International Journal of Innovation, Creativity and Change. www.ijicc.net
Volume 15, Issue 8, 2021

Architextiles: Design in its Multifunctional State

Asna Mubashra[1], Syed Ali Qamber[2], Nalini Madaan[3], [1]Incharge Department of Textile Design, College of Art & Design, University of the Punjab, Lahore, Pakistan, [2]Assistant Professor Textile Design Department, Lahore College for women University, Pakistan, [3]Hindu School of Architecture, Sonepat, India,

Clothing and shelter are among the basic human needs which have been developing in every respect since human history. The evolutionary process of each has not grown independently from each other. Architextiles is a multidisciplinary concept that combines the creative approach, materials and structures inherent to the discipline of architecture with the same of disciplines of textiles to explore the elements of cross fertilisation of both. This paper proposes a review of the architextile to find connecting points of architecture's relationship with textiles. The exploration is based upon the theoretical influence that Gottfried Semper specified in his writings on the topic of relationship in textiles and architecture. His was an attempt to investigate the similarities found in the design elements of both. The amalgamation of textile elements with dwellings here is explored with the aim of bringing into the limelight the conversion point in the orientation of a knowledge base for architextile.

Key words: *Architextiles, Multidisciplinary, Multifunctional*

Concept of Architextiles

Architextiles is a multidisciplinary concept that combines the creative approach, materials and structures integral to the discipline of architecture with the same of the discipline of textiles to explore the elements of cross fertilisation of both (Alsop 2006). Architextiles represent the conversion point in the orientation of design in a multifunctional state. The paradigms of textile design and architectural design have accelerated aesthetics and possess the ability to embody a growing, composite and complex range of interwoven design elements. The unification of architecture and textiles is not a recent development (Macquaid 2006). The fusion of textiles and architecture, including the processes, techniques and materials involved, has a long and

winding, but largely neglected, history. Only in recent times have theorists, architects, engineers, textile designers, material scientists and artists expressed a renewed interest in the possibilities that the combination allows (Coats 2006). Architextiles has always been a source of bringing together architects, designers, engineers, technologists, theorists and material researchers to unite methodologies of both. Textiles have always been among the materials with the most promising applications in architecture. Even though they were commonly reduced to be mere decorations in the everyday contexts, their enormous versatility coupled with their inherent physical quality gives textiles remarkable architectural potential, ranging from simple solutions to futuristic applications (Sarkissian 2006). Textile is the fifth material of architecture after timber, stone, metal and glass. Semper has illustrated in his drawings the potential for structural arrangement and space-defining qualities of textile structures. According to Semper, textile had a significance influence on early developmental stages of architecture, hence these are rarely seen in contemporary advanced forms of architecture. Modern architecture majorly consists of inflexible materials that are beyond the scope of textiles in character.

The main purpose of this paper is to bring into the limelight a thorough understanding of the influence that textiles had in the early developmental phases of architecture. The challenge to this study is non availability of textile materials in ancient existing architecture, so the concept has to be formulated upon the information discussed in certain studies, therefore an effort is extended to gather together the learnt material relevant to the concept of architextiles. This current exploration intends to unveil the multiplicity of this concept and to sketch a picture of futuristic possibilities of its application.

The current argument will highlight the ways in which 'architextile' may be defined, either at the purely aesthetic level (metaphor in the history), at the structural level, or at the methodological level (Fuksas 2006). This discourse of co-evolution in both fields will help to open new perspectives onto the history and theory of architextiles. Textile surfaces create architectural space; their qualities such as elasticity, foldability, flexibility, opacity and transparency are an important part of architectural language but are yet to be studied systematically (Balmond and Walker 2006). Most of the decorative symbols used in architecture have their origin in textiles, historically establishing a long-lasting relationship of both disciplines. Retrospective investigations can substantiate the place of architextiles in architectural design theory and textile design theory by tracing its history, its dominance and potential in the past (Toomy 2006).

