Computer Aided Design

Hamden, a Poole based company has a range of customers. It produces commissioned machines that go into the production line of other companies. These machines are used to coat meat or to put a glaze on products. The machines are also used to decorate biscuits and snacks.

When producing one off specialist items, there can be greater problems in the design and manufacture as all products are created to 2D drawings. The potential for error can occur at all stages especially when modifications are made in line.

The software they use creates a 3D view of the item to be made and this visualisation can help enormously. It allows the production staff to have a clear understanding of what they are producing and it enables them to investigate problem areas before manufacture begins.

As specific one off machines, the aesthetic element may not be as important as the functionality of the machine but the true saving comes in the use of material.

The software can provide the manufacturer with a 3D visualisation of the product as well as 2D elevations that gives the dimensions that the material need to be cut to. This reduces error and aids precision. The pattern to work from is created by the software where previously this was made by the workforce.

The system also detects clashes where two parts when brought into the final product touch or will not fit next to each other. This is a real problem with 2D dimensional drawings, as it cannot be seen often until the item is realised. By creating a 3D model and rotating the view, you can spot the problem areas and investigated further by enlarging the view and amend the design if need be before committing to production.

Any amendments to the original design can affect the many different parts of the final realisation. When making amendments, the software takes into consideration the other aspects that may be affected by the change and amends these also to compensate for them. So by using the inbuilt data management tools changes can be implemented efficiently and easily

So why is 3D so important.
- A 3D drawing is more comprehensible than a 2D drawing
- 2D designs are open to possibly irreversible and costly misinterpretation. That is why when most people sketch we do it in 3D.
- 2D drawings are very difficult to understand. The first time you can see a product is at the prototype stage.
- It all adds up to more cost and more delays before a design can be put into production.
- Money spent of tooling a production line and manufacturing set-up may be wasted if it has been based on a 2D drawing. The resultant rework could make the crucial difference between meeting or missing a deadline, resulting lost business and more frustration.
- Experienced engineers can "see" in 2D but for most people especially customers, a 3D view makes all the difference.

So, 3D helps you to:
- Evaluate and validate more design options more quickly
- Take into account the needs of everyone involved in the product lifecycle right from the outset.
- Prove and improve designs before committing to irreversible expenditure on manufacturing set-up, materials and processes.
- Improve the communication and understanding of design teams inside and outside the organisation.
- Obtain customer feedback and comment without having to produce costly prototypes.

So the software can help technical and sales staff by giving the an insight. This promotes a real understanding of customer needs and the product specification. The customer can see clearly their product and adjust and amend the design at its earliest stage allowing close involvement in the initial design. The customer may not be able to visualise a 2D drawing but when the 3rd dimension is introduced they can clearly see whether their ideas have been materialised. It reduces the wastage of time in developing unwanted prototypes and focuses the design process.

Layers

Complex structures such as buildings or cars can be designed using layers. A layer is similar to and acetate sheet on an overhead projector. Different layers are used for different aspects of the design. In a car, one layer will have the details of the transmission, another the electrics and a third will show the engine perhaps. Architectural drawings have the electric circuitry on one level, the plumbing on

another and the central heating on the third. An architect overseeing the design and construction can ensure that all the aspects will go together and fit within the structure. In a car design, the different layers can be switched on and off and then you can build up the various aspects of the final design. Specialists can also be brought in to deal with their specialist area. Layers are put over each other and make it simpler to design in the first place and, by looking then at all layers, clashes can be avoided.

Product Design
The time taken from design to production is reduced by the use of CAD/Cam. With this reduction in production time, it now becomes possible to shorten the shelf life of a product. As the production time comes down so the latest design is being constantly changed and evolved, a newer product is always on its way to the shop.

Not only does the software allow use to amend a product easily and quickly but it also reacts to the changes in the design by adjusting the production line to accommodate these adjustments. This is the merging of CAD/CAM. The product designed is produced without anyone in between.

Architectural Design
Visualisation is a very important aspect of architectural work. In bespoke designs, the commissioning customer can have a look around the design of their new house long before it has been built. They can tour the house looking out of the windows and studying the bedrooms and kitchen. You can

scrutinize the building from the outside in any direction at any aspect, again proving the worth of the visualisation of the building. You can change certain features such as the time of day and whether it is fine weather or not. You can add the snow or let it rain on your design.

Mathematically, the design is also safe as all the load bearings and such are taken into consideration. Such matters as the factors of safety can be taken into consideration and you can also ensure that your design for roof trusses will be strong enough and also allow you to have a room in the attic.

Clip Art Libraries.

When we think of clipart we tend to think of the a picture on a page to make some work look more interesting. Clipart in the architectural sense can be drawings that are in the correct perspective so as to add realism to a drawing. Cars can be added, people and trees also all the correct size to dramatise the drawing. It allows you to have more of a feel for the final design in situ.

The inside design can also be helped with the use of clipart so that it is easier to show in a kitchen where the cooker, sink and fridge are. When the drawing is then projected in the 3D it puts in the relevant detail.

Though this can be just to make the drawing look more real it is also possible to use clipart in the drawing to replicate the items that your can easily get a hold on. Windows for example can be selected from designs that are already is stock and can be incorporated into the final design. This cuts

the costs of the final design if these items are easily obtainable.

The use of a clipart library can greatly speed up designs of a range of items. Think of how the development of electric circuitry can be speeded up. Using a library of transistors and switches, circuits can be designed and tested to destruction long before they are made. By using standard produced products, costs can be kept down and new products can be tested long before they are made. The software can also measure the electrical inputs and outputs to ensure that they are up for the job.

As well as the use of clipart libraries, which can be bought as packages to go with your graphics package, textures can be changed in a drawing to replicate the use of different materials. When designing a kitchen, you can change the materials and see what effect that will have on your design. Your kitchen design can change from a very modernist view to a rustic Mediterranean feel by pressing a button. The worktops are changed and any of many standard textiles can be used for the curtains.

As well as changing the appearance of the kitchen, you can also take into account the cost of these changes. The software will forecast the amount of material that you need and predict from there the cost of the kitchen you are designing. You can keep an eye of the price as well as the looks of the kitchen.

The clipart library is a tool that quickens the design process and speeds realisation. New ideas are where whole buildings are put together on a module basis so that you can put a

chosen design together with a chosen bedroom module to create your dream homes.

Garden Design

When planting it is hard to imagine what your garden will look in a few weeks, months or even years. Garden design software can generate prediction of plantings. Using the principle of clipart to drag and drop plants in the correct place you can see how they will look in the coming months or the next 2,5 or 10 years.

Fashion Design

All people are different. Fashion asides, we all want to wear different clothes but look a lot the same. Fashion has not fallen behind in the use of computers.

Whole 3D body scans have been used to create and store the European Sizing Information Infrastructure (ESII) These will contribute to the EAD (European Anthropometric Database) which will with advanced 3D body shape analysis tools survey what we look like and how big or small we are. This then sets the sizes for extra small, small, medium, large and extra large sizes making sure that what we buy will fit.

3D body scanning is seen as the way forward. Using CAD/CAM technologies, you can scan somebody and then produce clothes that will fit the exactly. Virtual Reality Modelling Language (VRML) needs the input of your sizes (or dimensions) and then produce the clothes. Your body would be scanned and your size would be put into a credit card type information chip. You can then have a model generated to your dimensions and have them model clothes that you might like to see what they look like. The model would of course be interactive so you would be able to walk down a virtual catwalk to model your next suit. This then becomes the Virtual Fitting Room where you can have a Virtual Try On.

With this type of information being stored on your card, you would be able to choose your clothes over the Internet, the clothes being made anywhere in the world and shipped to you. CAD/CAM Machines would produce clothes that would fit you and you alone.

How We Work

The design of component, products and buildings are all global issues now as companies get bigger and bigger. The London Eye project brought together the finest structural engineers in the world to work on this innovative structure. They had to have the best people to contribute to this project and to complete the work.

It was by videoconferencing that this team came together. It ensured that though the team were spread around the world they would meet and communicate via the computers and web cams to discuss the way that the work was developing. The involvement of such a high profile team guaranteed that the cutting edge technology and the expertise needed was on hand to complete the task. The physical need to cross the world became unnecessary.

Devices for Input and Output.

Specialist input and output devices including graphics tablets allowing the designer to draw on screen in a suitable package. It gives a more fluid feeling to drawing lines.

Such graphics packages especially when the drawing is large take a lot of processing power. The speed of the processor is of vital importance if it is going to cope with the needs of re-rendering after changing textures for example. The quickest processors available need to be used here along with computers with over a Gb of RAM.

Output systems can be almost any type of machine be it a lathe, router, drill or miller. Some machines are designed and built to do specific work such as those in the start of this chapter used to coat food.

Plotters are used for hard copies of drawings and they can be either flatbeds where the paper is moved for the lines to be drawn.

Bitmap or Vector

Vector drawings are saved by a series of instructions. Bitmaps are the position and colour of pixels on screen, Vector drawings have the ability to be changed at a later stage so that they give more flexibility and can be amend easier. Bitmaps do not have that ability.

And Finally

InPart is a Internet based company which supplies drawings of different components to designers so that they can include them in their designs. These may be bearings, hoses, gears, actuators, pumps or fittings for example and they are supplied from multiple companies. If you want a particular part, you can use the website to locate the exact time you require and then download the details and the drawing off the website. It costs $1000 for this facility on a yearly basis.
Parts suppliers pay $20 000 to be listed on the web site.
Design Suite, the software that has been created to run the website has 200 000 different parts on it and that number is being constantly being expanded. So instead of thumbing through catalogues, engineers can scan the website, cutting down research costs and speeding up the production process. It has also made its innovative owners a certain amount of wealth.