The Language of Drawing

Chapter 10:

What's Next

In the Language of Drafting, you have examined aspects of making an individual part drawing and have repeatedly practiced the skills that enable you to a make a drawing project quickly. Although the engineering drawing is the primary product coming out of the modern Architectural and Manufacturing firms, companies have and are in process of moving towards the world of three-dimensional designs. The advantage of 3D over the 2D technique is largely that in the past, the intent would be to build a prototype or scaled model of the project to discover any mechanical problems such as interference to fitting parts or an artistic flaw such as texture, curvature or color. With the present software engines like AutoCAD, Microstation, Pro Engineer, Solid Works and CATIA, specialist are making 3D parts and assemblies that allow them to scrutinize in very close detail whether they meet the customer's specification. For the professional of the 21st century, 3D design will be the cornerstone to laying a successful foundation in the innovative process.

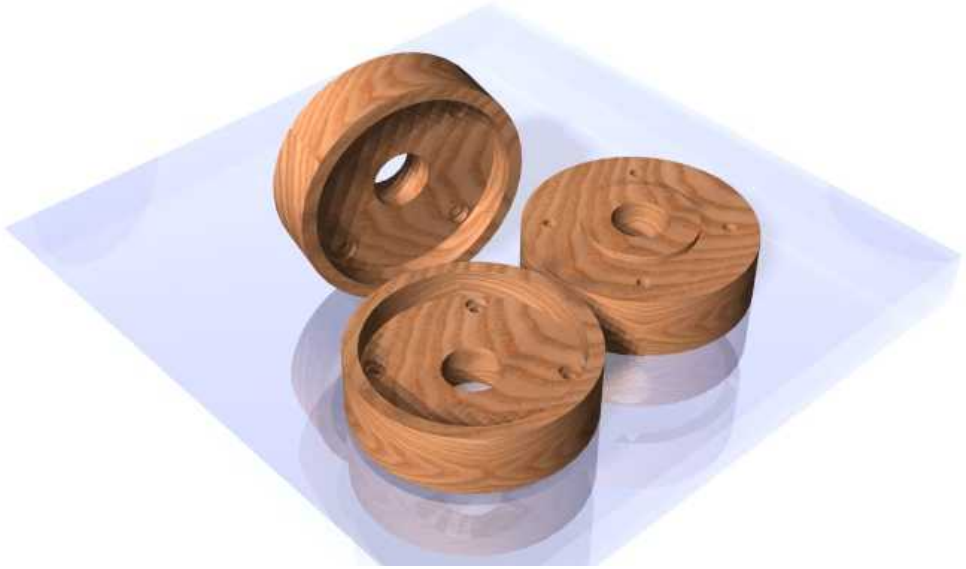

Figure 10.1 – A Marketing Image of a Simple Three Dimensional Part

While the Rectangular, Circular and Bracket problems in the Fundamentals of 2D Drawing pushed you both physically and mentally to create orthographic views of an actual part in the shortest period of time, the number of lines, arcs, circles and text phrases allow for a percentage of error in the result. The difficulty is retaining accuracy from the first view to the second and maybe a third perspective. In a two-dimensional drawing, every entity is a creation of the CAD drafter's ability to use the drawing tools or by modifying an existing object. This creates many opportunities to bring error into your work, since the drawing will contain hundreds of entities and just using a small percentage in the calculation, there may be ten to twenty mistakes in a single drawing just from human error. Since the late 19th century, engineering personnel using orthographic drawings have been responsible for allowing more individuals to participate in the industrial and construction process. In the last hundred years, this common language of engineering allowed every level of skilled technician to participate, where in the past the design process was privy just to the master artisan. You could say that the strategic use of placing lines, arcs, circles and dimensions on the x and y-axis is responsible for highly accurate parts and assemblies that can be repeated nearly perfectly in the manufacturing process.

