



**Royal Aeronautical Society
Hamburg Branch**

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Design, Art and Science

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Design Misconceptions

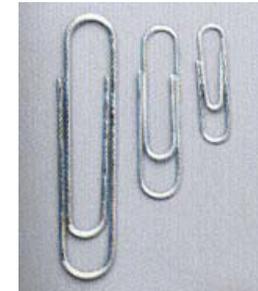
- The popular press frequently use the word 'design' to denote style and fashion, bordering on art
- Equally scientists are reported to have 'designed things' with the implication that design is about discovery and technology
- '...over to our science correspondent to talk about the latest Rolls-Royce engine/Concorde/Space Flight....'
- 'Design should never be seen as last minute, superficial packaging and styling rather than a management discipline. Used strategically to help in the development, delivery and communication of policies and services, design can help to deliver important benefits across the whole of government.'

Prime Minister Tony Blair 2001

- So what are Design, Art and Science and is there any relationship?

All can be nouns, only Design can be a verb
and hence a process

Outcomes of the Design Process



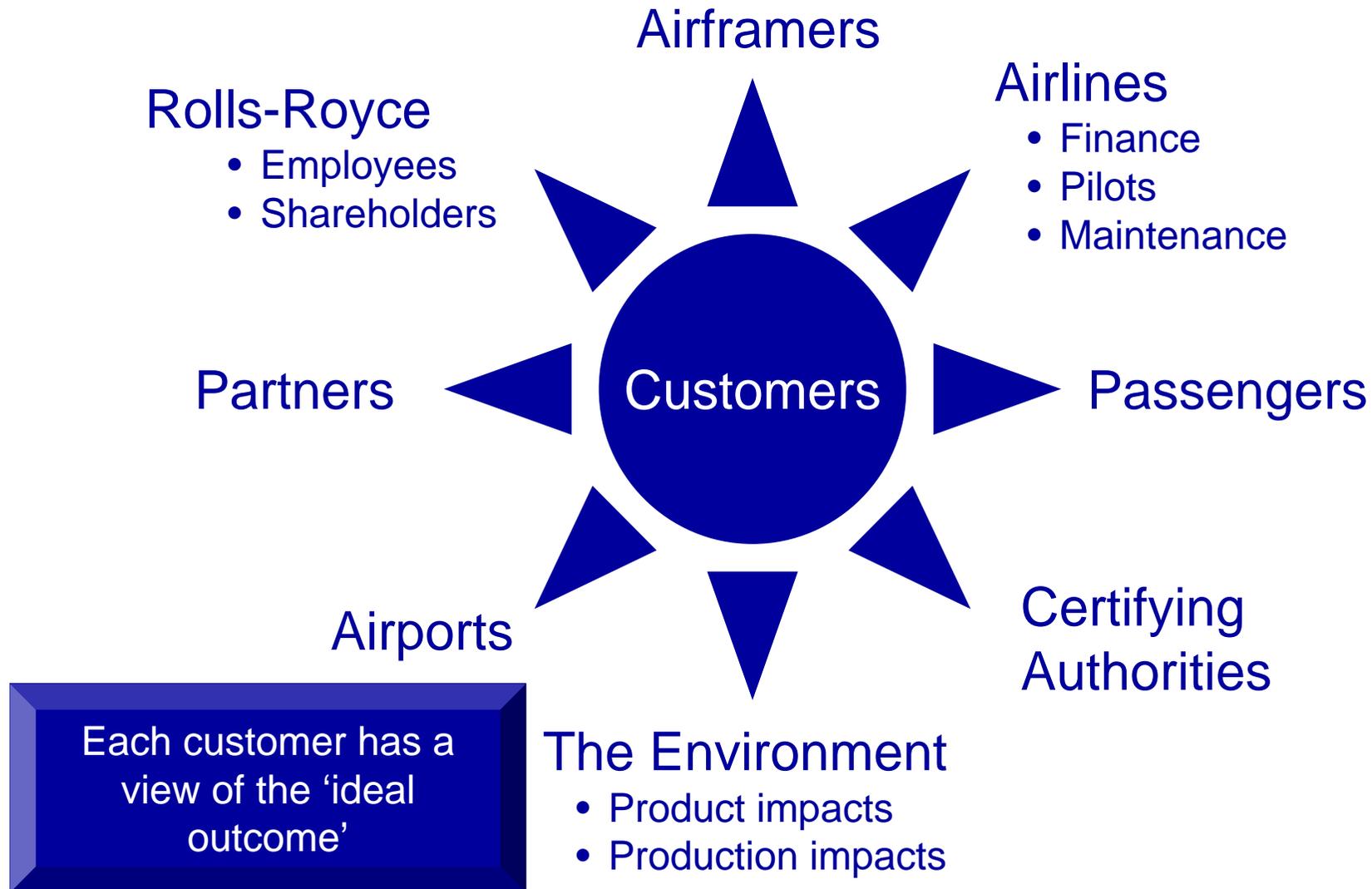
Design - A Definition

*To devise the optimum
artefact, component, system,
or process to satisfy
customer needs*

