-FROM THE "PRIMITIVE HUT" TO THE HIGH-TECH BUILDINGS.-

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The purpose of this essay is to examine the roots of the High–tech style in architecture of the twentieth century. More precisely we can spot the first fragments of the High-tech style back in the nineteenth century and the Crystal Palace, which affected the architectural thinking of contemporary architects. In addition, we will also need to research upon the philosophical background that enhanced the development of this movement and to support it I will seek information that date not only back to the 18th century but even further.

The nineteenth century presents a rather contradictory era for the architecture. On one hand there is the tendency to study the past, that is directed backwards and borrows forms and patterns of earlier techniques and on the other hand the new trend which is rather exploring, experimenting and aims towards a forward thinking. As far as the latter is concerned, they are trying to overcome the achievements of the past centuries by making use of new technologies and materials. As a result we have new buildings with great spans and heights. Major role to these innovations in architecture, play the technological achievements of the industrial revolution, which caused a great social impact that prompted the need for change.

In the nineteenth century architecture faces a paradox. It is a new century, that lacks any contemporary creative style, but instead makes the use of previous eras. To be more specific, there is not only one architectural style that is being followed but they are copying architectural styles from past periods. This is due to the fact that the nineteenth century is the century in which the study of history becomes more systematic than ever before.

Before discussing anything further we have to return our focus back to the mid-18th century and *abbé* Marc-Antoine Laugier, who was a great influence for the architecture. He visualized in the frontispiece of his book[1] the primitive hut that according to him '*upon which all the magnificence's of architecture have been imagined*'.[2]

Fig. 1 Essai sur l'Architecture Frontispiece.

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[1] *Essai sur l'architecture* was published in 1753
[2] Summerson(1980),p.91.

'He visualized it as a structure consisting of upright posts, cross beams and pitched roof-much what you see in the allegorical frontispiece to his book. This, he declared, was the ultimate image of architectural truth, the model (to use his own words)'upon which all the magnificence's of architecture have been imagined'.[3]

The novelty in his philosophy was the abolition of anything decorative, even the walls. His illustration is a symbolic diagram expressing that behind antiquity, there was a principle, as it were, the pure essence of Architecture. Due to this fact it is why he is often accredited as the first modern architectural philosopher.

The impact of Laugier and the engravings of Revett[4] led to the Greek revival and the Neoclassicism in the nineteenth century. They tried to revive the past by imitating forms of the previous eras. However, the advances of technological materials and building techniques seemed to create problems in the reproduction of the old forms[5] and it was due to those problems that a change was instigated.

During the same period, the ndustrial revolution starts from England and results in the industrialization of the British society and other countries around the world. As Hitchcock mentions, even today after almost two hundred years the potentialities of that revolution have not been fully actualized.

'The Industrial revolution induced a parallel but gradual revolution in building methods; even today, after two hundred years, the potentialities of that revolution have not been fully actualized. The technical story, particularly as it concerns the structural use of ferrous metals, first cast iron and then steel, begins well before 1800. Those innovations had a determinant effect on the total architectural result.'[6]

As a result of the production growth, the need to channel the new products into new international markets emerged and thus international exhibitions were born. The exhibits are chiefly industrial products, but also achievements in agriculture, industry, crafts, art, yet all conceptions, inventions, revelations and the imperatives of fashion. There are also developments in the process of ferrous metals and glass.[7]

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[3] Summerson (1980), p.91.
[4] *Antiquities of Athens* was published in 1762
[5] Giedion (2008), p.181.
[6] Hitchcock (1969), p.169.
[7] Henry Cort invented Puddling in Hampshire in 1783–84 and patented in 1784.

In this climax of economic and social change, architecture responds with a progressive style. However, it was engineers and not architects who were the pioneers of the creation of this new movement in architecture. For the first time in history the two professions are distinguished from each other and the architects encounter the challenge of form finding through different procedures than those used in the past. As the architectural historian *Siegfried Giedion* mentions, in the nineteenth century the professions of the architect and the engineer, that since then were identical, are now separated. For example, one of the first iron frame buildings, the Corn Exchange in Paris (1811), was a collaboration, between the architect Bellange and the engineer Brunei.[8]

New kind of architectural works are induced such as sheds, canopies, towers, bridges, arcades that are designed by engineers, gardeners, watchmakers, inventors and many other practical constructors.

Fig. 2 Hungerford.Fishmarket.

