Generative Techniques for Mass-Customized Form: Samsung Raemian Housing Masterplan, Haan River, Seoul, Korea

Hina Jamelle
Senior Lecturer and Director of Urban Housing,
University of Pennsylvania School of Design
Director, Contemporary Architecture Practice New York – Shanghai

The Raemian brand was launched within South Korea's apartment industry by Samsung C&T in 2000, to create comfortable, futuristic living environments for city dwellers. Raemian masterplans repeat quantitatively different floor plans in different building typologies ranging from a Flat-Type to an A-Type. At the outset, the buildings all looked the same, so much so that if you drove past them, the only distinguishing feature from one to another is a serial number painted on each building in the masterplan development.

This cost-effective practice lasted until 2009, when the mayor of Seoul wrote into law that if there were more than two buildings on the same development site, they must be distinguishable from each other. Initially, developers circumvented this decree by altering heights of buildings while keeping the same aesthetics, due to cost-saving measures. Later the ordinance was clarified to include the requirement of a change in the look and feel of each building. At this time the largest construction company in Korea, Samsung needed assistance in devising a cost-effective alternative that could adhere to the strict rules of plan configurations with variations in the nature and type of buildings.

Contemporary Architecture Practice (CAP) provided such an alternative. In addition to utilizing all of Samsung's research on housing within Seoul's strict zoning regulations, the practice made use of its own knowledge of writing a design program in C++, as well as of knowledge that it had previously developed with Wharton Business School to calculate costs for different masterplan configurations in real-time. Once the C++ system was developed to include all quantitative regulations, CAP elaborated a design component that worked well within the limitations of the Samsung design strategies, deploying their manufacturing techniques.

This interface set the limits of the amount of variation possible within buildings, yet allowed the possibility for there to be enough variation, and hence customization, in each. What became apparent is that the integration of the Samsung component logic generated the maximum profit for the housing associations that constituted the clients, yet also yielded qualitative difference between buildings. The interface, its design, and the logic of its mechanisms to generate outcomes on the scale of the city are

Figure 1: Due to the push for standardization in housing, the scale and size of the unit is the only attribute that is different from one housing development to another. The size is determined based on the tax structure for the scale of apartment unit, ranging from 59.99 square meters to 119.99 square meters.

inherently laced with CAP's desire to develop configurations which align with the practice's formal interests. The design research and the C++ generative system convinced Samsung that CAP's method was accurate enough for them to quantify the results, and that these results were reliable. Once this had been achieved, CAP put the system through a tremendous amount of testing under the auspices of the Research and Development Group at Samsung, using it to develop a masterplan comprising 18 high-rise buildings, together with the designs for each individual building. The masterplan incorporates all the programmatic and zoning codes required to maximize views and quality of light within the mid-highrise development. The proposal reassesses the value of a central recreation area for the entire community, and develops several microcommunities around smaller zones for recreation.

The advantages of this approach include the ability to provide variation within a microcommunity, as well as throughout the overall masterplan, through different qualities of buildings and landscapes. The structures adhere to strict building regulations, such as those on unit size, while maximizing the amount of variation of views and interior space within the plan configurations. This was determined primarily by the locations of all the buildings' vertical systems, including the circulation as well as dry and wet shafts. The building panels and glass are flat, yet they articulate movement across the facade, enriching the project form. Each unit affects the location of the adjacent units in each of the buildings, thus eventually developing a masterplan with a look and feel based on floor-by floor regulations and repeatable customized components in its manufacture, instead of typically mass-produced building-to-building relations only. The proposal re-assesses the value of a central recreation area for the entire community and develops several microcommunities around smaller zones for recreation. Benefits are gained, including the ability to provide variation within a microcommunity through different qualities of buildings and landscapes, as well as within the overall masterplan. The buildings adhere to strict building regulations, including as to the size of the unit, while maximizing the amount of variation of views and interior space within the plan configurations. Each unit within the building affects the location of the unit in the building next to it and so on, eventually resulting in a masterplan with a look and feel based on floor-by-floor regulations and repeatable customized components in its manufacture instead of typically mass-produced building-to-building relations only.

In summary, the Haan River masterplan was developed using a complex system of rules and programming code that generates masterplan opportunities which adhere to all the required regulations in minutes. Previously, these plans would take an architect a year to design, and always led to homogeneous outcomes. CAP's system adds value for the client, as all the pressures of codes and cost are taken into account at the beginning of the design process, enabling the development of a nuanced and elegant masterplan with innovative buildings using cost-effective variation that is mass-customized.

