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Anticipatory Architecture | Extrapolative Design

:abstract

The instrumental and aesthetic implications of architecture's engagement with science and technology has a long history, part of which includes the period following the Second World War when the rapid technological advances of the Industrial Revolution merged with a general cultural mindset characterized by themes of progress and futurism. For postwar thinkers like Reyner Banham, this interest in a futurist architecture suggested an approach to design rooted less in architectural precedent than technological extrapolation. While a precedent based approach might be viewed as more disciplinary in nature, technological extrapolation suggests an inclination towards interdisciplinarity. Thus, Banham's concept of extrapolation encouraged architects to look beyond the limits of their own discipline as a means of discovering new forms of knowledge and expertise.

Indeed Banham was engaged in taking stock of the technological advances particular to his time while simultaneously anticipating the implication of these advancements for the future. To this extent, the postwar period and its inherent futurism provides a useful and poignant lens through which to take stock of our own technological climate. Given the equally revolutionary advances in computer technology in the last twenty years, our contemporary moment can be seen as having many parallels with the postwar period, and not unlike the postwar generation of architects and thinkers, contemporary designers are inevitably faced with the challenge of engaging new technological advances and their implications for architecture. In our current age of digital and biological technologies, these advances are both rapid and widespread, and include LED and fiber-optic lighting systems, motion sensing, interface design, solar tracking photovoltaic skins and wind harnessing technologies, magnetic levitation, and robotics.

This paper begins with an examination of design work and criticism from the postwar period and proceeds to utilize that examination as an historical framework for addressing issues of contemporary design and 21st Century technological advancement.

1 Introduction

The instrumental and aesthetic implications of architecture's engagement with science and technology has a long history, part of which includes the period following the Second World War when the rapid technological advances of the Industrial Revolution merged with a general cultural mindset characterized by themes of progress and futurism. The Industrial Revolution and with it the emergence of machine technology contributed to an even larger philosophical shift from a Newtonian physics of certainty to one of increasing contingency and probability *(Weiner, 1954)*. As a result, architecture was re-imagined not only in terms of its formal and aesthetic appearance, but more profoundly in terms of a transition from a logic of stasis to one of temporality, and by extension from a preoccupation with space to one concerning time.

Given the equally revolutionary advances in computer technology in the last twenty years, our contemporary moment can be seen in similar terms. And not unlike the postwar generation of architects and thinkers, contemporary designers are inevitably faced with the challenge of engaging new technological advances and their implications for the discipline of architecture. While computer technology has been addressed quite extensively in recent architectural discourse, the general focus has been on modeling software and its potential as a design tool for discovering and developing new geometric and formal languages. For instance, one has seen much attention paid to computer modeling and simulation as a generative and time-based process for design with a particular interest in simulating biological phenomena. Given recent advances in genetic engineering, this interest in biology seems particularly prescient for the discipline of architecture, and indeed even Laszlo Moholy-Nagy suggested that architecture should turn to biology for inspiration as far back as the 1920's *(Summerson, 1957)*. However, while the aforementioned use of computer modeling might incorporate degrees of temporality and contingency into the design process itself, the end results are more often than not fixed, limiting architecture to a static representation of dynamic processes and thus reinforcing the perception that architecture remains fundamentally a formal discipline concerned principally with the design of discrete objects and cultural artifacts.

What has been less apparent in recent years is an exploration of how computers introduce ideas and qualities of temporality and contingency, and more importantly, feedback into the very performance of the architecture itself, shifting the discipline away from the referentiality of static objects and toward the instrumentality of dynamic environments. This would suggest the use of computers as a tool for simulating biological phenomena not only in terms of their formal and aesthetic effects but in terms of their organizational logics in which feedback, temporality, and contingency are central to the behavior of the organism *(von Uexkull, 1926)*. Extending beyond a strictly formal area of inquiry, the concept of an architectural environment would suggest the incorporation of digital technologies from fields as diverse as pervasive computing, interaction design, environmental science, and robotics directly into buildings as a means of expanding their capacity to adjust and respond over time to changing programmatic and environmental forces. Furthermore, the explicit interdisciplinarity of this approach, in which architects probe peripheral technological disciplines as a means of challenging and ultimately rethinking their own discipline's creative and technological limits, necessarily suggests a re-positioning of the traditional role and identity of the architect himself. As opposed to the more familiar heroic role of the architect as a master of form and geometry, the architect positions himself instead as a choreographer of technological systems and peripheral areas of disciplinary expertise.