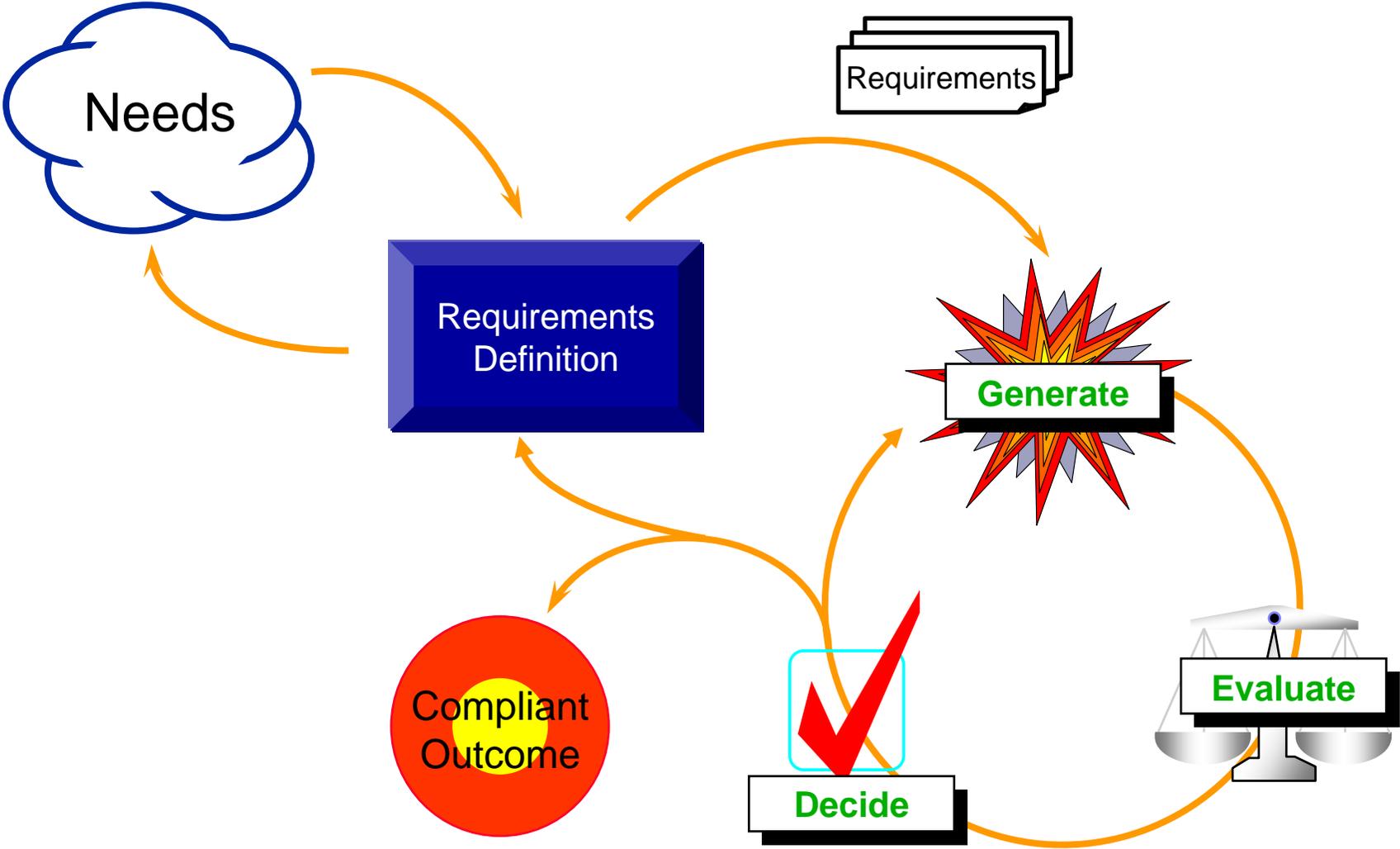
Customers and Needs

- Customer(s) come in several guises
 - an individual (self)
 - an organisation
 - socio-economic group
- Needs may be
 - Expressed
 - Specific or loosely expressed aspirations
 - In terms of their own requirements and language.
 - Implied
 - not specifically defined but are commonly accepted
 - Legal and moral
 - Obvious or perceived
 - Latent.
 - Not usually surfaced until an initial solution is envisaged

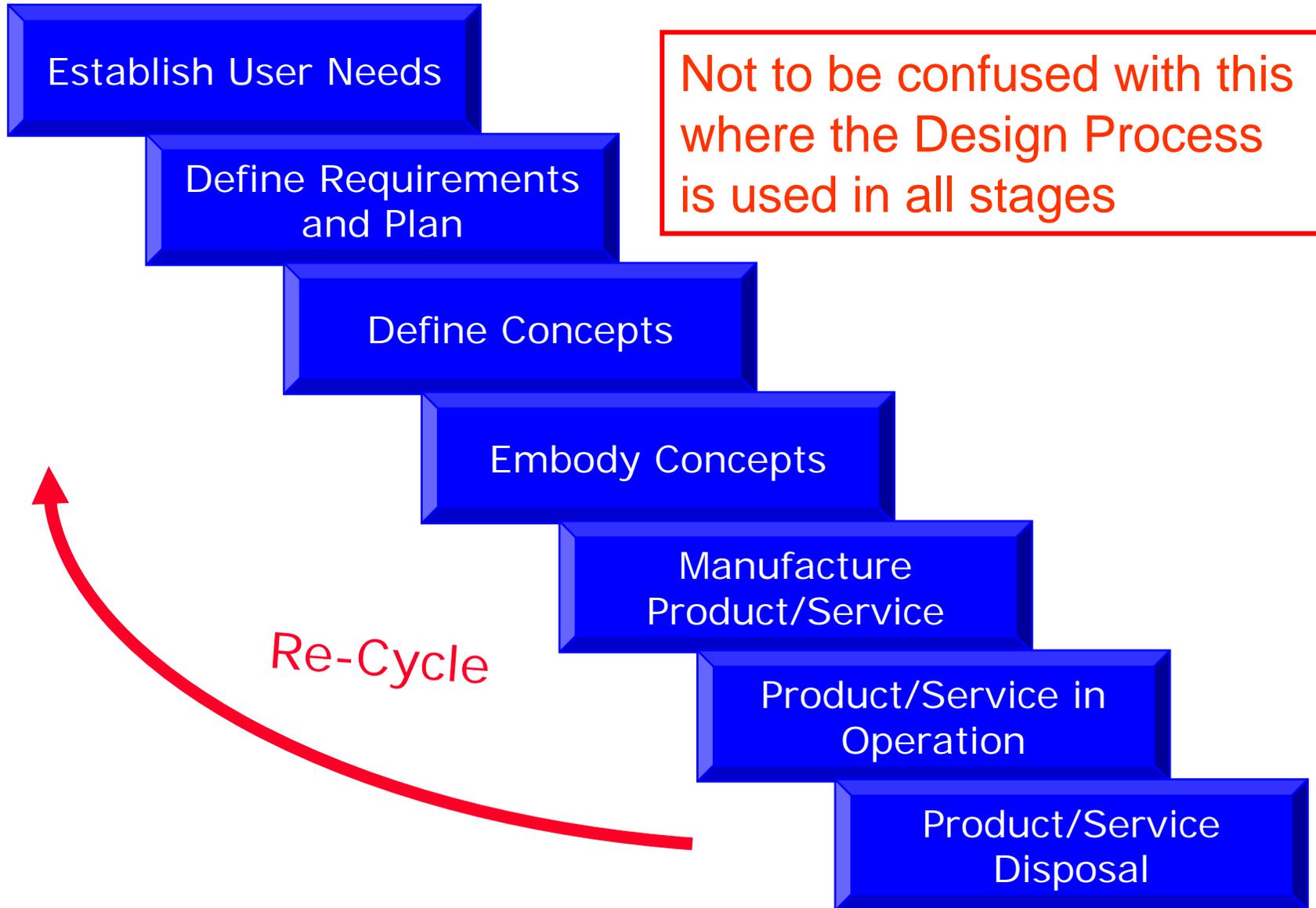
Customers and Needs – A Civil Aero Engine



