

Architectural and Civil Engineering

Innovation Diffusion Elaboration into Architectural Movement

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ABSTRACT

The research investigates the term innovation and its role in elaborating architectural practice based on diffusion. The complexity of the architectural field compared with other fields shows a problem in explaining how innovations in architecture diffuse as a thought and act in a certain context of practice. Therefore, the research aims to build an intellectual model that explains the way personal thoughts resembled by unique models introduced by creative and innovator designers diffuse in a certain pattern elaborate these models into a state of prevailing thought resembled by the movement in architecture. The research will apply its model to the more comprehensive movement in architecture, which is the modern movement, for model verification and enhancement.

The research concluded that innovation in architecture is about the continuity of events defining the innovator's roles in a time pattern. With this continuity, the innovative models developed into styles and currents within a major thought elaborates, if communication tools and external factors were provided, into a "movement" leading the architectural practice framing its aesthetical and spatial preferences.

Keywords: Innovation, Innovator, Change and Diffusion, Designer and Product, Movement in Architecture.

تبلور انتشار الابتكار الى الحركة المعمارية

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الخلاصة

يهتم البحث بالتحقق من مصطلح الابتكار و دوره في تبلور الممارسة المعمارية استنادا الى فكرة الانتشار. حيث يظهر تعقيد المجال المعماري بالمقارنة مع المجالات الاخرى مشكلة في تفسير الطريقة التي تنتشر بها نتاجات الابتكار كفكر و فعل في سياق معين من الممارسة. و عليه يسعى البحث الى بناء نموذج معرفي يفسر الطريقة تنتشر بها الافكار الشخصية و التي تمثلها النماذج المتميزة المقدمة من قبل المصممين المبدعين و المبتكرين بنمط معين يبلور هذه النماذج الى فكر سائد تمثلها

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الحركة في العمارة. يطبق النموذج لاحقا على واحدة من الحركات الشاملة في العمارة المعاصرة و هي حركة الحدائة لاغراض التحقق و التعزيز.
و توصل البحث الابتكار في العمارة يمتاز باستمرارية الاحداث معرفا المبتكر في كل مرحلة زمنية في هذه الاستمرارية في الفكر المتبلور وتتابع النتاج الابتكاري تتأسس معه اساليب و توجهات معمارية تمتاز: بخصوصية التوجة ضمن الفكر الابتكاري الاوسع. فأذا ما توافرت عوامل التواصل و (المؤثرات الخارجية المحيطة), تنتقل التوجهات الى تأسيس حركة معمارية تقود الممارسة المعمارية و تشكل معاييرها وافضلياتها الفضائية والجمالية.
الكلمات الرئيسية: إبتكار, مبتكر, التغيير و الانتشار, المصمم و النتاج, الحركة في العمارة.

1. INTRODUCTION

Many innovation studies rose with the dawn of the 20th century after the significant advances and inventions in industrial and technological fields due to the industrial revolution. These studies mostly aimed to improve the quality of society's life and the human environment. With the mid-20th century, the term "innovation" declared itself as more than the mere idea of a new product, with its links to social indicators and academic studies about its relationship with "creativity" as the two terms associated with the principle of "newness", thus opening the way for (innovation) to enter the psychological and human studies .

According to Godin, innovation is a contemporary philosophy that did not exist independently until the nineteenth century by acquiring a positive value with the rise of technological discourse at the dawn of the "industrial revolution", and the emergence of new individual roles in contemporary societies represented by inventors and entrepreneurs (**Godin, 2011, p. 15**).

To understand innovation is to understand the main differences between it and both invention and creativity. Invention for many researchers is the process of discovering or creating a new idea. In contrast, innovation is the application or exploitation of this idea, as innovation differs from invention by the principle of verification through an intentional application of knowledge (**Brookes and Poole, 2004**).

For innovation and creativity, the comparison lies mainly in the condition of verification, as many researchers see creativity as a prerequisite for innovation and that innovation cannot emerge if there was no creative act at some point (**Villalba, 2009**). Others find that creativity is associated with generating ideas, while innovation is associated with implementing these creative ideas towards better procedures, practices, or products (**Anderson, et al., 2014**).

Innovation is defined as producing something new (product or tool) in a different way that may turn into a process, strategy, or technology (**Costello and Prohaska, 2013**). It is also defined as a new idea, product, device, process, or strategy that contributes to overcoming the present's problems towards the future (**Kuczmarksi, 2003**).

Others conditioned that for innovation to happen is to contain something that has never been before, a thing to be done in a totally new way. This "new" thing is hard to define in most cases and took a chain of incremental innovation that eventually leads to a radical change (**Sehested and Sonnenberg, 2011**).

Other researchers describe innovation as the ways we use and engage with things that define our existence in the world beyond observing and thinking only, as innovation thought aims to understand the natural connections of things and realizing distinct interpretations shows strongly in certain situations (**Steiner, 1995**).

2. INNOVATION/ CHANGE AND DIFFUSION

O'Brien and Shenna describe innovation as a state of change that rises from an established balanced system towards a new one that we could never reach with known steps (**O'Brien and Shenna, 2010**). And according to El-Zain, Innovation is a situation awaiting fertilization or discovery, and it is the "early" acquisition of the first things to begin. It is a state of generating



ideas and embodying them in the discourse that possesses the novelty to make a change (**El-Zain, 2013**).

Therefore, many studies presented multiple classifications for innovation according to the nature of change it accrues, the product provided by the innovation itself, or how it diffused in a certain context.

Both Henderson and Clark classified innovation according to the degree of change and novelty presented in the elements and systems of the final product: 1) Incremental innovation, based on the improvement of elements and systems, 2) Modular, based on the introduction of new elements within an existing system, 3) Architectural, based upon the improvements of existing elements in a new system, 4) Radical innovation, based on the introduction of new elements and systems in the final products (**Henderson and Clark, 1990**).

