PROSTHETIC REPLACEMENT

MICRO OPERATION AND BOLD FUTURE

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Abstract:

This paper based on the problems appeared during the process of the transition of Santa Coloma from town at the edge of city to become a part of the entire Metropolis, analyzing and proposing a more appropriate urban renewal strategy. Among all the problems we focus more on the "necrosis" of the urban fabric and functions.

"Necrosis" cited in medical concepts, corresponding to "apoptosis", is classified as an abnormal situation of cell growth. The "Necrosis" refers to non-normal and pathological death due to external factors, it can cause illness of components and even death of the individual. In the city, "Necrosis" can be understood as a result of previous irrational urban planning or follow-up unscientific urban construction made the urban fabric abandoned or partial invalid, which cause a collapse of the bond of people in between the community. Currently, like majority cities in the world, the urban fabric of Santa Coloma is in a condition of partial necrosis.

For this case, introduced surgical processes - "prosthetic replacement", hoping to provide a more reasonable solution for Santa Coloma. "Prosthetic replacement" theory refers to use artificial prosthesis - new architectural space, to replace the temporary or permanent non-function part in the urban texture, or repair the failure of the function of the city.

In this process of regeneration of city, we focus not only in the urban fabric, but also concern about community life and neighborhood relations, this concept has been used in different scale of urban regeneration project, and demonstrate its advantages. In the paper, we summed up this strategy again, with the subtle operation, we can re-create a bold future for Santa Coloma.

Keywords: urban necrosis, prosthetic replacement, urban regeneration
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1 Introduction

“… complex (non-linear) [thus fractal entities], dynamic (growing), autophagic (space-devouring) heterotrophic process that displays rapid, uncontrolled fractal growth, distant colonization, invasion and destruction of adjacent natural ecosystems, and dedifferentiation.” Warren M. Hern[1]

1.1 Terminology

From The American Heritage® Dictionary:

Prosthesis, n (pl -ses / -si z/)  
1. An artificial device used to replace a missing body part, such as a limb, tooth, eye, or heart valve.  
2. Replacement of a missing body part with such a device.

[Greek, addition, from prostithenai, prosth-, to add; pros-, pros- + tithenai, to put; see dhē in Indo-European roots.][2]

From Encyclopedia Britannica:

Prosthesis, artificial substitute for a missing part of the body. The artificial parts that are most commonly thought of as prostheses are those that replace lost arms and legs, but bone, artery, and heart valve replacements are common, and artificial eyes and teeth are also correctly termed prostheses. The term is sometimes extended to cover such things as eyeglasses and hearing aids, which improve the functioning of a part. The medical specialty that deals with prostheses is called prosthetics. The origin of prosthetics as a science is attributed to the 16th-century French surgeon Ambroise Paré. Later workers developed upper-extremity replacements, including metal hands made either in one piece or with movable parts. The solid metal hand of the 16th and 17th centuries later gave way in great measure to a single hook or a leather-covered, nonfunctioning hand attached to the forearm by a leather or wooden shell. [3]

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3 http://global.britannica.com/EBchecked/topic/479532/prosthesis
From architect articles and books:

We all need means supplementing our natural capabilities. Since nature is Inhuman (extra-human), and inclement; we are born naked and with insufficient armor.... The barrel of Diogenes, already an improvement on our natural protective organ (our skin and scalp), gave us the primordial cell of the house; filling cabinets copy-letters make good the inadequacies Of memory; and wardrobes and sideboards are the containers in which we put away the auxiliary limb that guarantee us cold or heat, hunger or thirst ....Our concern is with the mechanical system that surrounds us. Which is no more than an extension of our limbs; its elements. In fact, artificial limbs.

This concern with buildings as "human limb objects" like clothing would even become as literal as Gideon's identification of the nineteenth-century interest in "the problem of mechanically operated artificial limbs" with the development of mechanized furniture as an extension of the mobile body. Which in turn, he identifies with modern architecture. In modern discourse, architecture is no longer simply the supplement of the body of the building. The classical relationship between structure and ornament, always understood as that between a body and its clothes, has displaced onto that between body and building. Traditional ornamentation appears to be removed from the building at the When the building itself becomes a kind of ornament worn by its occupant. But this mechanized ornament is structural. Indeed, it restructures the body that wears it. [4]

The previous paragraph provide a perspective on a philosophical level about the relationship between human and prosthesis. "Prosthesis" is to meet the demand of protection and shelter for human activities, to expanded coverage of human society In fact, every buildings can be defined as "Prosthesis".

Le Corbusier defined “prosthesis” - Tools are the useful extensions of man's arms and legs. This definition can be stretched to cover certain products of human ingenuity

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which are also intended to second the person as such: the dwelling is a tool, and so are the road, the workshop, and so on.  

In his Radiant City of 1930, from the diagram (Fig 2), we can see clearly that it was based on an anthropomorphic metaphor, Le Corbusier also conceived the master plan of Chandigarh as analogous to the human body. In Le Corbusier's theories, we can interpret as buildings (tools) are extension of human natural ability, while the logical structure of space of city is an imitation of human body. Buildings become the extension and prosthesis of urban fabric.

