Georgia Tech Summer Program Reflection

Wang Chih-Chien (Jamie Wang) August 20th

Introduction- Syllabus and Life in Georgia

Covering the July of 2019, the GIT Summer Program brought us to the mother school of BIM: Georgia Tech. We spend every morning from eight to twelve taking classes from two Ph.D. students respectively from Building Construction and Architecture Dept. The curriculum was divided into two:

First, the “BIM course” from Monday to Wednesday taught by Yuqing.
Covering up “Why do we need BIM?”, “What is BIM?” along with a lab for Revit, Naviswork, and dynamo. (Note: every student in Georgia Tech has to know python)

Secondly the “Shape Machine” from Thursday to Friday taught by Kurt.
Introducing a “real visual computing system” plug-in for Rhino (The most used software system for designers in the US.) within the purpose to make computer a more “intuitive tool” for Designers.

During the other half of the day, most of us had a taste of what it is like to live an “American life”. Meaning: very time-consuming to do almost everything (since we don’t have a car), having to cook our own meals everyday, and higher commodity prices. Despite such differences, we find ourselves encountering an education so different from Taiwan. Hence cherish the chance to learn more about the applicant of computer and design first hand, in Georgia.

What I've learned- BIM and Shape Machine

"BIM" and "Shape Machine" covers two spectrones of architecture: Construction (BIM) and Design (Shape Machine). Back at home, BIM is described as an advanced technology which helps construction process smoother; it is also known for its controversy whether it is overrated. Therefore, I came to this workshop within great curiosity of what BIM *really* is about, and challenging thoughts awaited to be answered.

BIM

If you can't find information inside BIM, you can't find benefit inside it.

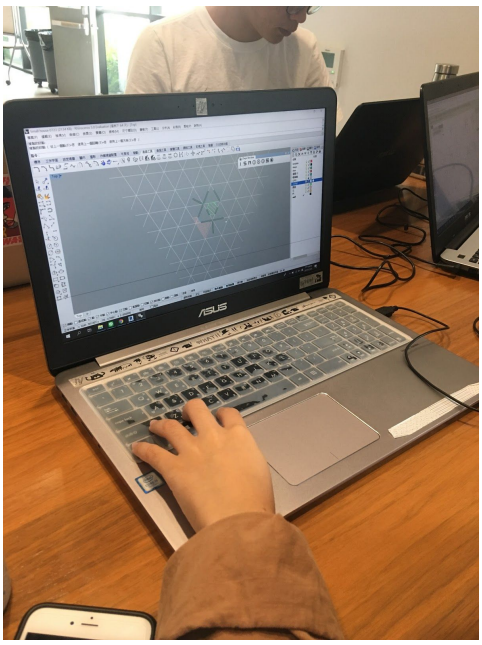
B.I.M, Building Information Modeling.
First and the most important thing I've learned in the class was that BIM is about modeling through "information". BIM is a tool designed in parametric thinking, which in my interpretation, you could see it as the BIG DATA of Architecture. The essence behind BIG DATA is that there are valuable information behind every activity online; likewise in architecture there are information behind every building, it's just that people do not know how to make use of them. In the past we do not have a system to organize the large amount of information, people overlook them since it could be too time consuming to achieve. However there is no doubt that within BIM, circulation flow check, safety analysis, energy analysis, and cost assessment could be done in greater efficiency and clarity. Behind efficiency is not only a more profitable business, but also a environment-sustainable industry.

Second thing that benefits from BIM is the unification of drawings. Different parties (contractors, developers and architects) have their own drawing requirements. Given people unnecessary information causes confusion, confusion then takes time to communicate, and time is money within useless drawings redone time after time. On the other hand, everything has to follow up to government's requirements. So far there are 2D drawing specifications but not 3D ones (Except Singapore). In terms of efficiency and accuracy, we can see 2D drawings as an exploded 3D object and document them by parts. If only government accept 3D models, in future we can have a more accurate picture of the project.

Perhaps the most debatable issue in the class was to which extend is BIM capable of. Where I find concern of not only BIM changing student's way of thinking as they do design, but the great improvement the industry will have to make in order to catch up with this technology itself: to be able to keep up with the advanced tools BIM provides, contractors, firms, developers and the government will have to come up with updated regulations, and people who understands how to operate such tool.

