



IAT 336: Materials in Design

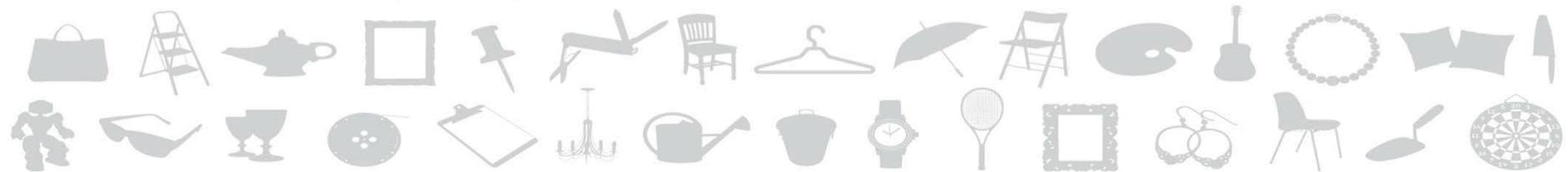
Week Four: Material Connotations





Boeing 787 Dreamliner

- Recently, Air Canada announced the delivery of the first of several Boeing 787 Dreamliners.
- This advanced aircraft will fly international routes from Toronto to Japan and partly because its advanced, lighter composite construction will be more fuel efficient than competing aircraft.





Unique Material Construction: Composite



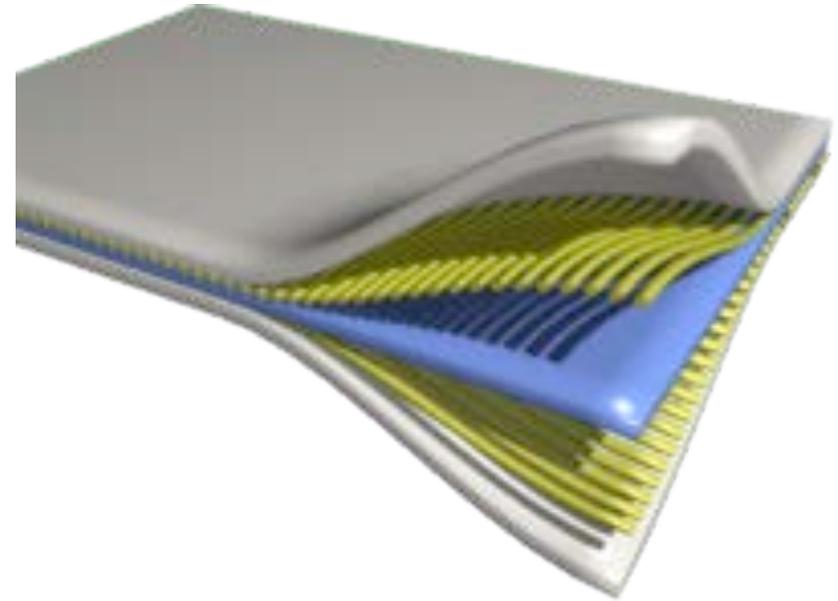
LIGHTWEIGHT

The composite material used in the construction of the 787 makes up 50% of the primary structure of the plane. Because composite material is lighter, it enables several enhancements, including cabin pressurization at a lower altitude, higher cabin humidity and less fuel consumption.

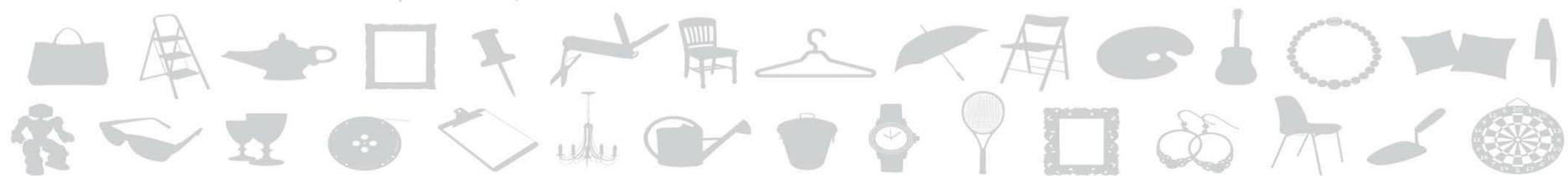


What are Composite Materials?

- **Composite materials** (also called **composition materials** or shortened to **composites**) are materials made from two or more constituent materials with significantly different [physical](#) or [chemical properties](#), that when combined, produce a material with characteristics different from the individual components. (Source Wikipedia)



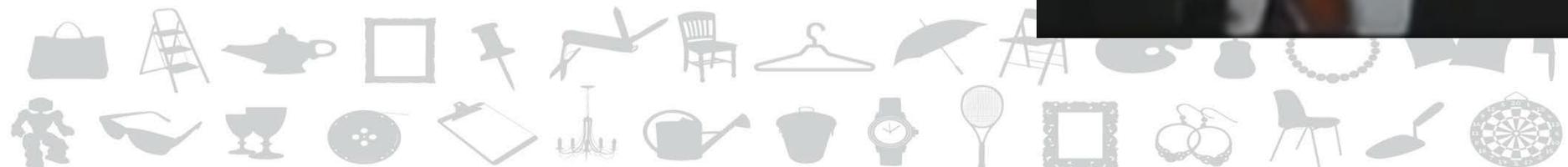
Composites are formed by combining materials together to form an overall structure that is better than the sum of the individual components





Vince Weldon: Boeing Dreamliner Controversy

- **Vincent A. Weldon** is an American aerospace engineer
- He is credited as been involved in designing critical components for the Apollo moon mission, as well as the Space Shuttle.
- Weldon attracted controversy in 2006 for his criticism of the [Boeing 787 Dreamliner](#), an airliner he claims is unsafe, and for his sacking from Boeing shortly afterwards under disputed circumstances.





Carbon-Reinforced Material

- Weldon later detailed his concerns about the 787 airliner in a letter he wrote to the [Federal Aviation Administration](#) (FAA).^[9]
- He also criticized the FAA's guidelines for composite airliners, saying they do not go far enough to guarantee passenger safety on the 787.^[1]
- Boeing fired Weldon in July 2006.



Vince Weldon: Boeing Dreamliner Controversy

- Weldon's experience in the use of composite materials led to him being commissioned by Boeing to research how advanced composites could be used to build its next generation passenger airliner, the **787 Dreamliner**.



Vince Weldon: Boeing Dreamliner Controversy

- Weldon told Boeing management that the carbon-reinforced material which was being used to construct the Boeing 787 *Dreamliner* was unsafe, less safe than a conventional aluminum aircraft, and that in the event of a crash the composite fuselage would ***"shatter too easily and burn with toxic fumes"***.





Aluminum vs. Carbon-Reinforced Fuselages

- Let's examine the use of materials in aircraft construction
- Aluminum alloys: Used in Aircraft fuselages since 1930s e.g. DC-3 below.
- Light; high strength to weight ratio
- Aluminum alloys crumple and deform cushioning impact and do not combust





Aluminum vs. Carbon-Reinforced Fuselages

- **ALCOA:** Powerful US Aluminum Producer / Lobbyist





Without aluminum, you wouldn't have gotten off the ground.

In a single lifetime, man has journeyed from Kittyhawk to the face of the moon. Along the way, it was aluminum that helped make the journey possible.

Every airplane built knows that the Wright Brothers flew 120 feet at Kittyhawk. They conquered that with a contraption that used a customized motorcycle engine, wooden struts and a cast aluminum engine block. Even in the very early days of aviation, designers knew about the high strength-to-weight ratio of aluminum. Subsequent planes, like Lindbergh's Spirit of St. Louis, were designed with more sophisticated weight-saving principles in order to make maximum use of fuel. Lindy landed in Paris with over eight hours of fuel to spare

—an excess that was partly a result of aluminum's weight-saving properties. And in commercial aviation—where every pound of weight saved in a jetliner equals a substantial savings in fuel and money—aluminum is contributing to economy of performance and increased payloads.

The properties of aluminum proved just as vital to the wingspan people who needed a strong, weight-saving metal that

could endure the stresses of leaving the atmosphere. Which is why aluminum was used as the principal structure of the awesome Saturn booster and the Lunar Module and will be used on the Space Shuttle.

The next time you're flying, remember that aluminum in the aircraft's structure, skin and power plants is saving thousands of pounds of weight and energy. In fact, you probably wouldn't have gotten off the ground without it.

For more information on the energy-related performance of aluminum, please write for our free brochures.

On energy, aluminum and the automotive, Aluminum Company of America, 345-H Alcoa Building, Pittsburgh, PA 15210.