Garcia gives four levels of innovation according to the nature of change it achieves within its context: 1) technological level, introducing completely new technological principles, materials, or applications, 2) market level, the emergence of new markets - or new industries, 3) organizational level, changes in strategy, structure, or processes, 4) cultural level, changes in attitudes, behavior and the knowledge base the users. Three stages achieve all these levels: invention, development, diffusion¹ of innovative products (**Garcia, 2014**).

Everet Rogers classify the roles of individuals and groups dealing with innovative products according to the act of diffusion. As he defines innovation as a diffusion process that starts from the source of the idea (individual) towards a wide state of adoption (groups) represented by the user and their general behaviors, the effectiveness of this process is due to the effectiveness of five roles shows in a time pattern (**Rogers, 1982**):

- Innovators: individuals who present unique ideas and take risks.
- Early adopters: a small group who adopt these ideas and develop them into innovative products.
- Early majority: groups usually related to academic and professional fields that are early in adopting developed products.
- Late Majority: the wide adoption of the innovative by the users after its success in markets.
- Laggards: those who refuse to adopt innovation due to their traditional or their skeptical nature, who may later adopt an innovation after its wide diffusion.

According to all presented above, innovation is about accruing change (radical and incremental) by those who initiate new and novel ideas as innovators and introduce them into new products that are diffuse within societies endeavor to improve the quality of life. And innovation represents the aspects of the individual as an innovator and an innovative product.

3. RESEARCH GOAL

The complexity of the architectural field and its relation to changes and transformations in various contexts (such as political, social, cultural, or economic) make addressing how innovation diffuse in architectural practice differs significantly from other fields like technological, industrial, or applied sciences fields.

The research goal is to build an intellectual model that explains the diffusion pattern for innovative products introduced by designers as innovators; diffusion pattern leads to elaborate styles and currents into a movement in architecture. For verification, the model is strengthened

1) Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication, in that the messages are concerned with new ideas (Rogers, 1982, p. 5)



by a deductive comparison in applying the model to the more comprehensive architecture movement, the modern movement.

4. INNOVATION DIFFUSION IN ARCHITECTURE

Reviewing architectural literature dealt with innovation showed its connection with the subjective and objective aspects of architecture such as the association to the designer as an innovator, dealing with innovative processes and methods, the role of contextual factors on innovation such as economic or technological factors and determinants of execution, the role of institutions supporting or adopting the designer and his ideas, and the final projects as the (innovative products).

Building the innovation model in architecture will be based upon the innovative product diffusion in the architectural field by reviewing the designer's roles as innovator, product, and change.

4.1. DESIGNER AS INNOVATOR

A designer, according to Antoniades, is the individual who contributes to creating new things in reality by transforming the imagination and intuitions within his environment and what is affordable (**Antoniades, 1990**). Keller otherwise describes the designer as an individual who practices his intuition in architectural formation within a rigid architectural behavior structure and practice (**Keller, 2017**).

The process of innovation in architecture, according to Raisbeck, is based upon an organizational process led by an innovator that aims to employ resources, opportunities, and ideas into successful practice include review, transformation, and adaptation. A process leads to introduce a "product" capable of diffusing within its context (**Raisbeck, 2011**).

Others find that an individual's goals and desires generate the activity of innovation that leads to solving problems by taking advantage of unprecedented opportunities within their societies (**Ambrose and Sternberg, 2016**).

Brooks and Pool point out the role of designers as innovators lie in their role as initiators of change, elevating the level of practice, reflecting a kind of "courage" in finding new solutions that elaborate later to new levels in the expression of architecture (**Brookes and Poole, 2004**). On another level, researchers emphasize the role of individuals as critics and theorists in communicating the innovative products to a wider audience, as their intellectual roles aim to link architecture to major developments and transformations of their context such as arts and politics, offering new explanations and promote change in the cultural context (**Gutschow, 2005**).

4.2. PRODUCT AND CHANGE

Innovative products, according to Kuhl, are these projects that express major transformations in the architectural context through history and led in a way or another to the emergence and derivation of new architectural styles (**Kuhl, 2012**). For Daniell, innovation is mainly related to the nature of change and transformations achieved by an "innovative" product as an "invention" introduced by the architect as an "innovator". This product contributes to expanding practice through adoption and simulation by other designers that will eventually lead to the emergence and derivation of new architectural styles and currents (**Daniell, 2013**).

Architect Bernard Tschumi broadens the concept of change in architecture by relating it to the concept of a breakthrough product as an event generates post-change transformations. This "event" in architecture to his is the "invention" that achieves a radical change in its context that can bypass its' moment by and contributes to generating a state of rethinking and reconfiguring



of various architectural elements continues through numerous explorations and subsequent derivations in the long term (**Noever, 1997**).

Others explain the innovative product in architecture as an "initiative" that functions as a catalyst for change by the possession of new ideas and design elements, generating new subsequent initiatives, and maintaining the initial initiative structure (**Valk, 2013**).

Publications by critics and theorists as for cultural events play a role in pointing out the nature of these innovative products' change. As the act of illustrating, analyzing, criticism, and theorizing, these products elaborate them from the state of individual creativity into a state of widespread communicative representation that becomes over time a part of the practice and mass culture (**Gutschow, 2005**).

According to all above, the research points out according to all above the main aspects that differ the innovation in architectural fields than other fields in our goal to build our innovation model in architecture:

- The architectural field's innovation is related strongly to the nature of resources and determinations of the projects and the nature of using technology that can elevate or reduce to factors of imagination and individual aspirations.
- This shows that the Innovators in architecture are those designers who can initiate their imaginations and intuitions through concentrated and exploited acts into adaptable and effective thoughts and models that accrue change in their context.
- Designers, according to innovation thought in architecture, are 1)"Creative", who is responsible for inventing the moment of "change". 2) "Innovator", who is responsible for transforming the change into an applicable model. 3) "Appliers" who are responsible for adopting and developing the "applicable model".
- This shows that innovative initiatives as products in architecture are about the novelty of change it accrues and their transforming from an individual's ways "styles" into a broader adopted practice "currents and movements".
- Innovation in architecture-related strongly to the presence of cultural and theoretical initiatives represented in critical and theoretical activities enhancing the culture of innovation in architectural practice.
- The research finds that the transformations of innovation "diffuse" in a pattern related to the way it develops the initiative products into "styles and currents" with conceptual and practical frames introduced to the certain context as content with the ability to elaborates into a "movement" in architecture.

