Rendering Environment

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For better or worse, opposition and difference are useful tools for understanding the current status of computation and all things digital in architecture. And let's be honest: there's a lot of opposition out there. Terms like "post-digital", various forms of a "new" "radical" post-modern historicism, the painful reboot of the form versus shape argument, sensation and affect and the renewed interest in phenomena… all of these "movements", when viewed with an ounce of cynicism, seek to steer the discourse of architecture away from the various digital mediums we all use. They close down conversations of process, they frown on technique, and they use the term "shop talk" as a pejorative. And yet oppositions and differences can be productive. They might be used to extend this project, as they might also create a critical distance by speaking of technology, process and production and finds value in "shop talk".

It seems that to fully engage the "critical digital" in the 2010s, we might begin by exploiting the gap between the computationally described object and the digitally constructed image. We have already spent much time and effort critically examining the object as a source of discourse in digital architecture, yet we have not fully examined the status and production of the image with the same fervor. Considering that the digital is consumed almost entirely through images, such an examination is long overdue. This paper and the images attached represent initial, ongoing attempts to seek a critical project within the digital processes and techniques used to produce images in architecture as opposed to images of architecture.

By now we are familiar with the story of Ivan Sutherland's Sketchpad, arguably the first Computer Aided Drafting (CAD) software, written and developed as part of his dissertation at MIT in the early 1960s. While not the origin of our computational tools, it represents a pivotal moment in the development of computation and its relationship to questions of form and geometry. However, with a few notable exceptions, it would take another 30 or so years for the computer fully to impact the discipline of architecture. The 1990s saw an explosion of computational techniques introduced into architecture. The role of computers has continued to grow through the turn of the millennium, and despite claims of exhaustion with the "Digital Project", computation and digital processes remain the dominant paradigm guiding architecture's production of forms, fabrications and images.

It's difficult to deny the impact the computer has had on these three categories. However, I would argue that only form and fabrication have received the critical attention necessary to engage the discourse of architecture. At the risk of over-simplifying, we can break down the developing role of computers in architecture into two prominent phases over two decades. The 1990s were spent experimenting with the computer's ability to find and manipulate "new" forms. The 2000s extended that project by expanding many of those techniques into questions of fabrication, often scaling those issues to include issues related to building construction. In other words, if we spent the first ten years becoming experts at generating digital objects, we spent the following decade becoming experts intranslating digital objects to material ones. (fig. 1, fig. 2)


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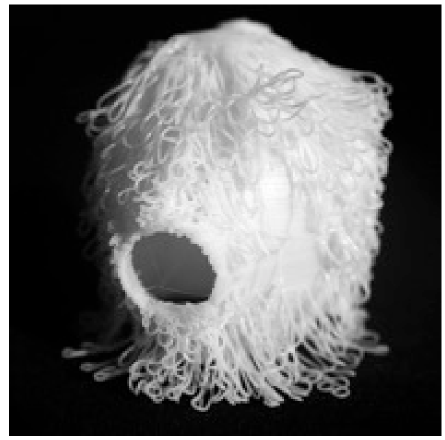
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Figure 1: Project 1, 2010.

Figure 2: Project 1, 2010

As a discipline we are highly attuned to objects. We have an established and mature discourse related to computer-aided processes of object production, and in parallel we have developed the intellectual tools to engage a robust and rigorous critical discourse around these objects. But architecture's obsession with objects evidently predates the computer's introduction to architecture. The story of this introduction in the 1990s has always been told as one hampered by limited access. The machines and the software were too expensive and the interfaces too complicated--but, given our affinity for objects, it's unclear what exactly we would have done with these machines prior to the early 1990s, because, for all their promise, early computers weren't very good at manipulating form and geometry. Instead, they were focused on creating and projecting images of geometry. This is the reason, for instance, for the use of standardized objects like the canonical Utah Teapot, developed by early pioneers in the computer graphics department at the University of Utah. The teapot was a fixed object that could be used repeatedly in image after image to display advances in image production without having constantly to generate and model new objects. It is true that the computer has done a lot to further a discourse of objects. However, if the digital ever really offered us the opportunity to engage something "new," it's not the object, but rather the image, which is the raison d'etre of the field of computer graphics.

