Building Envelopes For An Engaging and Interactive Urban Environment

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Abstract
This paper aims to confront the misconception of façade design where building envelopes and its parts are rationalized and mostly reduced to a utilitarian purpose or superficial representations only. Little is investigated about the implications of building envelopes and its impact on urban community and urban development that is synonymous for rapid industrialization and modernization but also characteristic for its monotonous appearance, sameness and lack of architectural design. Therefore, the paper first focuses on the evolution and misconception of building envelopes and its role in contemporary architecture and urban design. Second, the paper briefly assesses the predominant building envelope types. And third, the paper attempts to show the implications of building envelopes for creating engaging and interactive environments that can add value and promote sustainable communities beyond the limitations of energy conservation, efficiency and superficial representation only. Finally, this paper attempts to re-address the role of building envelopes and its need in contemporary architecture and urban design. For the design of building envelopes, the paper suggests that questions of building envelope (i.e. form and function) can also be questions of sustainable community (i.e. walkability and diversity) and questions of engagement and interaction.

Keywords: Building Envelope, Facade Design, Urban Design, Sustainable Community, Interaction

1. Introduction

Building envelopes occupy a special position in sustainable architecture and urban design. The building envelope is not only the primary building element that protects and separates the interior from the exterior but also a crucial part of architectural design that determines the formal qualities of the building and the urban environment. The envelope is possibility the oldest and most primitive architectural element that articulates social relationships between humans and non-humans. Moreover, the envelope assembles the building’s interior which it protects, and the external open space with which it communicates. When it becomes a façade, the envelope operates as a representational device in addition to its environmental and territorial roles (Zaera-Polo, 2008). However nowadays, the design and research of building envelopes is mainly characterized by functional, technical and energetic aspects that follow mainly “two core strategies of sustainable thinking, conservation and efficiency” (Lee & AlSayyad, 2013).

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Any inquiries in this context usually address the following questions: (1) Function: What is the practical purpose of the building envelope? (2) Form: What does the building envelope look like? (3) Construction: What are the elements/components of the building envelope and how are these elements assembled into a whole? (4) Ecology: What is the energy consumption of the building envelope during the construction, use and demolition (Lang, 2006)? Few of these strategies of sustainable thinking have led to a reconsideration of the purpose and function of the building envelope in general. Thus the misconception continues where the envelope is considered a utility, which results in an urban environment that is modern but also homogenous, monotonous and lack architectural design – mostly visible as generic forms in contemporary cities.

However with continuous urbanization and increased energy demand, the requirement for sustainable cities is inevitable. In dense cities, the development of sustainable communities become an important factor in order to promote sociability and responsibility through a walkable and diverse built environment. Walkable environment is the foundation of a sustainable city, where meaningful resource conservatism without it is not possible (Southworth, 2005). However while walkability and diversity gain public attention, the role of the building envelope on sustainable communities is usually neglected. Recent studies suggest that urban structures physiologically affect citizens, their mental states, moods and physical health. People are strongly affected and stimulated or engage and interact with building facades. “If the facade is complex and interesting, it affects people in a positive way; negatively if it is simple and monotonous” (Bond, 2017).

Therefore, this research aims to re-address the role of the building envelope in sustainable communities and urban environment. The paper first discusses the origin of the misconception. Second, it assesses predominant building envelope types. Third, through relevant literature, the paper relates the building envelope with walkability and diversity and brings forward its implications. Finally, the paper proposes that among others, questions of building envelope (form and function) and questions of social community (walkability and diversity) can also be questions of engagement and interaction (Fig. 1).