In the wave of post-modernism, numerous of avant-architects introduced advanced concepts from various industries, to transform the pure tool attribute of functionalist architecture. Standard-bearer of contemporary architecture- Rem Koolhaas linked the architecture of Manhattan to the surgical processes of the “lobotomy” whereby the outer skin of the building is freed from its internal programme.  

From this perspective, Koolhaas interpret the interior programs as “Prosthesis” of building, and for him, besides cities, buildings are anthropomorphic. Buildings are also "Prosthesis" of city, and both city and buildings are "Prosthesis" of human society.

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1.2 Status quo Analysis

Santa Coloma located at the east bank of Río Besós, and the other side of the river-bank is Barcelona. Around the 20th century, with the Cerda’s planning of Barcelona Eixample and development of industrialization in the Metropolis, Santa Coloma had been greatly changed. With industrial development and transfer, Santa Coloma has gradually become an important residential areas of surrounding industrial area. With a growing number of urban residents, the town has gradually expanded the area, 50% self-organization and 50% imitated Barcelona Eixample regular grid-style layout constantly enriched urban fabric, Santa Coloma forming the current urban form. There are 7 bridges connect the suburb to the Metropolis, in which one of those most important highways that links the Metropolis with the eastern cities. (Fig 4)

Figure 4: Diagram of road system, draw by the author
For those who familiar with the urban architectural style in Barcelona first come to Santa Coloma will undoubtedly be impressed by the exotic here, where the familiar and unfamiliar streets, building facades do not similar to the Metropolis-slightly classical Spanish catalonia-decor. The majority of existing buildings in Santa Coloma are nine-floors and generally below the height of 30 meters, in which mostly are about 20 meters apartments. (Fig 5) Although the building are not high, but under the restrictions of the existing urban tissue and some historical regulatory, the city has an unreasonably ultra-density. We can determine through the facade, most of the apartments were built during the "Great Leap Forward" period, the construction quality couldn’t be regarded as excellent, and overall living environment and quality of construction need to be improved.

Santa Coloma has an impressive community atmosphere, with a very active and harmonious atmosphere of the neighborhood, in the street we can see a lot of children playing and elderly sunbathing and chatting with each other. But the dark side of town shouldn’t easily be ignored, the overall urban space here are crowded, especially the historic district in the vicinity of town hall. If simply look at the aspect ratio from the road, this is a more walkable-scale city. From the perspective of pedestrian safety, small roadside store and active streets might be a
contradiction (Fig 6); since the building density too high, in fact, even Santa Coloma located in the edge of Río Besós, the town is extremely lacking in public space and green space, non-use public space and high-density urban fabric might be another contradiction (Fig 5).)

Santa Coloma located near to the downtown Barcelona, which gave it sufficient momentum in the process of urbanization in the past, but it also led to a high density, lack of public space, ordinary building quality. The inherent requirement of improve the living environment requires us to make a reasonable improvement on the overall Santa Coloma.

With the expansion of the city, The position of Santa Coloma is gradually from small town outside the Metropolis, became an area which must be accommodated by the city while the Metropolis expand eastward, can be said, Santa Coloma from the outside edge of the Metropolis is being re-defined as edge of it. From the new concept of West8- Sagrera linear Park, can be seen, Santa Coloma It is virtually defined as an important node of the green Diagonal, become an important suburbs of the future development of Great-Barcelona. (Fig 7)

Figure 7: Redraw West 8's Master Plan by the author

The demand for a better living environment of residents, and the requirement of overall development of the Barcelona Metropolis makes Santa Coloma facing the stress of development and evolution. But at such a high level of current urbanization and a severe economic crisis, economic, practical, beautiful are undoubtedly the three major urban renewal development principles. "Prosthetic replacement", an urban renewal theory from "medical concept", can it provide a treatment similar to "CPR" which could cure the "patient"-Santa Coloma?
2 Urban Artefact and the Theory of the City

The method which we are elaborating is precise enough to create spatial and built continuity and general enough to allow a great functional flexibility. It is a method by which time and memory participate in the urban composition……. A functionally complex and visually simple spatial continuum has to replace the contemporary system of disintegrated functions and buildings; Inside a precise relationship of building-typology and morphology of urban spaces, we re-establish a dialectic of public buildings (monuments) and urban fabric……7

2.1 Rethinking of modern urban planning

Santa Coloma’s planning weren’t from any certain Maestro, but because of the semi-autonomous development over years, more or less can be seen the process of modern urban development. As we know, since Le Corbusier proposed the concept of The Radiant City (Fig 8) at the beginning of the last century, since the functionalist concept appeared, most of the world’s new urban planning and construction are influenced by the impact of functionalism pursuit functional partition and practical oriented. Santa Coloma as a small town itself has not many functional areas, but through the distribution of the commercial around the streets, can be seen the uneven distribution caused by the functionalist urban planning.

The slogan “Une maison est une machine-à-habiter” Le Corbusier proposed not only can be understood as an interpretation of the ancient Greek philosophy - the basic expressed of “architecture is prosthesis”, but also pay homage to the machine era. The most famous slogan of Le Corbusier is entirely a worship to the machine age, but this deconstruction techniques broke the role of "human" being the center of social life, ignoring the spiritual needs and recognition of "human" on the “homeland”. The machine age make the behavior of "living" completely become a minor parts of the working machine of society, and only

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maintained the functional significance. Although this concept is generated based on postwar urbanization and industrial revolutions, as the need for a large number of residential buildings, but can also be seen that the heroism idea of the urban life in the future from this modernism Maestro.

