

## Year 11 into Year 12 Bridging work and key information– D&T

# A Level AQA Design and Technology

Year 11 into A Level - Bridging work - information and requirements

## **Administration** – Set yourself up well for success

Before you arrive to A level D&T in September, you need to complete the following tasks...

- 1) Print off the specification (7552) and familiarise yourself with the topics and content you will need to know by the end of this course. (Pages 9-46) You will find the spec on the link below.  
<https://www.aqa.org.uk/subjects/design-and-technology/as-and-a-level/design-and-technology-product-design-7552>
- 2) Buy a A4 folder and some dividers (pack of ten) and a full pencil case equipment and a scientific calculator.
- 3) If possible I highly recommend buying the A Level AQA Design and Technology course book that you will need to study from for this A Level. In addition to the course book the revision guide book would also be very beneficial as well as the Maths in Design and Technology book. Book details and ISBN numbers found below:

### **Course book:**



Authors: Will Potts, Julia Morrison, Ian Granger, Dave Sumpner

Publisher: Hodder

ISBN-13: [9781510414082](https://www.hodder.co.uk/ISBN/9781510414082)

### **Revision Book:**

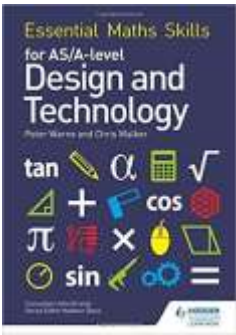


Authors: Julia Morrison and Dave Sumpner

Publisher: Hodder

ISBN-13: [978-1510432291](https://www.hodder.co.uk/ISBN/9781510432291)

### **Essential Maths:**



Authors: Peter Warne and Chris Walker

Publisher: Philip Allan

ISBN-13: [978-1510417069](https://www.isbn-international.org/product/9781510417069)

## Computer Aided Design:

Modelling using CAD- You will soon start developing your ideas for your individual project. In order to help with the design and development of your project design Bishop Luffa has purchased 2D Design, Sketchup.

### 2D Design link:

You can use 2D Design from home by using the link below to help draw parts to be laser cut at school.

<ftp://ftp.bishopluffa.org.uk/D-and-T/2D-Design/>

### SketchUp link:

<https://www.sketchup.com/try-sketchup>

Works on Chromebooks or any Internet-connected computer

**Google Classroom:** Join our google classroom

Link: <https://classroom.google.com/c/MzM2NTk3OTU0NDYy?cjc=7773tih>

Or

Code: 7773tih

Below you will find 3 tasks and 1 design task project to complete before our start date in September. You are to submit tasks and project work via our google classroom (code 7773tih) where all tasks can be found within classwork assignments to allow you to turn work in. We will share our findings and project work during our first few lessons in September – please do ensure your findings and presentations are completed and presented well.

## Task 1

To build your knowledge of production processes you need to research the following and give advantages and disadvantages of each:

1. Injection moulding
2. Die casting aluminium
3. Just in time manufacturing
4. Lean manufacturing

You might want to present this work as a table, or as 4 separate sheets of research. Include example products and where each type of manufacturing might be used in industry.

## Task 2

Research and produce a write up, with a step by step of processes for each of the following different forming methods, name specific products and scales of production (one off, batch, mass etc)

- vacuum forming
- thermoforming
- calendaring
- line bending
- laminating (layup)
- injection moulding
- blow moulding
- rotational moulding
- extrusion
  - compression moulding.

## Task 3

Develop your knowledge of designing and developing. Within your designs you need to show 'Iterative' approach to designing.

1. Design 2 solutions for a hand-held product to pick up plastic bottles from the floor
2. Pick your best idea and provide 2 developed iterations of your product.

(you could add photographs of models if you want to model at home, or use CAD to develop ideas)

3. For each of the above you need to annotate your designs for materials, components and ergonomics.
4. State how ergonomics and anthropometrics are considered in your design work.

## Bridging Work Design Task 4



# Design and Technology Y11 to Y12 Bridging Design Task

### Bridging Task: Styles and Interests.

Research & generate ideas for a product of your choice (*interests - what products are you interested in? i.e. industrial design, product design, architecture, engineering, etc.*), inspired by a famous designer / design era (*what styles/aesthetics do you prefer? i.e. Arts & Crafts, Art Deco, Steampunk, Modernism, etc.*) There are further slides attached from the AQA A Level revision guide as a starting point for your research.