2 Postwar Futurism

The postwar period of the 1950's and 60's brought with it enthusiastic and at times contentious debate over the impact of the machine on architecture, particularly in terms of the degree to which technology could be seen as a catalyst for engaging general issues of program *(Summerson, 1957)*. Critical of what was interpreted as a generally symbolic use of the machine by many modern architects, one that betrayed its promise of challenging the orthodoxy of formal practices concerned primarily with issues of representation, Reyner Banham, John Summerson, and other postwar thinkers called for a renewal of interest in technology in terms of its performative implications *(Banham, 1955)*. As a means of identifying this new architecture of performance and temporality, Banham and others developed a concept of "anticipatory design," which had two connotations for the discipline of architecture. The first addressed the potential of a building to incorporate flexible and adaptable technologies as a means of anticipating and responding to changing programmatic and

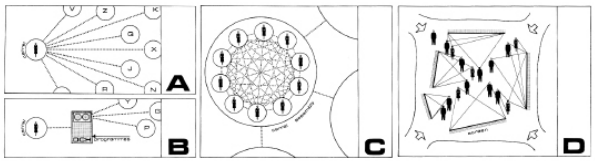

Figure 1. Cedric Price's "Hot/cold" media diagrams: User-environment interaction, Oxford Corner House (1965).

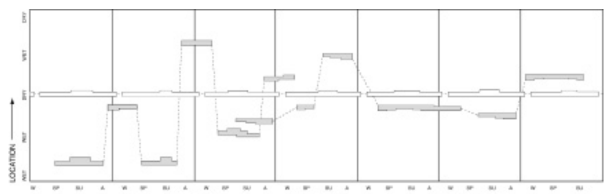

Figure 2. Cedric Price's temporal event diagram charting three programmatic activities compared in siting, duration (hours and months), relocation, and actual speed: Five-dimensional information presented on a two-dimensional chart (1967).

environmental conditions. The second connotation addressed an implicit futurism and an approach to design rooted less in architectural precedent than technological extrapolation *(Banham, 1961)*. While a precedent based approach might be viewed as more disciplinary in nature, to the extent that it relies primarily on architecture's own immediate history and more specifically the geometric and formal languages of that history, technological extrapolation suggests an inclination towards interdisciplinarity *(Cox, Graham, Alloway, 1960)*. Banham's concept of extrapolation encouraged architects to look beyond the limits of their own discipline as a means of discovering new forms of knowledge and expertise *(Cox, Graham, Alloway,1960)*. For postwar architects like Cedric Price, this included an engagement with the emerging field of cybernetics. His collaborations with the cybernetician Gordon Pask were instrumental in conceiving buildings which incorporate principles of feedback, specifically in terms of their capacity to respond and adjust to changing programmatic and environmental conditions over time *(Lobsinger, 2000)* (Figures 1 and 2). For Buckminster Fuller, his familiarity with the military's use of systems engineering as a means of integrating a wide variety of technologies and forms of disciplinary expertise in the design of sophisticated hybrid weaponry, led to a more technologically and materially synthetic approach to the design of buildings, which he referred to playfully as livingry *(Fuller, 1929)*.