The Generic Design Process Model



The Product Life Cycle - The Seven Ages



Creativity

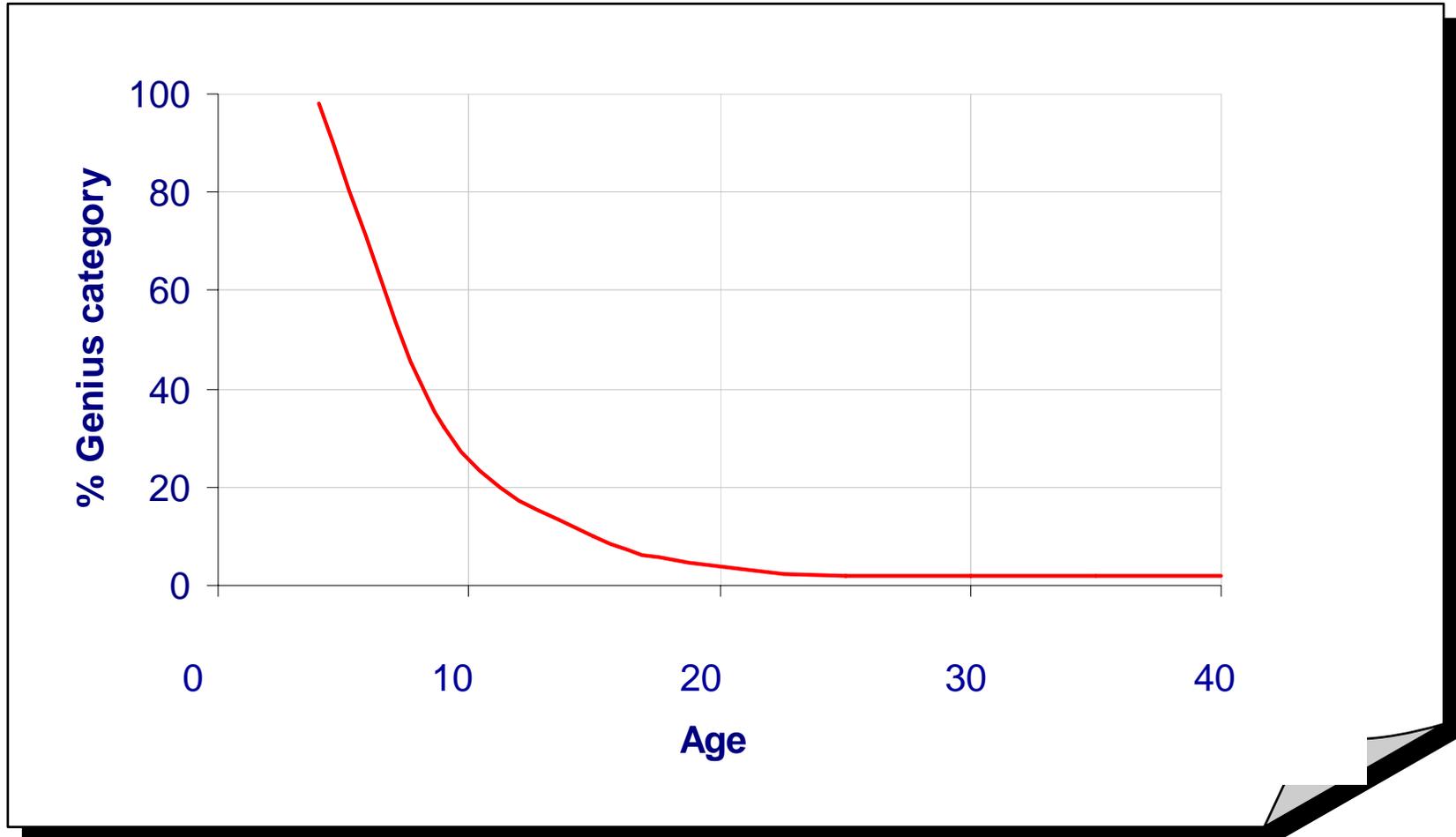
- Barriers

- psychological set
- experience
- pressure
- self imposed limits
- conformity
- fear of being wrong
- lack of effort in challenging the obvious
- belief that there is always one correct answer

- Requires

- time
- information
- imagination
- knowledge
- experience

Creativity



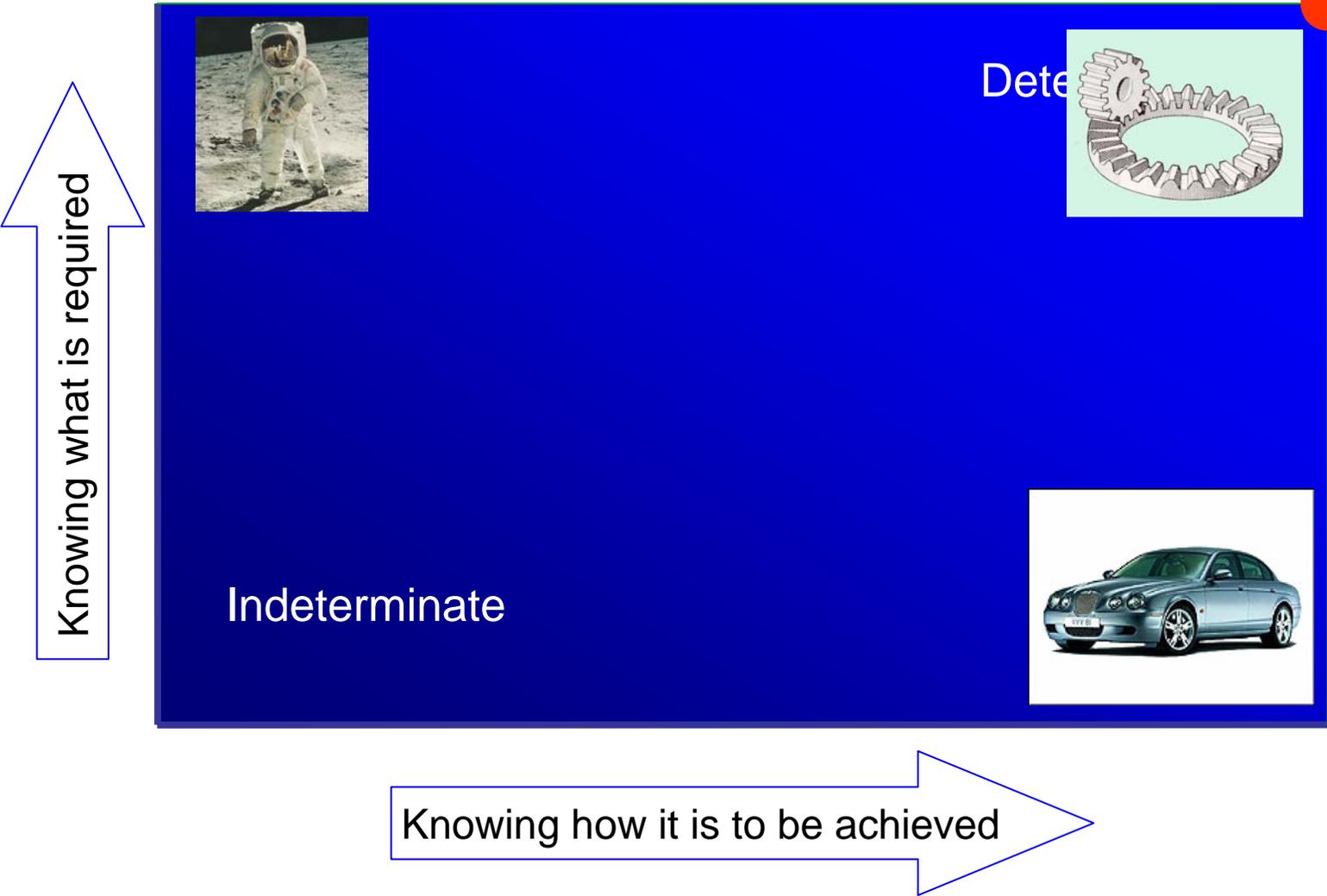
Every child is an artist. The problem is how to remain an artist once he grows up.

