

Relational aspects of space in design: Examples of Space Syntax

Saif Haq (saif.haq@ttu.edu)

Assistant Professor, College of Architecture, Texas Tech University, Lubbock, TX-79409-2091

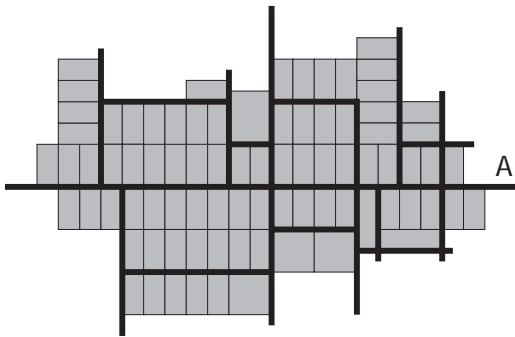


Figure 1 If everyone moved from everywhere to everywhere else, then road A would be used more than the other roads.

Architects design and create spaces, yet they seem to be better equipped to measure and discuss forms. Just as unit forms can be combined to create a complex shape, so can spaces connect to one another to create a complex spatial pattern. This relationship of spaces, also called its *configuration*, plays a vital role in our relationship with the environment. If we consider the fact that we move *in succession* from one space to another then the *topological* relationship of each space to others becomes important. Configuration influences movement and subsequent development of cognitive maps. Consider the directions that one may give to a lost person. More often than not, the route will be described in relational instead of metric terms. “Go straight; take the second left and then the right. It is the third house on your left”. Obviously spatial relationships play a role in the way we think about space (Hammer, 1999). Therefore, the value of studying spatial configuration for designers interested in user friendly environments cannot be overemphasized.

Taking it a step further by considering configuration as an independent entity, one might ask, how is one space connected not only to its adjacent areas, but to all others in a certain spatial system? In other words, if everyone is traveling from everywhere to everywhere else, which spaces are more likely to be used? Consider the layout in Figure 1. If residents of every house visited every other house, then certain areas would be more used. In this case line A. Obviously it has nothing to do with distance or direction. It is simply the layout which has privileged some spaces over others. (Hillier, 1999a).

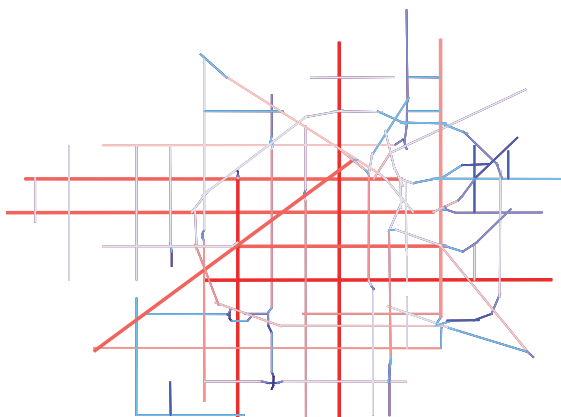


Figure 2 Configurational analysis of the major streets of Lubbock, TX. The top 5% integrated streets are shown in thick lines.

In real life people do not move from all spaces to all other spaces. Second, movement is not random, but is based on certain decisions and third, configuration being more complicated than that shown in Figure 1, makes it difficult to identify or *compute* the relational hierarchy of various spaces. These are important foci of the architectural research program called Space Syntax. Developed in London by Professor Bill Hillier and his colleagues, (Hillier, 1996; Hillier, 1984) Space Syntax is now used worldwide. It includes computer programs to model complex systems such that the *relational* hierarchy of spaces within it can be analyzed. Thus one can distinguish between areas that are well *connected* to the rest of the system, and those less connected. (Line A in figure 1 is most connected.) Space Syntax theory also speculates about the role of this hierarchy in social formation and behavior, especially in ‘natural movement’, wayfinding, traffic patterns, economic distribution, workplace productivity, shopping behavior, visitor interactions, and so on. Obviously configuration should be an important factor in architectural and urban design and is being considered increasingly by designers both as a predictive and an evaluative tool.

The following examples are presented to clarify basic Syntax concepts and give a sense of its applicability. Figure 2 is a Syntax analysis of major roads in the city of Lubbock, TX. The streets are colored so that red lines are more connected and blue ones are less connected. This provides a visual indication of the distribution of the more connected roads. If we consider the top 5% connected roads, (which are shown as thick lines) the following become important: University Avenue, 50th, Slide, 19th, a portion of 34th, 4th, Brownfield and Martin Luther King highway. Any resident of Lubbock will vouch for the importance of these roads because they have the most traffic and major commercial areas.