The method of the engineers is the correct one as it demands thinking and calculations. The simplicity of the forms is based on their accuracy. They are using new materials such as wrought iron and glass to meet the new criteria of architecture that are lightness, transparency and brightness. Engineers, being free from influences of the past, realized faster the demands of the new era. However this kind of architecture, although it was generally admirable, it was dismissed by more controversial minds that did not considered it to be architecture but mere engineering.[9]
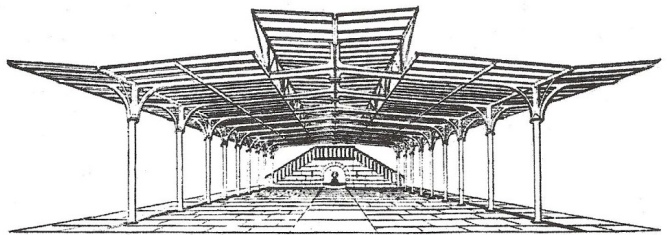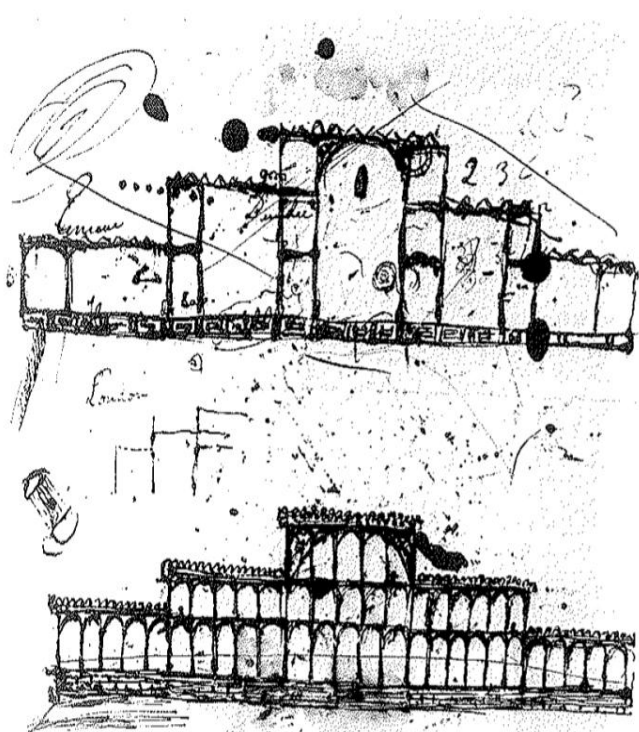

Fig. 3 End elevation and cross section of a first proposal of Crystal Palace.

[8]Benjamin (1999), p.154.
[9]Douglas (2010)

In the dawn of the industrial revolution, one of those controversial buildings that signified the beginning of a new era and mustered the technological achievements of the time was Crystal Palace. This building was fascinating because of many different aspects: historically, socially and structurally.

Crystal Palace was *one of the most influential buildings ever erected[10]*. It was constructed by Joseph Paxton to host the first Great Exhibition in London in 1851 and it was the largest building that had ever been constructed until then.[11] From a social point of view, it demonstrates the industrialization and the prevalence of Capitalism.

In the words of Prince Albert, was "*to give us a true test and a living picture of the point of development at which the whole of mankind has arrived*"[12] and Siegfried Giedion, describes the Crystal Palace as *"the full realization of a new concept of building."[13]*
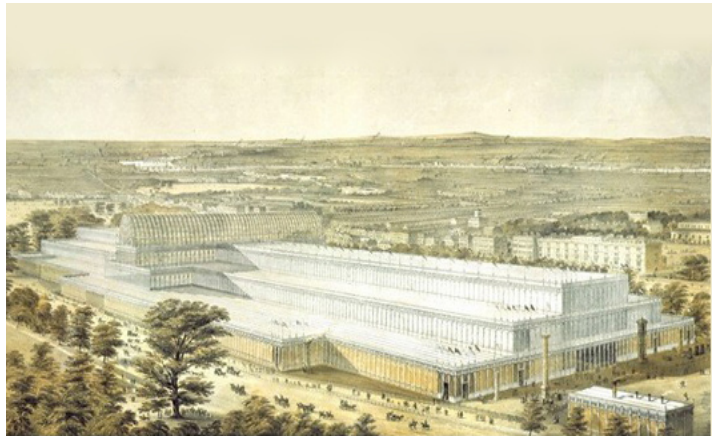

