Representational Imports

Brian M. Kelly, RA

University of Nebraska-Lincoln, USA

Introduction

The Renaissance architect played a significant role in the formation of the architectural profession, as we know it today. During this period in history, the initial separation of the architect from the process of making architecture began. Master craftsman became master draftsman and the task of the architect moved from building architecture to crafting its representation. Prior to this period, the representation of architecture would most likely have been limited to a plan and an elevation, giving the locational and proportional specifics of the edifice while the architect addressed the process and details of its construction on-site. As the architect progressively withdrew from the construction site, the need for communication became ever more paramount. Architects relied upon projections of future construction as a means of instruction to builders manipulating and assembling materials on the construction site. Stan Allen writes:

"By the translation of measure and proportion across scale, architectural projections work to effect transformations of reality at a distance from the author. Projections are the architect's means to negotiate the gap between ideas and material: a series of evasions, subterfuges, and ruses through which the architect manages to transform reality by necessarily indirect means."[1]

This condition necessitated more sophisticated techniques of projection as the distance from marking to making grew. This transition of 'doing it' to telling someone else 'how to do it' called for an expansion of communication in ways that could imbed more information within a drawing; information of materiality, connection, and sequence. As a result, architects looked outside of the profession to expand this knowledge base and range of technique.

For the greater part of the post-Renaissance profession, architects have appropriated techniques of documenting and projecting from sources outside of the profession as a means to better clarify architectural form and space while serving to enhance its legibility, complexity, and precision. This modus operandi has extended into contemporary practice where we continue to seek inspiration and appropriation testing its potential through the lens of design. With varying degrees, techniques have been borrowed from, for example, cartography, engineering, literature, art, industry, military, mathematics, film, music, space travel, fashion, weaving/quilting, biology, and medical imaging.

A considerable amount of scholarship exists regarding the influences mentioned above including film, music, mathematics, and biology.

For the purposes of this argument, the lens will be focused specifically on the influence of medical imagery and scientific illustrations on the profession of architecture. The exchange of techniques between the architectural and medical professions is many-fold and has had significant influence on the design and representation of architecture.

Medical Profession

Concurrent to the development of the architect proper, many other professions were institutionalizing themselves within this new society. The medical profession was attempting to gain public trust and to better understand how to diagnose, treat, and improve the human body. This was done partly through a process of documenting the specimen with illustrations and diagrams explaining the complexity and connectivity of the interior of the body. Scientists, artists, and scholars were dissecting cadavers while drawing what they saw. These illustrations were highly detailed and, although often incorrect, served as a means to establishing the profession as experts in the treatment of sickness and injury. From this formative phase, the medical profession saw the use of the image as a means of communicating the objectivity of its subject – dehumanizing to remove the identity and personality outside of codified notational systems within the margins. Although the illustrations were masterfully crafted and rendered, the overlay of explanatory information extended these representations beyond mere visual effect to the realm of professional reliability. This progression has seen medical imagery be continually developed from the category of illustration or image (meant for looking at) to the category of instrument, where the medical images of today are essential to the diagnosis and treatment of medical conditions.

Fig. 1. Rembrandt, The Anatomy of Dr. Tulp, 1632.

There exists a readily apparent lineage of architectural documentation techniques intended for communication of tangible specifics – dimensional data that relates to the arrangement, configuration, and manipulation of material. These are measurable, quantifiable representations useful in the construction of architectural form and material. These documents are most often the type used in a condition where contractual and legal implications exist and they can be judged objectively. They also often operate in the same manner as the medical image, meant to assess, communicate, and be instrumental in professional processes.

Parallel to this type is a group of image-based techniques that are meant to communicate qualitative, perceptual conditions relative to space, place, and essence. These are inherently subjective and difficult to quantify. They rely on perceptual conditions of how people experience space, which is unique per individual. Many architects would argue these are the representations that manifest the difference between architecture and mere building in that they are simultaneously expressing form, material, and idea.

Due to the architectural profession's obsession with the theoretical and aesthetic for a period of time in the late 20th century, it moved along a path favoring the visual and resulted in a sacrifice of precision. This movement produced a period of architectural practice where the rendering was the output, and the term "slop modeling" became prevalent. Object snaps were not effective and input of precise data for processing form was not available to the mass constituents. Architects were using software platforms to produce realistic imagery, assisting in communication of the final construction to external parties such as clients.

