

# Spacing Time

## *Engaging Temporality in the Realm of Architectural Space*

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*The paper is a theoretical approach regarding digital architecture, performance and time. It tries to reflect on the philosophical taxonomy of time -cosmological, phenomenological and narrative- and how digitally conscious architectural design developed by architects, media artists, engineers and multidisciplinary teams address the engagement of the architectural space in real-time. The traditional static conception of architecture is altered through performativity and the ideals of permanence and endurance radically questioned. The research also constitutes a reflection on interaction, participation and performance in an ample sense with regard to performative architecture and some urban implications it may entail. Various examples addressing these topics mainly installed or built during the last decade exemplify the different issues that the paper reflects on. A critical reading of the installations and the intelligent-façades commented is posed to the reader together with the conceptual implications the different performative approaches involve and the goals they may achieve. The question remains if buildings instead of being or meaning should, more than ever, perform.*

**Keywords:** *Temporality, Digital Consciousness, Performance, Interaction, Intelligent-façades*

*"He who loves practice without theory is like the sailor who boards ship without a rudder and compass and never knows where he may cast" Leonardo da Vinci.*

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### **INTRODUCTION. MATTER, SPACE AND TIME IN ARCHITECTURE**

Our universe is subject to perpetual change. Because it is made up of material "bricks" it is doomed to constant transformations that are energy consuming. The rate of these modifications is what Aristotle (Physics IV, VIII) called time, a human abstraction to measure these changes and what could be referred to as cosmological time. No matter how simple or apparently ethereal the architectural limits may be, they are always material. Considering

Diller&Scofidio's celebrated Blur Building as probably one of the finest examples in diluting the limits ever achieved -provided the foggy cloud is considered an architectural limit- its diffuse and unstable changing geometry has the materiality of the misty tiny drops that define its continuous flowing form. Architecture is configured as an act of delimitation (Mendelsohn, 1924:3) and since only matter can be perceived through our senses a corollary may be deduced implying the materiality of the limits in any architectural form. Space is the container of matter and time engulfs both. Thus, space can only be conceived through time and, reversely, time through space as changes occur within the limits of the latter and are measured according to time.

Due to the physicality of the architectural space a phenomenology occurs between the object -architecture- and the subject -its dweller-. This phenomenological approach of time, initially introduced by Augustine of Hippo (Confessions, XI) in the philosophical debate, takes into account the subjectivity of our individual perceptions and experience. A certain polarity arises between the world and its being -objective and alien to any phenomenology, on the one side, and the individuals and their perceptions of the world -subjective and depending on the duration of their own existence and context.

According to Ricoeur (1984) three different aspects of time should be considered: the cosmological (objective), the phenomenological (subjective) and the historical (narrated). The latter is conceived as intersecting both key notions of time. Shifts in the professional strategies, the bases of knowledge and the technological foundations have extraordinarily affected the way in which we think, make and build architecture within the broader framework of what has been coined as "Digital Culture in Architecture" (Picon, 2010). The development of responsive façades and the use of new materials allows us to apply the term performance to the interaction of architecture with the environment or with its dwellers in time.

This paper reflects on the way time is addressed

in the field of digital architecture or how temporality may be engaged in the architectural space in varied ways: the digitally conscious spacing of time through architecture.

## **ENGAGING COSMOLOGICAL TIME. ARCHITECTURE AS AN OBJECT**

Cosmological time could be envisaged as the "objective time", the articulation of being (matter) and becoming (in time). This worldly perpetual flow can be measured through our universe's chronology. Buildings are conceived to respond to these external changing agents affecting the living conditions of its inhabitants.

Architecture has traditionally been assigned the role of stasis (Lynn, 1999), being stable and enduring in time -reacting to it in various ways to provide an unchanging frame; a certain notion of permanence. Buildings are to support the loads in a world governed by gravity but they must also shelter men protecting them from the daily changes in temperature, rainfall, wind, or sunlight as well as seasonal fluctuations. Traditional architecture has responded to them passively; louvres, for instance, may control solar lighting inside the building.