Figure 10.2 – A Marketing Image of a Simple Three Dimensional Assembly

Although the success of the orthographic presentation in Computer-Aided Design process has been monumental, few individuals in the overall population can read a blueprint intelligently. The equalizer in the industry today, which will allow every member of an organization to participate in viewing technical documents, is the introduction of 3D software packages, the amount of Architectural and Engineering companies using 3D presentations and the push in the multimedia industry for 3D graphics. For example, at a local town meeting where an architect presents a new recreational facility, the viewing screen can show a computer model of the pool with life size human figures in the water. Meeting rooms can illustrate simulated session in progress, restroom facilities with a handicap patron at the sink and a weight room displaying each station for exercise and stretching. Seeing the view outside the building, each person in the audience can see a lighted parking lot with small, medium and large size automobiles to examine flow control and safety. The professional host shows every corner of the facility displaying an infinite number of different viewpoints to the public. Every citizen of that locality is able to comment not just on the square footage of the rooms, but be able to see the structure before construction, making the prospect of fund raising easier, and to promote interest

among the athletically inclined residents of the community. Three-dimensional models are much more effective in communicating the final product, where the old orthographic drawings concentrate on technical construction aspects of the job. As the number of specifications calling for truly pure 3D designs, the amount of companies using 3D systems will evolve leaving the 2D orthographic views in the past.

By the mid 1990's, Autodesk was writing software that really could draw virtual boxes, spheres, cylinders, cones along with extrusion and revolutions. The initial attempts to create three-dimensional solids with the early tools provided prove to be difficult. More tools and features were added over time to make the CAD operator more efficient when creating three-dimensional parts. Whether in training or in on the job application, managers of architectural and engineering departments discover that the limitation is not in the software package, but in the ability of their designers, architects and engineers to think three dimensionally.

You will soon learn that the CAD software is not the key element that needs work in converting a department from two-dimensional drawing to making virtual 3D assemblies. The process of taking information from the space where you live and converting the data to a flat piece of paper is done daily throughout the world. Because of both training and economics, teachers instruct young people to manage their information two-dimensionally at an early age. What kind of problems does that pose for training?

The student of three-dimensional graphics will need to think in real world spatial form instead of converting the information to a flat representation. Model Space becomes the realm where the individual part resides and Paper Space is the region for two-dimensional translation. The information that you see in Paper Space is automatically computed from the Model Space area. Presently, most companies do not have this capability, since they take their ideas and place them in a plane. Only through a systematic training program do architects, designers and engineers make the leap to the 3D province.

The World Class CAD method of training 3D computer aided design is accredited by the hundreds of successful students, who after completing the exercises to standard, have gone on to be thriving designers at their companies utilizing a more advanced skill. The graduates of this text can communicate effectively showing their ideas to anybody at a design review using the 3D images or models created

from them. For the other professionals in their office, Either they have had no exposure to 3D training or what training they had was very limited.

Step	Task	Problems
1	Basic Solids	10
2	Basic Revolutions	3
3	3D to 2D Conversion	13
4	3D Assembly	1

The first step in the process is to learn the basic building blocks such as Box and Cylinder. You will expand your knowledge throughout the fundamental instruction to include tools such as Wedge and Sphere. The problems will use editing tools to add or remove shapes using Union and Subtract Boolean commands. You can generate fine details using the Extrude, Fillet and Chamfer tools. By the time you reach the conclusion of the opening set of exercises in the Fundamentals of 3D Drawing, you will be somewhat knowledgeable in 3D part generation.

The second level is to learn revolutions where a closed Polyline detail can be rotated axially resulting in an even more complex circular solid. You draw a closed two-dimensional detail in Model Space, convert the feature to a Polyline and using Revolve the sectional outline is rotated any number of degrees to gain the desired part.

To make the orthographic drawing in Paper Space, you can use the Mview or Tenview tools. Many companies that wish to have a true 2D drawing with individual lines, circles and arcs will use the Tenview tool. Tenview creates Front, Top, Bottom, Right, Left and Back orthographic observations. The other four views are the northeast, northwest, southeast and southwest isometric views. The multiple view command "Mview" will do the same set of perspectives and even more. Both approaches have their positive and negative attributes.

The final and fourth step is learning how to use the XREF system to make a simple assembly drawing. The XREF structure makes AutoCAD a very powerful tool and you can make any orthographic drawing using the assembly version of Tenview or the AutoCAD Mview command.
After completing a solid, checking the form, fit and function in the virtual 3D

assembly, most designers will go ahead and make an orthographic layout of each part, dimensioning and noting the drawing. In AutoCAD, the Paper Space region of the software application is the section to do the 2D translation of the 3D entity. In Figure 10.3, you can see a drawing that has every component required to release the document to production. A drawing border, views, dimensions and notes. You need to do this step for each solid drawn in steps one and two of the 3D process. You should have the skill to draw any solid part, translate the data to Paper Space for 2D documentation, and be prepared to use the parts in an assembly drawing using the XREF system.