5. MOVEMENT IN ARCHITECTURE

According to Gelernter, movement in architecture is interpreted as a period explained by the prevailing spirit of the age that shapes its cultural characteristics, in addition to the external factors (such as social and economic), linking its individual and collective efforts with a clear definition (**Gelernter, 1995**).

For Teyssot, architectural movements are defined usually by periods that share a certain set of characteristics and basis (**Teyssot, 1981**). The conditions for these period characteristics, according to Gombrich, is to contain a set of special dictums that distinguishes its styles and currents within thought define its principles as a movement beyond the mere formal qualities (**Gombrich, 1963**).

Schulz defines architectural movement as the result of an intellectual activity that seeks to elaborate its models on the levels of theoretical level interested in delivering a set of theoretical and intellectual principles, cultural level about the appropriation range of styles and currents to



its context. A design level seeks to interpret to two levels above into architectural model fitting to its context (**Schulz, 1963**).

According to the thought of innovation, a movement is the participation of an active group with a specific thought that has its applications in their field of activity, within a coherent structure of variant styles and currents held their dictums and principles. The movement product represents others through designs and architectural projects that are diffused in different contexts through human perceptive communication tools (such as writing and publishing).

6. INNOVATION MODEL IN ARCHITECTURE

Building a model of innovation for the research is based upon achieving diffusion through phases starting from the act of creative idea towards the elaboration of movement in architecture:

6.1. PRE- CREATIVE/ INNOVATION

The changes and transformation in the context at different levels (such as cultural or social or political or economic levels) stimulate individuals' emergence with new ideas and imaginations that is unpare

6.2. CREATIVE DESIGNER

The **creative designer**, at this point, introduces creative thoughts, a novelty in thinking, new visions, or new interpretations through distinguished and unique buildings. These buildings (products) held an effective influence that still, after all (limited).

6.3. INNOVATOR DESIGNER

Innovator designers show at this stage with their innovative visions as the first group to catch the potential and new opportunities of the creative buildings. These innovators are mostly distinguished by their ability to understand the context and its new needs, presenting competitive new thinking through several architectural models as personal or new styles ready to be applied by others.

6.4. INNOVATOR APPLIERS

Here comes what we call **innovator appliers** that start to adopt these "inventive" styles with an act of adding at intellectual (theory and criticism) and practical (practice) levels. This leads to the emergence of derivative designs related to the main source and contributing to developing styles into architectural collective styles and currents.

6.5. PRACTITIONERS/ ADOPTERS

The diffusion of currents in this stage becomes clear with designers adopting these currents and practices them in professional or academic levels, elaborated as an architectural movement with clear principles and goals, led by distinguished pioneers and influencers and enhanced by the adoption of prominent institutions, decision-makers and clients within society.

6.6. CONSERVATORS

The diffusion of currents in this stage becomes clear with designers adopting these currents and practices them in professional or academic levels, elaborated as an architectural movement with



clear principles and goals, led by distinguished pioneers and influencers and enhanced by the adoption of prominent institutions, decision-makers, and clients within society. Nevertheless, it is not possible to assume complete linearity in the proposed model, as criticism or theorizing by the innovator appliers may contribute to the emergence of a creative designer who presents a unique model. The elaborated movement itself will function as the main source in the enrichment of each component of our model. Besides, it will act as a source of comparison and analysis of experiments and derivative models according to the degree of appropriate or newness. **Fig.1** presents the innovative model in architecture according to the research.

