Design Education of the Digital Native

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The design students now entering higher education have always lived in a digitally-mediated world. They have never known life without the internet, cell phones, email, social networking, and GIS. They are completely fluent in the social and cultural manifestations of digital media, as they are individuals who maintain constant contact through multiple digital channels in a way that previous generations would find perplexing. Multitasking is the usual modus operandi, as much as older generations may try to discourage it as inefficient. These cultural conflicts have been coming to the fore in another recent spate of news articles chronicling the behavior and management of Millennials in the workforce. Simultaneously, the transition from manual drafting to automation is the biggest cultural shift the design professions have ever seen. Given these enormous changes in behavior and thought patterns, design education needs to constantly reevaluate how best to pass on its skills. While many of these facts have been discussed previously and have been addressed by some pioneering educators, design education as a whole remains too conservative in its response to early integration and adoption of technology.

First we must mention the still prevailing bias toward teaching basic design solely through the analog techniques of physical model building and hand drawing. It is not logical for students who are fully immersed in a digital media culture to be forced to learn only hand drawing and hand building techniques at a first year level. Educators should not try to block them from discovering or using digital media for design until *we* are ready for it; the key is to demonstrate to them the relevance of the analog architectural tradition even within their native digital environment. Design educators can no longer simply attempt to mold students in their own image by recreating their own earliest design experiences at the drafting table. Should students prefer digital media as the vehicle for learning, they should have that choice available to them from the beginning and at their discretion. If design educators cannot find a way to teach the concepts of perspective construction and orthogonal drawing within a digital environment, then we really have to question who is to blame here.

Forbidding all use of computer modeling or drafting is commonplace in at least the first term of design education programs. This policy invokes the fear that one cannot learn basic design concepts beginning with the tools of digital media. Educators should refrain from propagating the myth that digital media “too early” can lead students down a false path, or worse, that they will be “ruined” and can never become proper professional designers if they are “exposed” at the wrong time. However, that ship has long since sailed, generally long before the digital natives arrived for their first days of design school. Additionally, any student designers who are simultaneously beginning internships in the field already must use CAD programs and digital graphic tools in the workplace, as they will for the rest of their professional careers. To ask them to ignore this knowledge and experience when entering design school is a sad waste.

It is possible that senior educators who are themselves uncomfortable with digital media and watched the faltering first steps toward CAD are not able to see how the current, increasingly sophisticated versions can be used to teach basic design, to teach drawing concepts, or to aid in design development. It can be threatening when students want to use tools right away that the teachers themselves do not use frequently. Teachers

are tempted to tell these digital natives to “slow down” and to “get back to basics”, meaning to get back to the physical drawing board. However, this new generation is more likely to have begun drafting or designing originally in a free version of SketchUp or another CAD program available in previous education and the outside world than to have begun drafting at a table by hand. This is not necessarily a bad thing! While the early steps taken in design tend to be clumsy and naïve regardless of whether they are taken in analog or digital, they are no less valid if they happen to use digital media. Educators need to learn to embrace and to encourage these efforts and to find a way to demonstrate the basic principles that teachers espouse using a fully integrated approach.

The free versions of SketchUp and Google Earth certainly have many weaknesses for professional drafting, however their ease of basic use and total accessibility via the internet make an extremely compelling combination. Digital spatial representation software is no longer prohibitively expensive or so complicated that it requires specialized training to get started. Instead, a computer with internet access, a rainy afternoon, a project in mind, and a little determination are the only prerequisites. To see some of this untrained work (mixed in with some trained and professional level work), one needs only to browse Google’s 3D Warehouse of models. The average consumer has access to the technical means to quickly visualize, develop, and execute a design as a 3D model-- a notion that 25 years ago seemed hardly conceivable. Despite the weaknesses of SketchUp, it is a gateway drug for the purchase and use of the more sophisticated and fully featured professional-level programs such as AutoCAD, bonzai3d, and form•Z, and it makes the learning curve much easier once exposed.

