Challenging Glass 7
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Beyond Materiality, Towards Craftsmanship: Applying Design Thinking to Glass Systems in the 18 Septemberplein Redevelopment

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This paper describes the design process UNStudio undertook in the redevelopment of the C&A Building on 18 Septemberplein in Eindhoven, the Netherlands. The design brief primarily called for the rebranding of the building while maintaining the building's façade historic value and aesthetic. Secondarily, the design is meant to activate the urban context where the building is located without competing with the neighboring landmarks. UNStudio saw an opportunity to rethink the transparent layer – the glass window – of the building as a tool to enhance its identity minimizing the aesthetic impact on its historic facade. This case study outlines opportunities to innovate while designing with glass through two often polarized perspectives: contemporary architecture and historic preservation. Architects constantly negotiate the value of private versus public space, transparency versus opacity, and building energy performance in our built environment through the use of glass. Emerging integrated technologies such as LED, photovoltaic, lamination, and touch sensitive layer are enabling new ways of rethinking the roles and applications of glass: as an architectural element, an information layering surface, and an agent for light and transparency. New opportunities are thus arising for glass in digital media facades and parametric façade design. On the other hand, architects' role in historic preservation requires a diligent approach to glass application due to the constraints of local zoning and aesthetic regulations (governed in the Netherlands by the Welstandscommissie) that seek to protect certain historic values in existing buildings. The objective of this paper is to apply UNStudio's design thinking sensibilities towards – and understanding of – glass as a system, to contemporary themes of community, social branding, and the environmental impact of architects' interventions on the built environment.

Keywords: Glass, Historic preservation, Retail, Innovation, Sustainability

1. Introduction

The earliest trace of glass dates back to around 3500 BC. The first trace of this innovation is thought to have emerged in the Mesopotamia region where ancient Egypt and Syria are located. The first references of glass were luxury and decorative items such as cups, vases**,** and coloured glazing done using the process of what is now known as glass blowing (Moorey). In the 11th century, stained glass became more embedded in architectural languages, prominently used a distinctive element in Romanesque and Gothic art often seen in church buildings.

For two millennia, glass started to be used to enclose space. Within this period, the material manufacturing processes and strength were gradually refined to match the demands and emerging trends in architecture. While its structural capacities are still in question, innovative manufacturing processes enabled stronger systems such as laminated, toughened, annealed and heat-strengthened glass.

It wasn't until the late 1700s that glass started to reach industrial production scales and was implemented as a building material. Joseph Paxton's Crystal Palace, constructed in London for the Great Exhibition of 1851, is one of the most iconic examples of glass as an architectural system. For the first time, glass was used to cover an entire 40-meter-tall commercial building. The Crystal Palace demonstrated the feasibility of glass as a construction material beyond its common decorative use. This large-scale implementation of glass as an architectural element challenged the solely aesthetic function of glass and pushed the construction industry at large to consider its materiality, processes, energy performance, and digital layers. In recent years, glass has taken on more structural capabilities that while not yet competing with steel in terms of strength and durability, still allow it to stand in its own category as one of the most load-bearing decorative elements in architecture.

2. Modern architecture

The achievement of the Crystal Palace has inspired many architectural visions for glass. The sudden shift from prior constructions with exterior walls or metal to support the load of an entire structure to this building where glass, in combination iron, forming a curtain wall, could also support the entirety of a building envelope and create transparency, bringing light into an enclosed space, produced a major shock in architectural design. The gesture inspired many to take on the challenge of designing glass buildings at a large scale, specifically in towers and office buildings.

Curtain walls became a subject of innovation in the 19th century. The development of structural steel and reinforced concrete columns relieved the exterior walls from load bearing requirements. Therefore, the exterior walls could be non-loadbearing, making exterior walls lighter and more porous.

One of the first iconic buildings to embrace the curtain wall was the Lever House, designed by Skidmore, Owings & Merrill in 1952. It stands 90 meters tall and its exterior is made entirely of curtain wall glass. New York's 1916 Zoning Resolution required towers to include setbacks in order to prevent from towers from overwhelming the urban streetscape below by obstructing light and air circulation, particularly in lower Manhattan. In combination with the sensitive placement of its building volumes, which isolated the tower component to a relatively small portion of the site footprint, SOM's inclusion of transparent glass softened the impact of the tower.

