Tracing Gangnam: Towards a Theoretical Model of the Superblocks in Gangnam

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Abstract
A theoretical model of the superblocks in Gangnam is presented in the form of a parametric schema. The grounding of the work presented here is based on the historical aerial photographs of Gangnam documented by the Seoul Metropolitan Government since the early 1970s and archived at the National Library of Korea. A brief survey on the aerial photographs foregrounds two particular superblocks. The superblocks commonly reveal a unique urban structure that features a highly differentiated configuration of diverse internal streets in terms of their centralities. Significantly, the structure integrates various scales, shapes and orientations of interior blocks, prevents internal segregations and provides coherence to otherwise perplexing urban localities. The street networks and interior blocks of the two superblocks are traced to analyze their development processes and current structures. A set of formal principles is postulated from the analysis to form a theoretical model of the Gangnam superblocks. The model is employed to generate a set of parametric variations of Gangnam superblock design that reflects upon the theoretical implications of the existing superblocks and inquire their potentials as a newly emerging model of contemporary urbanism at large.

Keywords: Gangnam; Superblock; Urban structure; Theoretical model; Parametric schema

1. Introduction
The land where the contemporary city of Seoul is built upon first became the primary city of the Korean Peninsula by the Kingdom of Baekje in 18 BCE. Since then, the city has been the epicenters of the successive Korean nations: Wiryeseong of the Kingdom of Baekje, 18 BCE-475; Hanju of the Kingdom of Silla, 475-918; Namgyeong of the Kingdom of Goryeo, 918-1392; Hanyang of the Kingdom of Joseon, 1392-1897; Hanseong of the Korean Empire, 1897-1910; Gyeongseong during the Japanese Annexation of Korea, 1910-1945; and Seoul Special City of the Republic of Korea since 1945 (Gim, B. 1145; Kim, J. 1452; Joseon Sillok Cheong 1655). Despite the persistent history of the city, its general area remained in the northern region, Gangbuk, until the late 1960s. Gangbuk is generally identified as the region that is north of

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Hangang (a river) and bounded by Bugaksan (a mountain) on its north. Yet during the implementation of the Second and Third 5-year Economic Development Plans of Korea, 1967-1976, a series of land readjustment projects expanded Seoul across Hangang and established eleven new municipal districts: Gangnam was the largest region that was developed under the readjustment projects and its area measures 2688ha (Kim, S. 2013). The city of Seoul continued to rapidly advance at an unprecedented rate and became one of the most prominent cities of contemporary Asia.

2. Gangnam Superblocks

The grounding of the work presented here is based on the historical aerial photographs of Gangnam documented on a triannual basis since 1971 and archived at the National Library of Korea (Seoul Metropolitan Government 2011). A brief survey of the historical aerial photographs foregrounds two particular superblocks that encompass wide varieties of built forms and diverse social characteristics—from self-organized urban villages to strictly planned arrays of skyscrapers. These superblocks are consecutively arranged along Gangnam-daero (an arterial) in between Gangnam-yeok and Nonhyeon-yeok (subway stations) and bounded by Teheran-ro and Hakdong-ro (arterials) on their south and north respectively (Fig. 1).

Fig.1. A figure-ground and street centerline diagram of Gangnam highlighting the two superblocks.
Each of the superblocks measures approximately 850m by 750m and consists of a variety of interior blocks in terms of their scales, shapes and orientations. The Gangnam superblocks commonly reveal a unique urban structure that features a highly differentiated configuration of diverse internal streets in terms of their centralities. The structure integrates various interior blocks, prevents internal segregations and provides coherence to otherwise perplexing urban localities. Street centrality analyses of the two superblocks are given in Fig.2. The centrality of each street segment is measured by counting the number of directional changes required to move from the given street segment to all other street segments in the network. A conventional color spectrum is used to map the measures (from the highest measure in red to the lowest measure in blue). The centrality measures reflect the cognitive effort entitled in the movement, rather than the physical effort associated with distances, and the analyses clearly suggest that the interplay between an orthogonal structure of periphery blocks and an oblique structure of interiors establishes a strong pattern of integration of different street types into a single whole (Peponis, J. et al. 2016). Also, the directional reach analyses of the two superblocks given in Fig.2 show that the great majority of internal street segments are reachable by less than two directional changes from the peripheries of the superblocks (reachable internal street segments in bold lines). The street networks of the two superblocks encourage movements through and within the interiors of the superblocks and support diverse urban conditions to coexist and converge within each of the superblocks.

![Figure-ground and street centerline diagrams, street centrality analyses and directional reach analyses of the two superblocks in Gangnam: a) the superblock in Nonhyeon-1-dong and b) the superblock in Yeoksam-1-dong.](image)

The urban structure of Gangnam is originated from the implementation of its arterials: An orthogonal and rigid network of arterials was emplaced at a virtually vacant region and the generous spacing between them formed a series of superblocks. The street networks and interiors of the two Gangnam superblocks are traced to analyze their development processes and current structures. In the early stage of the development, the peripheries of the superblocks were reserved for the future formation of the arrays of orthogonal periphery blocks directly engaging the surrounding arterials while the interiors were highly provisional with minimal government initiatives. Until the mid-1973, each of the superblocks only consisted of a few native hamlets and a new anchor-development. The anchor-developments are major public amenities situated near...
the center of the superblocks. The substantial footprints and orientations of these anchor-developments provided bases for the superblocks' unique interior developments. The initial subdivisions of the superblocks were made by the oblique traversing streets associating the anchor-developments to the arterial network of Gangnam. This installment of anchor-development and the corresponding traversing streets forwarded the interior developments and encouraged simultaneously the two polarizing kinds of urban development processes—top-down and bottom-up. The interior structures of the superblocks emerged from self-organizing clusters of non-corporate private developments (low-rise residential and mid-rise mixed-use buildings) surrounding the anchor-development. While, the developments along the peripheries of the superblocks were regulated to implement the government's specific and firm vision of urban city: Strips of high-rise commercial buildings directly engage the surrounding arterials forming typical urban corridors.

