

Article

The Architecture of Metabolism. Inventing a Culture of Resilience

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Abstract: The Metabolist movement, with its radical and visionary urban and architectural schemes, drew the attention of an international architecture community to Japan in the 1960s and 1970s. Seen from a contemporary perspective, the movement's foremost concern was cultural resilience as a notion of national identity. Metabolism responded to the human and environmental catastrophe that followed the atomic bombing of Japan and vulnerability to natural disasters such as earthquakes, with architecture envisioning the complete transformation of Japan as a *system* of political, social, and physical structures into resilient spatial and organizational patterns adaptable to change. Projecting a utopia of resilience, Metabolism employed biological metaphors and recalled technoscientific images which, together with the vernacular, evoked the notion of a *genetic* architecture able to be recreated again and again. A specific concern was to mediate between an urbanism of large, technical and institutional infrastructures and the freedom of the individual. My aim is to critically examine the notion of sustainable architecture by rereading Metabolist theories and products, such as terms, models, projects, and buildings. For a better understanding of the present discourse, this text searches for a possible history of sustainable architecture, a subject mostly presented ahistorically.

Keywords: metabolism; cultural resilience; systemic change; genetic architecture, national identity

1. Introduction

“Sustainable architecture,” as a response to environmental crisis, has become an overly used term in recent decades as a result of its broad applicability but typically partial application. Here, the term is reduced to its technical capacities, which can easily be translated to specific products while shedding its undesired regulative connotations. The term is mainly used to refer to recent ecotechnical building solutions, new materials, and ecolabeling, and rarely to social and cultural settings and practices. Despite the emergence of new building regulations, sustainable architecture is seldom discussed as a possible driver of greater systemic change, which would have to involve a radical rethinking of mainstream economics, consumption patterns, and sustainable life styles. This article explores the case of Metabolism in Japan in the 1960s and 1970s, which drew the attention of the international architecture community with its radical and visionary urban and architectural schemes targeting a sustainable society. Metabolism’s foremost agenda, seen from a contemporary perspective, addressed a concern for cultural resilience as a notion of national identity. It responded to the human and environmental catastrophe of the atomic bombing of Japan and the country’s vulnerability to natural disasters such as earthquakes and tsunamis. Its architectures envisioned a complete transformation of Japan as a system of political, social, and physical structures into resilient spatial and organizational patterns adaptable to change.

Envisioning a utopia of resilience, Metabolist architects employed biological metaphors, recalled technoscientific images, and evoked the notion of a recreatable *genetic* architecture in vernacular forms. They strove to mediate between an urbanism of large technical, and institutional infrastructures and the individual freedom with an architecture of customized cells and adaptable temporary configurations of dwellings, which could expand and shrink according to need.

One of the latest engagements with Metabolism is, *Project Japan: Metabolism Talks...* by Rem Koolhaas and Hans Ulrich Obrist (2009). It is an extensive compendium of interviews with the protagonists of the movement, by then in their seventies and eighties, previously unknown archive material, and photographs documenting the making of the book and revisiting the architecture. By unearthing the Metabolists’ theoretical and political stances—Marxist influences and the movement’s close relationship to a strong state and planning administration—and showing the protagonists’ studious research, the authors attempt to understand the movement’s revolutionary content, the success of Metabolist ideas in the 1960s, and its disappearance 25 years later “in the bonfire of neoliberalism [1].” For Koolhaas and Obrist, the Metabolist movement offers a significant alternative example for a current debate at a time when the market is dissolving local cultures and collegial connections. The Metabolists took on the project of their country, to be transformed with new tools derived from its own traditions. The group of widely diverse individuals joined in a strategic alliance and mobilized a vast range of other disciplines.

I claim that revisiting the Metabolist aesthetic and political strategies unearths a historical strand of sustainable architecture and that Metabolist schemes reveal a range of political issues concerning authority and citizen agency that remain highly relevant in a debate about sustainable architecture. My aim is to critically examine the notion of sustainable architecture through the rereading of Metabolist theories and products such as terms, models, projects and buildings. Central questions are: How were sustainable future architectures presented in the Metabolist schemes? What kind of life and culture was

envisioned? What notions of organizational patterns were brought forward? And how did they translate to the built environment and the use of space and infrastructure? To better understand the present discourse, this text searches for a possible history of sustainable architecture, a subject mostly presented ahistorically.

2. Resilient Urbanism

The concept of resilience first emerged in the 1970s in relation to ecosystems. Recently, it has become a key concept in contemporary urbanism in the context of environmental, economic, and social crisis. However, resilience is mostly addressed in environmental and technical terms and often disregards social and cultural implications [2]. Resilience deals with the ability of systems to adapt under change; thus, it also offers potential to rethink assumptions and build new systems [3]. Although the term was not in use when Metabolism was introduced to the international design community at the World Design Conference in Tokyo, 1960, the conceptual take of the Metabolists is that of resilient urbanism in technical, socio-ecological, and cultural terms. A resilient society implies here its systematic spatial reorganization in order to achieve a balance between change and preservation as expressed in the design of different life cycles of infrastructures and individual cells, and of permanent and flexible parts of the urban system. The Metabolists approached resilience less as an ecosystemic response to change, but especially in terms of the capacity of societies' to adapt in times of crisis.

Beside its influence on the Japanese architectural community, Metabolism had a decisive impact on Western architectural and urban discourse [4]. Conceived for the World Design Conference in Tokyo, the first international event Japan ever staged, it introduced new urban issues and turned the World Design Conference into a forum where cultural differences were discussed in relation to the Western debate. Going beyond a search for Japanese cultural identity distinct from Western models, however, Metabolism strove for new models, terms, and images that could be applied more generally, and reflected a broader shift, not limited to Japan, marked by the end of the Congrès internationaux d'architecture moderne (CIAM). With biological language, Metabolists connected traditional models with ahistoric, universally applicable, and structuralist spatial conceptions. They thus created a base for international communication. At the same time, their rhetoric of nature and the organic fulfilled an accepted Western stereotype of Japan that can be noted earlier in Frank Lloyd Wright's and Bruno Taut's organic projections. With Metabolism, the specifically Japanese re-emerges on modern terms. The network becomes the most central urban issue – an organizational form, but also a symbolic image presenting the city and the region simultaneously as structure, organization, and flow, a coherent whole in constant change and.