3. 18 Septemberplein

More recently, architecture has pushed the boundaries of glass by progressively engineering the structural properties of glass. As an innovative knowledge-based practice, UNStudio aims to participate in discourses of material research and spatial and cultural identity. In these spaces, there are potential discoveries in the articulation of design and its processes that enable groundbreaking innovations, most notably the 18 Septemberplein renovation.

The project design brief called for the rebranding of the C&A Building on the 18 Septemberplein in Eindhoven, the Netherlands, while maintaining the building's façade historic value and aesthetic. Named for its long-term tenant the fashion retailer C&A, the building plays an important role in the cityscape of Eindhoven as one of the monumental references of historic preservation in the city. This is due to its location on the 18 Septemberplein, the city's main square, which is also known as 'Eindhoven Boulevard.'

The 18 Septemberplein was initially constructed in 1950, when the city welcomed the opening of the Breda-Eindhoven-Venlo railway line connecting Eindhoven to the national rail network. The connection allowed for population growth, tourist exposure, and industrial development. This visibility enabled the station as a major commercial hub for businesses and cultural connectivity. In the 1990s, there was a new vision for the square designed by the Italian architect Massimiliano Fuksas, who developed four of the projects for the masterplan in 1998: the 7,000-square-meter square, the Piazza Shopping Mall, the Media Markt electronic retail store, and the Admirant Entrance Building.

From its opening in the 1950s when the square until Fuksas' masterplan in the 1990s, the square has undergone many changes. Cars and buses were relocated to peripheral streets in order to make space for pedestrians by connecting shops, artwork, and social activity, making the square a symbolic space of social connectivity and entertainment.

In line with the city of Eindhoven's recovery from the physical damages it suffered during World War II, 18 Septemberplein took on an energetic and highly visible atmosphere, playing host to numerous shops and Eindhoven's main cultural events. At the heart of the square stands a 9,000-square-meter, four-storey C&A Building, a significant piece of protected pre-war architecture. In 2018, the retail real estate investor Redevco invited UNStudio to collaborate on the redevelopment and renovation of the C&A Building, with the aim to better connect it to the urban context. The refurbishment project also includes two smaller, adjoining buildings on either side of the C&A Building on Demer and the Hermanus Boexstraat.

The urban reconstruction after WWII and the masterplan of Fuksas together overpowered the C&A Building, which once held a central presence in the square. The modern addition of the underground bicycle parking facilities obstructed the visibility of the building's historic facade. The physical distribution of the C&A building relative to Fuksas' works, notably the 'blob' underground bike entrance portal, seemed to repress the identity of the building and the accessibility of its storefront to pedestrians.

Understanding this history of the 18 Septemberplein and its impact on the city, UNStudio challenged the notion of rebranding in terms of physical relativity, history, and a future vision for both the building and the context in which it is situated. The brief required the repositioning of an entire floor to create better floor-to-ceiling heights, the addition of a glass plinth, and the installation of large illuminating motifs that could celebrate Eindhoven's design heritage, alongside its contemporary reputation as a centre of technological innovation. These large glass additions take the form of a series of light vitrines, which celebrate and complement the existing extruding windows on the north facade, whilst drawing the gaze of passersby towards the building. Furthermore, the refurbishment was approached with the goal to unify connections between the facades and the street level, creating smoother and more subtle transitions between the more recently constructed adjoining buildings and their surrounding streetscapes.

The building was originally designed by the Dutch architect Jan van der Laan in 1940 with a brick façade and wood framed glass windows. The building displays the feel and architectural values of Dutch modest exterior detail, reflected in, among other things, the classical façade structure (basic-monumental volume-architrave-frieze) and the authenticity of the complex in the integrity of the first two floors with the original façade and the authentic windows and frames. The renovation of the third floor, where the windows have been raised to create desirable floor to ceiling heights, has retained the classical structure of the facade and fits in well with the original design in terms of material use and proportions. UNStudio aimed to retain the historic imagery of the building front by preserving the structure of the building front while finding a solution for reviving the vibrancy of the building without overpowering its street edge and neighboring infrastructure.

Through this narrative, there was an opportunity to rethink the transparent layer – the glass window – of the C&A Building as a tool to enhance the identity of the building while minimizing the aesthetic impact on its historic façade.