Deadline - Present the work as a PowerPoint mini project at the start of the Y12 course.

### Project Suggestions:

- Research: Visit a design museum / gallery (many are running virtually or have good websites) to identify a product & designer/design era that you would like to base your project on.
- Suggested PowerPoint contents: Project introduction, designer/design era research, existing product analysis, concept ideas, development (this may include modelling) & a final design.



1 - Research a design era or an influential designer of your choice.



2 - Create a range of ideas for the product that you would like to design in the style of the era / designer.



3 - Develop & refine a final design, which may include a model.



The GCSE example illustrates how the influence of the designer Charles Rennie Mackintosh informed the design for a shoe & coat rack.



# 2.2

## Design theory

### LEARNING OUTCOMES

By the end of this section you should have developed a knowledge and understanding of:

- key historical design styles, design movements and influential designers that have helped to shape product design and manufacture
- key design styles and movements
- examples of designers and their work, and how their designs were influenced by design principles.

Successful product design relies on a combination of functional performance and aesthetic appeal. The view of Donald Norman – a design expert and Director of The Design Lab in California – is that usability is key in product design. This is true if we consider the hundreds of designed products we interact with on a daily basis such as lamps and mugs. All of these small products are used without thought as to who designed them, and this is the aim of most designers – not to be noticed.

When we talk about particular products, it tends to be due to negative interactions, and experiences that cause us discomfort or annoyance. Donald Norman, however, also recognises the need for emotional attachment to products. By this, he means the relationship we have with products that are not purely functional, different or just slightly harder to use than the norm. These products are selected for sentimental or aesthetic reasons, when we want to display our personality, to stand out from the crowd or to bring back kind memories as we use the product.

In this chapter, we will look at key design movements, and designers and their theories with regards to design.

### ACTIVITY

For a product you own, prepare a two-minute presentation explaining your emotional attachment to it.

### Design influences

When we look at the work of past designers and design movements, we must consider them in context, comparing their work with the work of others of the same time period. It is impossible to gauge the impact or innovation of these designers and movements unless we compare them with their peers.

### ACTIVITY

Research the work of Raymond Loewy, and produce a poster showing his major designs and the cultural, social and technological influences on his work.

We should consider a range of aspects when analysing designs from the past:

- cultural and social influences from the time
- major technological developments of the time
- key aspects associated with the movement/designer
- influences on design today.

### Design styles and movements

#### Arts and Crafts movement

After the Great Exhibition of 1851, which was hosted in London to promote and celebrate the development of modern industrial technology, there was a significant reaction to some of the perceived changes brought about by the industrial revolution. The **Arts and Crafts movement** was born from a concern held by prominent designers and social activists of the time – that the use of machinery and factory-based production created products with unnecessarily ornate decoration, and meant that appreciation of the materials used in their construction was lost. They drew inspiration from medieval craftsmanship, reflecting natural forms in textures and surface design such as wallpapers and focused on the natural beauty of timber in the production of handcrafted furniture.

The industrial revolution in Great Britain during the latter half of the eighteenth century and the first half of the nineteenth century caused huge social change, reducing the reliance on craftsmanship and increasing the use of machine tools. This was combined with the division of labour within manufacturing, reducing the skills of workers who were expected to repeat individual tasks within the production process rather than complete the whole process.

Despite their concern over the developing machine age, members of the Arts and Crafts movement could see the benefits of modern manufacturing techniques to enhance honest designs which retained the qualities of the materials used in the manufacture.

Major contributors to the Arts and Crafts movement were William Morris, C.F.A Voysey and Richard Norman Shaw.

Figures 2.2.1 and 2.2.2 show key examples of Arts and Crafts design.



Figure 2.2.1 'The strawberry thief', textile designed by William Morris, 1882.



Figure 2.2.2 The passage at Red House, Bexleyheath, Kent.



