BioDesign: The Nature of Design

Overview

• Introduction
• Design Vision
• The Future: Design In Nature
• Seamless mobility
• Conclusions

Franco Lodato, Chief Designer
Motorola IDEN
Our Design is the catalyst, connecting and converging Motorola’s superior technology with our Human User’s Real Life.
Bionics or Biodesign deals with the technical transformation and application of structures, procedures and developmental principles of biological systems.

An interdisciplinary research fields that combines biology with engineering, architecture and mathematics.
Design Analogies
Efficient aerodynamic form inspired by the tuna – Smartfish, Bern Switzerland
Beetle exoskeleton generates pigment-free structural colors

Paint with similar effect - BASF
Re-discovering a “New Language”
Technical Approach

1) Identify suitable opportunities target areas.

2) Select relevant biological models and undertake or commission research to understand them.

3) Abstract this understanding into Engineering analogues.

4) Assess the feasibility of incorporating this technology into useful product prototypes.
Integrating biodesign

Discovery

Identify natural phenomena and principles

Definition

Implement biological principle

Evaluation

Evaluate and compare

Delivery

Standard process of observation in nature

Input

Implement

Output
BioDesign principles
Proposta generale della prima potenza piccola ad inclinazione variabile

Concept:
Manico in mat. semi-rigido con estrema rigidezza variabile in lunghezza. Inserimento di elemento di uso comune (lato di guida, manubrio, ecc.).
Superficie generale in mat. anti-scaric. Elettrodo perforato in modo automaticamente elettrico (solare, termico, ecc.)
Impaginazione variabile mediante sistema reticolare geometrico
STUDIO GERALE DEI BECCHI DEGLI UCELLO: ANALISI COMPARATIVO

Caratteristiche più importanti e funzionalità della estremità.

[Diagram with various bird beaks and illustrations]
Engineering
Nature by Design
Outstanding results
Development of Personal Communication Network into Bio-communication:

**Technology:** Best at time, network, hardware, software.

**Industrial design:** Developing wearability, style, functionality.

**Fashion:** Beyond clothing and gizmos, aimed at simplifying and improving quality of life.

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**2000:**
- Cellular phone
- Pager
- Computer/internet
- Parasitic power/shoe

**2005:**
- PDA
- Contacts/glasses
- Vital's monitor as wearable

**2010:**
- PDA
- Bio-chip - vital's monitor
- Contacts/glasses
- Bio-energy
- Computer/internet

* Bio-chip technology is added to interrelated existing communication products.

*Priority should be on creating a distributed computing network of wearable products.

PAN Development
Future Needs
iDEN Wireless BodyNET Applications

- Telemedicine
- Seniors
- Base System
- Security
- Entertainment

Franco Lodato
October 2004
Entertainment Base System

iDEN Wireless BodyNET Applications

Telemedicine
Seniors
Base System
Security
Entertainment
iDEN Wireless BodyNET Technology

Personal Gateway

RF Passport

a) RF+DIG of phase 1
b) Design for ITM+IDM
c) Design for ITM+IDM+802.11b
Phase 4: iDEN Wireless BodyNET Technology Plan

Bluetooth with ACE

Bluetooth Biosensors
iDEN Wireless BodyNET concepts

Secure Zone Product Concepts with GPS, iDEN Radio and Bluetooth

PET

ELDERLY

INFANT

CHILD
MOTOROLA OFFSPRING (‘WEARABLES’)  
CONCEPTUAL DESIGN

Motorola Offspring (‘Wearables’) is a design exploration of a family of connected, modular wireless communication devices. The concepts utilize Motorola’s iDEN technology, as well as the latest advances in miniaturization and Bluetooth technology, to enable entertainment, business, and security-related communications and broadband applications. The devices, individually designed to be worn as fashionable accessories, each have an independent power source and memory. Each device communicates and shares information with the other devices and the user, operating as a seamless personal network.
bionic

- concepts and shapes that are rooted in Nature

1. organic
2. no straight lines
3. textured
4. color
5. relates to nature

fractals

- visually translating AI and algorithmic technology

1. repeating elements
2. systemic
3. scaled patterns
4. movement
5. micro to macro

design theme

- connect to the pioneering spirit of Motorola

1. machine aesthetic
2. industrial
3. homage to metals
4. machined parts
5. linear
The entire family of modular devices is wirelessly connected, allowing each device to share information with other devices and the user, operating as a seamless personal network.
Seamless mobility: Car /Person
3: INTELLIGENCE & BEYOND
The Brain: The Final Frontier?
To go Faster we need to look Further.....
BioDesign Database

**Sensors** – based on nerve functioning (stress, strain, temperature, vision, chemical)

**Mechanism design** - skeletal structure or pure biological geometry

**Mechanical structures, schemes and mechanisms** - exoskeletons, flexures/elasticity--bugs have it all

**Fluid systems** - pumps, valves, cooling of dwellings

**Heat transfer management** – cooling of core body temperature, transfer of heat from one region to another

**Energy management** – creation of heat, reflection, absorption, insulation

**Taking advantage of phase change** - one beetle uses its' shell to collect condensation and then hydrate itself

**Water resistance and waterproofing**

**Chemical resistance**

**Color management and color changing ability** – chameleon / octopus, pigments, bioluminescence.

**Behavior** - swarming and collective behavior, making computers behave with a "hive mind" similar to ants/bees.

**Motion control (incl. visual processing and feedback) algorithms** – MIT AI lab

**Methods of locomotion**

**Actuator development** - muscle mimicry, potential energy windup like in grasshopper or ballerina legs, etc.

**Learning / perception algorithms** -

**Interaction principles** - human-machine interaction is very different to human interactions with living things

**Use of exothermic reactions** - producing light, heat

**Energy storage** - nice fat cell in your next walkman?

**Sticking surfaces / adhesion**

**Construction techniques** – e.g. a gopher and beavers.

**Fluid management** - pumps, valves, hearts, etc.

**Textures** –

**Fibers** – materials, properties

**Information dissemination** – inspired by dandelion seeds, owl calls, bee dances, disease spreading, etc.....
**BioDesign Lessons**

**Humility**
Nature is THE master designer
Spider web vs. steel
Abalone shell vs. Kevlar

**Imitate, don’t duplicate**
Be creative in your interpretation of nature's lessons
Understand why nature chose its solution

**Biodesign ≠ Sustainability**
Be clear about your motives for applying Biodesign

Yet another argument for a multidisciplinary approach
The microscope is the designer’s new best friend
Biologist+Designer > Many Designers

**Mimicry can be the first step towards creative thinking**

**We are on the cusp of a great movement**
An opportunity for all of us to play a part
Conclusions

• The tool to influence the Concept Process
• Stimulate Creativity in design
• Results in innovative solutions
• Allows contributions from other Disciplines
• Expand knowledge and remove barriers
Molte GRAZIE!!