Digital Guise: The Ways of Digital Drawing that May Limit Design Creativity

Weiling He
Texas A&M University

Abstract

This is not a paper to criticize using digital media in design studios. On the contrary, the purpose of the paper is to seek to understand how to better use digital media in studios by being aware of and avoiding their misuse. This paper will investigate how certain drawing mechanisms in digital media may potentially limit design creativity. The main medium to be examined is AutoCAD.

Introduction

It is widely acknowledged that drawing is beyond mere post-design representation. Drawing is a design tool and an environment in which designs are formulated. As digital media are gradually becoming indispensable in design studios, more and more students believe that they have found powerful design tools in the digital world. However, as any medium does, digital media set up a boundary within which design processes can be better facilitated and outside which design processes could be hindered. Without the awareness of the potentials and illusions of digital tools, one cannot truly take advantage of digital drawing media.

This paper will use AutoCAD as a case study to investigate fundamental issues of digital media in the context of the initial design stages. We understand that the current trend in the field of architecture is to replace CAD drawing with BIM (Building Information Modeling), which may indicate a different context for the current discussion. However, in this era of transition, understanding what we have done with AutoCAD may provide insights of what we should do with BIM.

What Drawing Advantages Does AutoCAD Bring?

AutoCAD indeed entered the world of architectural design with tremendous advantages. First, precision is pushed to an extreme in AutoCAD. In AutoCAD drawings, one actually draws in precise measurements. Drawings are digitized in vectors but not raster images, which makes it possible to retrieve the precise measurements from a drawing. Therefore, the definition of a shape can be understood as its point of origin and the drawing operations taken from this point. Second, automation is incomparable in AutoCAD. Functions such as "copy" and "array" speed up repetitive drawing actions. These functions apply not only to identical drawing elements but also to similar drawing elements. One may copy a drawing and modify the needed parts to produce a new drawing, which is the third advantage of AutoCAD, modification. Because drawings are done in virtual space no marks of erasure are left. Nor is there any need of tossing away correct drawing parts. An existing drawing can be re-used and given the appearance of a brand new drawing. Finally, 3D modeling speeds up the process of model making and saves physical materials in case of modification. In addition, one can model in absolute precision and in any desired forms.

There is no doubt that the advantages brought by AutoCAD are desirable in the drawing production process. However, there is a big difference between drawing as production and drawing as a design process. Is AutoCAD as handy at the initial stage of a design process? To answer this question, we have to look at the five advantages closely.

Precision versus Vagueness

Often times one uses freehand sketches

to initiate a design. A sketch by its definition is a "rough" drawing. A sketch is also exemplified as an outline, a brief description or a short literary composition. The commonality among these exemplifications is the roughness of a sketch which enables it to catch the chief features of a piece and indicate possibilities for further elaborations.

AutoCAD is designed to be precise. Any shape drawn in AutoCAD has precise geometric traces. This does not mean that one cannot sketch in AutoCAD. One can surely ignore the precise numbers of the X, Y and Z coordination while sketching. However, the appearance of a precisely defined shape contradicts the intention of a rough drawing.

Further, the richness embedded in freehand sketch is missing in an AutoCAD sketch. A straight line by freehand sketching is not only a mark of two endpoints and a connection between them but also, more importantly, an exemplification of other drawing qualities that are derived from how the line is drawn. On many occasions, how the line is drawn is not accidental. It registers the thinking process of the designer. The changing pressure on the pen or pencil, the rhythmic trembling of the hand as well as the effect of how the tip of the pen or pencil smears has the potential for further interpretations in design. In AutoCAD, this thinking process is somehow lost in the drawing process because how a shape is drawn does not lead to different results. No matter how one's hand moves, whether there is a pause, whether the movement is fast or slow, the appearance of the line at the end will not be affected. A line is the shortest connection between two endpoints. Therefore, a line drawn in AutoCAD is a line in mathematics which is uniform to any conditions. It is not, however, an expression of the desire of the designer.

Automation versus Improvisation

Automation in AutoCAD is essentially repetition in ways of identical copying and gradually mathematical transformations. Automation may not be a desirable habit in design although it may fit perfectly the cases of transformations from mathematical rules. As opposed to automation, sketching can be a spontaneous action. While the hand is moving thoughts are rapidly evolving. Sometimes, the hand repeats the former action until the mind has a new intention. Sometimes, the former movement of the hand leads to a new direction of movement. The movements of the hand are not fully controlled or determined, which can neither be achieved by identical copying nor by gradual mathematical transformations. Instead, the ways of drawing remain in a loose state. This is what we call improvisation. Another reason why it can be hard to improvise in AutoCAD is that the medium of AutoCAD distances the involvement of the designer's body, the hand for instance, in the sketching process. As a result, the weight of initiating thoughts is loaded solely on the mind. The action of drawing becomes a representation of what the mind tells. "Accidents" that may lead to improvisation are less likely to happen.

Modification versus Variation

Both modification and variation start from an original piece. The difference is that the former works within the boundary of the original piece while the latter works outside the boundary of the original piece. For example, Frank Lloyd Wright modifies the floor plan of the Robie House in order to refine the design of it. Variation happens when he intends a series of houses, the Prairie Houses for example, and has a motif that works across individual cases of the series. Therefore, the boundary of the series is not set by the Robie House

or any individual house but by the motif of Prairie Houses. In modification, the designer usually has an instrumental goal to achieve. For example, the Robie House needs to be modified to increase the dining area. In order to achieve this goal, the designer has to stretch the floor plan or probably change the shape of the dining area. In variation, the goal is much less instrumental. The Prairie Houses are similar to each other, but each house is an individual design instead of a modified version of an existing one. To put it simply, in the case of modification, the existing form is important to the modified version. In the case of variation, the existing form is not important while the intention of the series is.