Fig. 3 Aerial view of Crystal Palace in Hyde Park, 28 May 1851
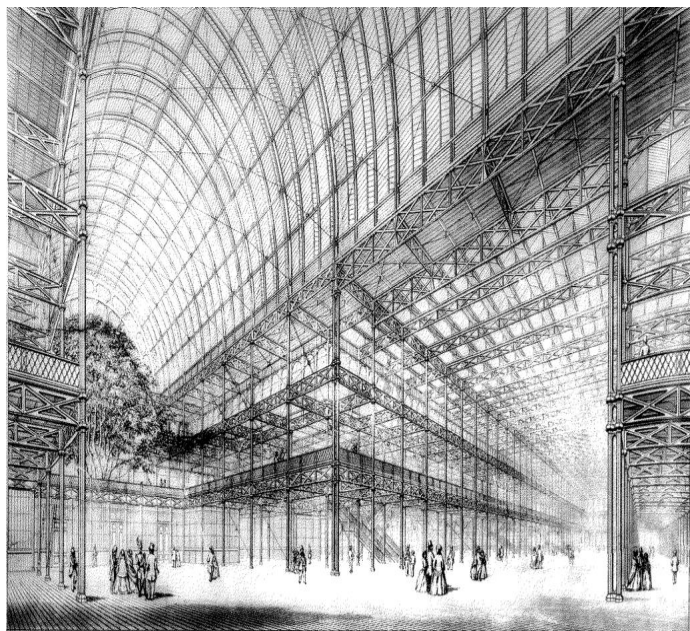Lithograph by Charles Burton.

Fig. 5 Interior of Crystal Palace.

As far as the structure is concerned, the building came to realisation due to the new developments in the iron processing, prefabrication and glass techniques (cast plate glass). Its name is sort of oxymoron because the term crystal gives a sense of fragility contrary to its iron frame structure.

The need for rapid construction and easy assembly and disassembly of a space that could be recreated elsewhere, directed Paxton to the solution of iron frame structure and glass panels, a technique that he had already applied for the construction of greenhouses.

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[10] McKean (1999), p.5
[11] 564 m long, interior height of 39 m.
[12] Douglas (2010).
[13] Peter (1964), p.9.

Preceding buildings to the construction of the Crystal Palace were numerous greenhouses and conservatories such as the greenhouse at the *Jardin des Plantes* in Paris (1833) by Charles Rohault de Fleury[14] and the Great Conservatory at Chatsworth (1837-1840) at Kew[15] by Paxton.

Of course this solution of Paxton not only solved the problem of large and high fencing of the exhibition but also "*was itself a demonstration of the capabilities of the most innovative technology and industrial period of mass production techniques.*"[16] The erection of the crystal palace used a lot of technical novelties and launched the technique of prefabrication, which was an aftermath of the development of iron construction[17]. With the creation Crystal Palace, iron was established as a prime building material for both its technical advantages and for ornamental purposes.[18]

Fig. 6 Great Conservatory at Chatsworth.

However, the professionals of the time claimed that it could not be described as architecture example. Some of the arguments against it were that it cannot be architecture since it is not permanent, it could be reconstructed anywhere hence it does not express a *genius loci* and it does not comply with Alberti's definition about beauty[19] since it is a very indeterminate building and new parts could be added to it in order to enlarge the exhibition.[20]

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[14]Hitchcock (1969), p.177.
[15] Mainstone (1998), p.237.
[16]Macdonald (2001), p.97.
[17]Hitchcock (1969), p.179.
[18] McKean (1999), p.6.
[19] Idea of beauty that was integrated by Alberti during the Italian Renaisance '*Beauty is that reasoned harmony of all the parts within a body, so that nothing may be added, taken away, or altered,but for worse.*'(Macdonald ,2000, p.90).
[20] McKean (1999), p.40.

The exhibition lasted six months before the building was dismantled and transferred to Sydenham (1879) where it remained until a destructive fire put it down in 1937.

Controversial as it may was in its time; Crystal Palace had seminal influence in the construction of other iron-framed public buildings such as the *Palais de Machine*s (1889) and also to the principle of "*form follows function*"[21] that imposes architecture free from decoration and banishes all elements that are not structural.

Fig. 7 . Palais des Machines from a photograph taken shortly before its demolition in 1909.

It became an inspiration for the construction of glass- roofed arcades and it is easy to understand the connection between the great exhibitions of the nineteenth century and the commercial structures of today.

What is more it worked as a stimulant that helped towards envisioning monuments such as Tatlin's monument to the Third International[22].