Under the guidance of functionalism, a lot of cities have been widely produced with high degree of similarity, numerous of buildings which seeking to maximize the functionality have been extended to the global market, and the convening of several meetings of CIAM let this internationalism concept spread worldwide. Because of all neglected tasks were being undertaken in the post-war era, it fit the huge demand of new residential and cities. From 1960s, in the suburbs of Paris, East Berlin, London, Dublin, Amsterdam, etc., can be seen in almost all cities had impact of CIAM.

Amsterdam suburb of Bijlmer (meer) was the best case. Affected by Corbusier and CIAM, began from 1966, this large-scale new town completely follow CIAM’s rules: strict distinction between living, working, recreation; car, pedestrian, bike paths were completely separated. (Fig 9/10) Unfortunately, Bijlmer had long been saddled with the stigma and became gathering place of immigrants and low-income households. Monotonous typology couldn’t attract middle-class residents, developers were reluctant to invest. Designed public space actually the best place for crime, over time Bijlmer became No-go zone. [8]

Figure 9: Master plan of Bijlmer, draw by Siegfried Nassuth

Figure 10: Perspective of Bijlmer by Siegfried Nassuth

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8 http://www.thebijlmerproject.com/
2.2 Unintentional thoughts of urban renewal

For some designers who stood at the cutting edge of practice and for the residents who were living in such communities, they began to have some doubts about this urban model which had reformed a new civil life just in few decades and destroyed the ideologies of neighborhood of over thousands years. They were confused about whether the thought of functionalism was the way of the development of the human society in the future.

German philosopher Ernst Bloch (Ernst Bloch, 1885-1977), during his exile in United States, had been sharply criticized functionalism what he called "a robot created by the consumer society of the cold world" (die eiskalte Automatenwelt der Warendgesellschaft) [9]. We could understand, from very begining, some wise has been aware the strengthening of relationship between the new buildings and the new cites have destroyed the existing delicate harmony between people- buildings- cities.

At 1960s, some young avant-garde architects were dissatisfied the concept of functionalism city, claimed that the modern city when lost the natures was the purgatory, where personality and spatial sense had been the elimination because of the fascination of mechanical. Many architects tried different ways to digestion the detention of "human" and the rupture of "bond between human" in the modern cities.

Since the Industrial Revolution to the 1960s, although urbanization worldwide is extremely uneven, but the main cities in Europe and North America have reached an advanced stage of urbanization, what would be rational strategy for the urban planning in the future? Although large-scale "bulldozer movement" still could be a popular choice to produce new metropolis, but how to renewal the old city center had been considered by those pioneers.

Undoubtedly the climax of reflection and criticism against functionalism was at the tenth meeting of CIAM, The TEAM X organization, they proposed all aspects of innovation for the entire architectural thought, from then, their actively introduced advanced concepts in various fields at that time to reforming and deepening the ideas and methods of urban planning and architecture design. But there were two schools of thought, from now on it seems, relative to their peers, definitely opened a new page.

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2.2.1 Thoughts of Archigram Plug-in city

Archigram was formed in 1960 at the Architecture Association in London by six architects and designers, Peter Cook, Warren Chalk, Ron Herron, Dennis Crompton, Michael Webb and David Greene. In the publication of them, 1961, David Greene wrote: “A new generation of architecture must arise with forms and spaces which seem to reject the precepts of ‘Modern’ yet in fact retains those precepts. We have chosen to bypass the decaying Bauhaus image which is an insult to functionalism.”[10] We could see, Archigram still follow the functional needs, and also follow the modern form and function, but proposed to make a distinction from international style.

In 1964, Peter Cook presented Plug-in City concept. It offered a fascinating new approach to urbanism, reversing traditional perceptions of infrastructure’s role in the city. This provocative project suggests a hypothetical fantasy city, containing modular residential units that “plug in” to a central infrastructural mega machine. The Plug-in City is in fact not a city, but a constantly evolving mega-structure that incorporates residences, transportation and other essential services, not limited to the concept of collective living, integration of transportation and the accommodation of rapid change in the urban environment—all movable by giant cranes.[11] (Fig 11)

![Figure 11: Draw by Peter Cook](image)

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10 David Greene. Archigram: magazine for new ideas in architecture. 1960

Inspired by Archigram, French artist Alain Bublex created his own work, with building site cabins (like those manufactured by Algeco or Portakabin) which replaced Peter Cook "components". He combined parasite methodology in his design, using to respond to domestic needs (to extend apartments, for example), they start to attack buildings, proliferating facades, monuments and other structures in an anarchistic fashion.\(^{(12)}\) (Fig 12)

Objectively speaking, Plug-in City concept is actually not completely out of ideas of heroism, and the approach of planning practices were similar to the functionalism. The concept of "plug in" reminiscent of the invention of the electronic components - transistors and vacuum tubes in about 1953, in fact, we can regard "Plug-in City" as a functionalist city based on the extension of the new generation of electronics industrialization "Context". We can regard the different functions of the city as "element", which can be inserted into different functions corresponding. "Component" here is "Prosthesis", then "plug-in" to the urban fabric, which easily for us to think of the "Prosthetic replacement" concept.