Simultaneously, this more instrumental engagement with science and technology suggested alternative forms of aesthetic expression in architecture, namely the emergence of new formal languages that were the direct result of technological and architectural performance. The postwar period is largely characterized as a period of rapid social and technological progress and these architectures likewise can be seen as offering a new formal aesthetic less characteristic of the traditional qualities of stasis and fixity than those of mobility and transience. Banham himself referred to this new architectural language as a "scientific aesthetic" to the extent that it emerged from the material, spatial, and organizational effects of new technologies integrated into conventional construction *(Banham, 1960)*. The emphasis here seems to be on a direct correlation between aesthetic effects and the actual use of the architectural environment, in so much as Banham's definition of architecture places emphasis not on its representational or referential capacities as a cultural artifact, but its actual performance as a useful and productive design apparatus in relation to programmatic and environmental pressures *(Banham ,1960)*. This definition of architecture, and by extension Banham's intentional use of the term 'environment' in place of 'building,' was a direct challenge to the discipline's design conventions and carefully protected orthodoxy, what Banham referred to as "the lore of the profession," and led to his conception of "Une Architecture Autre," or "an other architecture" *(Banham, 1955)*. This notion of otherness suggested an aesthetic quite different from traditional architectural formalism and was more specifically developed into his concept of "aformalism;" a means of aesthetically defining and expressing a building's formal qualities and yet doing so outside of traditional formal languages and in a way which is consistent with the programmatic and environmental performance of the building itself *(Banham, 1955)*. With the work of the Smithsons for instance, Banham noted an aesthetic expression resulting from the visible dynamics of human circulation and inhabitation. For those who were accustomed to seeing renderings of modern buildings in which inhabitants were noticeably absent from the scene, such that the emphasis would be placed on the form of the building and not its programmatic activity, this was a new and powerful depiction of an architectural environment that extended beyond built form to include and render visible social patterns of inhabitation, in effect, shifting emphasis away from the building's abstract formal traits and towards its actual use *(Banham, 1955)* (Figure 3). Furthermore, their use of plastic in the House of the Future project suggested a concept of materiality which differed dramatically from the implied permanence of most conventional building materials, associating itself instead with the portability and expendability of product design (Figure 4). Archigram, meanwhile, engaged in a broad multi-media experiment through which they explored the potential for technology and social engineering to reshape the built environment. Their speculative proposals operated at a variety of scales and included inflatable envelopes, walking components, soft and hard infrastructures, and man-machine interfaces which, similar to the work of Price, demonstrated an experience of architecture that went beyond static surface effects to capture the dynamic cultural forces of technological innovation, programmatic nomadism, social and political emancipation, and perpetual exchange *(Vidler, 2003)* (Figure 5). For Banham, these and other emerging architects of the period demonstrated the prospect of a new architecture in which the final product was not limited to built form and structure but was manifest instead as a total synthetic environment in which human, psychological, ecological, and technological conditions found aesthetic expression *(Vidler, 2003)*.

The scientific fields that interested Banham in terms of their potential influence in leading to this other architecture included cybernetics, environmental studies, and disciplines focused on human behavioral systems *(Banham, 1961)*. While operating outside the immediate disciplinary envelope of architecture, these fields were of particular relevance to designers in that each explored the nature of how organisms interact with their environment. Furthermore, the modes of interaction particular to these areas of study were characterized by principles of feedback and exchange in which both organism and environment adjust and adapt to one another over time. The first implication for architects, therefore, was to utilize the discoveries of science and technology as a means of reconsidering the dynamics between a building and its users and to do so in such a way that each are capable of responding to the other. The second implication addressed the larger question of architecture's very definition as a discipline, distinguishing between a conventional notion of architecture as the design of formal and static objects, and one which imagined buildings as open and reflexive environments for the organization and distribution of shifting conditions and relations.