![Fig. 1. Typical aspects of the building envelope (grey box) and proposed aspects (white box) connect Architecture (i.e. Function and Form) with Urban Environment (i.e. Walkability and Diversity). Questions of building envelope become questions of engagement and interaction.](image_url)

### 2. Misconception

The contemporary city differs from its past manifestations. The evolution and development of building envelopes is related to the morphology of the city and its open space (public space) that is formed in between buildings – by streets, squares, parks and water surfaces. Open space outlines and holds the city together and is least to change. Buildings and facades change functions or are replaced, especially in regard of technological obsolesce. The street pattern however forms the lasting infrastructure or background (Southworth, 1993). In the past century, the role of open space and the role of the building envelope that gave shape and identity to the neighborhoods, districts and cities, underwent changes in relation to the...
transformation of the city: From the traditional, modern to post-modern city.

The traditional city was composed of rooms and corridors, where building envelopes where part of blocks defining and enclosing space (internal and external.) The traditional city created a “figural space” with symbolic meaning of authority, community and identity, where in its place we could find e.g. a town hall. This space was engaging and belonged to the public while the building façade was representative. The Modernist approach emerged mainly as a response to the early Industrial Revolution of the congested traditional city with environmental issues, pollution and density but also to the technological advancements in building construction or the strong emphasis on the automobile. The Modernist approach transformed the city to a still life of unrelated objects, freestanding in landscape settings, following zoning, segregation and emphasizing on the “figural building” enabled through an extensive street network (spatial grid), which was thought of as a utility to overcome the size of the modern city, rather than a facilitator of social engagement and interaction (Hillier, 2009). Following the Modernist city and with the emergence of global economy and rapid urban growth, the Post-modern city changed the open space of the city into a “transit space” that connects private and self-sufficient environments like shopping malls that become a city within a city. Self-sufficient or single-zone environments occupy entire urban blocks and eliminate the fine-grained urban patterns that are vital for diversity and with it sustainable communities. The Post-modern city is characteristic for its generic representations, disconnected places and less individuality and distinctiveness of building envelopes that focus merely on form and representation instead of connecting places (Venturi & Brown, 2004.).

Since the early Modernist years of the 20th century, building facades experienced a dramatic change due to technological advancements in construction methods and industrial standardization. A crucial development was the separation of the building envelope from structure, creating the curtain wall. Additionally, the development of environmental technologies for conditioning, particularly HVAC (heating, ventilating, air-conditioning) during the late 19th and early 20th century, is widely credited with introducing comfort while simultaneously freeing the building from its role as an environmental mediator between the interior and exterior climate. The sleek glass facades that were the iconic representations of Modernism were possible only because the building location and materials could be decoupled from the interior environment. Mechanical and electrical systems provided heat, light and air or removed excess heat, humidity, and odors. At the same time, those environmental systems were comprised of discrete components that had no immediate relationship to the building structure (Addington, 2009).

The Modern movement focused on making the façade disappear where the external envelope of a building would become a by-product of either its programmatic organization or its constructive technology (Lee & AlSayyad, 2013). Released from its obligation to mediate between the exterior and interior, 20th century architects, such as Le Corbusier and Frank Lloyd Wright, interpreted the decoupling of the envelope from the environment as a transformation from the “boundary of exchange” to a “boundary of discontinuity”. Both architects used “hermetic” to describe the envelope’s new role (Le Corbusier, 1991). Variations of natural climate were considered as unpredictable and undesirable conditions that have to be kept outside with little variation inside. In this regard, “the envelope has morphed from its role as the mediator of surrounding conditions [in the traditional city] to the determinant of those [internal] condition” (Addington, 2009, p.13).

Following this misconception, building envelopes are mainly characterized by functional, technical and energetic aspects nowadays. The energetic aspect often becomes a crucial design criterion for building envelopes and also is the most-up-to date and most researched part of architecture. These three aspects follow mainly “two core strategies of sustainable thinking, conservation and efficiency” (Lee & AlSayyad, 2013, p. 123). Moreover, advancements in smart materials, interactive systems and responsive elements promise an increase in design complexity and energy efficiency on the level of the building envelope. Such “high-performance” buildings emerge as a typical solution to energy conservation with much of their focus on
the technological enhancement that is compressed into the layer of the building envelope. At the same time the development rationalizes the building envelope further while emphasizes on the feasibility and usability of the technology itself. In other words, the building envelope is reduced to a utilitarian purpose, to fulfill energy and safety requirements, and sometimes superficial representations that are driven by the novelty effects.