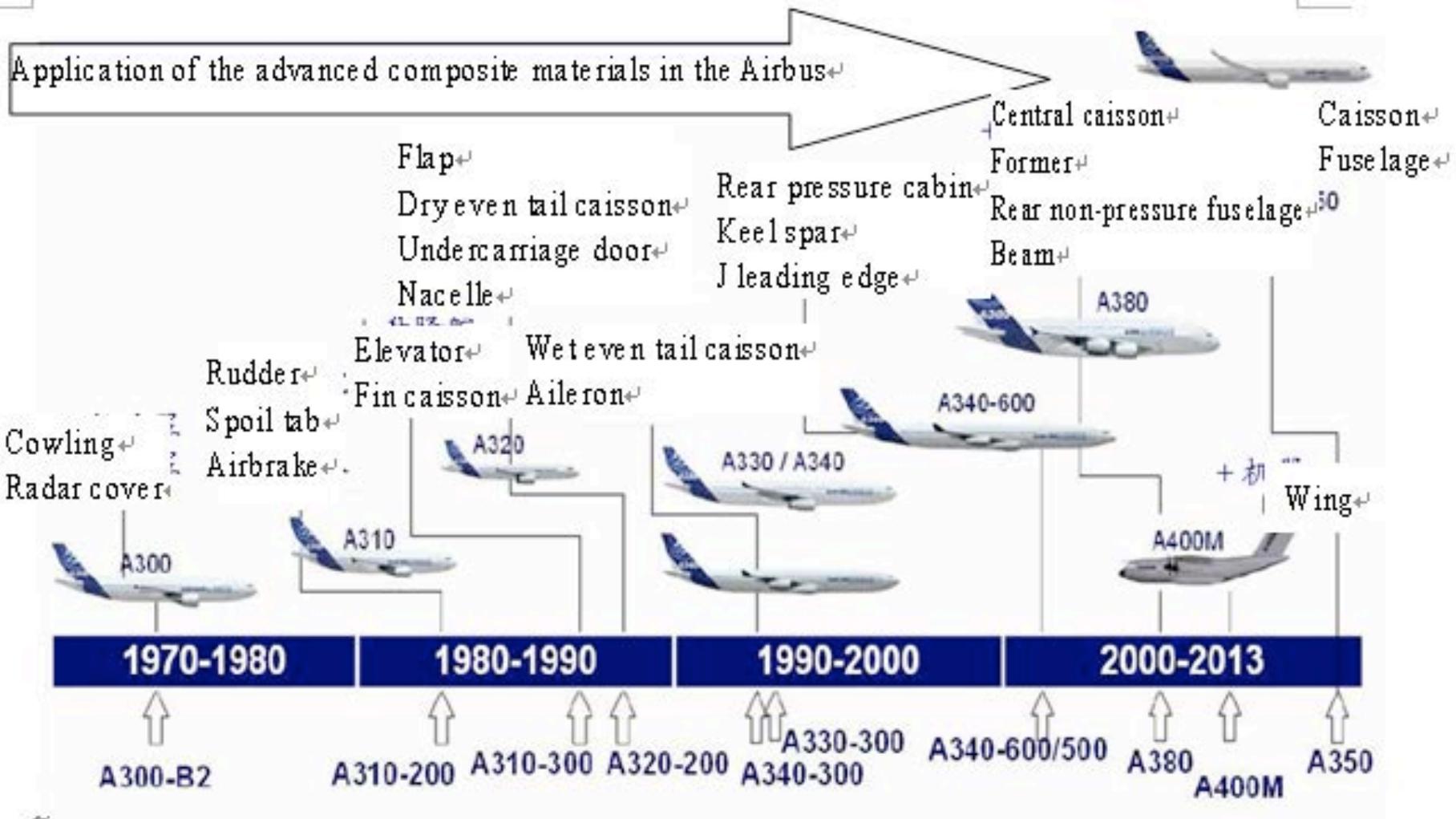
The reasons for using aluminum are found in aluminum itself.

 **ALCOA**





Carbon-Reinforced Fuselages on the Rise





Toyota: Carbon-Reinforced Auto Components

- Enough to guarantee passenger safety on the 787.^[1]



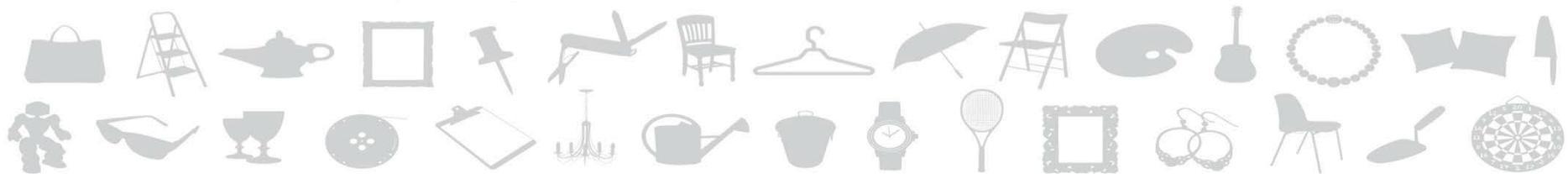
Image: toray.com





Carbon-Reinforced Fuselages on the Rise

- While the criticism of carbon-reinforced fuselages were very vocal and perhaps emotive from Weldon, aerospace industries continue to use this material.





Materials, Craftsmanship and Superstition

- Few technical subjects have been so infested with superstition as materials science.
- For instance, some ancient cultures required that corpses be buried in the foundations of buildings and bridges.
- The Romans felt this inhumane and substituted dolls.



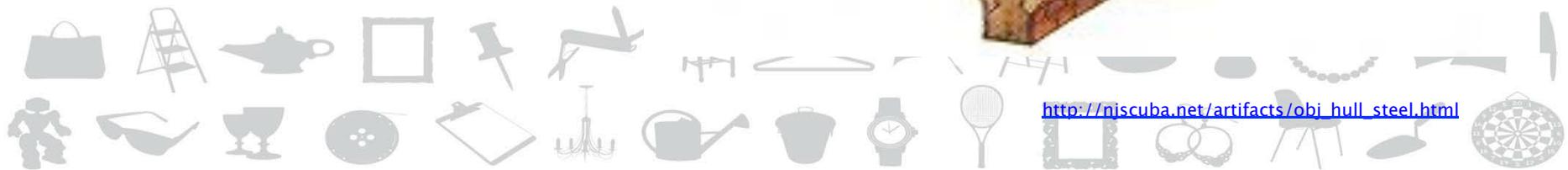
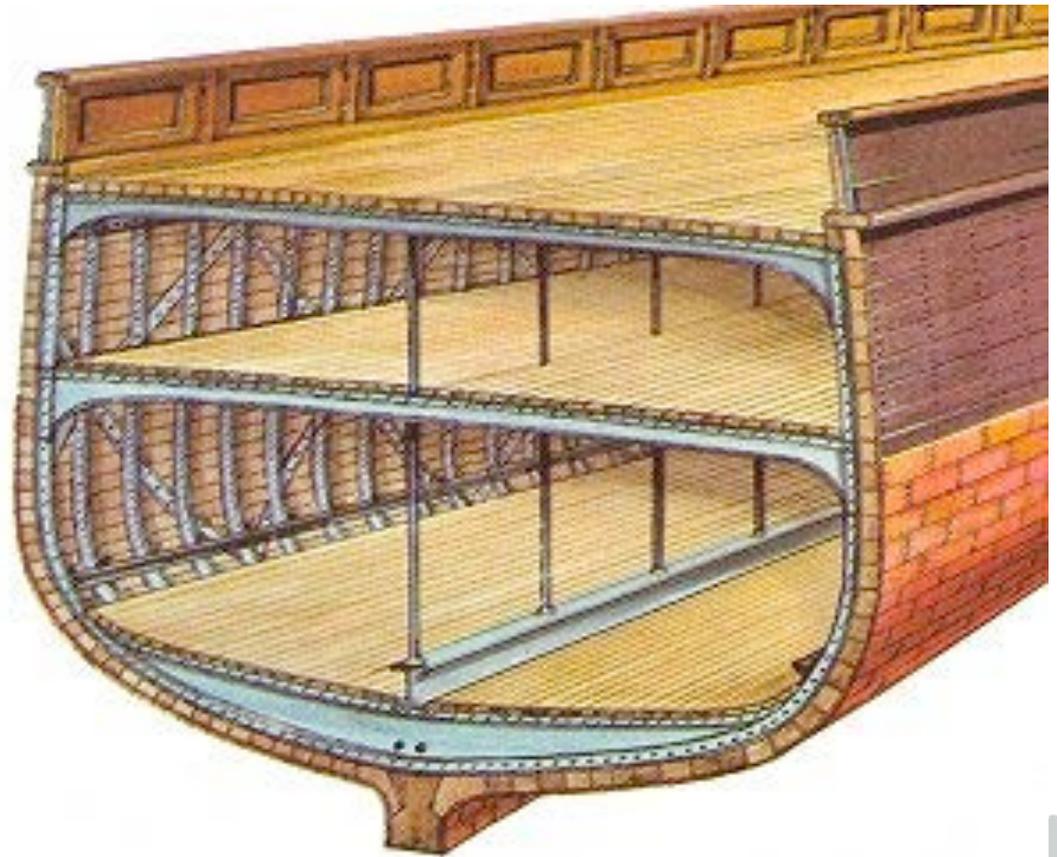
<http://www.apx.lvr.de/english/archaeologicalpark/themedbavilions/>





Materials, Craftsmanship and Superstition

- In modern times, we are less cruel than our ancestors, but no less superstitious
- There are still some irrationalities about the ways that we choose materials
- The question of old versus new, synthetic versus natural, steel hulled ships vs. wooden hulled for racing are ones that people approach with emotional fervour



