



Every retail store is stocked with
products that crossed the chasm...
...can it be so hard?
(a heritage of 10,000 years)

Crossing Chasms through engineering design

Some crossers and some non crossers
the role of complexity
utility and ROI: necessary?

Professor Rick Fleeter

10,000 Years of Successful Innovations each displaced something not all faced chasms



Innovation

Enabler

Alternatives

Wheel	Tools to cut wood / stone	Dragging, flailing, lifting
Bread	Agriculture, yeast	Cereals
Meat eating	Cooperation / tools	Gathering / starvation
Medicine	Scientific Method / Observation	Religion, Witchcraft
Gun Powder / Firearms	Chemistry	Spear, Sword, catapult
Electric Light	Electricity	Gas light, candles, daylight
Sugar	Transportation	Maple sugar
Kleenex	Paper tech, economics	Handkerchief
Toothpaste	Marketing / Medicine	Baking Soda
Plumbing	Electric Power, Water utility	Well, outhouse, aquaduct



how about...



frozen veggies
TV Dinners
Sushi
running shoes
running

Course Projects SOS

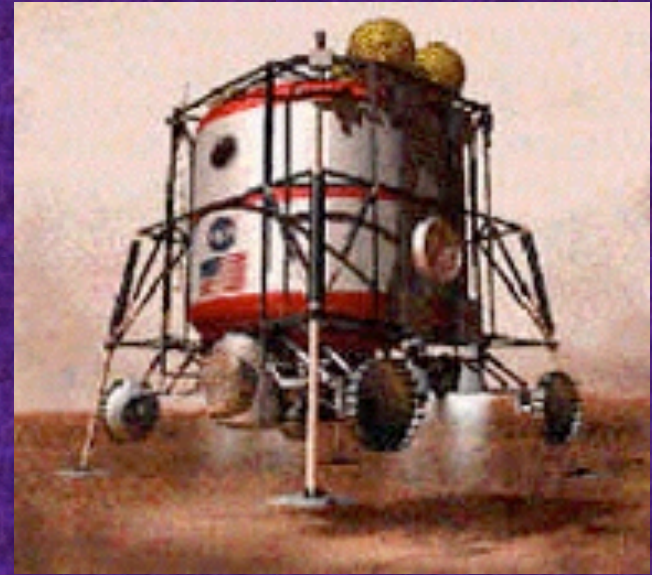
Categories

- Recreate niche product / activity / service you enjoy
 - increase relevance, impact on consumer's life:
laser => laser pointer // email => facebook
 - reduce cost, risk, complexity
Wii Tennis // Air Guitar // Ready-to-Bake
 - Convert from public property to ownership
endless pool (why didn't this cross?)
 - Cubical small watermelons and home solar power
- A new idea: programmable surfaces, washables
- Build a bridge across the chasm for a stalled concept
 - Technologies
 - tech breakthrough ID, mass production and modularity, leverage PC or phone
 - Sociologies
 - Institutions (libraries helped audiobooks cross)
(social workers and smart house?)
 - The Beach Head! (what is it...



BEWARE THE LURES OF MAGIC

on reading



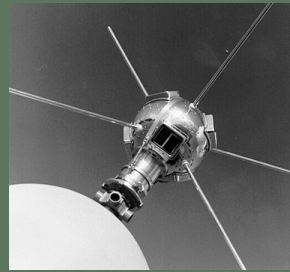
- **Reading:**
 - **Zubrin Case for Mars: forward, preface, & chapter 1:**
 - **intro to Christensen**
 - **Moore chapter 2 & 3**



Transitions and Complexity

'50s:

Can it be done?



Once we stopped laughing

satellites, human space
phones, cordless, cell, SMS
air travel, digital watch
PCs, laptops, tablets (Newton)
"TV Dinners" solar power
working women, voting women

▽ Pre-Sputnik

- ▽ Proofs of impossibility:
 - synthetic orbiting bodies
 - human survival in space
- ▽ Questionable usefulness:
 - distant imagery at high V
 - lethality

▽ Pre- Pre-Sputnik

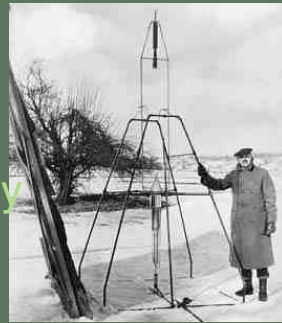
- ▽ Goddard Rocket
- ▽ Orbital Mechanics (Kepler, Newton)
- ▽ Chinese Rocketry
- ▽ A void filled by fiction
(specific references: HG Wells,
St. Exupery, Zodiac, Constellations,
Druids, Pyramids, Eclipses and lights,
comets and supernovae

