

Mind-meld: My mind to your mind, my thoughts to your thoughts.

-- Mr. Spock (episode TOS 011 of the original Star Trek TV series)



The profession of architecture can be thought of as residing in the space between art and engineering, incorporating the vocabulary of creativity and freedom of expression, but harnessed to the service of human clients and physical material rather than personal resolution or communication goals, and responsible to a larger scope of time and utility. Certainly, “architect” is a label claimed by people doing work at very different scales in space and time. From 2D drawings and 3D models and other “virtual” (unbuilt) architecture as seen in competition entries, to short-lived small-scale “installations”, to full-fledged “buildings” all the way up to urban-scale proposals—all are called “designs”. In addition, in most cases, they are executed by many hands and minds, not just one.

The distinction between architect and engineer is often understood in terms of *finding new solutions vs applying known solutions* to problems. Engineering disciplines tend to look for recognizable (and solvable) sub-patterns in the larger problems, whereas architects tend to push the problem pieces around looking for a different problem.

The distinction between artist and architect is sometimes harder to locate, but one important feature of architectural design occurs in the separation of the hands from the mind. Where a painter or sculptor uses their own eyes and hands to find or create the final work, the architect must conceive and communicate their idea to someone else for execution, usually at another time and in another place. Further, the ultimate materiality of built form is awkward and expensive to employ during the design process, even in miniature, so designers use various proxies—mostly graphical symbol systems and words—while working on their designs.

Certainly, the solo artist is a bit of a myth in the art world too. Some art and most design really ought to be described as the production of an *ensemble*, as with jazz music, the creation of glass-art, and certain other large-scale art installations. Group work is central to the AEC (Architecture Engineering and Construction) industry. Architects are contractually responsible for *coordination* of an effort that is almost always distributed across a variety of contributors, including the client, the contractor, and the designer’s specialty consultants (including various types of engineer, such as mechanical, structural, etc.).

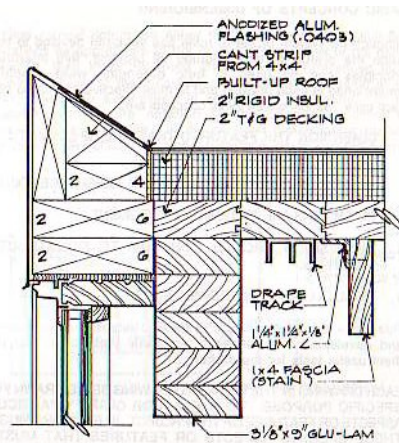
This separation means that one of the core challenges of architectural practice, which may seem, falsely, to be only peripherally related to design itself, is *communication*. This is where the Vulcan mind-meld, as demonstrated (fictionally) in the Star Trek TV series, would come in handy. On TV, Mr. Spock would spread his hands over the alien being's head and somehow tap into their thoughts, acquiring their world-view and memories, and sometimes controlling or influencing their behavior. Not an act of *communication*, but an act of *being the other*. A handy skill if you can learn it.

In the real world we communicate “from my mind to yours” through various media. The classic *conduit* model, often deployed to describe mediated communication, can be helpful here. It involves three stages: an *encoding* stage, in which our ideas or meaning is converted to some form of expression (such as words or drawings), a *transmission* step in which that information is passed to another, and a *decoding* step, in which the meaning is extracted from the communication by the receiving party. This is a technology-friendly description, in the sense that it sounds like parts could be replaced with information and communications technology (ICT).

Other theorists point out that *meaning* is often *emergent*, arising out of the interaction of two or more people. They observe that all action, including communicative acts, is *situated* in a particular historical and cultural context. The idea of emergent meaning finds support in the designer's tendency to anthropomorphize the drawing action as a “conversation” with the paper or the pencil. While these points of view challenge the transmission model, the strength of the “resonance” between the transmission model and ICT suggest this may be a fruitful place to start exploring design communications.

One key issue involves the character of the medium in which the architect works, even if he or she is the only individual involved in the design. Designers cannot draw what they cannot think of, and they cannot think of what they cannot draw. That is, the ability of the medium to accept and reflect the design ideas of the designer is important. Many studio critics lament the over-presence of “SketchUp designs” – by which they don't mean SketchUp graphics, but SketchUp *thinking*.