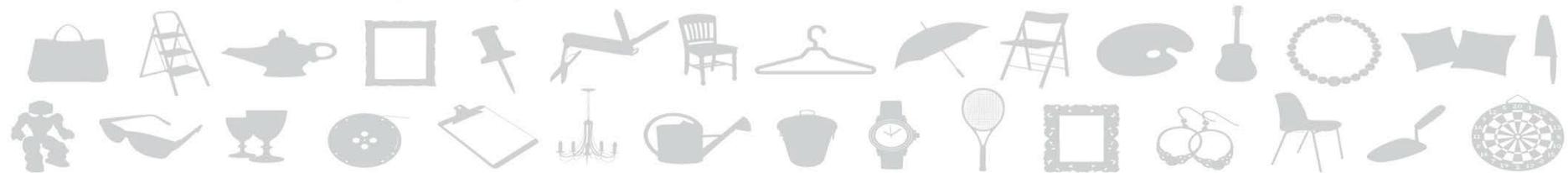


Case Study: The Saga of the Concrete Ships



- As impossible as it seems, the ocean once carried a fleet of ships constructed mostly of concrete!
- **Concrete**, a mixture of sand, gravel and iron reinforced bar bonded together to form a solid, heavy mass seems an unlikely material to build ship's hulls with.

http://www.concreteships.org/ships/ww1/peralta/paralta_only.jpg





Case Study: The Saga of the Concrete Ships



- The first concrete ship, a dinghy, was built by **Joseph Louis Lambot** in Southern France in 1848.
- Yet, during the First World War, steel was in short supply and a Norwegian patent to build concrete hulls was commercialized.
- In total, 12 ocean-going freighters were commissioned between 1917 and 1918.

http://www.concreteships.org/ships/ww1/peralta/paralta_only.jpg



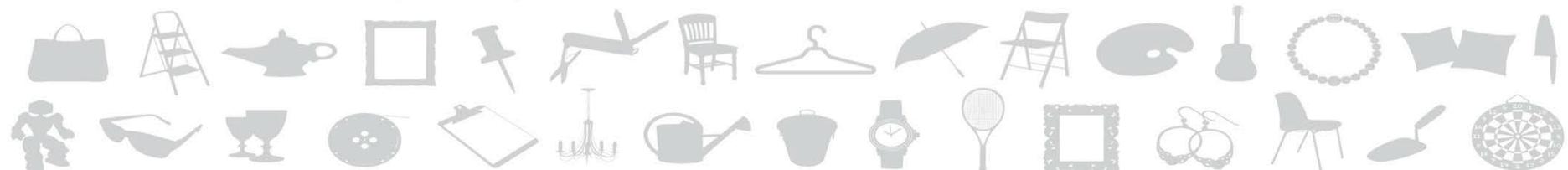


Case Study: The Saga of the Concrete Ships



- The concrete was also harder to manipulate than steel (e.g. no bending)
- They also were ‘heavier’ in the water, did not handle as well as steel ships and as a result, consumed more fuel.

<http://www.concreteships.org/>





Case Study: The Saga of the Concrete Ships



- While these ships actually functioned, sailors (a superstitious lot) referred to them as **floating tombstones** and did not like to serve on them (S.S. John Smeaton) above.
- Part of the reason is that these ships had unique maneuverability characteristics that made them handle differently from steel or wood.

<http://www.ww2f.com/military-history/29552-concrete-ship.html>



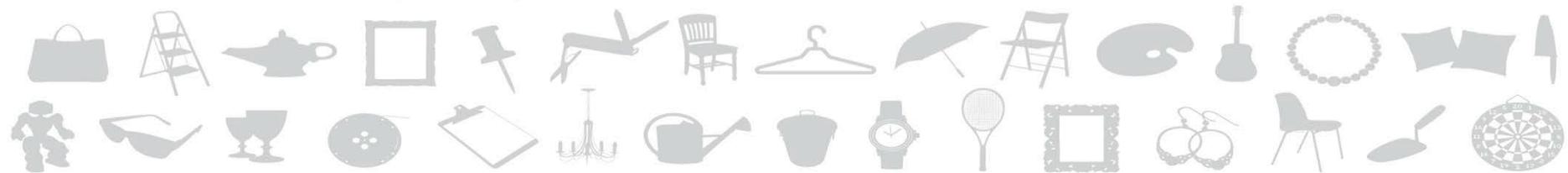


Case Study: The Saga of the Concrete Ships



- After the war ended, the heavy hulled ships became too expensive to operate (high fuel consumption) and became obsolete.
- The old MacMillan–Bloedel Pulp Mill in Powell River purchased the ships to construct an artificial harbour or breakwater.
- They exist to this day.

<http://www.w2f.com/military-history/29552-concrete-ship.html>





Materials: The Personal Dimension





Product Semantics: Semiotics

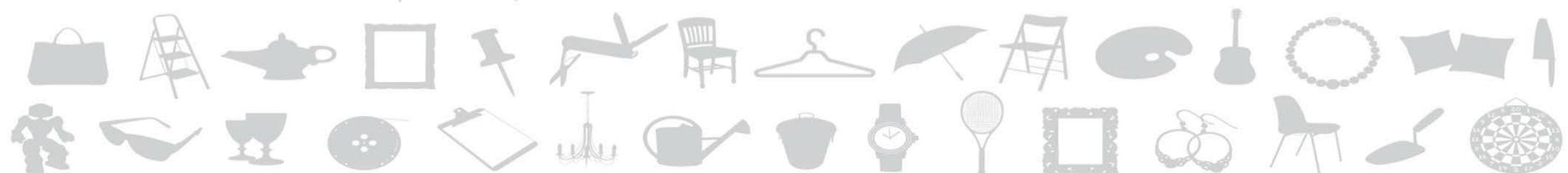
- Product Semantics was a theory developed by Reinhardt Butter and Klaus Krippendorf in the eighties and was influenced by contemporary continental philosophy.
- The term **'semantic'** refers to **'meaning'** in this context.





Product Semantics: Semiotics

- Semantic product design has origins in Sweden where **Rune Monö** has taught such courses since the early 1980s.
- Semantic product design reached its zenith in the 1980s and 1990s with the Post Modernists e.g. Memphis group in Italy.
- In his book, *Design for Product Understanding*, Monö attempts to develop a language and guidelines for designers to inject meaning into their designs. Hjelm, *Semiotics in Product Design*



Product Semantics: Semiotics

- Contemporary product semantic theory focuses on how *meanings* are made through *form and function* of the product.
- Product semantics has strong roots in the **semiotics** or the 'study of signs'.
- Semantic theory also studies not only how '**meaning**' is transmitted to the user but also how the user constructs meaning subconsciously.



Magritte's painting is widely associated with semiotics. It reminds us that we see is not a real pipe but a representation of one

Product Semantics: Semiotics

- **Semioticians** study the role of signs as a part of social life.
- Semiotics not only studies the signs in everyday speech such as traffic signs, symbols or pictures, but also our material culture which includes such things as buildings, furniture and products



Image: www.smashingmagazine.com



Product Semantics: Semiotics

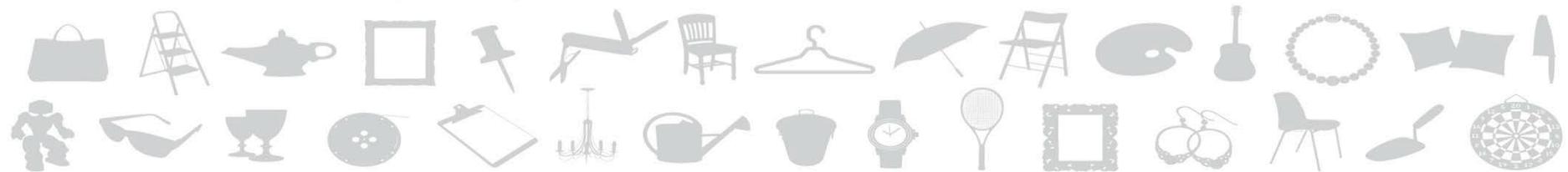
- Umberto Eco goes further to state that semiotics is “concerned with everything that can be taken as a sign”
- Therefore, the sign is central term in semiotics. A sign is composed of:

The Signified (signifié) – the concept it represents

A SIGN

A Signifier (Signifiant) – the form that the sign takes

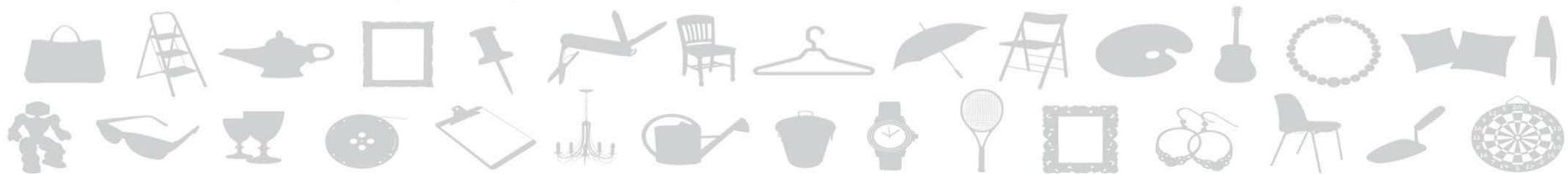
- A sign must have both a **signifier** and a **signified**; you cannot have a meaningless signifier/form or a meaningless signified/concept.
- The two always go together, they are like the two sides of a coin.