- ▽ 13th try
- ▽ all small, no people
 - minimal safety & bureaucracy
 - Reliability, utility & budget
subordinant to know how

- ▽ Chasms Crossed
 - 62 miles
 - 10 km/s ΔV
 - Motivations Exist
(not great ones, necessarily)

- ▽ Dies cast /Chasms Created
 - ▽ Military Space & Cold War
 - ▽ Stage: drama of human destiny
 - ▽ Rocket Science

Crossing the (your Chasm here)



'60s: Humans to the Moon

▽ Gemini, Apollo, Saturn

- ▽ Human suborbital, orbital, long duration and lunar
- ▽ Von Braun model verified (but also deified)
- ▽ Robotic alternative (largely suppressed viz pilots)*

▽ Soviet Institutions

- ▽ Rockets and Capsules
- ▽ Space Agency
- ▽ Soviet - philosophy realized in space engineering
 - massive inelegant efficiency
 - accept and manage failures
 - low tech
 - No Lewis & Clarke heritage

▽ Chasms Crossed

- Human spaceflight
- Escape from Earth
 - Interplanetary • Lunar
 - Deep Space
- Civil + Military = Stability

▽ Dies cast /Chasms Created

- ▽ Cult of safety / reliability
- ▽ Space-specific engineering
- ▽ Gvt / Science / R&D territory
 - not commercial:
 - 6 time-shared computers is plenty
- ▽ Human scale & presence:
 - Lewis & Clarke template
- ▽ (T)R&W as National Asset

***The Right Stuff:
movie vs. book**

Crossing the (your Chasm here)

'70s: Textbook Transition

▽ Government Retreat

- ▽ Apollo terminates
- ▽ No lunar base
No space station
- ▽ Shuttle planned
to routinize space
- ▽ Bush Sr:
Commercial Space Act
government legislating commerce



▽ Commerce takes over

- ▽ GEO Comsat takes off
- ▽ Remote sensing
to revolutionize
agriculture, weather, reconnaissance



▽ Hi-Tech / Tech Transfer

- ▽ digital Imagery: Pixels
- ▽ Parabolas viz. Cylinders
digital/imaging/jets/transport
- ▽ Skylab / Spacehab

▽ World View

Blue Planet / Earthrise and the
(1st)eco-revolution: Greens

▽ Chasms Crossed

- ROI - and lots of it (a bubble)
- Space permeates self image
- Space Heros with career paths
Lindberg / aircraft model

▽ Dies cast / Chasms Created

- ▽ Infrastructure gone or poor
Saturn, Station, Shuttle
- ▽ hype v. reality gap
space apps and spin-offs
logarithmic distance perception
- ▽ Government:
your in-laws living next door
- ▽ Diffuse plans for chasm cross
to practical markets

Crossing the (your Chasm here)

'80s and '90s: "not exactly..."

- ▽ Shuttle
 - Not cheap - more expensive
 - Payload and altitude limited
 - not routine and not safe
 - Spacehab fails
 - not scaleable as were von Braun's

▽ No commercial successes:

- remote sensing all gvt
- GPS all gvt
- GEOs face fiber and terrestrial
- LEOs even worse

▽ Human Experiments

- No human space flight (done that)
- Shuttle expensive
- Space Shuttle legacy of benefits

▽ No new DoD apps

- Reconnaissance now 30 years old
- Star Wars revealed as good fake
- Missile Defense: almost ready

▽ Successes...

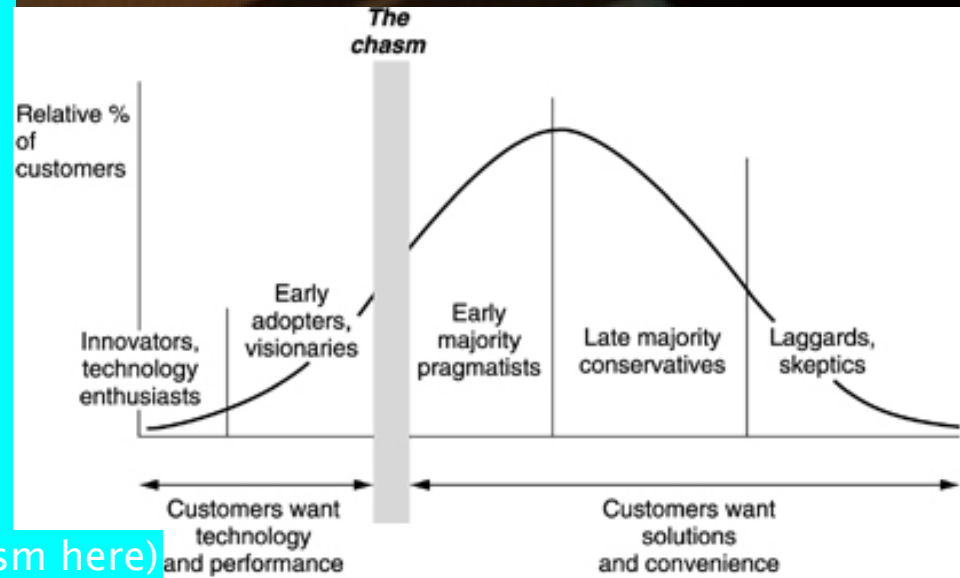
...but in "wrong" areas;