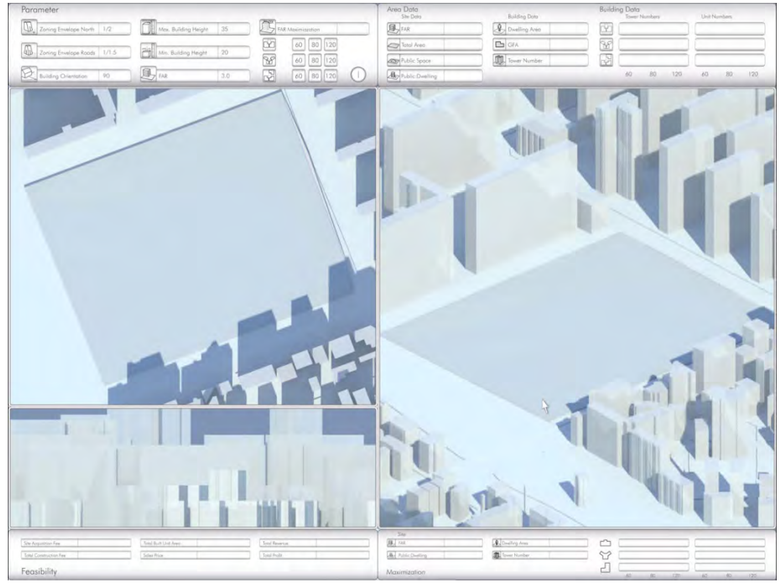

Figure 2: Generative software. The software was developed over a year of research after understanding the Raemian System that Samsung has developed, which created their dominance in housing in Seoul, Korea. The generative system takes into account all the building typologies, as well as housing unit sizes, and integrates this information with all the regulations to develop accurate masterplans that maximize floor area ratios. What is apparent in the system is that the coding actually designs the distribution of the masterplan. Hence, our goal was to adhere to the strict rules and logics that Samsung provided us and combine it with our design intentions.

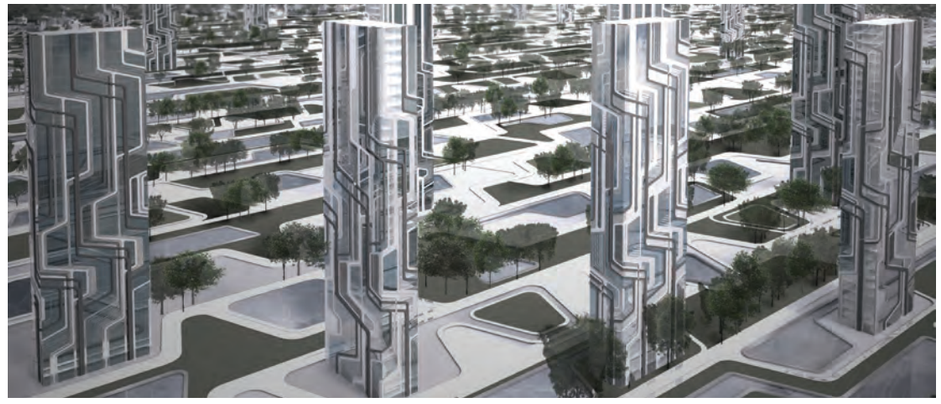

Figure 3: Haan River Masterplan. Our system is able to generate as many buildings as physically possible on the site to maximize floor area ratios. The configuration shown was the basis of the 18-building masterplan that we went on to develop.

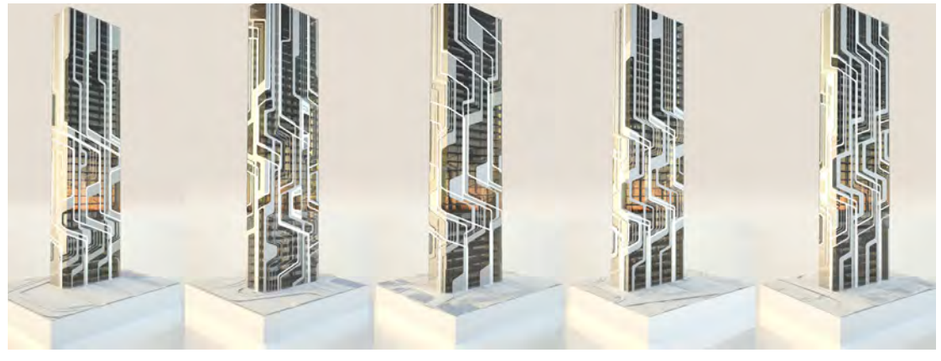

Figure 4: Building variation. The buildings are different yet related. We developed the greatest variation within the given parameters of regulations, determining the overall form of the masterplan as well as each building. We had to maintain the costs within an acceptable framework for the client, which required us to work within the levels of customization afforded to us by Samsung construction.

Figure 5: Haan River Masterplan, axonometric view. A system of relations based on unit-to-unit distributions in addition to the normative building-to-building regulations allowed for a system of variation.