Figure 2.2.3 The Chrysler building



Figure 2.2.4 Art Deco, South Beach, Miami



Figure 2.2.5 1930s Art Deco wooden coffee table

#### Key features of Art Deco design:

- **Sunburst motifs:** these rays or segments radiating from a central point were commonly seen in architecture and surface patterns.
- **Ziggurat (stepped pyramids):** the ziggurat is an element often seen in Art Deco architecture, especially the 'skyscraper' designs of New York, where buildings were restricted by the 1916 zoning resolution to reduce

#### Key features of the Arts and Crafts movement:

- **Appreciation of the beauty of materials:** the Arts and Crafts movement was keen to highlight the unique nature of materials, such as the grain and figure visible in solid oak. They resented the ornamentation of machine-produced products, which often hid this aesthetic beauty.
- **Hand produced using craft skills:** concerned that the machine-produced objects of the industrial revolution heralded the end of craftsmanship, the Arts and Crafts movement took inspiration from the hand-produced natural forms of medieval Europe.

#### Art Deco

Following the Art Nouveau movement (a style of art inspired by natural forms and structures), the Art Deco movement of the 1920s and 1930s was named after the Paris Exhibition in 1925 – the *Exposition Internationale des Arts Décoratifs et Industriels Modernes*. Before the exhibition, the movement was known as the modern style.

The discovery of Tutankhamun's tomb by Howard Carter in 1922 was a huge worldwide event, leading to increased interest in the art of the ancient world. This was a major influence on the design period, and is reflected in the use of simple geometric forms and stepped pyramidal structures (ziggurats) in the architecture of the time. The end of the First World War and changing social class systems beckoned a new age of modern living, often symbolised in design by sunburst motifs.

Major contributors of the Art Deco movement were Clarice Cliff, Eileen Gray, Alvar Aalto and Walter Dorwin Teague.

Figures 2.2.3 – 2.2.5 show key examples of Art Deco design.



Figure 2.2.6 'Red and blue chair' by Gerrit Rietveld, 1917



Figure 2.2.7 'Composition A' by Piet Mondrian



Figure 2.2.8 'Schneider house' by Gerrit Rietveld, 1924

the impact on light visible on the streets below. The zoning resolution required regular 'setbacks' as the height of the building increased, thus reflecting the ziggurat structures of ancient civilisations.

- **Simple geometric forms:** these were a distinct change from the natural realism associated with Art Nouveau.

#### Modernism

Evolving from the worldwide Art Deco style, Modernism is symbolised by key design schools such as the **Bauhaus** and De Stijl. As the First World War ended, both of these design schools were formed. The impact of the war on the infrastructure of Europe and the resulting need to rebuild presented them with the ideal opportunity to make changes and modernise.

Based in the Netherlands, the De Stijl movement focused on the use of basic rectilinear forms and primary colour schemes to produce abstract artistic pieces. Designs were largely asymmetrical. These forms and colour schemes were evident in furniture, interiors and architecture associated with the movement.

Major contributors of the Modernism movement were J.J.P. Oud, Piet Mondrian, Gerrit Rietveld and Robert van't Hoff.

Figures 2.2.6–2.2.8 show key examples of Modernist design.

The Bauhaus was a design school founded in Germany in 1919 by the architect Walter Gropius. Students at the design school undertook a programme of study giving them an appreciation of materials, manufacturing and form, before specialising in areas such as metalwork, furniture architecture and graphics. They aimed to be true to materials and relinquish ornamentation, focusing on the aesthetic associated with the manufacturing process.

Key features of Bauhaus products:

- **Form follows function:** the aesthetic appearance of a product is dictated by the way it works. This can be seen in the furniture of Marcel Breuer, who developed the use of tubular steel in furniture design, having been inspired by bicycle handlebars.

- Embracing the machine age: although the Bauhaus – like the Arts and Crafts movement – rebelled against ornamentation of designs, it differed in that it was keen to use modern machine-based manufacturing processes, seeing beauty in machined finishes and fabrication methods, as well as the natural appearance of the materials.
- Geometrically pure forms: inspired by the Art Deco movement, Bauhaus designs also used simple geometric forms, as seen in the MT49 tea infuser by Marianne Brandt.
- Everyday products for everyday people: in the aftermath of the First World War, Walter Gropius was keen to embrace modern manufacturing techniques as a method of providing affordable products for the whole population. This was another reason why ornamentation was avoided – because products were designed for easy mass production.

Major contributors of the Bauhaus design movement were Walter Gropius, Marcel Breuer, Mies Van Der Rohe and Marianne Brandt.

Figures 2.2.9 and 2.2.10 show key examples of Bauhaus design.



Figure 2.2.9 Bauhaus B3 Wassily chair, 1925.



Figure 2.2.10 Barcelona chairs in the Absolute Hotel, Limerick.