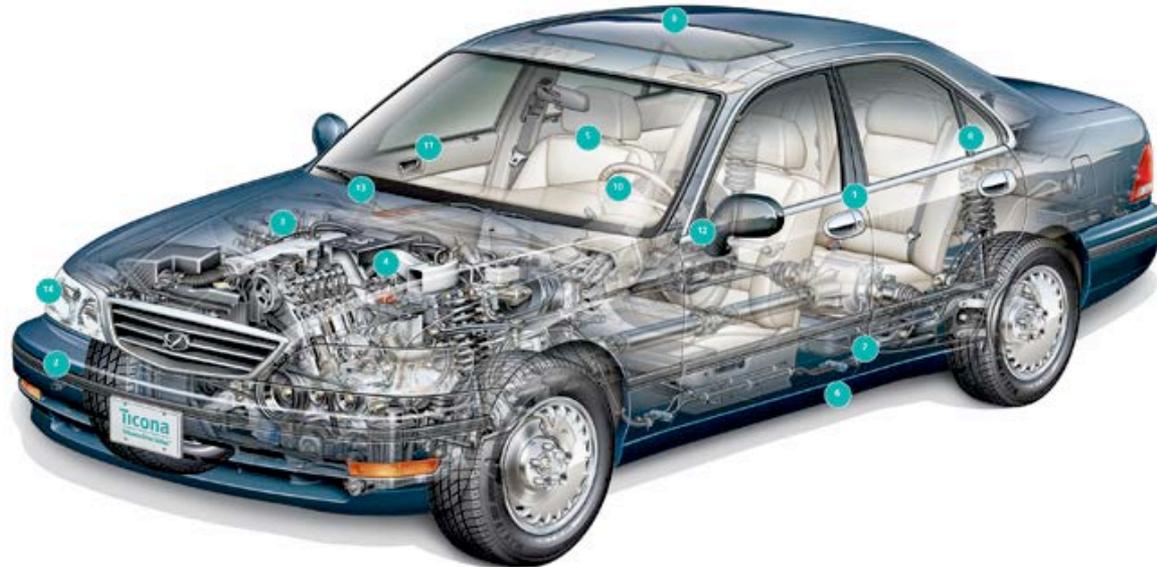
Product Semantics: Semiotics

- Therefore, a sign must have both a **signifier** and a **signified**; you cannot have a meaningless signifier/form or a meaningless signified/concept.
- The two always go together, they are like the two sides of a coin.



Product Semantics: Semiotics

- The **signifier** is the physical form of an object; what we see, touch and smell in the objective and shared reality.
- The **signified** is the content, the meaning of the object; what we experience, think and feel when we interact with the **artifact**.
- Therefore the signifier, the form is at the centre of our interest. If the word car signifies the concept car, but what does the car signify?





The Automobile: Signified



Image: pixshark.com 1600 × 1148 Search by image Vw Beetle Dune Buggy Kit





Semiotics: Denotation and Connotation

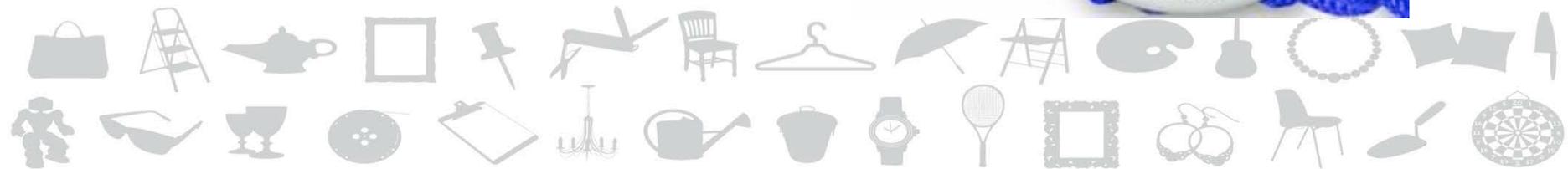
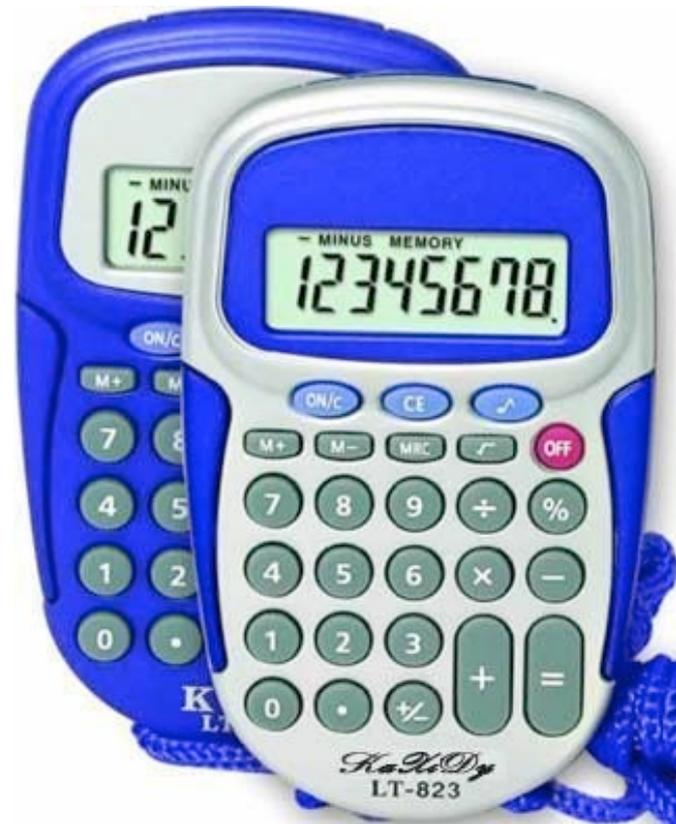
- Denotation and Connotation are two basic concepts in semiotics that are very useful.
- **Denotation** refers to the literal, actual meaning of a sign – what the product is, i.e. a chair, a telephone, a book etc. In this case, it is a calculator.
- To Denotation I also add the obvious function of an object: How to handle it. You sit on the chair, you use the telephone for making phone calls etc.





Semiotics: Denotation and Connotation

- **Connotation** can be referred to as the ideological or emotional meaning that we associate with a product.
- This calculator made be thought of as cheap, disposable, unreliable.
- Some people might think it represents exploitation, made by low-wage factory workers overseas.



Ceramics: Signifier and Signified

- Ceramics and glass have a long tradition since antiquity e.g. Roman and Greek pottery and glass.
- They are compatible with most pigments and can be produced in a variety of hues and finishes and can be adorned with detailed reliefs.
- They are resistant to most scratching, discoloration and corrosion actually gives them their longevity and great residual value



Ceramics: Signifier and Signified

- Hence they are **associated with the great craft-based industries:** Venetian glass, Meissen porcelain, Wedgwood pottery etc..
- Many craft-ceramics are passed down as heirlooms from generation to generation or are purchased for investment.



Ceramics: Signifier and Signified

ebay Shop by category Search... All Ca

Back to search results | Listed in category: Collectibles > Decorative Collectibles > Decorative Collectible Brands > Wedgwood > Other



Wedgwood Dipped Jasperware 10.5" Blue Port

Condition: **Used**
"Mint"

History: 1 offer

US \$2,500.00

[Buy It Now](#)

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11 watching

100% positive feedback Best offer available

Mouse over image to zoom



Ceramics: Signifier and Signified

- Ceramics have also survived the Industrial Revolution into the realm of high-tech
- We see an additional perception today of **high-tech**: kitchen stove-tops, space shuttle tiles, ceramic knives and various materials for extreme conditions.
- The **Kyocera** ceramic knife (right) is highly prized for its very sharp blade and aesthetic appeal.



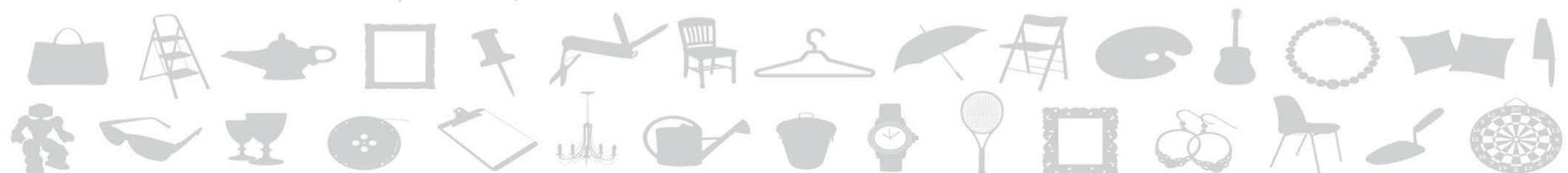


Polymers: Signifier and Signified

- **Polymers or plastics**, a relatively new material which grew in popularity in the mid 20th century, initially had the perception of being a “*cheap, plastic imitation*” which is hard to live down.



iramency.hubpages.com



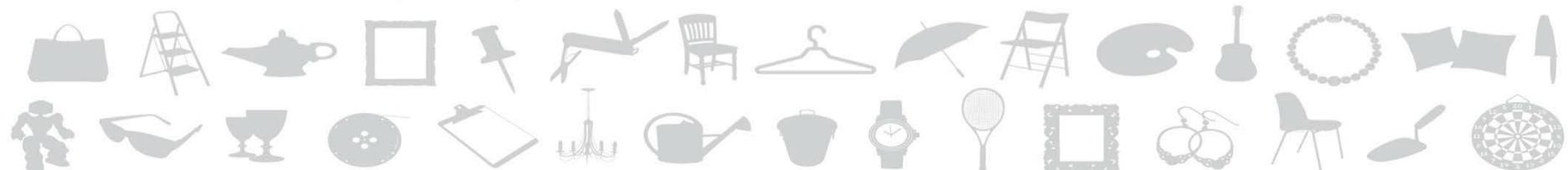


Polymers: Signifier and Signified

- The perception derives from the early use of plastics: to stimulate the bright colours and gloss of early Japanese hand-made pottery.
- Commodity polymers were and are inexpensive to process
- They are easy to mold and colour (hence the word 'plastic') making imitation easy!



