Concept Development of Megastructure

Study of Megastructure trend in longitudinal time horizon through Google Ngram Viewer and theoretical texts.

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Dictionaries often define "Megastructure" as "a very large multi-story building or complex" (*Merriam-Webster's Collegiate Dictionary*, 2022). Somebody who first encounters the term must value such a definition; although it does not reflect the actual meaning that architects attach to the term. In the mid-twentieth century, the concept of Megastructure in architecture and urbanism has been developed into a much broader sense. Even though the idea of visionary mega-movements such as Japanese Metabolism and the British Archigram has been abandoned since mid-70's, it has remained as a progressive concept in the field of architecture and urbanism. Integrating the two architecturally contrasting conditions together, such as large/small, permanent/transient, Megastructure transforms the uncertainty to architectural design. Thus, it raises the question of indeterminacy and adaptability over time. Therefore, the research asks how differently or similarly the ascent and decadence of the Megastructure trend is perceived back then and now. The final question to ask is: whether the concept of Megastructure is still relevant in the twenty-first century in the field of architecture and urbanism.

Contents List

Introduction

In the beginning of the twentieth century, industrialization had rather positive influence on many artistic and architectural works, resulting in the apparition of Modernism, Pataphysics and Cubism. After the Second World War, however, artists and architects realized that not all progress had meaningful motives. For instance, Dada's nihilistic nonsense was based on the destructive nature of the war. Constructivism in Russia reflected modern industrial society and urban spaces in a negative manner. At the same time, Gaudi practiced Art Niveau in Spain. All these artistic and architectural *trends* reflect the most significant events around the world and have become "the seeds of modern visionary architecture" (Spiller, 2006, pp. 23).

According to Spiller (2006), visionary architecture, thanks to its long and traditional history, is as crucial as the actual architectural practices. Architects' creativity and imagination have been used for political reasons, and for pursuit of their own architectural languages and pedagogical purposes. All these practices have influenced generations of practitioners such as Rem Koolhaas and Zaha Hadid whose works have become iconic.

Since Megastructure affected many architects all over the world such as Japanese Metabolism and English Archigram as one of the dominant design concepts from 1950's to 60's, this research focuses on the *trend* of megastructure over time and how the concept has been developed over time. Eventually, the research will answer whether Megastructure is still relevant in the modern architecture and urbanism.

For the analysis of the megastructure *trend*, it is critical to take quantitative analysis, not qualitative. Michel and Aiden from the TED conference in 2011 compares comprehension of all-published-books before and after the introduction of computation methods. He then argues that it has never been practiced reading all materials. However, now with the advancement of computer technology, one could read any relevant books "in a click of a button" to understand the change of human culture and history over time. The study of megastructure trend, thus, will take the quantitative analysis with the help of Google Ngram View.

To study the development of Megastructure concept more profoundly, Banham's book, *Megastructure: urban futures of the recent past* (1976), is selected as one of the books for the research. In his book, Banham clarifies the characteristics of Megastructure and traces back to the work of Le Corbusier in 1931 to understand the origin of the concept. Banham comprehensively describes the formation and development of the concept and ideas from different groups and countries. However, the book has little details about each project because Banham simply lists many megastructure-related projects that fit with the topic of the chapters in his book. Also, the book, written in the 70s, lacks the relevance to the influence of Megastructure trend in the later time. However, the books is still an important source for this research because Banham delineates a succession of Megastructure projects chronologically: from the origin of Megastructure to the peak of Megastructure, and its decadence.

Research Questions

Main Research Question

: How has the Megastructure concept developed over time?

Sub-questions

: How has Megastructure trend fluctuated between the late twentieth and the early twenty-first century?

: How has megastructure been defined and characterized in the theoretical texts?

: How differently/similarly has megastructure been described over time in the theoretical texts compared to the observation of megastructure trend from Google Ngram?

: Is megastructure still relevant now in the domain of architecture and urbanism?

Methodology

The focus of the research is to examine the fluctuation of Megastructure trend in the twentieth century and to drive the conclusion whether the rise and the fall of the Megastructure concept is relevant to the current architecture in the twenty-first century. This being so, the research adopts first the quantitative method to measure the Megastructure *trend* precisely by using Ngram frequency chart by Google. Then, the result and the relationships of cultural trend are analyzed with various combinations of words including the term 'megastructure.'

However, when examining how Megastructure is defined in the theoretical texts in different periods, several theoretical texts in different time will be qualitatively studied. This is done by literature study to examine theoretical perspectives regarding the theme through books, articles, and journals. Once the essential perspectives of the authors are studied, the quantitative result from Google Ngram will be examined by scanning whether the authors take the examples from the past, present or future, and in which manner the authors describe the term 'megastructure' in their writings.

Finally, Megastructure being the visionary architecture, it is essential to show diagrams and other visual forms that explain the adopted visual strategy in relation to the textual strategy. This will contribute to the thorough understanding of the Megastructure.

1. Megastructure Trend

The digitized metadata from 5 million selected books in Google Ngram shows how frequently a word or a phrase has been used over in which period of time (Michel et al., 2011). Thus, how frequently the word 'megastructure' appears in published books will be analyzed and compared in several combinations of words. Yet, if the word is formulated with articles (a/the), or prepositions ('of,' 'in,' et cetera), it will be excluded from the final result. For example, "Few of us realize that there is another kind of megastructure, a *megastructure in* terms of a whole environment" (Jackson, 1970, p. 153); the preposition 'in' is combined with the word 'megastructure' as part of the phrase 'in terms of.' Another example is: "McMaster's companion *megastructure of* 1973 was an expansion of the existing series of buildings known as Centennial Hall on the downtown campus of the University of Winnipeg in Winnipeg, Manitoba, by MMP/Winnipeg Architects Engineers" (Canada Council/Conseil des Arts du Canada, 1982, p. 130). In fact, 'megastructure of' uses 'of' to indicate a specific year. Instead, the combinations of words and the words in present and past tense: 'megastructure is' and 'megastructure was,' will be compared and analyzed through Google Ngram to examine if the comparisons of these words imply the trend of Megastructure over time.