Pablo Picasso (1881 – 1973)

To live a creative life, we must lose our fear of being wrong.

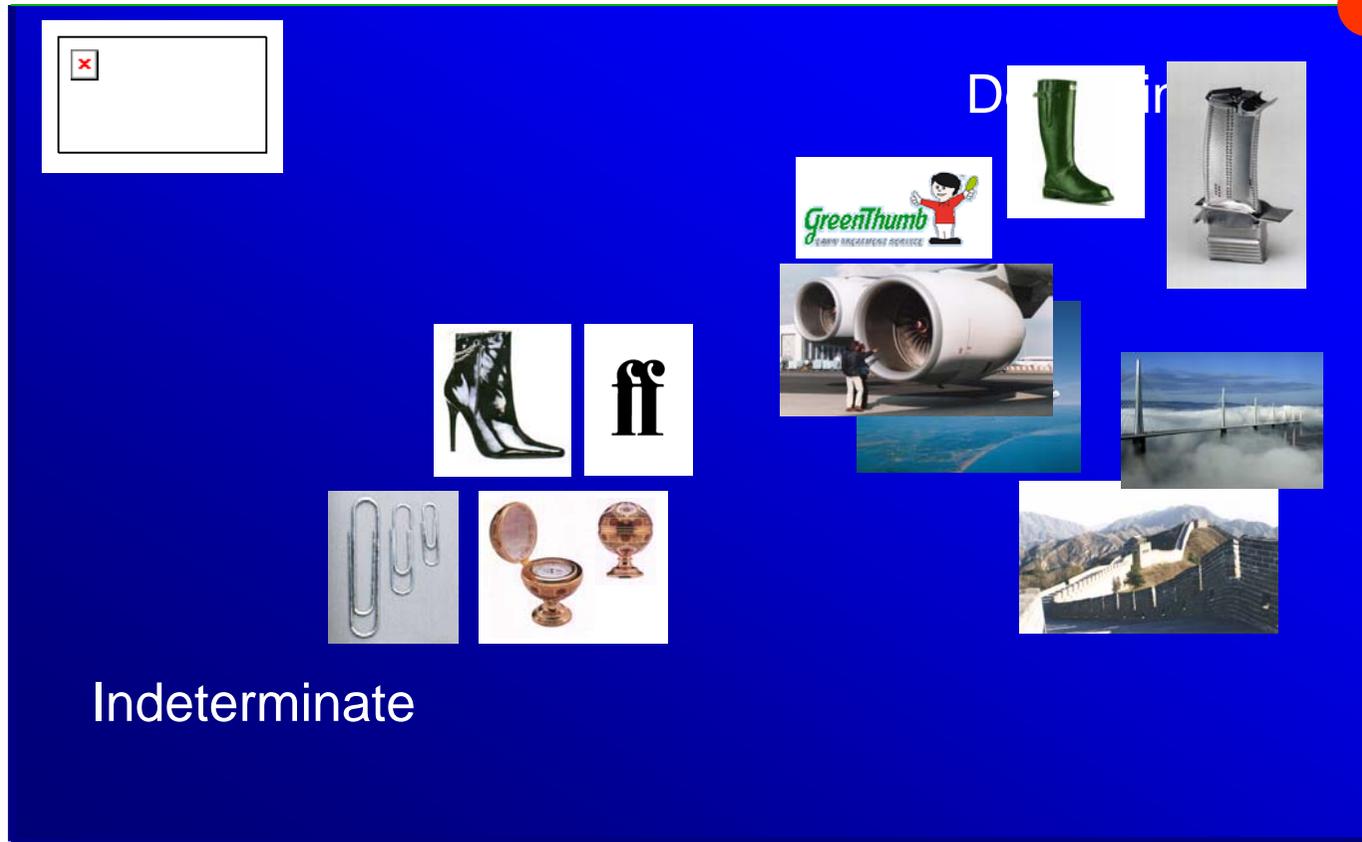
Joseph Chilton Pearce

Determinate and Indeterminate Designs



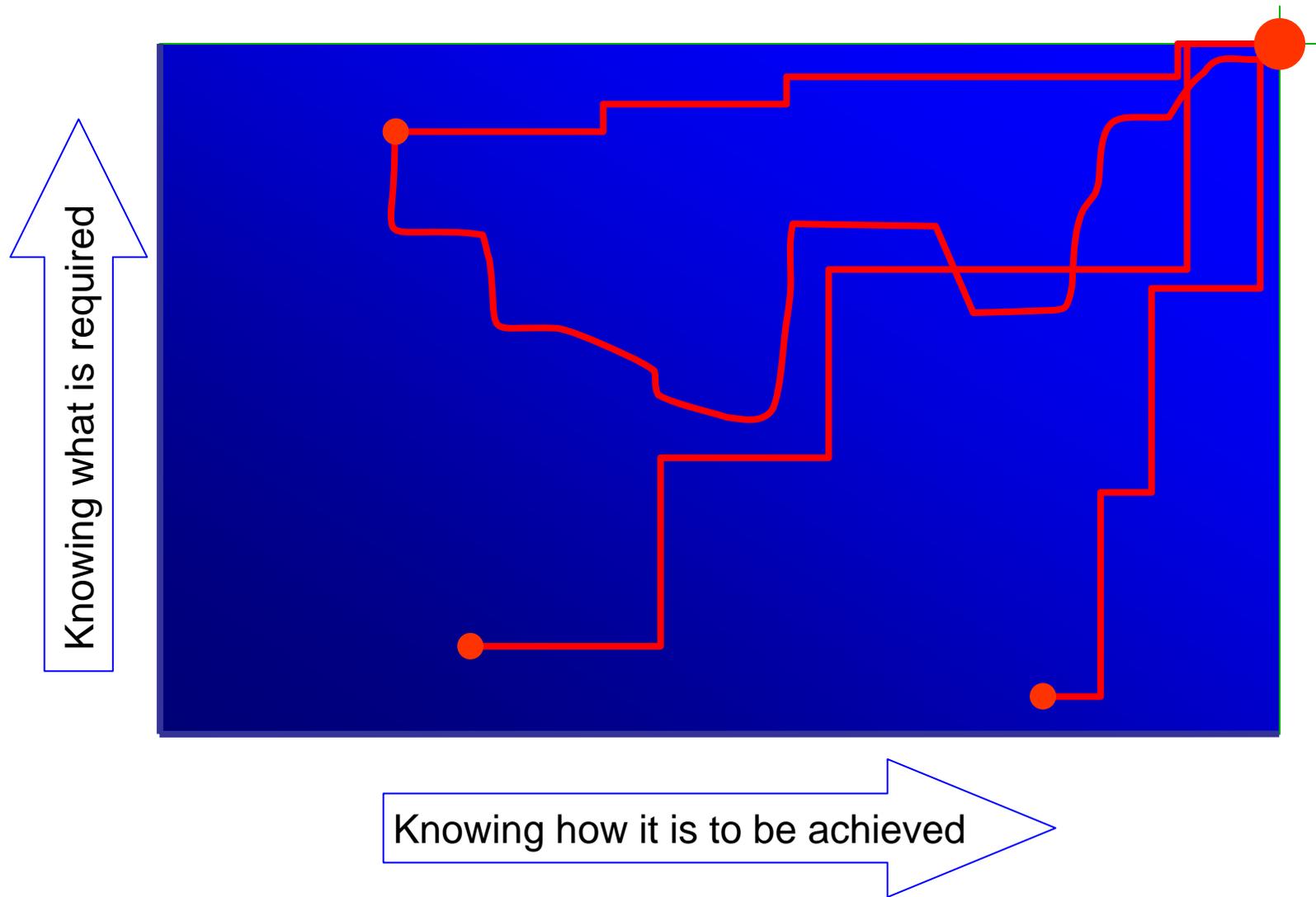
Determinate and Indeterminate Designs

Knowing what is required



Knowing how it is to be achieved

Determinate and Indeterminate Designs

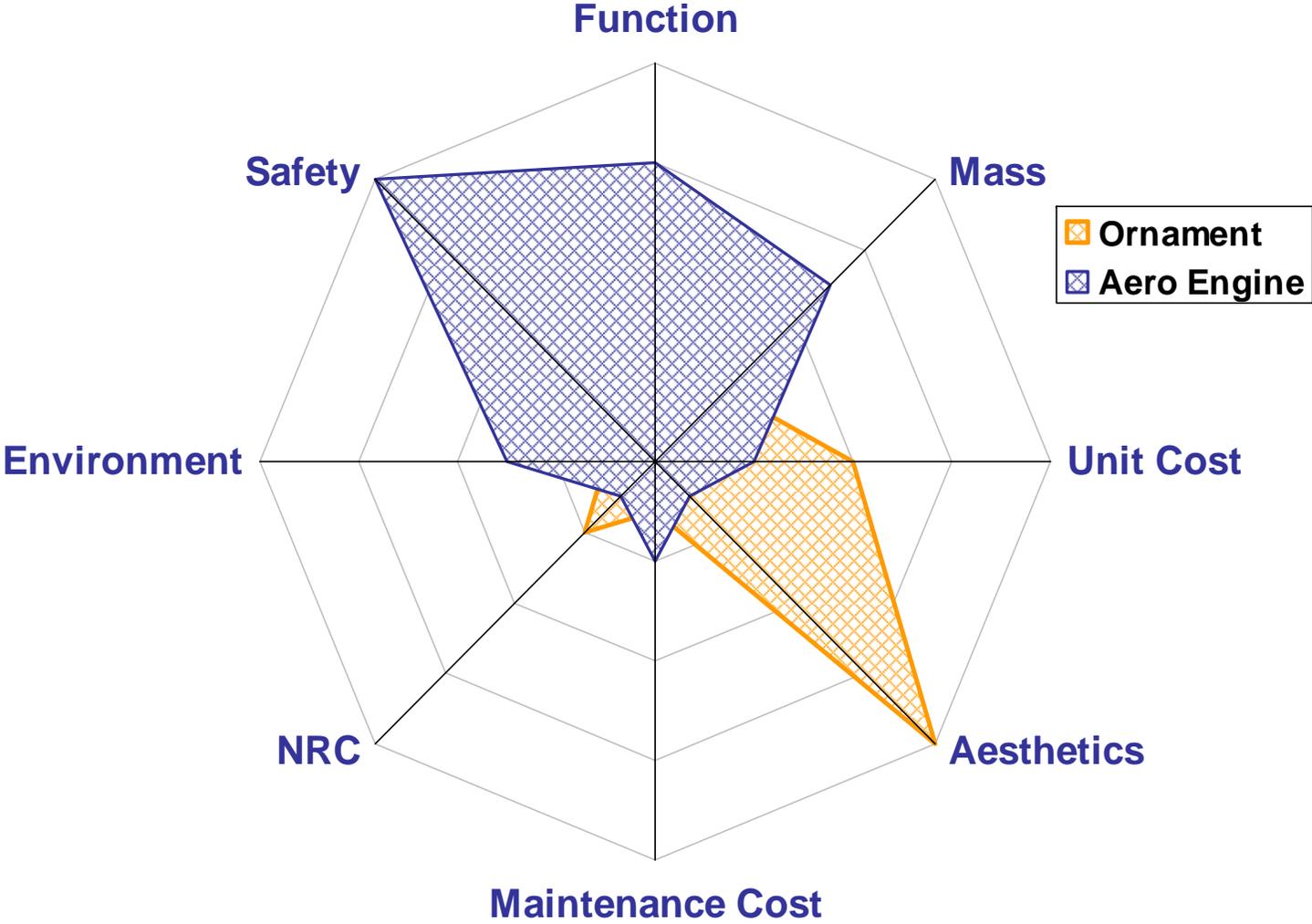