The relationship between textile art and architecture is an evolving one. Although the relationship between architecture and textiles was recognised more than a century ago, the connection between them has rarely been explored by historians or practicing designers. It can be studied in considerable depth, by examining the ideas, imagery, techniques and execution used by the artists of both fields (Garcia, Architextiles 2006). On the surface there are clear commonalities and differences between architecture and textiles. The way different structures respond within textile lattice depends heavily upon the scale, material and size of the structural

composition. The optimisation of the structural performance of textiles in architecture requires a specialised engineering knowledge. The current discussion is limited to the scarce resources available on the concept. Available literature has been critically analysed to understand the impact of textiles on the early development of architecture. Thus, the available theoretical writings are interpreted to learn this impact. The most recent cutting edge in architecture is not sharp and rigid but sensuous and soft. Contemporary textiles is emerging as mega materials, and side by side architects are pioneering newer possibilities of softer structures incorporating newly fashioned tensile buildings and inflatable pavilions tailored by the techniques of braiding, weaving and pleating for supple skyscrapers and bioclimatic enclosures.

Etymologies and Definitions of Architextiles

The etymological link among the roots of textile and architectural terminology is explicit. 'Textile', 'technology', 'text', 'texture', 'connection' and 'context' are all derivative inflictions of the same proto-Indo-European word 'tek', which is the root of architecture. 'Technology' and 'textile' are also derived from the same Latin 'texere', meaning to weave, connect and construct. Fabric has its origins in Latin 'fabricare', or 'fabre', meaning to work or to make. Architectural phraseology has more examples like urban fabric, curtain wall, ribbon window and sail vault. But as well as being related linguistically and conceptually, architecture and textiles are also linked via research programs. A hybrid of architecture and textiles, the word architextiles refers to such a body of projects and the way of thinking and making that joins the two. The hybrid body of work is structured by two linked and covering flows of ideas, two processes of interdisciplinary transmutation that are occurring within and through the meshing of the two disciplines (Garcia, Architextiles 2006).

The increasing architecturalisation of textiles and textualisation of architecture are, more simply, an architectural way of thinking and doing in textile design and a textile way of thinking and doing architecture. This approach expands the scope and possibilities for design and encourages a more exhaustive and rigorous challenging of conventional categories and concepts of both textiles and architecture. On the surface there are clear commonalities and differences between architecture and textiles – as practices, products, forms of materiality and as bodies of knowledge. Comparative analysis of the intersections between these disciplines offers unique insight of both (Wakefield 2006).

Types of Architextiles

The architextiles meshwork emerges across four loosely interlaced dimensions, each of which reflects and distinguishes the most significant points of interface and transaction within the meshwork. Interesting cross fertilisation can be seen exclusively in each overlapping venue and amazing combinations of more than one can also be found exploring architextiles.

1-Architects using a metaphor from textiles and textile-based processes in architecture, for example when a space is described as being woven or knitted

2-When a textile like spatial structure or form is produced in architecture, such as when forms are designed as skirts, veils, curtains, and so on.

3-When textiles or textile hybrids and composites are used in actual construction or materialisation of architecture

4-When architecture engages with textile texts in fictional as well as theoretical writings like using some specific terms of one discipline as metaphors of literature while relating to the other discipline.

Historical Analysis of Theory:

The German architect and theorist, Gottfried Semper, wrote comprehensively on the significance of art and architecture. According to Semper, the origins of architecture did not initiate from the primitive hut but from the practicing arts of that time: the initial structure required not just structure, but the weave, the knot, the textile and the tangible. Garcia, (Architextiles 2006) has also endorsed that the primitive hut then was not the first and 'natural' artifact sprung from the unadulterated needs of man, but rather a complex product of a long historical process.

Semper, despite his criticism, kept returning to the topic of origins: he clearly had in mind something other than the Vitruvius hut. The origins of architecture, he insisted, must be sought not in architectural form itself but in the precondition, which shaped it. He emphasized to have a greater focus on the belongingness of the fundamental units of the form which are from the observed form itself, that include its idea, its force its tasks and the means (Garcia, Architextiles 2006):