3. Envisioning Reorganization

The architectural historian Ryuichi Hamaguchi divides post-war modernism in Japan into two separate decades. After the war, all the main cities were in ruins, particularly Hiroshima and Nagasaki, 'where the atomic bomb had barely left a blade of grass.' Not much was constructed during these years, which were instead characterized by discussions and theoretical exchange. Early rationalism and functionalism as guiding theories were taken up again, and only when the economy started to flourish

in 1950/51, largely due to the beginning of the Korean War, did private building activities develop. Around the middle of the 1950s, an architectural discourse shifted from functionalism to what Hamaguchi calls ‘aesthetic consciousness’. This new strand, enabled by the progress in architectural material technologies and building techniques, he sees as a transitional period, characterized by a search for a variety of creative languages, which can be related to the debates within CIAM at the time. Around 1960, architects started to take part in a broader discussion on cities and urbanities in Japan, which formerly had been only an undercurrent of the architectural discourse. Proposals for urban redevelopment ‘from a plastic approach’ began to appear, though there was no possibility for them to be actually realized at the time. Kenzo Tange’s Metabolist proposal for Tokyo Bay represents one of the first examples of this both theoretical and utopian approach to urbanism in Japan [5].

Japan experienced an economic boom after its entry in the Korean War on the side of the United States, which turned Japan from an occupied country into an allied partner. Despite its enormous economic growth, by the end of the 1950s Japan was still struggling with the task of housing millions of people left homeless in its cities [6]. The consciousness of having lost the war, plus the experience of the devastation of two atomic blasts over Hiroshima and Nagasaki on August 6 and 9 in 1945, brought with it a deep concern with having lost touch with one’s own culture and the desire for the reconstruction of a national identity [7]. Due to dynamic population growth, from 1955 to 1964 the total population of the Tokyo metropolitan region rose from 13.28 to 18.86 million [8], and there was great pressure on land connected with Japan’s specific topographical situation, which allows only a fraction of its area to be used for agriculture and building [9]. The Metabolism movement can be understood in the context of this background.

The World Design Conference in Tokyo in 1960, one year after the official dissolution of CIAM, can be seen as an attempt to continue the culture of urban debate on Asian grounds. The conference was significant for the young nation of Japan in respect to the immobility of most Japanese under the American occupation – until 1969 restrictions limited overseas travel to only very few privileged people [10]. The conference thus represented a rare opportunity for many architects and designers to communicate directly with their foreign colleagues.

Tange was a member of the committee for the World Design Conference, together with the graphic designer Yasuka Kamekura, the industrial designer Sori Yanagi, the painter Taro Okamoto, the architectural critic Ryuichi Hamaguchi, and the architect Kiyosi Seike. Junzo Sakakura was the chairman of the World Design Conference and Takashi Asada the general secretary, both were architects. The group formulated their agenda in examining the nature of design, art and architecture in a continuously rapidly changing society.

Tange, who was well connected internationally through CIAM, had just returned from a guest professorship at MIT in Boston, and he invited architects from Europe, USA, and Asia. The event was attended by several members of Team 10, while no one from the core of the former CIAM group took part. We can take this event as both a marker for a generation shift in general and for a growing self-consciousness of a non-western architecture and design community in an Asian context. For the occasion of the conference, Tange presented a group of young architects who came together under the name of the Metabolists. The key figures of this group were the architects Kiyonori Kikutake, Noriaki (later Kisho) Kurokawa, Fumihiko Maki, together with Masato Ohtaka, and the architectural critic Noboru Kawazoe. The architect Arata Isozaki, who was a former student of Tange, and worked in his

office like Kurokawa, can be regarded as close to the Metabolists, at the time [11]. The movement was especially formed for the event. The scope of Metabolism was the encounter between urbanism and architectural design, extending from an understanding of the individual cell towards the organization of a larger cluster and network communities.

The World Design Conference was more or less the only public occasion where the protagonists came together as a group under the label of Metabolism. The manifesto *Metabolism 1960: Proposals for a New Urbanism*, prepared for the conference, contained essays and visionary projects, but it was the drawings of Kikutake, which were most visible, filling 35 of the 87 pages [12]. Kikutake's project *Marine City* (1959) was selected for the exhibition *Visionary Architecture* at the Museum of Modern Art in New York the same year.

The projects shown were theoretical designs dealing with the issue of accommodating a population growing into the millions, exploring sites that had not been considered before like the ocean or the sky. The publication also included an essay by Noboru Kawazoe, the theoretical head of the group, where he refers to the nuclear catastrophe and promotes 'the unity of man and nature and the evolution of human society into a peaceful state of unity, like a single living organism.' He closes with: 'Our constructive age . . . will be the age of high metabolism. Order is born from chaos, and chaos from order. Extinction is the same as creation We hope to create something which, even in destruction will cause subsequent new creation. This something must be found in the form of the cities we were going to make – cities constantly undergoing the process of metabolism [13].'

Retrospectively, The World Design Conference became known for its discussions on urbanism, which continued the late CIAM debates but with an emphasis on Japanese topics, such as rapid population growth and the development of megacities. The launching of the Metabolist manifesto at the World Design Conference is widely seen as the presentation of the concept megastructure 'as a unique Japanese contribution to modern architecture, marking the maturity of Japanese architecture and its independence of other cultures,' and of "neo-colonialist" views of what it ought to be,' according to Reyner Banham [14]. The word 'megastructure' itself appeared for the first time in print in Fumihiko Maki's *Collective Form* [15].

The Metabolists developed their organic schemes of network cities as a response to actual issues. One of the main problems was discerned as the lack of comprehensive infrastructure in Japan, which was an obstacle to urban physical and economic growth. Increased mobility was propounded as a matter of individual freedom. The urban design proposals by the different members of the Metabolist circle that included Tange dealt with topological questions [16]. They did not envision infill of streets and new public transportation systems to solve this task, but they worked out entirely new forms of total organizations that went beyond the existing city. The focus was set on unifying all urban aspects into one big organism: all sorts of flows were enabled by a basic three-dimensional skeleton of long-term service structures, which held containers for various functional units of different life-cycles. These megastructures branched in a hierarchy from large traffic arteries and transportation lanes down to streets on the pedestrian level. They connected public and commercial facilities with housing, which was being organized on terraces of artificial land where the inhabitants could build their houses according to their taste. In this total scheme, everything was regarded as part of a flow, in a constant process of becoming and declining. Through the reorganization of space the entire landscape of planning and architecture was meant to change.

