Digitally Disruptive Critical Regionalism: Climate, Place and Facade

Carlos L. Marcos
University of Alicante
University of North Carolina at Charlotte

Elizabeth L. McCormick
University of North Carolina at Charlotte

Abstract

The history of the built environment is quite extensive as building typologies have typically evolved slowly over time. However, the International Style inflicted a ubiquitous architecture indiscriminately across the globe, forever changing the urban skyline. Separating the occupant from the outdoors while also deploying uniform, anonymous styles around the globe, modernism cast on the dweller a certain sense of *placelessness*. Growing environmental concern and the impact that architecture may have as negative side effects was not part of the modernist agenda, at least not in the way we understand it now.

In the last three decades, the advent of digital tools in architectural design has produced a profound impact on architectural language. It is not a mere change in the way architects think or design architecture, it entails a significant transformation of the discipline in various groundbreaking aspects which affect the whole creative and materialization processes. Digital culture in architecture entails a shift of paradigm that goes beyond the tool to modify the conception, the design process together with the project's own materialization. The question is then, in relation to this research, how can digitally disruptive architecture contribute to rethink the idea of critical regionalism in response to façade design and climatic conditions?

Background

The *International Style* emerged early in the 20th century as an embrace of industry and globalization (Frampton 1992). The movement welcomed a revolution of 'new' materials including laminated steel, plate glass and reinforced concrete as an architectural response to its time (Eldemery 2009). After the 1932 exhibition at the Museum of Modern Art, a new 'modern style' was coined, its syntax most notably disassociated the façade from the function of structure (Hitchcock 1951).

Transparency soon became an icon of modernity (Oeschlin 1997) made possible by the invention of the curtain wall. This system proliferated as the predominant building enclosure method in Europe and America and quickly became the symbol of economic growth and prosperity in the West (Oldfield, Trabucco, Wood 2009). This modern syntax resulted in a considerable uniformity; its most conspicuous image was based on regularity and gridded glazed facades[1] that would become widely disseminated (Mies' Seagram building could well illustrate this modern high-rise[2] canon, Figure 1).

Regionalist Response to Modernism

Despite the extensive worldwide sprawl of modernism by the mid 1950's, it became evident that the imaginary and the universalization of this syntax was not ubiquitous. A new concept, *Critical Regionalism*[3], emerged, partly in response to the implicit critique of the international style's eurocentrism. The idea of *placelessness* of such a uniform style was patent in the critical discourse enriched in time due to its weak (or nonexistent) relation to local culture and tradition of place itself (Norberg Schulz 1979). Critical Regionalism was a response rooted in *place* not mimetically vernacular. It was a critical local reading of the modern legacy which ought to be reinterpreted and enriched,

Figure 1. Home Insurance Building, Le Baron Jenney, Chicago, 1984. Seagram Building, Mies van der Rohe, New York, 1958. Ministry of Education and Health, Lucio da Costa, Oscar Niemeyer, Affonso E. Reidy, et alt. Rio de Janeiro, 1945. Evolution of the façades according to modernist canon; note the different approach in the Seagram and in the prescient critically regionalist Brazilian architecture despite the time of completion.

while rejecting historicist postmodernism (Frampton 1983).

Defining 'Place' – Climate and Culture

Climate control was associated with social status and was symbolically man's victory over nature (Brager and de Dear 2008). Early office towers[4], such as the Home Insurance Building in Chicago (1885), used operable windows for ventilation, lighting and the control of passive solar gains (Figure 1). Less than 50 years later, the first air-conditioned office building, the Milam Building (1928), was completed in San Antonio, Texas. Air conditioning soon became an expectation of the modern workplace necessarily reliant entirely on mechanical solutions. Despite the energy implications for which modernists were initially unaware, the move from open, naturally ventilated spaces to completely sealed environments narrowed the range of acceptable thermal conditions alienating interior from exterior. Something which further contributed to modern *placelessness*.