Therefore, it would be unwise to underestimate the average incoming student’s exposure to modeling or drafting software prior to formal design education, especially considering that enjoyment and delight in the use of these ubiquitous modeling programs may have had a major hand in the recruitment of prospective students into design training. When students are forced to do hand drawings against their will, often they construct the drawing elements in SketchUp or CAD and simply trace over a scaled print for homework assignments. This does not mean they are failing to take in the lessons of perspective construction or of orthogonal drafting. Educators need to take ownership of the existing situation and to assess the information and skills they are truly trying to impart. While students should learn to use manual drawing tools as well, is the actual use of a T-square and mechanical pencil truly most basic to the development of a designer’s sensibility? Design instruction needs to learn to respond to the way young designers have already remodeled their minds. I believe that the potential of these young designers who have been conversant in three-dimensional modeling essentially from the outset of their careers is potentially immense and revolutionary, should educators foster it correctly.

Both hand drawing and digital modeling are efforts at representing our perceptions of a three-dimensional world on a two-dimensional surface, be it paper or a flat screen. There is not one correct method to learn these drawing concepts (simply because that is the way it has always been taught before). And to be fair to the students, one should probably admit that sometimes educators may feel the desire to find a way to slow students down so we can demonstrate our own superiority and gain credibility as experts. This stance will only damage our credibility as educators in the long run, if we allow ourselves to feel threatened by the potential and existing skills of the incoming digital natives. Teachers who are not accustomed to teaching the first steps of formal drafting and two-dimensional representation using CAD and other programs can critique the design work of these students, but it is often very difficult for them to understand or foster their process of development using design computing. We should resist the temptation to hinder it. We need to have the confidence as designers to allow students to develop along new pathways that were not previously available. Classes can become a truly mutual process of learning.

Another myth that needs to be re-examined is that the use of computers or 3D models “too soon” will “freeze” a project into its current state of development or lack thereof, and this is why student designers must be told to resist the temptation of “too easy” computer modeling and drawing. These preconceptions come out of the senior professional designer’s own experience of the design process in the workplace of the past ten years or so, in which senior architects began the design process along traditional lines with napkin sketches

and trace paper, and only once ideas and programming were well established, then usually junior architects began the task of CAD drafting (red-lined by the senior architect). When two-dimensional, well-established CAD plans were drawn, a dedicated 3D-modeler or outside specialized renderer would have been brought in to expensively and painstakingly finalize the proposed design as a 3D model and renderings for presentation, using different and specialized software. Thus, senior architects are accustomed to thinking of 3D models as expensive, labor intensive, and thus inherently final.

However, changes in software integration and ease of use have dramatically changed this workflow, for the many designers who embrace it. Early massing and site models can be created to increase the understanding of the scale and of the potential interaction between site and programmatic needs, or to analyze any other factors that can benefit from an interactive view in 3D space. These massing models need not become frozen, and they need not even resemble the finished project at all in literal form. They can be as "quick and dirty" as any napkin sketch or ragged chipboard model in the physical world. This is not a bad thing! Designers can easily modify, move, or completely change primitive shapes. They have not determined structure or materials at this stage. The model represents a concept, even if it might look like a building made of boxes stuck together sitting on a hill. Just because it could be rendered or have a slick look at this point does not mean it is finished.

Some critiques that a senior educator might typically give in order to progress from the programming to the conceptual stage of design (on paper) can be inappropriate to further the development of a conceptual 3D computer model. Adding doors and windows, wall thicknesses, and structural elements ***can*** actually freeze the 3D model in place, as they often add stylistic specificities and destroy primitives, leading to a lot of backtracking and extra work should the designer subsequently decide to make major formal changes, such as assigning a different structural material, rearrangement of spaces, or even changing the project's overall form from orthogonal to curvilinear. If students are working in both hand drawing and 3D modeling simultaneously, trying to produce required standard drawings such as plans and sections can, ironically, be somewhat counterproductive and detrimental in the earlier stages of development.

Projects that truly use 3D modeling for design development may follow a different trajectory than the one the teacher is used to seeing using hand drawing. To complicate the issue, beginning design students are always struggling to do justice to their own mental image of a project and its design concept as they struggle to develop their own powers of external representation. What appears on paper or even in the developmental stages of a 3D model may in fact be *very* far from their desired end result, as they will often tell you. Help with technical challenges and with modeling skill will help approximate their true concept more quickly, so that it can be fairly critiqued and then developmentally reiterated. If students can manage to truly express their intended initial concepts earlier so that professors can share and understand their vision near the outset, it could make a huge difference in the studio design process. Currently, much time is lost on representational weakness in hand drawing and just plain misunderstanding.