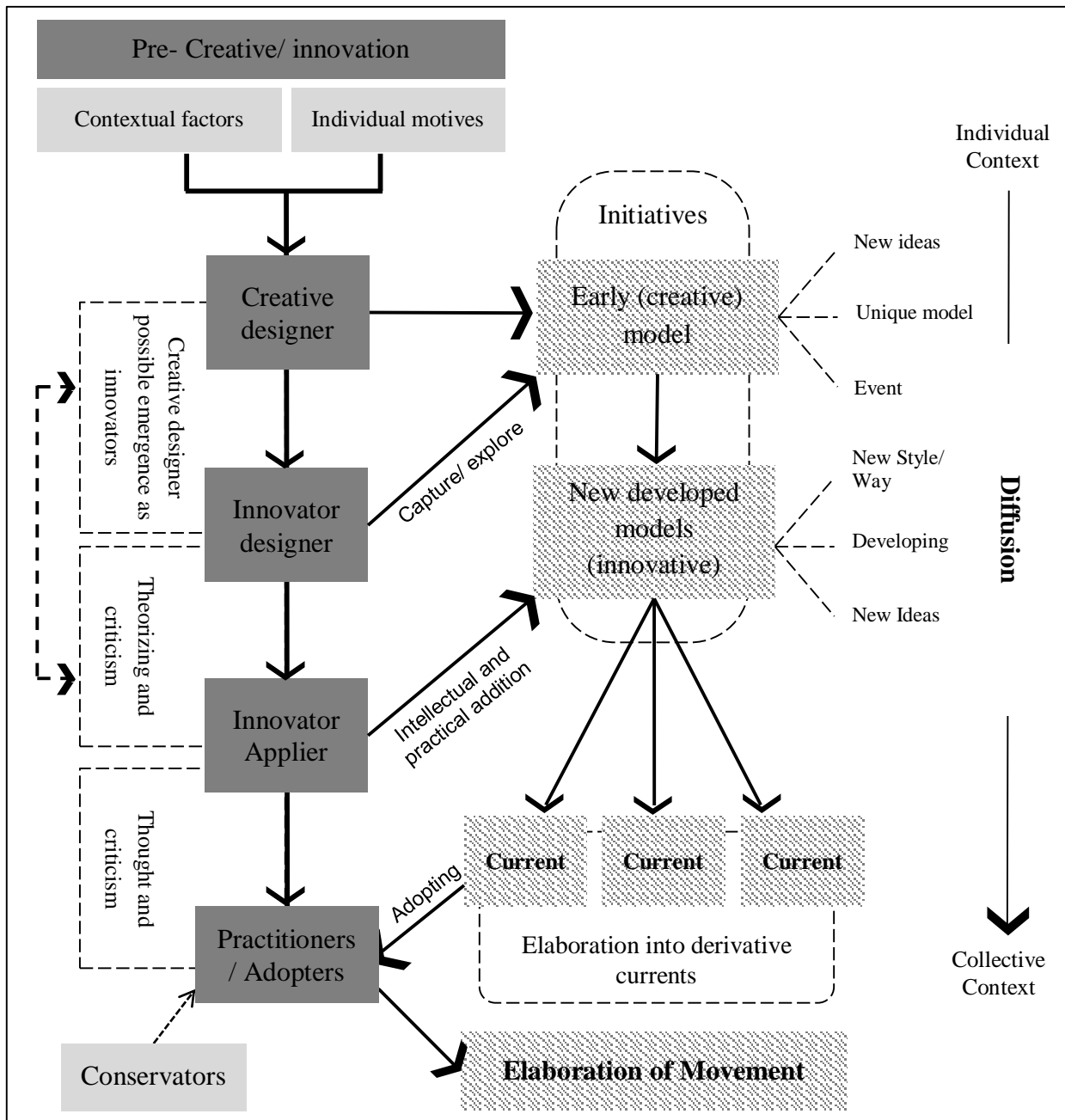


Figure 1. Innovation model in architecture.



7. ENHANCING THE INNOVATION MODEL

The research will apply the (innovation model) to the modern movement in architecture to strengthen its intellectual basis. Choosing modern movement is due to its spanning for nearly five decades as the most prominent movement in the 20th century led by distinguished pioneers and introduced consistent styles and currents, in addition to the clarity of its defining principles and goals.

7.1. PRE- CREATIVE/ INNOVATION (PRE-MODERNISM)

This phase introduced transformations that contributed to the promotion of an innovation culture led to the emergence of modern buildings and individual styles, as it was represented by:

- The emergence of the industrial revolution in the nineteenth century and the entry of new materials and technology into architecture by non-architectural engineers sparked an intellectual and critical activity that sought to achieve an architecture that reflects the radical change of industry its values.
- The shift to pragmatic and realistic thinking and scientific methods is based on the explanations of theorists such as John Dewey and the inability to contain knowledge in absolute terms, but by the individual control of the world through scientific approaches and innovation and science applications (**Gelernter, 1995**).
- The role of artistic transformations in enhancing individualism in modern societies. Antoniades refers to the role of the modern artistic and cultural currents in departing from classical and traditional frameworks, influencing architects to thrive with their imaginations to achieve unique and new meanings (**Antoniades, 1990**).

7.2. CREATIVE DESIGNERS (EARLY INITIATORS)

Several designers appeared at the beginning of the 20th century who described according to the model as a creative designer. They introduced several models and carried the seeds of change and reflected the transformations of their new context, initiating projects that had precedence at the level of thought and design, and presented a need of integration between the uniqueness of the architectural work and the generality of the industrial product while keeping the essence of architecture standing at the same time.

New spaces appeared with formations that reflected the space overlap presented in cubic thought established with the technique of reinforced concrete and presented the concepts of diversity in unity, simplicity, and rationality of movement as well as the concept of formal formation associated with the aesthetics of material and function. As shown below as examples:

- Charnley-Norwood house by Luis Sullivan in 1890, the designer introduced a different approach from the prevailed residential approaches and types in the nineteenth century by simplifying the external elements of the elevations and using a more open-plan towards to outside (**Frank, 2018**).
- Rue Franklin building in Paris by Auguste Perret in 1902, the designer introduced a new and different way in using reinforced concrete by showing the structure (columns and beams) as a major element in his elevation and the freedom accompanied in the material used to fill the open between these columns and beams (**Tietz, 2013**).
- Saving Bank Post office in Vienna by Otto Wagner in 1904-06, the designer introduced a new interior design approach, especially at the main hall, the lack of ornaments, and the minimum use of the elements forming the space (**Tietz, 2013**).
- These early Initiatives stimulate within their context the emergence of a "young" group of innovators who contributed later in developing these initiatives into the innovative styles that add to them at the intellectual and practical level. See **Fig.2**.

**Images from right to left:**

- Charnley-Norwood House, Mississippi, Luis Sullivan and Frank Lloyd Wright, 1890
<http://www.mdah.ms.gov/senseofplace/wp-content/uploads/2015/10/MS-288-57.jpg>
- House in the rue Franklin, Paris, Auguste Perret, 1902-03.
http://www.greatbuildings.com/buildings/Rue_Franklin_Apartments.html
- Saving Bank Post office, Vienna, Otto Wagner, 1904-06
<https://brewminate.com/wp-content/uploads/2018/08/081718-64-Otto-Wagner-Architecture-Art-History-Postal-Savings-Bank.jpg>

Figure 2. Creative Designers in modern architecture

7.3 INNOVATOR DESIGNERS (PIONEERS)

This period witnessed the rise of a young group of designers who were active in the second and third decades of the 20th century, capturing early designers' works and started an act of intellectual and practical addition to their models. Some of them worked with early designers such as Frank Lloyd Wright, who worked with Luis Sullivan, and Le Corbusier, who worked with Auguste Perret (**Tietz, 2013**).

Frank Lloyd Wright was one of these innovator designers who presented the Prairie houses style, with a generative pattern based upon a scheme of open space around a central chimney, and the apparent change in the exterior façade design from the one presented by his master at the time Sullivan (Charnley-Norwood house in the previous section). The style was described as an essential resource for young architects about the role of imagination against the austere of classical trends at the time (**Howard, 2016**).