- Planetary Flyby & Robotic Rovers

▽ Chasms Crossed:

▽ Dies cast

- Costly
- Human template
- Reliability and transport
- Commercial returns
- Challenger coupe de grace for
- civilian rides & repair missions
- Space as Cold War relic?

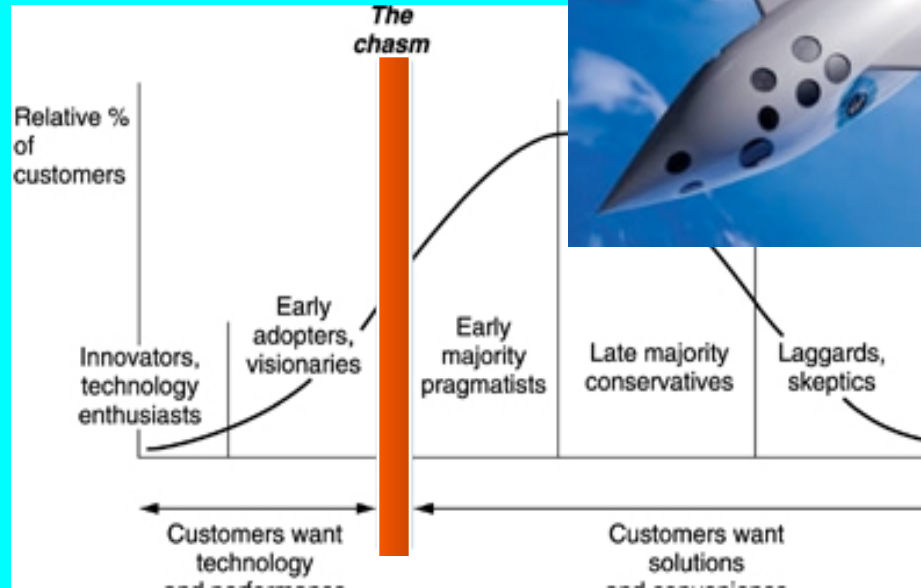


Crossing the (your Chasm here)

What Went Wrong?

▽ Your ideas here...

- ▽ Not palm pilots
- ▽ return on investment cycle
- ▽ human element to humanize the space experience
- ▽ Profit vs. societal progress
- ▽ Vision is unclear and un-bold
- ▽ People are now accustomed to space and not impressed with it for its own sake
- ▽ Government has created a non-economic space model
- ▽ Clumsy execution
- ▽ \$10,000 / kg



Better Tactics?

▽ Your ideas here...

- ▽ bring π motive into aerospace (e.g. SpaceX, Virgin Galactic)
- ▽ X-prize model to encourage private sector innovation





Product Information | North America | Chemicals

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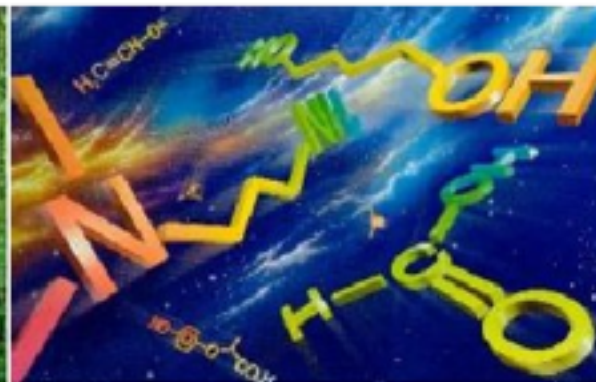
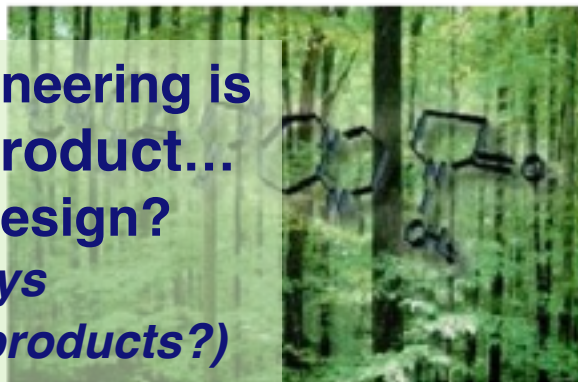
Welcome to Chemicals

BASF's Chemical operations are the traditional core business of BASF in North America. The extensive product range includes basic, intermediate, and performance chemicals, as well as specialty products. The chemicals group is committed to continuously meeting or exceeding the expectations of key stakeholders: customers, employees, the BASF Group, and the public. At BASF, "We don't make the products you buy. We make the products you buy better"™

We know that in a competitive environment, success depends on understanding the customer's needs, responsiveness, focus and efficiency. We view change as a challenge and an opportunity and are dedicated to responding to our customers' needs quickly.