It was Semper's lifelong ambition to find and define the 'constituent parts'- and he found them, not as archaeological facts but as a creative principle. Semper explains that through ritual, humans capture the creative law of nature. When seeking the simplest translation of ritual into tangible form, Semper turned to textile art (Sarkissian 2006). This was the Urkunst, he explained, a primordial embodiment of the ritual act of joining parts into a whole. Having identified the original motifs of art, Semper sought to map their development and inclusion in architecture. A key link in this development was the motif of the wall, which he traced back to the technique of weaving. The original enclosure, he argued, was not the solid wall of stone or wood, but rather the primitive fence, woven by branches and grass. Textile art therefore, itself an imitation of ritual, rhythm, and dance, is the source not only of the practical arts, but also of architecture (Fuksas 2006)

Semper declared that the beginnings of building coincide with those of weaving, Tracing the motif of enclosure from the primitive fence to textile draperies, Semper found the principle of "Bekleidung" (clothing or dressing) to be intrinsically linked to spatial enclosure, a use that preceded even the clothing of the human body (Alsop 2006). Focusing on the intersections between textiles and architectural design, this title communicates the full range of possibilities for a multidisciplinary design hybrid. It examines the generative concepts, forms, patterns, materials, processes, technologies and practices that are driving this cross-fertilisation in contemporary urban and architectural design. Architextiles represent a transition stage in the reorientation of spatial design towards a more networked, dynamic, interactive, communicative and multifunctional state. The paradigms of fashion and textile design, with their unique, accelerated aesthetics and their ability to embody an expanding, composite and complex range of properties such as lightness, flow, flexibility, surface, complexity and movement, have a natural affinity with architecture's shifts towards a more liquid state (Coats 2006). A hybrid term, architextiles encompasses a wide range of projects and ways of thinking that unite architecture and textiles. A significant rise of interest in the confluence by theorists, architects, engineers, textile designers, material scientists and artists has occurred. A hybrid mode of design and practice is better able to respond to society's fast changing cultural and consumer demands and enables the production of more dynamic, flexible and interactive, event and process-based spaces (Kronenburg 2006). Art and architecture first intersected when man learned to fasten a textile to a post. There is a continuous history of intimate exchange between textiles and architecture design encompassing multidisciplinary cross fertilisations and research. The preoccupation with textiles in architecture challenges traditional perceptions and practices in interior, architectural, urban, textile and fashion design. Interweaving new designs and speculative projects for the future, Architextiles brings together architects, designers, engineers, technologists, theorists and materials researchers to unravel these new methodologies of fabricating space (Rendell 2006). Most recent investigations suggest that this merger of knowledge between architecture and textile is intensifying. "Textile way of thinking in architecture" has witnessed a rise in interest by theorists, architects, engineers, textile designers, material scientists and artists. The concept is historically sewn into our everyday language (Wigglesworth 2006). Few words common in textiles and architecture are listed as: seam, joint, structure, pattern , draft, surface, brick, stone wash (also name of a texture/surface used in textiles as well as architecture). other than that fabric walls are very common , biggest example is the fabric wall of burj al arab in dubai.

History of Architextiles

Architecture's relationship with textiles has traditionally been of peripheral interest in the central theories of architecture. This inattention to what is a critical conceptual and material dimension in Islamic, Asian, African, tensile, mobile, pneumatic and vernacular branches of architecture has not troubled many critics. It is therefore timely that this neglect of textiles in architecture is now in a reversal. Textiles now offer a significant, unique and expanding range

of possibilities for innovation. The historical, theoretical, visual and built evidence of the ways in which textiles and textile concepts can be used and realised in architecture conclusively supports such a claim. The evidence also suggests that the architecture–textiles relationship provides both a unique and illuminating account of the present state and possible futures of architecture and of the city. This survey considers the architecture–textiles relationship across four of its most frequently occurring forms: when a textile or textile-based process is used as a metaphor, when a textile-like spatial structure (such as a weave) is produced in architecture, when textiles (or textile composites) are used as a real material in a real building, and where textiles appear in architectural theory and texts. The history has been divided into certain periods as:

➢ EarlyArchitextiles.

• 15th – 19th century

• 19th century and Gottfried Semper.

➢ Modern Architextiles.

• 20th century

➢ Postmodern Architextiles.

➢ Towards a new theorisation of Architextiles.

➢ Future of Architextiles.