The sealed-glass archetype decoupled inside from out, disrupting energy flows through the building[5]. Developed largely for cold and temperate climates, the significant increase in the glazing increased solar gains too. Although Le Corbusier once favored "a single house for all countries, all climates" under the functionalist ideal of the *machine d'habiter* (cit. Torres Cueco, 2004, p.133), he became increasingly concerned with climatic control. His original proposal for the curtain wall in the Centrosoyuz Building in Moscow (1928), featured the '*mure neutralisant*' and the '*air exacte*', his early air conditioning and mechanical ventilation systems[6].

The *brise-soleil* was made famous by Le Corbusier and further developed by the Brazilian modernists. The most celebrated building of this sort was the Ministry of Education and Health of 1945 (Figure 1) by Costa, Reidy, Niemeyer[7]. Le Corbusier, became aware about the need to adapt the modern syntax in relation to climatic needs. His collaboration with Missenard and Xenakis[8] helped him to achieve some of the finest designs in India.

Figure 2. Institute du monde arabe. Jean Nouvel, Paris. 1985. One of the first examples of kinetic façades.

Figure 3. Latticed revolving bricks façade, Farhad Mirzaei in Arak, 2015.

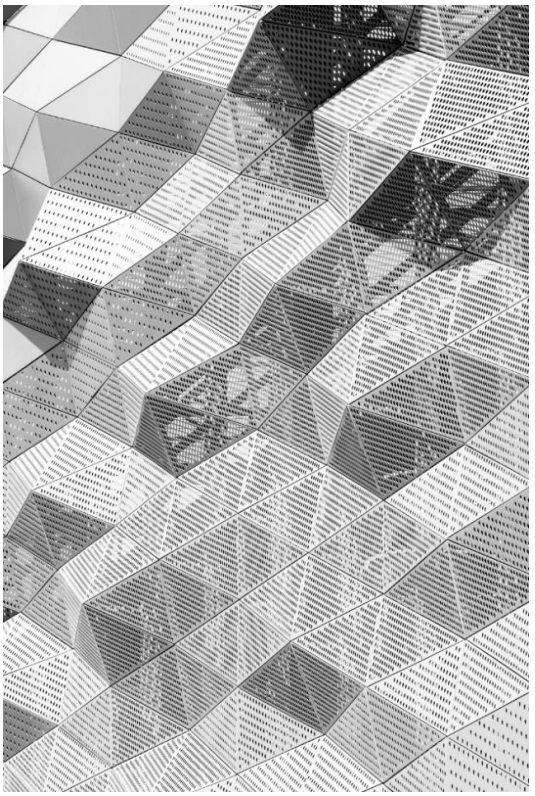

Figure 4. Street Ratchada in Bangkok Architectkidd, 2017. (note how the diffractive skin allows a certain degree of transparency from the exterior, something which accounts for the small amount of solar radiation that penetrates in the building. However, from the interior the street can be perfectly seen due to the diffractive effect. In fact, the level of transparency is ambivalent and dependent on the different intensities inside and out)

Nouvel's kinetic façade for the World Arab Institute in Paris (Figure 2), is a technological update of the *brise-soleil*. The abstract reference to Arab geometric ornamentation can be considered a cultural reinterpretation of vernacular Islamic architecture too.

Digitally Disruptive Critical Regionalism

In most cases, if not all, façades need not be completely glazed. Overhangs and louvres can be introduced to cast shadows depending on the orientation. In addition to the seasonal control of heat, external shading had other compelling attractions such as "the strong spatial character that reinforced the depth associated with mass walls to thin curtain wall construction" as well

as "regional specificity to location and climate"(Braham 2000), adding "new elements to the architectural vocabulary, and phrase a truly regional consciousness" (Olgyay 1976).

If architects want to maintain the curtain wall effect with the transparency and maximization of light, while avoiding many of the problems generated by the solar exposure and the flaws to this regard of modern language (Kelley and Johnson 2013), they may consistently improve the energy consumption in climates where the solar radiation is more significant.

Architectural disruption[10] involves a radical innovative transformation of architectural syntax, a shift that succeeds in embodying the zeitgeist of its age, contributing to set a new aesthetic framework displacing the existing. In fact, this paper holds that digitally conceived architecture can work on the idea of superimposed diffractive skins and latticed façades to achieve a more effective approach to this problem. This can be considered digitally disruptive in relation to façade design and the modernist precedent of the plain curtain wall.