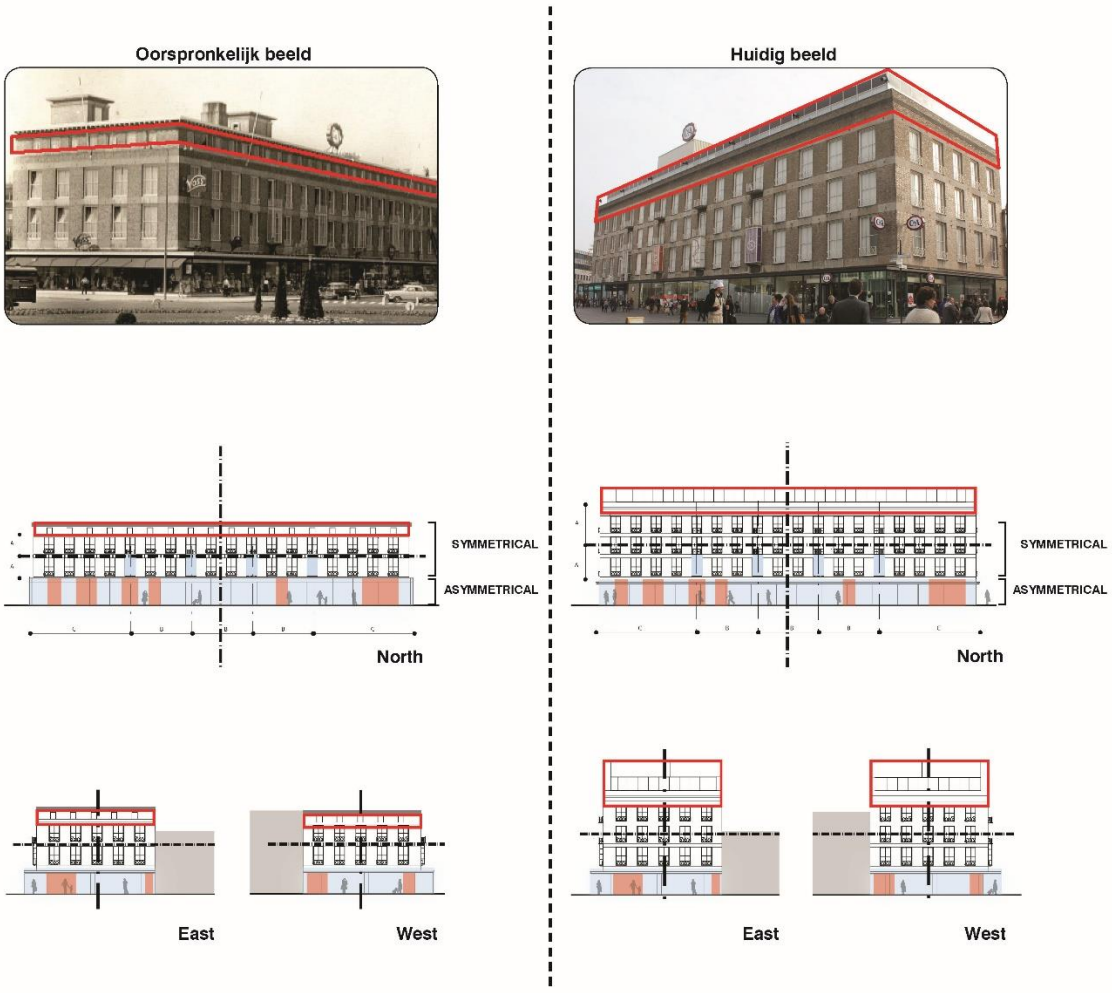

Fig. 1 18 Septemberplein, ©UNStudio.

To think beyond the materiality of the glass, UNStudio collaborated with a Dutch engineering consultant group, ABT, and the sensorial light designer Arnout Meijer Studio, as well as specialists in the market who helped us reverse engineer our way to the ambitious solutions we identified to balance the demands of the brief, notably, ARUP, SWINN, and W4Y.

The design phases of the project started with UNStudio initiation of a multidisciplinary approach by hosting recurring series of workshops and meeting, discussing and reviewing different design options best fitted for the innovation for the glass design, structure, connections, and technologies. The thought process was broken into two aspects, the first being the holistic design of identity and branding and the second being about the structural integrity and historic preservation of the façade. The early part of the collaborations was mainly between UNS and ABT for knowledge exchange on the potential of glass through the requirement of the brief best fitting to UNS holistic vision for a sensorial approach to the design.