\(^{(12)}\) Alain Bublex, Plug in City, Exhibition, Playgrounds - Contemporary French Photography, 2012
2.2.2 Thoughts of Metabolism

Let us turn to the East, in 1960, the authorities of the government intend to hold World Design Conference in Tokyo, Kawazoe organized a preparatory committee meetings, which became the start of Metabolism group, Kisho Kurokawa joined the Metabolism in the same year.

Kisho Kurokawa said: for instance, was a very interesting text foe the Metabolists because it was extended twice over 150 years into an asymmetrical plan, with modules for the old part, the middle part and the last part. Very interesting. In our tradition, we have metabolic and cyclical ideas of growth. People always admired the Katsura Detached Palace: They worshipped it during the first phase, then when the second phase was completed they said that was perfect beauty, and then again after the second extension. At each stage, people said it was perfect beauty. We though it made an excellent text. From Kurokawa's words, we can see the influence of seamless continuation of Buddhist thought and Shinto Japanese tradition...In eastern thought, unlike the eternal European beauty, we could make moving architecture. This is where Metabolism related to Futurism. [13]

Figure 13: Photo of constructing process, Beyond Metabolism: The New Japanese Architecture

Figure 14: Kurokawa Kisyo, Nakagin Capsule Tower Building, Tokyo, 1972. Photo: Ohashi Tomio.

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[13] Rem Koolhaas, Hans Ulrich Obrist: Project Japan: Metabolism Talks ... ; [an Oral History by Koolhaas and Obrist Documenting the First Non-Western Avantgarde Movement in Architecture and the Last Moment that Architecture was a Public Rather Than a Private Affair]· Taschen
As an outstanding representative of Metabolism group, Witnessing the firebombing of Japan’s cities in World War II was also fundamental: it made devastatingly clear to Kurokawa the impermanence of architecture He pioneered key Metabolist concepts: Prefab, the capsule, cellular growth, biological metaphors for urban planning on a national scale. Nakagin Capsule Tower was reputed to be the world’s first structure that implemented the innovative idea of capsule architecture, encasing his vision of an architectural movement representative of organic growth and restructuring within buildings. (Fig 13/14)

Similarly, from the practice, Metabolism is continuation and development of functionalism, but based on a completely different context to the Western philosophy, the importance of "repeat" in the East thought, which also complement the entire modern architecture and urban planning approach. Extracted the thinking of Kurokawa’ Metabolism, can be found some component similar to Archigram - "capsule", meanwhile they also point out "cellular growth". Metabolism is actually quoted from the process of cell division and growth alternating deaths and rebirths of plants, but applied to design, in the image (Fig 15), the new city modular growth outward along the rivers and existing infrastructure of the city. The texture of new – existing city have a different but with intrinsically linked.

Figure 15: Master plan concept of Kasumigaura Lake City, draw by Kisho Kurokawa
2.3 Evolution of urban regeneration theory

Whether Archigram or Metabolism, after experienced a brilliant 1960s and 1970s, gradually no longer be filed. All those ideas were made by architects biased in favor of kind of heroism, hoping create some new Mega-structure cities or buildings. But people ignored or disregarded some promising theoretical draft of urban regeneration strategy inside the original concept.

After more than 50 years of development, the metropolis of developed countries began to face the recession crisis in 1980s, great amount of industrial areas had been abandoned. The clearance of slum and the consequent of large-scale urban reconstruction and strengthening land use of urban center once brought prosperity of the city, but was soon brought a lot of urban problems, exacerbated the tendency of city decentralized. Large-scale urban renewal can be said unsuccessful, and brought great destruction of the city.

In 1944, Karl Polanyi proposed: The production of urban space is related to three regimes of socio-economic integration, which are labelled as "redistribution", "marketing" and "reciprocity". If from this perspective, functionalist urban planning, in the final analysis, only through different functions, divide the city by the most efficient way into one rigid blocks. In fact, urban renewal proposal is also re-organize and redistribute the urban space, more than just the renovation of old buildings and old facility, more than just a urban planning strategy, more than only an economic behavior leading by real estate development, it also has profound social and humanistic connotations.

Those urban renewal project in the last 80s were just add "marketing" on the principle of "simple distribution", replace community interests, humane care and the social context by Commercial civilization. Now is no longer the "bulldozer revolution" era, the reconstruction of material needs can’t fill the psychological needs of "human", we not only need to renew old city, but also re-link our "bond between people ", it is a social problem. We need to pay attention to "redistribution", "marketing", we also need to be concerned about "reciprocity", which are cleverly hit the core of functionalism. The ideology of urbanism should never just treat "human" as a minor part which could be neglected attached to the machine of society, but also have to consider the "human" impact on the urban scale.

All the urban planning are actually re-sort the relationship in between the human, buildings and cities, and for "Prosthesis Replacement", connect with "redistribution", "marketing" and "reciprocity", can be interpreted as buildings as redistribution of all different program of the city, while city is a combination of all different functional "Prosthesis" by the "marketing" principle. Buildings and cities constitute an integral

"Prosthesis" meet the demand of human activities. (Fig 16)

Recalling the development process of modern urban planning, we can see the building and the city as a "Prosthesis" to maintain and fulfill the development of human society. However, due to the early 20th century, the development demand of the post-war circumstance, this kind of "artificial limbs" just to meet the "quantity" of demand. After decades of development, the initial social needs are met, the pioneer architects began to face shoddy of "prosthetic", start thinking about urban and architectural growth pattern in a new perspective (Metabolism) and use a new way to construct the chaining mode (Archigram). People - building -urban influence each other in the demands of development of contemporary society, buildings and cities can be considered as "Prosthesis" human society, to build a haven for human society. In the modern highly urbanized environment, facing the aging or failure of existing buildings or urban functions, we can use the "Prosthetic Replacement" approach, transform urban space in subtle, to provide the impetus for the development of human society.