All Products Have Attributes

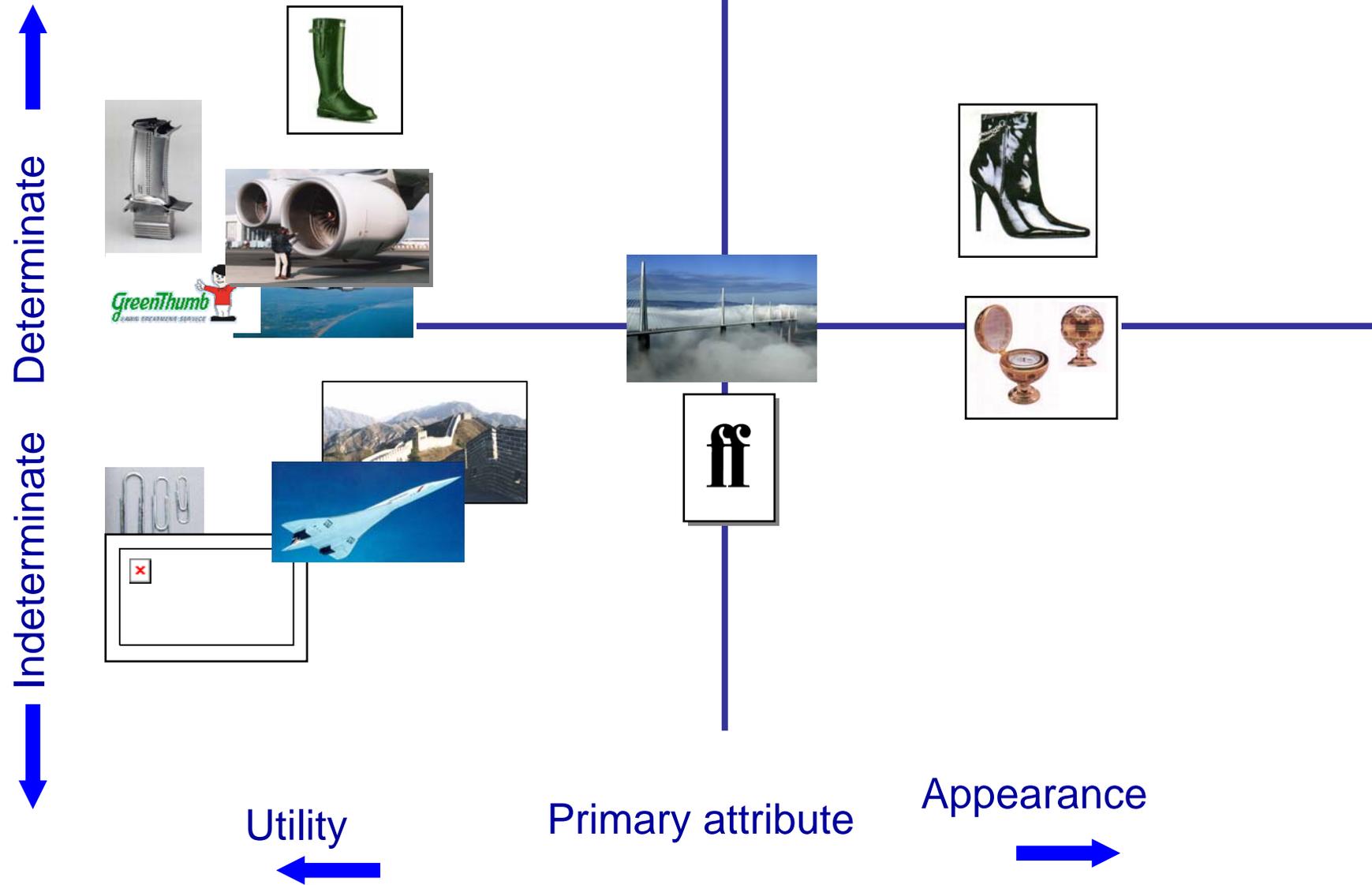
- Some attributes are Prime and some are Dependent
- For Example
 - **Function**
 - Mass
 - Size
 - Unit Cost
 - Operating Cost
 - Marketability
 - Service Lifetime
 - Safety
 - Reliability
 - Installation
 - Structural Integrity
 - Environmental Impact
 - Risk
 - Timescale
 - **Appearance**
 - Etc
- Not all have equal value – product and customer value dependent



