A Space Syntax Glossary

by Björn Klarqvist

SPACE SYNTAX is a method for describing and analysing the relationships between spaces of urban areas and buildings. Architects normally refer to these relationships as "the layout". In *Space Syntax*, the spaces are understood as voids (streets, squares, rooms, fields, etc.) between walls, fences and other impediments or obstructions that restrain (pedestrian) traffic and/or the visual field. The purpose of this glossary is to assist readers not previous familiar with *Space Syntax*, by providing a simple (non-mathematical) explanation of some basic terms.

There are three *basic conceptions* in Space Syntax Analysis:

- **Convex space** is a space where no line between any two of its points crosses the perimeter. A concave space has to be divided into the least possible number of convex spaces.
- **Axial space** or an axial line is a straight line ("sight line"), possible to follow on foot.
- **Isovist space** is the total area that can be viewed from a point.

The spatial structure of a layout can be represented using three types of *syntactic maps*:

- **Convex map** depicts the least number of convex spaces that fully cover a layout and the connections between them. The *interface map* is a special kind of convex map showing the permeable relations between the outdoor convex spaces to the adjacent building entrances.
- **Axial map** depicts the least number of axial lines covering all convex spaces of a layout and their connections.
- **Isovist map** depicts the areas that are visible from convex spaces or axial lines.

All three types of maps can be *transformed into graphs* for purpose of analysis:

- **Graph** is a figure representing the relationships of permeability between all the convex spaces or axial spaces of a layout. The spaces are represented by circles or dots (called nodes) and the links with lines. It is possible to also use links in order to represent relationships of visibility between spaces.
- **Syntactic step** is defined as the direct connection or permeable relation between a space and its immediate neighbours or between overlapping isovists. In an axial map a syntactic step may be understood as the change of direction from one line to another.
- **Depth** between two spaces is defined as the least number of syntactic steps in a graph that are needed to reach one from the other.
- **Justified graph** is a graph restructured so that a specific space is placed at the bottom, "the root space". All spaces one syntactic step away from root space are put on the first level above, all spaces two spaces away on the second level, etc. Justified graphs offer a visual picture of the overall depth of a lay-out seen from one of its points. A *tree-like* justified graph has most of the nodes many steps (levels) away from the bottom node. In such a system the mean depth is high and described as *deep*. A *bush-like* justified graph has most of the nodes near the bottom and the system is described as *shallow*.

There are *four syntactic measures* that can be calculated. They are used in quantitative representations of building and urban layouts:

- **Connectivity** measures the number of immediate neighbours that are directly connected to a space. This is a static *local* measure.
- **Integration** is a static *global* measure. It describes the average depth of a space to all other spaces in the system. The spaces of a system can be ranked from the most integrated to the most segregated.

• **Control value** is a dynamic *local* measure. It measures the degree to which a space controls access to its immediate neighbours taking into account the number of alternative connections that each of these neighbours has.

• **Global choice** is a dynamic *global* measure of the "flow" through a space. A space has a strong choice value when many of the shortest paths, connecting all spaces to all spaces of a system, passes through it.

It is also possible to develop *second order measures* by correlating these four first order measures. *Intelligibility,* for example, is the correlation between connectivity and integration and describes how far the depth of a space from the layout as a whole can be inferred from the number of its direct connections, i. e. what can be understood of the global relation of a space from what can be observed within that space.

The spaces of a layout can be ranked according to each of the measures. Mapping the rank order back onto the syntactic map offers a picture of *syntactic structure*.

• **Core is the set of the most** integrating (controlling, etc.) spaces of a system. For example, the 10% most integrated spaces are normally referred as the integration core. The configuration of that core, whether it is fully connected or split, whether it assumes a shape of a spine or a wheel, whether it penetrates into all parts or remains clustered in one area, is an important property of layouts.

The spatial measures can be related to *social indicators*, to test socio-spatial hypotheses or to develop predictive models the "social effects" of spatial layout. Such indicators can be the rate of crime, traffic flow, satisfaction, turnover, etc. The relation between the "socio-spatial" factors can be calculated using statistics such as linear correlation.

• **Encounter rate** is a measure that indexes the use density, i. e. the number of people observed in a space. We use a standardised technique to tally moving and static people on a route consisting of a stratified sample of spaces passed twenty times. The unit of axial analysis can be "number of persons/100 metres".

In traditional grid street patterns the encounter rate of moving people mostly has a high correlation to integration; i. e. integration is here a good predictor of pedestrian flow. On this fact an interesting debate has started, whether it is the spatial structure or if it is the attraction of shops and other functions that creates movement. We claim that shops locate to streets with high encounter rate or they are located where the plan designers can foresee a high rate. *Space precedes function!* Another question raised is whether a spatial pattern "creates" crime or if it just "attracts" crime; crime is in fact normally highly correlated to spatial measures.

The meaning of words used in Space Syntax changes slightly over time and even the scholars most closely associated with the development of Space Syntax have sometimes their own interpretation. The above is mine (with valuable comments by John Peponis and Ye Min). A brief glossary cannot be complete and comprehensive. It is just an opening. The following reference list might lead you to a deeper understanding.

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References

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