The work of the Bauhaus and Modernism was seen as extremely controversial at the time, with very few Bauhaus products making it to mass production during the lifetime of the design school. The introduction of tubular steel to furniture was such a huge change from the largely wooden interiors of the time, that it was often satirised – as seen in work by William Heath Robinson and K.R.G. Browne in *How to Live in a Flat* from 1936:

*'Whereas formerly the best furniture was made by carpenters, cabinet-makers, and similar skilled craftsmen, nowadays the trade is almost entirely in the hands of plumbers, riveters, blow-pipers and metal-workers of all sorts. As a result, the ultra-modern living-room resembles a cross between an operating-theatre, a diplomat's nightmare, and a new kind of knitting.'*

This can be likened to the reaction in the early 1980s to the designs of the Memphis design group.

Along with the use of tubular steel, the introduction of bent plywood furniture – epitomised by the work of Marcel Breuer when working with Isokon in the 1930s, and Charles and Ray Eames with the LCW (lounge-chair wood) and DCW (dining chair wood) models – was synonymous with the movement. This functional and minimal material was formed to

give continuous unbroken curves, also seen in the work of Scandinavian designers Alvar Aalto and Arne Jacobsen.



Figure 2.2.11 Chair by Marcel Breuer; London, UK, 1936.



Figure 2.2.12 DCW (dining chair wood) by Charles Eames.



Figure 2.2.13 Birch wood A60 armchair by Alvar Aalto.



Figure 2.2.14 Laminated veneer Air chair by Arne Jacobsen.

### Streamlining

As Art Deco developed, the evolution of **streamlining** saw the increased use in architecture of flowing curves and smooth exteriors, bisected with chrome detailing. This approach was seen in car design as early as the 1920s, when aerodynamics began to affect developments in car body design. The application of streamlining to household objects such as clocks and bridges was seen as a sign of modernity, and developments in materials such as Bakelite enabled replication of these flowing curves.

Figures 2.2.15–2.2.17 show key examples of streamlining.



Figure 2.2.15 Tesla Tatieman 308 U Bakelite streamline radio.



Figure 2.2.16 The iconic Mollard Hotel, Macclesfield, Lancashire, England.



Figure 2.2.17 1936 Chrysler Imperial Airflow.



Major contributors of streamlining design were Raymond Loewy, Norman Bel Geddes and Henry Dreyfus.

### Post-Modernism

The Modernist theory of design rebelled against the excessive ornamentation of design. Post-Modernism is seen as a counter rebellion against the simplicity of form and purely functional nature of Modernism.

During the 1970s and 1980s, the Memphis design group epitomised this challenge towards Modernism, and produced a range of playful products designed more as sculptures to be admired, with compromises made regarding practicality. The use of anthropomorphic (giving human appearances or traits to objects) and zoomorphic (giving animal appearances or traits to objects) characteristics within their designs added quirky associations for the user.

Key features of Memphis design:

- Bold and colourful playful designs: Memphis designs challenged the simplicity of Modernism, and often used a range of bright colours, including those directly opposite on the colour wheel.
- Simplistic juxtapositions of geometric forms: similar to Art Deco designs, Memphis designs used geometric forms, but the position of these could seem quite random, reflecting a desire to produce abstract sculptural products. This can be seen in the design of the Tahiti Lamp shown in Figure 2.2.18.
- Challenging forms that often compromised on function: the desire to produce sculptural designs often took precedence over functionality as seen in the Carlton dresser shown in Figure 2.2.19, where the angled shelving reduced the storage surface.

Figures 2.2.18 and 2.2.19 show key examples of post-Modernism design.



Figure 2.2.18 Carlton dresser, Ettore Sottsass, 1981.



Figure 2.2.19 Tahiti lamp, Ettore Sottsass, 1981.

Furniture designs by designers such as Marc Newson and Danny Lane challenge perceptions of how certain products should look; they were seen more as catwalk pieces than main stream high street products.

Marc Newson stated that the Lockheed Lounge designed in 1986 needed 'only to be more comfortable than a bus stop'. The aim of the project was to produce a chaise longue from what appeared to be a single 'blob' of mercury.



Figure 2.2.20 Marc Newson's Lockheed Lounge recliner.

### ACTIVITY

Compare and contrast the Lockheed Lounge by Marc Newson with the Cesca chair by Marcel Breuer.