Le Corbusier introduced with his Maison Domino in 1914-15 an innovative model by employing reinforced concrete technology and the skeleton structure to express the concept of space and volume instead of the mass, introduce freedom in the planning and a different approach from the one used in the rue Franklin by Perret. He enhanced the model practically with Citrohan houses' design in 1922, in which he introduced the employment of natural light, raised ground level, and minimized the function to achieve maximum utilitarian performance (**Flint, 2014**).

Le Corbusier's peak as an innovator was introducing Villa Savoye in the year 1931 by combining the abstracted form, light structure, and the fluidity of space. Gough describes the emergence of villa Savoye as the "perfect moment in innovative communicating with the world pragmatically and culturally" (**Gough, 2015**).

Walter Gropius was one of these early innovators who enhanced the idea of strong form derivative from function, with his Fagus factory and the Bauhaus school at Dessau in 25-1926 that introduced the glass wall (for the workshops and studios) as a new and modern functional elevation at the time (**Glancey, 2017**).

These approaches and styles established the early seed for the emergence of modernity critique, which was presented by a group of theorists who were concerned with laying the intellectual basis for the theory rather than providing criticism of these projects, **Fig.3**.

**Images from right to left:**

- Rubie Hoses, Frank Lloyd Wright, 1908.
https://en.wikipedia.org/wiki/Prairie_School
- Dom-ino House, Le Corbusier, 1914-15
[https://en.wikipedia.org/wiki/Dom-ino_House#/media/File:Charles-%C3%89douard_Jeanneret_\(Le_Corbusier\),_1914-15,_Maison_Dom-ino.jpg](https://en.wikipedia.org/wiki/Dom-ino_House#/media/File:Charles-%C3%89douard_Jeanneret_(Le_Corbusier),_1914-15,_Maison_Dom-ino.jpg)
- Bauhaus Dessau, Dessau, Walter Gropius, 1926.
<https://www.bauhaus-dessau.de/en/history/unesco-world-cultural-heritage.html>

Figure 3. Innovator designers in modern architecture.

7.4 APPLIERS AND PRACTITIONERS

The period between the thirties and the sixties of the 20th century witnessed a rise of an architectural activity led by applied innovators at intellectual and practical levels, leading to the emergence of thoughts and currents derivative from the innovative models.

7.4.1 INNOVATOR APPLIER/ INTELLECTUAL LEVEL

It could be said that the theoretical activities about modern styles and current thrived in the third and fourth decades of the 20th century by Gideon, Zevi, and Pevenser, as they developed the theoretical content for the initiative's models introduced by the early designers (like the publication of "space, Time and Architecture" book by Gideon). Also, to mention the role of architectural institutions such as (CIAM in 1928) in elaborating the modern movement by developing the concepts of modern spaces and aesthetics and relating them with modern culture, city planning, applied design for industrial products, music and literature, and modern social life (Ceylanli, 2008).

Exhibitions held by architects and theorists played a significant role in adding intellectual content to the innovative models, such as the one held in the Museum of Modern Art at New York in 1932 by Henri Russell Hitchcock and Phillip Johnson. The exhibition introduced European architects' projects to an American audience with the term (international style) describing the principles shared by these projects and distinguished them: volume instead of mass, abandon of ornamentation, Order, and proportionality (Howard, 2016).

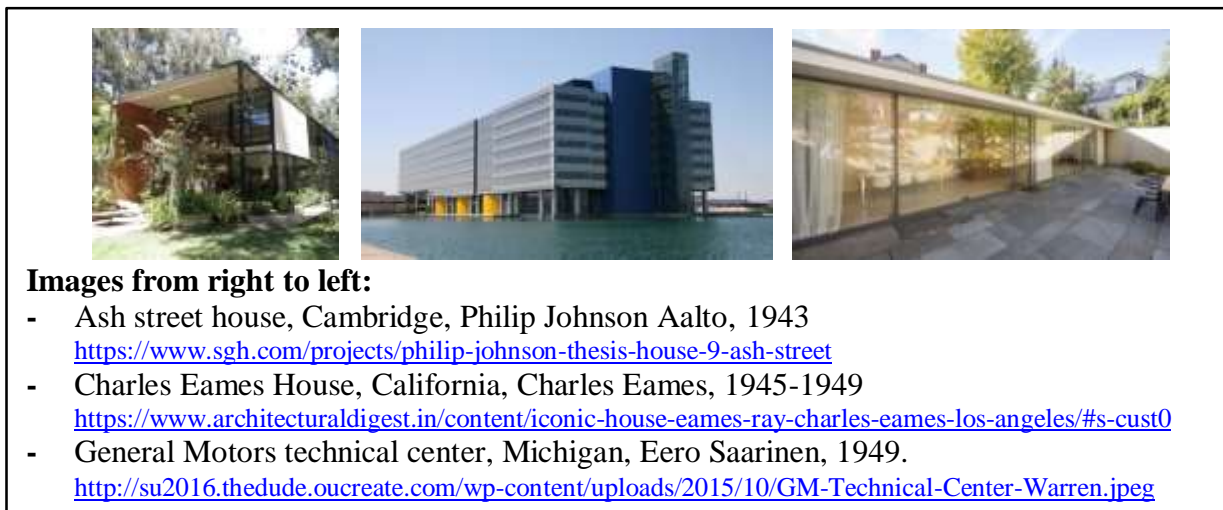
Others point out the role of institutional positions for architects and critics in introducing innovative models to a broader audience at an academic and practice level. For example, the presidency of the architectural schools in America by modern pioneers such as Mies van der Roh and Gropius. And the prominent positions for critics and theorists like Gideon and Zevi in Publishing houses and architectural institutions (Tietz, 2013).

The application of modern styles and currents at the theoretical level by thinkers, researchers, and critics contributed to the presentation of innovative modern models and their new ideas in a form of content (ideas and applications) that could be adopted and applied by other designers' various levels (local, regional and global), and as a result to its wide diffusion.

