

# THE CONVERGENCE OF LOCAL AND GLOBAL CONTEXTS - INNOVATIVE APPLICATIONS OF CNC WOOD FABRICATION TECHNOLOGIES

Oliver Neumann  
School of Architecture  
The University of British Columbia  
6333 Memorial Road, Room 402  
Vancouver, BC  
Canada V6T 1Z2  
neumann@oliverneumann.com

## Abstract

*Contemporary building technologies have the potential to contribute to regional building practices. With a focus on the cultural context in British Columbia, Canada, this paper explores how CNC timber framing technology can influence the generation of a regional building culture in the Pacific Northwest. Student projects serve as examples of creative applications of CNC timber framing technology sensitive to the complex conditions of our surroundings.*

## 1. Introduction

The research is based on the assumption that, as cultural contexts are undergoing continuous transformations, constant re-evaluations of territorially-specific building practices are required. The intention of the research is to show the possibilities of utilizing globally available digital fabrication technologies to develop building cultures specific to regional cultural contexts. Rather than to promote cultural homogenization, fabrication technologies can help redefine a regional building culture that is reflective of its economic and cultural context.

As a basis for the discussion of CNC wood fabrication technologies, it is useful to explore questions of place and territory as part the general architectural discourse. Given that “the increased importance of global-scale processes has brought about a corresponding increase in the importance of place,”<sup>1</sup> the question of architecture’s contribution to territorial cultural identities is of continuous relevance.

An evaluation of technology’s influence on regionally distinct building practices has to consider a range of factors that contribute to the complex cultural context. Economic, cultural and social aspects, local wood building traditions as well as a brief description of CNC timber framing technology provide a framework for the discussion of samples of graduate design. While playful

and exploratory, the projects investigate the potential of CNC fabrication technologies to contribute to a building practice particular to a cultural context and engage in general issues of architecture and urbanity today.

## 2. Place and territory: technology and culture

Locating regional building practices at the intersection of local and global influences is a common theme at least since the beginning of the 20<sup>th</sup> century when industrialization and the increase of mass-produced building components promoted a sense of regionalism as a reconciliation of the “universal and the regional, the mechanical and the human, the cosmopolitan and the indigenous,”<sup>2</sup> already indicating the influence of technology on the generation of local building practices.

Technology is essential to the discourse on place and territorial practices, as spatial concepts and the making of spaces are contingent on the logic of fabrication. The relationship of technology and specificity of place is often assessed negatively, however, as modernization is associated with the loss of regional distinctions and characteristics.

The critical attitude towards modern technology is due to “its propensity for proliferating placelessness.”<sup>3</sup> “The loss of traditional communities and the attenuation of ties to the particular and local”<sup>4</sup> are common themes of

the criticism of modern technology. The application of technology is seen as independent of space and place making. Technological innovations, in this understanding, have brought about “a dematerialization of building” parallel to “a literal mechanization/electrification of its fabric”<sup>5</sup> resulting in the separation of structure and building envelope and the artificial disjoining of the building’s interior to its context. Consequently, the technological achievements of late modernism - mass production and increasing standardization - are seen as irreconcilable with site and context-specific designs. However, more recent technological developments in building fabrication promote a new relationship of technology and aspects of place and site while conceptions of the context of architectural practice as complex ecologies overcome the “split between craft-practice and industrial technique.”<sup>6</sup> Advancing into the social realm, technology can be seen as “essentially a spatial concept because its operation depends upon the mobilization of human and nonhuman resources.”<sup>7</sup> The uniqueness of each cultural context, then, leads to societies that produce their own particular types of spaces. Consequently, “differing qualities of places” – and related specific architectural solutions - “are more a matter of technological practices than aesthetic choices.”<sup>8</sup>

### 3. Place and territory: nature and culture

Interestingly, ideas of specificity of place and attitudes towards the environment have followed similar trajectories. The concept of nature over time is directly related to notions of place and place-specific architecture. A brief outline indicates a parallel development in the conception of the natural surroundings from a disengaged realm of the untouched wilderness, notions of the sublime to the framed and aestheticized landscape of the picturesque.

Modern science, while “demystifying and ordering the natural world,”<sup>9</sup> was still based on an anthropocentric understanding of the environment. A more recent shift led to an all-inclusive definition of context inherent

in the changing terminology from environment to ecology. This shift towards ecology is emblematic of the reassessment of our surroundings. Aspects of place now include interrelated man-made and natural conditions including social, economic and technological aspects.