In addition to the chosen word combinations, this research will only take the result from the very original data released from the Google Ngram platform between 1900 and 2010: 1900 as the starting year of this spectrum since megastructure was prominent in the twentieth century, while mid-December 2010 as the end year since one of the initial developers of Google Ngram stopped working with Google.

1.1. 'megastructure' vs 'megastructure concept'

In terms of observing the frequency number, the word, 'megastructure,' has been used most frequently (Figure 1.1.). At its peak, the word 'megastructure' (combined both megastructure with and without capital letter M) was used 0.0000056681% in 1976. Compared to the result from the chart 'megastructure,' the combination of words, 'megastructure concept,' has much smaller frequency rate (Figure 1.1.). At its peak in 1964, the rate was 0.00000003%, 189 times smaller than the result in 1976. Thus, the numerical results from two charts are not comparable because the numbers from the chart 'megastructure concept' are much smaller than the numbers from the chart 'megastructure.'
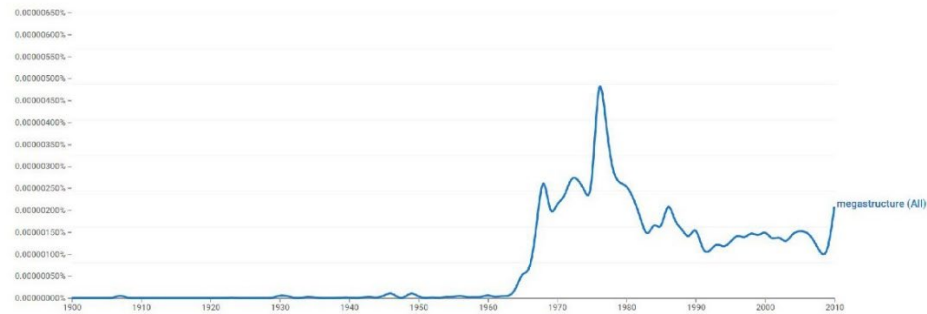
Figure 1.1.
'megastructure' vs 'megastructure concept'
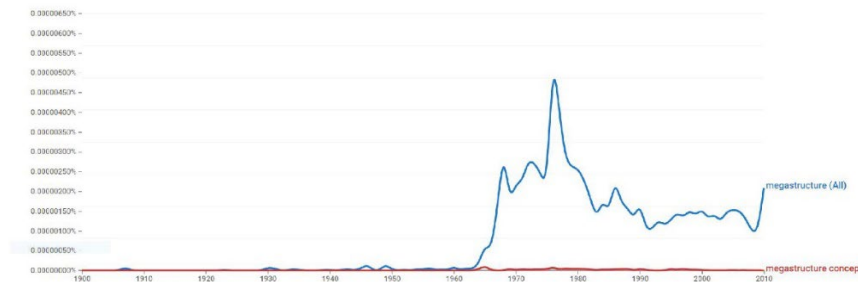
Note. Screenshot of the tool from Google Ngram Viewer site, <https://books.google.com/ngrams>

However, when looking at the frequency charts separately, it is interesting to compare those two charts in terms of the fluctuation (Figure 1.2. and Figure 1.3.). When the words 'megastructure concept' are used frequently in the year 1964, the use of the word 'megastructure' rises significantly as well. Even after the year 1964, when the chart 'megastructure' hits the peak, the chart 'megastructure concept' hits the second highest peak in the year 1976. Therefore, the two charts following similar pattern in the bigger frame, it is important to examine the periods where the two charts fluctuate significantly: the year 1964, the period between 1964 and 1976, and the year 1976.

Figure 1. 2.
'megastructure'

Note. Screenshot of the tool from Google Ngram Viewer site, https://books.google.com/ngrams

Figure 1. 3.
'megastructure concept'
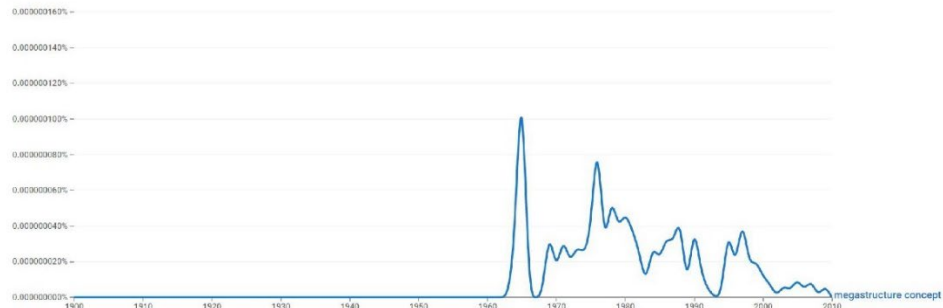
Note. Screenshot of the tool from Google Ngram Viewer site, <https://books.google.com/ngrams>

1.2.   'megastructure concept' vs 'megastructure is'

According to Figure 1.4., there is one outstanding moment when the word 'megastructure concept' hits much higher rate than the rate of the phrase 'megastructure is,' 0.00000003% in 1964. This percentage is twice higher than the percentage of 'megastructure is' in the same year. After the year 1964, the use of 'megastructure concept' was immediately decreased. This result could indicate that megastructure gained much attention when megastructure was first introduced officially in the published books in 1964.