www.plan59.com

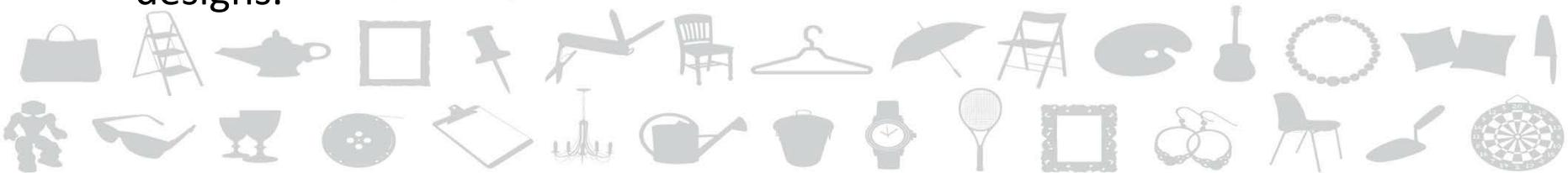


Polymers: Signifier and Signified

- But overall, polymers have more benefits than faults.
- They are a master of disguise: they can mimic the transparency of glass or the opacity of lead, as flexible as rubber or be plated to look like aluminum e.g. cell phones covers
- Polymers also have positive tactile features as they are perceived as being warm
- They lend themselves well to brightly coloured, humorous and lighthearted designs.



Walyou.com





Iron and Steel: Signifier and Signified

- From ancient times to the Industrial Revolution, there prevailed a long and solid tradition of building bridges of stone and timber
- Timber bridges were not only common, timber could also be used to create the falsework or forms for a masonry bridge
- However, in the late 18th Century in England, an acute timber shortage occurred. This was due to the wood needed for building warships to counter the Napoleonic threat.



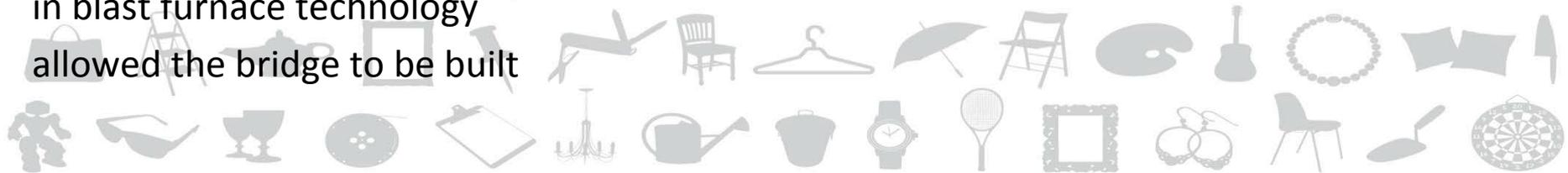
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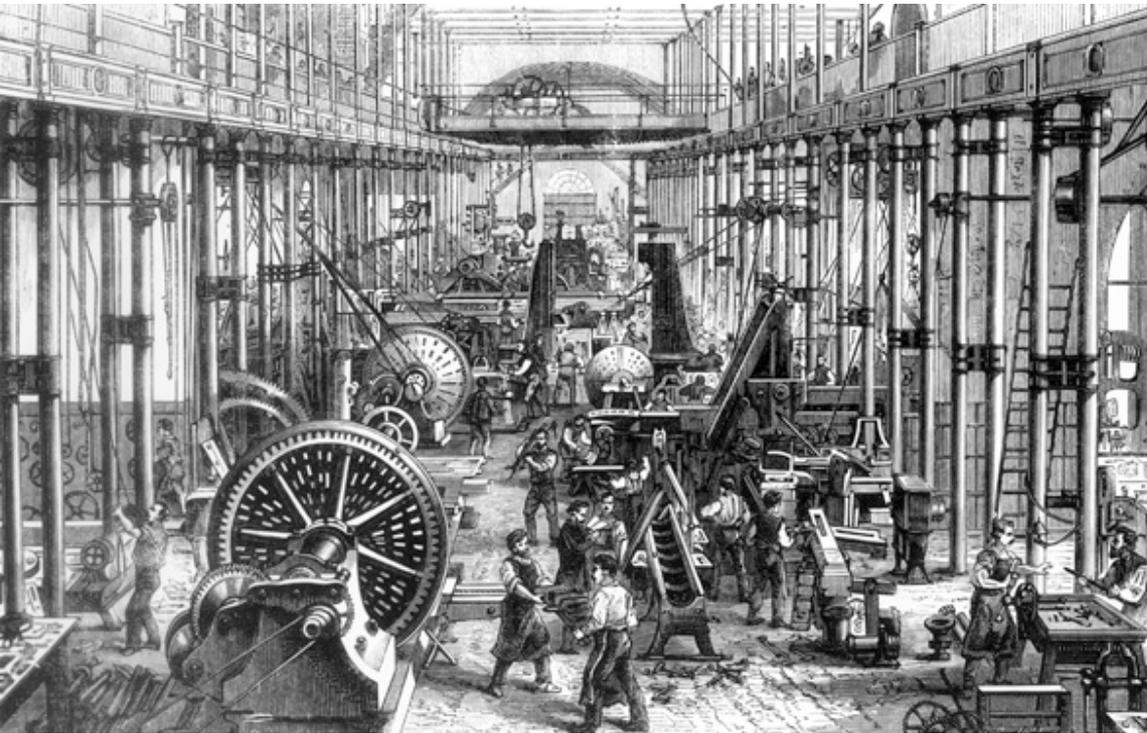
Iron and Steel: Signifier and Signified

- Because of necessity, iron was considered for the first time to be used in structural spans.
- The Severn River bridge (right) was assembled in 1781
- It was the first arch bridge to be made of cast iron.
- Although cast iron was expensive, recent innovations in blast furnace technology allowed the bridge to be built





Iron and Steel: Signifier and Signified



- What really changed human perception of iron and steel as design materials was the advent of the industrial revolution (c. 1830s onwards)
- Unlike other materials, iron and steel could be forged, stamped and formed into endless shapes and forms, lending themselves to mass production.
- This led to the consequent growth of the consumer goods market.





Product Semantics: Designing using Myth and Metaphor





Myth: A blend of Denotation and Connotation

- In reality it is difficult to separate the two levels (denotation and connotation)
- Roland Barthes himself noted that it is difficult to separate the ideological from the literal.



William Wallace Sword



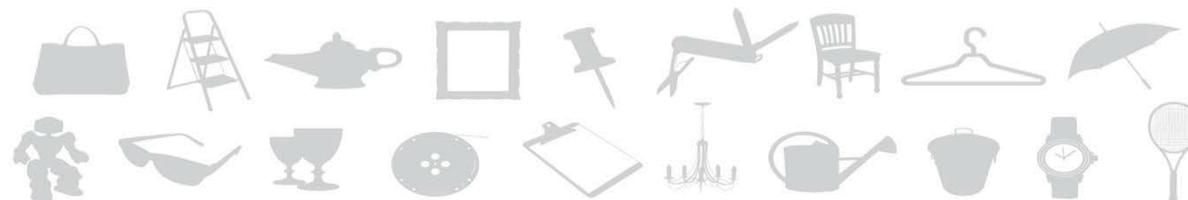


Myth: A blend of Denotation and Connotation

- Denotation and connotation combines *into the third order of signification*, which Barthes calls **Myth**. For Barthes myths were the dominant ideologies of our time.
- “...*Myth has in fact double functions: it points out and it notifies, it makes us understand something and it imposes it on us...It transforms*