Ten years after he first published his work on Sketchpad, Ivan Sutherland published an article that sheds some light on the production and role of the image in computer graphics. In 1974, he writes:

The computer programs which produce pictures of opaque objects accept asinput a description of the object to be shown, and a desired viewing position and direction for a hypothetical observer. From this basic data the program then computes what such an object would look like to an observer so positioned, a process long known by architects as "rendering".[1]

Sutherland highlights the separation between the object-based input and the image output. The input includes the "description" of the object and point of view; the output is the "look" and "picture" of the object from that point of view. It is the second part that is referred to as "rendering". He later gives a term to the object's description: "environment". He writes:

The environment is nothing more than a description, possibly structured, of all of the surfaces [of the objects].[2]

It is in the space between the geometric description of the object, what Sutherland's terms "the environment", and the projection of this environment to the substrate of the pixel screen, what he calls "the rendering", that the

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Figure 3: Shore Box Example, 2014

Figure 4: Proto-Image Example, 2014

Figure 5: Proto-ImageExample, 2014

subsequent work operates. This space of production houses the translation from object to image.

In a paper published a year after Sutherland's, Bui Tuong Phong at the University of Utah published his techniques for adding detail to geometric descriptions of objects in the computer.[3] This work allowed for low-resolution objects modeled using a finite set of planar surface patches to be rendered smooth by altering the way the objects are "painted" on the screen. These shaders, as they are called, further split the computer's graphic representation of an object--its rendering--from an object's computed, geometric description. This distance increases as an ever-growing list of rendering techniques continue to displace the geometric object from its graphic representation.

More recently, architectural discourse has focused on the author/architect and audience/user and shied away from conversations of builder/laborer or, in this case, renderer. "Shop talk" has all but disappeared from the conversation. There are many reasons for this,[4] but one is that, as with building, there is an embedded ambiguity of authorship in rendering. Especially in larger architecture firms, most renderings pass through many hands before the process is finished. Often a digital model is the product of several people's work, and rendering may be performed by a separate person or team entirely. Many renderings include photographic information for the sky, people, or trees usually found on websites like Flickr; this typically means the introduction of several more sources who remain anonymous. Furthermore, the CG rendering is produced not "by hand" but by a series of processes carried out by machines, making it what philosopher Vilém Flusser calls a "technical image," as opposed to a "traditional image".[5] These images are produced as abstractions of abstractions, further distancing them from any "original" creative source. In each case, whether discussing technique or authorship, the production of our images allows us to consider the expanding gap between our objects and our images of them as giving us more space to perform our task as architects. The success of the full integration of digital technologies and computation into the discipline over the last three decades has, in a sense, been too successful. It has closed down the gap between a building and its representation and made smaller the space where architects have traditionally operated. This gap, identified by Robin Evans in the canonical essay "Translations from Drawing to Building," was the space of architectural production.[6] Certain factions of the discipline have mourned this loss and made pleas for contrived reboots of anachronistic processes of architectural representation and returns to figuration of historical objects.

The attached images represent initial attempts to sketch out a new territory for architects to engage in a creative practice while embracing the digital. The series of images begins to unpack the technical image, even to "explode" it into its various components, by visualizing the abstractions produced by image making in architecture, as well as the images used to produce them. For now, we've groupedthem into four provisional categories: the Proto-Image, the Para-Image, the Post-Image, and the Meta-Image.

Proto-Images (fig. 4,5) are images used during the calculation and rendering of an initial image. They typically come in the form of "maps" and usually aid in the imaging of materials qualities. They include images like Bump Maps and Displacement Maps.