### 4. Traditional wood architecture in British Columbia

The recent selection of a log house to represent British Columbia at the 2006 Olympic Games in Turin indicates the continuing influence of the imagery of the heroic westward expansion of North American explorers on regional building culture. Log cabins, however, were never the primary building style in early North American settlements as many settlers “proceeded directly ... to framed houses.”<sup>10</sup> Nevertheless, the log cabin became a symbol for the struggle with the seemingly unconquerable wilderness. The simplicity of log houses, in many cases, made it a fitting building method that benefited from the defensive characteristics of the solid wood structures indicative of a culture of disengagement and separation rather than assimilation and integration.

In regards to more pragmatic considerations, log houses were considered to be wasteful of wood as the same number of logs needed to build a one-room cabin could be sawed into planks to construct two or more dwellings.”<sup>11</sup>

Moving from solid to open and flexible structures to construction methods that are reflective of the complex ecologies of their surroundings, British Columbia’s building culture mirrors the development of the relationship of technology and culture and nature and culture. Log cabins, an expression of the mobility and short-term occupancy characteristic for the expansion of North American explorers across the continent, were an economic necessity rather than an aesthetic preference. They constitute a transitional building practice for settlers who ventured into challenging territories. Therefore, log buildings should not be seen as “architectural types, but rather as a” timely “method of constructions”<sup>12</sup> that illustrates the social and economic conditions of the beginning westward expansion and colonization.

In British Columbia, the majority of wood buildings were wood frame structures. Starting in the 1930's, a new style of modern buildings in British Columbia brought together European influences with local building materials and conditions of climate and topography. As a synthesis of International Style spatial concepts and building technology with local building materials, "the development of the post-and-beam construction system allowed much greater freedom in positioning floors and windows"<sup>13</sup> than traditional architectural forms. The new flexibility led to open-plan layouts that promoted fluid transitions between interior and exterior. The houses of the new West Coast Style were sensitively integrated into their individual sites, considering topography, natural vegetation, views and orientation to the sun, while embracing modern building technology and methods. These post-and-beam buildings are a regional expression of a particular time and place. They "can be understood as a solution to postwar problems that ranged from economics and new markets and materials to culture (and its efficiency as a code of knowledge in a changing nation)."<sup>14</sup> As a building method adaptable to the local terrain and topographical conditions, as well as a result of regional and international technological and economic developments, post-and-beam structures can be seen as predecessors of a building culture integrated into the multilayered conditions of its complex ecology.

## 5. Territorial factors vis-à-vis CNC technology

The BC lumber industry depends on technology to enhance the value of wood products to remain globally competitive. The need to compete in a global market includes the ability to export ideas, technological know-how as well as sophisticated building techniques.

Considering the growing environmental awareness – with a need to promote sustainability through material efficiency and efficiency of construction assembly – the focus on the preservation of natural resources is a central aspect of a regional building culture. Contrary to the assumption that contemporary developments in

building technology are "abetting the undermining of materiality through the dematerialization of building"<sup>15</sup> CNC fabrication technologies can efficiently generate new spatial and material expressions of their particular cultural context. Given the technical ability to efficiently create ever-smaller building modules and spatially complex building components, CNC-fabricated wood building elements can be designed to meet the specific and changing requirements of individual building.

Flexibility and adjustability of CNC fabrication processes allow to explore formal and spatial conditions corresponding to ideas of complexity and the openness, individuality and self-expression of people's contemporary living conditions. With their inherent sustainable and economical characteristics, contemporary wood products, fabrication and production methods can help generate site specific designs as part of a more ecologically sensitive building culture.

While referencing traditional timber framing techniques and detailing, however, the technology is not limited to revisiting and reinterpreting timber framing structures and traditional joinery but provides a basis for design explorations specific to the economic and cultural context in British Columbia with its existing wood building culture, focus on sustainability, and the natural environment.

## 6. Design explorations

The graduate design projects presented here investigate the potential of CNC fabrication technologies to contribute to a design and building practice particular to a cultural context. The design projects explore socially, culturally, ecologically as well as economically sustainable designs that can accommodate a changing society and urban surroundings.