Dr. Ganapathy Mahalingam's article, entitled *The Search for Intensional Form* in this issue of the Journal, exposes some of the limitations of modeling software for the formal predesign process and suggests new potentialities. Currently, the predesign decision process usually occurs as a computation in the experienced designer's mind and is not formally available within the software itself. He proposes a software adaptation that could be a 'form finder' for structural, site-related, or stylistic information (rather than strictly an illustrator). Students could use help understanding early in the design process that the choice of concrete or steel construction versus wood has greater consequences to construction technique and form than simply eye-dropping on a new material to the same developmental 3D model (even changing the size of steel to meet structural needs within a project can often impact many other design choices, as experienced designers know). The ability to quickly visualize structural and material consequences early in a project could help students avoid the pitfalls and make better choices using their own visual judgment, not only based on the warning of a teacher. Students will not learn or understand these consequences until they can see or experience them in projects—just as the senior architect has had the chance to do.

Opponents might say that this software functionality would be akin to “multiple choice design”; however, it also has the potential to be a hybrid formal/ structural/ material visualization tool for predesign, when properly used as a further point of departure for aesthetic, programmatic, cost-related, and conceptual choices. What is the harm in viewing an informative sketch model of potential consequences prior to making an early choice that commits one to a final path? Are we concerned it could “spoil the surprise”? I would argue that the surprise in design, as well as the inspiration for design itself, comes from our intentional choices at each point and cannot be ruined by an early guess at the consequences of design choices, any more than a final built form can be ruined by being rendered for presentation for a client. If designers were not able to offer anything more to a client besides a choice among building materials, styles, costs, and types, then we would deserve to be replaced by a “choice engine”.

Drawing as a technique will not disappear: but it will become increasingly mediated by technology for ease of use. The drawings skills themselves will still be with us, as we will increasingly be using integrated tools like drawing tablets for entry into digital rendering and modeling software. Drawing tablets will proliferate beyond the bounds of the media lab. Manufacturers already see the potential for hand drawing and digital scribing as a faster, more fluid means of input with an immediate real time feedback response— the idea of human anthropomorphic input as the most elegant solution is not lost on them. The current generation of media tablets are now incorporating additional functions to hybridize the solution. Design studios or drawing classes can be dedicated expressly to analog or digital methods, but both the student and the educator should be free to choose among them.

Perspective drawing education should incorporate specialized tablets for instruction. This tablet would use simple software in conjunction with hardware buttons with dedicated commands for perspective drawing. This way the use of full featured CAD software can be delayed until a later stage. One can envision manipulating vanishing points, station points, and horizon lines in real time with a stylus or similar aid for input, receiving instant feedback from the tablet display. Finding ways to use these tablets will make them increasingly integrated in design programs, facilitating senior educators in sharing their accumulated knowledge either by pencil or by stylus. Just as the student should have options, so should the educators. Undoubtedly, further use of media tools to translate the traditional knowledge base can be developed for education.

Designers often say there are no textbooks for teaching design. However, there are plenty of textbooks for CAD instruction. In the various forms of manuals, help guides and tutorials, one can find explanations of perspective projection types as well as additional photographic or cinematic information that has been applied, such as focal length, depth of field, and much more. These texts contain digital construction of classic formal drawing techniques, a survey of mathematical primitives (and not just operational topics for CAD software, as one might otherwise assume). Credit has to be given to 3D CAD programs such as form•Z and to their tutorials and help guides for not only aiding in the instruction of the operator but also for addressing the development and understanding of basic formal concepts.

There are educators out there innovating design education techniques, utilizing an immersive approach to teaching basic design using digital media, such as Neander Silva and Ecilamar Lima, faculty of Architecture and Design at the University of Brasilia. Tom Fowler of Cal Polytechnic State teaches his course to students using analog and digital techniques in a rigorous weaving of recursive feedback. His Collaborative Integrative-Interdisciplinary Digital-Design Studio (CIDS) program is highly acclaimed and has been a recipient of an AIA achievement award. The educators reporting in this issue of the Journal and many like them are helping to dispel these assumptions and fears.

Kevin A. Cespedes, Guest Editor: For a photo and a bio of the author, please see page 82.

Tamara Suderman, Assistant to the Guest Editor, also provided input on the current student perspective and intelligence on the digital native. For her photo and bio, see page 117.