Once the design took on a direction, together with Arnout Meijer Studio, UNStudio started designing the possible digital layers of the fixture (Fig 2).

UNStudio sees design thinking process as a push-and-pull process between design and implementation. This design thinking generates a loop, which often brings to light unseen challenges by revealing the feasibility of a concept through processes and design scope. During this phase, the industry limitation of single size glass panels became evident due to two main concerns:

- What is the maximum glass size that can be manufactured and transported to the site by trucks?
- What is the maximum weight and framing profile the glass installation should have in order to keep the visual and structural integrity of the historic façade of the C&A Building?

For transportation, the panel size limit relates to the width of a single road lane so that the glass won't obstruct other vehicles during transport, unless it could be transported by helicopter. This latter scenario was less desirable for the further physical safety concerns it raises.

One source of inspiration was the New York-based architect REX's VAKKO Headquarters in Istanbul, where the slumped glass façade performs as a structural system in the adaptive reuse project. This approach seemed suited to the ambitions of the project and the design UNStudio envisioned for the C&A Building. As the Architect's Newspaper wrote in 2010, "the wafer-thin slumped glass reveals the [VAKKO] building's frame while adding vertical and lateral stiffness to the 5-by-10-foot [1.5-by-3-meter] panels. The x-shaped impressions strengthen the panels and reflect light."

On the other hand, the particularities surrounding the preservation of the C&A Building led UNStudio to take more precautions than other reuse projects might allow. The transparency of the glass was the main driver – UNStudio aimed to use its design as an enhancing layer to the transparency and vibrancy of the retail facade. In the case of 18 Septemberplein, the transparency of glass allowed for the reinstatement of the vibrant vision of the square by framing the relic of its identity without significantly altering the original building features or overpowering the neighboring infrastructure it once stood behind (Fig 2).

Fig. 2 18 Septemberplein, ©UNStudio.

4. Earlier case studies in glass innovation

UNStudio engages glass beyond its materiality and position it instead within processes of the field of architecture such as design technology, manufacturing, brand and social value, and sustainability. Emerging integrated technologies such as LED, photovoltaic, lamination, and touch sensitive layer are enabling new ways of rethinking the roles and applications of glass: as an architectural element, an information layering surface, and an agent for light and transparency. New opportunities are thus arising for glass in digital media facades and parametric façade design.

Beyond the primary case study in this paper, the 18 Septemberplein, UNStudio has worked on numerous projects involving sensitive, innovative and experimental uses of glass. On the P.C. Hooftstraat 138 in Amsterdam, UNStudio made glass the 'main attraction' while modulating vertically in order to fit within a sensitive neighborhood. In the Galleria Centercity in Cheonan, UNStudio developed a proprietary system of aluminum, glass and LEDs to create a visually stimulating and constantly changing shopping mall façade. Finally, in the La Defense Offices in Almere, UNStudio made a leap by integrating multi-colored foil into glass panels.

4.1. P.C. Hooftstraat 138, Amsterdam, the Netherlands

Between 2017 and 2019, UNStudio developed a façade design called 'The Looking Glass' for a three-story retail and residential building in Amsterdam, that seeks to represent the deft hand of craftsmanship common to architecture and fashion (Fig. 3).

The P.C. Hooftstraat is the primary high-end shopping street of Amsterdam, linking two of the most visited attractions in the city: the Museum Quarter and the Vondelpark. Facades along the street display Dutch design, creative heritage and elegance, but like the 18 Septemberplein in Eindhoven, are subject to stringent regulations. Thus, the use of glass in the façade needed to match the high standards of design (in architecture as well as fashion) on the street, as well as fit within Welstandcommissie limits.

Fig. 3 P.C. Hooftstraat 138 © UNStudio.

The P.C. Hooftstraat 138 facade celebrates textiles, both in form and function; three eight-meter-tall curved glass panels flow down from the upper floors in a design that mimics billowing transparent cloth. This play with glass creates opening spaces on a pedestrian eye-level that unveil the latest garment designs inside. In a fluid gesture, fashion and architecture come together to represent and celebrate the geometry of high-end, tailored clothing, creating harmony between aesthetics and function. All this while keeping true to the original design of the three-windowed vertical division of an Amsterdam town house, where the upper floors above the retail section house a bespoke apartment.