Figure 1. 4.
'megastructure concept' vs 'megastructure is'
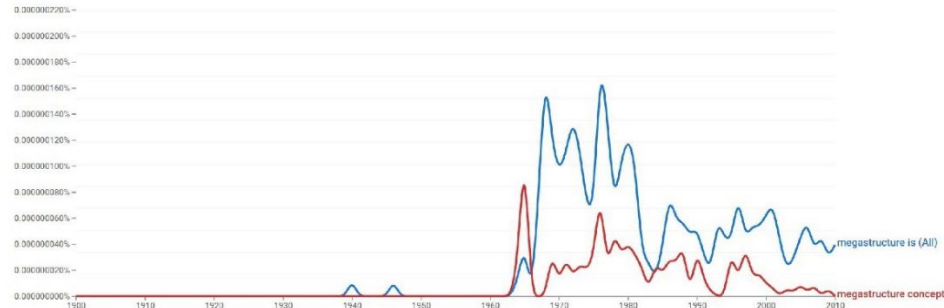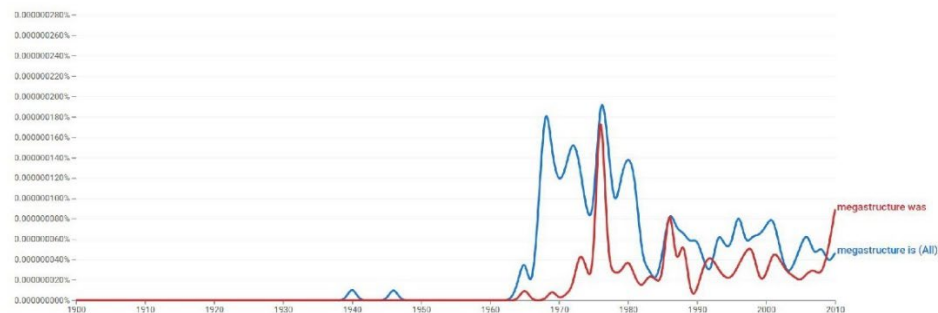

Note. Screenshot of the tool from Google Ngram Viewer site, <https://books.google.com/ngrams>

1.3.   'megastructure is' vs 'megastructure was'

According to Figure 1.5., the word 'megastructure was' (in the past tense) was used much more frequently than that the word of 'megastructure is' (in the present tense) in 1976 with the percentage of 0.0000002475% over 0.00000022%. With the decline, megastructure might have been already considered to be outdated, losing its popularity in 1976.

In 2008, the phrase, 'megastructure was' appeared more frequently in the books again. Considering that the phrase is in the past tense, the authors assume megastructure was once popular in the past and recur to it. This result agrees with the result of Figure 1.2.; from the year 2008, the word 'megastructure' has been used increasingly. Thus, it could suggest that year 2008 could have been the 're-rising' period in the recent years.

Figure 1. 5.
'megastructure is' vs. 'megastructure was'

Note. Screenshot of the tool from Google Ngram Viewer site, <https://books.google.com/ngrams>

1.4.   Conclusion

In the first section of Google Ngram frequency charts, similar pattern of fluctuation between 'megastructure' and 'megastructure concept' determines when the popularity

of megastructure proliferated. From the year 1964, megastructure gained its popularity until 1976. After 1976, its popularity in books declined.

Similarly, the second section, 'megastructure concept vs megastructure is,' delineates when megastructure trend had its rising period and on which the authors focus more; it was the year 1964 when the term 'megastructure concept' was used the most extensively out of the entire set period. Because the term 'megastructure concept' appeared more frequently than the term 'megastructure is,' it could also be concluded that authors, in the rising period, might have focused on the concept more.

Combined all observation of three different sub-chapters, the result has similar pattern of fluctuation in the popularity of the word ussage. This will be the guideline of the research, suggesting different periods to be focused separately: the year of 1964, 1976, and 2008.

The year 1964 iss the first rise of megastructure with the authors focusing much on its concept. During the year between 1964 and 1976 megastructure continues to gain its popularity. The year 1976 is when the popularity of megastructure is at its peak. After the period between 1976 until 2008, megastructure trend declines constantly. Even though there have been small ups and downs between this period, they are not as significant as the period before 1976. Finally, the year 2008 has the re-rising trend of megastructure in literature.

2. Development of Megastructure Concept between 1960's and 1970's

In the previous chapter, the terminology of "megastructure," "megastructure concept," "megastructure was," and "megastructure is" is used to observe certain pattern in the frequency of different combinations of words in printed books from 1900 to 2010. The analysis shows that the graph of the frequency charts fluctuates greatly in the year 1964 and 1976. In 1964, the word(s) appears much more frequently for the first time in the period between 1900 and 2010, and from the year 1976, the usage of the word(s) decreases significantly. Therefore, books written in those two years are selected for the further research: *Investigations in Collective Form* by Fumihiko Maki, written in 1964, and *Megastructure: Urban Futures of the Recent Past* by Reyner Banham, written in 1976.

From the books, the research continues to study whether the results of the analysis are consistently true in the theoretical texts. To do so, it first questions the way authors describe Megastructure; did the author directly use the terms, "megastructure" or "megastructure concept," in the text? Did the author use present or past tense in the text? What did the author focus: concept, project, or history of Megastructure? Were the examples cited in the books proposed in the past, present, or future?

Then the second part explains the two authors' Megastructure approaches. Rather than concentrating on the term usage and style of writing, how each author defines and

describes Megastructure is going to be delineated. To conclude, it compares and contrasts the Megastructure approaches between Maki's and Banham's.

2.1. *Investigations in Collective Form* by Fumihiko Maki in 1964

Fumihiko Maki, interested in technology and in applying new technology in his design, called himself a modernist. He studied architecture with Kenzo Tange, one of the former Metabolists in Japan, in University of Tokyo in the early 1950s. After graduation, he finished his Master of Architecture degree at Harvard Graduate School of Design (The Pritzker Architecture Prize, 2022). He worked as a professor in the School of Architecture at Washington University in 1956 and as an Associate professor at the Harvard Graduate School of Design from 1962 to 1965. He was known as one of the founders who led the "Metabolism" movement in Japan and known for the "Team 10" (Maki, 1964). At the Harvard Graduate School, he published the book, *Investigations in Collective Form* from which Maki used the term "Megastructure" for the first time in print (Banham, 1976).