The Metabolist proposals were greeted with great interest. At a time when the profession of town planning (in the Western sense) didn't yet exist in Japan, they responded to an urban situation characterized by a 'lack of infrastructure' and an 'absence of city planning,' with 'the will to plan,' as the editor of the *Architectural Review* J. M. Richards pointed out [17]. The Metabolists' 'researches challenge the whole conservative concept of city life on which the recent *laisser-faire* urbanization has been based. They try to face realistically the problems this process is throwing up and see the opportunity that lies in them. . . . [S]ome of the best architects openly and actively accept their profession's wide social responsibilities [18].' In this statement, Richards addressed not only the seeming absence of planning, but also the lack of public area in the city. The city of Tokyo was pulverized into millions of small private plots, which made comprehensive planning a difficult task. As an example, in the case of the planning of twenty-three new city highways in Tokyo for the 1964 Olympics, only some of them were half built in 1962, some not yet begun; the chief cause of the delay being the number of property owners who were reluctant to move. Six thousand houses or shops stood in the way of the new roads, and in 1961 only the owners of 1.6 thousand had signed evacuation contracts. In this light, the political goal of Metabolist urban planning could only have meant the erasure of private land ownership and its total re-organization. The issue of 'freedom' however was frequently addressed in their projects, now focusing on the element of the individual cell, or the capsule, and on the new possibilities for mobility and change.

4. Metabolism in Architecture

Metabolism is a biological term, which describes the anabolic and catabolic processes of a living body. The expression occurred already in the urban sociologist Ernest Burgess' article 'The Growth of Cities', first published in 1925 in the book, *The City*. Burgess used the term 'social metabolism' to elucidate the process of growth and transformation of cities. Revolutionary in Burgess' concept at this time was the view of cities' growth as 'normal' and not as the reason for social demise, as in the rhetoric of the Garden City promoters [19]. Because a city behaved like an organism it grew and changed, and thus underwent naturally periods of disintegration and reintegration.

Beside its biological connotation, the term was often brought up in the context of Buddhist values, especially by Western commentators, stressing the pattern of death and rebirth, as for example in a special Japan number of *AD* in 1964, edited by Günter Nitschke. 'Metabolism' can be translated to the Japanese expression *Shinchintaisha*, meaning renewal or regeneration, closely related to the Buddhist concepts of transmigration and reincarnation, as Cherie Wendelken has pointed out [20]. In this way, the Japanese adaptation of the metaphor 'Metabolism' carries both a universal scientific connotation as well as a Japanese spiritual one.

At the heart of Metabolist thinking is the reorganization of the relationship between society and the individual. Comprehensive planning would make people free [21]. The dissolution of the city into 'cells' corresponded to the breaking away from patriarchal family structures and the strengthening of the position of the individual in Japanese society. In their visionary proposals, Tange and the Metabolists took the specificity of the Japanese social and cultural context as their point of departure, but they also stressed that the emerging models were of universal validity and applicability. As an indigenous model for the impermanence of architecture and a trigger for Metabolist principles served

the national monument of the Ise shrine, reconstructed every 20 years since the 7th century in the Shinto tradition. Another historical model became the 16th century Katsura Detached Palace, which was extended twice over 150 years into an asymmetrical plan, as exemplifying a Japanese tradition of metabolic and cyclical ideas of growth [22].

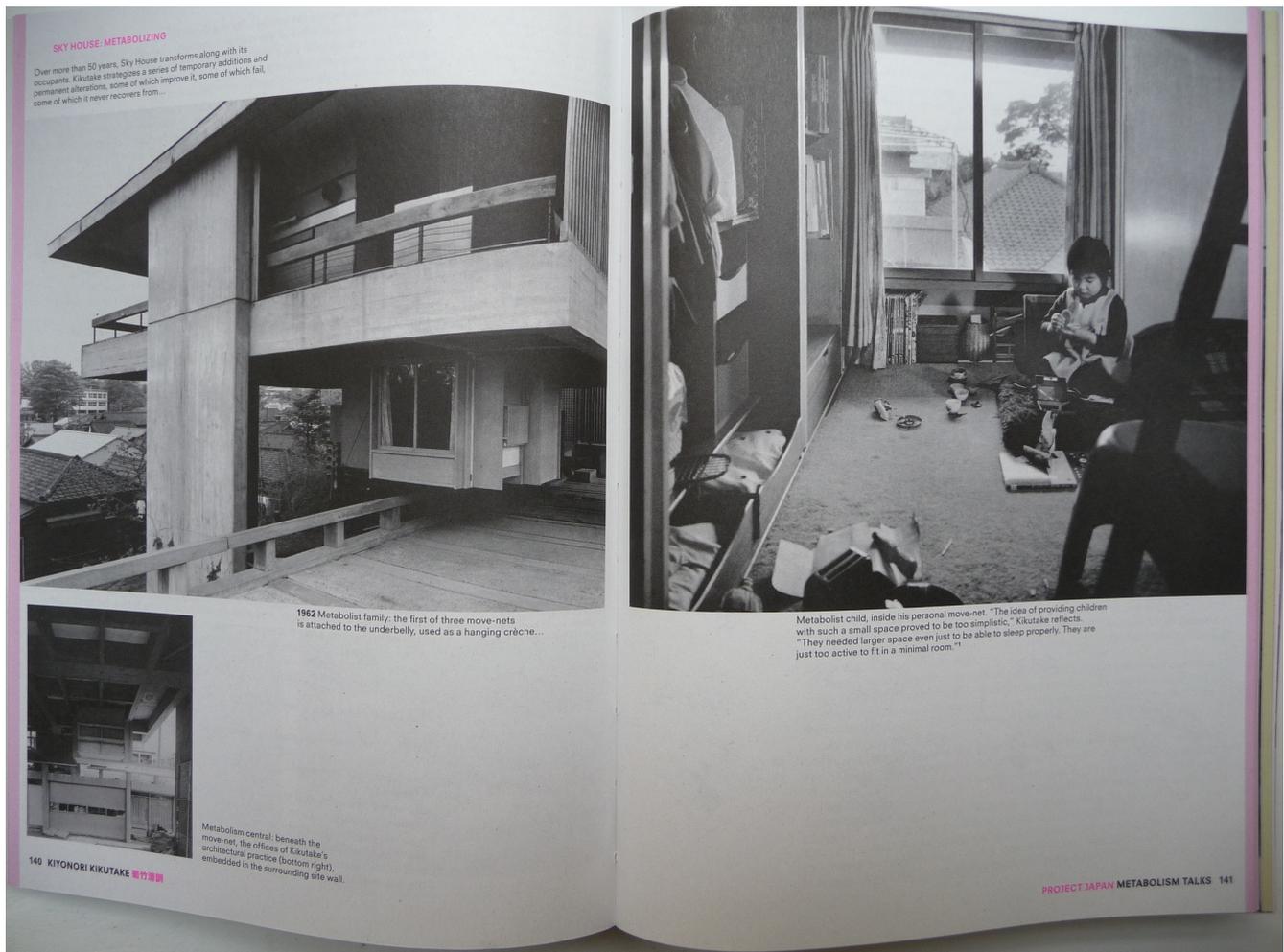
Finally, Metabolism was also an expression of critique. The socio-political area is accused of failing to adapt to the rapid techno-economic development. Tange and the Metabolists criticized the entire Japanese planning system for its non-transparent forms of power. A new language was sought that would be powerful enough to establish 'urbanism', a field that hardly existed in Japan at the time in the Western sense. Until then, post-war city planning in Japan had been difficult, Tange said, because 'cities did not redevelop as a result of urban plans.' Instead, the redevelopment process was 'a product of the power of relationships' reflected in 'layer upon layer of political, economic and social realities behind these burned cities [23].' Tange criticized the pragmatic spirit of the early years of reconstruction. Even before WWII, most attempts to implement comprehensible planning strategies in Japan seem to have failed.