Two main features connect the ground and the first floors: glass boxes surrounded by brickwork. The three structural glass ‘box elements’ are each assembled in the factory and mounted on site. Large laminated annealed low-iron glass panels, both curved and straight, are bonded with structural silicone to the adjacent glass panels with stainless steel edge profiles in between, thus forming a glass box (Fig. 4). Each glass box is then bonded to a hidden steel frame for protection and shipping purposes, before being installed as a single unit on site.

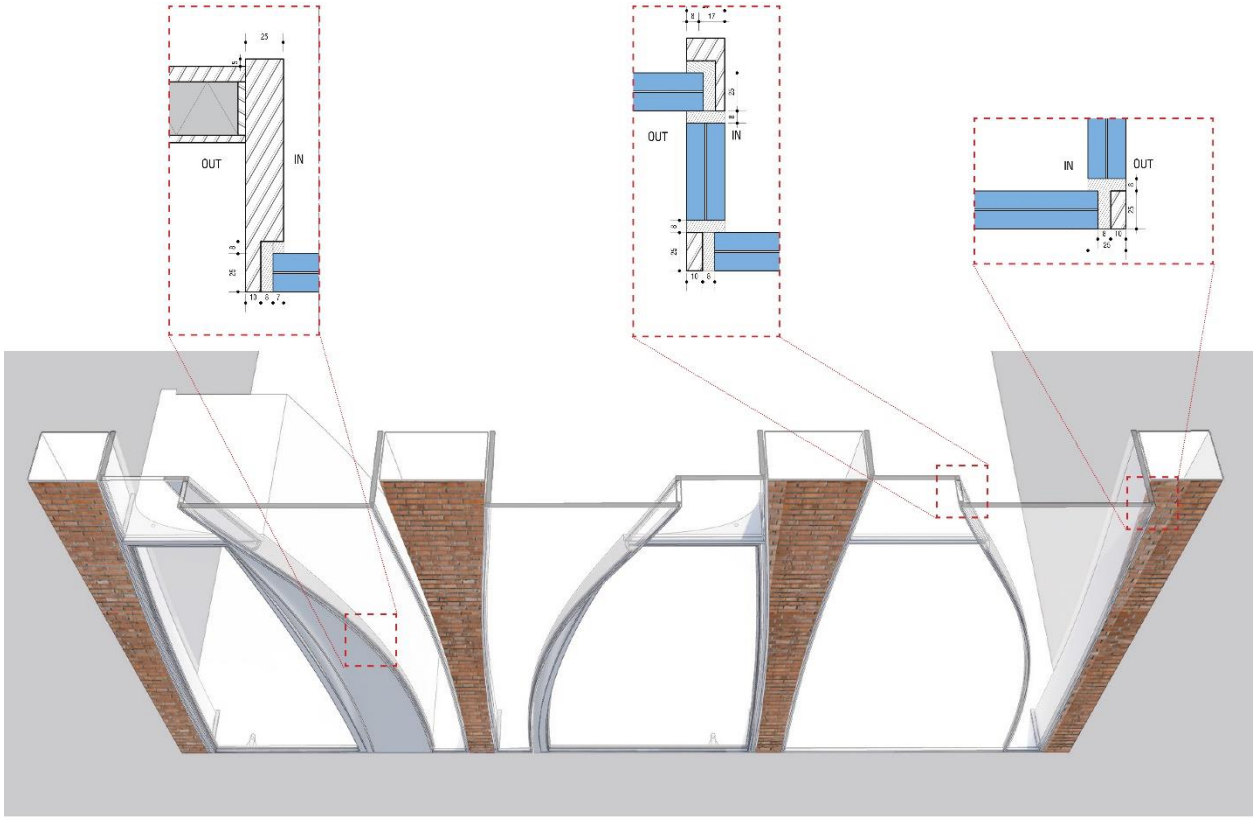

Fig. 4 PC Hooftstraat 138 glass panel fittings. © UNStudio.