Figure 16: Analogy diagram, draw by the author
3 Prosthetic Architecture

We expect that as the majority of people pass through the capsule and ask themselves these questions, the implications of each one after the other will be to suggest that the hallowed role of the ‘city’ will not remain quite so hallowed. It may soften, or dissolve. \(^{15}\)

With the expansion of area, cities slowly lose their shape texture. Facing those problems of society, facing the "cancers" in urban tissue, we hope to use this strategy - "Prosthetic Replacement" to provide new ideas for urban renewal:

1. Overall transformation of urban functional areas. As urban development, some areas lost its vitality, such as the abandon industrial area, the decline of the city center, etc. “Prosthetic Replacement” provides substitution for these areas by demolition and reconstruction, insert the new complex projects, re-gathered popularity.

2. Transformation of important spot. For those dilapidated public spot which were important before in the city or the community. "Prosthetic Replacement” rehabilitate the cohesion and attractiveness of the existing space for surrounding by preserving important elements of it.

3. Building renovation. For those existing buildings, consider the possible bias of the functional practicality, thus leading to restricted user experience, through transformation or addition,"Prosthetic Replacement" could increase flexible space of the building and improve the user experience.

As can be seen, “Prosthetic Replacement” is a set of regeneration strategy for the human society and human' "Prosthesis" – cities and buildings, based on complexity and people-oriented philosophy to solve several important issues of modern cities:

1. Scope. Prosthetic replacement does not limit the scope, but usually choose a subtle part to intervene the entire project. The goal is to regenerate the community through the replacement or regeneration of the un-applicable part of the urban fabric or the building, refused large-scale demolition.

2. Timeliness. Prosthetic replacement not pursue a radical improvement in the urban environment, but hope that through gradual evolution, the urban fabric and neighborhood relations can "reciprocity", adapt to each other, and Continuing to maintain the maximum the relationship, which has been established, between "human" and "environment".

3. Functionality. The aim of Prosthetic replacement is to remove the useless features, insert a new "Organ", the new part must be a composite programs, with a certain degree of humanistic care, capable to maintain neighborhood of the original project or recover the damage of the original urban fabric function.

\(^{15}\) Osakagram: special edition of Archigram for Expo '70
3.1 Overall transformation of urban functional areas - Housing units/Studios Cheval Noir

Figure 17: by L’Escaut + Atelier Gigogne

Architects: L’Escaut + Atelier Gigogne  
Location: Brussels, Belgium  
Project Year: 2010  
Project Area: 3300 sqm (Renovation), 752 sqm (New construction), 177 sqm (Outside space)

This project is located in Brussels, Belgium, which was part of Hallemans brewery’s abandoned factory, this part of the urban fabric with industrial restructuring has "necrosis", while the designer’s task was to renew and regenerate this building, to convert it into 35 housing units for artists.

Abandoned plant has significant architectural Figure 18: Draw by L’Escaut + Atelier Gigogne
characteristic of the 1900s, the building complex is located in the canal bank, in the period of industrial production, there were numerous products were produced and shipped out here, but now, how could be a reasonable transforming of the buildings, provide more beneficial social relations to the surrounding communities? (Fig 19)

Benefit from the client of this project, which belongs to "Fonds du Logement" of the Brussels-Capital Region, was founded in 1989, committed to improving the quality of urban social housing. The client choose relatively smaller quantities of rehabilitation programs. The insertion of the project in its urban environment can be summarized in two words: openness and visual presence. Since the site is situated between two public spaces (a street and a square), both have an entrance to the building which makes a visual connection between the two spaces. The combination of the old and the new building, both higher than the industrial halls along the Canal, can be seen from the right bank of the Canal and participates in the skyline of Molenbeek.

For the existing building, the project seeks to integrate as much as possible all the structural and architectural elements that are characteristic of the old brewery. On this
inheritance background, the necessary interventions for contemporary living will be clearly identifiable, creating a dialogue with the existing building, never imitating it. As for the new building, it will be clearly different from the old brewery, both by its contemporary architecture as by its zinc facade.

The building closing the site on its northern side is demolished to make place for a compact, tall construction, creating space and views in the courtyard. (Fig 21) The new construction shelters the elevator, which reaches all the units in the complex via footbridges over the courtyard. All distribution is outdoors, in direct relation to the court. To improve natural lighting, the upper part of new building is withdrawn from the property limit, to allow a façade with the benefits of northern light\textsuperscript{16}.

With the efforts of the owner and designer, this project became a space for artists and provided a work / life space, breaking the original spatial pattern of industrial area, as shown, the new studios can be considered "Prosthesis ", and the public space (Fig 22) can also be understood as "Prosthesis" which carrying the community relations, directly re-organize the cracked texture in between the canal and the city.

The project, just remove the unwanted function of the original industrial "production" area, and replace "Studies", while providing a "bond" relationship, re-establish the relationship of residents (people) and Canal (naturally), which had been cut off by functionalism and the modern industrialized. The new "Prosthesis" closely connect the original architectural and urban fabric, providing a harmonious relationship.

3.2 Transformation of important spot - Convent of Sant Frances

Figure 23: Photography by Jordi Surroca

Architects: David Closes
Location: Santpedor, Spain
Project Year: 2011
Project Area: 950.0 sqm

The intervention in the church of the convent of Sant Francesc, located in the Catalan town of Santpedor, was meant to convert the building into a cultural facility. (Fig 23) The two phases implemented have allowed the building to be put to use as an auditorium and multipurpose cultural space. It is expected that in the future, a third stage will allow the upper floors of the chapels (on the south side of the church) to be used as a historical archive.

Figure 24: Photography by David Closes
The convent complex of Sant Francesc was built in the eighteenth century by Franciscan priests. The convent, which includes the renovated Church, was built between 1721 and 1729. The complex was used as a convent until 1835. In 2000 the convent, by then in ruins, was demolished by the state. (Fig 24)

The renovation of the church occurred in 2003. The building had never been isolated, but an inextricable part of the whole convent complex. With the demolition of the convent, the church, which originally only had two walls, went on to have four.

The church, due to its very modest construction quality, was in ruins. It bears noting that the roof had sunk, the choir had disappeared, and the vaults of the nave and chapels had partially fallen. The church, from the outside, was only interesting from a historical perspective. The interior of the church, however, showed – despite its dilapidated state – remarkable spatial qualities. Thanks to the sinking roof and crumbling ceiling, the church was surprisingly enhanced by large inflows of natural light. The interior of the church, which originally received virtually no natural light whatsoever, took on a majestic air in the light. (Fig 25)

The premise of the project intervention was to maintain the size and spatial quality of the nave of the church as well as the important inputs of natural light. Attempting to maintain light inputs at different points led architects to propose different solutions: a large skylight on the north side of the apse, a skylight with views of the belfry from the inside of the nave, an open main chapel, and a cut in the roof right at the beginning of the nave to ensure light would reach the inside of the entrance wall. (Fig 26)
The renovation of the building has been developed with the goal of differentiating the new elements constructed (using contemporary construction systems and languages) from the original elements of this historical church. With the aim of preserving all aspects of the building's past, the intervention has not hidden traces, wounds or scars.

Figure 27: draw by David Closes

Another challenge was to maintain the unity and dimension of the nave of the church, even with new volumes for uses and requirements the church had never had before: stairs to climb to the upper floors, toilets, and equipment rooms. To preserve the sense of space and unity inside the church, these volumes have been located, in part, outside the building or have been placed inside in a way which maintains the vision of unified space, in both the nave and the main chapel. (Fig 27) The set of stairs and ramps built, apart from ensuring access to the upper floors of the church, also define a circular path that runs throughout the whole building, much like a museum’s.

The construction and the building methods used have sought to strengthen the church without deleting the signs of deterioration the building has suffered. The intervention has sought to preserve the building’s historic legacy by adding new values that enhance it and give this ancient convent a unique, contemporary form.¹⁷

The church originally belonged to center space of this small town, because the church was not just a place to hold religious services, but also a very important place for social activities, because of historical reasons, this church has dilapidated and was abandoned, and the various practices of architects, undoubtedly hopes to restore and strengthen the church’s social function, reconfirm the relationship between citizen. By replace and insert Prosthesis like new path/new entry of the church, bring new life back to the church, with "Prosthetic Replacement" strategy, a regeneration of a small building successfully update the city fabric.

3.3 Building renovation - Housing transformation, Saint-Nazaire, La Chesnaie

Architects: Lacaton & Vassal  
Location: Saint-Nazaire, France  
Project Area: 10282 sqm

This project is located in Saint-Nazaire, France. From the site plan and the facades we can see the urban planning and architectural features of the 70s, based on the massive development of modern housing in the context of providing apartments for all and an optimistic vision of the future. From the location of the existing district, can also be considered as a redistribution of city communities during the era of suburb developing movement. (Fig 29)

After almost 40 years, the district had no more attractiveness and is depreciated, towards the inhabitants of the city. The image is degraded. These situations, here as somewhere else, lead the authorities to demolish, to disintegrate, to drill, to spread, to
recompose, and to redraw the mass plans without cares for the existing.

But the architect are more positive: We do not like this method. We think that to demolish is an error, and that we can make differently. Because if we look at the district attentively, objectively, from the inside, we see qualities and capacities there:
. The inhabitants, the green spaces, the beautiful trees,
. The modernity,
. Solid constructions, rather well preserved,
. The beautiful views far away in front of,
. An urban situation close to the city center, well connected by transport
. A good management of the buildings by the owner, closer of the inhabitants, in order to solve their problems,
. The conviviality, and often people rooted, attached to their district, but bothered by the bad image which sticks on it.

All this has a value, a sufficient value to consider that the existing situation has assets and precious qualities, which are a consequent support in a radical and positive transformation.

The transformation of the building 3 rue des Ajoncs goes into this attitude, as an action of longer term, which will re-qualify durably housing and all the district [18]. From the statements, we can find that designers don’t agree with the general urban renewal strategy, they try to keep focused on the neighborhood, hoping to get the maximum effect by making minimal design.