15th- to 19th-century Architextiles

Early textile-based architectures can also be found in less temporary forms than traditional solid and compression-based structures. The Ottoman Palace of Topkapi Sarayi, 3 Istanbul, was erected on the convenient site of the sultan's former military encampment, on the summit of the main hill of Sultan Ahmet. As architectural historians have demonstrated, the plan, tensile-tectonics and morphology of the palace are derived from the forms, plans, meanings and circulation and access protocols of the earlier Ottoman tent encampments (Bono 2006). The interiors, and some of the structural and tectonic components (as with the 13th and 14th century Nazrid palaces of the Alhambra in Granada, Spain, and the mobile tent-palaces of the Mughal emperors in India), are directly derived from the textile geometries, patterns and structural properties of the knots, carpets and wall hangings of their earlier, less permanent tent-like structures. The gradual move away from textiles to solid versions of the same buildings continued throughout the 17th and 18th centuries and entered mainstream architectural practice in western Europe via the modelling process.

19th-Century Architextiles and Gottfried Semper

The 18th and 19th centuries included brief periods when high profile interiors that drew on tent aesthetics emerged in rooms for Friedrich Wilhelm II's Marble Palace (1790), for Napoleon at Malmaison, and at the Charlottenhof Palace, Potsdam, by Schinkel. Throughout the 19th century, the key technical architectural innovations that architecture drew from textiles continued to be in terms of the tensile-based, networked grid and steel meshes and other structures that were developed for industrial and civil engineering projects. In the Deleuzian sense of the diagram as an 'abstract machine', the diagram of the textile as a networked, woven and flexible mesh began to emerge as a conceptual tool in the thinking of Gottfried Semper (1803–79). After studying Assyrian textiles in the Louvre, he came to London where he was struck both by Paxton's Crystal Palace and an exhibit of a 'primitive' hut within it. In his treatise In 1851, in the book The Four Elements of Architecture, Semper redefined the wall as a spatial enclosure, or 'Wand', rather than as a structural and critical tectonic member ('Mauer'). He referred to a building's envelope as an example of 'clothing' and found a common etymological root to the German words for 'dress' and 'wall', likening textiles building surfaces, describing both as types of 'veiling'. For him it was the hanging wall-carpets and their status as non-structural spatial dividers that made them 'the true walls, the visible boundaries of space'.7 Also, for Semper the knot is etymologically related to the seam, which is based on the idea of the continuity of bands and threads at joining points. He describes the knot as the oldest tectonic joint in history and supports this claim with the evidence that in German the words 'joint' and 'knot' share a similar linguistic root.8 Semper's new notions of a textile-based architecture represented a distinct break with previous theories of architecture and influenced later 20th-century Postmodern theories of space. This description reveals that the simple textile techniques of the weave and the knot constitute the joining techniques of structural elements in early Maori architecture. These techniques stood in complete contrast to the building techniques of early European explorers. By 1772, European architecture was highly developed, with the Gothic, Renaissance and Baroque movements having already passed. Yet, the Frenchman, Jean Roux, "admired", the Maori architecture as "so skillfully was it made" (sic). These skills that the Maori possessed in crafting their architecture, were heavily derived from textile techniques.

20th-Century and Modern Architextiles

French, German and American Modernism contributed greatly to the development of the nexus of architecture and textiles. Both Mies van der Rohe and Frank Lloyd Wright used textiles at certain points in their careers. In 1912, Mies, like Soufflot before him, used a full-scale in situ canvas model during the design development for the Kröller-Müller House in Wassenaar, the Netherlands, and Wright's Ennis-Brown House (1923) in Los Angeles was the result of research into developing what he referred to as 'textile blocks', large panels and walls constructed from concrete and cement blocks, moulded into the forms of his complex

geometric designs and linked together with a lattice of metal rods. Made with little quality control, these are now deteriorating rapidly. During the 1910s and 1920s, the idea of urban structural networks and a more densely interconnected, multilevel morphology of the city, more akin to the diagram of a textile, began to appear in a number of utopian drawings and designs for the future city. In 1908, Moses King's 'Cosmopolis of the Future' and William Leigh's 'Visionary City', published in Cosmopolitan magazine, both presented designs of a Manhattan-like city, connected across each level with bridge like linking structures holding double-decker railroads and streets in the sky. In 1913, Harvey W Corbett published a similar, more detailed version of the same concept (Watson 2006).