Basic, intermediates, and performance chemicals are manufactured by BASF in North America. The Chemicals group also has access to BASF plants in Europe, Asia and South America allowing us to respond rapidly to customer needs.

To search for products by industry, please click on the menu item [Industries](#) on the main navigation menu located on the left side of the screen. To search for products by BASF trade name, please click on the menu item [Brands](#). You can also search for products by [Product Groups](#).



- * Google Earth
- * GPS
- * In-flight TV, phone, internet
- * Exploration

* Not all engineering is for an end-product...
=> is it still design?
(hint - who buys intermediate products?)

Is every chasm crosser something you buy?
Or does it make something you buy better / possible?*

Designer's Notebook #3a: Industrial Design

Examples

Connectors, Insulation, heaters, rods&pipe, chemicals, tools, coatings, task-specific clothing & uniforms



But what color is it?

ATF, Gold Anodize, Red Wire / Black Wire
Whites, Greens,



Industrial Does & Don'ts

- Functional, uniform, labeled, form<funct.
- overt style, labeling v. naming,

Venues for Industrial Design

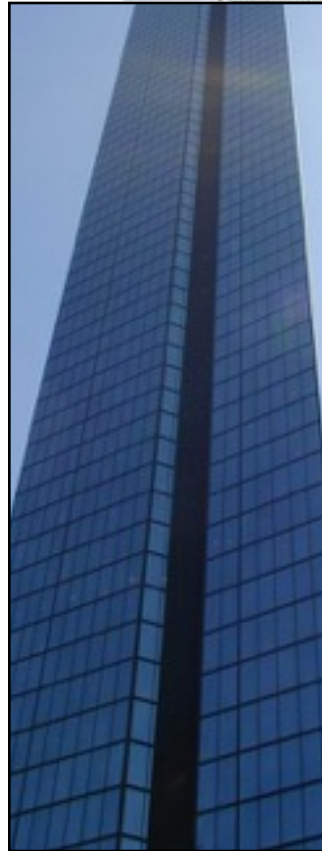
certain catalogs, shows, corp web sites

Why does it matter

Image connotes/communicates functionality

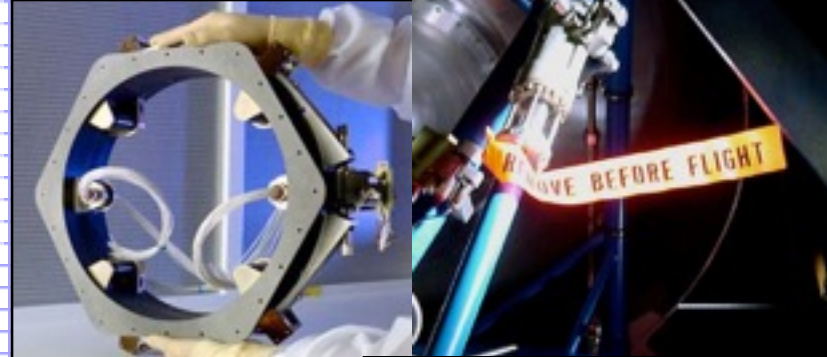
Uniformity connotes reliability

Advertising and branding



Designer's Notebook #3b: Industrial Design for Space

- Coatings:
Conductivity, fit/re-fit, thermal ϵ/α , cleaning
- Color:
polarity, uniformity, coating undamaged, remove before flight! (hazards etc.)
- Fasteners:
vibration?, how many / how frequent?
- Materials:
magnetics, outgassing, hydrogen brittle, whiskering, vacuum weld, O_3 attack, Thermal: expansion, temper, λ , (breakable: hazards, particles)
- Shapes:
edges as stress concentrators, shell strength, plate vibration, envelope fit: pizza boards?