Additionally, Banham's interest extended into the field of science fiction, principally in terms of the inherent futurism of much of the work from this period and the ways in which he imagined architecture as a projective

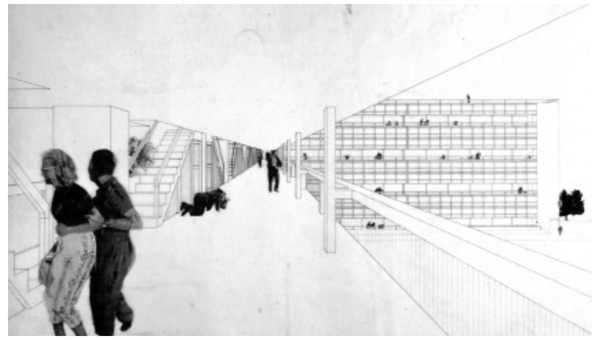

Figure 3. Alison and Peter Smithson, Golden Lane Housing (1952).

Figure 4. Alison and Peter Smithson, House of the Future (1955-56).

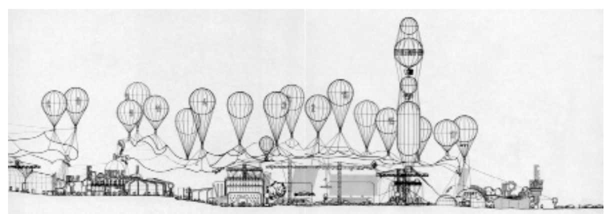

Figure 5. Archigram, Instant City (1968).

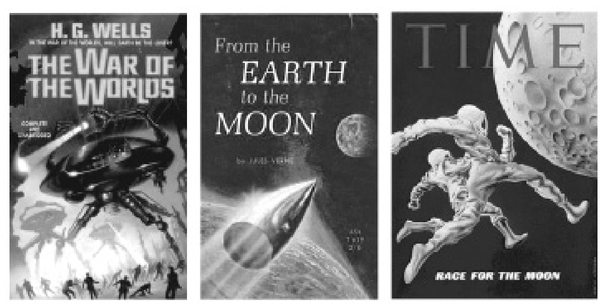

Figure 6. H.G Wells, War of the Worlds, (1898); Jules Verne, From the Earth to the Moon, (1865); Time Magazine (1968).

discipline, particularly its capacity to forecast possible futures for the built environment *(Farnham, 2000)*. Science fiction generally falls into the two categories of extrapolative fiction and speculative fiction. While the latter is driven less by science and more by fantasy, as characterized by the idealism of early 20th Century writers such as H.G. Wells, the former approach utilizes rigorous research of emerging technological advancements as a way of projecting potential scenarios for the future application of those technologies and, more significantly, their impact on society as a whole *(Farnham, 2000)* (Figure 6). It is this latter category, as characterized by the realism of pioneering science fiction writers like Jules Verne that was of interest to Banham to the extent that it offered a new model of practice both for historians and architects *(Farnham, 2000)*. This method of extrapolation suggested that architects and historians alike, by way of a general awareness of both past and present technological advancements, might be able to utilize that awareness to forecast potential trajectories for the further development and eventual application of those technologies in the built environment, thus anticipating a set of possible futures for architecture.

Banham's total investment in the prospect of a futurist architecture fueled by the instrumental potential of emerging technologies recalls a long history of debate within the discipline over basic issues of expression and utility, and by extension, art and design. At the turn of the 20th Century, as modern architecture was coming into formation as a distinct movement, critics such as Hermann Muthesius discouraged the use of the term "architecktur" to define the movement and argued that "baukunst," translated as "building art," would be more appropriate as it would emphasize functionality over monumentality *(Wigley, 2000)*. Similarly, Heinrich Wolfflin expressed interest in the explicit design utility of "minor" arts such as cookware, clothing, and carpet design *(Wigley, 2000)*. This realm of everyday industrial design became a source of inspiration for the architects of the postwar period, who aspired to transcend the classical distinctions between high and low art by incorporating the everyday utility of electronic and industrial products into architecture.