Postmodern Architextiles

For writers like Sean Hanna and Phillip Beasley, it was the more complex textile-like structures of the steel meshes of the Eiffel Tower in Paris and those inside Eiffel and Bartholdi's Statue of Liberty of 1886 that were seen as the 19th century precursors of the architectural macro textiles of the 20th and 21st centuries. Hanna and Beasley argue that 'a new generation of giant-scale textiles is at the core of a revolution in architecture and cite Foster's St Mary Axe in London, the OMA Seattle Public Library and Testa and Weiser's Carbon Tower, as the exemplars of this new movement. Only with the advent of the computer and the digital meshes of building skins and NURBS surfaces did architecture begin to take on more of the qualities of textiles in the 1990s. The modelling and building of such architectural mega textiles and the translation of physical textiles and textile techniques into architecture with the aid of the computer has been a sustained preoccupation for architectural theorists and advanced research architects like Lars Spuybroek, for whom Semper and Otto have been formative precedents. From 1998, many of Spuybroek's projects have dealt specifically with the textile tectonics of complex buildings and propose radical new urban concepts, such as the Paris Brain (2001). These draw directly, explicitly and extensively on design methodologies driven textile tectonics. Though, like Alsop and Perrault, Spuybroek's work represents the cutting edge of architextiles, his rigorous and intense research in this field is the single but spectacular example of its type. Today, Zaha Hadid's work is presented by her office under the categories 'ribbons' and 'carpets,' and Dominique Perrault and Will Alsop both have strong bodies of prize-winning international projects behind them which, like the work of a rising number of international and emerging architects, have been explicitly driven by research on architectural textiles and textile architectures. The integration of architectural textiles with new technologies has also been the preserve of respected academic research institutes. A number of the most imaginative and innovative interactive architecture projects, for example Diller + Scofidio's Brain Coat (2002) for their artificial Cloud 'Blur' in Switzerland, Enric Ruiz Geli's Hotel Habitat (2006) and ONL's kinetic architectural experiments such as 'Muscle Body' (2005), are all contemporary examples.

Drivers of Architextiles

Theoretical explorations, material science ventures, engineering innovations, technological experimentations and economical as well as socio cultural developments are key drivers behind the expansion of the architextile body of work. Late postmodern theories of space are dominated by dynamic, interactive, flexible, event and process-based paradigm of space and articulate various aspects of the new metaphysical and ontological characterisation of architectural space. In the transition stage the material and energetic state of textile with a common property of surface continuities, lightness, softness, flexibility, thinness and fluid like dynamism, make them an apt martial group for the expression and realisation of this new anti-theoretical paradigm (Kronenburg 2006).

Textile Material Science

The increasing prominence of textiles in architecture is also the result of innovations in material science and technology, such as 'the extreme textiles' exhibited at the Cooper Hewitt Museum, New York in 2005. Such textiles also enable the realisation of new types of functions, which were impossible to achieve with traditional textile material groups. Textiles are now being manufactured from a surprisingly broad spectrum of raw materials including peat, silicon, urine, soya, nettles, bamboo, crab shells and charcoal for example, all relatively new. Materials such as modern tensile glass, contemporary ceramic and carbon fibres, aramids, liquid crystal polymers, polyphenylene benzobisoxazoles, PIPDs and high-modulus polyethylenes are able to perform under extreme forces and with a complex mix and range of qualities. In addition to this, complex and precise performance specifications are being discovered, and synergies between demands for sustainability and composite are explored. Today's high-performance textiles are at the fore front of a quiet material, design and engineering revolution. New materials and technologies driven from advancement in biotechnology, nanotechnology, electronics, 3D printing and weaving, biomimetic and shape memory alloys offer extraordinary properties that enable faster, lighter, safer, stronger and smarter high performance technical textiles. All new textile ventures are rapidly finding new ways of application in sectors such as architecture, medicine, sports, agriculture, transportation, defence, aerospace and leisure (Coats 2006). All such textiles also enable the realisation of new types of material functions, impossible to achieve with other material groups. Synergies between demands of sustainability and performance specifications are being discovered and textiles of today are being derived from a surprisingly broad spectrum of raw materials (Rendell 2006). Advanced textile manufacturing processes such as ultrasonic welding, laser cutting, advanced digital printing, thermoplastic setting, electrospinning, relief spinning and pultrusion are creating remarkable super textiles incorporating a wide range of structural performance and functionality in responsive and interactive ways. Such surfaces are now capable of imparting a wide range of properties and so are suitable substitutes for older materials in the field of architecture. These are expanding the category and definition of textiles, dissolving the boundaries between textiles

