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Media(ted) Practice: The Globalization of Architecture through Standards, Softwares, and Spatial Imaginations.

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Abstract

In 1980 the World Bank undertook a project at a number of Chinese universities to encourage the development and adoption of Computer Aided Design (CAD) softwares in the country's construction and manufacturing sectors. Two decades later, in 2005, the official magazine of the American Institute of Architects, Architectural Record, published an article entitled "Are We Exporting Architecture Jobs?" in which it detailed the opportunities and challenges for American architects posed by a growing global, particularly near-eastern, architectural workforce versed in American software and standards, whether in the form of offshoring opportunities and market expansion, or increased competition and labor devaluation. In 2014, almost another decade after the Architectural Record article, and three decades after the World Bank CAD project, four near-simultaneous intersections of architecture, economics, and politics made international news: the construction of the 57 story "Mini-Sky-City" in China's Hunan Province in under 19 days, the potential housing market collapse in a growing number of Chinese "ghost cities," Chinese president Xi Jinping's call for an end to the construction of "weird buildings" in China, and controversial statements by Zaha Hadid shirking responsibility for the deaths of migrant workers, mainly of south and eastern Asian origin, on construction sites in Qatar.

What connects this set of occurrences is a decades long series of changes in the practice of architecture reciprocally spurred/enabled by the proliferation of standardized materials and construction practices, the development and deployment of information and communication technologies (ICTs), CAD softwares, and the globalization of media culture surrounding the Financial, Insurance, and Real Estate (FIRE) economic sectors. Largely upstaged by the buildings and controversies it has given rise to, the techno-governmental background which is the topic of this paper

has in fact shaped contemporary architectural practice, cultural imaginations of space, and the spaces of everyday life around the globe.

Narratives of Techno-Globalization

The logics of contemporary architectural production's globalization, an ongoing process since the end of World War II, have received a large degree of critical attention in comparison to the technological developments which have both shaped and been shaped by this process. The introduction of information and communication technologies (ICTs) such as Computer Aided Design (CAD) softwares, the proliferation of standardized materials and construction practices, and the globalization of media culture surrounding the Financial, Insurance, and Real Estate (FIRE) economic sectors, in particular, have had impacts beyond the channeling of capital flows.[1] These technological developments have marked, and continue to mark out shifting intersections of global and local forces, and have given rise to new cultural imaginations surrounding everyday spatial practices.[2] In doing so, these technological developments implicate architecture and the means of its production in the national policies and international divisions of labor associated with globalization, for which the history of technological developments and the globalization of architectural production in China offer paradigmatic examples.

Examining how technological developments and globalization have informed one another in the context of China provides insights into the interrelationships of space, capital, and technology in a manner that is attentive to the complex, and often contradictory logics of governmentality. Tracing these interrelationships challenges narratives of globalization based on distinctions between "developed" and "developing" countries, capital/technology transfer, and the application of western, capitalist motivational logics to the decisions of diverse actors. Instead, the co-production of technological developments and processes of globalization manifest in Chinese architectural production since the 1980s clearly connects otherwise distinct actions and events into a broader milieu, a kind of spatial imagination. This spatial imagination, as an onto-epistemological regime in which multiple narratives and agendas intersected, formed the conceptual infrastructure through which global and local actors understood their relationship to space and capital.[3]

The introduction of CAD softwares within the profession of architecture offers a lens for understanding the underpinnings of this spatial imagination by allowing the tracing of connections between local actions and distant built environments as well as its obverse.[4] Since their conception, CAD softwares have been co-productively entangled with material definitions, construction practices, divisions of labor, and media culture. These entanglements with elements of globalization were/are the overlapping mediums through which governmental power was/is negotiated and exercised.[5]

Transferred Standards, Adopted Practices

While the operational goal of early CAD systems was the mechanization and standardization of drawing production, these technologies originated in the precision, repeatability, and efficiency of Computer Aided Manufactuiring (CAM) designed to meet the complexity and scale of post-wat industrial production.[6] Further, as CAD systems became capable of representing large and complex forms, the realization of these forms necessitated precise and standardized materials and fabrication methods.[7] Issues of materiality and fabrication which are at the forefront of contemporary proposals for the non-representational nexus of CAD/CAM, have therefore been and continue to be central to when, how, and to what ends CAD systems have been developed and adopted.