7.4.2 INNOVATOR APPLIER / PRACTICAL LEVEL

Other designers followed the approaches and styles showed with creative and innovator designers. Those whom we can consider the innovator appliers who initiate through their works the modern currents, such as:

- **Industrial Current:** projects that enhanced the technical and employment of the latest materials, such as the designs of Phillip Johnson Ash Street house 9 in the year 1943 and the Glasshouse 1949 that introduced a derivative interpretation of the Barcelona Pavilion. General Motors Technical Center by Eero Saarinen in 1949 in which he enhanced the concept of using innovative materials and techniques as the main building expression, **Fig.4.**



Images from right to left:

- Ash street house, Cambridge, Philip Johnson Aalto, 1943
<https://www.sgh.com/projects/philip-johnson-thesis-house-9-ash-street>
- Charles Eames House, California, Charles Eames, 1945-1949
<https://www.architecturaldigest.in/content/iconic-house-eames-ray-charles-eames-los-angeles/#s-cust0>
- General Motors technical center, Michigan, Eero Saarinen, 1949.
<http://su2016.thedude.oucreate.com/wp-content/uploads/2015/10/GM-Technical-Center-Warren.jpeg>

Figure 4. Innovator appliers in modern architecture/ Industrial current.

- **Expressionism Current (late modernism),** these designers enhanced the concept of individualism, iconic and sculptural expressions in the final product, and introduced the functional aspect in a new way. These projects thrived in significant contexts such as international events or cultural functions. For example, TWA terminal by Eero Saarinen 1962, Opera Sydney by Jorn Utzon 1956-, and Berlin Philharmonic by Hans Scharoun 60-1963, in which the designer introduced a new interpretation for the free and fluid space with his placement of the stage at the center of the project, **Fig.5.**
- **Regional Current:** or as it called Neo-vernacular, presented for example by the works of Alvar Aalto, Josep Lluís Sert, in which they connected modern thoughts with local material and environment, assuring project related to its local environment (**Glancey, 2017**). As it shows in Villa Mairea in 1939 by Alto and the American embassy in Baghdad in 55-1969 by Sert, **Fig.6.**



Images from right to left:

- TWA Flight Center, New York, Eero Saarinen, 1956-62
<https://www.archdaily.com/772104/spotlight-eero-saarinen>
- Sydney Opera House , Sydney, Jorn Utzon, 1956-74
<https://medium.com/sap-innovation-spotlight/sydney-opera-house-the-architect-the-engineer-b0f4f3f70eab>
- Berlin Philharmonic Concert Hall, Berlin, Hans Scharoun, 1963.
http://s11.photobucket.com/user/danperry/media/Germany/Berlin/Berliner%20Philharmonie%20concert%20hall/IMG_1977.jpg.html



Images from right to left:

- Villa Mairea Center, Finland k, Alvar Aalto, 1939
https://en.wikipedia.org/wiki/Alvar_Aalto#Works
- Embassy of the United States, Baghdad, Iraq, Josep Lluís Sert, 55-1961
<https://modernbaghdad.tumblr.com/post/127473255974/proposal-for-the-us-embassy-jose-luis-sert>

Figure 6. Innovator appliers in modern architecture/ Regional current.

The designers of this phase considered as the third generation of modernism who showed a contradiction in expressing form and function in many currents, yet these currents were an extension of the formal content of modernism and reflection to the change transformation for its early models.

7.5 PRACTITIONERS/ ADOPTERS (MODERNISM DIFFUSION)

The emergence of different currents with their intellectual addition and variant stances enriched the presence of the modern projects and their content, which elaborated the presence of modernism as a movement through its projects, pioneers, theories, and its wide applications around the world, especially in different schools of architecture.

7.6 CONSERVATORS

According to this innovation model, the emergence of new ideas and early models faced conservative acts in the first half of the 20th century, as several practices kept adopting a conservative view in the face of change, exemplified by the writings of Paul de Lagarde and Müller van de Burke in Germany, as they expressed their strong dissatisfaction against the

emergence of modern styles and its renewal of German cultural state, showing a clung and nostalgia for tradition and the past (**Gutschow, 2005**).

The number of architects also showed clung to produce architecture based upon traditional and local metaphors, especially in regional contexts. For example, the Technical Institute projects in Abadan in Iran 1939 and the Baghdad International Station 47-1952 by British architect M. G. Wilson, **Fig.7**.



Figure 7. Conservators in modern architecture.

7.7 THE EMERGENCE OF A COUNTER-THOUGHT

According to many researchers, the mid-20th century resembles a turning point in applying modern thought in architecture.

Many writings at the time represented a counter view to modernism, such as the Architectural Review issue in the year 1955 titled "Outrage". The issue included articles by the ex-pilot Ian Nairn who introduced the term "Subtopia" as a description of unpleasant new cities and their sprawling suburbs (**Glancey, 2017**).

The years 62-1966 introduced the widespread articles of Robert Venturi's "complexity and contradictory in architecture" as an example of the counter theorization against modernism's intellectual content. In his articles, the architect states that "less is bore" and "more is more" pointing out the importance of going back to historical and traditional resources in architectural formation (**Glancey, 2017**).

Changes in cultural context and arts in the sixties contributed to deriving imaginations into new paths, as Antoniades points out to the influence of Oldenberg as a sculptor and his works about the romantic visual scene of the streets on a young architect at the time, Frank Gehry (**Antoniades, 1990**).

The research finds that counter activities generated a state-based upon introducing initiatives in thought and practice against a prominence movement's content in its context. And therefore, we add the role of counter thought to our model of innovation.

8 ENHANCING THE MODEL ACCORDING TO MODERNISM

In addition to the components and stages of the research model of innovation, applying it to the modernism movement showed the following:

- The rising of the art movements at the beginning of the 20th century played a major role in enhancing the imaginations and motivations of several creative and innovator designers to introduce new and unique personal styles, ideas, or ways.
- The importance of a consistent time range pattern for innovations to diffuse in architecture, is initiating from a single idea towards a prevailing thought resembled by clear, consistent movement.



- Prevailing movement functions intellectually and practically as a catalyst with its "diffused models" for counter thought to emerge. Counter thoughts resembled initiatives that can achieve change (as we see with post-modernism initiatives' emergence counteracts to modernism thought).