and other material groups used in architecture. Thereby, resulting in more and more experimental contributions from the experts of both fields to create enriching cross-fertilised design forms as best fit for the arena of architextiles (Balmond and Walker 2006).

Textiles and Engineering

Postmodern textiles in built-environment applications also extend into large-scale landscaping projects, as well as into roads, storm rooms, ship hulls and aeroplanes, and in concrete and exterior building envelopes. For engineers, architects and researchers with more technical and structural interests, it is the macroscale tensile, pneumatic and structural-formal aspects of textiles that have become their focus. Together with tensile structures, pneumatic building technologies have witnessed a revival with the advent of CAD/CAM. CAD software such as Testa Architecture's Weaver and Tensys' in TENS are specifically designed to model textile architecture. The range of design advances in the field of complex pneumatic forms and structures that have resulted from CAD/CAM technologies have been demonstrated by Royal College of Art (RCA) graduate Judit Kimpian's 'Pneumatrix' PhD research project (2001). In this, buildings are hybrid pneumatic/rigid structures developed for extreme conditions whose stiffness and load-bearing capacities surpass conventional inflatable and pneumatic structural performance by many magnitudes. For researchers, architects and engineers like Phillip Beasley, it is the large-scale, lattice-like, tension-based structure of textiles that has opened up the largest territories of technical innovation. These types of construction systems are particularly effective in extreme physical conditions, being able to withstand dynamic loading forces that can result in twisting, torsion, buckling and bending, such as encountered during earthquakes, wind-directed heavy snow, and during hurricanes. When constructed from lightweight glass and carbon fibres, especially in composites, the textiles are also faster, easier and cheaper to transport, making the construction process simpler and more efficient.

Socio Cultural and Economic Drivers of Architextiles

Changes in economics, society and culture have also contributed to the demand for architextiles. For architecture to be able to more effectively express and assimilate the accelerating changes in life styles, identities and economics, that is the demand of contemporary globalised world: faster mannerism, more like what is used in fashion and textiles is used in architecture, becomes necessary. The new demand of a more fluid, adaptable, interactive, variable, multimedia functional and dynamic architecture drives hard the search for new architextile forms and aesthetics (Toomy 2006).

In parts of cities such as Tokyo and Los Angeles where buildings are constructed and demolished rapidly, architecture begins to take on a nomadic status. The shifting sites of architectural programs in the accelerating cycles of economic global and sociocultural capitalist production systems leads architects and theorists like Herzog and de Meuron, Hani Rashid,

Rem Koolhaas and other aestheticians of speed to conclude that conventional architecture is too slow to keep up with significant changes in society and culture. While the computer and its related technologies have compressed the time of the standard architectural production cycle, and while architecture, as designs (disseminated through photography, magazines, new media, films, exhibitions, drawings and models), is able to match the speed of other design disciplines, the realisation and materialisation of built architecture, as yet, cannot. Economic and faster design-cycle pressures impose these new conditions and situations on architecture and are now fuelling a burgeoning desire for a faster, lighter, smarter, more transportable, easily de/reconstructed and technologically facilitated architecture. New retail, media, cultural, entertainment, leisure and sports events impose new architectural problems to solve in servicing and housing new programs, functions and phenomena.