While making information more translucent definitely helps integration, here are a few things we still have to keep in mind:

1. How much information should be exposed?
2. If we don't try earning money through bragening that price, what should we do?
3. What could be done if government doesn't permit?
4. How do u make use of the DATA?
5. It is in violation with how three parties make money?
6. Company private information leak at risk.
7. Full digital trace on software: who built it? How much time spent?

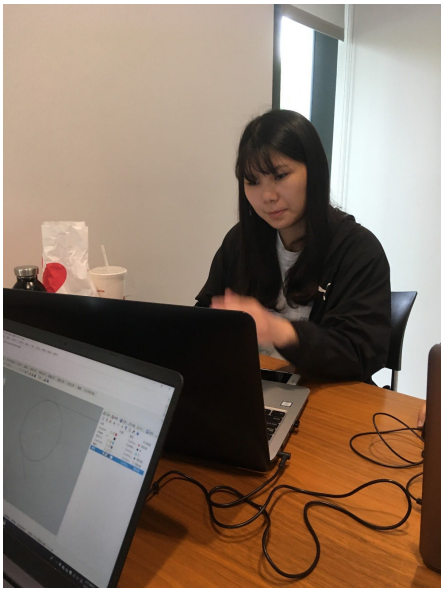


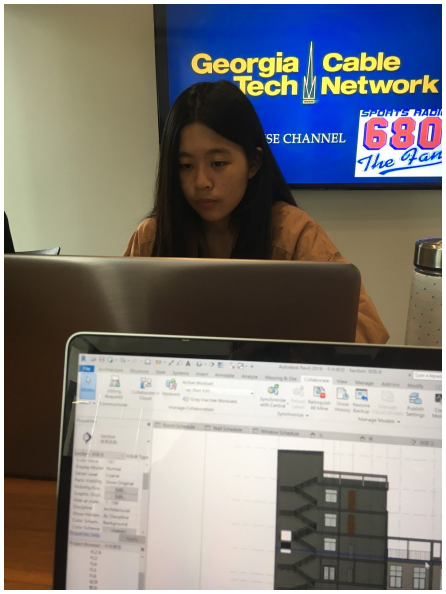
Digital models that can't be build

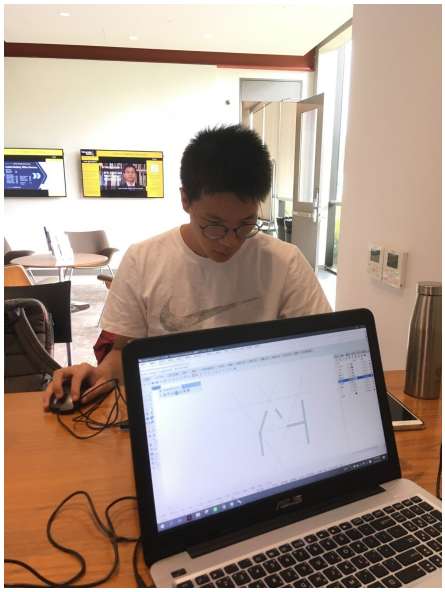
In architecture, different models serve different purposes. In the early ages, one of the most important purposes for architects to build model was to simulate construction possibilities (A famous example: Sagrada Familia.) Nowadays, construction and architecture design seem to part from each other more than ever. Before BIM, architecture software such as autoCAD, Rhino and Grasshopper doesn't provide basic architectural drawing regulations. Contractors often receive drawings that fail to communicate, physical models play an important role of filling in the gap of such miscommunication by drawing. What happens when drawing and building models no longer corresponds to real construction? While 3D printing models became more and more popular in between students, it seems that we architecture students nowadays is more likely to forget what the real purpose of building models is.

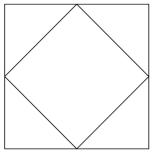
Despite being a great tool for integration, BIM has its own flaws when it comes to Design. In studio, students complain that Revit limited their creativity due to its parametric system. In which, you design the building through puzzling "elements" (doors, windows, walls). This is an

interesting phenomenon since such circumstances *is* what people encounter in the practical field: design *is* limited to what the industry (or the software in this case) can provide. Good design in a perspective, can say that it's because it had made the most out of what it is provided. When we compare Revit to AutoCAD or Rhino, the benefit of these pure graphic software is that: a line on the drawing is "undefined". It is *human* that is capable of recognizing/defining what the "line" represents. Taking advantage of that, it allows designers to have a different perspective of drawings, which then leads towards creativity. From that, it brings us to the discussion to Shape Machine.