The introduction of CAD technologies to China in the early 1980s through a short-lived World Bank-funded program was in response to such issues.[8] The goal of this program, which brought western computer technology and software experts to a number of Chinese universities, was the transformation of China's manufacturing and construction industries through technology transfer. The World Bank program represented a simultaneous attempt by its western funders to create a market for their construction products and exploit a newly available cheap labor pool for manufacturing such goods, as well as an attempt by the Chinese government to attract foreign investment and introduce contemporary technology-based production methods to its newly open economy. To that end, the program focused on building China's capacity for precise standardized mass production and its market for consuming mass produced standardized materials.[9] (Figure 1)

The program aimed to achieve this market and capacity in a twofold manner. First, by introducing CAD softwares predicated on and encouraging the use of standard materials, spatial

dimensions, and construction practices, it reinforced attitudes towards materiality, construction practices, and imaginations of space associated with China's early socialist era mass production of housing. Second, it tautologically reoriented those attitudes, practices, and imaginations towards the consumption of standardized western products coded as modern and quality because they were representable in CAD softwares.[10] Conversely, by fostering the development of Chinese language-native CAD softwares alongside other government-mandated technology transfers, the program supported the development of a manufacturing and specification base capable of designing and producing objects and buildings which met contemporary international standards. Such developments helped engender the imagination of these spatial standards as the norm.[11] However, for a variety of reasons, including the initial lack of both computer availability and Chinese language support in commercially available CAD softwares, as well as the control of construction documentation and administration by government-run design institutes, these transformations were slow to impact Chinese architectural practices.[12]

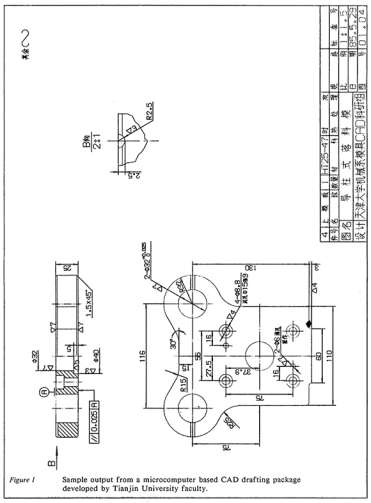

Figure 1. Sample Output from Microcomputer Based CAD Software Package Developed by Tianjin University Faculty (Richard Gallagher, "Developing Computer Aided Design Technology in China," *SIGCHI Bulletin* 18, No. 2 (October 1987), 15.) Reproduced with permission from Richard S. Gallagher

By the mid 1990s, foreign investment in China by financial, real estate, and other service firms, the development of Chinese "language packs" for softwares, and changes in Chinese law which allowed for subsidiaries of western architectural firms to practice more freely, enabled the realization of these CAD software-based transformations of China's construction industry.[13]

Standardized materials, documentation, and internationally recognized construction/management practices were all required to meet the International Organization for Standards (ISO) and International Building Code (IBC) specifications that foreign investors in China demanded. To meet these demands the central government undertook reforms in national construction and material standards laws, modeling them after those in Australia.[14] In addition, China further encouraged the transfer of design knowledge, with a focus on best practices of CAD usage in architectural production, through a wide range of efforts:[15] permitting the national membership body for Chinese architects, the Architectural Society of China, to join the Architects Regional Council of Asia in 1989;[16] the encouragement of large western architectural practices to form joint ventures or partnerships which employed Chinese architects;[17] the sponsorship of academic exchanges between Chinese and western schools of architecture;[18] and ultimately, the hosting of the 1999 Computer Aided Architectural Design Research in Asia (CAADRIA) conference in Shanghai.[19]

