Wealth, Innovation, Design, & Economic Growth …
and How it Begins with Entrepreneurship

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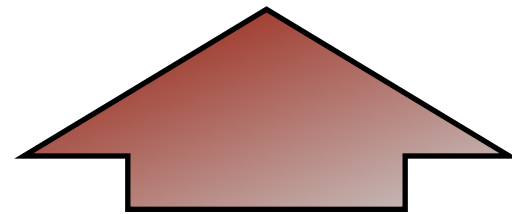
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History Lesson: *What Was and What Will Never Be*

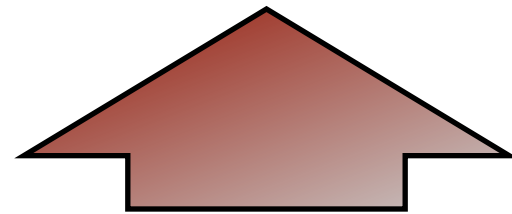[… and, yes, that is an oblique **Led Zeppelin** reference …]
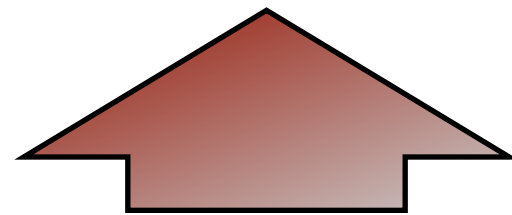
(My) Agenda

all individuals in society become wealthier

economic growth

innovation & good design

entrepreneurship

Wealth: Being well off, lazing on a sunny afternoon, also — *having something other people want*

[… and, yes, that is an oblique **Kinks** reference …]

What is Wealth?

Wealth

Not Wealth

What is Wealth?

Wealth

Not Wealth

What is Wealth?

"User data integrity is more valuable than the money in our wallets"
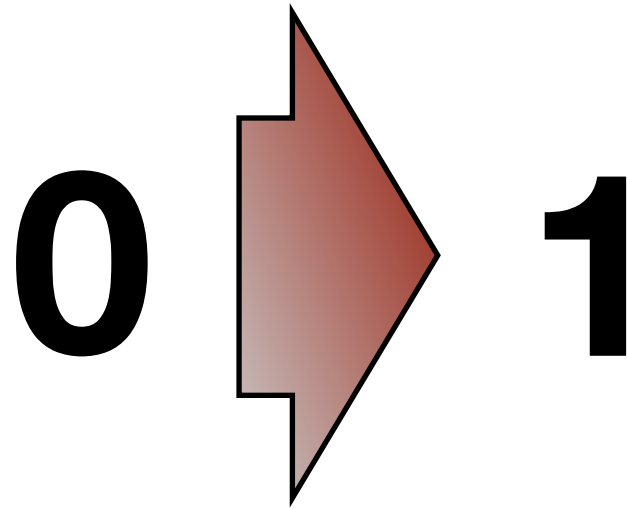
Google reliability talk, yesterday
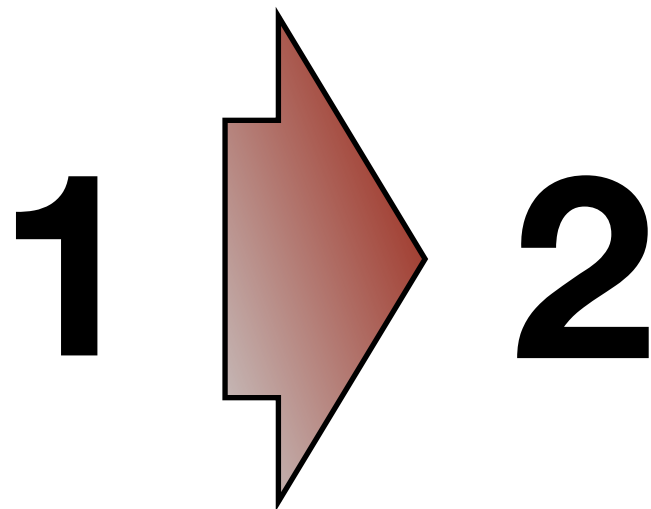
Economic Growth: 0 → 1 → 2 (an engineer's perspective)

Economics of **0 → 1 → 2**

0 ▷ 1

1 ▷ 2

Fundamentally, there are *(at least)* **two types** of economic growth:
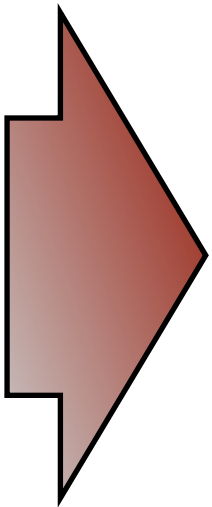
- giving people something they **don't** already have, and

- giving people **more** of something they **do** already have

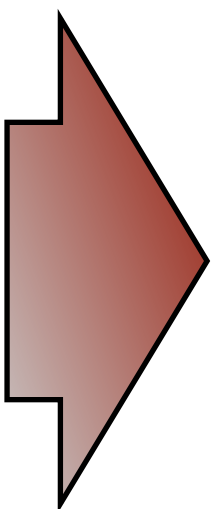**My claim:** 0 –> 1 is significantly more transformative than 1 –> 2

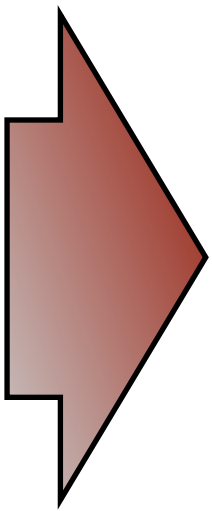# Economics of **0 → 1 → 2**

0 ⟶ **1** Food, housing, communications, transportation, medical care, etc.