Metabolism created an organic concept for imagining the regeneration of Japanese culture after the destructions and severe environmental devastations of fire bombings and two atomic blasts. It proposed the acceptance of Japan as ground zero - a site of rebirth where culture would be regenerated from an underlying spirit of 'Japan-ness.' With this the Metabolists suggested an organic link between the individual and a fundamental cultural pattern [24].

5. Structural and Symbolic Reorganization

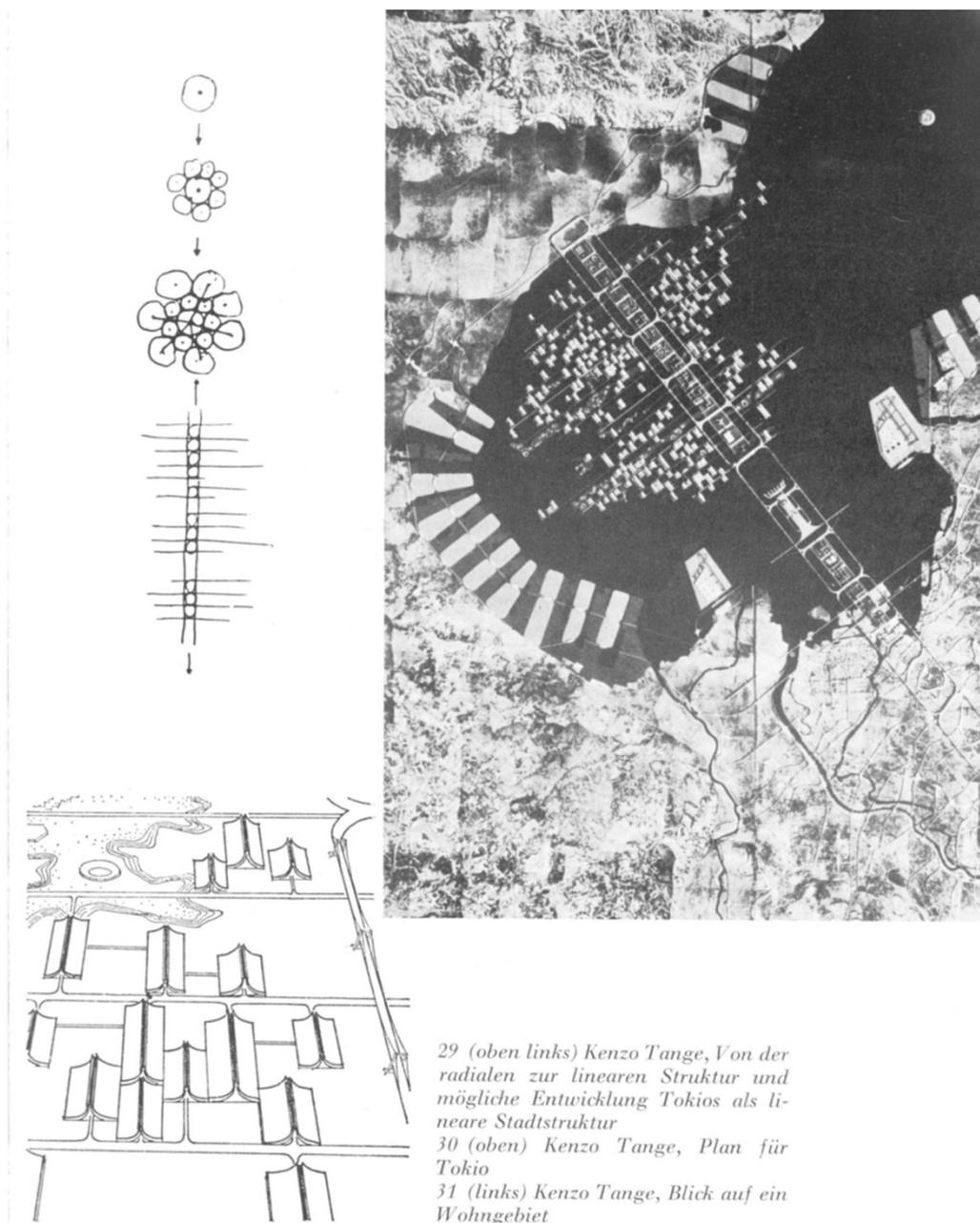
Kiyonori Kikutake's own house - the *Sky House* of 1958 - served as the prototype for the 'cell', staging Metabolist principles. The *Sky House* consists of only one open square room, floating above ground on piers containing plumbing compartments appended on two sides of the building indicating expandability. It suggests possible expansions extending from the main cell by what Kikutake called 'move-nets', which would be plugged in beneath the floor to provide bathrooms, storage space, and removable children's rooms for an expanding and contracting family. The design is extraordinary in that it follows the logic of structuralist or system thinking, while adapting the organizational principles of the traditional Japanese house with its open plan, as well as its symbolic imagery expressed in the form of the roof [25]. The *Sky House* can be seen as a first built prototype for the following mostly more or less utopian or visionary Metabolist proposals that stayed on a discursive level.

Figure 1. Kiyonori Kikutake, Sky House (1958) in Koolhaas and Obrist (2009), pp. 140-41.



Kikutake's Metabolist project, *Ideas for the Reorganization of Tokyo City*, had already been presented at the last CIAM meeting in Otterlo in 1959 through Kenzo Tange. In consideration of the lack of space and the high land prices in Tokyo, Kikutake proposed here an infill of towers on the edge of Tokyo Bay, carrying exchangeable capsules of domestic units. Kikutake's high-rise projects for a Tower City and a Marine City (literally 'City on the Sea'), previously published in the journal *Kokusai Kenchiku* (*International Architecture*), were presented again as parts of a comprehensive project entitled *Ocean City* at the World Design Conference in 1960, and were included in the publication *Metabolism 1960: A Proposal for a New Urbanism*. It was the only Metabolist project that had been chosen for the *Visionary Architecture* exhibition in the MoMA in New York in the same year. Nevertheless, the most famous Metabolist project became the proposal for *Tokyo Bay* by Kenzo Tange. Kisho Kurokawa and Arata Isozaki collaborated on the project with Tange, among others who were not part of the inner Metabolist circle [26]. This scheme basically rejected as dysfunctional the plan proposed for Tokyo in 1956 on the model of Abercrombie and Forshaw's plan for Greater London, which foresaw a central core and the city expanding according to radial-concentric pattern.

Figure 2. Kenzo Tange, Tokyo Bay (1960) with Kisho Kurokawa and Arata Isozaki, reproduced from Schumpp (1972), p. 111



Tange's organization consisted of a linear spine-like element made of layered systems of intersecting infrastructural cycles on different scales, which extended from Tokyo center, eighteen kilometers across Tokyo Bay, in the form of a 'civic axis' as he called it. Tange had conducted several city plans over the post-war years in the spirit of reconstruction. However, the background to this plan was that through rapid industrialization, Tokyo city was at the time already on the verge of having ten million inhabitants, experiencing an immense physical investment, and expecting a tremendous alteration of the cityscape. This meant the organization of new communication systems was a significant challenge. They would become, in fact, the most central element in a growing metropolis where mobility was one of the basic individual necessities. Tange would discuss communication

henceforth in terms of a characteristic of an open society and as a means for change. As a consequence, Tange thought, it was essential to reflect on the nature of urban structures that would permit growth and change. Biological processes became the overall metaphor for managing the new development. In Tange's words:

'In terms of the growth process of organic bodies, at an early stage, an egg has a central core. Ultimately, however, this core develops into a spine, which breaks the shell making possible a shift to a new growth phase. In vertebrates, a spine is essential for the transmission of information through the nervous system from the brain to the spine. When applying this line of thought to Tokyo, it becomes obvious that the clinging to the concept of a civic center makes further development hopeless. As a model we were exploring what happened when we extended a spine from the civic center across Tokyo Bay. I called this a civic axis. In addition, rising land prices in Tokyo made new developments over the sea feasible [27].'

In its visionary intention, the Tokyo plan is comparable to Le Corbusier's 1922 *Ville Contemporaine* for Paris, a city of three million inhabitants, in terms of its symbolic forms, and to Hilberseimer's *Groszstadt Architektur* of 1927 in its organizational focus [28]. Hilberseimer had already put forward an urban scheme that envisioned communication in three dimensions. He had reduced urban space to a grid structure that would house the 'cells', an organizational system that he called organic. Worth mentioning is also Le Corbusier's plan for Algiers of 1931, which Banham calls the first proposal of an urban architecture based on megastructural principles. Its massive curved linear structure, 'a super-highway,' served as the container, 'like a giant bookcase of reinforced concrete,' for all housing, commercial and public facilities, including infrastructures such as a highway on its roof. Banham recognized the project 'as a true ancestor of megastructure because of its seemingly unlimited length and the clear distinction between the main permanent structure and the infill housing adapted to individual needs,' cultural expressions and individual tastes [29].

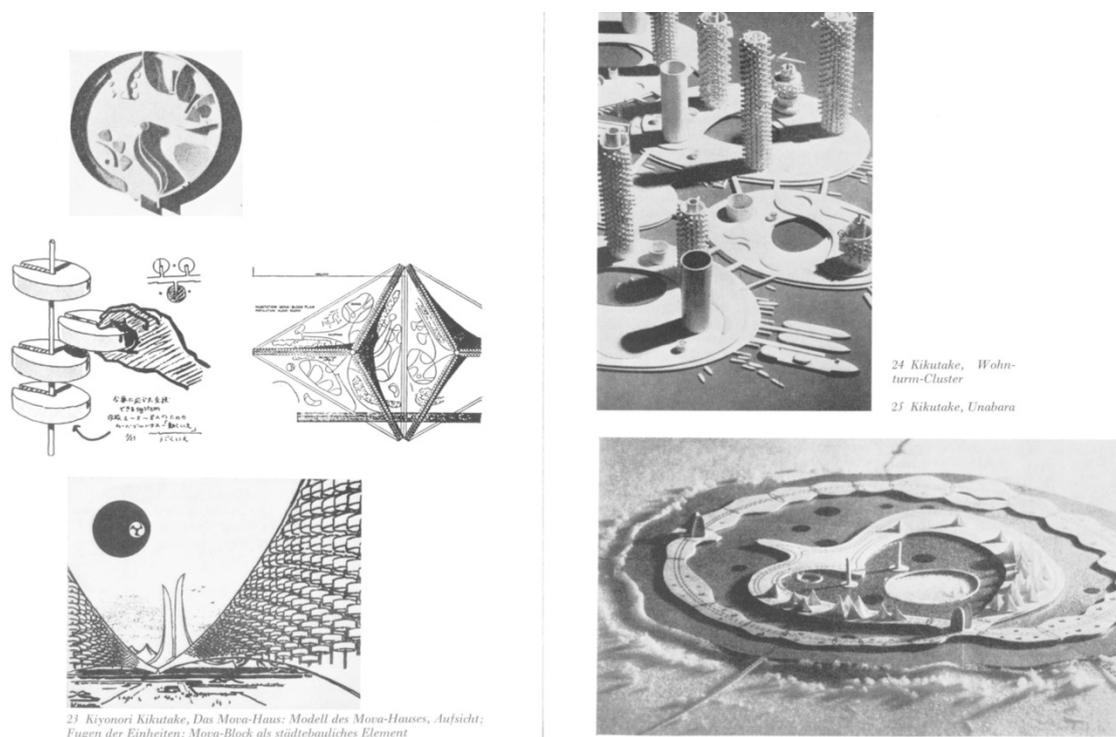
Tange's plan addressed a cyclic transportation system on which cars could run without intersections. The system would support a flow of traffic for between two and seven million people every day. On each unit of two square kilometers would stand a high-rise building complex symbolizing entrance and exit, or interchange with a three-dimensional communication network and underground parking. Flanking these axes would be housing for five million people on man-made islands, each megastructure a little city or community of its own. Megastructure meant here a superstructure, consisting of terraces on which the inhabitants could erect private houses according to their own tastes while the artificial land stayed in public hand. 'Private space where man lives and works in the air, and common space on the ground level where modern society unfolds freely its own interactions are separated [30].' The entire looping infrastructural system was hierarchically arranged from highways down to the speed of the pedestrian. Hereby Tange saw a natural order emerging, which connected an urban system with an architectural system. The figure of the cycle occurred not only as an infrastructural solution, but was also present as an underlying economic principle as well as symbolic form. The plan rejected the traditional form of the static master plan and envisioned an 'organic', more dynamic system that was able to absorb programmatic changes and to respond to economic and social ones, a scheme that could grow and change. The main form, the spine, accommodated different elements with various metabolic life cycles. The scheme was based on the same principles as Kiyonori Kikutake's *Ocean City* project, which Tange had presented in Otterlo as