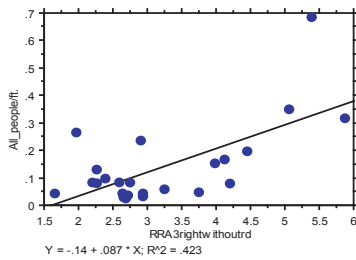


Figure 3 Scattergram shows the relationship of the presence of people in TexasTech campus with their Syntax values.

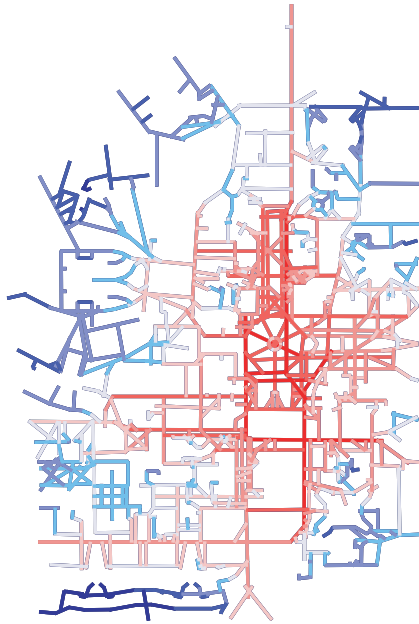


Figure 4 Space Syntax analysis of the pathways in TexasTech campus.

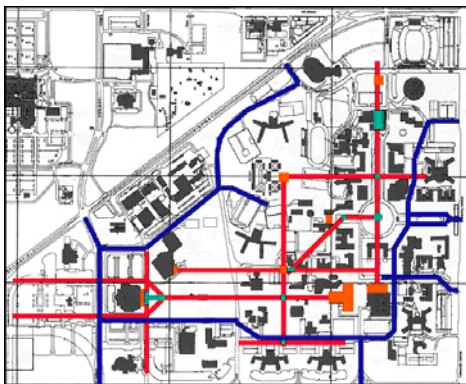


Figure 5 Student proposal for new pedestrian paths (shown in red) in TexasTech campus. This is based on a study of 'imagability' of the campus.

The configurational structure revealed by computer analysis is based only on how each road is connected to others and not on any other factor; yet it has closely resembled the existing situation¹.

The second example is of the TexasTech campus. An ongoing study of pedestrian behavior and configurational analysis of the existing paths indicate that presence of people in any path is a function of its syntax value² i.e. more connected spaces will have more people in them ($r=.650$, $p=.0006$, see figure 3 and 4). This is another example of the applied value of syntactic studies. Figure 5 shows the work undertaken by graduate students³ as part of Arch 5362, Theory in Architecture. Working with data from a small sample regarding 'imagability' of the campus, (Lynch, 1960) the students proposed appropriate paths (shown in red) in the campus. If this is compared with the master plan designed by HOK and partners (Figure 6) we see a remarkable similarity. Additionally, syntactic analysis of the master plan confirms that the new paths will be the most connected areas in campus and therefore may be expected to be most crowded. It is interesting to note that the common aspects of both research on students 'image of the campus' and an architect's intuition are being matched by computational outcomes. One can therefore extend these ideas and begin to understand the usefulness of Space Syntax as a design tool.

Syntax results in Lubbock, TX are not isolated. They follow a pattern seen in numerous research literatures where configuration has been found to be indicative of various patterns. For example, Alan Penn (2001) informs us that about 60 to 80% of variation in movement rates from location to location, in areas where land uses and development densities are relatively homogenously distributed can be accounted for by measures of spatial configuration alone. This is based on plentiful studies in various cultures distributed globally. The author himself has studied the role of configuration in the case of wayfinding in three large US hospitals and has concluded that configurational properties of spaces and their use during wayfinding are correlated strongly (average $r=.60$). Additionally spaces of higher values also feature in the cognitive maps (average=.68) and that syntactic properties of entry points influence wayfinding success. (Haq, 1999) It has been shown that relational properties are also important factors in crime distribution and prevention (see Hillier, 1999 for British examples and Fanek, 1997 for studies in Austin, TX) and to some degree features in the success or failures of shopping areas. (Brown, 1994) Also, Syntax methods have been quite useful in archeological explorations. (Ferguson, 1996)

The most pervasive argument of Space Syntax is that configuration influences location characteristics and this impacts our understanding and use of spaces. It also provides computer programs to model configurational values. Recently, Space Syntax has moved to the professional realm where its computational methods are called upon to analyze existing conditions and to investigate design proposals. They have proved to be extremely useful in design decision making. Space Syntax brings rigor to the design process specifically those involving complex buildings, community development and urban design.

¹ A full fledged analysis of Lubbock city is presently being undertaken by the author at TexasTech University.

² A larger study of TexasTech Campus is also in progress.