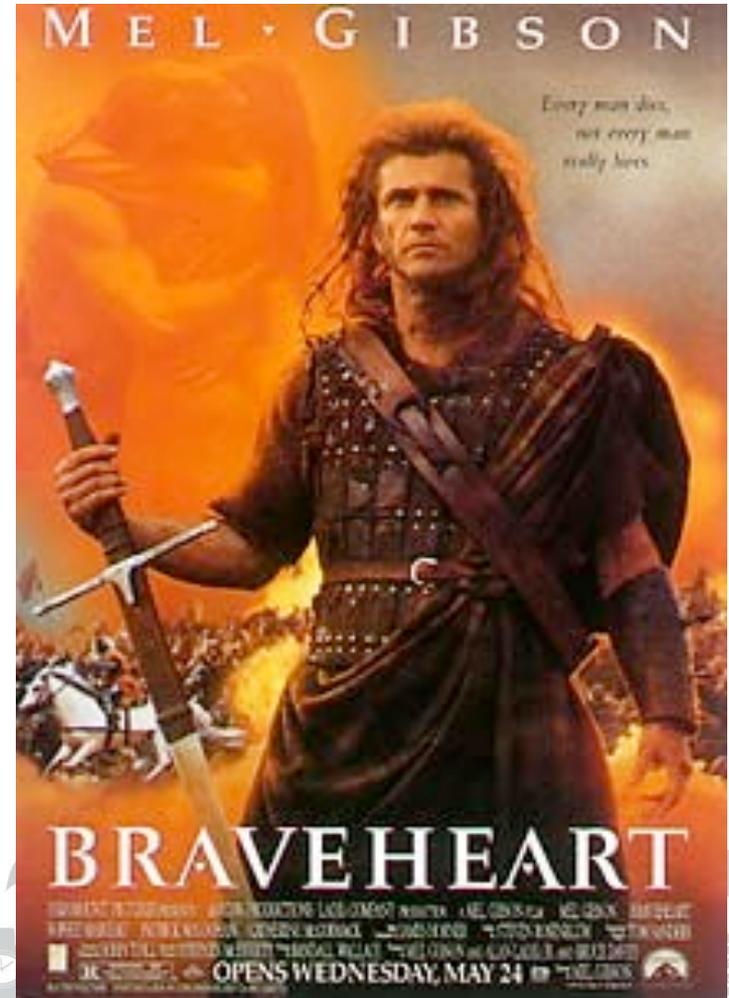


William Wallace Sword



Myth: A blend of Denotation and Connotation

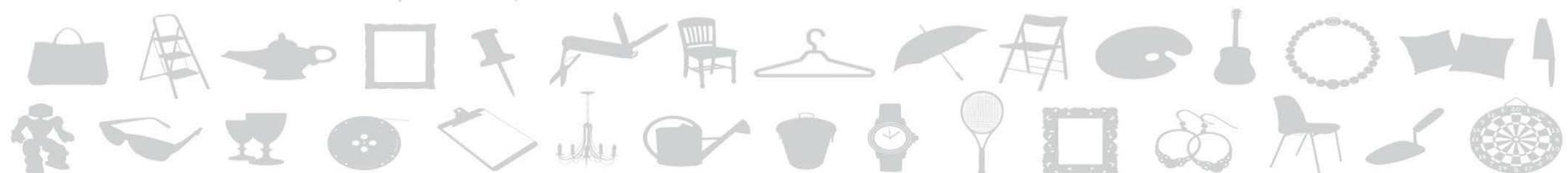
- The Denotation or literal meaning of Wallace's sword is that of a very long double-edged cutting instrument or weapon.
- The connotation is the long struggle for Scottish independence movement
- **The Myth:** William Wallace as a quasi-superhero with super powers (note the length of the sword) leading the revolt against the superior force of the British.





The Importance of Myths

- In summary, myths can be seen as **extended metaphors**.
- Like metaphors, myths help us to make sense of our experience within a culture.
- Their function is to make dominant historical and cultural values; attitudes and beliefs seem entirely “natural”, “normal”, obvious and commonsense – and thus objective and true reflections of “the way things are”.





Metaphors: Recognizing the New

- The use of **Metaphors** in design is fundamental.
- In semiotic term, a metaphor is something that explains the unknown in well-known terms.
- Whether in products, graphics, film or media, metaphors are a key element.





Metaphors: Recognizing the New

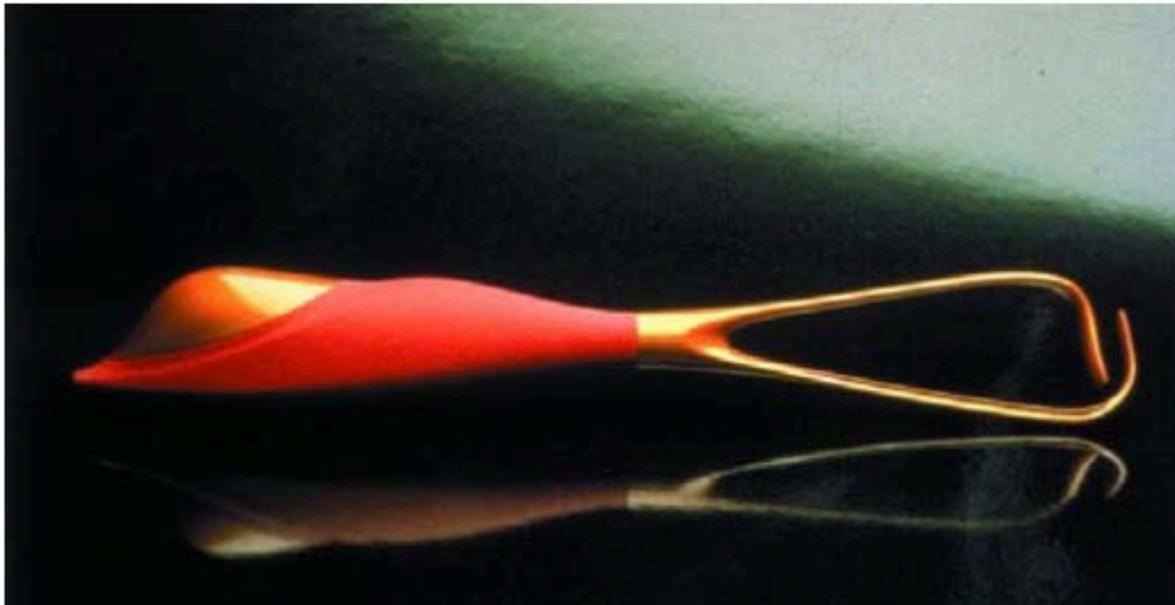
- Many products today lack clear, formal traditions and are complex to most people especially with the new computing technologies that we possess.
- Using metaphors as inspiration can help new designs resonate with users.





Metaphors: Recognizing the New

- Robert Venturis motto “Less is a bore” paraphrased Mies van der Rohes famous slogan 50 years earlier (Less is More) and signaled a new approach towards the material in the 1980s.
- Venturi claimed that architects should work with the references and culture that surrounds them rehabilitating material and historical ornaments.
- Ornament and metaphorical reference could now connote meaning.



This electric mixer has used the metaphor of an Octopus to facilitate intuitive use. When you squeeze the “body” of the Octopus in your hand it rotate the “arms” in an attempt to escape. I you press harder it will rotate faster.

M. P. P. P. P.

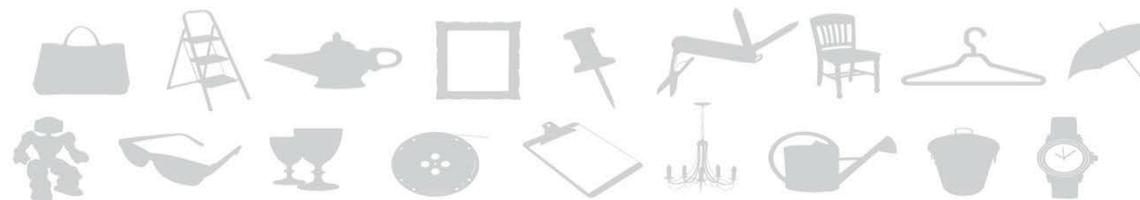


Metaphors: Recognizing the New

- Quite often, designers are tasked with creating the fascia of a new product.
- How may we recognize something entirely new? The answer is that we cannot. There must be something familiar in the new.

Solution:Lea

Lea, a vessel for the steeping and serving of tea. Inspired by the flowing and relaxed forms of nature and a desire to improve the enjoyment of life. A beautiful and inspiring piece designed to enhance the experience of steeping and serving tea. The natural shapes and flowing form create an added calm and enjoyment from the ritual that is tea.



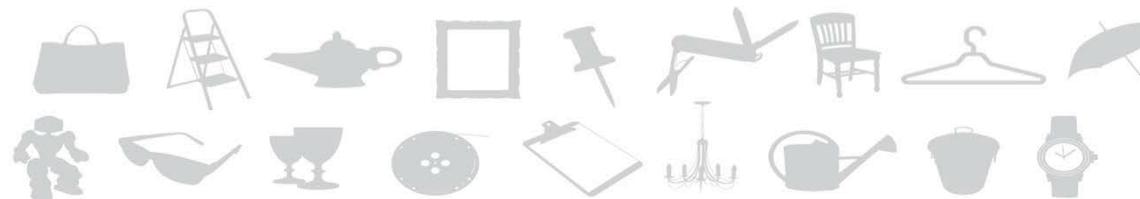


Metaphors: Recognizing the New

- The solution is to make an analogy to something well known. We can use a metaphor that helps to create understanding of the function;
- it facilitates a re-cognition of the product. Therefore design exists in the interplay between tradition and transcendence.