Reg. Trade Mark. Made in Denmark
Violoncello I Special
Fino



cts



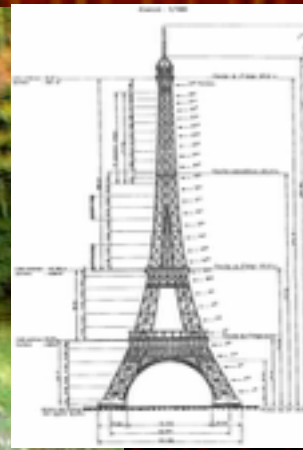
ound stations



TMI: Complexity

Overt Complexity

- Blinking VCRs
- DOS and much of Windows
- Ikea (critique of?)
- Space
- Black Box Labels
- Symphony, Ballet, Forest
- Vegematic
- Mezzi



Managing Complexity

Hierarchy of Messiness



⊗ Science:

⊗ Physics -> Chemistry -> Biology ->
Medicine -> Psychology ->
Religion, War & Macroeconomics

⊗ Electronics

⊗ Physics -> Resistors (etc.) -> Oscillator ->
Processor
-> Computer -> Chess -> Internet

⊗ Human Development

⊗ Existing -> Nouns -> Others ->
Career -> Justice

⊗ Engineering

⊗ Science / Math -> Analysis (FEA, S-plane)

Science:

Physics -> Chemistry -> Biology -> Medicine ->
Psychology -> Religion & Macroeconomics

Electronics

Physics -> Resistors (etc.) -> Oscillator -> Processor
-> Computer -> Chess -> Internet -> HAL

Human Development

Existing -> Nouns -> Others -> Career -> Justice

Engineering

Science / Math -> Analysis (FEA, S-plane) -> Design



Dealing With Messiness

Analogy

- Grasp a concept
- World Wide Web

Idealizing

- Inviscid Flow
- Current Source
- Federalist design

Reduction

- Accounting
- Race / Religion /gender
- Subsystems
- ICs

Abstraction

- Bird (aircraft), eyeball (camera)
- Modeling (finite element)

Evolution

- Bicycle
- AM -> FM -> Digital -> XM

Darwin, Bread
& Fast Food

Trial & Error / “Luck”

- Light Bulb, Pioneer 13
- Penicillin (would you have noticed?)
- Teflon (would you have looked)

Tools Cut Clutter

(clean room, micromanipulation)

in defense of Complexity

Covert Complexity

- i(everything)
- automobiles
except BMW's (idiotic) idrive
- CuisineArt
- White Goods
- Bread
- Every food in a package
- Home Mortgage
- Televisions until 2008



People, their stuff and everything
evolve ever more complex and then die,
replaced by simplicity

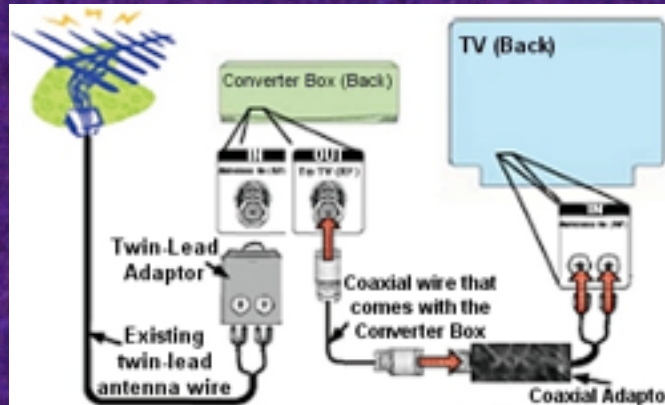
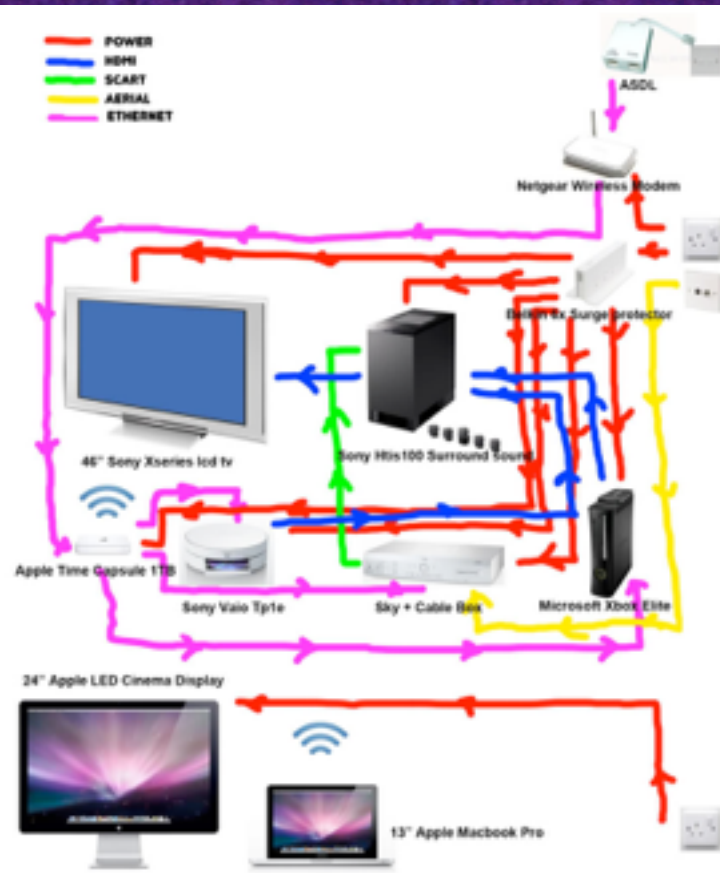
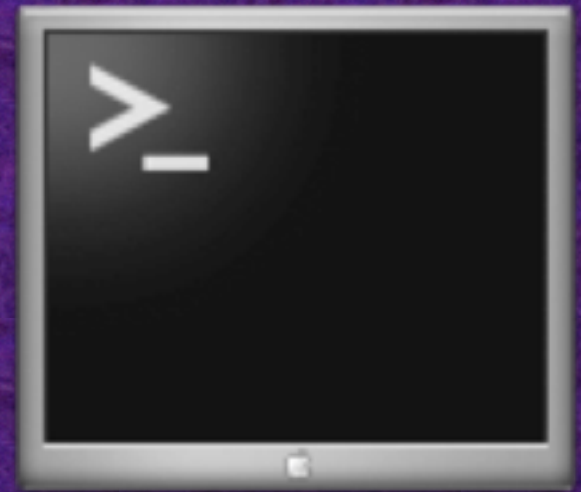
Rick Fleeter Predicts: TV is dying:

- more complex, more gadgets
- misunderstanding non-real time
- but it will take a long time, like a tree
- old platforms competing with new:
(fixed line phone v. stretch levis)

smart marketing

Web-Enabled Phone
Home Automation
Web Enabled TV

Smart Phone
Smart Home
Smart TV



Switch
to
Digital

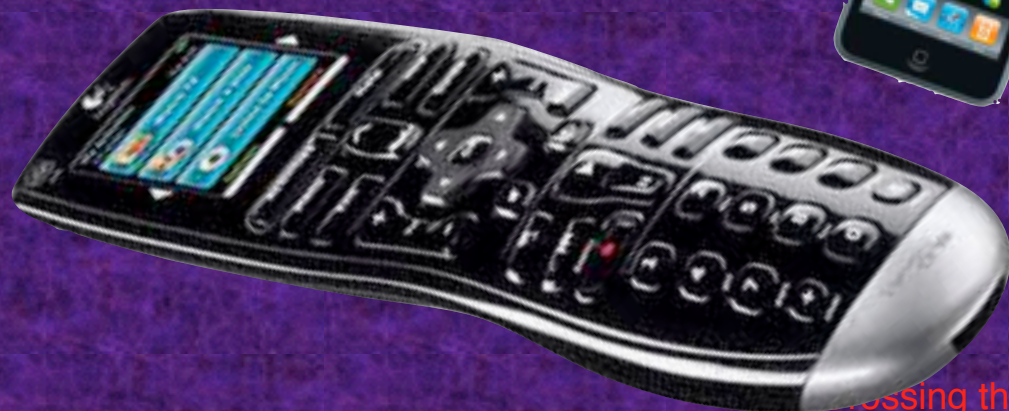
AT&T
U-verse
DVR

MacTV

Crossing the Chasm



If you're so smart



- Is Your idea...
 - "Accomplishable by mere mortals working in earth time?"
 - Providing retailers a marketable product?
 - Providing the end customer a concrete ROI? (Fleeter)
- What is your equivalent of...
 - England? • The Channel? • Europe?
 - Who now controls Europe? (Moore, ch. 3)
- How could you overwhelm the status quo...
 - by seizing Normandy?
 - and then by dominating Europe? (Moore, ch. 3)

Smart Home



- no remote, no training, no learning curve
- initial and recurring revenue
- Value Proposition: Stay in your home
- England: home builders? VNAs? Nursing homes? home security services? sensor vendors? iRobot?
- Channel: Complexity, Trust, Financing (current conception of "smart house")
- Beachhead a: web active singles in rehab
- Beachhead b: social workers
- Europe: everyone in assisted living
- Controlled by Long Term Care Providers like Life Care Services and families – at home care

