

Session_01 Biomimicry : Abstracting good ideas from nature

Sunday 07 Dec Notes

Compiled by Posan Pang, Limegrass

Visual Notetaking – Emergent Themes

▪ Systems & Organisations

- Similarities between species in the organisation of specialist areas of function.
- Areas generally divided into : Ideas → Engines → Tools

▪ Pattern & the Function of Pattern

Pattern for a Physical Functions

- Sub- cutaneous ridges over a dolphin's body follow the same contours as the streamlines that water follows over their body surface. These ridges are about the same size as the ridges on our fingertips and the outer skin of a dolphin keys into these ridges and prevents the skin from slipping. The ridges follow the flowlines as it appears to be the best arrangement for preventing the skin from slipping against the resistance of water.
- The grooves on a whale's throat allow it to expand and take in huge mouthfuls of water and krill when feeding. The grooves also enable the throat to contract when the whale is swimming, to give it a more streamlined shape.
- Nautilus. Each chamber leading out from the middle of the spiral is younger and larger than the previous one; the nautilus only lives in the outermost chamber. A hard membrane separates the chambers, which are connected by a vein through which liquid is removed or added to the chambers enabling it to maintain neutral buoyancy.

Function of Pattern as Camouflage

- Countershading. When the sun shines on top of an animal's body, it's underside is left in shade. This shadow makes the animal easy to see unless it's body is countershaded. A countershaded body is dark on top and light underneath eg spinner dolphin.
- Lack of markings and pattern is used as camouflage in the ocean's depths. In very low light levels it appears that pattern makes a creature stand out.

▪ Asymmetry

- In nature irregularities in pattern can also be seen.
- Asymmetry could also be seen as beauty. Classical arts define absolute rules for beauty – rules for proportion and symmetry. Studies on faces suggest symmetry and beauty are directly proportional. Beauty spot introduces asymmetry and imperfection.
- Crab with one large claw. The large claw has a functional purpose – it may be used in defense. The claw is also used to attach mates. In daylight, the crab waves it's claw, by night it hammers the ground with it's claw.

▪ Attachment

- Some mussels bury into rocks for protection.
- Date mussels chemically erode the rock.
- Invertebrates that literally eat into rock.

- **Repetition**

- Notion of simple blocks forming complex shapes.
- This repeats itself from the molecular level eg. DNA, to macroscopic level eg. snake's spine. Nature's Lego.

- **Evolution for Performance**

- Mountain goats hooves evolved to cope with demanding terrain and weather conditions. Hard and soft surfaces. Wet and dry climates.
- Nike studies of the mountain goat led to the development of Goatek Traction trainers.
- Fur is hollow in order to cope with the cold weather.
- Randomness in the design of nature – evolution of new ideas which have yet to be explained. eg the spike on a swordfish.
- Performance characteristics can be mapped out in a fitness landscape. In some instances species have missed the peak, their evolutionary path cannot take them back.
- Convergent evolution – where two similar environments have led to similar species evolving independently. Eg. the Kingfisher in Europe and Kukuborough in Australia.
- Sunfish – power is in the dorsal fin, able to be very streamlined. Analogous with submarine.