Despite being hampered by regulatory complexity, oversight limitations, and resistance to large-scale change, the CAD software-enabled trend towards standardization in materials and construction practices continued with the adoption of Building Information Modeling (BIM) tools by China's national design institutes in 2003. The Chinese government also encouraged contractors to adopt these tools as a mean of ensuring the speedy, efficient, and accurate delivery of complex projects involving international parties/consultants concerned more with material procurement/management than labor.[20] By adopting and adapting BIM tools and their standard products and construction details to the Chinese context, contractors, design institutes and their foreign partners began the process of integrating design, documentation, and construction. This laid the groundwork of technology and skills for the delivery of formally adventurous signature buildings that would come to characterize Chinese real estate development. At the same time, the size of the architecture, engineering, and construction (AEC) industry as a proportion of China's economy grew to the point that the national government considered its regulation crucial enough to require the definition of National BIM policies in 2011 and 2016.[21]

Offshore but Close at Hand

Just as they were tied to transformed understandings of materiality and fabrication, CAD softwares also had implications on divisions of labor within the design aspect of architectural

production. Further, as with material and construction standards, the changing divisions of labor informed by CAD softwares in which China was entangled were sites of negotiation with and of processes of globalization. It is through such global spatializations of labor, knowledge, and skills leveraging of differences between local social, political, and economic regimes in pursuit of capital gains that governmental power was and is exercised. Accordingly, it is through the co-production of these spatializations with value-centered imaginations of space that processes of subjectivization and globalization were and are integrated.[22]

Even before China's economic opening up in late 1978, or the World Bank-sponsored CAD project two years later, a combination of CAD, CAM, and other ICTs was already allowing architectural firms such as Skidmore Owings and Merrill (SOM) and HOK to take on large-scale projects far from their main offices.[23] As this pattern continued and these firms opened satellite offices, the administrative and technological groundwork was laid for them to globalize their operations and engage China's opening economy in the mid-1990s.[24] However, this engagement was not uniform. The divisions of labor it gave rise to were heavily influenced by differing approaches to global practice, ways of negotiating Chinese markets and regulations, and applications of technology. Some firms like Welton Becket and Associates, headed by MacDonald Becket, took a paternalistic and almost neo-colonialist approach to early projects in the 1980s that required technology and knowledge transfer. To avoid this requirement, Becket's approach segregated the design of projects within the United States while relaying drafted information and specifications to representatives overseeing construction in major eastern Chinese cities.[25]

Other firms, such as SOM, viewed China primarily as a strategic, high growth-potential market in which to expand their business.[26] With the aid of ICTs, company-wide CAD software standards, a change in emphasis on the part of the Chinese government from technology transfer to capital investment, and a corporate management style, SOM was able to open offices in mainland China. This allowed them to distribute both design and construction administration work in a manner that leveraged employee's local knowledge, skills, and partners for increased return on investment.[27] (Figure 2)

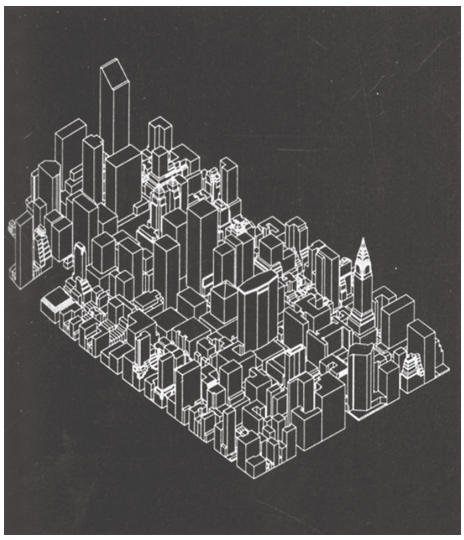

Figure 2. Skidmore, Owings & Merrill (SOM), Midtown Manhattan Digital Model, 1984 (Progressive Architecture, May 1984, p. 145)
Reproduced with permission from Wright's Media

Taking this practice further, the engineering firm Arup used the offices it opened in China as a foothold to expand its global reach. Arup did so by taking advantage of internet connectivity and standardized CAD file-types to transform its global network of offices into a system of twenty-four hour production.[28] Under Arup's model, while engineers in their London headquarters slept, their Chinese counterparts continued work on structural calculations, wind models, etc., and vice versa, with the CAD-based information transferring back and forth.[29] What Arup's organization amounted to was an imagining of the space of the globe in terms of temporally distributed labor values in a way that increased the speed of project delivery. The ICT-enabled global division of labor pioneered by Arup's office network model eventually became popular with smaller firms which saw an opportunity to increase their productivity at minimal cost.[30] For these firms, the growing rate of CAD literacy and awareness of western architecture amongst Chinese architectural workers combined with the comparatively low cost of Chinese labor to make overnight outsourcing of CAD-based documentation work to China a profitable, if sometimes fraught, business decision.[31]

Just as this globalization of architectural production through the western outsourcing of architectural labor overseas followed the outsourcing of other service professions and manufacturing, so too did the questioning and critique of outsourcing architectural production follow the terms by which globalization was being critiqued in the west. By 2005, this practice of

outsourcing and the level of concern around its devaluation of labor, management oversight, and cultural/disciplinary identity had become pervasive enough that the headline of a prominently featured article in the January issue of *Architectural Record* asked, “Are We Exporting Architecture Jobs?”[32] Between evocative images of a container ship in the Panama Canal and interviews with representatives from firms that employed outsourcing, the oft-mentioned but seemingly neutral background actor in the *Architectural Record* article was CAD software. (Figure 3) Further, the article failed to include any accounts or interviews with workers to whom western firms were outsourcing. Instead, two quotes by GBBN partner Kimberly Patton and CADFORCE board member Robert Vanech respectively describing Chinese workers using CAD as “intelligent, very well trained people who are willing to work at a schedule and pace we can’t match” and “lov[ing] what they do and want[ing] to do more and be better, as opposed to young architects who want to be designing award-winning projects” made clear the orientalism, othering, and devaluation of labor latent in such outsourcing practices.[33] By marking the Chinese CAD worker as “presumably… familiar with the U.S. firm’s CAD standards,” but also less-skilled—their work was “subject to the firm’s quality controls”—this ICT-based form of outsourcing treated human labor as a simultaneously material and ideological tool for increasing return on investment. The screening operation of ICT interfaces facilitated encouraged identification and communication only when necessary and reduced labor to a dehumanized set of procedural operations.[34]

Figure 3. Are We Exporting Architecture Jobs
(Architectural Record, January 2005, p. 3-4)
Reproduced with the permission of Architectural Record and BNP Media

We can understand statements like Zaha Hadid's 2014 denial of responsibility for the deaths of migrant workers constructing projects in Qatar in light of this altered and ICT-driven spatial imagination.[35] By spatializing architectural production in terms of market shares, labor pools, and the space-time distribution of work, these imaginations and their associated practices came over time to be reified in a system of techno-epistemic risk isolation/circulation. Through this system foreign and national capital, an international "starchitect," and low-income migrant laborers, mainly from India, southeast Asia, and China, were all brought together and obscured in the realization of a massive, complex, and iconic architectural project.[36] Like the Chinese worker to whom CAD drawings were outsourced, the migrant laborer performs as a tool within both architectural production and processes of globalization by their ability to almost invisibly transform information into material capital and absorb systemic risk. Thus, as the division of labor within architectural production becomes imbricated with the control of access to knowledge and agency within the scope of an architectural project, it shapes and is shaped by the globalization of social, economic, and political power regimes. In fact, it was this governmental power, enacted by the technological and legal invisibility of financier, architect, and worker to one another, that was made apparent by Hadid's statement regarding workers' well-being. While her claim that "it's not my duty as an architect… I have no power to do anything about it" was surely callous, what is more disheartening is that it was technically and effectively correct.[37]

"Weird" Space Circulation

Contrasted with the invisibility of migrant construction workers and Chinese CAD draftspersons, the projects on which they are employed are often spectacularly visible in global finance and media. The 2008 Beijing Olympic Stadium by Herzog and De Mueron, like Hadid's Al-Wakrah Stadium in Qatar, represents the intersection of ICT/CAD-enabled international divisions of labor within architectural production with global media spectacle. In such spectacles, symbolic national identity, the investment of foreign capital, and their financialization are brought together in the form of an iconic, singular piece of architecture.[38] (Figure 4) Collapsing image and value into a spatial imagination in which buildings are understood as a kind of investment, such pieces of architecture become both literal financial capital, and images of social, political, and economic power. This image-power, as it is manifest in buildings, becomes an investment in attracting

further financial capital, particularly from the Finance, Insurance, and Real Estate (FIRE) industries for whom this collapse of image and value is a fundamental premise.[39]

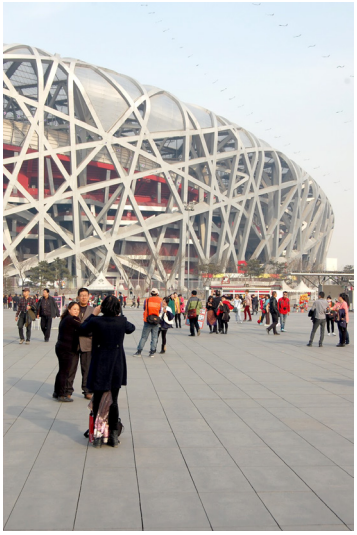

Figure 4. Intr-national Tourists Taking Photographs in Front of the 2008 Beijing Olympic Stadium, Beijing, China March 9, 2014
Photograph by Author

Much like the development and adoption of CAD tools, the standardization of materials and construction practices, and the training of a CAD-literate workforce, the production of a spatialized image of modernity through architecture was ingrained in the official policies of China's central and municipal governments following the inauguration of the Reform and Opening Up program in 1979.[40] Throughout the 1980s these governments funded a glut of symbolic cultural architecture, including concert halls, train stations, and stadiums in major Chinese cities at least in part for the purposes of attracting foreign attention and investment. In addition, they encouraged the adoption of styling and details from the western architecture firms such as Welton Becket & Associates, I.M. Pei and Partners, and John Portman & Associates who were engaged to undertake signature architecture projects in Beijing and Shanghai.[41] The goal of these projects was the projection of an image of a rapidly modernizing China capable of offering the spatial qualities demanded by the western FIRE corporations whose investment the Chinese government was eager to attract.[42] As more western firms entered the Chinese market and the Chinese government undertook further economic and land policy reform in the mid 1990s, the engagement of foreign architects in formally adventurous projects became seen as a way to attract investor attention to a specific area of a city.[43] In addition, such projects, typified by the 1999 completion of the SOM-designed Jin Mao Tower in Shanghai, ensured return on

developer investment and constructed a municipal brand identity which government officials could tout as they marketed their city for future investment or tourism.[44] (Figure 5)

Figure 4. Jin Mao Tower, overtaken by its even more spectacular neighbors, Pudong, Shanghai, China, March 3, 2014
Photograph by Author

Crucial to the success of such projects as investment tools was the circulation of their images, but not the CAD-enabled divisions of labor and material practices by which they were realized, in global media ranging from trade journals such as *Architectural Record* to more popular outlets such as CNN and *Time Magazine*.[45] Connoted in *Time*'s choice to term the new Chinese architecture a "dreamscape" on its May 3, 2004 cover, many western firms came to see efforts by Chinese municipalities and developers to gain investor awareness through architecture as an opportunity for a similar form of double investment. Firms which took work in China believed they could both expand into a new regional market, as well as solicit future commissions by leveraging the circulation of their iconic, virtuosic, and formally/programmatically experimental designs in highly publicized images.[46] More recently, at the 2017 New Cities Summit, held in Songdo, South Korea, Elie Gamburg of Kohn Pedersen Fox Associates (KPF) reiterated this approach. Citing how KPF's recent projects and office practices in China and Korea has influenced their work in American cities, Gamburg described Asian cities as an architectural "testing or proving ground...that other places around the world can then follow."[47]

The game of formal and economic one-upmanship being played by Chinese cities seeking foreign investments and the western firms seeking notoriety was shaped and shaped by CAD software's impact on project representation and material realization: Photorealistic renderings of

proposed projects made from CAD files became commonplace in the mid 2000s as marketing tools for soliciting global investors and distinguishing municipal or firm identity in state and foreign media campaigns. At the same time, manufacturing processes capable of translating CAD-based digital representations of form into customized but industrially producible and globally available material components were developed.[48]

