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CURTAINWALL: METAPHOR OR TRANSMATERIALIZATION

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What is a curtainwall? Is the term purely a metaphor, or have tapestries and rugs of years past transformed themselves into glass, aluminum and steel? As the AEC industry moves towards more complex geometries, it is time to look to textiles once again for inspiration.

“If clothing is an extension of our private skins to store and channel our own heat and energy, housing is a collective means of achieving the same end for the family or the group. Housing as shelter is an extension of our bodily heat-control mechanisms – a collective skin or garment.”¹

The power of the metaphor helps us communicate and comprehend ideas and concepts through the application of earlier media, actions or systems. Metaphor aids in the conveyance of ideas across generations. It gives us the ability to relate one thing to another comparatively, but does not transcend into the built environment. In the case of curtainwall, however, there may be something more than just the metaphor of hanging fabric.

As building enclosures developed over time, materials were changed and replaced. In turn, fabrication is adjusted to accommodate the newest material. Some theorists, specifically Gottfried Semper, suggested that through this replacement process, the previous material is metabolized, transforming itself into another material.² Unlike metaphor, this metabolized material is physically embodied through material and the human senses. The question then becomes: can qualities of the hanging textile be found within the system of the curtainwall, or is it all a metaphor?

THE METAPHOR

“Metaphor is a transposition of meaning from one word to another.”² A metaphor can be written as $X = Y$. In the case of curtainwall, we have an object metaphor where curtain = wall. The conceptual properties of a curtain are examined and applied to the concept of a wall and vice versa. The curtain hangs in front of a window or opening of an enclosure. Its primary purpose is to cover and visually block the window; it becomes a delineator of public and private space. Serving a slightly different function, the wall is used to enclose and define space. It too is a delineator of public and private, but has the additional quality of delineating inside and out. In the metaphor, the curtain and the wall merge conceptually to define a new concept and enclosure system: curtainwall. This new concept is a wall system that is suspended from a hanger and moves in the wind and other external forces while still defining and delineating space in terms of interior and exterior. Through the use of the



FIGURE 1 + 2
These columns represent the transmaterialization of organic material into stone.



FIGURE 3
Though the detailing in modern curtainwall might not seem directly related to textiles, visually the vertical seams and horizontal stack joints can be read as the warp and weft of a woven textile, or the openings within a knitted or crochet surface.



FIGURE 4
Louis Vuitton store facade at The Crystals mall in Las Vegas, Nevada.

metaphor, the application of one object's properties to another create a new hybrid concept, one that ties the skyscraper to the hanging textiles of the domestic window.

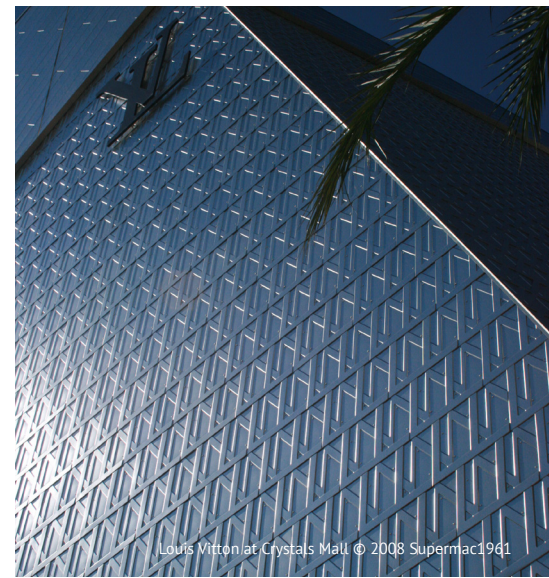
TRANSMATERIALIZATION

"From which ancient techniques did the house enclosure evolve? From none other than the art of dressing, that is, of weaving and wickerwork."³

The German architect Gottfried Semper is perhaps most famous for his theory of *The Four Elements of Architecture* which he developed through the synthesis of the primitive hut. In the analysis of these structures, Semper deduced that architecture is comprised of a hearth, roof, enclosure and mound, with each element specific to a technique: the hearth – ceramics, the roof – carpentry, the enclosure – weaving / wickerwork, and the mound – masonry. Here, the roof is the framework for the enclosure to wrap. The wickerwork, the woven textile, then becomes the primary divider of space.

In this theory, Semper keeps his focus on material and technique without conceptually connecting hearth with ceramics or enclosure with textile. Here, the technique and material are intimately tied to a process and result in a physical manifestation, be it frame, hearth, mound or enclosure. Each result is different to one another but specific to its purpose.

He continues to explore the motifs of the textile in architecture as it develops from wood framing to stone structures and other materials. The textile is not abandoned in such cases; instead it is noted that the hanging carpets are in fact the coverings of the stone wall. Though the stone wall exists, its purpose, in some cases, is to act as a defensive mechanism or a support



of the textile. However, "[The] hanging carpets remained the true walls of the visible boundary of a room."³

In studying the stone work and stereotomy of great buildings, the pervasive use of the textile begins to diminish as ornamentation in stone and the use of other material increases. It is this that causes Semper to propose a radical theory. In this theory, he suggests that the textile that was the primitive enclosure and the primary delineator of space has now been transmaterialized into stone and steel. Semper defines this as "stoffwechsel," which is German for "metabolism"; however, it can be broken down and literally translated as "fabric change," a translation of material or transmaterialization.³