After installation, a rigid insulation layer is added on top of a GRC panel. Brick slips are then glued on to the insulation layer. Between the slips on the ground floor level, a metal strip is introduced to create slight differentiation from the rest of the brickwork and to meet urban requirements.
Eight-millimeter-wide silicon seams between the polished stainless steel edge profiles and the glass panels allow for any tolerances in the curved glass that might occur during the manufacturing process, while the steel profile protects the glass edges from damage and absorbs the transformation in geometries.

4.2. Galleria Centercity, Cheonan, South Korea

Between 2008 and 2010, UNStudio designed the Galleria Centercity shopping mall in Cheonan, South Korea. The project included a double-skin, glass façade with layered profiles produced by vertical mullions. During the daytime, the monochrome façade gives a three-dimensional ‘trompe d’oeil’ sensation, while at night the façade takes on a multi-coloured, ever-changing mediatic appearance.
The façade is comprised of aluminium composite back panels and a laminated low-iron glass front layer, affixed as customized aluminium triangular profiles (Fig. 5). The outermost layer contains the hardware that enables the media facade: 22,000 LED lights project inwards on the white back layer. UNStudio worked with Spacecannon, part of Zumtobel, to create custom-made RGB-LEDs that integrated into the 12,600-square-meter façade.

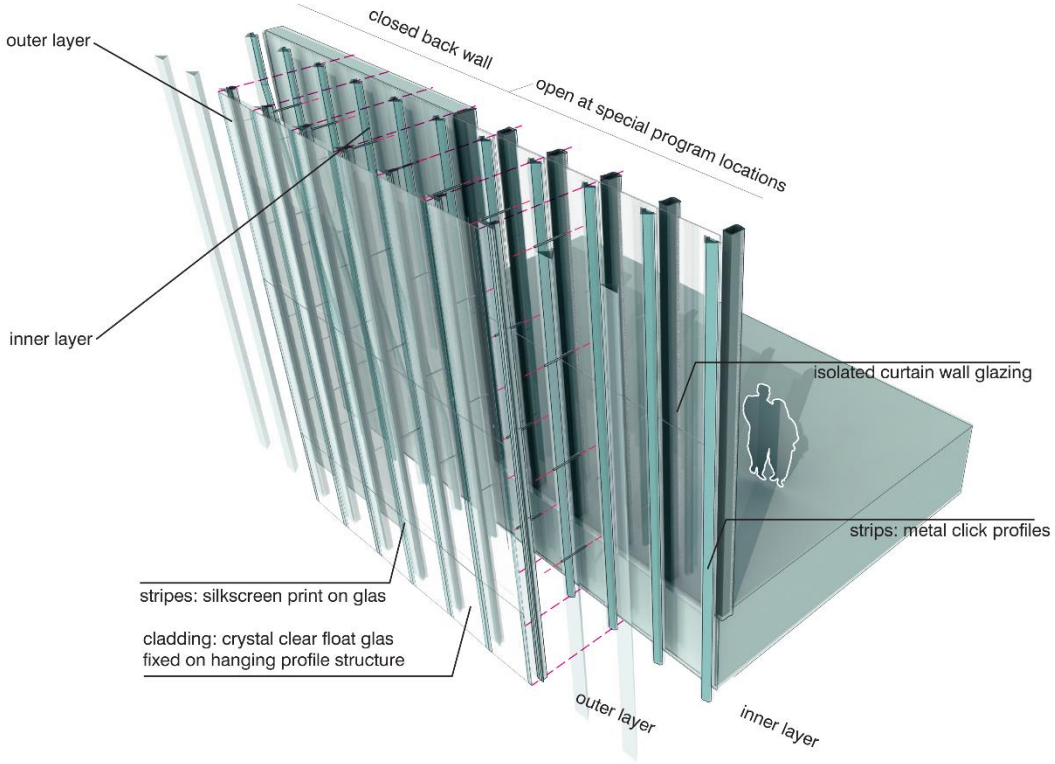

Fig. 5 Façade components of the Galleria Centercity. © UNStudio.

The role of the media façade is to enliven and activate the building space beyond daytime hours, as its function goes far beyond a retail space (Figs. 6 and 7). As Erika Kim wrote in Designboom, "in Asia where places of retail also serve a highly social function, the project focuses on providing a memorable experience for the shoppers by treating the communal space as a point of cultural exchange." The façade thus extends the cultural program within the building to its exterior, marking it as a mutable, transitioning space within the city.