- **Sustainability**

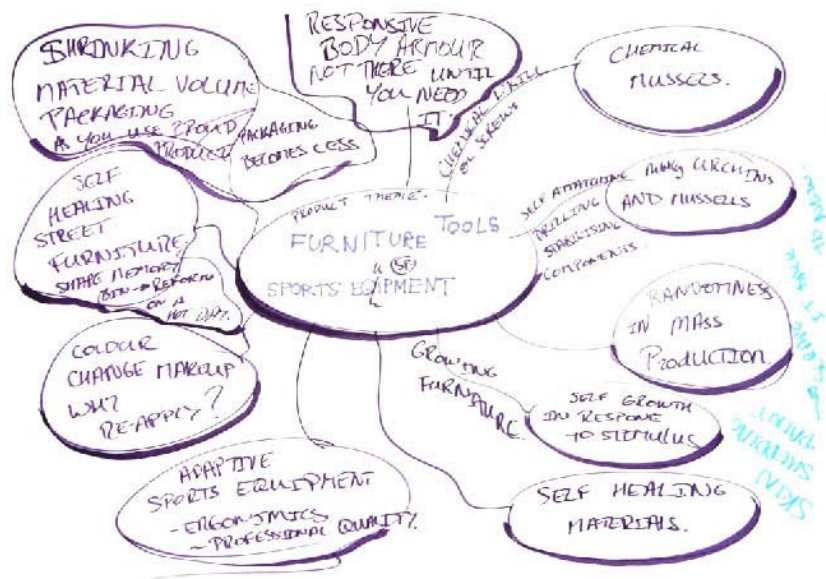
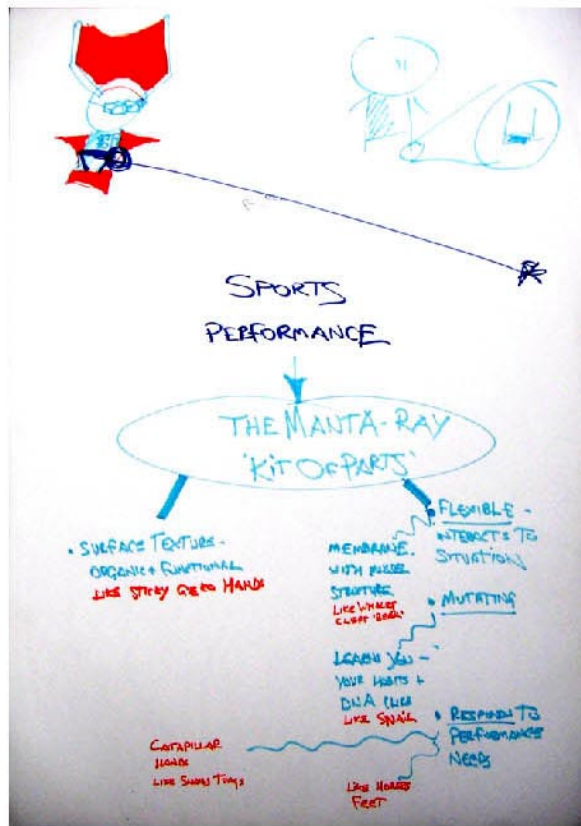
- Birds make their nests from local materials available. In general Humans have moved away from this.

- **Self -regulation**

- Alligators cover their eggs with vegetation during incubation process. Vegetation rots down releasing heat to keep the eggs warm. Temperature linked to gender?
- Hagfish produces a very slimy coating on it's skin - deterrent to predators? Hagfish self cleans by tying itself into a "slime" knot.

Brainstorming Session

A theme that emerged from the day was an interest in self-evolving or adaptive technology ie the ability of an object to transform to suit purpose.



creative weekend ^{dec}03



Session_01 Biomimicry : Abstracting good ideas from nature

Sources of Further Information

Compiled by Posan Pang, Limegrass

General

▪ Institutions

- **Centre of Biomimetics, University of Reading**

www.reading.ac.uk/biomimetics

Some current research topics are: plant fibres for sustainable composite materials, smart actuator gels, spider silk synthesis.

- **Centre of Biomimetics, University of Bath**

<http://www.bath.ac.uk/mech-eng/biomimetics>

<http://students.bath.ac.uk/en1regb/biomimetics/biobath.html>

- **Bionis** – The Biomimetics Network for Industrial Sustainability

<http://www.extra.rdg.ac.uk/eng/BIONIS/>

▪ Books

- Benyus, Janine; **Biomimicry : Innovation Inspired by Nature** ; Perennial 2002
- Bappert, R. et al ; **Biologie Technik, Zukunfts –Technik lernt von der Natur** ; Siemens Forum 1998

Applications of Biomimicry

▪ Web:

- **Interface's Entropy** carpet tiles emulate the random pattern of fallen leaves or stones, thus minimising the need to match patterns when one tile requires replacing.
http://www.interfacecarpets.com/internet/IEEnglish.nsf/V_LUSCW2/InterfaceEntropy?opendocument&framedoc=body

- **Lotusan** – Water repellent silicone paints based on the surface microstructure of a lotus leaf.

www.ispo-online

- **Nautilus**
buoyancy

<http://natzoo.si.edu/Publications/ZooGoer/2000/6/nautilusshellgame.cfm>

<http://www.sciencedaily.com/encyclopedia/Nautilus>

the golden ratio

<http://www.dal.ca/~ceph/TCP/Npompil.html>

- **Gecko Glue**

<http://dsc.discovery.com/news/briefs/20020826/gecko.html>

- **Emperor Penguins**

<http://www.aad.gov.au/default.asp?casid=3524>