The students worked with a CNC beam processor to fabricate samples of their design projects. Each project identified specific aspects relevant for the discourse on fabrication technology's contribution to the complex ecology of our surroundings

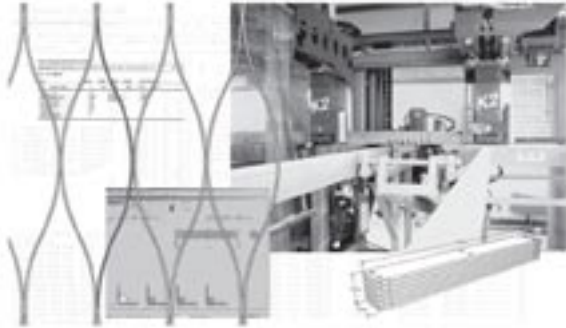


Image 1: CNC fabrication process. Image credit: Alex Minard

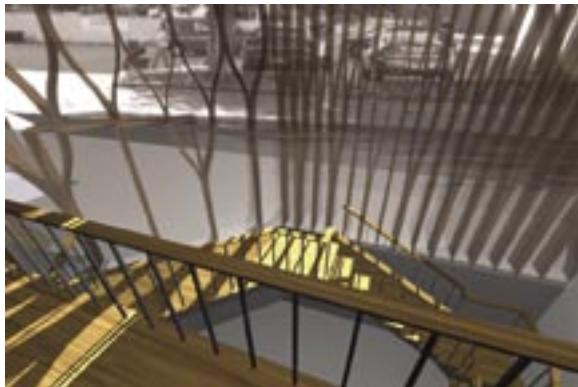


Image 2: fluid transitions. Image credit: Alex Minard

### 6.1. Material efficiency, spatial flexibility and continuity

The first project explores the CNC beam processor's capacity to produce traditional wood joinery to fabricate components for a material efficient façade system that allows for open and flexible spaces. Ideas of changing activities in an urban environment are incorporated with a building appearance specific to its method of fabrication and construction. The openness of the facade promotes fluid transitions to the surrounding urban context.

The variable façade system interprets standard timber framing joinery and typical material dimensions. While the wall system allows for open floor plans and multi-story spaces, the density of the façade module can be adjusted to accommodate changing load conditions. The

size and depth of façade components can be varied to control visual relationships to the exterior and to limit solar radiation.

### 6.2. Modularity and spatial appropriation



Image 3: Joinery detail. Image credit: Ana Sandrin



Image 4: Adjustable site configuration. Image credit: Ana Sandrin

The second project considers the different constituencies that share public spaces in the urban realm. Throughout the year, these spaces serve a variety of activities ranging from temporary commercial uses, festivals as well as spontaneous gatherings. Focusing on the temporary appropriation of public spaces, the design proposes a flexible structure that can accommodate changing activities over time. The project builds on the ability of CNC beam processors to efficiently fabricate large

numbers of similar building components. A connection detail that references traditional wood joinery allows for flexible configurations at a variety of scales.

### 6.3. Mass-customization and spatial interconnectivity



Image 5: Circulation space. Image credit: Manson Fung

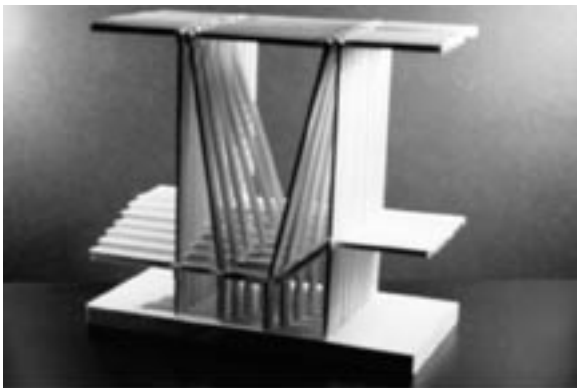


Image 6: Adjustable building section. Image credit: Manson Fung

The third student design project investigates relationships of materiality, structural logics, techniques of assembly and particular spatial configurations within a multi-story building. Focusing on subtle variations in a building section, the project explores degrees of spatial interconnectivity between interlocking programmatic spaces. Given CNC technology's capacity to efficiently fabricate large numbers of individual building components, variation and adjustability becomes the focus of a responsive structural wood framework.

Variations in size and joinery details as well as the varying density of building sections lead to a diverse range of visual and spatial experiences.

Bringing together conceptual ideas on the contemporary urban condition with wood fabrication technologies, the projects reveal the potential as well as limitations of the CNC beam processors. While in many cases the CNC beam processor was able to execute individual cuts and drillings necessary to fabricate sample details, preprogrammed tool paths and machining sequences often limited the successful fabrication of connection details. The detail studies also revealed how fabrication sequences involving CNC beam processors in combination with conventional wood processing tools can produce sophisticated details beyond the current capacity of the CNC technology.