3. Building envelope types

Envelopes are related to the dimensions of the form, where every type can trigger specific technological and social effects. Specific ratios between the envelopes primary dimensions enable to categorize the envelopes in flat-horizontal, spherical, flat-vertical and vertical (Fig. 2) (Zaera-Polo, 2008).

(1) The flat-horizontal envelope is considerably larger than vertical, delimits edges, frontiers and boundaries and shelters the program it encloses. Comprehensive perception can only be obtained from an aerial view, and flat-horizontal envelopes are experienced in a fragmented manner and therefore less concerned with representation and figural performance than with the organization of material flows. This type is highly political charged and turns into large-scale obstacle to urban flow. Buildings like stations, retail and leisure complexes belong to this category.

(2) Spherical envelopes have the lowest ratio between its surface and the volume it encloses. Generally the envelope encloses a wide range of spatial types with specific functions and is less determined by repetitive spatial conditions and rather gathers a variety of multiplicity of spaces. Spherical envelopes often correspond to public buildings, like city halls, libraries and indoor facilities.

(3) Flat-vertical envelopes or better known as slabs exploit the freedom provided by modern city zoning. This envelope has priority over traditional determinations of urban fabric, such as alignment to the property boundary and definition of private and public space. Land-uses, orientation functional conditions are important drivers for this type. Mostly mid-rise residential and office buildings are in this category.

(4) The vertical envelope is characterized by its multi-directional orientation of the plan and generic extrusion with an extreme technical performance and high visual impact. Apartment towers, offices and hotels can be found in this category (Zaera-Polo, 2008).

Fig. 2. Building Envelope Types: (1) flat-horizontal; (2) spherical/compact; (3) flat-vertical; (4) vertical. (Based on Zaera-Polo, 2008, 80.)

4. Implications

Building envelopes have a direct impact on a functioning and sustainable community which relies on a walkable and diverse environment that in turn contributes to health, promotes sociability and identity of a community. Walkability operates on a small scale. Michael Southworth (2005) identifies six performance dimensions of a walkable environment that affect the likelihood of walking and can be improved through design: Connectivity; linkage; fine grained, varied land use pattern; safety; path quality; and the path context.

Although the path context relies on subjective experience of every pedestrian and is difficult to describe qualitatively and quantitatively, certain characteristics deal mainly with the walking experience such as the coherence of built form, street design, visual interest of the built environment, transparency, spatial definition,
landscape, and the overall explore ability. In this sense, walkability requires “rooms and corridors” where the main objective of the built form is to create volumes enclosed or shaped by building envelopes that can articulate pedestrian scaled streets with small scale details, changing vistas and focal points, and numerous alternative pathways. Besides, walkability correlates with place diversity or more precisely place vitality.

Place vitality is a theory of place diversity that signifies an interrelationship between diversity and a specific context (Talen, 2006). Place vitality is crucial and practical to the design of building envelopes. Place vitality is affected by particular “generators of diversity” that connect the city design with diversity directly. These generators can be described as (1) a combination of mixed primary uses that can activate roads at different times of the day. (2) Short blocks with frequent streets enabling higher pedestrian permeability and therefore walkability. (3) A mixture of buildings of varying ages and styles. And (4) dense concentration of varying users. These generators are important as they increase interactions among urban components and establish a direct relationship between spaces and people (Jacobs, 1961). Also, they affect the characteristics of the physical design of a particular area and especially of building envelopes.