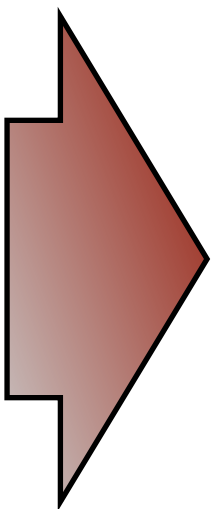**1** ⟶ **2** Food, housing, communications, transportation, medical care, etc.

Economics of **0 → 1 → 2**

0 ▷ **1** Food, housing, communications, transportation, medical care, etc.

Better

1 ▷ **2** Food, housing, communications, transportation, medical care, etc.

More

Economics of **0 → 1 → 2**

For example — access to telecommunications improves the standard of living of **everyone**

Economics of **0 → 1 → 2**

0 ▷ **1**
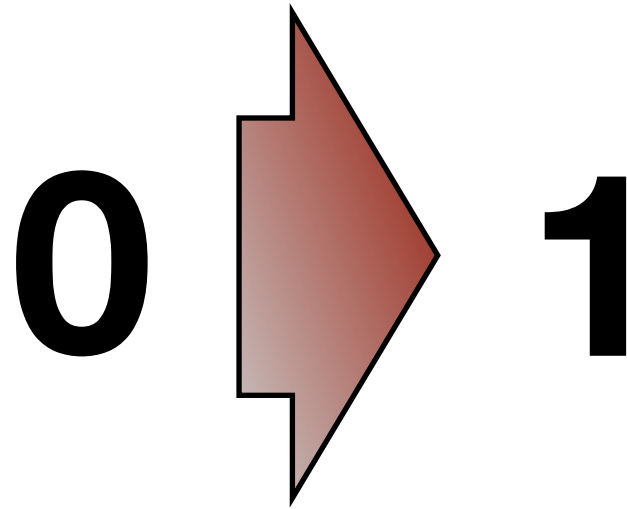
Economics of BETTER:
Transformative
Innovation-driven
ALL in society benefit

1 ▷ **2**
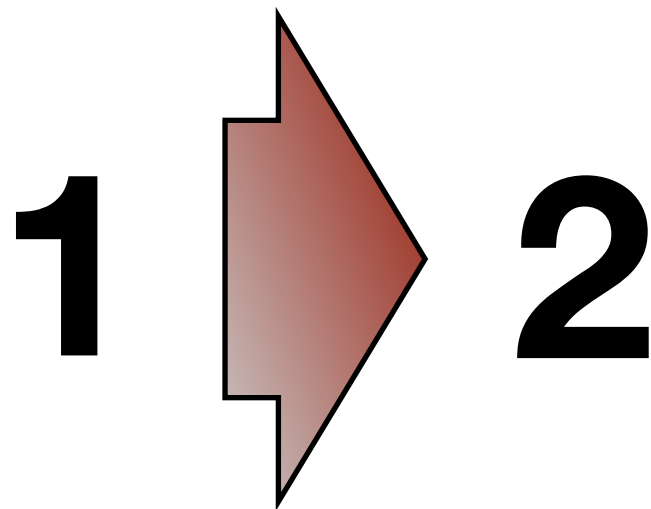
Economics of MORE:
NOT transformative
Optimization (cost)-driven
Optimizers benefit

(My) Agenda

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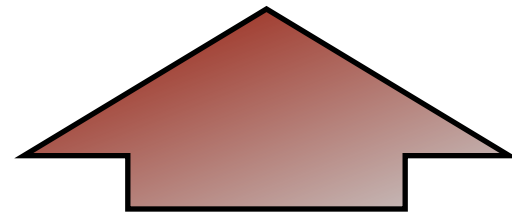
economic growth

innovation & good design
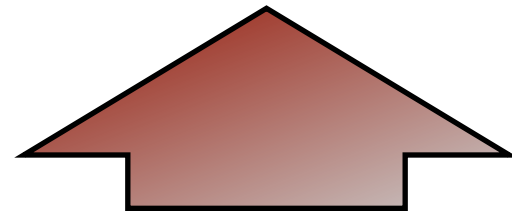
entrepreneurship

Innovation: um …

Innovation: um … Just be like Apple?