While precision may have been a desire and was supported in drafting software platforms such as AutoCAD, most modeling programs were not equipped to deal with precision in a manageable way. This was predominantly due to a lack of demand for the software to do more. This relegated digital modeling to a category of luxury and embellishment where the output did not significantly assist or alter the construction in any way. As digital modeling entered the mainstream of the profession it focused on the generation of image-based results. The software was an endpoint without output beyond the pixels within the image.

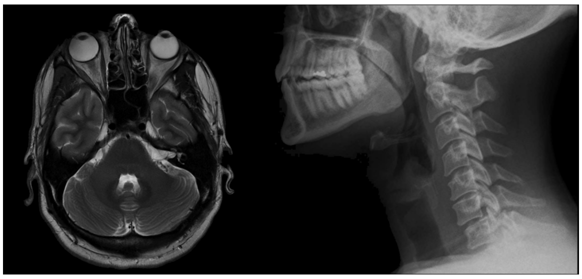

Fig. 2. Various medical images (CAT and x-ray)

Medical to Architectural Exchange

In order to establish a context for discussion, the following cross-referential typology positions the role of various medical imaging types and how they have assisted in the development of each profession.

Notational systems

Medical and architectural imagery incorporates the use of notational systems that might augment the pictorial content supplying information such as context, identity, dimension, and proportion. Within the medical profession, these systems might identify an adjacent organ, register the dimensional data of an abnormal growth, or identify biometric data relative to a specific system such as flow rate or pace. This information is highly useful in the documentation of sickness or disease. The aim of the notational system is clarity, and remains objective in its delivery.

Within the architectural profession, this system of notation might perform similarly in its desire to objectively communicate information and do so with a level of clarity. A primary difference is the potential of this system to communicate procedural instructions outside of the image. The medical image is typically reflective conveying information that 'is', while the architectural image often is projective, conveying information that 'could be'. Stan Allen cites philosopher Nelson Goodman and his theory of an allographic system defining it as one "capable of being reproduced at a distance from the author by means of notation."[2] He uses the example of the musical score as one that, with its system of notation, can be replicated outside of the original with a great level of accuracy. The ability to communicate a material and formal condition in architecture, and its potential to be replicated regardless of place and time is a significant subtext to the charge of architectural representation.

This is also important as it relates translation and authorship. The architectural image is authored and thus, often subjective. Decisions have been made in regards to a diverse set of parameters where value is assessed. The medical image is most often objective communicating the facts of its subject without bias or preference. This objectivity allows the medical image to achieve a level of authority where content is valued over authorship.

Cross section

The cross section was used as a technique to document the arrangement and sequencing of the human body as scientists and artists began to better analyze its physiology. Several illustrations from the Renaissance period show parts of the human body cleanly sliced in a lateral or transverse means, thus clarifying the arrangement of internal systems kept private by the skin. The cross section provides referential information of body's associative qualities in regards to its internal 'construction'.

Architects borrowed this technique as dialogue progressed regarding the similarity of the body as it relates to medicine and that of the body of architecture. Architects harvested the potential of the cross section through, for example, a cathedral dome to convey simultaneously the spatial, proportional, and constructional properties of the design. This also extended the architectural dialogue to include interior to exterior relationships exploring how the space of the interior might relate to a context outside of itself, and ultimately to the constructional arrangement of an architectural detail. The cross section has been deployed at all scales and has become irreplaceable as a tool from the design to detailing stages of architectural conception and production. In the same way it reveals that which is unseen in the human specimen, the constructional systems within the architectural poche are brought to the light of day.

Exploded three-dimensional illustration

In a similar way to the cross section, the exploded 3d drawing allowed the medical illustrator the ability to give the viewer better association of the arrangement of the body in regards to a larger whole. This type primarily developed out of need to communicate the complexity and overlap of multiple components, systems, or connections within one 'body'. Most often this was a three-dimensional drawing, although it can be used in two-dimensional orthographic projections as well. These drawings were often focused in on a specific region where the technique was deployed while the balance of the body remained intact.

The architectural profession has taken this technique and elevated its ability to communicate both arrangement and sequencing. While the medical illustration typically uses exploded drawings to dissect and analyze the already conjoined body, the architectural drawing is typically done before construction and offers instructions for completing the assembly. Often done in a paraline format, it is also a measurable drawing and can assist in the placement of materials in ways that are objectively instrumental.