follows:

‘The structural elements are thought of as a tree – a permanent element, with the dwelling units as leaves – temporary elements, which fall down or are renewed according to the needs of the movement. The building can grow within this structure and die and grow again – but the structure remains [31].’

The tree represents not only a specific hierarchical, spatial and temporal organizational structure, but can also be read as a symbolic figure referring to life itself, and through its possession of a trunk, roots, branches, and leaves to change and rhythm, as a historical and social marker, and as a habitat for other life forms.

Figure 3. Kiyonori Kikutake’s ocean and marina projects, reproduced from Schumppe (1972), p. 111.



According to Nitschke’s analysis in *AD*, the plan mirrored a process that he saw as already on its way: ‘the awareness that our large-scale constructions, like a communications infrastructure, increase in scale (in respect to space and time); while our small-scale structures, like our individual dwelling houses and consumer goods (that is to say our element structures) decrease in scale in respect of a growing “throw-away culture”.’ He continues, ‘[t]hese extremes of durations in parts of an urban cluster, the long-term large-scale structures, which curtail individual freedom more and more, and the short-term element structures, which are expression of freer individual choice and of contemporary susceptibility to novelty, are brought in harmony in the triangle-shaped dwelling structures. The terraced concrete levels of these structures form an artificial ground and floor provided by communal investment upon which individual investment takes place in form of private constructions and consequently reflects rapid changes in taste [32].’

Tange stated that he had been giving thought to this plan since the MIT studio work where he had

assigned his fifth-year students to design a community for 25,000 on Boston Bay. Various ideas including megastructures were thus already under development at MIT. After his return to Japan, Tange carried out some research work on this issue together with members of his studio. The result was presented in an hour-long television broadcast by the Japan Broadcasting Corporation (NHK) in late 1960. The same material appeared in magazines and architectural journals in 1961 and evoked considerable response.

The scheme of Tokyo Bay gained much international attention and triggered discussions on city planning at large. However, it was also widely criticized for its technological determinism and its monumentality. The danger of the main infrastructure becoming obsolete itself, although allowing infill and change, was even debated by the Metabolists themselves. Fumihiko Maki had reflected on Group Form, already in an article in the Metabolist manifesto, as the solution for a ‘system that permits greatest efficiency and flexibility, with the smallest organizational structure [33].’ Members of Team 10, namely Peter Smithson, also objected to the plan in pointing to the ‘tertiary’ activities: communications that became overtly determining for the inhabitants of the megalopolis, which he thought were doomed to fail, economically as well as politically. He saw the ‘interlocking’ of all functions as a totalitarian concept, an organization that tended to crawl into and determine people’s individual lives. He called the plan centralized, absolutist and authoritarian on all levels – in its basic thinking, its organization, and its imagery – and instead promoted a non-interlocking of activities and a politics of decentralization for the deliberate dispersal of ‘value-creating’ centers. ‘With regard of [sic] the general planning concepts which are brought forward, I have little to criticize – which is hardly surprising considering the closeness of the theoretical position of Tange and myself,’ Smithson stated. He criticized, however, the extreme focus on infrastructures suggesting the continuing ‘heaping up’ of the population as a natural thing. In more detail he stated: ‘a linear transportation system . . . leads to a terrific number of lanes being necessary, each filled to capacity, with a probable redundancy of lane capacity in the feeders. . . .’ However, he admits that it was ingenious because it produced a traffic flow that never stops, even though it necessitated going around right-angles and also created longer journeys. Smithson judged: ‘The pyramidal housing units over-the-water are formally the finest things in the scheme, but unhappily as in thousand student projects (from the time of Le Corbusier’s Algier project onwards), the romance of the idea of ‘each man building his own house on man-made platforms, stands unsupported by a demonstration of how it is to be done.’ He concluded: ‘The project as architecture is at its strongest when it is closest to the traditional Japanese vocabulary,’ which is articulated for Smithson in the ‘straight lines and a soft curve defining the major forms.’ He praised the formal brilliance of the scheme and its graphic representation, as well as ‘the boldness of the attack,’ which had ‘expanded the frontiers of search for the form of the metropolis more than would have believed possible in a single study [34].’

Not only Western commentaries, but also the Japanese architectural press reacted for the most part skeptically to Tange’s project. Ryuichi Hamaguchi was concerned about the lack of professional expertise in terms of technology, construction, economy, and politics, in favor of ‘form’. Above all, he questioned the role of the architect in city planning when he claimed:

In my opinion, when the architect functions as an architect, he should be not the conductor of the orchestra, but one of the first violinists. . . . He should take his place among the other players – the construction engineer, the road expert, and others whose work is necessary to the construction of a

city. The difficulty with the Tange Team is that it is an orchestra of first violinists [35].’