2.1.1. Term Usage and Manner of Writing
2.1.1.1. Importance of Megastructure Concept for Maki

In the opening chapter "About Fumihiko Maki," Maki directly puts emphasis on the concept of Megastructure (Maki, 1964).

> "This book represents a 'progress report' for architects and planners who have interest in its important conceptual content." (Maki, 1964)

He explains why the new concept Megastructure is required. Maki stresses the importance of reading spatial languages in urban design instead of regarding buildings as separate segmented individuals. Therefore, he views Megastructure as the first step to analyze structural principles in making collective forms which will "satisfy the demands of contemporary urban growth and change" (Maki, 1964, p. 4-5).

> "Our problem is this: Do we have in urban design an adequate spatial language (an appropriate master form) (…) Cities today tend to be visually and physically confused." (Maki, 1964, p. 4)
>
> "We lack an adequate visual language to cope with the superhuman scale of modern highway systems and with view from airplanes." (Maki, 1964, p. 4)

Hence, Maki suggests Megastructure as the concept that drives a solution to read "an adequate visual language" by explaining why architects need a new concept megastructure.

2.1.1.2. Use of the term 'megastructure concept' in Maki's text

Because Maki focuses on the 'concept' of Megastructure, he uses the term "megastructure concept" often when he defines megastructure.

> "Inherent in the megastructure concept, (…) is the suggestion that many and diverse functions may beneficially be concentrated in one place. A large frame implies some utility in combination and concentration of function." (Maki, 1964, p. 8)

"Urban designers are attracted to the megastructure concept because it offers a legitimate way to order massive, grouped functions." (Maki, 1964, p. 8)

Indeed, when Maki focuses on the concept in the book, written in 1964, the Ngram frequency of the term "megastructure concept" bursts as well. In this regard, the sudden rise of the Google frequency chart (Figure 1.3. 'megastructure concept' and Figure 1.4. 'megastructure concept' vs 'megastructure is') in the year 1964 is relevant to the frequent usage of the term and the way he writes the necessity of megastructure concept.

2.1.2.   Maki's Megastructure Approach

In the book, Maki introduces two formal definitions of megastructure: one from himself and the other from Kenzo Tange, one of the ancestors of megastructure concept.

Maki defines Megastructure as:

"The megastructure is a large frame in which all the functions of a city or part of a city are housed. It has been made possible by present day technology. In a sense, it is a man-made feature of the landscape. It is like the great hill on which Italian towns were built." (Maki, 1964, p. 8)

According to his definition, Megastructure is, with the direct use of the word "megastructure" in print for the first time in history, as a man-made landscape where there is a large frame filled with dynamic units of urban functions.

Then Maki cites Tange's proposal for a megaform as a former concept of megastructure:

"A mass-human scale form which includes a Mega-form, and discrete, rapidly-changing functional units which fit within the larger framework." (Maki, 1964, p. 9)

Here, "Mega-form" corresponds to "Megastructure" because a "Mega-form" is a large framework that includes changeable functional units.

From these two definitions, Maki describes Megastructure as "urban structure" because the demands of infrastructure, monumental form, and mass production to create buildings imitate miniature cities. So, he approaches megastructure with an urban scale, a bigger scale than looking at a single building.

2.2.   *Megastructure: Urban Futures of the Recent Past* by Reyner Banham in 1976

Reyner Banham (1922 – 1988), started with his carrier as a mechanical engineer during the second World War. As a writer on architecture, design, and pop culture between the mid-1950s and the late 1980s, he was obsessed with technology and also with pop culture (Davies, 2019). He was a professor at University College in London and the State University of New York in Buffalo (Banham, 1976). The book, *Megastructure: Urban Futures of the Recent Past*, was written as one of the responses to the issue of growing population and urban densification in the late twentieth century (Davies, 2019).

2.2.1. Term Usage and Manner of Writing
2.2.1.1. Megastructure in the Past Tense

Banham begins the book stating:

> "This book is, in all useful aspects, a product of what we used to call 'the great ongoing international megastructure conversation' of the 1960s –a world-wide talk– in with a cast of thousands, to all of whom I am indebted." (Banham 1976, p. 6)

Banham himself already describes Megastructure as once-prominent idea in the 1960s by citing "what we used to" and setting a specific period in the past, "of the 1960s." He stays with this reflective manner throughout the entire book as if Megastructure was still present in the past.

In terms of the term usage in relation to the observation from the Ngram chart (especially, Figure 1.5. 'megastructure is' vs 'megastructure was'), he uses the past tense to describe Megastructure.

> "Megastructure was born and bred in an epoch of unprecedented historical awareness among modern architects." (Banham, 1976, p. 13)

> "Megastructure, then, had become a thinkable and buildable proposition in more widespread and more conservative contexts than would have seemed possible, or desirable to the front-runners and visionaries of barely five years before. (Banham, 1976, p. 167)

2.2.1.2. Decadence of Megastructure

In addition to the use of past tense, he additionally describes the decadence of Megastructure in the books:

> "It was abandoned by them because it offered to generate a form of order that they themselves could not manage." (Banham, 1976, p. 216)

> "The concept itself was about exhausted as well. (…) megastructure proved to be a self-cancelling concept." (Banham, 1976, p. 216)

Throughout the book, Banham uses obvious language when explaining Megastructure by not only writing "megastructure was," but also assuring that Megastructure is already a dead concept that was once popular during a certain period in the past, using such terms: "abandoned," "exhausted," and "then." Therefore, Banham's book, *Megastructure: Urban Futures of the Recent Past*, harmonizes with the result from the Ngram frequency of the year 1976. When the usage of "megastructure" decreases, and the frequency of the word "megastructure was" overruns that of the word "megastructure is" for the first time in 1976.