In general however, most of the contemporary urban development focuses on large-scale development of entire urban blocks where e.g. flat-horizontal envelopes are used for shopping malls, flat-vertical or vertical for master-planned communities. This single-use development is usually characterized by homogeneity of one building envelope type that e.g. implies a sort of dull and pleasant aesthetic order but because of its monotony and repetition of sameness, it creates disorder of conveying no real direction. Jane Jacobs describes this situation as where “north is the same as south, or east as west [and] sometimes north, south, east and west are all alike, as they are when you stand within the grounds of a large project (Jacobs, 1961, p.224).” The irony of it is that these superficial and monotonous places of homogeneity create the kind of chaos we would expect in a place with a high diversity of uses. Moreover, if homogeneity in building envelope types is very high and places lack differences, the temptation for uniqueness and a difference from its neighbor emerges and usually manifests itself in superficial, eye-catching and meaningless details. This lack of diversity is due to a lack of other primary uses, where all buildings have the same use, age and style. There is usually little dialogue between single-use spaces and people. Interactions are at minimum, resulting in an isolated environment that lacks human scale, visual interest and is stripped off a sense of public life.

The problem is not new: City zoning regulations are the main cause of rationalized cities of sterile, regimented and empty things. Jacobs (1961) criticized the usefulness of city zoning as it permits the development of places of monotony and that its “greatest flaw is that it ignores scale of use […] or confuses it with kind of use” and thus diversity and place vitality is intentionally suppressed toward homogeneity (Jacobs, 1961, pp.237-238). Thus, in developments of large urban blocks with lack of primary uses, the design of the building envelope gains relevance and plays a crucial part in the shaping of such single-use developments. Emphasis on the role of the designer, whether architect or urban designer, is paramount to manipulate or articulate the envelope in different ways in order to create unique spatial situations that can engage and facilitate interactions between the citizens and buildings and therefore enable different kinds of (social) uses.

One such recent example that has significance is “The Interlace” in Singapore designed by OMA/Ole Scheeren (2013). The Interlace is an anti-thesis to the tower-block-housing development and re-started the discourse on the typology (Pearson, 2014). Instead of utilizing flat-vertical or vertical building envelopes, the necessary volume of the complex is divided into 31 blocks, each six stories tall, and stacked in a hexagonal arrangement around generous courtyards (Fig. 3). Through the interlocking of the blocks, a multitude of spatial situations is created forming a dramatic topography of envelopes that can be inhabited. But more so, the several pieces of the envelope display design features of the facade and have a positive impact on the place vitality, generating a multiplicity of spatial qualities and choices and gives the place a sense of multi-layered richness while its users engage and interact with it. Ole Scheeren describes the project as a
“vertical village” with an “extensive network of private and shared social spaces in a radical interpretation of contemporary life in a community. Instead of following the default typology of housing in dense urban environments – clusters of isolated tower – the design turns vertical isolation into horizontal connectivity and reinstates the notion of community as a central issue in today’s society (Buro Ole Scheeren, 2013).”

Fig. 3. The Interlace. Anti-thesis to prevailing tower-block typology. (Source: Buro Ole Scheeren)

5. Conclusion

The paper aims to increase awareness and re-address the role of building envelopes in sustainable communities and urban environment. Place vitality and with it walkability and diversity are a combination of primary mixed uses, block sizes and street pattern that affect the design of building envelopes and its capacity to engage and interact. Homogeneity and monotony (of use) combined with inappropriate size and scale of building envelopes can suppress interaction and engagement. Especially in regard of single-use developments, the design of building envelopes can compensate for the lack of place vitality, e.g. by breaking up the scale into smaller volumes while enabling various spatial situations. Thus, besides controls on the kind of uses, perhaps controls are also needed on the scale of the envelope’s volume permitted to a single use. Moreover, besides questions of building envelopes on (1) function, (2) form, (3) construction and (4) ecology, the paper proposes additional relevant questions for an engaging and interactive environment: (5) Walkability: What are the activities that the building envelope provides and supports? (6) Diversity: What are the primary uses and the scale of the building envelope (Fig. 1)? However as each building envelope type depends on the project type, the site constrains and the client’s requirements, further research is required on building envelopes for a sustainable development – or an engaging and interactive environment.

References