The idea of permanence in architecture has been progressively questioned, especially since the advent of new technologies and the so-called digital revolution. Digital architecture has evolved towards a non-linear conception of interactions of complex dynamic systems (De Landa, 2011:14). Responsive architecture is shaped incorporating membranes of mutable appearance with space programs that are not specific nor predetermined, but multiple, fluid and deliberately ambiguous. Led by dynamics of temporality they depend on socio-economic, cultural, and technological changes attaining multiple connotations. This emergent approach to architectural design with its new dimension of temporality defies architecture's usual static conception of form and function.

These possibilities are explored in the SOMA's proposal for the Thematic Pavillion at the 2012 World

Expo in (Yeosu) South Korea. A kinetic façade is opened to the sea with rotating vertical lamellas that allow a greater amount of light to the interior or an ampler visual connection with the sea. An ingenious system of displacement at one of the edges in combination with the different lengths of these elements produce an irregular opening of this "gilled" imaginary on the "sharkish" shaped pavilion enhanced at night with LEDs illumination.

The development of intelligent façades and reactive membranes implies challenging the static conception of architecture to redefine a new dimension of temporality; an architecture anew that could well be referred to as performative. The possibility of designing enclosures or constructive systems capable of reacting to environmental changing conditions or interacting with its dwellers transforms architecture into a real machine to be manufactured rather than constructed, alike dynamic engineering designs. We may speak of a new materiality or animated matter involving a qualitative change with regard to stable appearance over time of the architectural work thus becoming a sensitive reality with a certain capacity of reaction to external stimuli. Something which, to some extent, implies a cyborgisation of architecture (Picon 2010). Although the influence of new technologies in architecture in the last decade has increased performative approaches, these have been addressed in various ways during the previous decades which prefigured what we now understand as performance in ample terms. Performance is an emergent design approach in which the performative capacity of the building becomes a guiding principle of the design. Performance is assessed together with the conception of the architectural form -form-making- employing digital quantitative and qualitative simulation technologies -performance-based design- to offer a new global approach to the design of the built environment.

### ***Performance-Based Design***

A performance-based design analyses and reflects on how the environmental context can "in(form)"

the complex processes of design synthesis. Oxman (2014) defines three seminal concepts of PBD: simulation, parameterization and optimization. Simulation involves the use of tools that enhance instrumental analytical procedures. This simulation is subject to the consideration of multi-value parameters pursuing the integration and balance of various factors for a specific theoretical problem. This entails a considerable complexity of the design methods even if simulation techniques are limited to the parametrisation of physical and environmental data such as structure, climate or acoustic factors. Finally, optimization is related to the evaluation criteria and how should they be formulated and applied to the design itself.

This digitally driven design strategy has conceptual implications and is indebted to the capacity to predict the performance of structural behaviour or energy optimization thanks to the possibility of simulation, to mention only two. Thus the development of parametric models that consider the stresses that the structural elements may have to bear or the radiation gain which a façade may be subjected to may serve as a guiding tool in the design process itself. Consequently, the material properties and the actions in time that are to be expected in a particular design may be accurately predicted and introduced in the design assessing it and contributing to form-finding strategies following iterative processes. A research on shape-morphing wind responsive façade systems by Lignarolo, Lielieveld, and Teuffel may illustrate this digitally conscious approach. Wind loads in high-rise buildings with shape-morphing façades may be analysed by numerical simulation, taking into account the influence of the surface texture on the wind pressure and velocity fields. The research concludes that the texture of a building façade may have significant effects on the wind flow fields. Using smart façade tessellation with materials capable of modifying their shape in real time and, consequently, changing the texture of the skin depending on the wind speed or its direction, may modify the building's overall reaction to wind stress. This phenomenon can be exploited to modify natural ventilation inside the build-

ing, the heat exchange through the skin, and, conveniently designed and positioned, to achieve a reduction of the drag forces with the incorporation of roughness elements on the façade actuating as strong vortices (Lignarolo et.al.2012). By integrating design and analysis of buildings with digital modelling and simulation technologies, the roles of architects and engineers are increasingly being assimilated into a digital collaborative enterprise from the earliest conceptual stages of the design (Kolarevic 2005).

The Homeostatic Façade System (Fig. 1) developed by Decker&Yeadon architectural office (Mossé et. alt. 2012) may exemplify a responsive approach to external changing conditions, making a wise use of biomimicry and new materials. The engineered ribbons inside the double skin glazing react to solar changing conditions contributing to control solar heat gain as well as natural lighting in the interior in real time.