## 7. Conclusion

Technological developments are synchronous with cultural changes and need to be considered as part of the complex ecologies that constitute our surroundings. New technologies allow for the development of building cultures and regional identities that explore the “dynamic polarity between technology and culture, between economy and landscape”<sup>16</sup> characteristic for Canada. CNC timber framing technology offers an opportunity to create an architectural culture consistent with many Canadian practices that simultaneously “look to the global freeway and the particularities of the context.”<sup>17</sup> Aspects specific to British Columbia provide a basis for a territorial building culture, while globally available technologies produce *technological networks* with contributors to the regional building practice located in spatially discrete locations elsewhere. Technological networks create spatial relationships “that tie social network of producers”<sup>18</sup> to the economic and material resources necessary for construction. The related idea that “technology is best understood ... through geography”<sup>19</sup> goes beyond the notion that regional building practices simply are a combination of climate, geographic influences and available talent. Geography takes on a broader definition that encompasses the extended range

of the cultural spectrum including local social, economic, cultural and technological factors.

Consequently, the consideration of social, economic and technological conditions and their influence on the notion of context-specific building cultures makes apparent how style and aesthetic references alone offer no adequate basis for regional building practices. They are not aesthetically driven and need to be understood independent of formal preconceptions. To promote territorial practices and regional building cultures, then, we have to be open to a broad range of influences including building technologies significant in the local and global context.

## Endnotes

- <sup>1</sup> Jonathan M. Smith, Andrew Light, and David Roberts, "Introduction: Philosophies and Geographies of Place", in Jonathan M. Smith, Andrew Light, ed., *Philosophies of Place*, (Lanham, 1998) 5.
- <sup>2</sup> Joan Ockman with Edward Eigen, *Architecture Culture 1943-1968*, (New York, 2000) 107.
- <sup>3</sup> Kenneth Frampton, "Technoscience and Environmental Culture: A Provisional Critique", in *The Journal of Architectural Education*, 53/4, (2001) 128.
- <sup>4</sup> David Wasserman, Mick Womersley, and Sara Gottlieb, "Can a Sense of Place Be Preserved", in Jonathan M. Smith, Andrew Light, ed., *Philosophies of Place*, (Lanham, 1998) 191.
- <sup>5</sup> Kenneth Frampton, "Introduction", in Kenneth Frampton with Arthur Spector and Lynne Reed Rosman, ed., *Technology, Place & Architecture. The Jerusalem Seminar in Architecture*. (New York, 1998) 12.

- <sup>6</sup> Frampton, 12.
- <sup>7</sup> Steven A. Moore, "Technology, Place, and the Nonmodern Thesis", in *The Journal of Architectural Education*, 53/4, (2001) 134.
- <sup>8</sup> Moore, 134.
- <sup>9</sup> George Thomas Kapelos, *Interpretations of Nature. Contemporary Canadian Architecture, Landscape and Urbanism*, (Kleinburg, 1994) 28.
- <sup>10</sup> Shurtleff, 186.
- <sup>11</sup> C.A. Weslager, *The Log Cabin in America. From Pioneer Days to the Present*, (New Brunswick, 1969) 92.
- <sup>12</sup> Weslager, 58.
- <sup>13</sup> Sherry McKay, "Western Living, Western Homes", in *Society for the Study of Architecture in Canada Bulletin*, Vol. 14, (1989):67.
- <sup>14</sup> McKay, 73.
- <sup>15</sup> Robert M. Oxman, "The Deamons of Place", in Kenneth Frampton with Arthur Spector and Lynne Reed Rosman, ed., *Technology, Place & Architecture. The Jerusalem Seminar in Architecture*. (New York, 1998) 190.
- <sup>16</sup> Arthur Kroker, *Technology and the Canadian Mind*, (Montreal, 1996) 8.
- <sup>17</sup> Sherry McKay, "Ideas of Canadian Architecture", in Andrew Gruft, *Substance over Spectacle*, (Vancouver, 2005) 199
- <sup>18</sup> Steven A. Moore, "Technology, Place, and the Nonmodern Thesis", in *The Journal of Architectural Education*, 53/4, (2001) 134.
- <sup>19</sup> Moore, 134

## Oliver Neumann

Assistant Professor at the School of Architecture at the University of British Columbia in Vancouver. He has professional degree in architecture from the Technical University in Berlin, Germany, and a Masters in Advanced Architectural Design from Columbia University in New York. He is a licensed architect with the Architektenkammer in Berlin, Germany. Oliver Neumann's research focuses on the role of digital technology in the building process and in broader speculations of emerging material culture, contemporary fabrication technologies and mass-customization processes and their implications for environmental design and building.