You should refer to:

- materials
- function
- aesthetics.

## Designers and their work

### Philippe Starck

The portfolio of work undertaken by the French product designer Philippe Starck is eclectic to say the least. He has famously worked on kitchenware for Alessi, and some of his designs can be regarded as postmodern sculptural pieces, focusing on aesthetics before function. However, his work in architecture and interior design is aimed at 'democratic design' for the population rather than the elite.

Starck challenges perceptions and aims to enhance the experience of the user through playful and thought-provoking design. His desire to experiment with modern materials and manufacturing processes make him a highly influential designer.

Look up the Juicy Salif product online. It is a single-piece aluminium casting, designed after Starck squeezed lemon juice over squid in a restaurant. The juicer functions successfully, although there are flaws. Key features of the design:

- The design has a very high centre of mass and becomes unstable during juicing.
- The head of the juicer is large enough for a lemon, but when juicing an orange, much of the fruit is missed due to the small diameter.
- The form of the product is striking and lends itself to being displayed in a kitchen, rather than stored in a drawer as with most juicers.
- The tripod legs exit the body of the juicer at an angle to prevent juice running down the legs. This also widens the base of the juicer to increase stability and allow a glass to be placed under the juicer.



### James Dyson

James Dyson is a British design engineer who has developed a wide range of highly successful household products through the application of innovative technology to existing products. His developments of wheelbarrows, vacuum cleaners and hand dryers have revolutionised the way we see functional and essential household items.

With the Dyson vacuum cleaner DC01, he introduced 'bagless' cleaning to homes, utilising technology used in dust extraction systems to separate the collected particles from clean air. Through detailed product analysis of existing vacuum cleaner technology, he identified problems with the bag collection system, which blocked with the collected dust and reduced suction from the cleaner.

Key aspects of the DC01 vacuum cleaner:

- By changing the dust collection system, Dyson was able to separate the dust without reducing suction.
- Contrasting colour schemes mean that key features are highlighted, aiding the ease of use by the consumer.
- The 3D form of the product is produced largely from injection moulded ABS components, apart from the clear dust bin, which is polycarbonate (PC).
- A large number of integral fixings allow disassembly of the product and aid maintenance.
- The 3D form is sculpted around the technology within, which means the user can follow the path of the dust after collection. This may increase their confidence in maintaining the product.
- The clear dust bin can be seen as a positive feature, giving the user a sense of achievement as they see the dust they have collected. Also, this gives visual feedback as to when the container needs emptying.
- The negative aspect of the clear dust bin is that, once collected, the dust within the bin is unsightly if not emptied.

### Margaret Calvert

Margaret Calvert is a highly influential graphic designer who, working with Jock Kinnear, developed the Transport font and many of the standard pictograms used on UK road signs. The development of stylised silhouette forms for the signage produced simple and clear communication with motorists. Their work in the development of signage introduced a mix of upper and lower case lettering to road signs, after testing proved that this improved readability at high speeds.

Figures 2.2.21 and 2.2.22 show key examples of Margaret Calvert design.

M62 (A1)	
The NORTH	
Pontefract	14
Selby	16
Leeds	28

Figure 2.2.21 UK motorway destination distance sign.



Figure 2.2.22 Roadwork warning sign.

### Dieter Rams

The German functionalist designer Dieter Rams has had a huge impact on product design in the latter half of the twentieth century. His simple approach to design and application of ten key design principles has been referenced by many contemporary designers, who have been influenced by his work with German manufacturer Braun. During his early work for Braun, he worked with Hans Guggelot, a product designer and lecturer working at the Ulm school in Germany.

Dieter Rams and Braun did for consumer electronics what the Bauhaus did for furniture – taking ornamental wooden casings and replacing them with functional minimal designs in white and grey, as demonstrated in the SK4 radio set in Figure 2.2.23 and the subsequent iterations of the product. These developments, as with the Bauhaus, relied heavily on technological developments – specifically the transistor and thermoplastics.

