COMPREHENSIVE PARASITES

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Abstract. This paper describes a final-year graduate architectural design studio in which students examine strategies of dissection, infiltration, and parasitization as means of operating within and extending existing constructions. There is a focus on developing rule-sets which are defined locally but lead to large-scale form. Ultimately, this studio is an attempt to critically examine the role of comprehensive design within the larger project of architectural epistemology.

Keywords. Parasitical architecture; architectural epistemology.

1. Introduction

The studio discussed in this paper is a final-year M. Arch. design studio enrolling ten graduate students. The studio project is the design, using algorithmic methods, of a parasitical intervention within, attached to, and atop an existing building, or ‘host’. The project is sited in Kyoto, Japan, as an intervention on Tadao Ando’s TIMES’ I & II Building. The purpose of the intervention is ambiguous: while the existing Ando-designed building is purposed as retail/service, student design projects are at liberty to alter this purpose, to retain it or to adapt it. In general, the evaluation of student projects is not contingent on their suitability to a specific purpose, but is done with respect to four factors: first, how convincingly the projects operate parasitically; second, how well the projects make the host building and the city of Kyoto uniquely perceptible; third, how well they introduce contemporary construction technologies (explicitly including digital fabrication strategies) into the existing fabric of the building, and finally, how competently the projects are designed as comprehensive architectural interventions.
2. Comprehensive design

The final evaluation criterion – the requirement for students to demonstrate comprehensive design – is problematic due to the responsibilities borne by the word ‘comprehensive.’ Examples of course syllabi exist in which the term ‘comprehensive design’ implies the ability to demonstrate knowledge of all previous coursework in support of thoroughly detailed, buildable proposals. Yet, while comprehensive design certainly recognizes the need for students to familiarize themselves with multiple dimensions of building design, the greater emphasis is typically placed on students’ ability to integrate ideas, concepts, and requirements. In particular, a student demonstrating competence with comprehensive design has shown these various forms of input to be "appropriately synthesized and coordinated to sufficiently demonstrate a student’s capacity to integrate these items into an architectural project" (Parker, 2012). In the studio described here, competence with comprehensive design means precisely the ability to resolve inevitable conflicts through design.

3. Studio approach and philosophy

In its reliance on algorithmic methods, the studio positions itself as a hybrid of two trajectories in contemporary architectural pedagogy and research: an analytical trajectory and a form-generative trajectory. The analytical trajectory is characterized by the use of algorithmic techniques to reveal design principles specific to a body of work (Gomez de Silva Garza and Maher, 2001), or principles of a building’s structural behaviour or energy performance (Díaz-Vilarino, Lagüela, Armesto, and Arias, 2013). The form-generative trajectory is characterized by the use of algorithms to derive form from various inputs (Shi and Yang, 2013), to integrate performance requirements (Turrin, von Buelow, and Stouffs, 2011), or to optimize a solution space (Besserud and Cotten, 2008). By hybridizing these two trajectories, the studio sets out to explore and test how form-generative tactics can contribute to the reading or analysis of the existing Ando-designed building. As part of the larger project of architectural epistemology, the studio’s intent is to emphasize the role which software has in reading buildings, i. e., generating a specific form of architectural knowledge. In this sense, the studio’s intent echoes my earlier work concerning architectural untranslatability explored in a graduate-level seminar at North Dakota State University (Christenson, 2011).

To be clear, the studio’s reading of Ando’s work is not positioned as an attempt to disclose and analyse Ando’s design intent. Instead, the existing building is treated solely as geometry capable of influencing the form of new
geometry. Moreover, although form-generative tactics are brought to bear in student design projects, the studio is not simply an environment for generating novel form. The forms and geometry produced in the studio are first and foremost positioned as readings or representations of the existing building.

4. Defining parasitical architecture in the studio

Given this context, the concept of parasitical architecture provides the studio with a means of proceeding to address comprehensive design as a unique means of generating, structuring, exchanging, and activating architectural knowledge.2 But what is parasitical architecture? Within the context of this studio, while factors such as aggregation phenomena (Branzi, 2005), weathering (Mostafavi and Leatherbarrow, 1993), repurposing (Brand, 1995), and appropriation (Papalexopoulos, 2003) are taken into account, three specific characteristics of parasitical architecture are emphasized: infiltration, resistance, and a mechanism or process of self-propagation for new geometry. For an intervention to be understood parasitically, it cannot simply attach to the exterior of its host: it must thoroughly infiltrate the existing structure. Secondly, the geometry of the parasite needs to recognize the simultaneous resistance and support of its host: it needs to be seen to push against the host, and the host shown to be capable of resisting, sustaining, or steering the parasite’s growth. Finally, a mechanism for self-propagation means that there should be a simple algorithm or set of rules (e.g., in this studio, a Grasshopper definition) guiding the process of the parasite’s growth or its extension through and beyond its host.