When we communicate with others about built form, we use a combination of media, including 2D images, 3D miniatures (models) and descriptive words. Each serves a specific purpose, largely defined by custom, cost, and experience. Models have use largely in the “design phase” and in persuading clients and other stakeholders to accept the project. Some of the written vocabulary is common: “marble”, “cedar”, “bronze”, “tempered glass.” Other words are very specific to the construction industry: “ADA”, “egress”, “2-hour wall”, “2x6” (which doesn't mean 2” x 6” at all), etc. Drawings, when used, depict specific limited aspects of the intended building—structural steel connections, door and window



geometry, material sequencing in walls or floors, lighting or signage, etc. This system is highly symbolic. The detail shown above shows position and size of material (and implies material quality) but not what you would see if you cut the building with a saw. Still, it is relatively correct and consistent geometrically. The items shown in the next figure are geometrically inconsistent. The plan view of an outlet is placed *next to* the wall, not in it (where it might be hard to see). Doors in plan and elevation show information relevant to the door (area covered by the swing, hinging, knob location, trim, etc) using the best view for the information, not a consistent geometry.

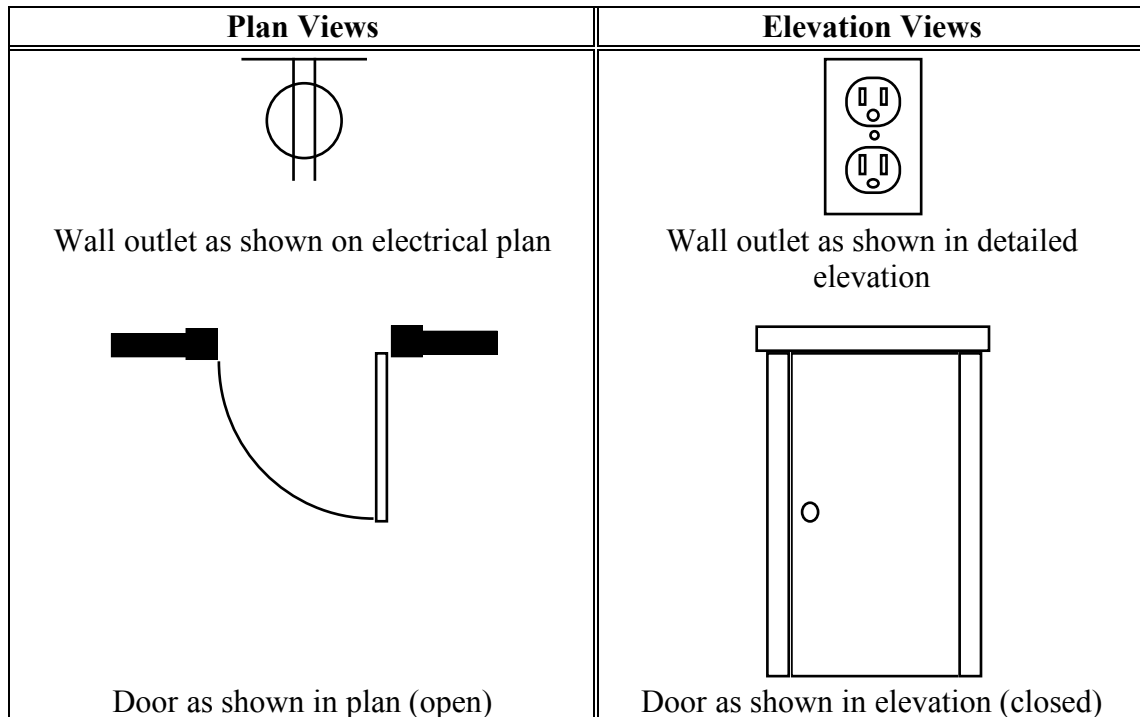


Figure 2: Differing Plan and Elevation Views

Depending on the legal relationships among the parties, these communications have particular roles. Legally, design documents issued for construction are expected to represent *design intent* by communicating the *configuration and extent* of materials. They are told not to specify *construction process* (which is the contractor's responsibility) because it would make them liable for process errors. Often drawings are incomplete and slightly ambiguous. This is not due to error, but to provide contractors the opportunity to offer alternative (cost saving) responses using their unique resources and expertise. These may be followed-up with "shop drawings" by the contractor's subs, showing precisely what is proposed. The "conversation" may continue, in the form of drawings and/or words, through several iterations.