In our current age of digital and biological technologies, the "minor" arts might be seen as including those industrial design disciplines developing LED and fiber-optic lighting technologies, motion sensing, solar tracking photovoltaic skins, wind harnessing infrastructure, magnetic levitation, and robotics. Thus, the postwar period and its inherent futurism provides a useful and poignant lens through which to take stock of our present technological climate and the ways in which contemporary architecture is continuing as well as advancing Banham's notion of an anticipatory or extrapolative design practice. And similar to the generation of architects from the postwar period, this other architecture of the present continues to challenge conventional definitions of architecture as well as the orthodoxy of formal practice, to the extent that much of this work places less emphasis on the design of discrete and static objects, focusing instead on the development of technologically diverse and synthetic environments which respond both to programmatic and environmental forces as they change over time.

4 Contemporary Futurism

One example of this contemporary futurism can be found in the research and design work of two recent architectural studios, one conducted at the Yale School of Architecture and the other at Pratt Institute's School of Architecture. While taking time to revisit the past through an investigation of the relationship of architecture to science and technology in the postwar period, both studio's ultimately focused on issues of futurism. To this extent, each of the design proposals featured here anticipate the potential impact of new scientific and technological breakthroughs on the discipline of architecture and responded accordingly. Additionally, the proposals are highly interdisciplinary in nature, each exploring the integration of architecture, infrastructure, and landscape in the development of synthetic building systems which at a variety of scales respond to both internal and external programmatic and environmental pressures.

5 Advanced Design Studio, Yale School of Architecture

This design proposal by Francisco Waltersdorfer operates as both architecture and infrastructure in the development of a large-scale planning proposal for CERN (the European Laboratory for Particle Physics located near Geneva). At the infrastructural scale, a grid of elevated corridors supported by structural nodes comprise a regional distribution system for light rail as well as pedestrian circulation. This system doubles as a new energy collection, storage, and distribution grid, utilizing a variety of technologies to harness wind and solar energy. At the architectural scale, a series of programmatic hubs and clusters located throughout the grid provide for a wide variety of new programs and serve as local transfer stations which connect to the existing building fabric below. In this way, the proposal attempts to operate at both regional and local scales, providing organizational and distributional coherence to CERN's Meyrin campus while at the same time responding to the inherent diversity of its existing building fabric. Simultaneously, the proposal presents a new and distinct architectural image for the campus and one which might be seen as consistent with the organizational principles of CERN as an institutional network (Figures 7 - 14).

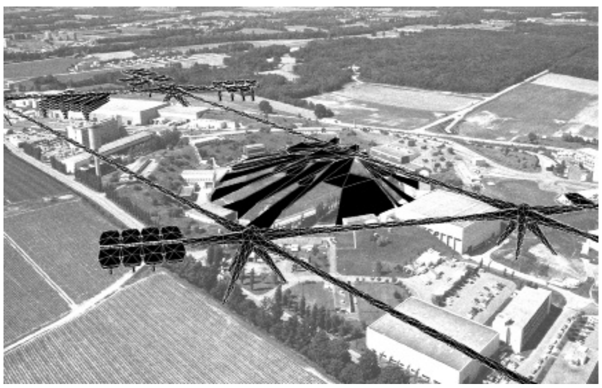

Figure 7. View of the proposed elevated transit-energy grid on CERN's Meyrin site.

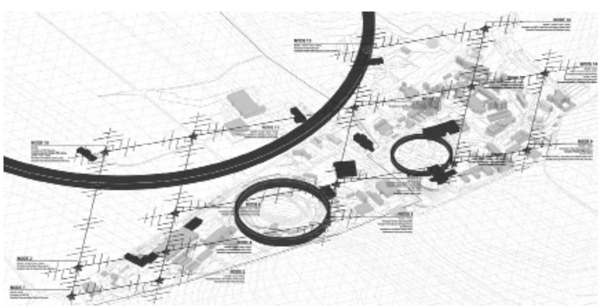

Figure 8. Diagram of the Meyrin Transit-Energy Grid showing existing buildings (blue), existing buildings selected for general upgrades and integration into the proposed grid infrastructure (black), and existing underground particle colliders (black).