Several built projects are discussed in the studio and critiqued as parasites. From the point of view of this studio, the Urban Woods project designed by Yoshiaki Oyabu Architects in Osaka exemplifies most of the characteristics of parasitical architecture.3 (Figure 1). Urban Woods strongly expresses the notion of infiltration and is clearly expressive of the simultaneous resistance...
and support of its host. The structure is envisioned as spreading and changing over time (acknowledging self-propagation as well as the inevitability of aggregation and weathering).

Perhaps the most significant characteristic differentiating this studio’s approach from certain other projects explicitly characterized as parasites is that these other projects make no overt claim to learn from or to read the existing buildings in or upon which they are installed. For this reason, many other projects characterized as parasites would, in the context of this studio, be more accurately termed additions or installations (Roudavski, 2009; Artopoulos, Roudavski, and Penz, 2006).

5. How are parasites generated?

Consistent with the definitions of parasitical architecture in the previous section, this studio’s process of parasitic design is positioned as a process of reading, infiltrating, and extending existing buildings. In the studio, digital models of existing buildings are used as convenient proxies for the existing buildings. Students begin the studio by constructing detailed digital models of the existing Ando-designed host building in Rhino. Grasshopper, running within Rhino, provides an excellent mechanism for parasitic experimentation precisely because it facilitates the creation of algorithms for reading existing form and generating new form on the basis of input. Its use is critical in emphasizing interdependency between the host and the parasite.

Early in the studio, students are asked to write Grasshopper definitions for generating self-replicating geometries within Rhino models of the existing host building. As the studio progresses, students iteratively modify their Grasshopper definitions to take account of specific situations such as the building’s geometry, the need to consider natural lighting, the possibility of views, site conditions, constructability and materiality, etc. Their iterations are assessed by their ability to uniquely ‘read’ the Ando building’s geometry. As the definitions are refined over time, the newly defined geometries are allowed to propagate and extend through the Rhino models according to the specifics of the Grasshopper definitions. Ultimately, the definitions result in geometry which successfully ‘reads’ the existing building through new construction, and consequently, the host building is said to be parasitically occupied by new geometry.

The iterative development of Grasshopper definitions test the host building’s resistance and how that resistance is translated or learned by the parasite. Parasitical geometry may escape through the host building’s envelope and begin to generate a wholly new structure external to the existing build-
ing, one based on rules (implied or overt) the student has learned in the process of propagating the geometry through the host.

6. Examples of student work

The student projects described in this section illustrate the range of explorations present in the studio as taught in 2013. The 2013 studio enrolled ten students, and in general, the students were successful in achieving the studio objectives, although they chose to emphasize differently the relevant evaluation factors (parasitic operation, effect on perception, digital fabrication strategies, and comprehensive design).

The first student project (Figure 2) began by establishing two closely related, sinuous paths leading through all levels of the existing building. Treating these paths as ‘seeds,’ the student wrote a Grasshopper definition to loft between the paths and generate a truss geometry. For this student, the use of Grasshopper was instrumental in reading the building’s unique geometry – specifically, its blurred interior-exterior zones – and expressing that geometry through the introduction of the new truss structure. Comprehensive design, for this student, dealt with the specifics of truss constructability and attachment to the existing concrete building: she proposed a fabrication method involving laser-cut flat plate. Her small-scale iterative models were produced using an in-house MakerBot 3D printer.

Figure 2. Path parasite.
Another student designed a parasitical structure by establishing a series of spring points on the existing building’s exposed concrete beams (Figure 3). She wrote a Grasshopper definition to generate a series of laser-cut ribbons spanning between these points. She adjusted the spring points as a means of affecting the visual perception of the city from within the building. For this student, Grasshopper provided a means of highlighting critical points or intersections within the existing building, and dynamically adjusting the connections between these points to modulate the view from within the building. Comprehensive design, in the case of this project, was understood as a mediation between (a) the function of natural light coming into the building, (b) the significance of views from the building into the city, and (c) the constructability of the ribbons, informed by the use of the CNC router.
A third student imagined a parasitical structure extending through the city of Kyoto (Figure 4). His parasite proceeds through Kyoto as if the city were completely permeable to its progress; it operates as if the Ando building were the only thing capable of sustaining it and the river the only feature capable of interrupting it. From the point of view of architectural and urban epistemology, the project’s use of Grasshopper was interesting insofar as the definition allowed for a specific ‘reading’ of the existing building within its urban context. The student’s approach to comprehensive design was strongly focused on the materiality and constructability of the parasitical structure, as informed by digital fabrication strategies (e.g., the use of the laser cutter).