Monocular/binocular

Renaissance vision theory declared the ways in which the human eye(s) collects and processes information. These claims were developed through a series of treatise illustrations showing both monocular and binocular conditions with indications of connections to the nervous system and brain. Notable scholars such as Descartes, Desargues, and da Vinci created illustrations stating how the human eye digests its view. Some were obviously more accurate than others, most notably as shown in da Vinci's drawing where the eyes are anatomically part of the brain. Da Vinci, supporting a monocular condition, also drew correlations between sight lines moving through the lens of the eye and lines of light projecting shadow from a single point light. And although Descartes' illustration shows a pair of eyes looking at an object (binocular vision) the claim remains that visual information is overlaid and processed as one flat image directly behind the eyes which is then moved to the brain to process content.

Initially, Renaissance perspective theory proposed no separation between the ways we see and how we represent what we see – they were one in the same. Brunelleschi first developed the technique of linear perspective by employing the tool of the picture plane, which became a depository where distortion and collection of the perceived depth was deposited. For a period of time this was seen to be accurate, truly mimicking the human eye. The exposure of linear perspective as an artifice surfaced in its inability to accurately represent stereoscopic vision. This was manifest through the sacrifice of formal distortion and the deletion of one of the viewer's eyes. At the same time, techniques like anamorphic projection attempted to accentuate the discontinuity between these two and expose the artifice of perspective by challenging its 'laws'.

Sadly, this is an area in which the exchange between the two professions has seen little development outside of the margins of mainstream practice. Although we may be looking at a digital model on the computer screen, we still look at a perspective view that is deposited on a picture plane shown in pixels on the monitor. Some development has occurred in regards to virtual reality and stereoscopic imagery, but this has had little effect on the profession at large.

Animation/simulation/augmented reality

While the injection of animation and film into architecture came primarily from the Hollywood film industry, the use of a continual progression of images through a specimen as a means to comprehending the ways in which the combined systems are arranged and altered in relation to form is prevalent in the medical field. The photographs of Eduard Muybridge used multiple images sequencing as a way to explain bodily movement while the medical profession used it as a means to diagramming variable change and interaction within internal bodily systems. This technique is most dominantly seen in radiography technologies such as magnetic resonance imaging (MRI) and computerized axial tomography (CAT) scans, where the technology captures a succession of images that are analyzed both individually and combined to reach diagnosis.

Many architects, including Morphosis and Foreign Office Architects (FOA), have used this technique of multiple sequential sectional drawings to explain spatial and formal sequencing in architectural form. This is most often deployed through architects who are interested in the sequential manipulation of form to create a spatial narrative. Farshid Moussavi of FOA, in her book *The Function of Form,* discusses a transversal system as one in which a system's "base unit is not geometrically fixed, it is versatile and can vary as it repeats, or even mutate, when hybridized with other base units."[3] The documentation of this condition through multiple sections, possibly animated, becomes irreplaceable to communicate both change and time.

Additionally, simulation occurs within medical procedures where a doctor's eyes are not sufficient assistance or where diagnosis might occur with less invasive means. Additionally, the medical profession has been fully invested in the use of digital tool extensions that assist in the movement of the hand or tool in delicate operative procedures where the slightest movement in the wrong direction can cause extremely detrimental effects. Doctors can now perform surgical procedures where the surgeon's hand is digitally navigated once the tool is calibrated for location. This is a significant increase in the ability of an image to go beyond mere communication into the realm of instrumental action and performance. Similarly, Frank Gehry is well known for his involvement in the formative years of complex digital modeling and formal exploration. His use of a digitizing arm to translate points from analog to digital space was pivotal in the exchange of the physical hand and digital tools. This process began to actively break down the separation of the analog and digital worlds for beneficial use in the design and documentation of architecture.

The trajectory has resulted in the development of meaningful images that are data-rich and contain essentials to a communication of designer to software to tool to artifact.

Architects are now beginning to explore appropriating augmented reality where occupation and navigation of the space of the city and its built environment can be enhanced through the use of data-rich spaces. This will eventually allow participants to interact with an image that is captured, analyzed, and enriched with up-to-date live data regarding its identity. This is poised to have a profound impact on the design of the built environment from the part to the whole.

X-ray/Radiography/CAT/MRI

Developed and used in the medical profession, x-ray technology allows for non-invasive imaging of the interior of the human body. This technique uses electromagnetic radiation to penetrate the body being absorbed in varying degrees based on density of material – bone versus tissue density for example. This varying level of attenuation results in degrees of contrast producing an image that can show the structure and skin of the body. The appeal of this image is the simultaneous availability of the structural components (bones) existing with ghosted envelope of the body (skin). The Computer Axial Tomography (CAT) scan uses x-ray technology, but does this through a series of x-ray slices through the body.