6. Megastructure versus Group Form

In 1964, Fumihiko Maki publishes his research on ‘group form’ in the publication *Investigations in Collective Form*, which contains an article written together with Masato Othaka and originally printed in the Metabolist manifesto, and an investigation on ‘Linkage’ written in collaboration with Jerry Goldberg [36]. This spatial concept differs from the concept megastructure. In short, Maki distinguished three different ‘collective forms’, the compositional (the modernist space), the megastructure (Tange’s Tokyo Bay project, for example), and the group form. The group form differed from the compositional in its way of relating the elements to the totality. Elements can be added and taken away from the cluster without destroying the balance of the whole composition as in a modernist ensemble. This consisted of a fixed number of certain elements according to the master plan principle, where the design process was clearly divided into a functional planning phase followed by the phase of erecting individual buildings. The megastructure, on the other hand, was an open structure without a fixed concept of composition denominating the infrastructure, a man-made landscape, upon which all functions and elements of society grew and thrived. Here a ‘master system’ replaced the master plan. Maki saw the task of the master system in its adaptability to change to swing into place ‘in ever new stages of formal and structural equilibrium,’ preserving at the same time ‘visual integrity’. Group form was rather based on a ‘group program’ than on a determined plan, resulting in non-hierarchical collective forms, in contrast to the master plan and the master system. The layout of a group form always stayed dynamic and open-ended. Maki described its cluster-like arrangements with the words ‘it is not necessary to limit composition to inorganic, geometrical, structural, or mechanical patterns. Rather group form is an intuitive, visual expression of the energy and sweat of millions of people in our cities, of the breath of live and the poetry of living [37].’ Koolhaas, in his recent publication, has compared group form to a social process instead of a technological proposal, whereby group form ‘surrenders to change rather than imposing mastery, and that asserts interdependence among disparate, even unfinished elements, rather than hierarchy and isolation [38].’

Twelve years later, Reyner Banham looked back on the megastructure era in his *Megastructure: Urban Futures of the Recent Past*. The main issue he recognizes in the Metabolist proposals is the attempt to find a relationship of the ‘massive, even monumental, supporting frame,’ and ‘various arrangements of habitable containers beyond the control of the architect [39].’ He sees a conceptual approach and basic contradiction in the marriage of a technocratic attitude, as in Walter Gropius’ *total architecture* [40], and modernism’s fascination with indigenous cultural artifacts and built forms, whose designs appear self-generated and ‘natural.’ The artificial landscape is ‘made possible by present day technology,’ but its giant (infra)structure is supposed to serve as ‘the great hill on which Italian towns were built,’ and thus to connect modern with vernacular aspects, as Fumihiko Maki had pointed it out [41]. To legitimate the megastructure, its concept is often derived from existing ‘accidental structures,’ as Banham calls them. ‘A-formal’ and extensible, such as Maki’s example of the ‘Italian hill town,’ they differ from architect-designed historical precedents. What brings them within the canon of megastructures is ‘their visible extensibility and adaptability, their lack of obvious regular geometry in spite of the fact that their overall form is usually easy to grasp and their small parts

extremely regular [42].’

For Banham the megastructure – although having been the dominant progressive concept for architecture and urbanism at the beginning of the 1960s, promising ‘to resolve the conflicts between design and spontaneity, the large and the small, the permanent and the transient [43]’ – has failed. In Banham, it presents the culmination and the end of the modern movement, which continues to be expressed in the modern claim to control ‘the design of the whole human environment,’ while now admitting individual desires for self-expression, a contradiction that the megastructures were finally unable to resolve. Spontaneous processes of self-building could happen but ‘within a framework created by professional architects’ and still ‘reflecting the monumental and aesthetic values of professional architecture [44].’

7. The Image and the Reproduction of Metabolism

In the metabolist schemes, the notion of place is neglected in favor of issues of spatial relationships, change, temporality, and process. The interest in exploring new spatial organizational patterns is more prominent than the longing for recreating a lost place; rather, potential new forms of ‘habitats’ are explored. The experience of war and consequent loss of place trigger the creation of new architectural terms, architectural imagery, and a shift in the discourse. In the work of the Metabolists the architectural image replaces the category of ‘place’.

During the 1960s, the group produced mostly visionary theoretical work on a large urban scale. However, the few projects that actually got built were of mostly moderate size. Although showing Metabolist features such as signs of expandability and mixed use, they often only looked Metabolistic, but did not necessarily work that way. This is the case in Tange’s broadcasting center in Kofu (1968), and Isozaki’s library in Oita (1968). However, over time their program could become more mixed by appropriation, as is the case in the Metabolist icon, the Nakagin Capsule Tower, a residential building by Kisho Kurokawa built as late as 1972 in Tokyo. Its capsules now serve different purposes and are used for living, working, and as space for storage, as one can see through the washing-machine-like windows.

Two different aspects of the Metabolist image can be discussed: first the early visionary proposals and second the work that was actually built. Kyonori Kikutake’s built work and his theoretical projects differ quite heavily in language and scale. His visionary projects for experimental dwellings speculate on urban scales of hundred thousands of inhabitants and are represented in a sketchy way, often in charcoal with a dreamy character and frequently containing some national-romantic details, such as using the rising sun reflected on the surface of the ocean or Mount Fuji as a backdrop. Kikutake’s early built architecture orientates itself towards traditional forms and styles while using contemporary materials and construction methods. Most buildings are of a moderate scale and well integrated into their surroundings, as for example the Izumo Shrine Administrative Building and Treasury of 1963 on the grounds of the Izumo Shrine, and the 1964 Tokoen Hotel in the summer resort of Tottori.

A more ironic use of images can be found in the photomontage ‘Incubation process’, often also called ‘Future City’, by Arata Isozaki in 1960/61. In this drawing from Isozaki’s competition entry, *City in the Air*, for Tokyo’s Shinjuku district, Isozaki represents a megastructure situated within a field of classical ruins. The image pictures the city as the place where many life cycles of various cultures

rise, overlap, and decline. In this juxtaposition of the already declined (Western classical architecture) with the visionary (Japanese Metabolist architecture) and its future (parts of the new scheme already collapsed), historical time appears compressed.

8. Conclusions

Metabolism received as much media attention in the West as in Japan itself. Abroad, it generated an enormous interest in Japanese culture in general, and architectural magazines, such as British *Architectural Review* in 1962 and *Architectural Design (AD)* in 1964, both of which produced special issues on Japan. However, Metabolism meant different things in the East and in the West. In Japan, the movement triggered an engagement with Japanese past culture and a departure from preconceived Western architectural conceptions. In the West, the Metabolist schemes triggered a new appreciation of visionary projects on grand scales, especially in Europe.