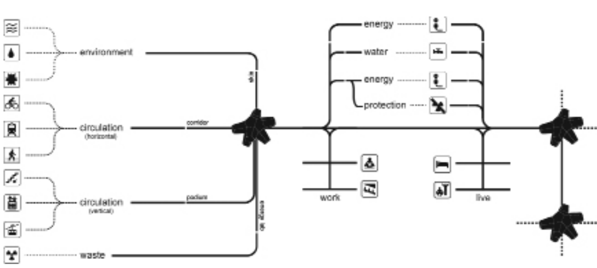

Figure 9. Flow diagram of Meyrin Transit-Energy Grid.

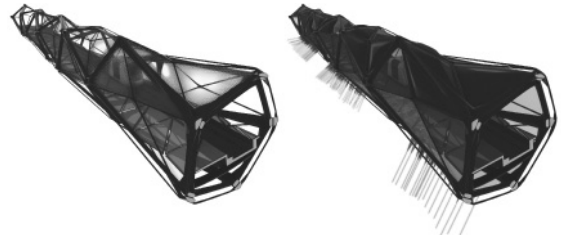

Figure 10. Renderings of a typical circulation / resource distribution corridor.

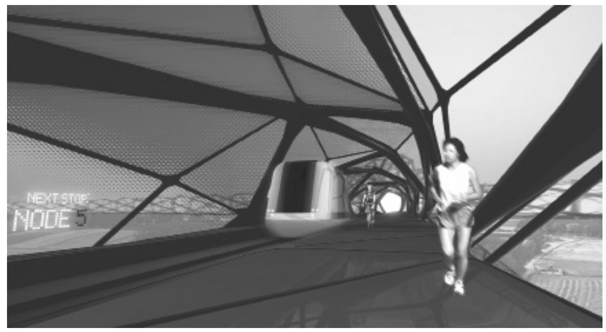

Figure 11. Interior view of a typical circulation / resource distribution corridor.

Figure 12. Rendering of the ISR Collider Ring site.

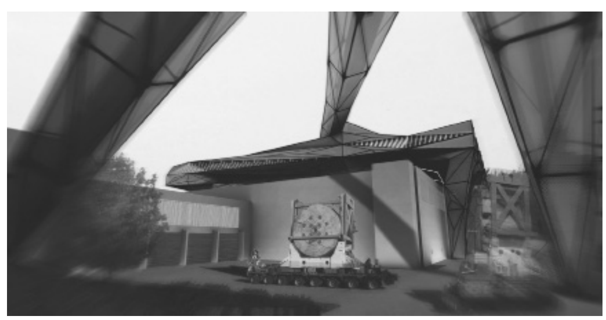

Figure 13. Rendering of the Meyrin North Building Complex site.

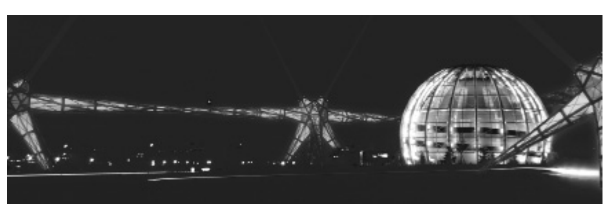

Figure 14. Night view of proposed Meyrin Transit-Energy Grid.

6 Advanced Design Studio, Pratt Institute School of Architecture

This design proposal by Andrew Bloomfield, Nick Scalone, and Justin Snider integrates architecture, infrastructure, and landscape in the design of an interstitial building fabric for Bryant Park and the New York Public Library at 42nd Street. This new architectural fabric, which we might imagine as a softer, more site responsive version of the postwar 'mat building' and one which mediates between architecture, infrastructure, and landscape and by extension interior and exterior conditions, serves as a connective tissue for the site by providing for increased pedestrian circulation between the existing library building, the park, and adjacent sidewalks and underground subway platforms. Simultaneously, the proposal integrates robotic and maglev technologies in the development of a spatially flexible environment capable of responding to programmatic and environmental conditions as they change over time (Figures 15 – 21).