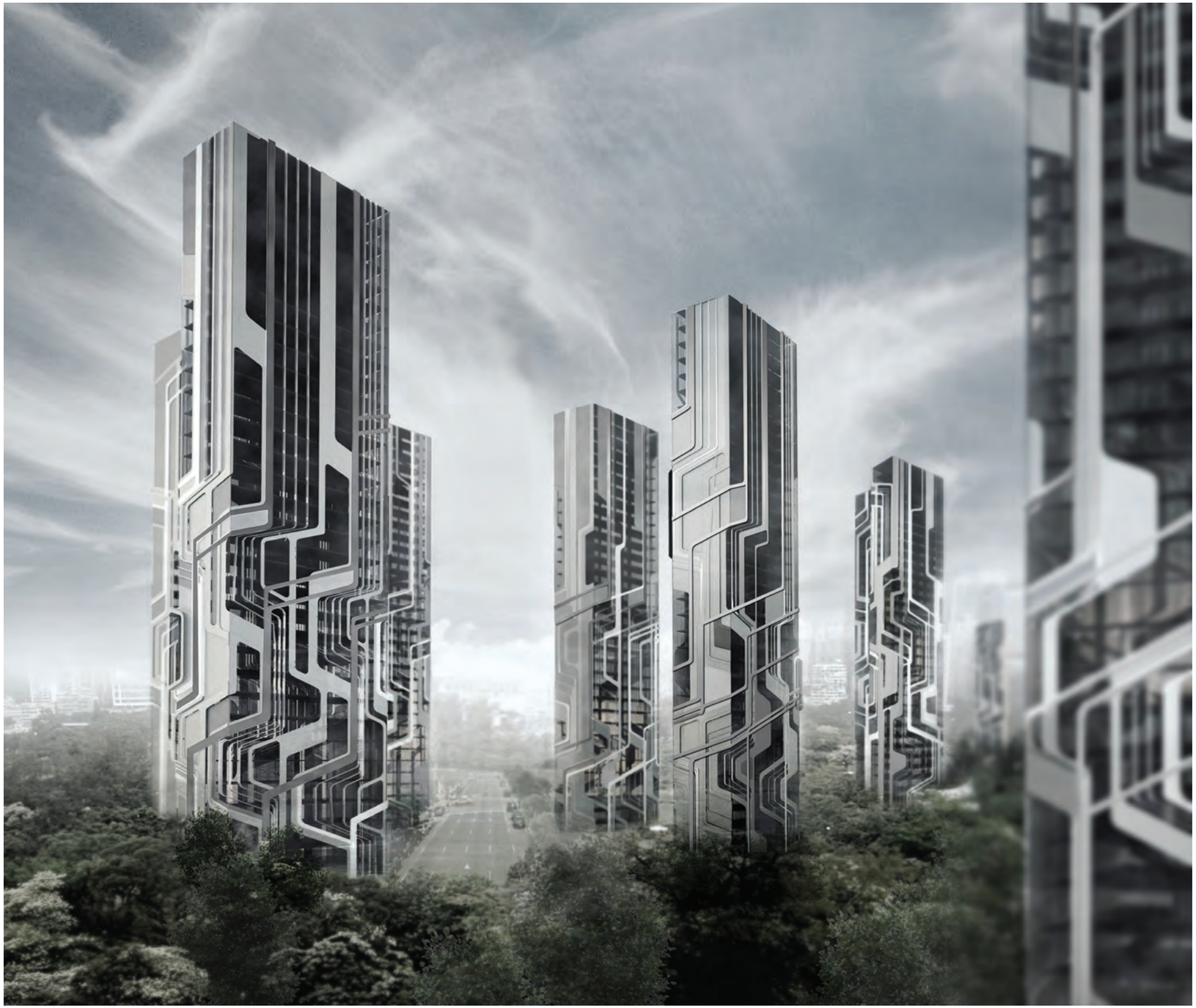

Figure 6: Building design. A three-dimensional prototype of a building contained within the masterplan showing the inflection of form due to interior spatial configurations, vertical alignments, and maximal variations permitted within Samsung building components.

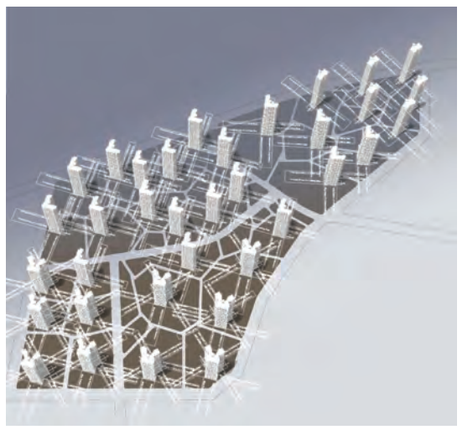

Figure 7: Masterplan view. The qualities of the masterplan distinctly differ from the typical housing development in Seoul. The efficiencies of mass production are circumvented for mass-customization in the production of large-scale building populations within cities.