Magnetic Resonance Imaging (MRI) is a technique that utilizes magnetic fields that activates cellular structures that are then detectable through the imager. This image can give incredible amounts of information about the internal structures of the body and be adjusted to detect fluids, active dyes, and various other systems. These contrast mediums can increase the legibility of a specific target increasing the potential of the image to assist in diagnosis. While at first this technique may seem quite similar to the x-ray, the MRI extends the imaging potential to capture additional data over time such as flow and systems exchange.

Digital fabrication

While a large degree of experimental use of this technology finds itself in the architectural and design fields, the medical profession is embracing the use of digital fabrication in a parallel but discrete trajectory. Design fields are challenging the future and limits of fabrication, imagining the potential of these technologies to shape material and, in turn, the built environment. Medical professionals are using the technology to print living tissue, bones, organs, and devices to assist natural functions. One could argue that the use of digital fabrication is, again within the medical field, being absorbed and deployed to attack real problems in an objective, effective manner. While this is also the case within the design professions, the ability to speculate on the potential of these media to create new types of spaces and forms coupled with the lack of it jeopardizing human life in its initial phases give the design fields more leverage to explore. Fabricated elements in the medical field have life depending on them.

From Image to Instrument

In her article titled “Skinless Architecture”, Beatriz Colomina discussed how early 20th century modern architects, such as Mies van der Rohe and Le Corbusier, as well as contemporary architects, including OMA and FOA, were inspired by medical imagery and allowed it to influence their design process. She elaborates on modern architects’ fascination with medical imagery, namely the x-ray stating:

“X-ray technology and modern architecture were born around the same time and evolved in parallel. […] While the X-ray exposed the inside of the body to the public eye, the modern building unveiled its interior, subjecting what was previously private to public scrutiny.”[4]

This relationship between the two professions resides in a more conceptual nature, drawing parallels based on the idea of the image and less on its performative potential. The image and its novelty in some fashion encouraged a divergent viewpoint and architects did what they have done for centuries – appropriated it for use within the lens of architecture. They made images that looked like x-rays. They removed the skin of architecture to reveal its skeleton. They even cast shadowy silhouettes of activity onto the skin of architecture as a way to elicit the voyeuristic acts that are ingrained within medical imagery. Beatriz Colomina contends that architecture has always followed the medical profession.

"Today, there are new instruments of medical diagnosis, new systems of representation. So if we want to talk about the state of the art in building envelopes, we should look to the very latest techniques of imaging the body and ask ourselves what effects they may have on the way we conceive buildings."[5]

She continues stating that the imaging technique deployed in the medical profession has significant effects on the design of architecture in the future, possibly seen most in the erosion of the building envelope. I would suggest that perhaps the influence might be also be seen in the techniques we use to conceive and communicate these future designs – that the image itself might become more instrumental in its conception AND its execution. Colomina's assertion halts at the medical image's influence as a conceptual device alluding to its ability to have a significant effect in its conception and projection.

But to what real effect has this history had on our cities and built environment outside of what it looks like? At a time when the relevance of the architectural profession is being questioned and we are being charged with establishing our place in the future shape of the our cities, do we find ourselves in a similar place to that of the medical profession of the Renaissance needing reestablish our reliability and viability in a contemporary debate?

The 'image' of architecture needs to be refocused to become more instrumental in establishing this position. How can the tools we use, and they way they communicate become more instrumental in the issues we are facing on a global scale? Software platforms are no longer an endpoint, but rather a mediator or pipeline to output. This is being seen in software that can communicate outside of itself to other software, fabrication machines, analysis tools, or web sources. The forms we are making in the computer must become more useful as tools both internal and external to the profession. Modeling is no longer a term which equates to scaled projective mockups of scaled material, but is much more inclusive of modeling scenarios, contexts, phenomena that can illustrate, for example, change to a region over time or better negotiation with ecological systems already in place. A perspective, for example, is not enough to communicate the essence of a project. It should also be able to talk about the potential effect of an edifice on its context, or the process in which it is made. The static image as an endpoint is losing its influential power in a younger generation that is savvy in the collecting, processing, and manipulation of data for its use in addressing the issues that we face today and tomorrow.

Notes

[1] Stan Allen, Practice Practice: Architecture, Technique and Representation (London: Gordon and Breach, 2000), 2.
[2] Ibid., 33.

[3] Farshid Moussavi, The Function of Form (New York: Actar and Harvard Graduate School of Design, 2009), 28-29.

[4] Beatriz Colomina, Skinless Architecture. (Weimar: Wissenschaftliche Zeitschrift der Bauhaus-Universität Weimar, 2003), 123.

[5] Ibid., 124.