Climate is a well-studied science and its indicators are quantifiable. Though day-to-day weather conditions may vary from average conditions, climate is relatively predictable. Culture, on the other hand, is more nuanced. However, culture is partly informed by a region's climate, as evident in clothing and vernacular architecture.

Figure 5. Thom Faulders Architecture. *Airspace Tokio.* 2007.

The Jaipur Palace of the Winds (Hawa Mahal, 1799), for example, shows a historical approach to this kind of design strategy. Here, the latticework façade was used to conceal the royal ladies within while allowing their gaze towards the street and, additionally, allowing cooling breezes to pass through the façade. In the same way that Le Corbusier and the Brazilian modernists embraced the thickness of the *brise-soleil*, latticed transparency (Marcos 2012) allows to step over the limitations of literal transparency characteristic of some of the modernist designs (Rowe, Slutzky, 1963). Lattices allow transparency to different degrees, depending on the balance between the openings on built geometry. Seemingly opaque patterns still allow for transparency, especially from the interior towards the exterior.

Digital tools in architecture still require the thoughtful hand of the architect to identify parameters and priorities[11]. Parametric designs in combination with digital fabrication have generated different examples of latticed facades that benefit from this kind of design strategies.

The revolving-bricks façade designed by Farhad Mirzaei in Arak (Figure 3) is an excellent example of how digital tools may help to define new ways in which to address materiality while addressing the idea of latticed façades. Developing the ideas that Gramzio and Kohler popularized with their celebrated façade for the Swiss winery in 2006, Mirzaei reinterprets parametrization with a conventional material - brick- that is conceived as a veil over the glazing of the building, protecting it from strong solar radiation while showcasing a contemporary design[12]. Moreover, the latticed façade design can be enriched with diffractive effects. What is most remarkable about the effect of light diffraction is to achieve transparency despite apparent opacity. Thanks to the possibility to build perforated skins warping the building the effect will invariably remain because of the physical diffraction effect - light peeping in through tiny perforations on the surface and yet allowing it to go through them and see the exterior from the inside. Varied and changing day and night effects may be achieved as the transparency flows from outside to the interior in the daytime while it reverses at night. Depending on the light intensity, this diffractive transparence effect may serve in one direction or the other (the most intense will prevail).

Recently, such an effect has been wonderfully accomplished in the latticed diffractive façade designed by Architectkidd for the Street Ratchada in Bangkok commercial center (Figure 4). A complex triangulated paneling alternating diverse density perforations and opaque elements achieve a stunning façade superimposed to the glazing to reduce solar gain in the daytime while producing sharp night lighting effects enhanced by led illumination. Thus, what could have been an anodyne glazed façade has become, in fact, a very characteristic image in Bangkok's urban busy area.

Another approach to latticed façades and the idea of a superimposed skin warping up the glazing has been addressed by many digitally conscious architects keen on parametricism. Schumacher (2009) has claimed this should be considered a global style, and although this position is probably excessive, parametric designed skins has been one of the hallmarks of computationally designed architecture in the last decade and a half. Thom Faulders's Airspace Tokio project (Figure 5) is a good example of this kind of façade which, in as much as it reduces the amount of exposed glazed façade it is an improvement with regard to solar gain. It addressed this kind of latticed transparency that was built on a site "previously wrapped by a layer of dense vegetation" (Iwamoto 2009, p. 54).

Conclusions

As other syntactic *clichés* of modernist architecture, the curtain glazed façade became a stylistic feature associated with modernity and prosperity, despite its flaws. The universal adoption of air conditioning, high-rise buildings, and curtain wall technology all within the span of a single generation, not only did generate a significant impact on the urban skyline but also a lacking sense of *self* and *place*.

Many regions sacrificed their local identity and age-old construction techniques for the sake of Western building styles as symbols of power and prosperity, giving way to a ubiquitous *placelessness* among modern buildings, an overall detachment from nature and ecological degradation.