³ Alicia Jones, Eden Livingstone and Justin Noble, Fall 2001

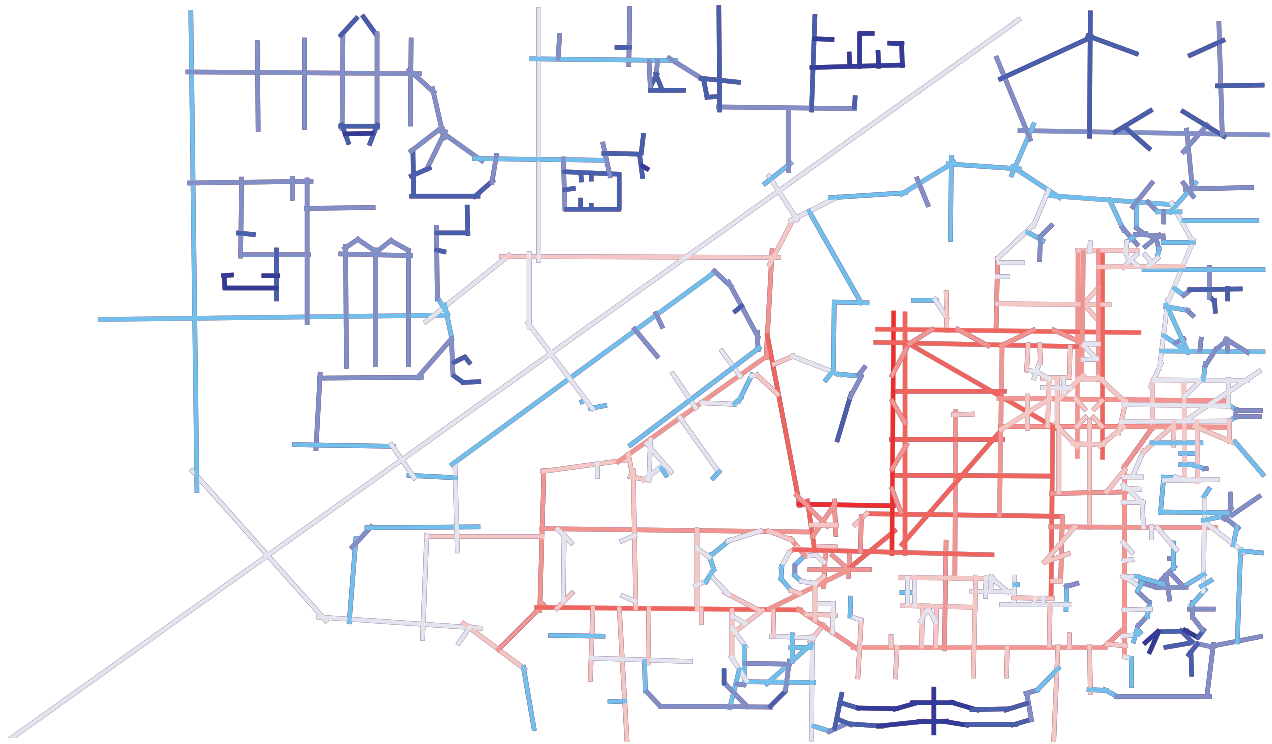


Figure 6 Computer based Syntactic analysis of proposed master plan of TexasTech University campus by HOK and partners.

Brown, M. G. (1994, Sept). Autopsy of a Shopping Center. *Urban Land*, 32-37.

Fanek, M. F. (1997). *The use of Space Syntax methodology in predicting the distribution of crime in urban environments*. Unpublished Doctoral dissertation, TexasTech University, Lubbock.

Ferguson, T.J. (1996) Historic Zuni Architecture and Society An archeological Application of Space Syntax, Tucson: The University of Arizona Press

Hammer, M. (1999). *Well Connected*, [journal electronic publication]. Available: www.newscientist.com/ns/19991113/wellconnec.html [1999, November 15].

Haq, S. (1999). *Can Space Syntax Predict Environmental Cognition*. Proceedings of the Space Syntax Second International Symposium, Brasilia, Brazil.

Hillier, B. (1999a). The hidden geometry of deformed grids: or, why space syntax works, when it looks as though it should'nt. *Environment and Planning B*, 26, 169-191

Hillier, B.(1999) *Do Burglers understand Defensible Space*. Available: <http://www.spacesyntax.com/housing/BillCrimePaper/BillCrimePaper.html> [2002, 15 Aug, 2002].

Hillier, B. (1996). *Space is the Machine*. Cambridge: Cambridge University Press.

Hillier, B. H., Julienne. (1984). *The Social Logic of Space* (Paperback Edition 1988 ed.). Cambridge: Cambridge University Press.

Lynch, K. (1960). *The Image of the City*. Cambridge: Joint Center for Urban Studies.

Penn, A. (2001). *Space Syntax and Spatial Cognition Or, why the axial line*. Proceedings of the Space Syntax 3rd International Symposium, GeorgiaTech, Atlanta.