However, despite these technological advances, the media and financial spectacle of exuberant architecture reached a social, political, and economic limit in October 2014 when Chinese president Xi Jinping called for an end to the construction of "weird architecture," citing recent scandals over safety, corruption, cost, and a perceived abandonment of traditional Chinese cultural heritage as justification.[49] Additionally, the central government had been rocked earlier in the year by international news reports of "ghost cities" like Ordos in Inner Mongolia, with flashy foreign-designed but unoccupied architecture that called its urbanization policy into question. Xi responded by reiterating the long-term nature of Chinese planning policy and by undercutting the spatial imagination equating spectacularity with value that had fueled much of the short-term speculation at the center of the news reports.[50] Implicit in Xi's pronouncement and its intention to reassert the central government's control of development/planning was a shift in the image and technical economy as well as in the kind of investment the Chinese government was seeking to attract.

The call to end the construction of weird buildings, as it became instantiated in planning regulations, was ultimately less directed at limiting the building forms that CAD technologies made realizable, and more about embracing concepts of project oversight, coordination, and sustainability as equally valuable symbols of technological development and global awareness.[51] Not coincidentally, these same concepts were simultaneously being promoted by government design institutes alongside their adoption of BIM softwares. Further, Xi's inclusion of an appeal to traditional Chinese culture can be seen as situating the desire for less "weird" buildings within a broader governmental policy seeking to restructure China's economy. This policy aimed to give China's economy a more infra-national focus by integrating the expansion of China's consumer and professional classes to with an assertion of a strong national identity.[52] By encouraging the creation of Chinese architecture for the Chinese people by Chinese architects with its subtextual connotation of "weird" as "foreign," Xi's statement proclaimed that Chinese architects had achieved, and in fact surpassed, the technological proficiency that was

the goal of the original 1980 World Bank CAD project. The country was now ready and able to define its own technological and architectural future.

Leveraging Contingency

The history of the introduction and adoption of CAD softwares in China offers a concrete example of how such tools have come to mediate architectural practices, cultural imaginations of space, and the spaces of everyday life. It also shows how this mediation shaped and was shaped by governmental policies, professional structures, and financial arrangements that encouraged the globalization of each. By coordinating material specifications, construction practices, and documentation into an international industry integrated by information, CAD softwares connected the economic agenda and national image aspirations of the Chinese government with the imagination of space in terms of quantified standards, supply chains logistics, and total information networks. By connecting the labor of individuals, the organization of firms, and the built environment into a network of communication through which information/documentation could flow, the introduction of CAD softwares intersected with the interests of corporations and the Chinese government as they sought to leverage the increasingly global market for labor and investment that such networks were making possible. By supporting the mediation and financialization of space through the production of spectacular images and spaces they enabled, CAD softwares brought together collective aspirations for the space of everyday life with the understanding of space in terms of literal and symbolic investment. Through an embrace of the images of technical proficiency whose circulation such investments are predicated upon, Chinese national identity became fundamentally interlinked with the globalization of the real-estate market.

What the interconnection of technological development and processes of globalization in each of these areas illustrates is the socially, economically, and politically contingent nature of technological development and processes of globalization. Neither is a necessarily determinate force in the history of architectural production, nor can they be fully understood outside of the material and cultural contexts in which specific aspects of them are manifest. Further, neither can be reduced to the simplistic meta-narratives of developed/developing, east/west, or national/international. Acknowledging the locally contextual social, political, and economic contingency of technological development and processes of globalization implicitly acknowledges agency on the part of those involved in technological development and

processes of globalization to shape them through their everyday practices and the ways they imagine space. Such an acknowledgment allows for these actors to be held accountable for past, present, and future actions, while suggesting that the current state of globalized architectural practice, imaginations of space, and the spaces of contemporary everyday life are not fait accompli. What the myriad forces shaping and shaped by the historical development and adoption of CAD in China show is that different divisions of labor, different understandings of material, different architectural practices, and different ways of imagining space are possible, and that a non-determinist engagement with the history of CAD's role in globalization is an important first step in opening such possibilities.

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