In response, this paper explored how to reference the past with current digital tools, analyzing different ways in which to design glazed façades, especially in latitudes alien to

most of the western countries' climatic conditions where mid-century technological innovation occurred. Digitally designed latticed and diffractive skins are a critical reading of the modern curtain wall which, in addition, may find ways in which to reinterpret local traditions avoiding mimetic and superficial approaches and following a computational logic.

Using the defined parameters of climate, one can begin to use digitally disruptive means to achieve a regionalist approach to contemporary architecture, preserving both energy and the sense of identity.

New materiality characteristic to CAD-CAM convergence and customized mass production allow to think of these proposals as a new critical reading to architectural modern legacy in the context of digital disruption.

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Endnotes

1. Ian McCallum, the executive editor of Architectural Review, described the curtain wall as "the new vernacular" in 1957 (Yeomans 1998), probably spurred by its ubiquitous sprawl.

2. High-rise towers emerged quickly and universally, triggered by the adoption of steel structures, the invention of the elevator (Koolhaas 1995, p. 500), and the increasing accessibility of mechanical conditioning technologies. The international style set a uniform enclosure for high-rise buildings. This typology was simple: a curtain glazed façade with set-back columns and an internal core comprised of vertical communications and services - the rest a flexible space.

3. Lewis Mumford was one of the first to address these issues in the 1940's in what some have referred to as the 'Regionalist Rebellion' (Lefaivre, 2003).

4. This generation of buildings was bulky and compact with load-bearing masonry walls and only 20-40% glazing, as compared to the 50-75% glazed facades of modern buildings (Oldfield, Trabucco, and Wood 2009).

5. The premanufactured nature of the curtain wall demanded caulking and sealants that in turn suppressed the potential for natural ventilation strategies.

6. In his Cité de Refuge for the Salvation Army in Paris (1929) he had been sued and forced to place windows at his cost as the system didn't work as expected. He was able to replace all the enclosure of the façade due to war bombardments and took the opportunity to add a *brise-soleil* in 1951 (Requena 2011, pp.55,56).

7. Others buildings with louvred façades included the building for the Brazilian Press Association (Ribeiro brothers) or Obra do Berço (Niemeyer), both built as early as 1936. While the first two used vertical louvres, the Ministry of Education and Health combined a larger scale *brise-soleil* façade to which smaller adjustable, horizontal louvres were added. Le Corbusier was called to act as a consultant for this building. All of these buildings were constructed in Rio de Janeiro. The other influential modernist school in Brazil being Sao Paolo, with Vilanova Artigas and Mendez da Rocha as the main figures.

8. Xenakis elaborated the grille-climatique in 1951. This chart introduced four variables for design considerations -temperature, relative humidity, air speed and walls temperature- for which Le Corbusier himself drew 16 different plan schemes with a series of case-studies (Requena, Siret 2015, p.1837-8).

9. This research is part of a research project on disciplinary disruption and digital architecture for which I have taken a sabbatical leave from my home university to join the University of North Carolina Charlotte. The purpose is to address the topic within a multidisciplinary scope on the basis of collaborative work thus researching varied disruptive aspects digital and computational design entail. The idea to address digital architecture and critical regionalism spurred from an informal conversation held at a lunch with Dimitris Papanikolaou and myself shortly after my arrival.

10. The apparently novel concept of disruption can be traced back to research in innovation within the field of business management. It refers to situations of swift and intense change in pre-existing business models or to the emergence of others completely new due to accelerated processes of development, commercialization and use of innovative products or services (Christensen and Bower 1995). The term has subsequently undergone, further development by Christensen and has acquired a significant popularity amongst other disciplines.

11. Furthermore, the convergence of CAD-CAM techniques allows the achievement of customized mass production, as well as a notion of a new understanding of materiality in the context of a broader digital culture (Picon 2010).