Dieter Rams came up with some key principles of good design:

- Good design is innovative: it is a product that uses modern materials, technologies and approaches to solve a design problem with innovation.
- Good design makes a product useful: a product must be functional, and successfully solve the design problem it set out to address.
- Good design is aesthetic: as a functionalist, Dieter Rams believes in the phrase 'form follows function', although the aesthetic success of a product depends on the market it is designed for.
- Good design makes a product understandable: the use of a product should be intuitive and require minimal guidance. Any guidance required should be evident through the form of the product.
- Good design is unobtrusive – this refers to the idea that form follows function, and all aspects of the product should be designed for a purpose, with no feature added purely for aesthetics.
- Good design is honest: this sounds peculiar, but we are often led to believe a product is something that it is not, such as a table with a wood veneer pretending to be a solid timber product.
- Good design has longevity: a product has longevity if it stays relevant over a long period of time.
- Good design is thorough down to the last detail: all aspect of a product must be designed, down to the smallest of details, such as the ridges on the battery cover of a remote control.
- Good design is environmentally friendly: the environmental impact of a product is key to its success. This could be down to the use of materials or processes during production, use or disposal.
- Good design is as little design as possible: it concentrates on the essentials – a true minimalist statement.



Figure 2.2.23 Dieter Rams and Braun SRA radio set and record player.

### Charles and Ray Eames

Charles and Ray Eames were an American husband and wife design partnership, famous for their work on moulded furniture both in plywood and polymers. Their modernist house made from used parts found in catalogues (the Eames house) reflected the cubist architecture of the De Stijl movement. Charles and Ray's work on the LCW (Gouge chair wood) evolved from their work with the USA Navy, developing leg splints from laminated plywood forms. The application of this technology in furniture design paved the way for single form seating both in plywood, and later in polymers.

Figures 2.2.24 and 2.2.25 show key products of Charles and Ray Eames.



Figure 2.2.24 Eames lounge by Charles and Ray Eames, 1955.



Figure 2.2.25 Unstitched fiberglass shell office chair by Charles and Ray Eames.

### Marianne Brandt

Marianne Brandt was a student at the Bauhaus design school, and became the head of the metalwork department in 1928. She developed a range of geometrically pure kitchenware products, which were successfully marketed and sold at a time when most Bauhaus products were still regarded as too controversial for the mass market. The simplicity of form used in her designs has ensured their longevity and relevance in modern design.

**ACTIVITY**

Use the principles of good design written by Dieter Rams to compare the Tahiti lamp by Ettore Sottsass with the Anglepoise lamp by George Cawardine.



Figure 2.2.26 Tahiti lamp, Ettore Sottsass, 1981.



Figure 2.2.27 Anglepoise lamp, originally by George Cawardine.

**KEY TERMS**

**Arts and Crafts movement:** a nineteenth-century design movement that rebelled against the use of machines in design.

**Bauhaus:** an early-twentieth century German design school started by Walter Gropius.

**Form follows function:** the aesthetic appearance of a product is dictated by the way it works.

**Memphis design:** a late-twentieth-century design group who challenged modernist design views.

**Streamlining:** the development of products using flowing curves and chrome detailing inspired by the increased study into aerodynamics in the early twentieth century.

**KEY POINTS**

- The Arts and Crafts movement drew inspiration from medieval craftsmanship, reflecting natural forms to produce handcrafted furniture.
- The Art Deco movement drew inspiration from ancient Egypt to produce simple, stylised products, using geometric forms that reflected a modern approach to design.
- The Bauhaus design school embraced the machine aesthetic to produce functional products designed for the mass market.
- Post-Modernist design challenged the minimal designs of Modernism, adding bold colours and sculptural aesthetics to products.
- Philippe Starck challenges perceptions and aims to enhance the experience of the user through playful and thought-provoking design.
- Dieter Rams developed a range of functional principles for good design.

**Check your knowledge and understanding**

- 1 Name four key aesthetic characteristics associated with the Art Deco design style.
- 2 What was the major social change that affected the Bauhaus design school?
- 3 Why was the Arts and Crafts movement concerned about the introduction of the factory system to product manufacture?
- 4 Which female designer developed the British transport font?
- 5 From where did James Dyson gain inspiration for the cyclone?

**Further reading**

*Great Designs* by DK books

*Design: The Definitive Visual History* by DK books

*Scandinavian Design* by Charlotte and Peter Fiell

*Less but Better* by Dieter Rams

*Eames* by Gloria Koenig

[www.eamesoffice.com](http://www.eamesoffice.com)

[www.vitra.com/en-gh/corporation/design/details/charles-ray-eames](http://www.vitra.com/en-gh/corporation/design/details/charles-ray-eames)