The approach simply was to add prefabricated balcony. The balcony is the most living space, there is no fixed purpose, can increase ventilation and lighting physically, functionally can be semi-private/public. Add balcony is not simply increase the area, but it is an increase of interest in life, is a place for the scenery and for semi-outdoor activities.

After completed this transformation, the architect also consider to add more living space in both wings of the tower, using the original structure of the apartment, exploiting the ultra-low-volume ratio of the residential, and re-adding more population of this community, increasing more vitality. (Fig 31-32)

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In this project, when facing the aging residential building which couldn’t meet users’ demands, instead of taking a general demolition and reconstruction strategy, but simply add the "Prosthesis"- a balcony on to provide residents multi-element for their daily life, and carefully preserves the original community neighborhood. After the completion of the retrofitting balconies, architects also through clever way, according to the needs of the entire community, increasing the number of area of habitable apartment, these renovation projects step by step, showing persistent "Prosthetic Replacement" strategy. (Fig33)
3.4 Comparison of different proposals in Santa Coloma

Let's revisit Santa Coloma. During the wave of industrialization in the early 20th century, it began to develop based on the existing urban pattern, thus the urban space was limited by the spatial pattern of the original town. In the initial era of industrialization, it faced a lot of residential demand, the residential in Santa Coloma accumulated naturally to become high-density residential area. 

At the beginning of the 1970s, the entire Barcelona facing the pressure of industrial transformation and upgrading, a lot of factories moved out of the city, part of them slowly gathered in Santa Coloma periphery, and because relaxed immigration policy, different populations from Spain and around the world were increasingly choose to live in Santa Coloma, the demand for Santa Coloma residential space and urban space had been re-stimulation, the entire town had emerged a large number of new high-density apartment again, this period of new-district construction last longer, impact greater. These two separate urbanizations, form the current Santa Coloma's urban fabric. 

After several decades of development, Santa Coloma basically stay in a mature state, of course, this doesn't mean a reasonable urban spatial mature, but it is a description about the suitable for the development of urban land were already developed and exhausted, besides, the original urban communities have gradually form a mature neighborhood, which put forward a higher requirements for the architects' regeneration proposal.

In the existing urban fabric of Santa Coloma, can be easily found some of those "necrotic" areas. After screening, identifies several important spots in the town. For instance, in the residential area of Santa Rosa mountain, where with extreme high density but has some old abandoned houses which occupied valuable land, we consider to replace it with some cultural facilities. In Riu Sub district, although close to Río Besós, and has a community school, but lack of civil activities. We can strengthen ties between the school and the surrounding community by making micro operation of the school and the neighborhood. In Llati district, situated in a very high mountain slope and without sufficient street commercial, we consider by adding public space and commercial facilities on the hillside, enhance activity of the community. For Can Franquesa-Guindadera district, which is a poorer neighborhoods away from the of Santa Coloma center, we can insert "small market+ public house" in the neighborhood close to the public space of Río Besós' bank, stimulating atmosphere of the community.
Figure 34: Master plan of all potential regeneration spot, draw by the author
In the previous case study, we saw three cases of regeneration project, in these cases, the architects use subtle design, without destroy the social atmosphere but restore the original urban fabric. In Santa Coloma government website, we can see some urban renewal project which belong to the same period, coincidentally, one of the project selected the same site with one of our student. It located in the Santa Rosa Mountain, let's compare these two projects, and find out the similarities and differences. We can see the existing environment here (Fig 35).

Figure 35: Photos from Modificació puntual de PGM al sector 2 de l'eix bruc
Analysis the architects' proposal

This is a reconstruction project which had been approved in Santa Coloma. The area AMBIT1 is on the Santa Rosa Mountain, the original area was a rundown residential area, which like the surrounding blocks, had a very high building density, and because the site was located on the slopes, with the height difference of about one floor, the entire site was in one of the old areas which the residents gradually moved away and less attractive. (Fig 36)

The architects' propose is to demolish and reconstruct the ruined part of the existing buildings follow the topography, the new part are highly similar to those social housings in Barcelona Metropolis, whether the typology or the facades or functional distribution. [19] From independent perspective, this project can be considered as a highly sophisticated program, with shading facade, as well as a new public space which has rich feature and combined with the terrain, located next to the apartment. (Fig 37) All these functionalism design are very practical but boring.

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The approach here were to demolish the existing buildings and replace it with a new but more functional residential. If only consider those blocks nearby, it help to reduce the overall density indeed, and it also provides a new urban space. In certain extent, this approach also correspond the "Prosthetic Replacement" theory. But this "Prosthesis" - public residential, compare with the original function, it has no change, lack of possibility to transform in the future. This "Prosthesis" is only functional and marketing, but didn't really think about the demands of residents. Can be sure, even after the reconstruction, the new residential complex is still a lack of sufficiently attractive to residents and unable to unite the neighborhood. We can say that the architects lack of adequate prospective. (Fig 38)
Analysis the student’s proposal