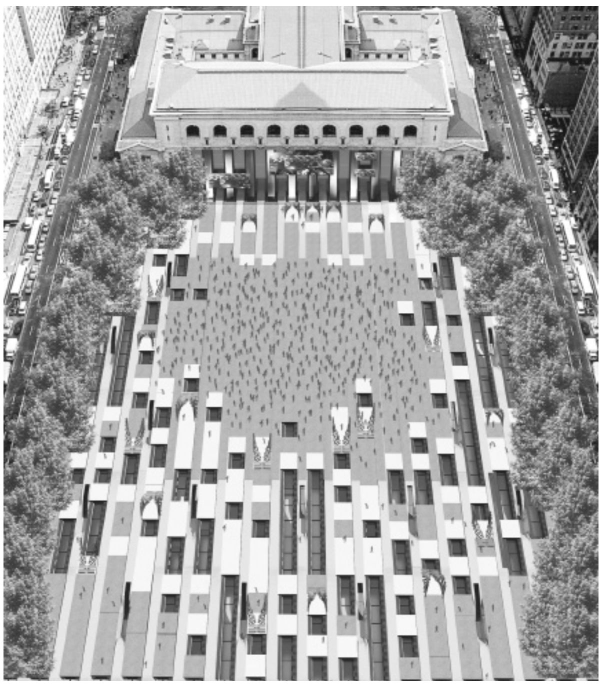

Figure 15. View of the proposed park / building infrastructure on the Bryant Park / New York Public Library site.

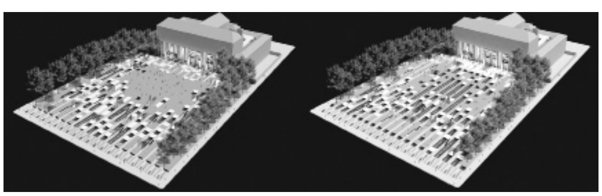

Figure 16. Proposed park infrastructure allows for spatial and programmatic reconfigurability.

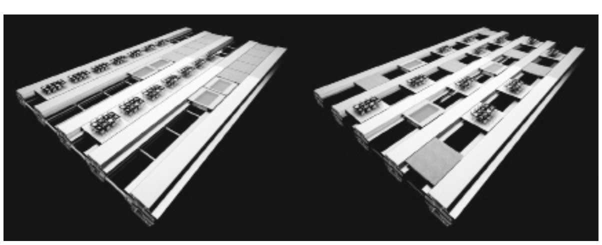

Figure 17. View of the new park infrastructure's plate / tray system.

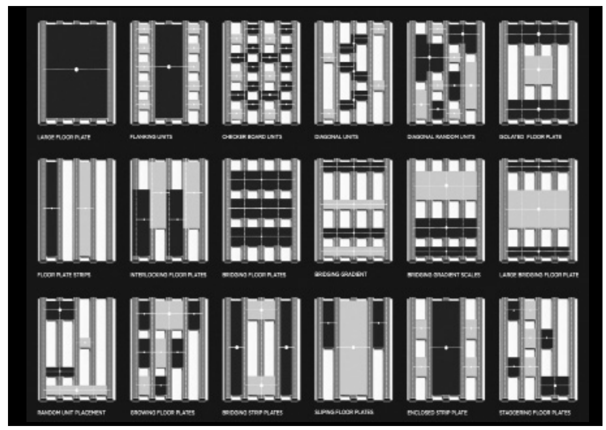

Figure 18. Reconfigurability diagrams.

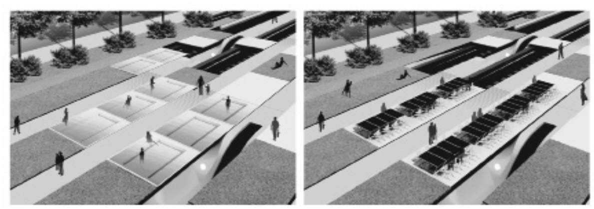

Figure 19. View of programmatic scenarios.