By the time you finish the last drawing in the Fundamentals of 3D Drawing, you should have the skill to draw any solid part, translate the data to Paper Space for 2D documentation, and be prepared to use the parts in an assembly drawing using the XREF system.

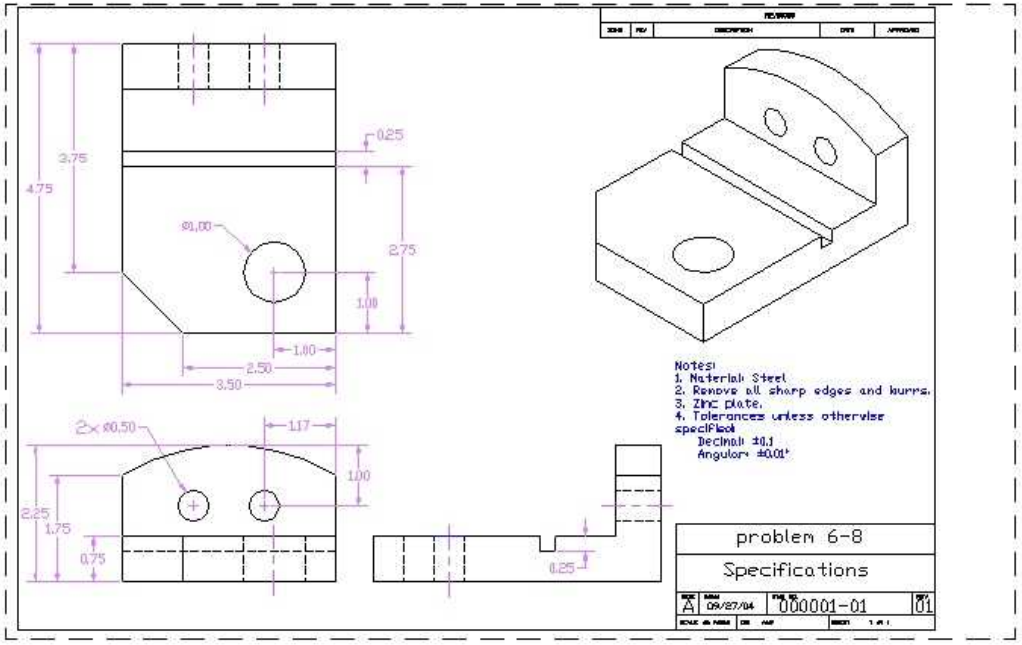

Figure 10.3 – A Sample Orthographic Drawing made from a 3D Part

The last phase of the training involves making simple assemblies for relatively simple part drawings. Your first XREF assembly will be the footstool shown in Figure 10.4.

Students and professionals are amazed at the clarity of the marketing images made for the assembly, the ease of documenting each of the solid parts and orthographic drawings, and the effortlessness of making 3D assembly drawings.

