Value through Precision, Beyond the Realms

Onur Yüce Gün
Kohn Pedersen Fox NY Computational Design Specialist
http://yesterdesign.com
onuryucegun@alum.mit.edu

Abstract: Today we portray designs with analytical systems and systems with the emerging terminology of computational design. Generative, intelligent, digital, parametric, associative, biomimetic designs sound valuable, whereas the integrity remains questionable. The tool, enabling designer to play with forms, patterns, models is neither granting him the knowledge nor teaching him the appropriate technique. Are we really able to digest and master all the information we’re subject to, to be used in our designs? Or do we have much to learn about the investigations of the renaissance men to reach to a level of proficiency?

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Knowledge and expertise

Digital excitement versus concentration
Prof. Chris Wise calls the disoriented efforts in computational design as “digital drunkenness”. Today, with so many tools to play with in such a large playground, everybody wants to get their hands dirty. Everybody wants to be the part of the ongoing digital conversation, or at least to catch up with it. However, the extreme level of excitement somehow spoils the level of precision. The moment Wise is about the claim that a more controlled direction is necessary; he changes his mind and admits that a “technological orgy” is inevitable, and maybe it’s not such a bad thing, since it “might get us further, faster even if it has the directional stability of a bucking bronco.”

Young architect, with enthusiasm, opens the script editor of a 3D modeling program to be a part of the ongoing digital design conversation. After the first baby steps, he creates some points in the virtual 3D space. Writing and manipulating scripts, he later develops lines, curves, surfaces, and then colors, reflections and parts. Once satisfied with the level of generated complexity -be it a computer aided design (CAD) model or a digital rendering- the young man posts his creation on internet, to share it with the rest of the world.

Each day we wake up to see a new post on the design blog we follow. A collection of imagery stands before our eyes, tagged with fancy labels related to computation, nature or like. In the virtually infinite playground of digital design the abstract designs try to stand bold with the support of the abused terminology of the computational design era. But there is not necessarily a strong foundation to discuss the value of the proposed design conception and imagery.

Exploration is certainly a must while moving into the territory of the new in design. But how are we going to question the value of the explored? While
searching for richness we’re stuck in the mist of digital noise. We’re about to mix abstraction up with ambiguity and variety up with richness. Every new day added another word into the design terminology, yet made the two of the universal ones diminish: Adequate knowledge and procedure of proper application of it, technique. So we ran downhill on that bronco but the dust came off the ground was thicker than expected.

Are we being stubborn looking into the expression (representation), and trying to understand, both the intention, and the reason? Would a stronger body of knowledge together with the excitement we have show us the way to the better design?

**George Stubbs and relevance of expertise**

Each period of art and architecture history features enthusiastic characters willing to explore and –if possible- build the new. Yet history keeps just a couple to be granted. George Stubbs (1724-1806), the British born painter, is known for his horse paintings. He resembles Leonardo in the way he studies the anatomical features of mammals, mainly horses. Stubbs had a crane on which he was able to examine carcasses, once a tiger and a pregnant woman carcass along with a horde of horses.

Besides his paintings, Stubbs has technical drawings depicting horses, still or moving, portrayed in various layers of skin and flesh, starting from the fur into the bone (Figure 1). Royal Academy of Arts Collection classifies these drawings as working drawings, measured working drawings, and finished studies. These drawings are the proof of time Stubbs invested in understanding and discovering the proper way to express and depict a horse’s posture, movement or even feeling and it’s reflection on its body. Stubbs builds a body of knowledge by doing a thorough investigation and uses this knowledge in his paintings with an ultimate precision.

Stubbs studied anatomy via literally cutting into it. His investigation of the tiger carcass helped him depict scenes he haven’t necessarily witnessed, as in the paintings like “A Horse Affrighted at a Lion” and “A Lion Attacking a Horse” (Figure 2). Note that these paintings have various versions; specifically seventeen versions for the latter one, in which Stubbs tried to enhance his technique and finally surpass himself.

Stubbs’ paintings have a certain level of precision in depiction. Although arguable, his paintings could be referred as beautiful, and life-like. Which architectural artifacts will evoke similar feelings in the future? The ones of the novice-in-precision designer, who keeps faking it? The algorithmically-generated ones justified not by what it is but by what lies beneath? The ones which were appealing to the market-driven motivations thus got built? Or the ones which were rapidly modeled and rendered because the know-how was shared via a wiki-site?

Expertise definitely plays an important role in proper execution of design ideas. And it is built over time, as one repeatedly works on a specific subject. In architectural practice, the field of computational design is mostly driven by young designer-researchers (sometimes technicians). These young professionals are the ones with adequate technical skills in use of the emergent design tools (as most of the time they are trained in this specific subject during their architectural education), however their conceptual design strength and expertise is open to discussion. To illustrate the idea, we can consider the specialized groups forming in the large architectural offices. These architectural offices have specialized
groups that focus on subjects such as advanced and computational geometry, geometric optimization and rationalization, parametric modeling, software and project specific tool-making. The sizes of these groups vary according to the size of the office (while the group is around or less than 1% of the population of the office). However the group mainly consists of young practitioners and expertise couldn’t be discussed in the means of decades (the way we could do for Stubbs).

The argument we generally face is that the information is so easy to access in our time that we spend much less time to gain knowledge compared to the past. Although this argument could be true, it’s hard to judge how much time one needs to learn, digest and apply the body of knowledge.

**Terminology and (mis)interpretation: Voronoi**

1854 Soho cholera outbreak showcased an interesting scientific investigation by British physician John Snow. Snow was one of the first scientists to use a Voronoi diagram to illustrate the comparative distances of the pumps around the neighborhood to the Broad Street pump, which was suspected to be the main source of the disease.