3. Theoretical Model

A set of four formal principles of the two Gangnam superblocks is postulated from the analysis of the historical aerial photographs. First, an anchor-development initiates the interior development of the superblock. The anchor-development is a large-scale public amenity on a single interior block oriented obliquely from the arterial network of Gangnam and situated near the center of the superblock. Second, a set of non-orthogonal traversing streets instantiates the major subdivision of the superblock. The traversing streets are tangential or parallel to the perimeter edges of the anchor-development, thus derived from the shape and orientation of the anchor-development. Third, an array of orthogonal periphery blocks constitutes a ring surrounding the perimeter of the superblock. This perimeter ring interfaces the global context of Gangnam and the local environment of the superblock and further divides into outer and inner rings. The outer ring consists of high-rise commercial buildings that are oriented orthogonal to the arterial network and directly faces the surroundings of the superblock and the inner ring consists of mixed-use mid-rise buildings facing the interior. Fourth, a set of independently oriented clusters of urban blocks constitutes the interior of the superblock. These clusters consist of low-rise residential and mid-rise mixed-use buildings on relatively small blocks. The boundaries of the clusters are defined by the anchor-development, the traversing streets and the perimeter ring and each cluster independently employs its own underlying grid that is either orthogonal or oblique to the arterial network of Gangnam.

These formal principles are casted into a parametric schema to form a theoretical model of the Gangnam superblocks. The model consists of six generative stages: a) Initialization, b) Anchor-development, c) Traversing streets, d) Periphery blocks, e) Interior blocks, f) Finalization. In each stage, a set of parameters is assigned to specify a sequential instance and these instances cumulatively generate a Gangnam superblock design. A set of conventions to specify four identified types of streets is outlined: a) Gangnam arterials that bound the superblocks measure 35m in their widths; b) Traversing streets measure 16m in their widths; c) Ring streets that interface the perimeter ring and interior of the superblock measure 12m in their widths; and d) Internal streets that completes the street network of the superblock measure 8m in their widths.

A sample derivation of a Gangnam superblock design is given in Fig.3 to illustrate the generative process of the theoretical model. First, the superblock's boundary, perimeter ring, interior and the width of the surrounding arterials are specified to initiate the generative process. Second, the anchor-development is specified; and third, the traversing streets are specified and they subdivide the perimeter ring and interior. The traversing streets are configured to extend either straight or perpendicularly through the perimeter ring to connect to the surrounding arterials. These three stages specify the underlying compositional structure of the superblock design. Follow by, fourth, an array of periphery blocks constituting the perimeter ring is configured. The corners of the perimeter ring are specified either to connect the adjacent ring streets with the surrounding arterials by adding aligned street segments in between them or to have elongated or L-shape
periphery blocks closing the corners. Fifth, clusters of the interior blocks are independently configured—one for each of the subdivided areas of the interior. In the final stage, all assignments of the parameters are finalized and a Gangnam superblock design is generated in the form of a two-dimensional diagrammatic representation.

Fig. 3. A sample derivation of a Gangnam superblock design.

4. Discussion

Gangnam is one of the most foregrounding images of Korean urbanism. The theoretical model of the Gangnam superblocks is implemented in an algorithmic modeler, Grasshopper for Rhino, to assess its merit by generating parametric variations of Gangnam superblock design that reflect upon the theoretical implications of the Gangnam superblocks and inquires their potentials as a newly emerging model of contemporary urbanism at large. A set of four hypothetical Gangnam superblock designs automatically generated by the theoretical model is presented in Fig. 4. Despite wider range of possibilities, the set specifically features four design variations derived from varying dimensions of constituting urban blocks upon an identical compositional structure. Dimensions of urban blocks found in Gangnam, Manhattan and Chicago are used to assess the relevance of the model in wider perspectives. Notably, these hypothetical superblock designs inherit the differentiated configuration of internal streets of the two existing Gangnam superblocks and great majorities of the superblocks are reachable by two directional changes from their peripheries. A forward-looking aspect of the work presented here is that a simple aggregation of the hypothetical Gangnam
superblock designs shows a potential of expanding the theoretical model for larger scale applications. The street centrality analysis of the aggregated model shows that the model continues to feature differentiated configurations of internal streets of each superblock module and highly central arterials forming a larger scale network (Fig.5).

Fig.4. Two-dimensional diagrammatic representations, street centrality analyses and directional reach analyses of four hypothetical Gangnam superblock designs: a) a design that features urban blocks measuring 50m by 100m, b) a design that features urban blocks measuring 70m by 70m, c) a design that features urban blocks measuring 60m by 190m and d) a design that features urban blocks measuring 100m by 100m.
Fig. 5. An aggregated model of hypothetical Gangnam superblock designs: a) two-dimensional diagrammatic representation and b) street centerline analysis.

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