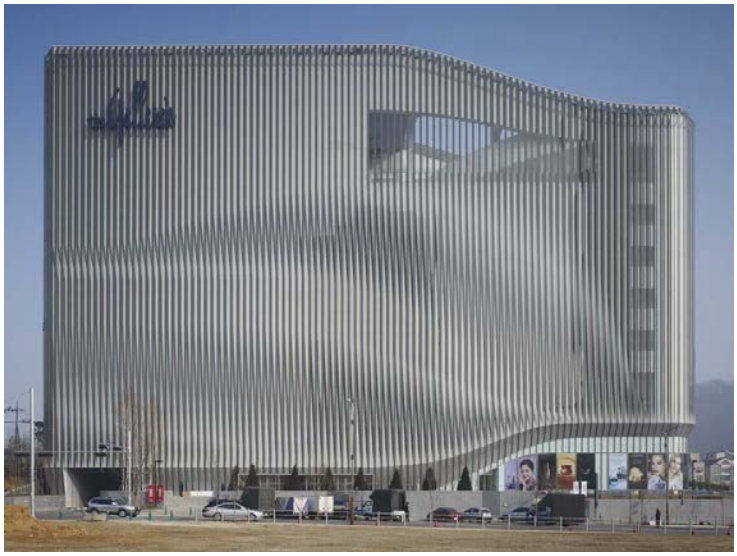

Fig. 6 Daytime view of the Galleria Centercity. © Kim Yong-kwan.

Fig. 7 Nighttime view of the Galleria Centercity. © Kim Yong-kwan.

4.3. La Defense Offices, Almere, the Netherlands

From 1999 to 2004, UNStudio designed an office complex in Almere, the Netherlands called La Defense, which comprises two multi-pronged buildings that nestle within one another. Courtyards connect the buildings and allow light in from all sides. Light is the key element in this project, for it reflects on the façade panels, which themselves consist of glass incorporating a multicolored, custom foil developed with the day, and provide an otherwise static environment with an ever-changing appearance of colors and moods (Figs. 8 and 9).

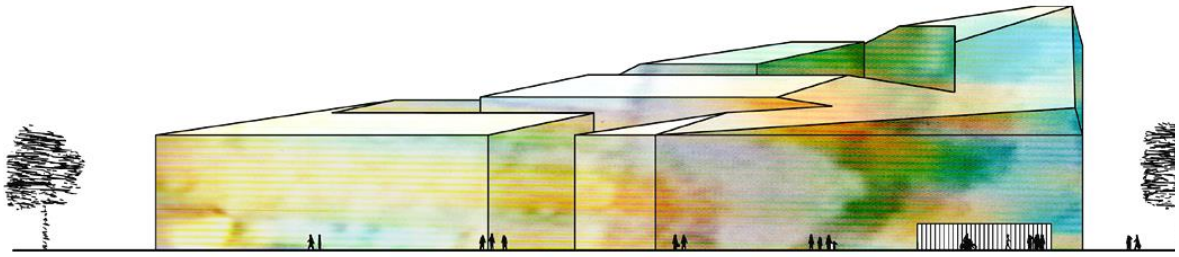

Fig. 8 Diagram of La Defense Offices with foil application ©UNStudio.

Fig 9. La Defense Offices ©Christian Richters.

Developing a material application for this project transformed what would have otherwise have been a typical glass façade into an experiment on color, orientation and reflection. Despite current trends towards digitizing facades, this project shows that relatively 'low-tech', materially based applications can also produce impressive results that remain relevant well after their initial construction.

5. Managing preservation requirements

The primary concern in the 18 Septemberplein project was balancing this need for sensitivity with UNStudio's drive to innovate and experiment. As such, architects' role in historic preservation requires a diligent approach to glass application due to the constraints of local zoning and aesthetic regulations that seek to protect certain historic values in existing buildings. For the 18 Septemberplein, UNStudio needed to manage the limitations and expectations of the Welstandscommissie, in particular how the new proposal relates to the historical context of the building and site. In order to describe this, we first conducted a historical building analysis, where we identified zones on the façade. The blue zone where the proposed glass boxes sit has the highest monumental value (Fig. 10).