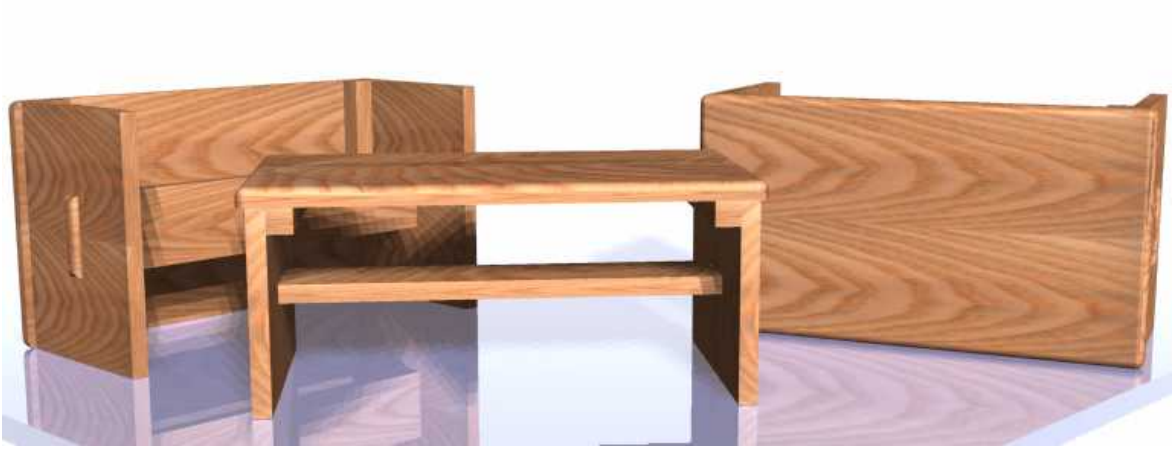

Figure 10.4 – A Marketing Image of your First Simple Three Dimensional Assembly

When you first start 3D training, like most technicians, the concept of creating artful designs is usually not considered. As people learn to add material, light and rendering to their components in the computer file, the virtual compilation of parts become much more than an architectural or engineering drawing. You can show the actual device to a supervisor or customer. When a person learns the material in the Fundamentals of 3D Drawing textbook, they find the experience results in faster drawings, fewer mistakes in the assembly of the components and the assembly technicians or customer know what to expect with the completed product.

So as we move towards 3D drawing, relax, since as in previous World Class CAD training, you do not have to learn every tool on each new toolbars to create entire series of three-dimensional solids, but you do need to learn the basic primitive solid commands, and the modification tools to create 90% of all the parts that workers manufacture or construct in the industrial world.

If you need to re-read the ten principles and the reason they exist from the first two books, go ahead. The World Class CAD training method has no parallel from any series of instructional booklets in use today. This is modern schooling, like being a

pilot of a design computer. Having the 2D, 3D and programming capabilities to provide fast, accurate and visual solutions to anyone. Thousands of designers know these principles, not from memorization, but because the exercises in the World Class CAD training series have them built in.

The World Class CAD system of learning integrates the following ten principles:

1. Mastering a single tool or concept in conjunction with a believable drawing or problem
2. Grouping a single tool or concept together in logical sequences for like problems
3. Using training material where repetition and coaching improves drawing techniques and therefore quality
4. Using video gaming techniques of passing through levels or gates before learning new tools
5. Adding competition among the students to challenge them to the next level
6. Returning to a basic tool or concept that is now visually understood at a later time to add complexity
7. Guaranteeing success in like problems when finishing a training problem
8. Guaranteeing drawing speed that are a fraction of those trained by other methods
9. A high percentage of individuals (85%) that are able to achieve the World Class CAD standard
10. Provides continual training throughout one's career

As in your previous computer aided design work, the concept of video gaming involves mastering basic techniques in order to advance ahead in the quest to capture a prize and win the match. In everyone's favorite game, Pong, one must master the art of deflecting the pong ball in such a way so that the computer foe is unable to rebound the ball. As the game goes on, the computer is able to move faster, so that one must make increasingly difficult deflections to defeat the level. World Class CAD periodically employs the same concept in the form of Challenges. These "tests of skill" encourage the student to accomplish a sequence of related tasks consistently in a specified period of time.
Your results of the World Class CAD Challenge located at the end of a unit can be compared to other students and professionals' scores by posting them on the World Class CAD website. Drawing times and a copy of the computer file need to be

submitted to the World Class CAD team. Your editing time and amount of errors will be calculated, and then the time and score will be posted on the Units' Results webpage. Having the ability to see your name, organization such as school or company, your score and time will allow anyone to place themselves among the world ranking of CAD drafters, designers and degreed professionals.

Figure 10.5 – A Marketing Image of a Complex Three Dimensional Assembly to Come

The next few texts to look forward to are:

Book	Name of Manual	Time to learn
1	A Complete Introduction to Computer Aided Design (CAD)	10 weeks
2	Fundamental of 2D Drawing	10 weeks
3	Fundamental of 3D Drawing	10 weeks
4	Visual AutoLISP Training Method	10 weeks
5	Visual Basic Applications for AutoCAD	10 weeks

* World Class CAD Challenge 01-00 * - Complete this textbook in 40 hours of classroom training.