In AutoCAD the various 2D and 3D modification tools are designed to use the existing shapes in order to create new ones. However, in the case of initiating a new design with a motif, modification tools may imply too much importance for the existing shapes and draw the designer back to the original design rather than helping him or her to achieve a newer design rather than a modified version of the old one. Therefore, although AutoCAD is capable to facilitate both modification and variation, modification becomes habitual to many CAD users.

3D Modeling versus Physical Modeling

3D views generated from computer models and animations help designers to visualize accurately aspects of spatial experience. However, the modeling itself can be questionable in a few cases.

The Faux-three-dimensionality

Extrusion is a convenient tool among new AutoCAD users to fulfill a 3D dream. It is quite exciting to see a shape become a volume. However, does extrusion truly create three-dimensionality? In most cases, extrusion is derived from a 2D shape. The variable of extrusion is the height of extrusion. The direction of extrusion is perpendicular to the base shape. Therefore, all sections parallel to the base shape are the same as the base shape. The 3D volume created from extrusion is a 2D shape with a thickness. Strictly speaking, this kind of 3D volume still embeds certain 2D characteristics in that the changes of form only happen in the X and Y axis but not in the Z, supposing that Z is the direction of extrusion. True three-dimensionality should embed variations in more than two dimensions, which cannot be fully illustrated by a volume that is a result of the extrusion from a 2D shape. Therefore, certain convenient 3D modeling commands, such as extrusion, can mislead students from truly understanding what three-dimensionality is. Especially for foundation year students, whose 3D consciousness is not developed enough to take control of drawing tools, it is usually the case that their design orientations are prone to be driven by the convenience of drawing tools.

Virtual Space versus Physical Space

The major conflict between computer modeling and architectural design is the issue of gravity and materiality. Virtual space defies gravity. Therefore, a mathematically ideal form makes perfect sense in virtual space. This is not the case in physical space where architecture exists. In the physical world, loads not only determine the thickness of architectural elements but also cause deformation of these elements. An architectural form is not abstract as is the ideal geometry. It has to be able to stand. Therefore, it is a great danger if the foundation architectural education starts from computer models.

The issue of materiality, which is critical in architecture, is easily overlooked in

computer modeling. AutoCAD modeling enables far more complicated forms than physical modeling can achieve. One is almost able to model any forms as he or she can imagine. However, these fancy forms are not made of materials but vertexes and surfaces. In the virtual space, there is no joint problem. One element is connected to the other if their vertexes coincide. In the physical world, an architect has to consider not only how one element meets the other but also how strong this connection is to stand the pressure and tension from the system. Therefore, a joint drawn in virtual space is a representation of a joint. No physical feasibility is tested. This is not the case in a sketch model, which even when made in cardboard may demonstrate issues of physical feasibility, especially when glue is not allowed. Making a sketch model is at the same time experimenting in the context of gravity and materiality. It is a design process instead of a post-design representation.

Conclusion

Observations made in this paper bring to our attention the issue of how to introduce digital media in design studios. We should all be persuaded by now that any drawing medium, digital or free-hand, suggests and facilitates certain ways of design thinking. Habitual operations in AutoCAD may not suit the goal of design, especially in the initial stages of design.

The above discussions on precision, automation, modification, 3D modeling and organization are in fact about the issue of efficiency. There is no doubt that computer drawing and modeling can be efficient. However, there is a difference between drawing efficiency and thinking efficiency.

The efficiency of computer drawing and modeling relies heavily on the automation of repetitive actions, such as "copy" and "array," or actions of regularities, such as "rotate" and "scale." However, at the early stage of a design process, repetitiveness and regularity may not be necessary unless the designer thinks in repetitive terms. When it comes to non-repetitive actions, drawing speed in AutoCAD may slow down thinking speed. The clicks on the mouse cannot catch up with the movement of a sketching hand, let alone the fast revolving mind. However, the mind needs feedback from drawing in order to produce more thoughts. If one cannot draw fast enough, his or her thinking speed will be dragged down. Further, drawing in AutoCAD is clearly a synchronic process while thinking may be a diachronic process. Drawing speed becomes a crucial issue to be able to achieve a quasi-diachronic state.

No one would deny that the design process replies on the intensive collaboration between hands and mind in a swift speed. In the case of making a sketch model, the hands' rotating elements, tearing pieces and cutting out parts, are always in an evolving mode. Nothing is fixed so that nothing is precise. To look at the model, one only needs to hold and rotate it. The coordination between the head, the eyes and the hands makes a synthetic viewing of the object. Everything happens quickly. In the case of computer modeling, the coordination of the body becomes the control of the hands hitting the keyboard and clicking the mouse. The viewing becomes distanced and hence slower to stimulate the mind. Therefore, the efficiency provided by AutoCAD is geared towards drawing efficiency but not necessarily thinking efficiency.

It is critical that one realizes the hidden dangers of operations in AutoCAD that we take for granted. Any software can be used wisely or misleadingly. The user has to

consciously operate the software in order to achieve design goals instead of being controlled by the drawing commands and slipping into the drawing production phase too early. It is also critical for us as instructors to be sensitive enough of the ways of digital drawing that may limit design creativity.