Product Attributes



The Taxonomy of Designs



What is Art?

- The definition of art is elusive. It is difficult (or perhaps impossible) to come up with a single definition that will please everyone
- This is compounded as there are many forms of art; visual, fine and performing arts, each with their own characteristics
- There appears to be as many definitions as there are people prepared to offer one
- Paintings and sculpture provide a basis for discussion

What is Art?

- ...most modern art is pretentious, self indulgent, craftless tat... (*tat = poor quality merchandise*)
Kim Howells MP House of Commons Early Day Motion 2001-2
- Abstract art is a product of the untalented, sold by the unprincipled to the utterly bewildered
Al Capp (1909 - 1979)
- Art is making something out of nothing and selling it
Frank Zappa (1940 - 1993)
- Art is a collaboration between God and the artist, and the less the artist does the better.
Andre Gide (1869 - 1951)

Modern Art

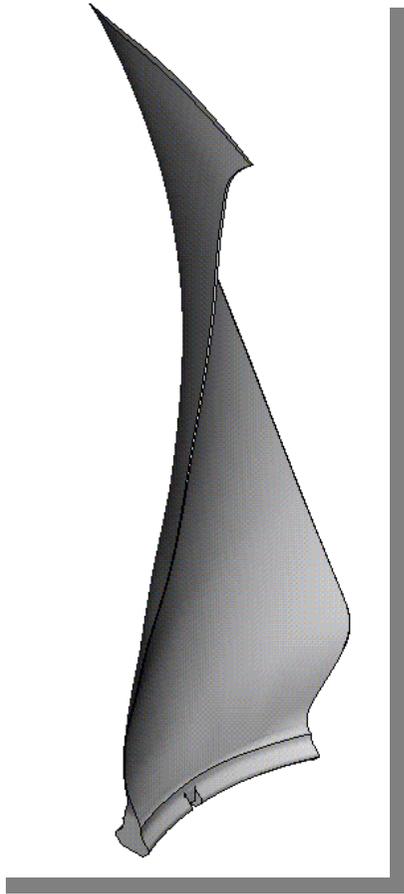
- A cliché comment about some modern art is that “a child (or a monkey) could have painted that.”
- This implies that the work is somehow less worthy of the title "art" either
 - the viewer fails to find meaning in the work,
 - or because the work does not appear to have required any skill to produce.

Art – My View

- Art is definitely in the judgement of the beholder
- Art is directed at human senses and emotions in order to arouse them
- Art continually challenges the norm
- Any human creation which contains an idea other than its utilitarian purpose, and ceases to be art if it has utilitarian value. It's overriding attribute is itself
- This does not imply Art being valued as "beautiful", but merely as "meaningful", containing an "idea".

Fan Blade

Art



Not Art



Art and the Relationship to Design

- How can art, which strives not to have utilitarian value in order to exist, possibly have any relationship to the design process whose objective is to produce useful things?
- It is all about satisfying the customer's needs, the customer does not want it to be useful and utilitarian
- Art objects are the result of applying the generic design process
 - there is a customer - even if done by artists for themselves
 - there is certainly a creative phase
 - probably an evaluation phase
 - and compliance