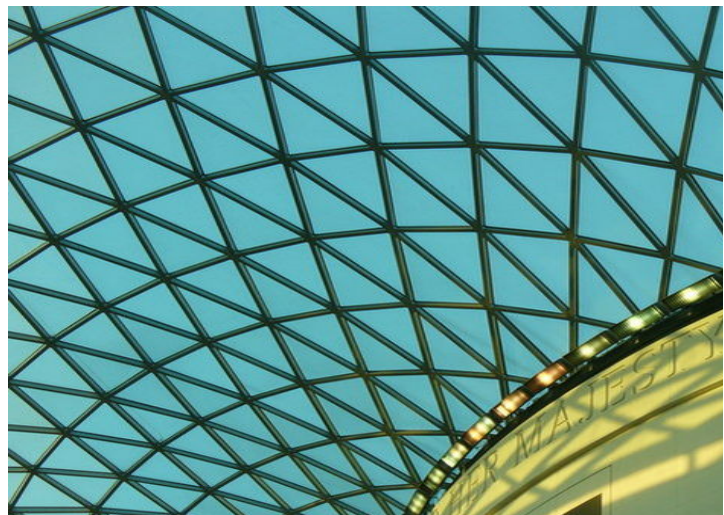Fig. 8 Modern glass roof designed by Foster and Partners above the central Queen Elizabeth II Courtyard of the British Museum.

It helped to re-define urban structures and monumentality from the nineteenth century and hitherto.

Since then, the emphasis to the structure is something that many architects started emphasising when designing and forming their

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[21]Louis Sullivan coined the phrase in his article
The Tall Office Building Artistically Considered in 1896.(Wikipedia,n.d).
[22] It was to be built from industrial materials: iron-glass-steel, but never constructed.

Fig. 9 Tatlin's Tower wooden model.

ideas. Architecture started searching for the truth in the form, and the truth was strikingly evident in the exposed structure.

The style, which came to embody these ideas, is known as High-tech and it was first applied in buildings in the period of 1960s to 80s, redefining the relationship between architects and engineers. According to it, the exposed structure of defined appearance played a major visual role. *It re-establishes the engineer as an active participant in the creation of architecture form.*[23]

The importance of the structure according to Macdonald, on the acquisition of a comprehensive understanding of the architecture has been appreciated since the time of Vitruvius, who identified the three main components of architecture: *firmitas* (stability), *utilitas* (utility,) and *venustas* (elegance). From these three components, the most directly connected to the structure is stability, while the utility and elegance are connected to the practical function and aesthetics of a building respectively.[24]

Pioneers to the High-tech movement are the works of the architects Sir N.Foster, Richard Rogers and Archigram architects who were inspired by Britain's innovative engineering heritage and also Buckminster Fuller's geodesic structures.
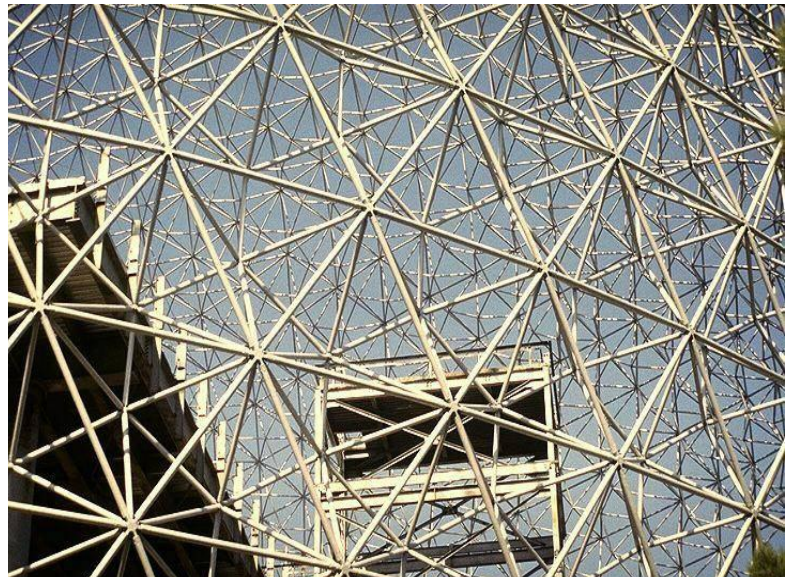

Fig. 10 .US Pavilion at Expo '67, by Buckminster Fuller and Shoji Sadao, at Montreal, Canada, 1967.

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[23] Macdonald (2000), p.6.
[24] Macdonald (2001), p.97.