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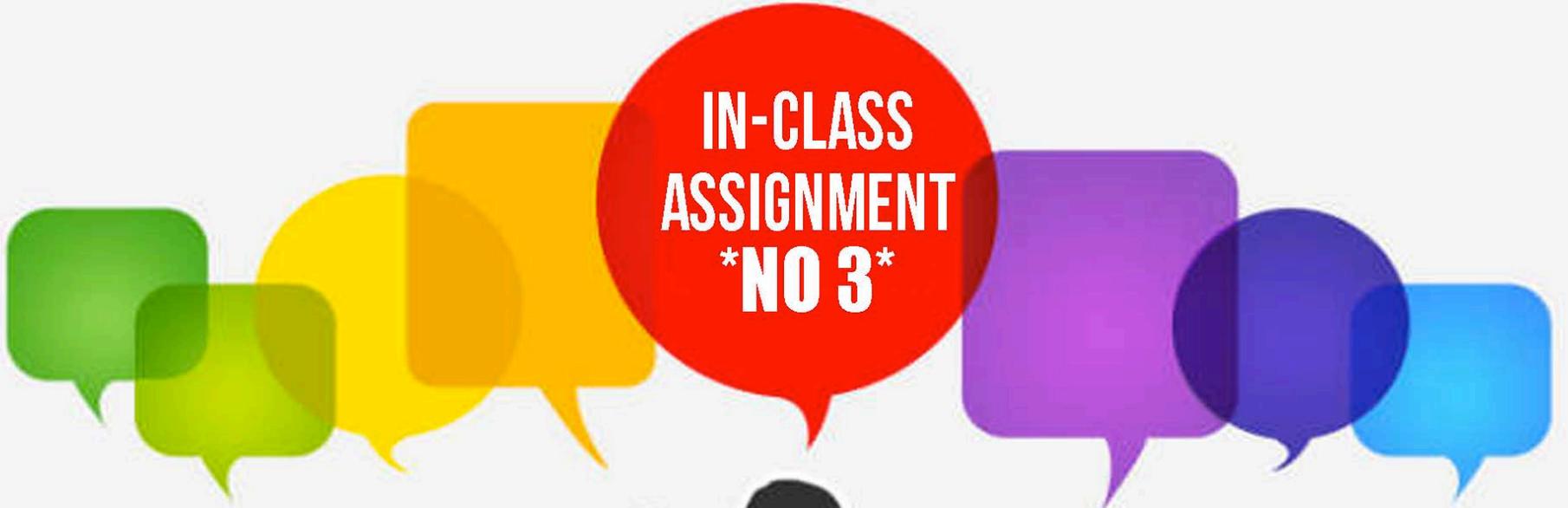
Metaphors: Recognizing the New

- In this redesign of a traditional tea kettle, the designer has been inspired by the flowing and relaxed forms of nature to enhance the experience of steeping and serving tea.

Solution: Lea

Lea, a vessel for the steeping and serving of tea. Inspired by the flowing and relaxed forms of nature and a desire to improve the enjoyment of life. A beautiful and inspiring piece designed to enhance the experience of steeping and serving tea. The natural shapes and flowing form create an added calm and enjoyment from the ritual that is tea.







In-Class Assignment 3



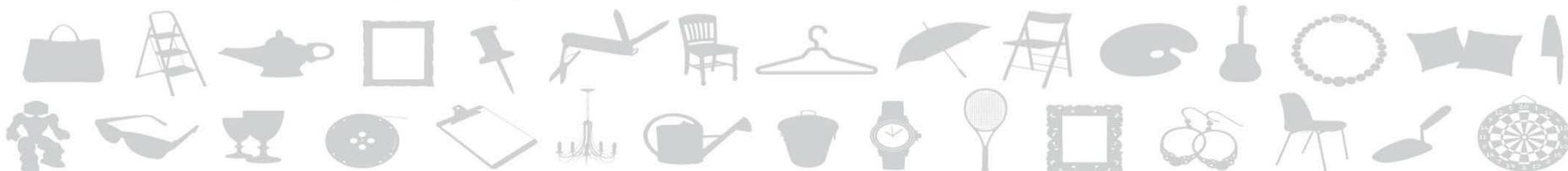
Braun Shaver



Singer Sewing Machine



Cocktail Shaker





In-Class Assignment 3

- 1. Background:** In addition to form and function, product designers need to be mindful of the semantic aspect of their designs. In week 3, we discussed how the study of human factors has made products more usable and intuitive. Similarly, the study and application of product semantics can make the new forms associated with new technology more recognizable, particularly through the use of metaphors and analogies.

In this exercise, we will examine three consumer products and analyse their form, function and semantic references (if any) to generate a persona for each.





In-Class Assignment 3

2. Steps to Follow:

- Your team will pick up 11x17 sheet to draw upon. (All students must collaborate on this project). Time providing, we will have some students explain their findings on the document projector.
- We will show three slides on the the screen of three distinct products. For each describe the following: (you make use point form and sketches if needed)
 - (a) Describe the denotation (literal) and connotative (idealized) aspects of each product. Be as descriptive as possible.
 - (b) How would you rank this product for aesthetics (form)? 1 being poor and 5 being excellent
 - (c) How would you rank the functionality of this product? (1-5)
 - (d) Rank the suitability of the design materials (1-5)
 - (e) Are there any visible metaphors or analogies being used in the design?
 - (f) Apply a,b,c and e to each product to generate a persona of an end-user. (you can draw and use annotation



3. Due: At end of lecture

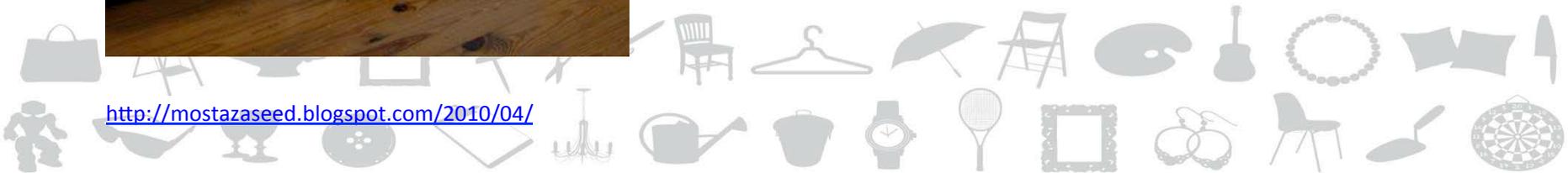


Material Perceptions are Qualitative, Evolve



- Research exists that explores the aesthetics and attributes of products.
- They suggest that a consensus exists in describing perceptions
- **But defining attributes of materials can be tricky because of subjectivity!**
- As well, products are usually perceived in the culture and context in which they are used.
- Perceptions can vary from culture and even context, especially historic periods

<http://mostazaseed.blogspot.com/2010/04/>



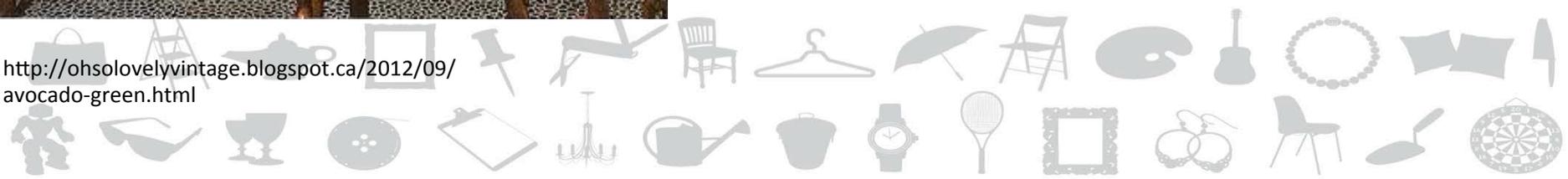


Material Perceptions are Qualitative, Evolve



- For the last two decades, white and stainless steel have been the most popular colour for appliances.
- But in the 1960s, consumers demanded a wide variety of hues and finishes
- The 1960s was a period of rebelling against authority and psychedelic music. Prevailing tastes reflected this era.
- White was associated with conformity

<http://ohsolovelyvintage.blogspot.ca/2012/09/avocado-green.html>





Material Perceptions are Qualitative, Evolve



- As an example, a product that appears luxurious, cutting-edge and aggressive in the 1970s can be seen as ‘kitschy’ tomorrow.
- **Kitsch** describes artifacts that are pleasingly distasteful. It's melodramatic, overdone, gaudy and tacky.
- Think of 1970s or 80s car styles, with their excessive chrome treatments.





Material Perceptions are Qualitative, Evolve

**INTRODUCING A NEW WAY
CORDOBA CAN OPEN UP YOUR LIFE.**

Some automobiles have it from the beginning. An indefinable combination of character and substance that gives them an immediate appeal. And makes them more than a mere necessity. Cordoba, from the beginning has been such an automobile.

And we've kept it that way. By maintaining the classic sculpturing of Cordoba's design. By continuing the choice of luxurious interior materials like soft Corinthian leather. By refining it technically with the ingenious computer-controlled Leon-Burn Engine. By keeping the price surprisingly affordable. And by adding

new things to Cordoba's appeal. Point in fact: The optional new T-Bar roof.

When opened to the sky, it affords you much the same, spacious pleasure of a convertible. When closed, you have the quiet and security of a hardtop.

Indeed, the spirit behind Cordoba's new T-Bar roof is the same as that behind the automobile.

To make driving not just one of life's necessities, but one of its pleasures.

CHRYSLER
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Not available in California and certain other areas.

*Chrysler
Cordoba*

ClickAmericana.com

- Let's examine this commercial from Chrysler for the Cordoba, a mid 70s luxury coupe.
- Do you think the material treatment in this car is applicable to today?



<https://www.youtube.com/watch?v=vIL3fbGbU2o>



Material Perceptions: Sustainability

- Here in British Columbia, the timber industry has seen its own turmoil.
- While wood is popular for furniture and home construction, its preservation for renewability has been called into question
- Ironically, even though steel-framed homes are not a new invention, wood is still the builder's material of choice.



www.googleimages.com



Material Perceptions: Sustainability

- We naturally think of materials in clichés e.g. fibres are soft, ceramics are fragile and brittle.
- We therefore expect their application to be narrow.
- But examine Marcel Wanders's knotted fiber chair.