Unpredictable spread pattern of the disease amongst the dwellings and the households in the neighborhood made Snow to examine household’s daily use of the water resources. Snow found out that different dwellings and households preferred to use different pumps within the area, either due to the taste or to water’s purity. Voronoi diagram was a tool to prove that the neighborhood would still have access to sufficient water in case of sealing of the Broad Street Pump. Snow simply outlined the imaginary periphery that was crossing from the half distance between the Broad Street pump and the other ones (Figure 3).

Today the word voronoi is now well-known by the design community due to its (proper and improper) wide range use. When “voronoi design” is searched online, Google returns 44 pages of images with an additional note: “In order to show you the most relevant results, we have omitted some entries very similar to the 876 already displayed.” Only a small portion of the imagery is vivid and inspirational, most of it is open to interpretation and a vast amount is hard to relate to the idea of voronoi algorithm. This is understandable as some of the 3D modeling programs come with built in voronoi plug-ins which makes it possible to access and play with the tool.

One common use of voronoi diagram is procedural texture mapping in computer graphics. The results are claimed to be organic looking. Unfortunately in architectural design exploration too, most of the voronoi algorithm applications cannot necessarily go beyond being “some kind of organic looking [3D]
already depends on the expired climate data will over-expire by the time the building starts its lifecycle. We need to question the reliability of the data we produce and use it within the awareness of possible performance biases. Second, the solar analyses studies are mostly handled in one go, although iterative simulations have to be used for proper optimizations of designs. In successive loops, the design or the design components should be tested and updated depending on the latest design generation.

Here my aim is not to de-value the ongoing studies about solar investigations in the design process but rather propose an inquiry towards the value attributed to these studies.

KPF’s Eco-City study, developed for Tianjin district in China, incorporated genetic algorithms together with solar analyses to explore optimized organizations in urban scale. Studies were run by all three members of the KPF computational geometry group.

Local codes require each apartment to receive sunlight no less than two hours per day. In the first step the possible building positions are marked as nodes. Then each buildings’ specifications including its footprint and the shadows it casts during day are determined. The script, developed in Rhinoceros 3D distribute the buildings into regions which vary in tower percentage that could be placed, and the tower height range. As a building block is placed on the site, the shadowing conditions are tested. If there are no discrepancies with the already existing buildings, the new location is saved. If there are discrepancies, the new building mass is rotated to see if any

Techniques in making

Simulation vs. reality

In last couple of years solar analysis tools have become easily accessible. Then it didn’t take too much time for the design studies incorporating the solar simulations to become main stream. While the basic intuitional results are useful representational methods, advanced studies require more sophisticated understandings and approaches in design. However, with market driven motivations, these simulation results are mostly handled in a superficial way. Derived data is either used for creating simple color charts, or creating apertures or shading devices without further investigation.

Two very important points are overlooked: First is the accuracy of simulation. The potential bias between the simulation and reality is neglected. Although these simulations would enhance the performance of the design, they cannot be taken as the only driver for the design advancement. We’re debating over designs using the climate data that has been collected within last ten years and taking decisions (or selling designs) depending on these. Most of the time the buildings that are on the table to be designed today will be designed over the next a year or so, and will be built in the following couple (Figure 4). The proposed environmental performance that

Figure 4
Approximate schedules for design-construction of a large scale building
Discontinuity in processes

Rule based generative systems not only enable the users explore iterative variations of designs via use of parameters but also do it so in an automated way. However due to the level of complexities in different stages of design, no design is resolved purely with computational methods.

Design still is a process ran via use of hybrid techniques. So a perfectly structured analytical system does not necessarily generate the perfect possible solution. Some manual applications incorporated in between the automated ones may enrich the design process. Besides, while genetic algorithms succeed in creating generations of designs that qualify for the fitness criteria, not all the criteria could be numerically defined. Thus some conventional techniques in design are still needed.

Facade pattern studies we did at Kohn Pedersen Fox Associate, for several high rise buildings illustrate the claims above. Design studies done for Songdo Buildings incorporate the user input within the automated facade-making process. After the
Figure 6
Panel encoding for Shenyang Tower

Figure 7
Shenyang tower form. Edges require trimming of the panels.
first façade generation is created with the rule sets embedded in the script, the program pauses for user input and the user can update several floor patterns depending on individual design ideas. This was an intentional choice, since the visual qualities of the façade were not evaluated computationally. So the computational design process was fused with a conventional one to achieve the better result.

The tool developed for Shenyang towers generates the patterns with specific rule sets and panel types (figure 6). But because of the discrepancies between the overall tower form and the panel sizes, the corner intersections of the curtain wall has to be resolved with an additional function in the script. This secondary part is not necessarily a design tool, rather a tool to fix unwanted conditions that's emerging from the mismatch of the pattern and the overall form.

Both efforts of integration of user input within a computational system and implementation of algorithms to fixed unwanted discrepancies highlight the attention that needs to be given: computational tools are there for the designer to use, but there is more effort to put in while using them.

**Epilogue: expression through precision**

This paper is a product of discomfort. While stepping into the new realm of design, we're grasping the computational and digital, and using both to dress our designs to go with the fashion of our decade. This paper intends to highlight the importance of knowledge and proficiency.

There is much more struggle designers will go through while discovering the appropriate ways of applying the new techniques and acquiring valuable designs. The digital imagery while keeping us excited and inspired, should not hinder us from looking deep into the logic and reason of design forms.

Renaissance gave the art and architecture history the re-birth, because it was the time of learning. Today, the architect has an even greater responsibility to become equipped with broader technical and conceptual skills, thus he can design with precision, since it’s the only way to go deeper than skin.

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**References**