The similarities between high-tech design and the design of Crystal Palace are: the prefabricated construction that can be rapidly constructed and then dismantled, the exposed structure, the highly adaptive interior, and *the modulation of space by skilled lighting.* According to Macdonald(2000), Foster managed to create a *stylish but style-less* architecture thus the *venustas* (elegance) of the form is based on the structure. In addition, as in Crystal Palace techniques

Fig. 11 Sainsbury Centre, by Norman Foster, at Norwich, England, 1977.

previously established for the greenhouses, were used, similarly in Foster's buildings new technologies are being used, often foreign to the building industry .The Sainsbury Centre (1977) may serve as example, as aerospace technology was applied.[25]
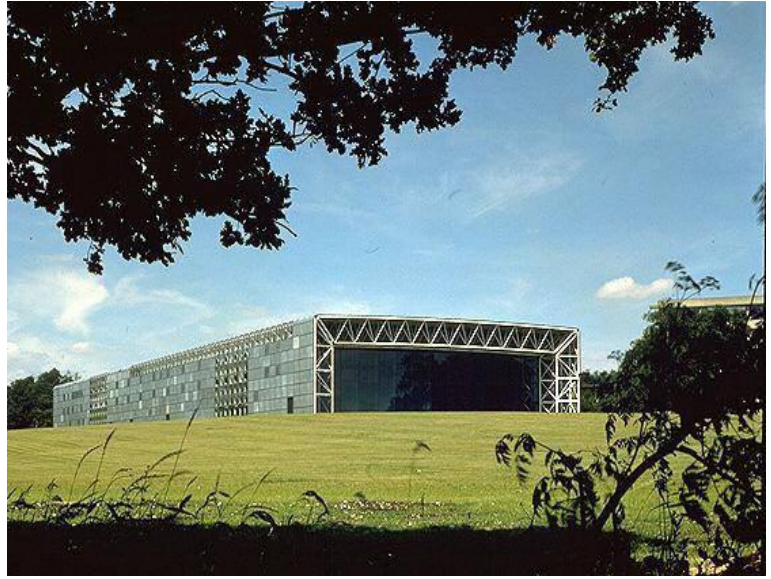
N.Foster created his very own unique style that it can instantly be recognised. He achieved that by following firmly his belief that the best solution is the *appropriate solution*.[26]

Indirect influence on the interests of Rogers was the British tradition of innovative engineer architects of the 19th century, Crystal Palace and major railway stations and factories that explore new production techniques, prefabrication, building systems applications and materials forming new architectural and spatial typologies serving the functional needs of a newly technological world.
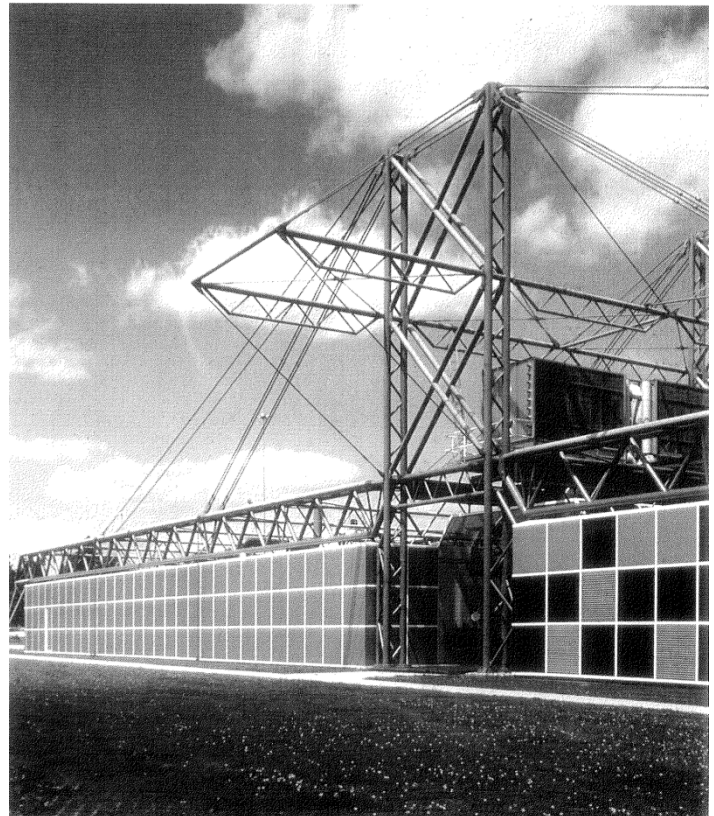

[25] Forsyth (n.d. b).
[26] Macdonald (2000),p.62.