(Marcus, What is Design Today?)

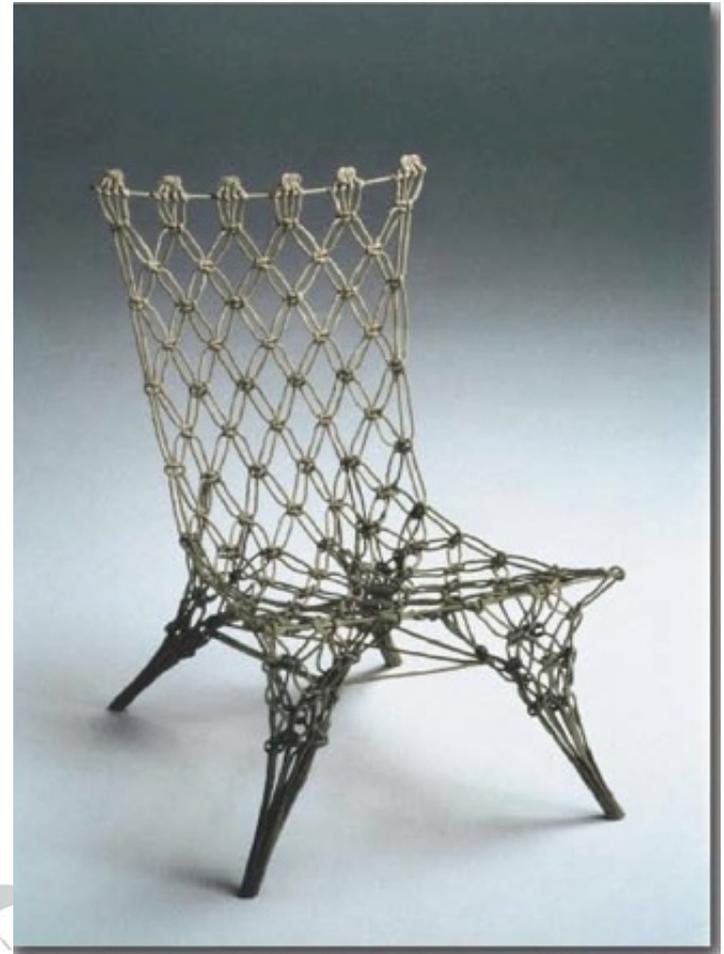


image: <http://www.dutchdesignvents.com/>

Material Perceptions: Sustainability

- Fibers do not normally create a rigid material, yet by impregnating it with epoxy a fabric created of an up-to-date replacement for the age-old hand knotting macrame technique that is rigid enough to sit on.
- In this way, Wanders arrived at a product that is not only totally new, but also confounds pre-conceptions of its material.
- **Keep this in mind for your final project.**
(Marcus, What is Design Today?)

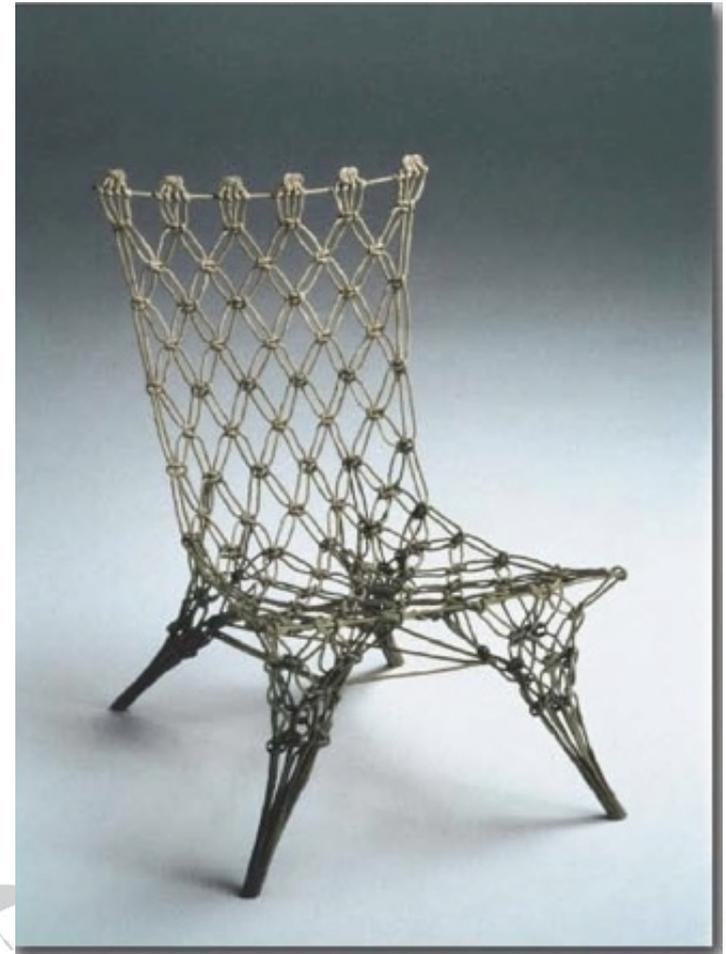


image: <http://www.dutchdesignvents.com/>



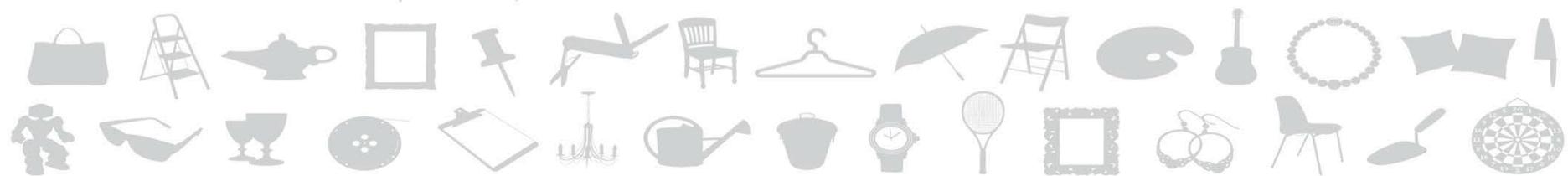
Material Perceptions: Sustainability



Image_ www.ca-doro.com/bK/index.htm

- **Bar and Knell**, a group that works with the German National Recycling Agency to create environmental awareness, molds its furniture from used plastic packaging.
- The plastic packaging itself is not strong structurally, but when laminated in layers, it rivals wood.
- The designers have also flaunted the origins of the materials with the distorted labels that shroud their surfaces.

(Marcus, What is Design Today?)





Designing Identity with Materials





Designing Identity: The United States



- America's culture is full of confirms of what it means to be American, a characteristic that seems odd to non-Americans, but has been very important to the development and cohesion of the nation.
- The **'Streamlined Style'** of the 1930s utilized with steel and aluminum and was associated with American culture and progress
- Ironically, the material adhered well to aerodynamics although many products were not tested in the wind tunnel

http://obviousmag.org/en/archives/2008/04/the_wondrous_locomotives_of_raymond_loewy.html



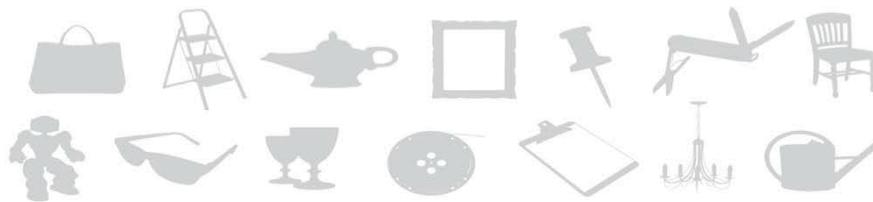


Designing Identity: USA

- The slick, clean surfaces were not only a nice and modern style but signified the hygiene, cleanliness and comfort that were shared by all Americans irrespective of national origin.
- Another important constituent of the idea of American-ness was the belief in material prosperity and the abundance of commodities, which thus needed to be freely available and identifiably American.



www.egodesign.ca



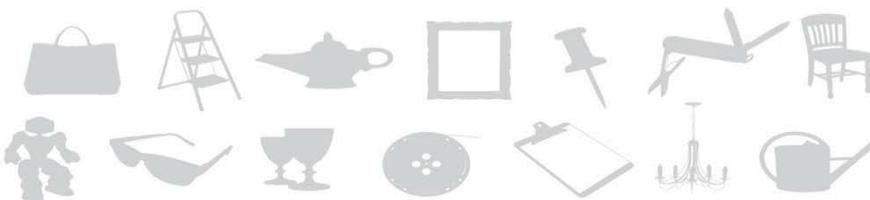


Designing Identity: USA

- Streamlining embodied the characteristics that would make products identifiable as American and create a cohesive mass market.



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Designing Identity: The U.S.S.R.

- Interestingly, material perceptions can overlap in the world of politics.
- In 1912, an ex-theology student named **Joseph Djugashvili** (1878-1953) changed his name to Stalin, a translation from 'steel' in Russian.
- Stalin later proceeded to live up to his name and incidentally instigated massive industrialization, building up the steel industry, in a series of five-year plans.



Designing Identity: The U.S.S.R.

- One of the by-products of expanding steel production was that there was overproduction.
- With the fall of Communism, many Eastern-Block countries were forced to close inefficient steel mills due to a surplus of materiel.