Finally, a fourth student designed a parasite which she understood as a ‘drape’ covering the city (Figure 5). Similar to the previous student’s approach, she posited that the Ando building both interrupts and sustains this drape. Her Grasshopper definition allowed her to modulate the spacing and angular configuration of the members composing the drape structure. For this student, comprehensive design focused on the integration of design intent across scales: she worked to establish and sustain relationships between the connection details of the ‘drape’ structure, its attachment to the existing building, and the urban-scale effects of the parasite.

7. Pedagogical challenges
The most significant pedagogical challenge in implementing the studio was the need to instruct students in the use of Rhino and Grasshopper. Of the ten students enrolled in 2013, only two had any prior experience with Rhino,
and neither of these two had used Grasshopper. I chose to treat the introduction of Rhino and Grasshopper as an open-ended experiment. I began by requiring the students to complete several introductory tutorials even as I encouraged them to push the software beyond what was given in the tutorials. The bulk of studio time was given over to independent work time; group meetings at the end of each session were absolutely essential to collective success as students shared experiences, describing mistakes made or opportunities recognized, asking questions of each other and challenging each other to experiment.

In their discussion of an exploratory class in which students from multiple disciplines worked with industry mentors, Nicknam, Bernal, and Haymaker (2013) discuss the possibility of "Separate learning of concepts from applying concepts." In line with their conclusions, the parasite studio was structured to introduce Rhino and Grasshopper through stand-alone tutorials prior to the ‘application’ of concepts with regard to the Ando building. However, when students in the studio found that stand-alone tutorials continued to be of use during the application phase, the studio curriculum was specifically modified to enable the students to share useful tutorials with each other. In future iterations of the studio, the possibility of increasing cross-pollination between ‘learning of concepts’ and ‘applying concepts’ will be further tested.

In the context of considering pedagogical challenges it is useful to consider student comments received after the conclusion of the studio. Although the students had not previously addressed the concept of ‘parasitical architecture’ they generally found it rewarding. A student commented that "The studio was useful because it showed us a new way of designing that we haven’t engaged with." Another student commented that "This studio definitely opens another view or avenue for design."

Students commented on the challenges inherent in comprehensive design. A student commented that "It was difficult to work with the host building because the information [i.e., existing drawings] was limited." Indeed, Ando’s drawings are deliberately formulated to collapse plans, isometrics, and sections together, making them a rich source of potentially rewarding (mis)interpretation. Another student acknowledged that "Although the information [concerning the existing building] was vague it gave something to push from."

Referring specifically to the use of Rhino and Grasshopper, a student commented that "I can’t remember a time [in our education] when we’ve been asked just to experiment and find out the limitations of a tool." Although it is certainly unfortunate that opportunities for experimentation have
apparently been limited for the 2013 cohort of students, that this particular experiment worked as well as it did is cause for encouragement.

8. Future directions

The studio as taught in 2013 identified and explored several questions characteristic of parasitical architecture without fully resolving them, such as:

- *The seed* – how instances of parasitical architecture are differentiated based on whether they originate from a specific point, or are global in their extent.
- *The motive force* – to what extent the characteristics of the parasite’s propagation is dependent on the Grasshopper definition as distinct from the specific geometry of the host.
- How failed or incomplete attempts establish a genealogy of iterations suitable for subsequent mining and cross-fertilization.
- How *physical models* play a role in investigations and presentations, e. g., how physical models are constructed with demountable parts to reveal the workings of the parasitical structure.
- The extent to which the parasite can learn as it propagates about different layers in the building fabric, e. g., the building’s structural components as distinct from infill walls.

Future iterations of the studio will attempt to clarify and substantiate the significance of these questions, testing their relevance to graduate-level investigations of comprehensive design. In related ongoing pedagogical research, questions concerning the efficacy of ‘parasitic architecture’ as a medium through which to teach Rhino and Grasshopper are being tested in an undergraduate lecture course.

Endnotes

1. For example, see course syllabi selected from other institutions: "Arch 402 Syllabus"; "LA 4376 Syllabus"; and the description of MARC 519 in the document "Course Descriptions."
2. This idea is developed in Christenson, M. (2013).
3. See "Untitled Document (Urban Woods)."

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References

"Arch 402 Syllabus": 2009. Available from:

"Course Descriptions": n. d. Available from:


"Untitled Document (Urban Woods)": n. d. Available from:


