


LogiCAD
Leonardo da Vinci Project

BACKGROUND TO CAD TECHNOLOGY

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Seminar on Understanding & Exploiting CAD for Logistics,
Malta, Jan'14



MALTA BRANCH – IED



A local branch of the *Institution of Engineering Designers (IED)*, UK

Our mission statement:

“to promote the aims and activities of the Institution of Engineering Designers (UK) as well as to develop the design profession in Malta.”

We organise a number of technical events incl. public lectures, design competitions and industrial visits

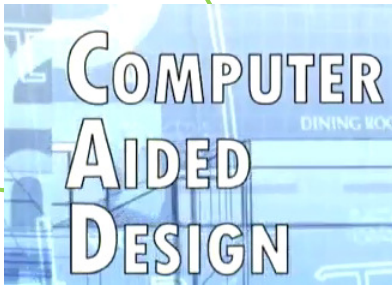


PRESENTATION OUTLINE

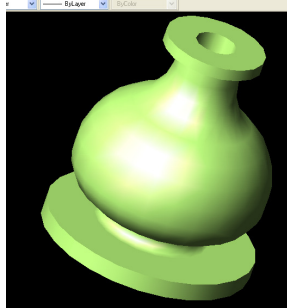
- What is CAD Technology?
- 2D Modelling
- 3D Modelling
- Benefits of CAD
- Recent Developments
- Conclusions

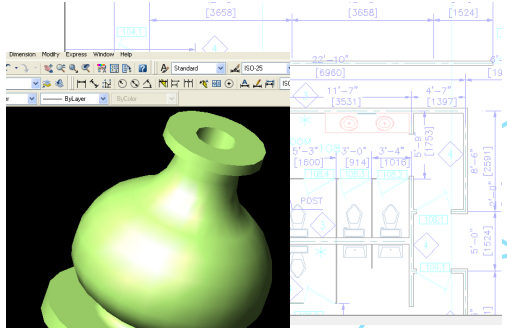
WHAT IS CAD TECHNOLOGY?

- *Computer-aided design (CAD)* is the use of computer technology to aid in the design and in the generation of two-dimensional (2D) drawings and three-dimensional (3D) models of a component or product



**COMPUTER
AIDED
DESIGN**

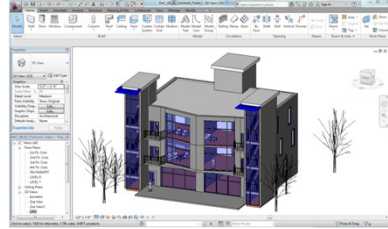




<http://www.youtube.com/watch?v=LPTje97q5hk>

WHAT IS CAD TECHNOLOGY?

- ▶ CAD technology has nowadays become part and parcel of a design activity in a range of sectors including:
 - product design
 - interior design
 - architecture
 - production layout...just to mention but a few.



Source: www.directindustry.com

PRESENTATION OUTLINE

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TWO-DIMENSIONAL MODELLING

- o CAD can be used to create 2D shapes in, say, the xy plane using simple drawing entities (e.g. lines, arcs and circles)
- o We can also modify 2D shapes by applying basic modify commands such as mirror, etc.
- o Dimensions can also be added

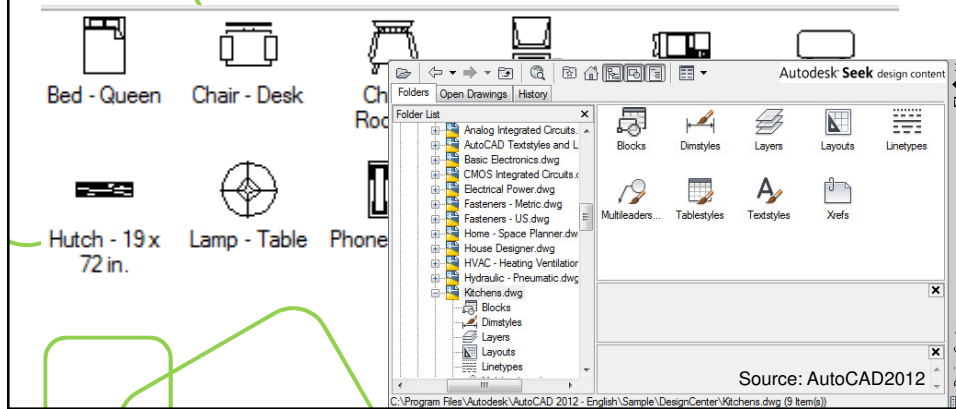
TWO-DIMENSIONAL MODELLING

- o 2D drawings can get quite complex (e.g. a plan of a building containing electrical and water services, furniture etc.)...
- o CAD software allows to manipulate *layers*. Layers can be perceived as computer based transparent overlays (or transparent papers)
- o Each layer contains specific information such as plumbing, electrical, HVAC, furniture etc.

Source: Gladfelter, AutoCAD2012

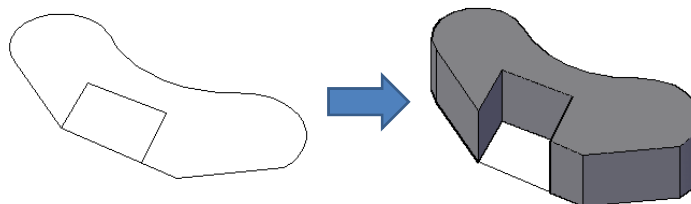
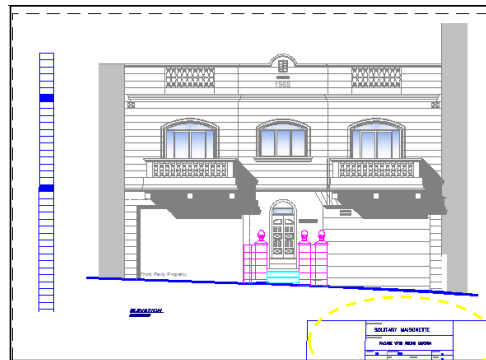
TWO-DIMENSIONAL MODELLING

- o To facilitate the rapid generation of 2D plan layouts, we can insert symbols representing 3D entities (e.g. office furniture, etc.)
- o CAD packages have libraries of such '2D blocks'



TWO-DIMENSIONAL MODELLING

- o CAD software allows us to insert standard title blocks in 2D drawings
- o CAD also allows you to scale and hence to accurately plot your 2D drawing
- o 2D shapes can be used to generate 3D models...

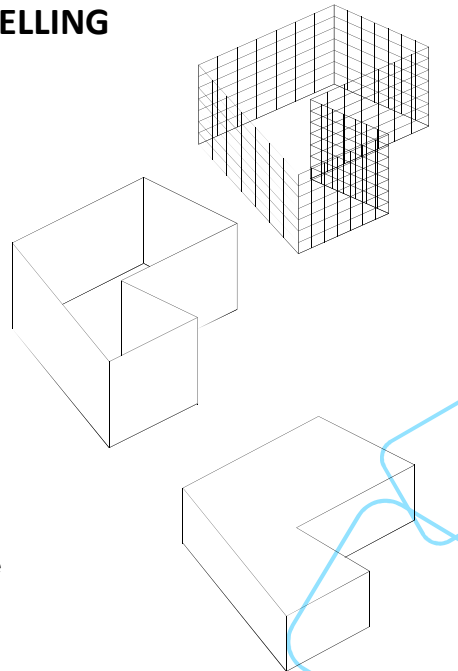


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THREE-DIMENSIONAL MODELLING

- There are three main types of 3D models:
 - *Wireframe* (made up of vertices & edges)
 - *Surface* (represent the boundary of the object, not its volume – analogy: thin eggshell).
 - *Solid* (represent the volume of the object)



THREE-DIMENSIONAL MODELLING

- o Many 3D geometries have a common 2D cross-section on which a 3D operation has been applied
- o How we can convert 2D shapes into 3D entities?
- o We have already seen how we can transform a simple 2D polyline to a 3D entity
- o Basic 3D modelling commands (e.g. *extrude*, *sweep*, *loft*), which are commonly found in commercial CAD packages, allow use to create a wide range of 3D models

www.houzz.com

www.jdonovanandson.co.uk

THREE-DIMENSIONAL MODELLING

- o There are various ways of obtaining a 3D CAD model from a 2D profile, e.g.:
 - o revolving profile around an axis
 - o Extruding profile along a height
 - o Sweeping profile along

THREE-DIMENSIONAL MODELLING


- Other advanced 3D operations are available such as *loft*. There are different options of how 3D models can be created with loft:
 - lofting using cross-sections only*
 - lofting using guides*

THREE-DIMENSIONAL MODELLING


- In addition, 3D primitives (e.g. sphere, cone, cylinder etc.) can be used to build 3D CAD models
- Such primitives can be combined to form complex 3D CAD models

THREE-DIMENSIONAL MODELLING


- Boolean operations are applied on 3D primitives in order to create one CAD model. These are *union*, *subtract* and *intersect*.
- The order of applying such operations makes a difference:



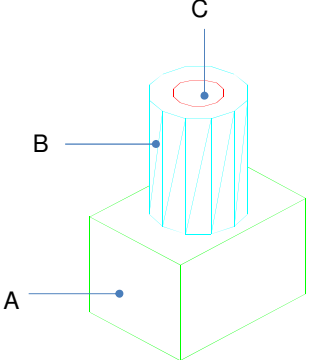
Union



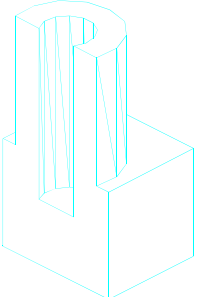
Subtract



Intersect



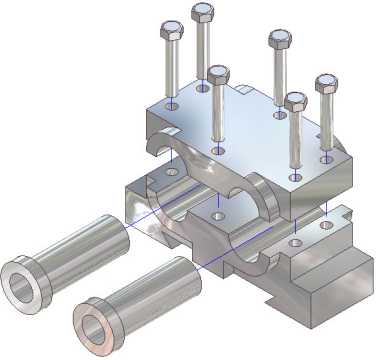
(A + B) - C

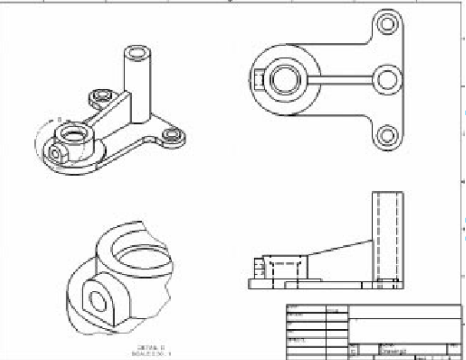


(B - C) + A

THREE-DIMENSIONAL MODELLING

- Assembly of components is also possible
- Another important facility is that from a 3D CAD model you can *directly* obtain orthographic views (e.g. front, side and plan elevations) and much more...

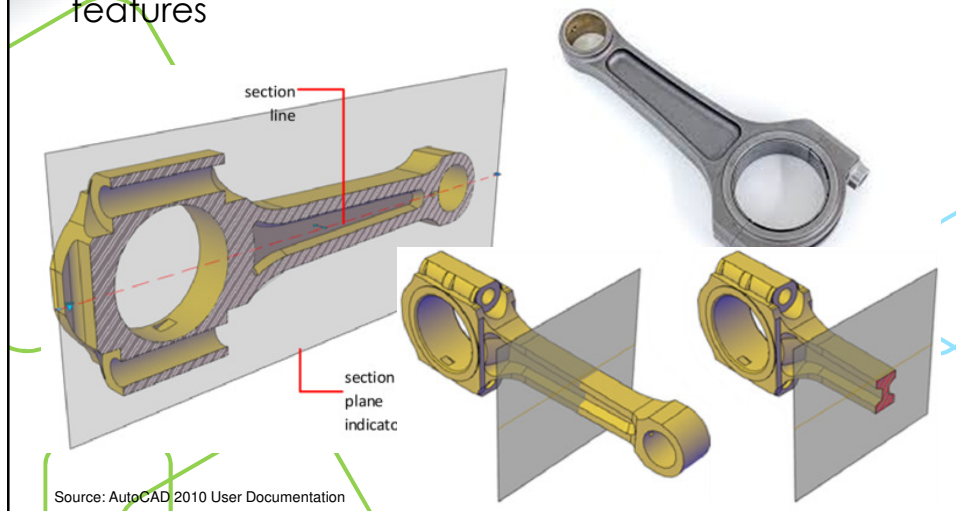




Source: Tickoo, 2011

THREE-DIMENSIONAL MODELLING

- We can also create cross-sections through a 3D CAD model in order to illustrate/visualize hidden features

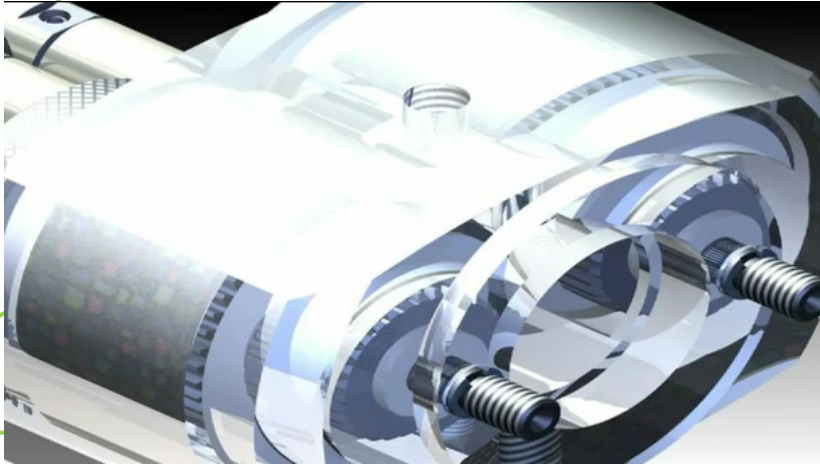


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BENEFITS OF CAD

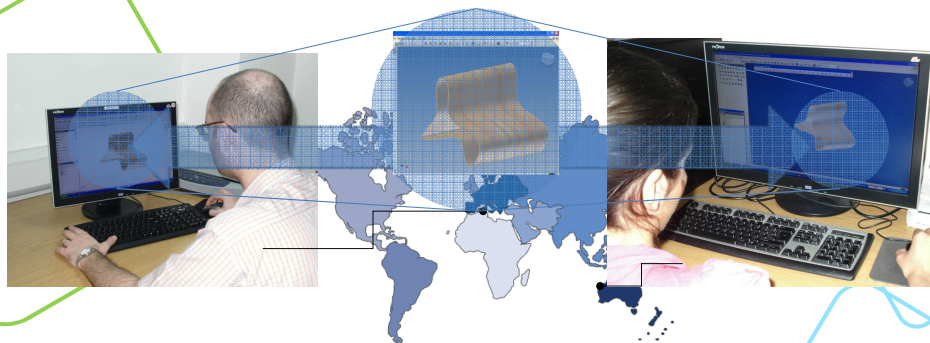
- CAD virtual models can be rendered statically and dynamically to mimic physical artefacts



Source: <http://www.youtube.com/watch?v=zvowrFhaEdk>

BENEFITS OF CAD


- CAD models can be shared and modified in real-time by relevant stakeholders situated in two or more remote locations



- => shorter product development time, improved communication, hence improved product performance metrics (i.e. cost, time & quality)

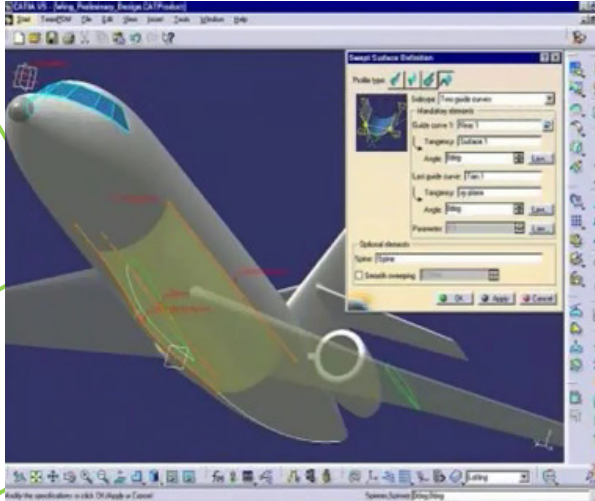
BENEFITS OF CAD

- 3D models can be exploited by other technologies such as:
 - Additive Manufacturing
 - Computer-Aided Manufacturing
 - FEA & CFD
 - Production layout
 - etc...



BENEFITS OF CAD

- Typical applications of CAD models:



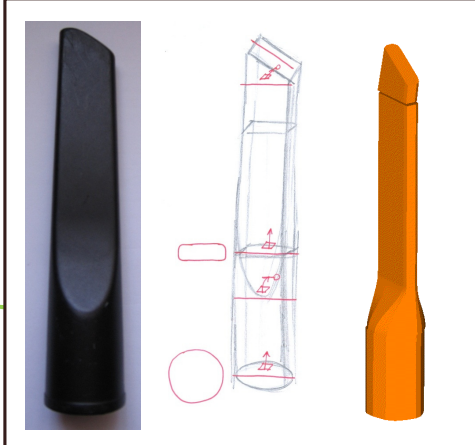
Source: <http://www.youtube.com/watch?v=Fyd8ld2s76A>

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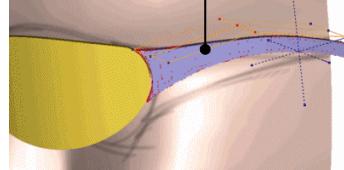
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RECENT DEVELOPMENTS

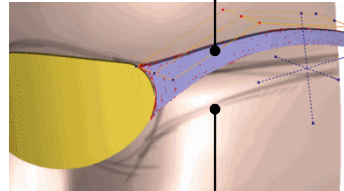
- Development in the user-interface of CAD systems, such that it becomes more natural and intuitive, by integrating sketching



Form concept 1



Form concept 2

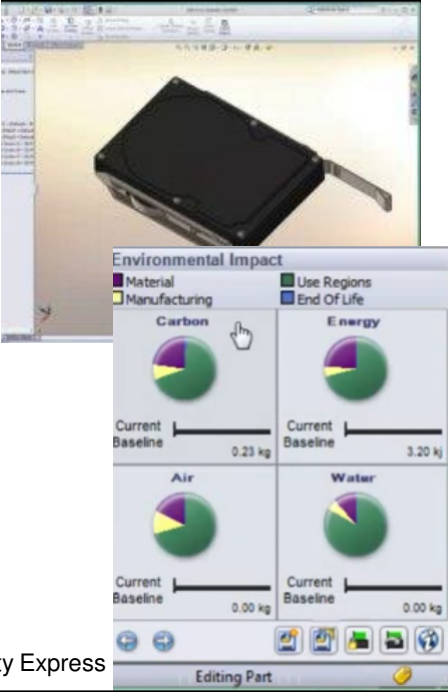


Sketch strokes on 3D model

Source: PTC/S, PRO/Concept

RECENT DEVELOPMENTS

- o Development of *Knowledge Intensive* CAD applications...
- o ...e.g. guiding the designer to take appropriate decisions on the evolving model to eliminate problems later on during the manufacturing phase, impact on the environment etc.




The screenshot shows the SolidWorks Sustainability Express interface. At the top, there is a 3D model of a black electronic device. Below it, the 'Environmental Impact' panel is visible, featuring four pie charts and sliders for Carbon, Energy, Air, and Water. The Carbon chart shows a 'Current Baseline' of 0.23 kg. The Energy chart shows a 'Current Baseline' of 3.20 kJ. The Air and Water charts show 'Current Baseline' values of 0.00 kg. The interface also includes checkboxes for 'Material', 'Manufacturing', 'Use Regions', and 'End Of Life'.

Source: SolidWorks, Sustainability Express

RECENT DEVELOPMENTS

- o CAD applications on mobile devices
- o Research at UOM aimed at developing Computer-Aided Sketching systems for mobile devices



The diagram illustrates a mobile CAD workflow with four steps:

- 1** Designer located at Sydney, Australia, receives a phone call from client situated in Genoa, Italy, requesting the design of a shaft. The designer sketches his concept on paper using PSL and captures it with a cameraphone.
- 2** X-Skelion system located at Malta, Europe, processes the sketch image sent by the designer through MMS and generates the 3D CAD model.
- 3** An animation of the 3D model is sent to the designer in Sydney, Australia, for visualization on the cameraphone.
- 4** 3D model is made also available on a web-site to be accessed by client in Genoa, Italy.

Source: <http://www.youtu>

RECENT DEVELOPMENTS

- CAD models are used for:
 - *Augmented Reality*: where a view of the physical, real-world environment is supplemented by CAD models, videos, sound etc.
 - *Virtual Reality*: "is a computer-simulated environment that can simulate physical presence in places in the real world or imagined worlds"

Source: wikipedia.org



Source: technomarketer.typepad.com



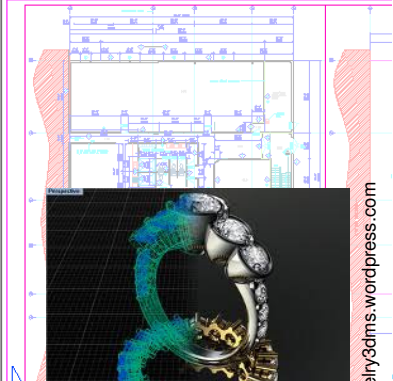
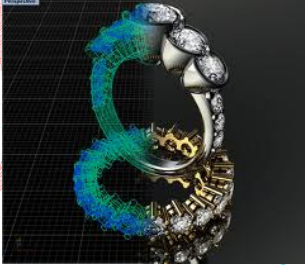
Source: FAKESpace Systems Inc.

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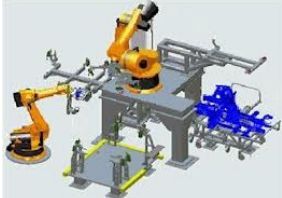
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CONCLUSIONS

- CAD technology has improved a lot – it offers a vast range of possibilities both in 2D and 3D
- It is part and parcel of product development in the ever-increasing competitive market environment
- Relevant companies must exploit CAD technology

Source: jewelry3dms.wordpress.com







Lifelong Learning Programme

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THANK YOU FOR YOUR ATTENTION

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