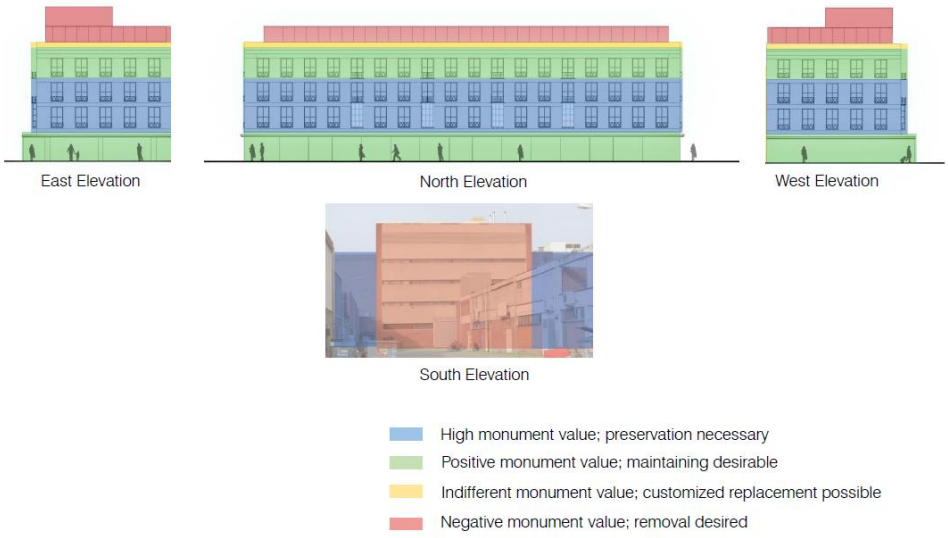

Fig 10. 18 Septemberplein section showing degrees of monumental value ©UNStudio.

The proposed glass boxes intend to mimic the original feature of the building, its glass 'etalages' (display windows), in a new, innovative way (Fig. 11).

Fig. 11 Original Etalage at C&A Building in Eindhoven.

6. The future of craftsmanship & forecasting about glass technology

The objective of this paper has been to apply UNStudio design thinking sensibilities towards – and understanding of – glass as a system, to contemporary themes of community, social branding, and the environmental impact of architects' interventions on the built environment. Since Joseph Paxton's groundbreaking Crystal Palace, architectural applications of glass – structurally, materially and decoratively – have greatly expanded. References to 'glass as a system', then, describe the multiple roles of glass in architecture and the effects of the buildings in which it is applied. Each of the three UNStudio case studies outside of the 18 Septemberplein – P.C. Hooftstraat 138, Galleria Centercity, and La Defense Offices – put glass to use in connecting the buildings to their social and environmental contexts.

For 18 Septemberplein, UNStudio decided early on in the project to use the glass boxes and interactive light installations as tools to activate the square. This activation does not only serve the retail program of the area, but also creates a sense of security for people passing from the train station to the rest of the city after the shops close at 6 p.m. Physiologically, then, the installations invoke a sense of comfort, safety, security for pedestrians who commute through the main plaza. Considering this social-economic scenario formed part of UNStudio's holistic approach, designing beyond the physical 'hardware' of the site by including the emotional and social 'software' as well.

These 'hardware' and 'software': are not strictly separate concepts: energy infrastructure that reduces carbon emissions is a social good as well as a technical optimization. UNStudio's initial planning in this realm proposed installing semitransparent solar panels on the bands on top of the building and along the south façade. Solar panels like those produced by the Spanish photovoltaic manufacturer Onyx Solar appropriately fit the theme of glass innovations in this project: their PV Glass product is a building integrated photovoltaic safety glass that allows any architectural glass component to perform aesthetic, structural and energy producing roles (Onyx Solar). However, due to budget limitations, the 18 Septemberplein project does not include solar panels, but rather simple glass for the roof and tiles on the south façade.

Financial considerations will always play a role in which materials are specified, and how. However, the dichotomy of pushing for glass innovation in contemporary architecture and sensitively respecting historical buildings will change in the future as technological advances proceed, and regulations change in response to societal needs. Architects, as ever, will continue to negotiate the value of private versus public space, transparency versus opacity, and building energy performance in our built environment through the use of glass.

The challenge will rest on engagement and understanding across stakeholders: how can architects work with regulatory bodies and clients to integrate and invest in sustainable components for architectural projects? Glass will remain a key lens through which we negotiate these contradictions.

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