Towards a New Theorisation of Architextiles

The manifold ways of theorising or materialising collisions between textiles and architecture and the possible transferable qualities and effects of each for the other can now be argued to be of central importance to architecture per se. Moving towards any useful theorisation of this ragbag of historical precedents and concepts requires a synthesis of the salient textile qualities and concepts that have been embodied in the architectural projects and texts in this issue, and in general. The qualities and concepts, as described in this body of work, are often contradictory – vague, but approximate. Together they reflect some of the paradoxical but real qualities and concepts in many of the most interesting new (and older) textiles and buildings today. Grouped and considered as a whole, such qualities and concepts seem to offer a robustly useful framework for understanding, interpreting and designing contemporary architecture. Moreover, these categories and qualities suggest further, as yet unexploited, programs for their materialisation and realisation in both architecture and textiles: soft, flexible, convoluted, networked, continuous, dynamic, variable, woven, latticed, folded, adaptable, translucent, tensile, pneumatic, pleated, creased, knotted, pliable, porous, veiled, elastic, plastic, supple, knitted, draped, flowing, interactive, patterned, comforting, cosy, fashionable, enveloping, clothing, protecting, lighter, faster, stronger and smarter.

The Future of Architextiles

Utopian and futuristic representations of the architecture–textile nexus also are of interest for the designers and researchers of today, and those of the future. They raise aesthetic, social and cultural issues that provoke more complex, sophisticated critiques and discourses within architecture, unencumbered by the problematic needs of clients and material and financial constraints. Speculative, conceptual and fictional architextiles provide useful counterfactual thought experiments on subjects as diverse as dynamically reconfigurable cities and landscapes, nanotechnologies, smart materials, carbon-based architectures and

biotechnological buildings. Innovative and high-tech textiles and giant meshes are now being proposed by ambitious projects like ETALAB's Tate in Space, Testa and Weiser's Carbon Tower and the giant megastructure of the Shimizu Corporation Mega-City Pyramid project.20 In nature, there are four main biological, low-density, fibre based structures: cellulose in plants, chitin in insects and crustaceans, collagen in animals and silk in arachnids. These structures are interesting to biomimetic researchers as they are able to vary their form and density, allowing them to perform a variety of different functions. Complex functions and qualities like self-repair, growth and replication are the organic qualities of architecture being sought after within this model of research currently shared by architects, textile designers, engineers and other scientists.

Structure Modelling

The basic requirements of any design software for membrane structures are rooted in the need to first determine an appropriate equilibrium form: to analyse the response of that form under applied loading and to produce membrane cutting patterns and cable schedules that enable the accurate replication of the form in construction. Analysis software is based on the finite-element method. This is a numerical technique whereby the membrane surface is subdivided into a large number of triangular elements, its geometry defined by the spatial coordinates of the triangle corners that are also the node points at which adjacent triangles are connected. Cables are subdivided into a series of line elements between intermediate nodes that coincide with those of the connecting membrane. The mathematical approximation lies in the assumption of constant stress within individual elements, and thus the accuracy of the numerical model may be increased by increasing the number of finite elements representing a particular structure.

Textile Tectonics

In an interview with Lars Spuybroek, he says, 'Architectural design is not about having ideas, but about having techniques, techniques that operate on a material level. It's about making matter think and live by itself.' Here Lars Spuybroek of NOX talks to Maria Ludovica Tramontin about his engagement with the work of Gottfried Semper and Frei Otto, and how it has led him to his own brand of textile tectonics or 'soft constructivism'. This involves textiles being transformed into the tectonic through conventional textile techniques – weaving, bundling, interlacing, braiding, knitting or knotting – effectively building structure through softness and flexibility.

Semper Reversal and Textile Tectonics

"Textile Tectonics" refers to Semper's adoration of textile and his four elements of architecture, being: earth for foundation, wood for construction, textile for enclosure and fire for climate. It's such a beautiful way of ordering, from heavy to light, not being a pure materialism of built forms, but more like the Greek earth, water, air and fire, the constituent elements that make up all the other materials and life forms. A concept that Semper is famous for is the Stoffwechselthese, the transformation of materials, which means buildings aren't made of textile any more, but that textile has been transmaterialised into stone and steel and other constituent parts. Thus, it's not so much ideas that inhabit matter, but other materials. Textile inhabiting stone. Materials in materials, that I find that astonishing. It's an abstract materialism, saving us from idealism and realism at the same time. He was very conscious of that, he wanted to steer in between "speculative aesthetics" and "mere engineering". Literally it means "change of substance" and even more literally, "change of fabric". Topotectonics, continuity and their relationship to decoration, are key features of Spuybroek's unique body of work. In his work, topotectonics is a definitive tectonics of continuous elements, which is curious and almost paradoxical. For Frampton, the continuous always leads to unhappy sculpturism, carved earthwork. Spuybroek's views on sculpturism are complex and critical. He states that: 'I want to stay far away from sculpturism, it doesn't even recognise architectural problems. I totally agree with Frampton about Gehry – though we should be forever grateful to Gehry for stealing the technology out of high-tech offices – but it is pure formalism. Though there is a very powerful, floral logic behind Bilbao, it's not structure, it's hardened geometry. Beautiful facades versus beautiful roofs. Now, to successfully have a roof on the ground, tectonically you have a big problem to solve, since the light structure of the roof is generally not capable of supporting floors.