Semper suggests in his Theory of Transmaterialization that the wall cladding which was once the textile has been metabolized by the material of the wall and the ornamentation through various techniques, and that it is the embodied textile within the wall. Though

these walls are not woven, knotted or looped, the textile remains an important feature in the definition and ornamentation of a wall. The ornamentation in stone and steel begins to take on the visual characteristics of the textile. This is crucial to the reading of transmaterialization. In *Frame and Generic Space*, Bernard Leupen states that: "Semper is referring to the phenomenon whereby a change in material and mode of manufacture makes no difference to the outward appearance". Leupen continues to note the crucial point within Semper's theory: "To illustrate this idea, Semper describes how the formal idiom of the primitive hut's cladding grew out of the way this cladding was woven." He goes on to relate this weaving technique to the formal idiom of the alabaster carvings on the facades of Assyrian architecture.⁴

From this reading of Semper's Theory of Transmaterialization it can be understood that the element of enclosure has evolved over the centuries through the change and development of new materials and techniques. However,

with the use of glass facades and transparent enclosure systems, the outward appearance has been altered significantly.

DEFINING CURTAINWALL

Here the differences and similarities between metaphor and transmaterialization become apparent. One could argue that transmaterialization is the metaphorical reading of a material existing within another material. The metaphor is the abstract connection of one thing to another through the name and language; the difference lies within language and materiality. The title of curtainwall is a descriptive tool which aids one's understanding of the concept; it conjures images of both a hanging textile and the notion of a wall. The mind then combines what we know about both into a hybrid idea, which we use to validate the target system, which is the actual, physical curtainwall made of glass and metal.

Transmaterialization does not require language to express the abstraction. Instead it conveys its relationship of material and process through the senses. Here, the conveyance of information takes place not just through the visual reading of a symbolic string of characters which represent the idea; instead the idea has a materiality. However, this is not to say that in the visual and sensual understanding one does not compare what one knows to what one sees and experiences. It is impossible to examine a material without comparing what we know to what we do not.

With this understanding of both metaphor and transmaterialization, it is clear that the two are not mutually exclusive: instead it can be argued that Semper's Theory of Transmaterialization is the abstract and metaphorical reading of an architectural element which has been metabolized through time, technique and material. The

literal metaphor of curtainwall engages two concepts, merging the two seemingly disparate objects into a hybrid idea that one can use to understand it without standing before the physical system.

Though the detailing in modern curtainwall might not seem directly related to textiles,



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FIGURE 5
The Unilever Headquarters in Hamburg, Germany includes an ETFE Pneus double-skin facade.

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FIGURE 6
The Beijing National Aquatics Center includes an ETFE Pneus enclosure system.

visually, the vertical seams and horizontal stack joints can be read as the warp and weft of a woven textile or the openings within a knitted or crochet surface. Not only that, in recent cases frit patterns and embossed or perforated metal panels can be found as a part of the curtainwall. It is impossible to deny the similarity and connection of curtainwall design to the textile patterns of hanging tapestries or woven wickerwork of the primitive hut.

LOOKING FORWARD THROUGH THE REAR VIEW MIRROR

The early projects that utilized curtainwall as a means of enclosure were relatively simple

in geometry. Many, like the Lever House or Seagram Building (photo on page 90), are straight-lined extrusions. These towers and the unitized rectilinear gridding of their glazing enclosure went hand-in-hand. Many buildings today are still suited towards the orthogonal unitized curtainwall. However, the advancement of modeling techniques, primarily digital modeling, has led to increasingly complex forms, which in some cases, must have a grid projected onto the surface in order to rationalize its form.

At its core, the digital modeling environment and its tools can have their origins traced back to an analog modeling technique or a rule-based system. As a result, many of these building forms are moving from geometric shapes to topological forms. Generally the methods employed to construct and fabricate these forms are primarily Euclidian based. As an example, the fabrication of an undulating surface modeled in a digital environment becomes a difficult task. The surface must be rationalized based on the size of the material, rapid prototyping machinery, and even transportation. If the surface is the result of a static, hardened geometry, in a way it has undergone materialization; the digital concept now manifests itself within the material. However, in this materialization from digital to physical, it must be noted that the undulating surface found in the digital could have been fabricated through the bottom-up processes of the textile techniques rather than a top-down geometric methodology.

In continuing the tradition of Frei Otto's membrane structures, in recent years many projects have begun to utilize the possibility of thin membranes for enclosures or large heat sinks in building design. Though these projects are using mono-surfaces created from petroleum, they shine a light on the possibilities and suggest a movement towards surface coverings rather than the typical glazed enclosure.



With the increased utilization of digital technology and the development of new material, there is an opportunity to look back to the textile enclosures of the primitive hut for inspiration. Due to the development and growing use of the digital environment and complex geometries, it may be time to see Semper's transmaterialization as a sin curve, oscillating from textile to stone/ glass/steel and back once again to the textile.

Just as stone and steel metabolized the textile over centuries, the conscious understanding of one material relating to another (and even occupying another) takes time. Only with the development of new technologies in the early 20th century did the modern hanging facades of glass become the leading enclosure systems of tall buildings. As Marshal McLuhan use to say, "just as we shape our tools, our tools shape us"¹ and the use of digital technologies may be the catalyst for a return to pliant, flexible membranes and skins that enclose and once again become the first dividers of space.