Fig. 12 INMOS factory,Gwent (Rogers Hunt YRM).

The construction of the *Cultural Centre Pompidou, Beaubourg* (1971-7) by Piano & Rogers in Paris was an outstanding moment for the architecture of the 20th century and since it's opening in 1977 it has been cemented as a *monument of definition* for the High-tech architectural design.[27]

Fig. 13 Centre Pompidou, by Rogers and Piano, at Paris, France, 1972-1976.

The central idea amongst the work of Rogers is to celebrate the image of technology as a powerful element of the dynamic expression of contemporary culture. His aim was to set buildings as a powerful tool in the hands of the modern citizen of the world, as a creative self-expression sector. He is trying to create a collective contemporary cultural heritage without local identity. The prefabrication and industrialization are presented not as evidence of mass culture but as a unique feature.

'Beaubourg was conceived as a live centre of information and entertainment – a flexible container and a dynamic communications machine, highly serviced and made from prefabricated parts. Cutting across traditional institutional limits, we created a vibrant meeting place where activities would overlap in flexible, well serviced spaces, a people's centre, a university of the street reflecting the constantly changing needs of its users-a place for all people of all ages, all creeds'.[28]

Peter Cook from Archigram believed that a more humane architecture would merge from the combination of the technological advance along with the social change in order to keep up with the complexity of contemporary living.[29]

Those qualities as described above for the High-tech architecture are the same principles that were followed for the design of Crystal Palace. According to Semper, Chrystal Palace is a marvellous building in which architecture is expressed in its most primitive type.[30]There, t*echniques of wood construction were*

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[27] Banham (n.d.).
[28] Rogers+Architects (2010), p.42.
[29] Design Museum (2007).
[30] Semper (1989), pp.1-44.

simply transposed to iron.[31] That resembles the description of Vitruvius about the origins of the orders of the Greek temple that advocated that the first stone temples descended from their preceding ones, made out of wood, when the techniques of wood were transposed to stone. [32]

According to Violet-le-Duc in *Entretiens sur l'architecture* , there are two 'dominant principles' for being true. Firstly, it is being true according to the program which means to function as '*imposed by need*' and secondly to be true according to the methods of construction, that is to use the materials as per their properties and qualities.[33] For these two reasons he acclaimed the Greek temple for the truthful expression of its construction. "*Greek architecture served as a model for the correspondence of structure and appearance*".[34] Similarly Laugier illustrates the need to go back to more sincere forms.

To conclude, Laugier fostered the idea of the archetype building and the primitive hut, which inspired the Greek revival. As the Parthenon was the compendium of the classic culture similarly Crystal Palace was the building that epitomized the technological achievements of the industrial era. The High-tech movement ultimately derives from the Antiquity[35] and the ideals of Renaissance, embracing the diversity of contemporary life.
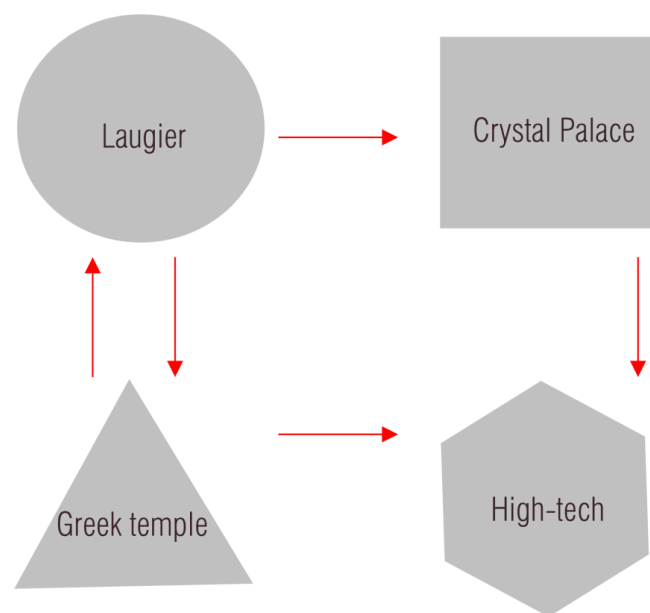

Fig. 14 Diagrammatic architectural correlations.

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[31] Benjamin (1999), p.154.

[32] Remainings of the techniques used in wood construction are the metopes and triglyphs on the entablature of the Doric order.

[33] McKean(1999),p.42.

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[35] Macdonald (2000),p.90.

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