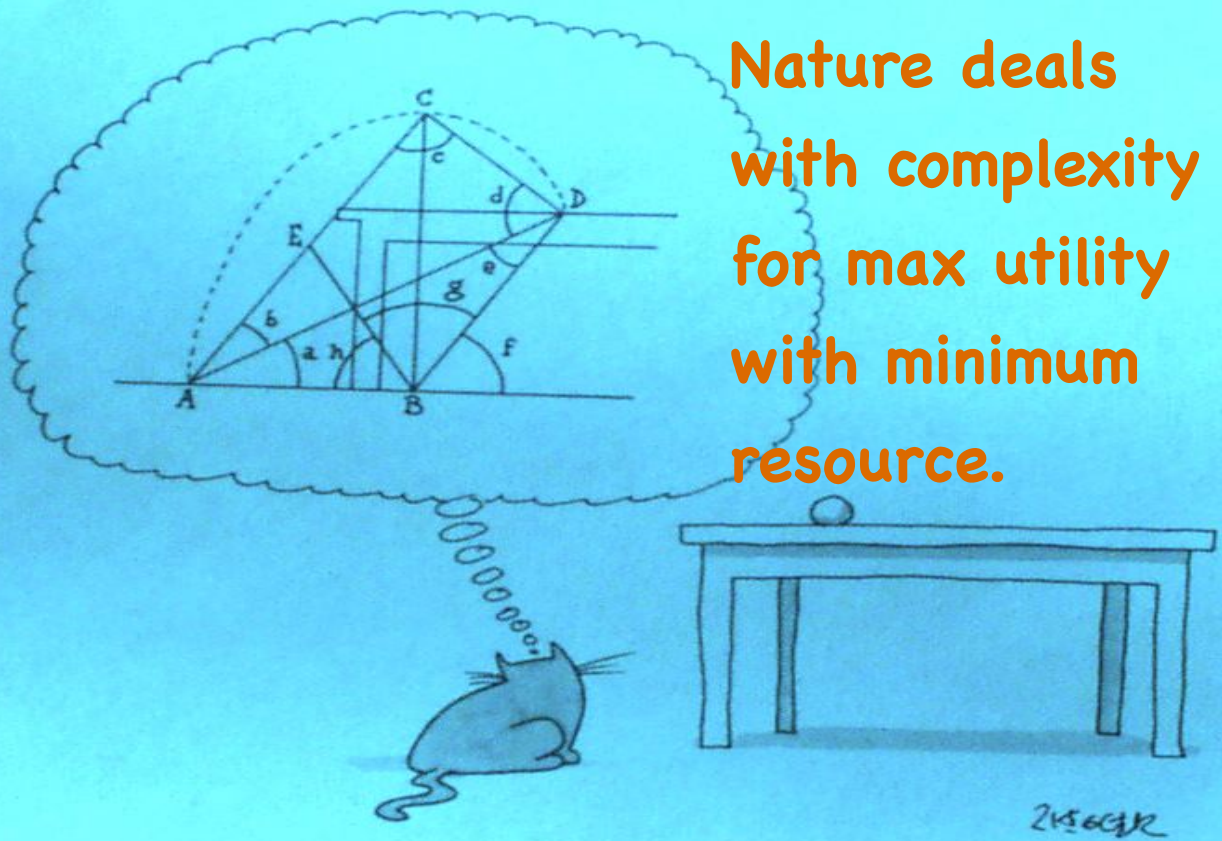




- **Complexity is real and we can't just hand-wave it away**
USB spec is 600 pages long, WiFi over 2000 pages long
- **What is the relationship of Design to Engineering?**
Akin to Art and Science / Intuition and Reason & Analysis

Complexity vs. Utility

- Why 50% of smart phones are still not smart
- Taxi vs. Bus / Subway
(also bike v. car)
- From-Scratch vs. Mix



- Channel Surf vs. digital cable
- GUI vs. C>
- Stick vs. Automatic (which is which?)
- typing vs. voice recognition

Designer's Notebook #2a:

Consumer Design for Simplicity

Referring to bullets:

Is complexity always a problem to chasm crossing in consumer goods?

Can it be a feature?

- Truly Simpler
Paper/Pencil, Hand can opener, Henkel vs. Electric knife, weedwhacker
- Complexity Self-managed / isolated
Automatic Transmission, Ipod Shuffle
Hard disk, electric car
- Complexity Masked / Layered
GUI, Nikon CoolPix, Magic,
- Complexity Cosmetics
Inlet / exhaust ports
translucents (eMac), autumn leaves, layered cut + streaked color
- Complexity as Feature
Komakai, Excel and Word
Prius, Hot Rod, Chopin, Rachmaninoff, Tolkien



Choosing Simplicity v. Complexity



Satisfyingly simple.

Shoot frame-worthy photos and beautiful HD videos perfect for sharing on Facebook® or YouTube™. This powerful, pocket-sized camera makes it a breeze with supremely simple, user-friendly features. Its 16.1MP sensor delivers lovely, high-resolution images while 5x optical zoom makes capturing close-ups a snap. You can even edit pictures straight from the camera with Beauty Effects—adjust skin tones, blot out blemishes, whiten teeth and more. It makes for utterly eye-pleasing portraits.