Architecture is, thanks to this performative approach, reactive to environmental external agents, such as the solar radiation. On the one hand, this produces an animated enclosure whose aspect is in constant flow; on the other, the enclosed space and its living conditions are simultaneously altered in time. It is obviously an engagement of the cosmological time provided the changing conditions are subjected to the physicality of the solar radiations. Consequently, this

animation of the responsive architectural limit goes beyond a mere aesthetical proposition on the façade; it improves the dwelling conditions on the interior in real time.

Nevertheless, the homeostatic façade is, to a certain extent, a passive reactive skin in as much as the solar radiation induces it to be reshaped but there is no machinic intervention in the reaction; however, there are other possibilities that digital design may enhance. Responsive architecture is based on its reactivity to external stimuli. More sophisticated interactions can be envisaged in terms of performative architecture which may be the result of an active response of the building itself. A fully "performative" architecture involves incorporating devices which include four different categories: sensors, controllers, actuators and materials (Achten 2011). That is, if architecture is no longer passive and must be able to react to environmental inputs it is necessary for these complex systems to equip themselves with sensors able to identify, discriminate and perceive such stimuli. Analogously to their role in living organisms these sensors constitute the perceptive appliances of the "mechanic organism" which now becomes architecture. To be really interactive, an assessment of these stimuli and the actions that should be carried out due to them is necessary to be operated by the "technologically animated body" in accordance to the nature of the stimuli and the capacities of the sensors; this role falls on controllers. Actuators, conversely, are the mechanisms that respond to the controller's input enabling the reactions of this responsive architecture. Finally, all this has to be embodied into a physical membrane capable of responding to these stimuli. Evidently, this process of animation is not easy due to the complexity of the scale involved and to the limited experience of architects in this field.

The Flare façade by WhiteVoid is an example of kinetic façade. Modular tilttable metallic shingle bodies pneumatically activated and computer controlled produce the possibility to reflect or to hide sunlight. Thus, dark or bright "pixels" appear on the façade de-

Figure 1  
Homeostatic  
Façade System,  
Decker&Yeadon  
Architects. New  
York, 2010.

pending on the sensor controlled activation of the shingle bodies allowing to create patterns or to shift the skins' permeability depending on the desired effects and modifying the static condition of a conventional façade [1].

## ENGAGING PHENOMENOLOGICAL TIME. ARCHITECTURE, SUBJECT AND OBJECT

Agustine of Hippo in his Confessions (XI) introduced the psychological dimension of time placing the individual as an observer of the flowing world and considering how his subjectivity affects the temporality he is to live, the recollection of his lived experiences or his expectation towards the forthcoming ones. The abstract Aristotelian conception of time as a cosmological chronology is confronted with the living temporality of the human beings and their perceptions of the world in the moment they live. While traditional architecture was attributed a certain role of permanence reacting to the world flow in a passive way, performative architecture is responsive to external stimuli in real time, modifying part of its limits to react to them. But this has further conceptual implications as the perception of the temporality of architecture is shifted from permanence to instability and, consequently, the phenomenology between the building and the observer introduces a new dimension to architecture if it is considered as part of the design itself.

### Addressing Perception

Digital conscious architecture may challenge the boundaries between the real and the physical generating new layers of meaning to the reality of the physical limits on whose surface virtual images may be displayed. Time literally creeps through the display of ambivalent images on architectural limits that suggest multiple readings in continuous flow introducing temporality as a changing dimension in a discipline traditionally characterized by form stability; architecture thus assumes a new role within the paradigm of mediation and communication. Cosmological and phenomenological times are synchro-

nized through the changing appearance of the building's skin and its varied perceptions. Within this new paradigm of communication, façades become screens conveying a narrative of meta-architectural contents. Architecture no longer is or means, it is a channel for advertising, announcing cultural and social events, transmitting weather data or financial markets exchange rates, etc.; in summary, it informs (Fernández 2010).

Screen work by architects is not new; it forms part of a disciplinary assimilated lineage. Ray and Charles Eames were pioneers of multi-media presentations with their work "Glimpses of the USA" (1959). Some of the boldest architectural proposals on the second half of the twentieth century incorporated large projection screens such as the utopian visions of Archigram's "Instant City" (1969-1970), the initial draft of the CNAC George Pompidou in Paris by Piano and Rogers (1977), Koolhaas's unbuilt proposal for the ZKM in Karlsruhe (1992) defined by the author as an "electronic Bauhaus", the KPN Tower by Renzo Piano in Rotterdam (2000) or the architectural-media installations by Diller+Scofidio such as Jump Cuts (1995) or Facsimile (2004).



Digital architecture finds in creativity one of its hallmarks. The possibility of conceiving façades as displays introduce new possibilities to work on them as a design element; that may include working on the displays themselves. The idea of using a low resolution display based on conventional circular fluores-

Figure 2  
BIX communicative  
display skin for the  
Kunsthhaus Graz,  
realities:united,  
Graz, 2003

cent tubes was used by realities:united (Jan and Tim Edler) for the BIX installation (2001-2003), (Fig. 2). The dynamic display of light -the changing of light patterns- is one of the primary project's performative features. BIX is a light and media installation, placed behind the Plexi-glass membrane to create a communicative skin on a low-resolution computer controlled basis; a "media façade" that, through display signs, adds and banners, refers to activities that take place inside the building transmitting to the city the internal processes of the cultural institution [2]. Performative aspects of the building are all geared towards a "strategy of urban communication". This was an interactive installation for the Graz's Kunsthaus (2003) blobby-architecture design by Peter Cook (co-founder of Archigram) and Colin Fournier.

GreenPIX façade (Fig. 3) developed by Simone Giostra & Partners and ARUP for the Xicui entertainment complex in Beijing is a recent example of a media-façade which is, moreover, a sustainable projection screen. This ground-breaking design is a promising example of what is to be expected out of a successful interdisciplinary approach applied to architectural design. The collaboration between the architectural office lead by Giostra, ARUP, Schucco and SunWays produced one of the finest examples of smart-façades up to date. Polycrystalline photovoltaic cells were laminated within the glass of the curtain wall and positioned with varying density on the building's façade. The density patterns on the façade produce a certain irregularity of the glazing modulation in accordance with one of digital architecture's most characteristic aesthetic features. Simultaneously, the building's performance is increased as natural light is allowed when required by the interior program while reducing heat gain by solar radiation and transforming its excess into energy for the media wall. At night, all the accumulated energy during day hours is beautifully displayed with a combination of LEDs that instantly and colourfully transform the appearance of the building projecting low resolution digital art to the city [3].



Figure 3  
GreenPIX, Zero  
Energy Media Wall  
by Simone Giostra &  
Partners and ARUP,  
Beijing, 2008

Thus, phenomenological façades screened rather than walled are capable of projecting images at a large-scale introducing a new notion of temporality in architecture that challenge the latter's role although the still expensive technologies to employ may undermine their diffusion. For example, the original draft for the Markthal by MVRDV in Rotterdam included liquid crystal displays for the great dome covering the public space but their cost and the immense surface forced to replace them by a static colourful image rendered by Pixar at 6000 dpi printed on aluminium plates (Fernández-Galiano 2014). LED's, on the other hand, keep reducing their cost as their production increases and their generous life service hours make of them a competitive "construction material". Maybe low resolution imaginaries for phenomenological façades could contribute to the exploration and development of this kind of digitally conscious approaches. Additionally, if

the costless energy these screens may gain from the sun is considered into the equation -just as in the GreenPIX project- things may change sooner than expected, especially as sustainability issues become more and more part of the social and political agenda.

### **Addressing Interaction -Individual and Collective**

The aforementioned examples of media-façades constitute a clear example of architecture's engagement with a phenomenological notion of time. Nevertheless, they show how architecture can go a step beyond its own meaning -if there is such a matter apart from considering the building with regard to its disciplinary narrative-. In any case, this engagement could only be in one-way since the communicative skins simply display information. However, what if those skins became sensitive and were able to react to individual or collective inputs? New possibilities of information coding would allow to integrate this temporary factor into a dynamic network of interactions, of multi-layered processes, interconnected, challenging in new ways the concepts of form, structure, value, or stable meaning conventionally assigned to architecture.

This is, in fact, another approach of digitally conscious designed architecture. Not only do buildings become part of a cityscape with gleaming façades that are able to inform or display information useful to their inhabitants; they may also interact with them. This is a totally different way in which to address temporality in architecture. Buildings are able to interact in real time with individuals, showing and incredible potential of architecture that entails a friendlier engagement towards the public space. Architecture does not simply react to the weather conditions but to the action of pedestrians or even through the Internet with the city inhabitants comfortably sitting on their sofas at home. WhiteVoid's proposal of LivingSculpture 3D modular system (2012) for Philips homonymous initiative (Fig. 4) is an example of this interactivity between intelligent lighting

systems (it is a small sized prototype) and users. An irregularly tiled double-curved surface built with Lumiblade OLEDs is lit through an Ipad application that controls the order and arrangement of the on and off values for each tile. The users may play orienting the Ipad in space and changing different parameters on the application to modify and unlimited variety of visual patterns for the illuminated OLEDs [1]. This interaction is intentionally driven by users that are able to modify the visual aspect of the set at their will; therefore, temporality is addressed here in a truly interactive way.

Figure 4  
Aperture by The-  
GreenEyl+Sengewald,  
2004



Figure 5  
LivingSculpture, 3D  
module system,  
designed for  
Philips, WHITEvoid,  
London, 2012



A pedestrian fed media-wall was conceived by the Berlin based interactive artists The-GreenEyl+Sengewald in 2004 with their proposal "Aperture" (Fig. 5), a mixed system to produce images from an array of diaphragms that react to hu-

man activity in the vicinity. The question posed was whether the buildings being equipped with sensors and diaphragms could have recollections of what "they" experienced to depict the previously perceived images. The diaphragms acted as the façade's installation eyes and also, due to their arrayed disposition, as a pixelated matrix capable of reproducing in low-res previously perceived images on the "pixelated" display. In doing so, the role of interaction and perception between users and architecture was completely inverted hinting an alternative path to reflect on the phenomenological notion of time to be dealt with by architects and media artists alike. This installation also evidences that full interaction implies a notion of reciprocity and a synchronization of the phenomenological times of subject and object.

The introduction of motion on responsive façade adds still another layer of complexity to the performative potential of buildings regarding the perception of architecture itself. Both, interaction and participation emerge as relevant features of the new digital media. Therefore, a significant change is observed regarding the way in which users relate to the built environment and also with regard to the way in which the environment relates to us. Aegis Hypo-Surface proposal by dECOI Architects (Mark Goulthorpe) address this topic of responsive motion animated membranes (Kolarevic 2003). A multifaceted perception of form resulting from varied performative processes appears. In it, architecture is conceived as an animated being able to interact with its dwellers or with the environment where it is rooted in instead of simply enduring or lasting over time.

Projects as the D-Tower by Lars Spuybroek - NOX- (1998-2003) can be considered pieces of performative interactive and participative architecture. D-Tower is a digital hybrid material consisting of a biomorphic structure, a website and a questionnaire form that generate an interactive system of networked relationships. D-Tower changes its colour depending on the prevailing emotional state of the residents in the city that is processed from the answers given by the people to an on-line question-

naire about their daily emotions -hate, love, happiness, fear; their inputs are then mapped using a four colour-code (green, red, blue and yellow). The "mood" of the city is also accessible through a website showing the "emotional landscape" of the neighbourhoods in real time. A similar urban-scale interactive and participative pioneering proposal for an architectural display can be exemplified with the Blinkenlights project (2001) located in Berlin's Alexanderplatz. The group "hacker media art" Chaos Computer Club (CCC) transformed the building of the "Haus des Lehrers" in the world's largest digital interactive device: a rudimentary screen on which project's participants could play Pong, send simple designs through the Internet or using their mobile phones to create and send images to be displayed on the building's façade. Each of the 144 windows of the building became a pixel with an on/off value controlled by a software system based on GNU/Linux. Pedestrians and those who wished to participate in the initiative were engaged with a real-state property which was alien to them evidencing to what extent the façades of buildings in the city are in fact part of the public space.

## **INNOVATIVE NARRATIVES OF SPACE. SPACING TIME**

Ricoeur's contribution to the philosophical debate regarding time is the notion of narrative as the intersection of the cosmological and the phenomenological times providing what could be thought of as a certain social dimension of time. Thus, ontological and phenomenological approaches of time are somewhat merged in any narration which is sequential and inserted in history. Historical events happen within the framing of the cosmological notion of time, but are experienced by individuals subjected to a phenomenology that connects events with those individuals, and must necessarily be narrated by different actors to be recalled and interpreted in various ways by future generations. To Ricoeur, both, "city and architecture are stories that come together in the past" (Ricoeur 2002).



### **Architectural and Urban Performing narratives**

BIX light installation blurs the boundaries between architecture and performative media. At the Kunsthhaus, McLuhan's famous aphorism "medium is the message" comes into being extrapolating his ideas to the realm of performative architecture. The black and white low resolution array (only 930 pixels of 40w. lamps) imposes severe limitations as much as it evidences the need to produce specific content but at the same time generates a poetic of "low resolution" as a feature of the intervention.

The more recent outstanding GreenPIX smart-façade has managed to merge the notions of cosmological, phenomenological and narrative times in one single design as the sun radiation - a physical external agent, the idea of the display - implying a perception of the city inhabitants, and the projection on the skin of contemporary media art match together justifying the whole conception and producing a contemporary piece of digitally conscious architectural design. The LEDs technology and the irregular distribution of the photovoltaic cells produces a colourful and more expressive low resolution poetic compared to the BIX installation that allows to use it as a wall for the expression of media artists. Moreover, this green-architecture -zero energy consuming- is not only digitally conscious but also consistent with sustainability issues; the curtain wall even allows opening windows for natural ventilation. Its impact on the city during the night spreads at various distances. Night spatiality emerged in the XIX century as a result of artificial illumination in the cities and buildings (Holl et. alt. 2012) but became more influential with the advent of curtain walls and high-rise buildings. The suggestive glowing images of modern city downtowns could well be reinforced with media façades if they were to become a widespread trend.

The interactions of the city dwellers with these technologies do not exhaust with media façades. New applications are developed enriching the possibilities of the pedestrians to participate and enjoy the public space. German studio Phase 7's Onskebronn

first installed in Sandnes (Norway) in 2008 (Fig. 6) consisted in an interactive transparent floor reactive to the pedestrian movement with LEDs arranged beneath it glowing and changing colourfully synchronized with the people's steps in real-time.



It could be argued that the lively mediated architectural skins have the potential to change the way in which we relate to the built environment and, conversely, how the built environment relates to us. Cyberspace permeates the urban space itself setting an intricate network of connections and channels for human interaction (Mitchell, 1996) thus challenging the conceptions of cosmological or phenomenological time and their synchronic relations. These digitally conscious designs also imply a novel narrative of architectural space within architecture's own history; something that could be paralleled with Ricoeur's conception of historical time. The way in which these buildings make use of these new technologies and the ways in which time is engaged in the realm of architectural space may well be interpreted as the emergence of a new architectural narrative of space or rather as spacing time in architecture.

### **CONCLUSIONS**

Performative architecture addresses the ideal of real time in architecture in various ways. Digital approaches transform the way in which architectural form is conceived. Rather than formal stability it should be envisaged as a dynamic and complex operation addressing performative aspects that include

Figure 6  
Onskebronn by  
Phase 7,  
Sandnes(Norway),  
2008

perceptual and behavioural focusing.

The classic duality of the conception of form based on image or on a mere functionalist attitude must be replaced with a multi-layered perception of complex geometries as a result of various performative processes. Architecture should thus be designed as an animated artefact able to interact rather than remaining or simply enduring over time.

Smart-façades may introduce new design variables including the possibility of contributing to improve the sustainability of this hyper-technological architecture, but they should also ensure the visual connection between interior and exterior.

The goal towards a performative architecture would imply a new logic in the conception of the architectural form and a new relationship between the nodes of the triangle "form-function-subject" shifting the focus of the architectural discourse to the performative approach.

Networked interactions may introduce collective participation and a social dimension into performative architecture. This technological new media-façades, with their large-scale displays, can become a live city art museum able to exhibit media artist works in real time in a more progressive commitment towards the public space.

We are facing a new conception of temporality in architecture: a dynamic and active conception in which architecture is no longer an immutable object. Neither is the city a virtually permanent framework in which to develop human activities but rather a networked place coupled with an architecture whose appearance or capacity to respond to specific needs may change over time. The performative approach is therefore disruptive rather than evolutionary as it introduces a shift of paradigm in architectural design with regard to temporality.

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