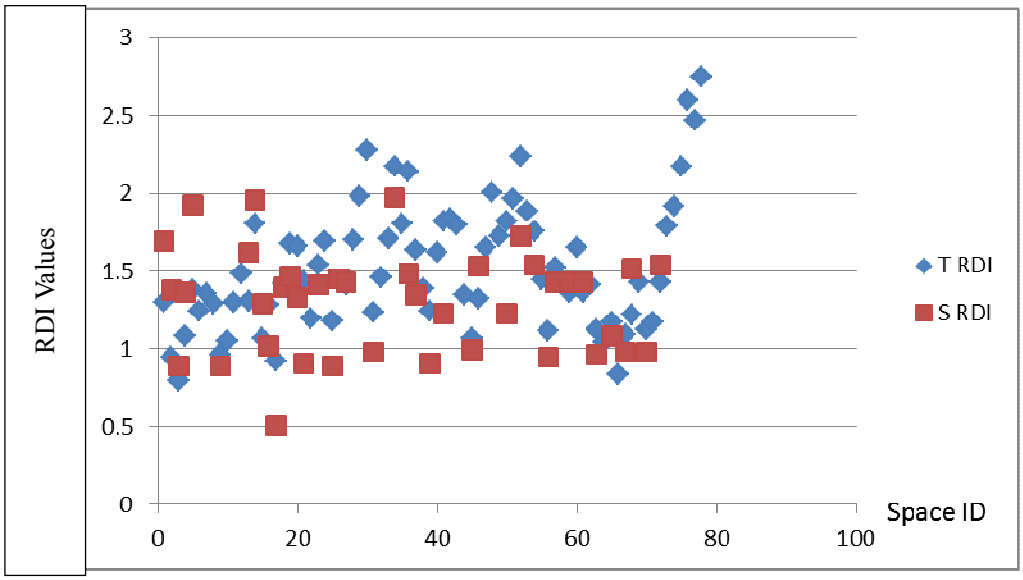


Figure 3 shows the scatter gram for the correlation of the RDI values of both the simplified and the traditional layouts

Table 1 shows four categories of the differences between the traditional layout and its simplified design.

	Traditional spaces characteristics	Social, essence and perceptional spaces		Simplified spaces characteristics	Social, essence and perceptional spaces
1. Street Numbers	78 streets	• Max number of turn from space 1(the entrance) to reach any peripheral spaces (24, 78, 30, 34, 54, and 48) ranges from 6 to 10 turns • Short streets • Uneven street width • Easy to get lost, discourage non-residence to enter the neighbourhood casting		36 streets	• Max number of turn to reach the peripheral spaces (24, 78, 30, 34, 54, and 48) ranges from 4 to 6 • Long streets • Even street width • Almost straight forward movement, that encourage non-residence to enter the neighbourhood

2. St. Characteristics	• There are 7 Brocken streets and 4 curvilinear	• 11 changes in geographical direction • Change of shadow casting • Sequence of focal points • Various street characteristics give each space its identity		• Straight lines (There is only one broken line)	• One direction for each street • Shadow casting is fixed • Single focal point • Easy accessibility • Uniform, feeling of placelessness
3. St. Perception	Manipulated view	• Curiosity • Feeling of entertainment • Attraction • Un-expectation		Straight forward view	• Get easily bored • Easy discovery of the accessibility • One perceptive for every single street
4. Intersection	• 30 nodes (inter section or T-junction) • Square-inter-activities	• Choices of roads selection are many • Social activities some nodes that come wide (*Muslaba*)		• 24 Nodes (inter section or T-junction) • Intersection	• Choices of roads selection are less • Passage has weak opportunity for social interaction
1. Social Rules	33 % private spaces, 51 % semipublic and 16 % public	Good division of space order		43% private spaces, 49% semipublic and 8% public	Public spaces are few giving the feeling of security and privacy (unexpected result)