Conclusion

Advanced materials have become a new tool for designers and architects. Because textiles handle and behave in very different ways to wood or metal, they need to be treated differently, this is where new solutions and exciting designs begin to emerge. It is also a time of dialogue and collaboration between the creative and manufacturing industries. As so much of what is produced in technical textiles is to order, designers and architects are having to sit down with fabric engineers and discuss their projects rather than simply submitting a purchase order. Thus, new materials and ideas are emerging from such interaction, and the impact and possibilities are proving to be very exciting indeed. As nanotechnology and biotechnology are starting to be used commercially, in the future anything seems possible and everything is likely.

The absence of textile materials in finished architecture was one of the catalysts of this study. I have drawn conclusions regarding the cross- fertilisation of architecture and textiles:

The first application of textiles in architecture, is using textiles as building materials. Textile meshes, and tensile membranes in architecture provide sensual qualities of space that only textiles can offer, their ability to control light, be semi-transparent, flexible and create a 'soft' architecture, as evidenced in Perrault's architecture.

The second way in which textiles inform a contemporary architecture is the translation of textile geometries, techniques and forms into tectonic materials. For example, my crocheted models cannot be constructed out of textiles at a large scale. Through digital means these complex curved forms can be translated into tectonic form. This is evident in the work produced by AGU Arup, Shigeru Ban and Lars Spuybroek.

This new avenue of knowledge of architextiles aims to find as many ways as possible to probe the field and begin to stretch and test its limits. The historical threads, academic and professional contributions as well as the futurological, utopian and more fantastical assumptions in this respect, all provide alternative scopes of thought (Macquaid 2006). Conclusively it is stated that architecture and textiles borrow from each other and merge together to further the potential of interstitial spaces and bodily relationships. While considering human body as mediator the differing notion of space, as delineated by boundaries, can be transcended enabling a new understanding of space making, allowing the two disciplines to become more synonymous.

REFERENCES

Alsop, W. (2006). Otherworldliness: The pull of black velvet, latex, tights, quilts, tablecloths and frocks. Architectural Design, 36-41.

Balmond, C., & Walker, C. (2006). Woven Surface and Form. Architectural Design,82-89.

Bono, C. D. (2006). Thomos More Council Estate, London: A refabricated picturesque landscape. Architectural Design, 60.

Brown Deidre , (2009). Maori Architecture: From Fale to Wharenui and Beyond. Auckland: Raupo.

Coats, N. (2006). Skin/ Weave/ Pattern. Architectural Design, 44-49.

Fuksas, M. (2006). The Great Veil of the Central Axis. Architectural Design, 69-70.

Garcia, M. (2006). Prologue for a History and Theory of Architextiles. Architectural Design, 12-20.

Kronenburg, R. (2006). Fabric Architecture and Flexible Design. Architectural Design, 74-80.

Macquaid, M. (2006). Tectonics and Textiles. Architectural Textiles, 98-101.

Quinn, B. (2006). Textiles in Architecture. Architectural Design, 22-26.

Rendell, J. (2006). An Embellishment: Purdha. Architectural Design, 97-98.

Sarkissian, S. (2006). The Notion of Membrane and Aesthetics of Trans-Textuality. Architectural Design, 73-74.

Toomy, A. (2006). Architextiles. Architectural Design, 80-82.

Wakefield, D. (2006). Tensile Structure Design. Architectural Design, 92-95.

Wigglesworth, S. (2006). The Straw House and Quilted Office. Architectural Design, 27.