According to the points above, **Fig.8** represents the final innovation model in architecture introduced by the research.

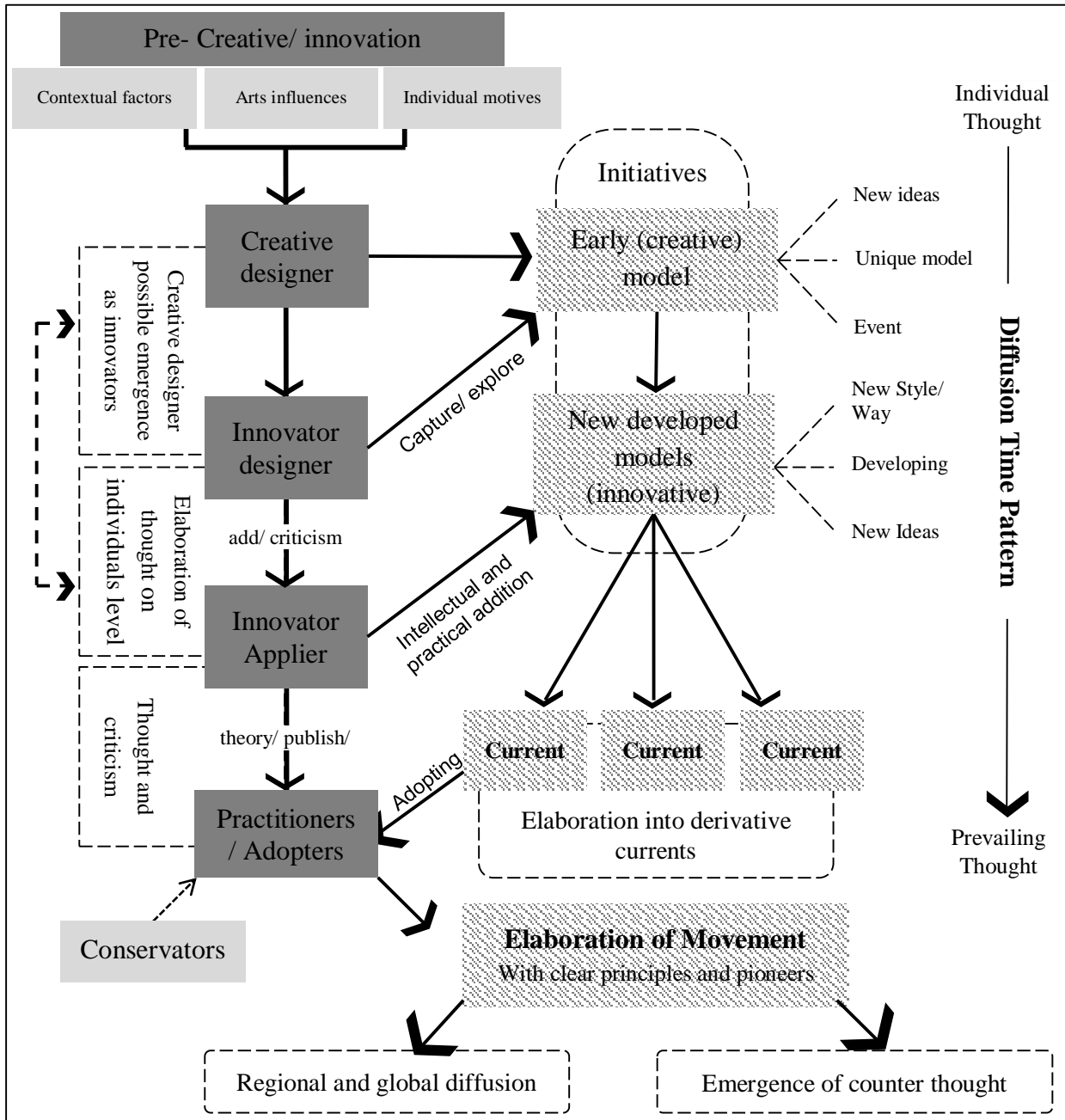


Figure 8. Innovation model in architecture (enhanced).



9 CONCLUSIONS

- Innovation precedent creative acts, within thoughts and acts that transform them (creative acts) into a state of an effective pattern of change in their context.
- Innovation in architecture is about capability in initiating change that delivers new (additions) and (improvements) related to new needs beyond the creative acts.
- Distinguish thought of innovation in architecture is realized by 1) acts that accrues change in understanding architecture, 2) innovators who catch the change and apply it with additional thoughts, 3) critics and theorists who publish their analysis that expand the range of thought related to innovation and its acts of change.
- The research concluded that innovation in architecture is about the continuity of events defining the innovator's roles in a time pattern. With this continuity, the innovative models developed into styles and currents within a major thought elaborates, if communication tools and external factors were provided, into a "movement" leading the architectural practice framing its aesthetical and spatial preferences.
- Styles and current would not establish without innovative thought in architecture. Therefore, elaborating a movement in architecture will not accrue, and the creative cases will still be unique but with no effect or relation to its context.