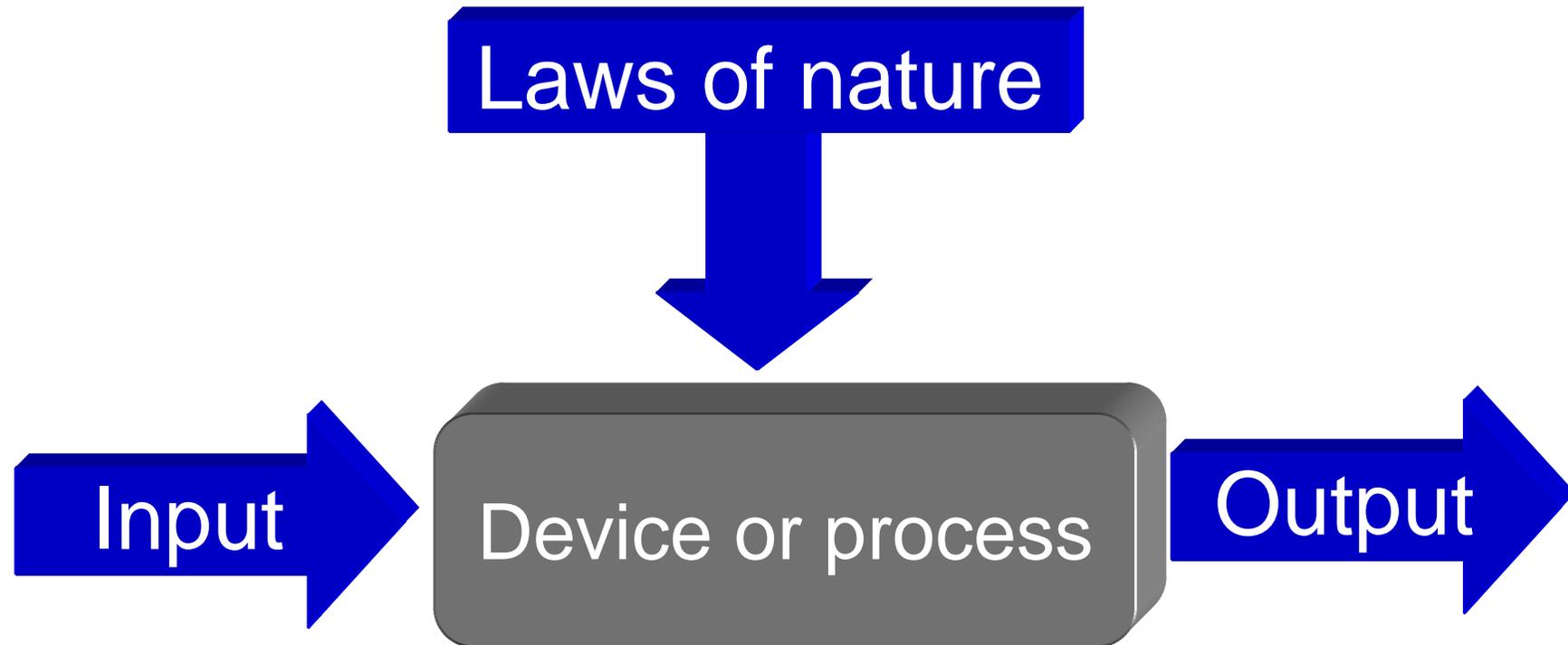
Aesthetics and Design

- Appearance is a factor present in most design tasks
 - In engineering there is the concept of 'if things are right, they will look, right - the eyeball test'
 - 'The Golden Ratio $\Phi = (1+\sqrt{5})/2 = 1.61803:1$ ■
- However all designs are not aesthetically pleasing
 - - Some are by intent
 - - Some are by virtue of their function
 - - Some are not by virtue of their function
 - - Some are not by intent

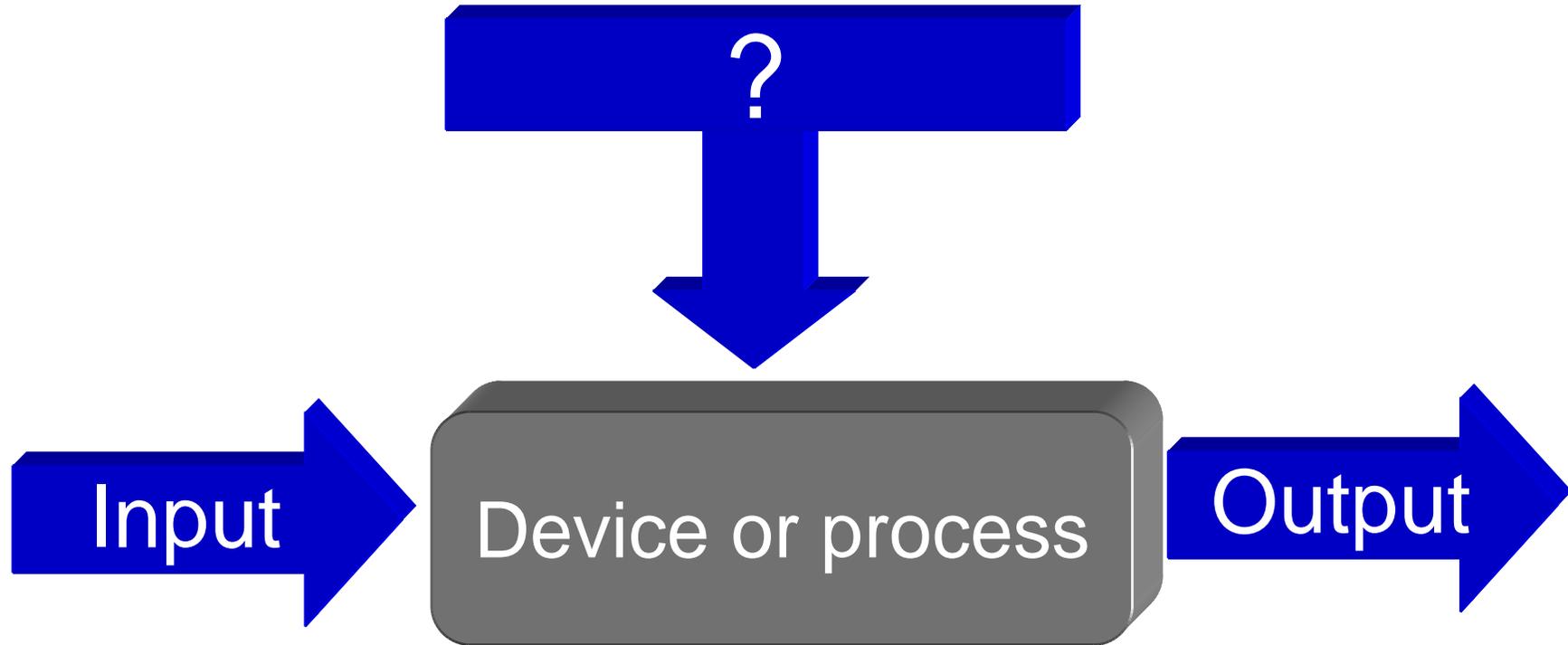
What is Science?

- An endeavour to construct an accurate, reliable, consistent and non-arbitrary representation of the world
- Uses the Scientific Method
 - Observe some aspect of the universe.
 - Create a hypothesis that is consistent with the observation
 - Use the hypothesis to make predictions
 - Test those predictions by experiments or further observations and modify the hypothesis in the light of results.
 - Repeat steps 3 and 4 until there are no discrepancies between theory and experiment and/or observation.