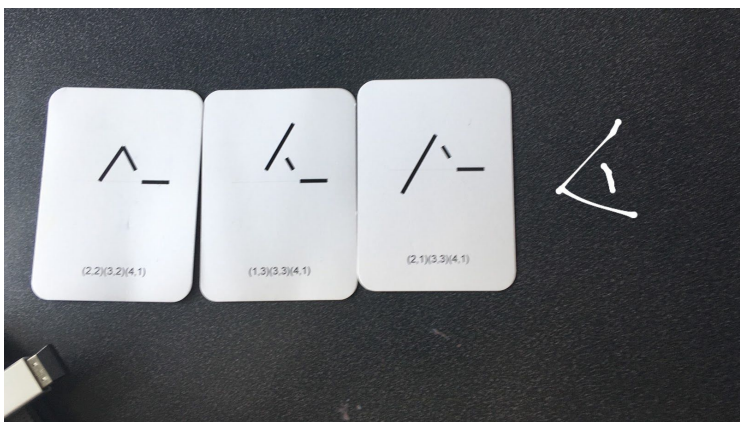


Shape Machine

If you can see it, you can find it.

"Imagine now when you type command+F, instead of finding texts, you can now find 'Shapes'." Said Kurt our instructor during the first class.

Shape Machine is a plug-in designed for Rhino, a product by Georgia Tech. It is a "real visual computing system", meaning it is trying to make computer break limits of the way graphics are drawn at the first place, recognizing what a human "can see" instead of what the computer has drawn[2]. To be more specific, Kurt had us look at the diagram above. Let's say this shape is formed by two squares in Rhino. How many triangles can you see? Four. How many triangles can be "selected" directly by rhino? None. The only shape that can be directly selected now are the two squares. Therefore in the database of our computer, the triangles does not exist. The triangles were recognized by human's eyes but not by the computer can now be found with the help of shape



1

Tzu-Chieh Hong (2019 Summer)
"Shape Computation Introduction" powerpoint slide.

2

Tzu-Chieh Hong (2019 Summer)
Why the CAD can never draw perfect geometry.
Almost all CAD tools such as AutoCAD, Rhino, SketchUp and SolidWork are vector-based system. So, the concept of this type of tool is actually from Euclidean geometry in Cartesian coordinate system, which is point (dot) to line (curve) to plane (surface) to solid (volume). However, while these engineers were implementing the CAD tool long time ago (probably in 70s), even though they try to implement this system on computer, the computer is a digital system, which cannot represent the geometry perfectly. By the definition of geometry, "point is a thing which does not have a part, and a line is an infinite set of points". Therefore, geometry itself is based on the concept of "infinity" but there is no way to implement infinity on computer (so, if your computer is 64 bit, then the smallest unit you can represent is 1/(2^64).

machine. This is done by math. Finding a shape is a breakthrough step. Once you can find a shape, we can now “change” it. Through math we can also list out all the combination of how many shapes one can create under certain rules: How many categories of shapes can you create through three lines? Or discover certain rules that kept generating the shape (or in some cases floor plans.) In Architecture school its about finding your design intention and figure whether that design intends matter to that building or not.

It is a true computer for Designers.

Above all, why do we need machine and how much manwork could be replaced?
We use machine during the times we can't assure workers/ man are always performing consistent quality under time pressure. For example: 3D printed premade objects. Now, not only we have machines that produce products, but also machines that helps generate ideas (Shape Machine). Does it really matter who is doing the work, when we learned how the man did it? Can we define a man in work by calculating all his abilities? It's like acting, a great actor picks up certain person's mannerism and reaction, does the actor then becomes that person? If so, how do we define identity then?
One can now multitask with the help of machine and perform just as well as ten men. From now on,
the real question we should be asking ourselves is: Which one is more affordable? Man or Machine?

Software lists:

- *Building Smart (For Contractors)*
- *IFC (Industry Foundation Classes)*
- *Vector works*
- *Solibri (model check circulation, you can construct your own rule/ use IFC files)*
- *Tekla*
- *Bluebeam (PDF reader)*

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