2.2.2. Banham's Megastructure Approach

Unlike Maki's approach of defining Megastructure, Banham focuses on the historical sources that formed the Megastructure concept even before the term 'megastructure' existed. He investigates the projects in different countries that had similarity in characteristics of Megastructure from architectural and urban history. Moreover, to define Megastructure, he tries to correct common misunderstandings of Megastructure.

2.2.2.1.   Misunderstanding 1: Largeness

According to Banham (1976), Megastructure usually refers to a large building. However, he insists that not all large buildings are Megastructure.
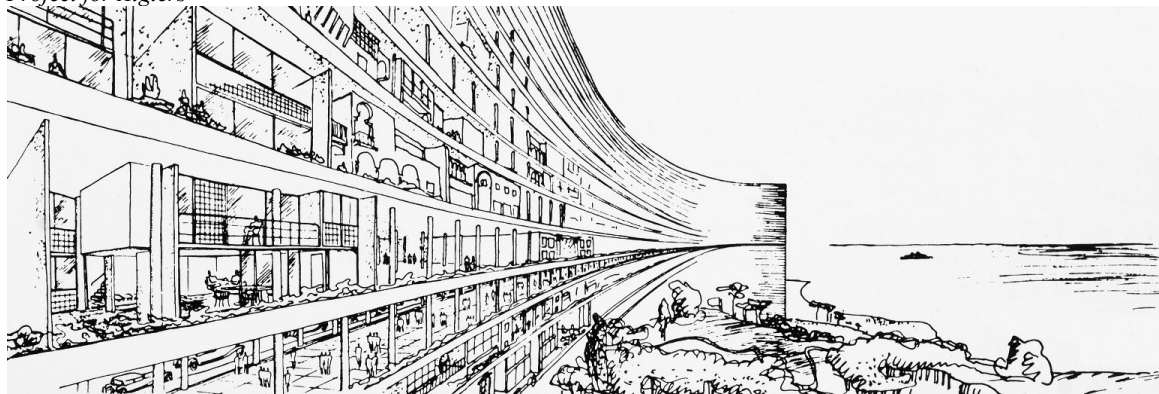
> "The purely lexical meaning of megastructure, when it is finally committed to the standard dictionaries, will probably be as wrong-headedly correct and boringly true." (Banham, 1976, p. 196)

What makes Megastructure distinctive from simply a large building can be traced back to 1931, approximately 30 years before Megastructure became an official term in print and a popular concept in architecture. He claims that Le Corbusier's Font l' Empereur project from his Algiers plan of 1931 is the "true ancestor of megastructure" because it contains fundamental elements of Megastructure (Figure 2.1.).

> "The massive sub-structure of an elevated super-highway, built like a giant bookcase of reinforced concrete on the shelves of which the inhabitants have built two-storey houses to suit their own tastes." (Banham, 1976, p. 7-8)

Through Le Corbusier's Font l' Empereur project, Banham defines Megastructure as: the clear distinction between the main structure that is massive and permanent, and the habitable housing units adapted to individual needs that are modular and repetitive (Banham, 1976, p. 7-8).

Figure 2.1.
Project for Algiers

Note. By Le Corbusier, 1931, Drawing,
(https://images.lib.ncsu.edu/luna/servlet/view/all/who/Le%20Corbusier/what/Urban%20Design%20and%20City%20Planning?showAll=who&res=2)

2.2.2.2.   Misunderstanding 2: Utopia

Another element that is commonly discussed with Megastructure is Utopia. Banham sees this as another common misinterpretation of Megastructure. He distinguishes between Megastructure and Utopia. He describes the "real utopia" as "obsessional about the real social system, but not too concerned about architectural form," whereas the Megastructure approach as "architectural adventurism." For this reason, he says, Megastructure is considered as "ideal models for future cities" (Banham, 1976, p. 80).

"In terms of (…) distinction between ideal cities and Utopias, megastructures can probably be defined as ideal cities." (Banham, 1976, p. 80)

2.2.2.3.   Misunderstanding 3: Comprehensibility

Continuously, he provides another correction on the misunderstanding of Megastructure; Megastructure is comprehensive. According to Banham 1976, the word "comprehensive" is used as "a grab-bag concept" that "everything can be stuffed, somewhere, somehow, some time" without having "a specific place designed for it" (Banham, 1976, p. 198).

Yet, instead of being comprehensive, it is rather "comprehensible" that architects can pose an architectonic order and layout on "the huge, uncontrolled and sprawling chaos that now call City" (Banham, 1976, p.199).

Banham gives an example of Paolo Soleri's project, Mesa City, that gives the most convincing megastructuralist proposal for this kind of order (Figure 2.2.). In this project, Soleri represents the metropolitan landscape that is "physically compact, dense, and three-dimensional.

> "The natural landscape is thus not the most apt frame for the complex life of society. (…). The man-made landscape has to be a multi-level landscape, a solid of three congruous dimensions. The only realistic direction towards a physically free community of man is toward the construction of truly three-dimensional cities" (Banham, 1976, p. 199 – 200).

Figure 2.2.
Mesa City project.

Note. By Paolo Soleri, 1959, Drawing, (https://www.archdaily.com/359716/paolo-soleri-mesa-city-to-arcosanti)

From the Banham's Megastructure approach, Megastructure can be defined as;

1. Megastructure has a clear distinction between the massiveness and its arrangement of the infill from within.

2. Megastructure is not a desire for utopia but for ideal models for future cities.

3. Megastructure is orderly that it is compact and multi-layered.

2.3.   Similarities and Differences between Maki's and Banham's Megastructure Approaches

When it comes to defining Megastructure, the two authors, Maki and Banham, take different methodologies. While Maki stresses the importance of the concept of

Megastructure itself, Banham characterizes Megastructure by correcting the common misunderstandings of Megastructure with the help of the historical sources.

As a precedent of the Megastructuralists, Maki defines Megastructure based on the coexistence of a main structural frame and the accommodated functions within the large frame.

Similarly, Banham also speaks for the massive structure and its sub-infills. However, Banham goes further and gives emphasis on the clear separation between the main structure and sub-structure; the main structure is massive and permanent whereas the sub-arrangements are adaptable and modular.

In a bigger perspective, both Maki and Banham perceive Megastructure in an urban scale. Maki describes Megastructure as "urban structure," and Banham as "ideal for future cities" to give order and layout to the chaotic city condition.

3. Re-rise of Megastructure in 2008 and Possible Continuity of Megastructure Trend

This research has explored how the theoretical texts, published in the years of 1964 and 1976 are consistent with the fluctuations of Megastructure Trend observed from the results of the Google Ngram fluctuation chart analysis. The final year is 2008 that the Google Ngram chart has fluctuated significantly according to the observation in Chapter 1. As mentioned in Chapter 1, the period span stops at the year 2010 because of the possible inaccuracy of the data after 2010. In consequence, it is hard to conclude whether the fluctuation in the year 2008 continues until now so that it is justified to call it as a re-rise of Megastructure, or whether the fluctuation is a temporary phenomenon. To resolve this issue, this research takes another article, *Megaform versus Open Structure or the Legacy of Megastructure* (2018). With similar topics, this article studies whether the Megastructure Trend continues in the following years after 2010.

3.1. Legacy of Megastructure: Open Structure and Bigness

In the previous chapter, the similarities and differences between Maki's and Banham's Megastructure approach are investigated through the study of their theoretical texts. Van Rooyen (2018) also traces back to the writings of Maki (1964) and Banham (1976), sorts out the common megastructuralist ideas that the two authors share, and categorizes them into two key concepts: 'Open Structure' and 'Bigness,' which Van Rooyen called the 'Legacy of Megastructure.'

3.1.1. Recall of the readings by Maki and Banham from Van Rooyen's perspective

To recall the Maki's definition of Megastructure,

"The megastructure is a large frame in which all the functions of a city or part of a city are housed. It has been made possible by present day technology. In a sense, it is a man-made feature of the landscape. It is like the great hill on which Italian towns were built." (Maki, 1964, p. 8)

"A mass-human scale form which includes a Mega-form, and discrete, rapidly-changing functional units which fit within the larger framework." (Maki, 1964, p. 9)

Maki (1964) highlights not only the functional separation between "a large frame" and "discrete, rapidly-changing functional units," but also his perception of Megastructure as "the landscape" and "towns."

In addition to Maki's conception, Banham points out the four key concepts of Megastructure by referring to Ralph Wilcoxon's definition on Megastructure in the book, *A Short Bibliography on Megastructures* (Banham, 1976, p.8).

Wilcoxon's definition of Megastructure is described as (Wilcoxon, 1968, p.2):

"not only a structure of great size, but … also a structure which is frequently:
1. Constructed of modular units;
2. Capable of great or even 'unlimited' extension;
3. A structural framework into which smaller structural units (for example, rooms, houses, or small buildings of other sorts) can be built – or even 'plugged-in' or 'clipped-on' after having been prefabricated elsewhere;
4. A structural framework expected to have a useful life much longer than that of the smaller units which it might support

Banham mentions that Wilcoxon's definition is invaluable because its emphasis is not only on the distinct hierarchy of structural frameworks, "dominating frame" and "subordinate accommodations," but also on the different characteristics of the two: "permanent" and "transient" (Banham, 1976, p.9).

3.1.2.   Van Rooyen's categorization: "Open Structure" and "Bigness"

From the readings of Maki and Banham, Van Rooyen (2018, p.37) states the two authors have something in common:

1. "the distinction of the fix/transient pair, a primary/secondary structure"

2. "the capacity of the building to contain the functions related to the city […] becomes a landmark."

First, he focuses on putting the two opposite concepts together: "large frame" that lasts for a longer life cycle and "secondary system" where smaller units are plugged into the larger framework and modified due to the shorter life cycle. He names this distinction as "Open Structure" and calls it as the first legacy of Megastructure (Van Rooyen, 2018, p.37). The concept, "Open Structure," supposes the capacity for expansion and change in time. While the primary structure organizes the spatial arrangements, giving the implemented functions supports and facilities, the secondary structure is the functional programmes that are modifiable and indeterminate (Van Rooyen, 2018, p.39).

Second, He relates the common point 2. to the second legacy of Megastructure and named as the "Bigness." The "Bigness" has the potential to become a landmark as referred in Maki's text as "megaform" (Maki, 1964, p. 9) and referred in Banham's text as

"the overscale and landmark qualities" (Banham, 1976, p.40). "[The Bigness] desires to give shape to landmark and indeterminacy, articulating transient and permanent design, representing or anticipating the perpetual change of the society and in so doing constitutes a legacy of megastructure to urban theory and history" (Van Rooyen, 2018, p. 40-41).

Further on, Van Rooyen (2018) puts Rem Koolhaas, and Lacaton and Vassal forward to make references of more recent projects that follow the legacy of the Megastructuralist idea to see the possible continuity of the concept in the contemporary architecture. The ideas of the contemporary architects will be dealt in the next two chapters.

3.2. Open Structure in the Work of Lacaton and Vassal, School of Architecture

3.2.1. Lacaton & Vassal's Open Structure

For Anne Lacaton and Jean-Philippe Vassal, it was crucial to conceptualize "extra space" in their projects. It is a "complementary space, indeterminate, free of appropriation, considering various scenarios," providing freedom of usage with minimum restrictions to the users (Van Rooyen, 2018, p. 48).

Lacaton and Vassal in their book, *Structural freedom, a precondition for the miracle*, directly mentioned the term "Open Structure" and its principles.

> "We always aim to make [the structure] independent of what it contains, so as to let this content emerge. The structure should be free, very roomy, in order to create a new rapport with climate and the ambience, a new rapport with activity so as to produce the conditions for mobility and enjoyment. A structure that generates urbanism through its capacity to interfere with existing structures and activate the urge to continue the city. We always approach this concept of an open structure through the imaginary aspect of the fabric, the imaginary aspect of the expanse […]" (Lacaton & Vassal, 2012, p. 175).

For these architects, "Open Structure" has indetermination in programmes ("the structure independent of what it contains" and the capability for growth ("activate the urge to continue the city," "imaginary aspect of the expanse"). The design of Lacaton and Vassal builds three-dimensional structure in which transient functions are plugged. Van Rooyen argues that even though the scale of their projects is just a fragment of a city, they still "try to tribute to megastructure by shaping the dual primary/secondary structure" (Van Rooyen, 2018, p. 48).

3.2.2. School of Architecture, Lacaton & Vassal

School of Architecture in Nates, France in 2009 shows the architects' interpretation of "Open Structure." In this project, "extra space" that is about the same size as the initial program (Figure 3.1.) is added through a reflection on the construction system and on an open-ended approach. The area with the mark in light blue color indicates "extra space" whereas the area with the mark in green is the initial school program. This leaves the users as active actors with possibility of investing their own spaces and programs (Van Rooyen, 2018, p. 48).

Figure 3.1.
School of Architecture, "extra space"

Note. By Lacaton & Vassal, n.d., Floor Plan, (https://www.lacatonvassal.com/index.php?idp=55)

To overcome the financial limitation, the insertion of the "extra space" is realized by adopting "cross-typologisation" system. The system takes a foreign construction to a totally different program. In this case, the construction form of a multi-level parking buildings is taken to the school program. Consequently, this makes the school create a spatially flexible connection similar as the connection, what is similar to the connection of a warehouse or a shed. Figure 3.2. expresses how the multi-level car parking building system makes it possible to have a continuous movement from the ground level to the sky. The double height configuration of the three main floors allows the secondary subdivision of the floors. These subdivided floors are connected by the external ramp (illustrated with the line drawing on the right side of the top image) connecting the ground floor to the top floor (Van Rooyen, 2018, p. 48).

Figure 3.2.
School of Architecture, "cross-typologisation"
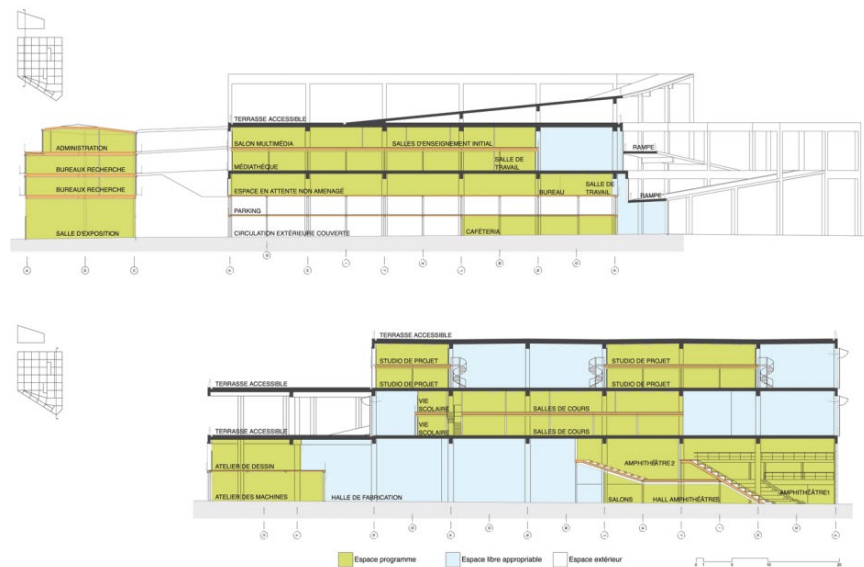
Note. By Lacaton & Vassal, n.d., Section, (https://www.lacatonvassal.com/index.php?idp=55)

Regarding the structural perspective, there is a clear distinction between primary and secondary structure.

"The primary structure of the three main levels, is made of reinforced concrete and consists of a square grid of 10x10m poles. Its load capacity allows trucks to arrive inside the project and allows students to build on a 1:1 scale. If offers the advantage of longer durability than the secondary structure.
The secondary structure, lighter, is made of steel, and offers unscheduled trays, creating a system suitable for its extension and its future development. These 'infills' are similar in their plastic expression and forms a programmatic indeterminacy." (Van Rooyen, 2018, p. 48-49)

Figure 3.3. describes the primary structure with the reinforced concrete floor and the 10x10m poles, and Figure 3.4. illustrates the secondary structure made of light steel frames, leaving the space with potential extension and with indeterminacy.

Figure 3.3.
School of Architecture, primary structure

Note. By Lacaton & Vassal, n.d., Photograph, (https://www.lacatonvassal.com/index.php?idp=55)

Figure 3.4.
School of Architecture, secondary structure

Note. By Lacaton & Vassal, n.d., Photograph, (https://www.lacatonvassal.com/index.php?idp=55)

3.3.   Bigness in the Work of Rem Koolhaas, Rue de la Loi

Van Rooyen exemplifies Rem Koolhaas' book, *New York Délire*, to show how "Bigness," the second legacy of Megastructure, is succeeded to the work of Koolhaas in the twenty-first century.

3.3.1.   Koolhaas' Bigness

First, he points out how Koolhaas describes town as "archipelago: cities within cities" (Van Rooyen, 2018, p.42). According to Koolhaas (2002, p. 294), because "archipelago" and change are mutually associated, indeterminate and diverse qualities such as values and identities unify the system of archipelago. This, according to Van Rooyen (2018, p.42), reminds the idea of Maki's definition of Megastructure as Maki describes 'the megastructure is a large structure in which all the functions of the city or parts of the city are contained." It can be found in the works of the OMA, one of the leading architectural firms in the world now.

In addition to Koolhaas' conception of "city within cities," Koolhaas explains in his book, *S,M,L,XL*, how the change of scale from an urban to architecture crystalizes the concept of "Bigness." For Koolhaas, "Bigness," demanded by modern programs, can be realized by the skyscraper which represents the massive extensiveness in vertical direction (Koolhaas, 1995, p. 499-502).

> "In Bigness, the distance between the heart and the envelope increases to the point that the façade can no longer reveal what is happening inside. The humanist expectation of 'honesty' is doomed; interior architecture and exterior architecture become separate projects, one being linked to the instability of programmatic and iconographic demands, the other – agent of disinformation – offering the city the apparent stability of an object" (Koolhaas, 1995, p. 499-502).

Here, Koolhaas combines the dichotomy between indeterminate programmes inside and architectural specificity outside from the architectural scale. For him, "Bigness" as a strategy of spatial design integrates the indeterminacy of programmes that are present in a big building as if anything and everything can happen. (Van Rooyen, 2018, p. 45)

3.3.2.   Rue de la Loi, OMA

The consideration of "Bigness" integrated with indeterminacy in architecture is well presented in OMA's project for Rue de la Loi in Brussels in 2009. The two design strategies proposed by OMA rely on the representations of the Megastructure to solve the morphological and typological challenges in the project.

The challenges are:

> "- to improve the urban qualities of the already congested Rue de la Loi by doubling its density;
> - to create a new European quarter on a site which is already occupied by a traditional example of the European city.
> The first issue is morphological, the second symbolic." (OMA, n.d.)

Rem Koolhaas and his team respond to the morphological challenge by borrowing Superstudio's use of "three-dimensional neutral grid and programmatic indetermination,"

freeing up the street so that there is nothing to show what is happening inside (Figure 3.5.).

In terms of responding to the symbolic challenge, OMA imposes the plan area itself as a landmark.

"At right angles to this political axis, housing and the "private" will be aligned perpendicular to the street, … As a skyline, the contrast between the 'European' and the 'private' orientation, represents a prototype of retroactive planning that is not based on the brute power of the Tabula Rasa, but that accepts the givens of context to avoid the sterility of a new beginning that typically defines articulations of political space from Washington's mall to the Forbidden City" (OMA, n.d.)

The response regarding the symbolic challenge is monumental with the desire of highlighting the skyline of the European capital. According to Van Rooyen, Koolhaas' proposal is "a legacy of megastructuralist theory and contemporary development" (Van Rooyen, 2018, p. 46).

Figure 3.5.
Rue de la Loi

Note. By OMA, n.d., Diagram, (https://www.oma.com/projects/rue-de-la-loi)
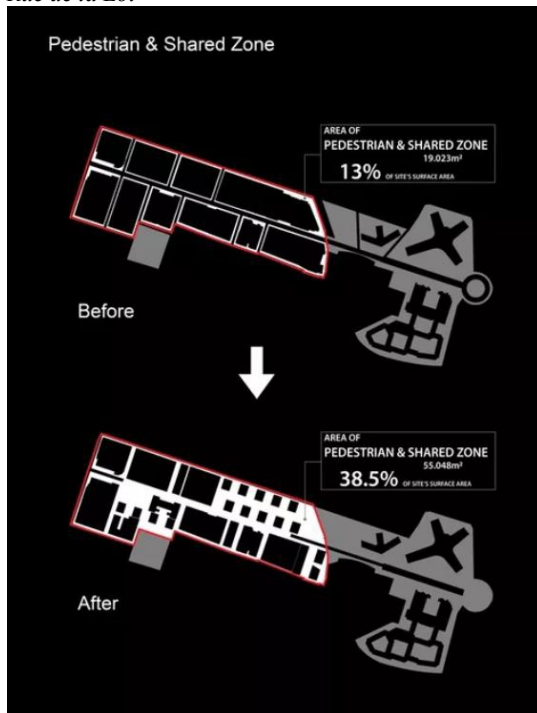
4. Conclusion

This article has explored the developing concept of Megastructure in the twentieth and twenty-first century.

Through the analysis of Google Ngram frequency chart, the time horizon has been divided into three periods which eventually have become the guideline for selecting theoretical texts of Maki and Banham:

- 1964 as the first rise of Megastructure concept
- 1976 as the peak as well as the beginning of the decline of the popularity of Megastructure
- 2008 as the re-rise of Megastructure Trend

Then the definitions of Megastructure by Maki (1964) and Banham (1976) have crystalize the turning points of the Megastructure Trend discovered by the Google Ngram Chart. As a precedent of Megastructure, Maki focuses on the concept of Megastructure by using the term Megastructure for the first time, while Banham analyses the characteristics of Megastructure by focusing on historical sources of megastructuralist ideas.

For more accurate analysis of the recent fluctuation in 2008, the article from Van Rooyen (2018) has become an additional guideline for the literature study in the following years after 2010. As this article studies the theoretical texts from Maki and Banham, Van Rooyen also reads the same writings of the two authors and put forward the concept of "Open Structure" and "Bigness." Further, he relates the concepts, named as the legacy of Megastructure, to more recent architectural practices of Rem Koolhaas, and Lacaton and Vassal.

It is still not certain that the principles of Megastructure are continuous in the domain of Architecture and Urbanism in 2020's. However, from the recent projects of the current architectural practitioners, the principles of Megastructure are still taken by the architects and applied to the recent projects. Finally, "megastructure theories are still relevant in the contemporary urban and architectural discourse" (2018, p. 49) as Van Rooyen clearly mentioned in his article.

List of Figures with Sources

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