Choosing

Details Have Nowhere to Hide

Sony's flagship Alpha a99 interchangeable lens camera fully leverages the potential of Translucent Mirror Technology™, the 35mm full-frame format and Sony's professional broadcasting technology. Take a major leap forward in quality, performance and handling ease. Behold the future of Sony Alpha.

Complexity v. Simplicity





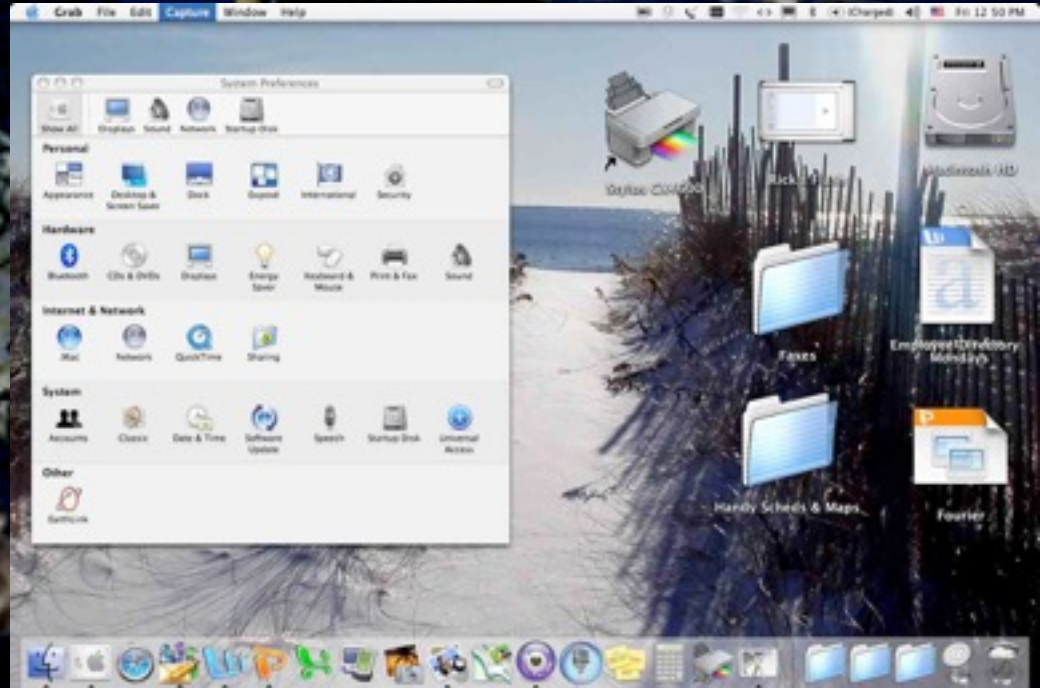
Complexity vs. Utility: *summary*

- Hierarchy of complexity in physics, biology, tech, language
- Dealing with it:

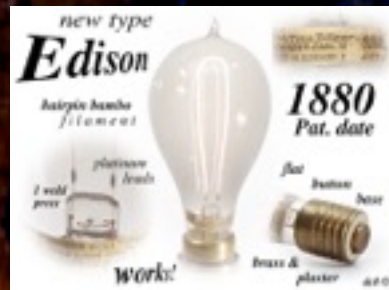
Analogies (desktop);
idealize; reduction;



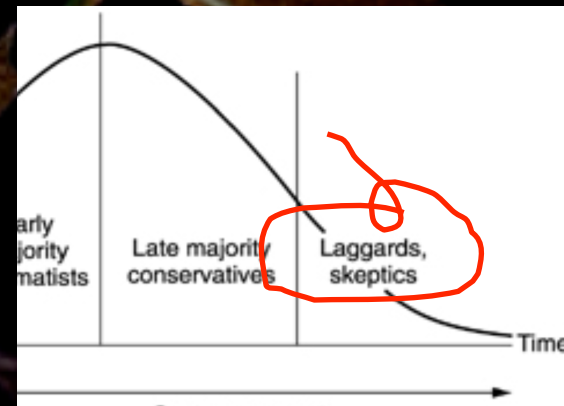
Abstraction; Evolution;



- Trial & Error:



Ignore:



Crossing the Chasm



Every retail store is stocked with
products that crossed the chasm...
...can it be so hard?
(a heritage of 10,000 years)

remember we started here?

Successful Crossers *a rare species*



Company / Product

Beachhead

Vs. (non-crossers)

Brodmann

conservatory seniors

Microspace

LANL

Warm Ice Cream

Afghanistan

Dots

Home Robots

Roomba

Sony

US Gvt / High speed transport

Parkways, Pasadena Fwy

high-speed rail

US Gvt / Jetports

Dulles

Denver Stapleton