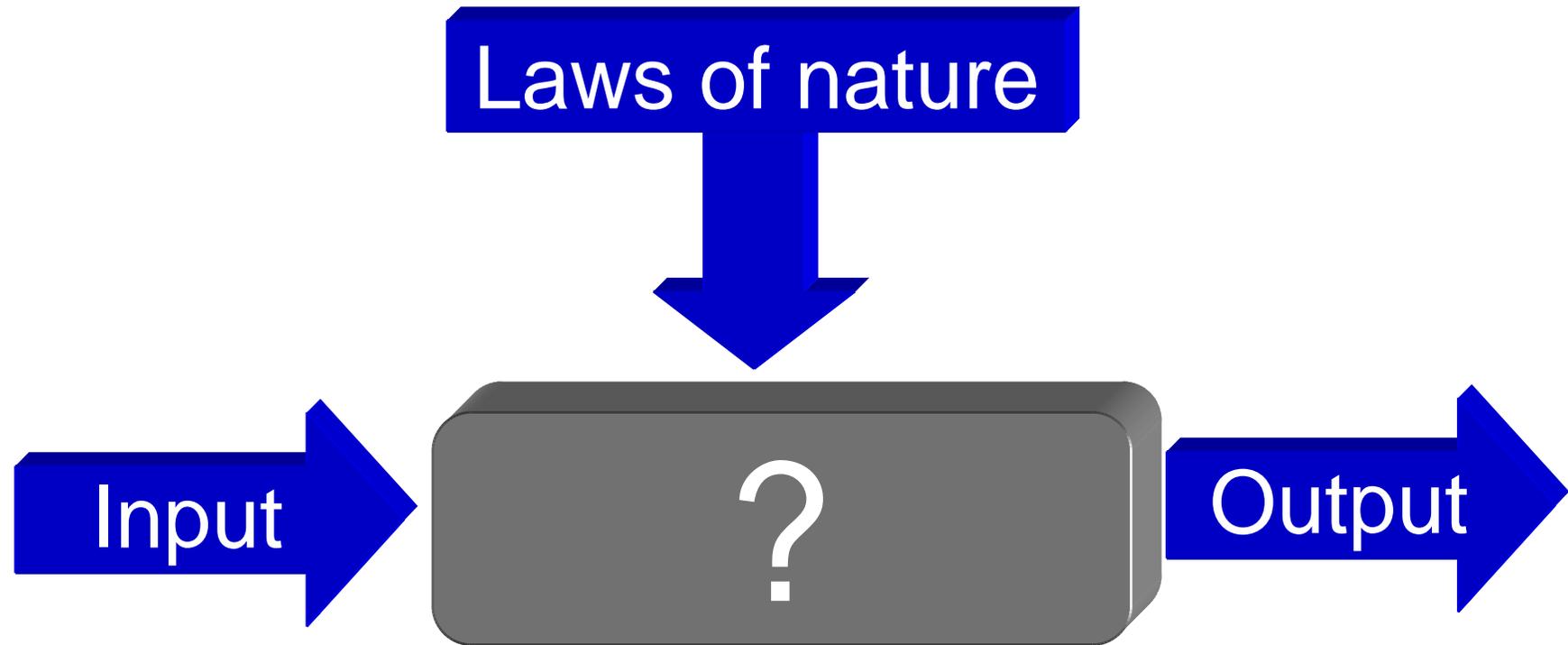
A High Level Process Model



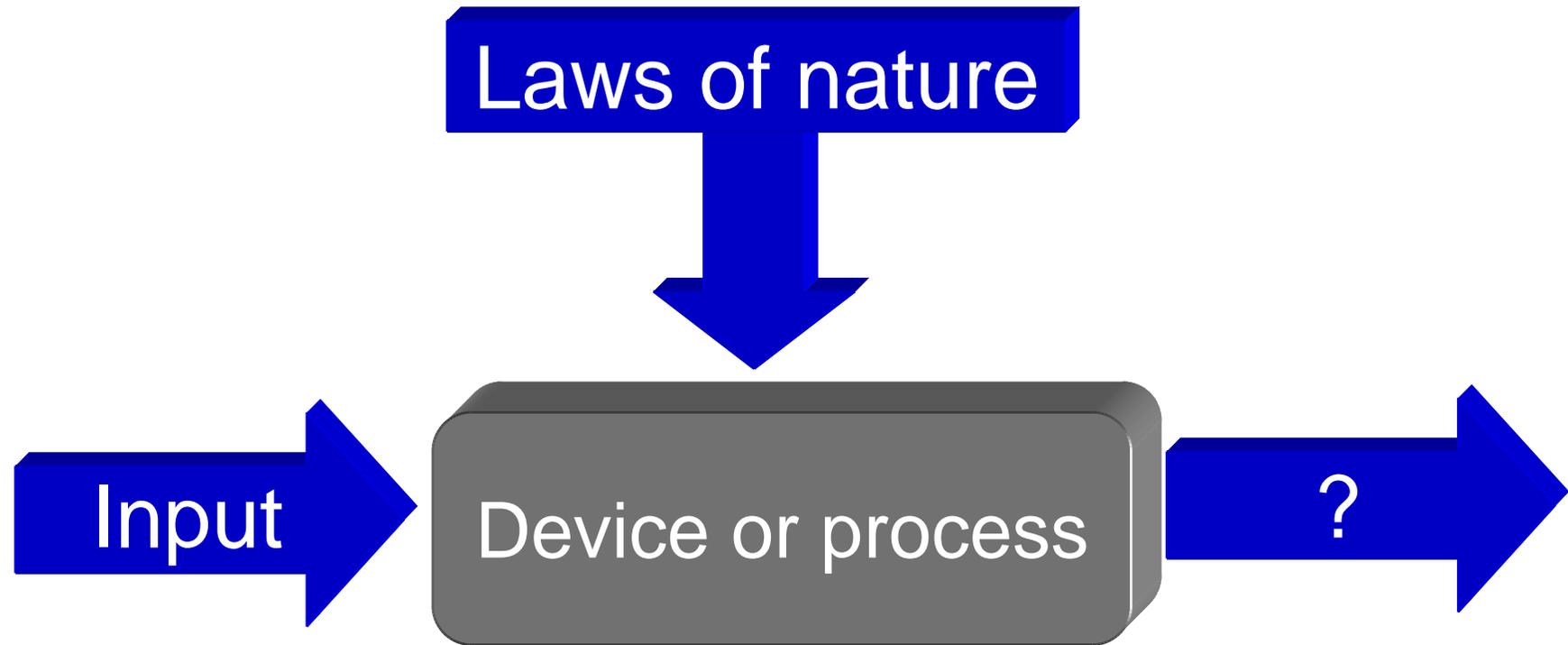
Science Identifies the Laws



Design Defines the Transform



Evaluation Predicts the Output



Aesthetics and Science

The Dirac Equation

$$\left(\beta mc^2 + \sum_{k=1}^3 \alpha_k p_k c \right) \psi(x, t) = i\hbar \frac{\delta \psi}{\delta t}(x, t)$$

where

m is the mass of the electron

c is the speed of light

p is the momentum operator

\hbar is the reduced Planck's constant

x and t are the space and time co – ordinates

- 'I found it beautiful'
P A M Dirac (1902-1884)
- 'The scientist does not study nature because it is useful; he studies it because he delights in it, and he delights in it because it is beautiful. If nature were not beautiful, it would not be worth knowing, and if nature were not worth knowing, life would not be worth living.'
Henri Poincaré (1854-1912)

Relationship between Design and Science

- A Symbiotic Relationship
- Science to Design
 - provides the basic building blocks for design technology and capability
 - provides the rigour required in analysis and understanding of problems
- Design to Science
 - It has been said “designers are scavengers of science and the resulting technology” - implies dead or discarded technology
 - Designers at least are hunter-gatherers of capability in that they seek the most succulent and appetising
 - More recently designers have progressed to be cultivators, capability is seeded ready to be harvested when ripe for exploitation
- People who would consider themselves as scientists do design things but when they do they are designers

Scientists ask why? Designers ask why not?

Summary

- Design is a fundamental process common to many roles and industries
- The design process is used by many who would not normally describe themselves as 'Designers'
- Art objects are an output of the basic design process
- Aesthetics is recognised as an important factor in all three disciplines
- The creativity of artists has something to offer more functional designers. Designers should never be satisfied with the status quo
- Science provides the basic building blocks for design capability and the rigour required for analysis. Designers need to set the 'agenda'



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