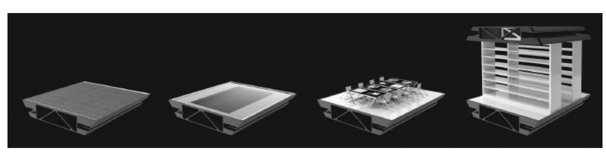

Figure 20. Catalog of maglev tray system.

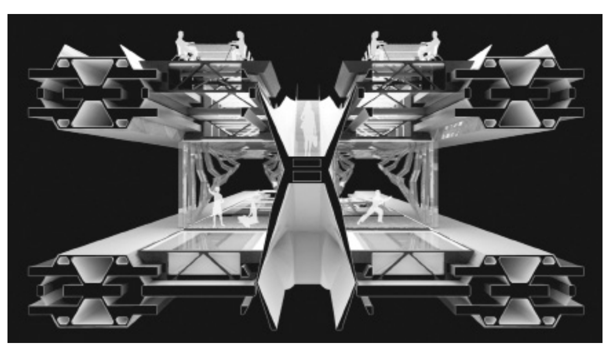

Figure 21. Perspectival section of 'mat building' infrastructure.

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References

A.C. Brothers, M.E. Drummand, and R. Llewelyn-Davies, *"The Science Side: Weapons Systems, Computers, Human Sciences," Architectural Review 127, no. 757 (March 1960)*
R. Banham, *"The Machine Aesthetic," Architectural Review (April 1955)*
R. Banham, *"The History of the Immediate Future," Journal of the Royal Institute of British Architects 68, no. 7 (May 1961)*
R. Banham, *"Stocktaking," Architectural Review 127, no. 756 (February 1960)*
R. Banham, *"The New Brutalism," in A Critic Writes: Essays by Reyner Banham (University of California, 1996), p14. Essay originally published in Architectural Review 118 (December 1955)*
R. Banham, *"The History of the Immediate Future," Journal of the Royal Institute of British Architects 68, no. 7 (May 1961)*
A. Cox, G. Graham, L. Alloway, *"The Future of Universal Man Symposium," Architectural Review 127, no 758 (April 1960)*
J. Farnham, *"Pure Pop for Now People: Reyner Banham, Science Fiction, and History," Lotus 104 (2000)*
B. Fuller, *"Dymaxion House: Meeting Architectural League," New York (1929), in Your Private Sky: Discourse, ed., Joachim Krausse and Claude Lichtenstein, Lars Muller Publishers*
C. Hight, *"A Mid-Century Renaissance," Architectural Principles in the Age of Cybernetics (Routledge, 2008)*
M. L. Lobsinger, *"Cybernetic Theory and the Architecture of Performance: Cedric Price's Fun Palace," in Anxious Modernisms: Experimentation in Postwar Architectural Culture, Ed., Sarah Williams Goldhagen and Rejean Legault (CCA / MIT Press, 2000)*
J.M. Richards, Nikolaus Pevsner, High Casson, and H. de C. Hastings, *with sidebar notes by Reyner Banham, "Propositions," Architectural Review 127, no. 760 (June 1960)*
J. Summerson, *"The Case for a Theory of Modern Architecture," Journal of the Royal Institute of British Architects 64, no. 8 (June 1957)*
J. Von Uexkull, *Theoretical Biology, (New York: Harcourt, 1926)*
A. Vidler, *"Toward a Theory of the Architectural Program," in October 106 (MIT Press, 2003)*
N. Weiner, *The Human Use of Human Beings: Cybernetics and Society, (Da Capo Press, 1954)*
M. Wigley, *"The Architectural Cult of Synchronization," October, Vol. 94, The Independent Group (MIT Press, 2000)*