Building Information Modeling (BIM) is an information technology (not a product!) that aspires to capture the full 3D geometrical and material description of the building in digital form in a single central database, from which textual and graphical "reports" can be generated as needed. All consultants would be guaranteed the latest information, and consultant data (HVAC layout, for example) would be immediately available to the rest

of the design team. In the most complex designs, model data can be directly converted to orders for structural steel, or used with laser-guided cranes to place that steel precisely in space. This means the economic benefits of BIM may not be easily realized by all participants in the traditionally segmented architect + consultants + contractors models of practice. For this reason, BIM is often linked with a form of practice called *integrated practice* or *integrated delivery*. This connection is revealing—the technology works better with a different model of practice! *Integration*, in this context, refers to the inclusion of construction and consultant players (and knowledge!) *throughout* the design process, from the earliest stages. By working together all the players respond to the client's need for a building in a way that promises to find the most efficient, attractive, inexpensive, yet error-free product possible.

Along the way, information technology is changing the character of practice. To make it work the traditional patterns of work, risk and reward (legal liability and corporate profit) need to be adjusted. Questions of data ownership and access could mean radical restructuring—changing the traditional role of the architect as the project lead and client representative. Recognizing this, the American Institute of Architects (AIA) is reworking its standard contracts, reflecting the legal structures that were put in place to create projects such as the Disney Concert Hall, or the Denver Art Museum.

CAD and BIM tools, as well as other ICTs (teleconferencing, fabrication, etc) are enabling new approaches to practice as well as new types of practice. At the same time, architects need to examine and challenge the decisions that underlie the tools we use, reconsidering assumptions and searching for opportunities to improve the mind meld across the industry. That's how we'll get from my mind to yours.

This quarter you are encouraged to think about the role of all forms of documentation in design – from personal sketches to text specifications to diagrams to details, models, etc. Speakers will help us look at aspects of design (not always architectural design) in new ways, covering many aspects of production and use of building information.

The conduit model of communication often isn't adequate to explain the emergence and dissemination of a conceptual design idea within a design team, or even within the mind of a single designer. Media play a role not in communicating to *others* as well as communicating to *self*. Drawing in a personal sketchbook or a brainstorming whiteboard may help the designer orchestrate competing ideas, establish hierarchy in the problem, reflect the ideas of others, etc. Use of any medium in this subtle enabling role is critical to design (architects often speak with almost mystical reverence of the connection of hand to pencil and eye).

As a strategy (rather than a product), BIM has some mutability. This is appealing to vendors, who can each market their own BIM product, but it presents challenges to those who want the data—there is a need for *interoperability* amongst BIM systems, something which would allow them to use the same data format. One such representation is known as *Industry Foundation Classes (IFC)*, and we'll hear from someone involved in the development of the IFC standard, among other data-exchange efforts.

We will also hear from some of those who make “downstream” use of design data: governmental bodies who must approve projects, the builders and contractors who turn data into buildings, and the building owners or facility managers who work with the final product. We'll also consider the building *user*, the ultimate consumer of the design product. To get a glimpse into this area, we'll hear from a UW CSE researcher who is looking into the ways in which we might study long-term effects of ICT on users through devices carried or worn, or perhaps embedded in the environment (a field known as *ubiquitous computing*).

We should also recognize the possibility of “direct expression” – of returning direct control of the product to the hands of the architect. Running parallel to the development of BIM as a modeling technology has been a phenomenal change in the process of delivering and placing material in a building project. Computer-controlled fabrication of individual components, combined with computerized-tracking and organization of materials for delivery and placement means that buildings composed of an assemblage of unique components are just *somewhat more* expensive, rather than *prohibitively* expensive, and raise the possibility that increased efficiency in use of material might even make it less expensive. What does it mean when you can make customized parts of a building?

Finally, we'll hear from each of you. What topics related to design and computation are you interested in? Each of you will be asked to research a topic and present your findings in the second half of the quarter. It should be fun!