10 REFERENCES

- Aksamija, A., 2016. *Integrating Innovation in Architecture: Design, Methods and Technology of Progressive Practice and Research*. United Kingdom: Jhon Wiley & Sons.
- Anderson, N., Potočnik, K. and Zhou, J., 2014. *Innovation and Creativity in Organizations: A State-of-the-Science Review, Prospective Commentary, and Guiding Framework*.
<https://pdfs.semanticscholar.org/da92/24dca3f6ff91ca7c147a13a00b9e07ea3cc4.pdf>
- Antoniadou, A. C., 1990. *Poetics of Architecture*. New York: Van Nostrand Reinhold.
- Brandon, P. S. and Lu, S.-L., 2008. *Clients Driving Innovation*. Oxford, United Kingdom: Wiley-Blackwell.
- Brookes, J. and Poole, D., 2004. *Innovation in Architecture*. London: Spon Press.
- Ceylanli, Z. 2005. *Siegfried Giedion's "Space, Time and Architecture": an Analysis of Modern Architectural Historiography*. Doctoral dissertation, Middle East Technical University.
- Costello, T. and Prohaska, B., 2013. Innovation, *IT professional*, 15:3, 62-64.
- Daniell, T., 2013. The mothers of inventions. *Architectural Design*, January/February, 83(1), pp. 114-123.
- El-Zein, M., 2013, *Culture in the Lean Times - The Philosophy of Culture in the West and Among the Arabs*. Beirut: Defaf Publications.
- Flint, A., 2014. *Modern Man, The life of Le Corbusier architect of tomorrow*. Boston, New York: New Harvest.
- Frank, T. 2018. *The Charnley-Norwood House: A Turning Point in the History of American Environmental Design*. <https://www.semanticscholar.org/paper/The-Charnley-Norwood-House-%3A-A-Turning-Point-in-the-Frank/0db70a488eb1b2e302aacead785fde424a8f244e>
- Garcia, R., 2014. Types of innovation. *Wiley Encyclopedia of Management*, pp. 1-9.
- Gelernter, M., 1995. *Sources of architectural form, a critical history of western design theory*. Manchester: Manchester University Press.



- Glancey, J., 2017. *What's so great about the Eiffle Tower-70 quistions that will change the way you think about architecture*. China: Laurence King Publishing.
- Godin, B., 2011. *καινοτομία: An Old Word for a New World, or, The De-Contestation of a Political and Contested Concept*, <http://www.csiic.ca/PDF/Old-New.pdf>
- Gombrich, E. 1963. *Art and Scholarship*. London: Phaidon press.
- Gough, T., 2015. Architecture as a Strong Discipline-1:1. *Architecture and culture*, pp. 20-41.
- Gutschow, K. K., 2005. *The Culture of Criticism: Adolf Behne and the Development of Modern Architecture in Germany, 1910-1914*, Pittsburgh, United States: Columbia University.
- Henderson, R. and Clark, K., 1990. Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. *Administrative Science Quarterly*; 35, Mar, pp. 9-30.
- Howard, H., 2016. *Architecture's odd couple- Frank Lloyd Wright and Philip Johnson*. New York: Bloomsbury Press.
- Keller, S., 2017. *Automatic Architecture: Motivating form after modernism*. Chicago: The University of Chicago.
- Kuczmarksi, T. D., 2003. What is innovation? And why aren't companies doing more of it? *The Journal of Consumer Marketing*, 20:6, 536-541
- Kuhl, I., 2012. *Architecture: The Groundbreaking Moments*. London: Prestel.
- O'Brien, M. J. and Shenna, S. J., 2010. *Innovation in Cultural System, Contributions from Evolutionary Anthropology*. Massachusetts: Massachusetts Institute of Technolog.
- Raisbeck, P., 2011. Paradoxes of innovation and architectural design: a model of design knowledge generation in architectural practices. *Amsterdam, Management and Innovation for a Sustainable Built Environment MISBE*.
https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=Paradoxes+of+innovation+and+architectural+design%3A+a+model+of+design+knowledge+generation+in+architectural+practices&btnG
- Rogers, E. M. 1982. *Diffuision of Innovations*. New York: The Free Press, Third edition.
- Schulz, C.N., 1963. *Intentions in Architecture*. Rome: Allen and Unwin Ltd.
- Sehested, C. and Sonnenberg, H., 2011. *Understanding Innovation*,
<http://www.springer.com/978-3-642-15894-0>
- Steiner, C. J., 1995. A Philosophy for Innovation: The Role of Unconventional Individuals in Innovation Success. *The Journal of Product Innovation Management*, 12(5), pp. 431-440.
- Teyssot, G. 1981. Neoclassicim and Autonomous Architecture: The Formalism of Emil Kanfmann", *Architectural Design*, Volume 51
- Tietz, J., 2013. *The story of modern architecture of the 20th century*. China: h.f.ullmann.
- Villalba, E., 2009. *Is it really possible to measure creativity?*. Brussels, European Union, pp. 3-14.
- http://s11.photobucket.com/user/danperry/media/Germany/Berlin/Berliner%20Philharmonie%20concert%20hall/IMG_1977.jpg.html
- <http://su2016.thedude.oucreate.com/wp-content/uploads/2015/10/GM-Technical-Center-Warren.jpeg>
- http://www.greatbuildings.com/buildings/Rue_Franklin_Apartments.html
- <http://www.mdah.ms.gov/senseofplace/wp-content/uploads/2015/10/MS-288-57.jpg>



- <https://brewminate.com/wp-content/uploads/2018/08/081718-64-Otto-Wagner-Architecture-Art-History-Postal-Savings-Bank.jpg>
- https://en.wikipedia.org/wiki/Alvar_Aalto#Works
- [https://en.wikipedia.org/wiki/Dom-Ino_House#/media/File:Charles-%C3%89douard_Jeanneret_\(Le_Corbusier\),_1914-15,_Maison_Dom-Ino.jpg](https://en.wikipedia.org/wiki/Dom-Ino_House#/media/File:Charles-%C3%89douard_Jeanneret_(Le_Corbusier),_1914-15,_Maison_Dom-Ino.jpg)
- https://en.wikipedia.org/wiki/Prairie_School
- <https://medium.com/sap-innovation-spotlight/sydney-opera-house-the-architect-the-engineer-b0f4f3f70eab>
- <https://modernbaghdad.tumblr.com/post/127473255974/proposal-for-the-us-embassy-jose-luis-sert>
- <https://www.archdaily.com/772104/spotlight-eero-saarinen>
- <https://www.architecturaldigest.in/content/iconic-house-eames-ray-charles-eames-los-angeles/#s-cust0>
- <https://www.bauhaus-dessau.de/en/history/unesco-world-cultural-heritage.html>
- <https://www.ribaj.com/culture/james-mollison-wilson-architect-of-empire-baghdad>
- <https://www.sgh.com/projects/philip-johnson-thesis-house-9-ash-street>