It was the aim of the Metabolists to find catalysts for urban development to solve the issues that came with the rapid growth of megacities never before seen on that scale. They addressed questions of land scarcity, housing shortage, and unplanned sprawl. They also addressed fundamental organizational considerations and philosophical and political reflections on the structure and essence of society in general, and on national identity and culture. The strict separation of public and private realms, making one part of the megacity an infrastructure at large and dissolving the other part into a micro landscape of cells, would mean a radically different conception of the city. It shows a population constantly on the move, freely connecting and disconnecting according to personal desires. This society was not bound to place; it integrated through the non-representational availability of the megastructure and group form, symbolic images such as cycle and tree, and the idea of an underlying cultural code.

What knowledge can we gain from the historical case of Metabolism for a contemporary discussion on sustainable architecture? The search for resilient environments and sustainable architecture is not new, and, though the terminology did not exist in the 1960s, new tools, terms, and images were formed then. Revisiting the Metabolist visions of a resilient world reveals several contemporary, urgent issues. The current debate on how to design sustainable cities is driven by similar challenges—land scarcity, unequal development, pressure on infrastructures, and democratic issues in planning—yet recent waves of sustainable architecture have not led to the emergence of more resilient cities, and may never. One reason is the retreat of the state and the prominence of the market in driving development questions, Koolhaas and Obricht point out. In their Metabolist reader, they show the network of relations behind the movement. They demonstrate the movement's agency and ability to collaborate and build alliances with colleagues and in the bureaucracy, politics, industries, and a wide range of other disciplines in order to bring about their vision of a resilient culture and make an impact on urban research and design.

I claim that sustainable architecture cannot be conceived separately from its environmental impacts, its everyday use, the way it is produced by whom and for whom, political systems, or markets. The Metabolist movement as a historical case reveals current problems in the disconnection of actors and in partial approaches, which prevent a culture of resilience. A systematic conceptual approach would have to broaden the narrow view of materiality and technology toward a fundamental rethinking of

how to bring about socioculturally just environments, including a change in consumption patterns, labor relations, and the provision of more effective policy frameworks.

The Metabolist proposals intensely discuss the social relationship between a controlled public system and the individual freedom of the consumer. In the megastructures, the public structure dominates and controls urban life. It devises a secondary system of cells, an expression of individual freedom, and of approximate spatial equality. An alternative to the posthumanist attitude of a control-system megastructure is that of the group form, which accepts order in chaos, and more spontaneous assemblages on artificial land that give the power to plan back to the community. This exposes the issues in designing for resilience then and now: The fundamental contradiction between these two views is that of the ideal of an informed, active, and responsible citizenship on the one hand, and, on the other, the necessity of expert planning and exertion of political power associated with a set of regulations for achieving a fair redistribution of resources and wealth.

The Metabolists were driven by a search for a global scientific language and, at the same time, a poetic expression of a sustainable architecture that communicated a renewed and specifically Japanese cultural identity. Beyond nation-states, what could a desired future version of this be? Architectural schemes would emerge, which went beyond metaphors and mechanical and partial approaches to address effective designs for adaptation to change. Architects would build new alliances and reorganize their work in transdisciplinary practices. In future sustainable architectures, designers will learn from existing resilient multicultural practices in cities and landscapes and address a variety of spaces for new commonalities, aesthetics, and cultural values.

Conflicts of Interest

The author declares no conflict of interest.

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4. “Western” refers here to the Occident-Orient divide.
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- 3.8% according to the *Statistisches Jahrbuch für die BRD 1961*. See Schump, M. *Stadtbau-Utopien und Gesellschaft. Der Bedeutungswandel utopischer Stadtmodelle unter sozialem Aspekt*. Bertelsmann Fachverlag Gütersloh, 1972, p. 101.
7. The first atomic bomb over Hiroshima, a city with 350,000 inhabitants killed 71,000 people instantly. 129,000 died within the next five years. 150,000 survived. Joan Ockman has pointed out that in Japan a certain myth of victimhood coalesced after the loss of the war around the notion that Hiroshima was the first city on which an atomic bomb was dropped. The indelible image of the mushroom cloud made Hiroshima a well-known city whose ground zero became a universal symbol of this horrific and unprecedented form of modern warfare and the focus of an important project of reconstruction and memorialization. Ockman, J. *Out of Gound Zero. Case Studies in Urban Reinvention*. Prestel, Munich/ Berlin/ London/ New York, 2002, p. 16.
 8. In Lin, Z. *Kenzo Tange and the Metabolist Movement. Urban Utopias of Modern Japan*. Routledge, London/ New York, 2010, p. 137.
 9. Only one sixth of the area of Japan can be used agriculturally and the population density of this area was 1,540 per km² in relation to 392 in Germany in 1961, for example. Numbers are taken from *Statistisches Jahrbuch für die BRD 1961*. Schumpp (1972), p.102.
 10. The American occupation ended officially in 1953 with the exception of a few military bases, and the island of Okinawa, where the occupation lasted until 1972.
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 14. Banham, R. *Megastructure. Urban Futures of the Recent Past*. Thames and Hudson, London:, 1976, p. 45.
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 16. The following years are characterized by the preparations for the Olympic games in 1964. Beside building for the games and the hotel building boom, infrastructural constructions peaked, the famous Tokaido Line between Tokyo and Osaka opened, and new highways and highway service buildings went up.
 17. ‘In spite of the area over which the city [of Tokyo] spreads, the space occupied by roads is relatively small (9,2 per cent of the total, which can be compared with 23 per cent in London, 25 in Paris, 35 in New York, and 43 in Washington). . . . [N]o street has a parallel one a practicable

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18. Ibid., pp. 203-204.
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 36. The research was published in 1964 by the School of Architecture of Washington University, where Maki had been Associate Professor between 1956 and 1963, after having received master degrees from Cranbrook (1953) and Harvard (1954). By the time of the publication he was teaching as Associate Professor of Architecture at the Harvard Graduate School of Design. See also, Maki, F. *Some thoughts on collective form. With an introduction on group-form*, Washington University, 1961.
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39. Banham (1976), p. 8.
40. Ibid., p. 9.
41. Maki (1964), p. 8.
42. Banham (1976), p. 16.
43. Ibid., p. 10.
44. Ibid., p. 9.

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