Para-Images (fig. 6) are images produced during the processes of image production. They often exist as discrete data sets used to help renderers visualize the internal, parallel processes that occur while an image is being rendered. Examples include separate channels or image elements like ZDepth, Sampling Rates, Caustic Calculations and others. These processes are part of the large process that produces an image, but because they exist as discrete data sets they can be visualized as their own images.

Post-Images (fig. 7) are the images created in "post processing". This may include the addition of lens blur or change of contrast or brightness of an image. Post-Images may also take the form of separate images or people and trees and cars, often called entourage.

Meta-Images (fig. 8) are images about images. These images are produced not as a representation of an object, but as the representation of a process of representation. As such, they are further removed from the original objects by yet another set of translations. They attempt to expose the processes and conventions associated with renderings in order to gain critical distance and knowledge about the disciplinary habits that are typically assumed in the interface with digital tools.

"Exploded" representations are familiar in the context of structure. They describe how an object comes apart and reveal the much-touted part-to-whole relationships that underlie the object. The explosion of the rendering into proto-, para-, post-, and meta-images is intended to reveal the complex network of components involved in the image. The image is not simply a means of viewing the object; it is in fact constructed of a variety of components, some integral, some arbitrary. Considering the growing impact of images in our culture both inside and outside of our discipline, this paper calls for an examination of the construction of the image as careful as that which has already been applied to the object.

Images:

As a point of origin, we started with interior photographs by the American photographer Stephen Shore. Shore's photographs were chosen because they displayed simple interiors with basic lights as well as a finite set of objects in the scene. These objects were typically discrete in their composition, which made it easy to identify a set number of objects in the scene as well as locate similar digital versions online using sites like Google 3D Warehouse and Turbo Squid. The selection of an existing image and sampling of existing digital objects was intentional as it further exposed the complicated issue of authorship in the process of contemporary digital image making. As an additional nod to the history of computer graphics, the "room" we selected to render our interior was based on the Cornell Box (fig. 3, fig. 4). This object was the first interior model used to test early radiosity algorithms at Cornell University's Department of Computer Science in the early 1980s.viii

For this initial set, we chose Stephen Shore's Room 110, Holiday Inn, Brainerd, MI (1973) as the source image (fig. 5). These images are not final and will be expanded on as the work progresses. These represent early attempts to deal with the issues discussed in the text above.

Stephen Shore's photograph was used as the source for content to place into the rendering environment, including textures, objects, and lights. The original rendering for this set was created inside of a modified Cornell box (fig. 3).

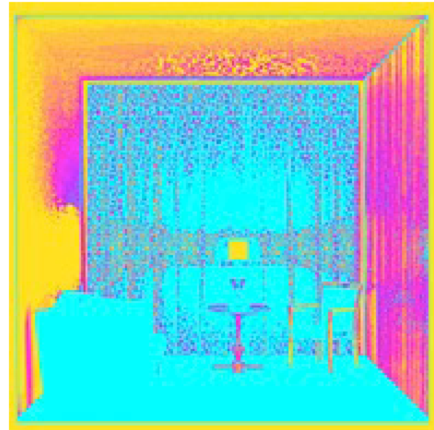

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Figure 6: Post-Image Example, 2014

Figure 7: Meta Image Example, 2014

ENDNOTES

1. Ivan E. Sutherland, Robert F. Sproull, and Robert A. Schumacker, "A Characterization of Ten Hidden-Surface Algorithms," Journal, ACM Computing Surveys (CSUR), Volume 6 Issue 1, March 1974, p. 2.
2. Ibid., p. 4.
3. Bui Tuong Phong, "Illumination for computer generated pictures," Communications of the ACM, Volume 18 Issue 6, June 1975.
4. Sylvia Lavin, "Practice Makes Perfect," Hunch, Volume 1, Winter 2006/7, pp. 106-113.
5. Vilém Flusser, Towards a Philosophy of Photography, 1984.
6. Robin Evans, "Translations from Drawing to Building", AA Files no. 12, Summer 1986...