12. The use of bricks as a veil in this façade is certainly disruptive, not only with regard to the ways in wich the bricks are laid but most significantly because of its denial of masiveness and oppacity that masonry is generally associated with. Moreover, with out a computational approach to this design façade and its digitally positioning the results obtained would have been impossible to achieve. This project is a characteric digitally conscious arhitectural desig in the way CAD-CAM techniques are merged. The concealment and privacy needed for an office building within a residential neighborhood complemented the need to control the solar exposure due to orientation.

References

Brager, Gail S., and Richard J. de Dear. 2008. "Historical and Cultural Influences on Comfort Expectations." In *Buildings, Culture and Environment: Informing Local and Global Practices*, edited by Raymond J. Cole and Richard Lorch, 177–201. John Wiley & Sons.

Braham, William W. 2000. “Erasing the Face: Solar Control and Shading in Post-Colonial Architecture.” *Interstices Journal of Architecture and Related Arts*.
Bower, Joseph L. and Christensen Clayton M. 1995. "Disruptive Technologies: Catching the Wave", in *Harvard Business Review* 73, no. 1, 43–53.

Eldemery, I.m. 2009. “Globalization Challenges in Architecture.” *Journal of Architectural and Planning Research* 26 (4): 343–54.

Frampton, Kenneth. 1983. “Prospects for a Critical Regionalism”, *Pespecta, 20, 147-162.*

Frampton, Kenneth. 1992. *Modern Architecture. A Critical History*.Thames and Hudson.

Hitchcock, Henry-Russell. 1951. “The International Style Twenty Years After”, Architectural Record, August: 237-255.

Iwamoto, L. 2009. *Digital Fabrications. Architectural and Material Techniques*. Princeton Architectural Press.

Kelley, Stephen J., and Dennis K. Johnson. 2013. “The Metal and Glass Curtain Wall: The History and Diagnostics.” In *Modern Movement Heritage*. Taylor & Francis.

Koolhaas, Rem, “Bigness or the problem of Large” (1994, a), in Koolhaas, R., Mau, B. (Eds), *S,M,L,XL*, OMA, The Monicelli Press, New York, 1995, pp.499-500

Koolhaas, Rem. 2013. “The Metal and Glass Curtain Wall: The History and Diagnostics.” In *Modern Movement Heritage*. Taylor & Francis.

Lefaivre L, Tzonis A. 2003. *Critical regionalism: architecture and identity in a globalized world*. Prestel.

Marcos, C L. 2012. “Beyond Phenomenal or Literal Transparency: Physical Digitality”, *Proceedings eCAADe 2012*, TWU Vienna.
Norberg-Schulz, C. 1979. *Genius Loci: Towards a Phenomenology of Architecture.* Rizzoli.

Picon, Antonie. 2010. *Digital Culture Architecture*, Birkhäuser.
Oeschlin, W. 1997. “Introduction”, *Transparency*, Birkhäuser.

Oldfield, Philip, Dario Trabucco, and Antony Wood. 2009. “Five Energy Generations of Tall Buildings: An Historical Analysis of Energy Consumption in High-Rise Buildings.” *The Journal of Architecture* 14 (5): 591–613.

Olgyay, Aladar. 1976. “Solar Control & Shading Devices.” University Press.

Requena, Ignacio. 2011. “Arquitectura adaptada al clima en el movimiento moderno: Le Corbusier (1930-1960)”, PhD Dissertation thesis, Universidad de Alicante (Available at:

Requena, Ignacio, and Siret, Daniel. “Construcciones ambientales para el hábitat moderno: Le Corbusier y André Missenard (1937-57)”, In *Le Corbusier 50 años después*, Valencia. 2015.

Rowe, C and Slutzky, R 1963, “Transparency: Literal and Phenomenal,” *Perspecta*, Vol. 8: 45-54.

Schumacher, Patrik. 2009. “Parametricism: A New Global Style for Architecture and Urban Design”, *AD Architectural Design, Digital Cities*, 79(4): 14-23.

Torres Cueco, Jorge. 2004. “Le Corbusier: Visiones de la técnica en cinco tiempos” Barcelona: Fundación Caja de Arquitectos.

Yeomans, David. 1998. “The Pre-History of the Curtain Wall.” *Construction History* 14: 59–82.