Another project is from the 5th year student Esteve Torrent Fotnbona, the site he selected are located also in Santa Rosa, contains AMBIT-1. Different from the architects’ proposal, he concern more about the overall community relationship. Considering lack of associations and companies with adequate facilities involving in the performing arts in all the Santa Coloma, and for the neighborhood of Santa Rosa Mountain, with the commanding heights, it could be a best location for insert some cultural complex there to make attractions to gather more activities. For this reason his strategy is to demolish some abandoned buildings in those extreme-density blocks, and try to replace them by some new "Prosthesis", which can improve the civil life for the surrounding communities. (Fig 39)

In this proposal, the whole cultural facilities including schools, theaters, studios, libraries, etc. Unlike the general cultural complex, this cultural complex has distributed into the various funtions (Fig 40), thinking of the different elevation of the site, he forms several platforms, which provide the residents with different height of public space, so people can take the high
ground from all directions. The facilities are separated in three different parts: library, theater, dance school, which located in three blocks. The triangle-form of the facilities makes a short and direct routes between them, and create a cultural hub for the surrounding. Through adding "Prosthesis"- the new cultural complex, he successfully attract more functions and activities for Santa Rosa, which improve the bond of the neighborhood and increase the site's own value. (Fig 41)

Figure 41: Diagram of the triangle form of cultural facilities, draw by Esteve Torrent Fotnbona

From the ground-floor plan and the concept of the section, can be seen that the new "Prosthesis" are not only fit the topography of Santa Rosa, but also forming a subtle guiding role, allowing people to enjoy a rare public space on the platforms of second-floor or above. This time, the new "Prosthesis" meet the demand of filling the lacking cultural facilities in Santa Coloma in functionality, and more important, these public spaces can also provide plenty "humane care" for the neighborhood.

In both two proposals, neither the architects or Esteve Torrent are trying to demolish the existing dilapidated buildings, and insert new features, but the focus of the two proposals leads to huge differences. The architects just focus on taking place of those abandoned apartments with same residential. But for our student, through the analysis of the entire community, he try to introduce cultural facilities, make the whole neighborhood more value. Student's design approach by considering re-zoning and economic principles, providing a wealth of public space (which is most essential for old town) to attract residents to use, and to bond the city and residents on a new level.

Figure 42: Diagram of section, draw by Esteve Torrent Fotnbona
In the same site, but has an different impact on the surrounding community, compared with architects’ design, student’s design is more humane care, and better fit the demands of the neighborhood. In this case, the "terrain + neighborhood life" as an important part of the community, "insert" in urban fabric, which can even be extracted as a strategy. It gradually change the high density of surrounding, which will be more reasonable "redistribution", "marketing" and "reciprocity" for the urban space.

Figure 43: Ground floor plan, draw by Esteve Torrent Fotnbona
4 Conclusion

知行合一 - The approach is via research by design.\textsuperscript{20}

The famous Chinese philosopher Wang Mingyang has a very important philosophical theories, "知行合一", which can be translate as "combination of knowing and doing'. This philosophy can be understand in two ways, first, knowledge is the basis of practice; Second, the practice is the extension and supplement of knowing.

Modernist urban design theory after the deepening and development of Plug-in City and Metabolism in the 1960s and 1970s, has a great progress in ‘Humane Care’, and here we try to summarize this new strategy which deal with the contemporary demands of urbanism and city renewal as "Prosthetic Replacement". This approach not only requires sufficient and objective understanding of the site, but also have to be clear about the distribution and the function of the entire community and the real needs of the residents. Under this premise, through the replacement of those artifacts-buildings and urban space to promote the quality of the overall neighborhood.

After analyzing a number of cases, we can see for the ultra-high-density community in Santa Rosa mountain of Santa Coloma, architects and the student spontaneously choose to use "ProstheticReplacement" approach, in order to provide the region a new environment, and student's proposal is more forward-looking and sustainability.

After the initial validation of the feasibility of this hypothesis, our goal is to apply this theory to the whole Santa Coloma area, contemporary urban regeneration theory has generally serious dependency of the government, the will of community residents need to obey the majority owners or government investment. And because of the lazy-political-behavior of the government and the stakeholder’s demand of pursuing higher profits, the urban renewal projects often evolve to a simple reallocation of urban space, a commercial behavior. In fact, Prosthetic replacement can be understood as another level of Polls and democratic design.

Currently, urbanization problems encountered worldwide is that the entire city has been alienated, unlike anyone's memory. Cities and regions in the process of development, continuous demolition and re-construction, increasingly become a city without any sense of belongingness. Development of city detach the growth people's awareness, "people" in this city can only be a lonely "soul". We need to have a correct understanding of most important status quo of city, that is majority of the city has been successfully established, we need to do is re-activate those sleepy community, allowing residents to return to these communities, return to the "human society ".

\textsuperscript{20} Frederick Goodrich Henke: The Philosophy of Wang Yang-Ming Translated from the Chinese (Classic Reprint), Forgotten Books (June 18, 2012), ASIN: B008YE182
In the other end of urbanization, many slums appeared are considered as a "cancer" of city, as the slums in Rio de Janeiro, Brazil, and as city-villages in my homeland-Guangzhou. The expansion of urban annexed the surrounding towns and formed enclosed space, should we bulldozing the whole "slum" like what Hong Kong did for "Kowloon Walled City" (Fig 43) or by other ways to solve it?

"Prosthetic replacement" is not a perfect theory, but I hope it can offer a more humane care and more economic solutions for the current problems of the development of cities.
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