It's All About Innovation …

"Innovation and trade: the ultimate engines of growth."
—*Economist*

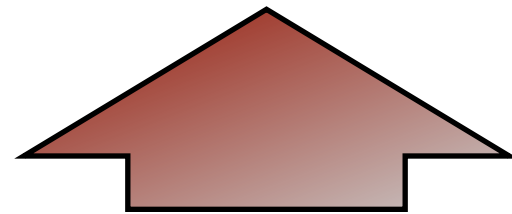"We have to choose to do what past generations have done: shape a brighter future through hard work and innovation."
—Barack Obama
(ASEE's "Obama Touts Innovation Agenda At New York Community College")

"In the new knowledge economy, innovation and knowledge are the most important factors driving economic growth."
—Progressive Policy Institute: *The Innovation Economy*

"Innovation is the heart of economic recovery & future prosperity."
—*Roll Call*

... But Innovation is **Really** Hard

- "In an era when most technology outfits have tightened their belts to adapt to a slower-growing market, one company stands out for forging ahead on innovation: Apple Computer." *(BusinessWeek)*

- "Big companies are losing their 'A' players, and they're struggling to attract 'B' players. In an industry where everything is about people, large tech companies are in trouble because they are losing the talent war. And keep in mind, an 'A' player in an organization can usually produce the same results as three 'B' players." *(VentureBeat)*

- "Lots of companies have tons of great engineers and smart people. But ultimately, there needs to be some gravitational force that pulls it all together. Otherwise, you can get great pieces of technology all floating around the universe. But it doesn't add up to much." *(Steve Jobs, on innovation)*
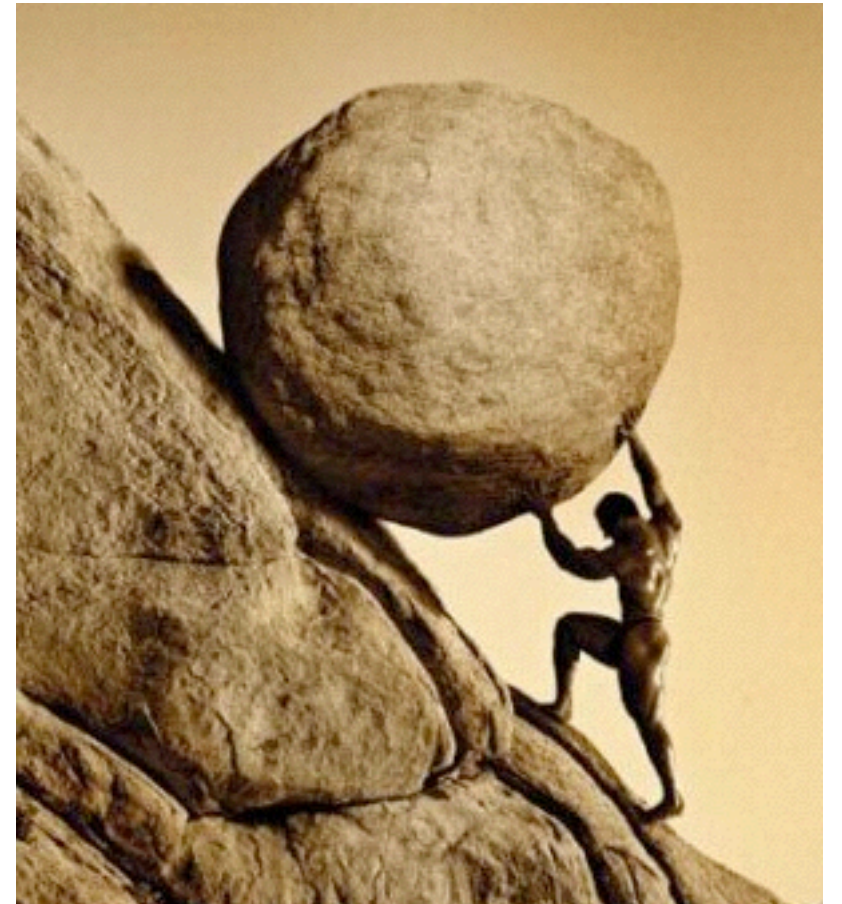
Some Perspective

Big companies cannot innovate, whereas startups **must.**

Startups are engineer-dominated; **founders** (engineers) are rewarded for company's success.

Upon maturity, startups become management-dominated; **executives** (non-engineers) are rewarded for company's success.

(thus #1, above)

Goal: break this cycle

"Paul Graham's prose is brimming with contrarian insight and practical wisdom."
—Andy Hertzfeld, co-creator of the Macintosh computer

PAUL GRAHAM

HACKERS & PAINTERS

BIG IDEAS FROM THE COMPUTER AGE

Some More Perspective

Middle managers believe themselves to be innovators.

"Intrapreneurship" (also termed "corporate entrepreneurship" or "corporate venturing") tries to foster creativity within corporate environment.

Most studies empower middle management. None investigate rewarding engineers. WTF?

The term *managerial creativity*, a common term in the research literature, probably says it all.

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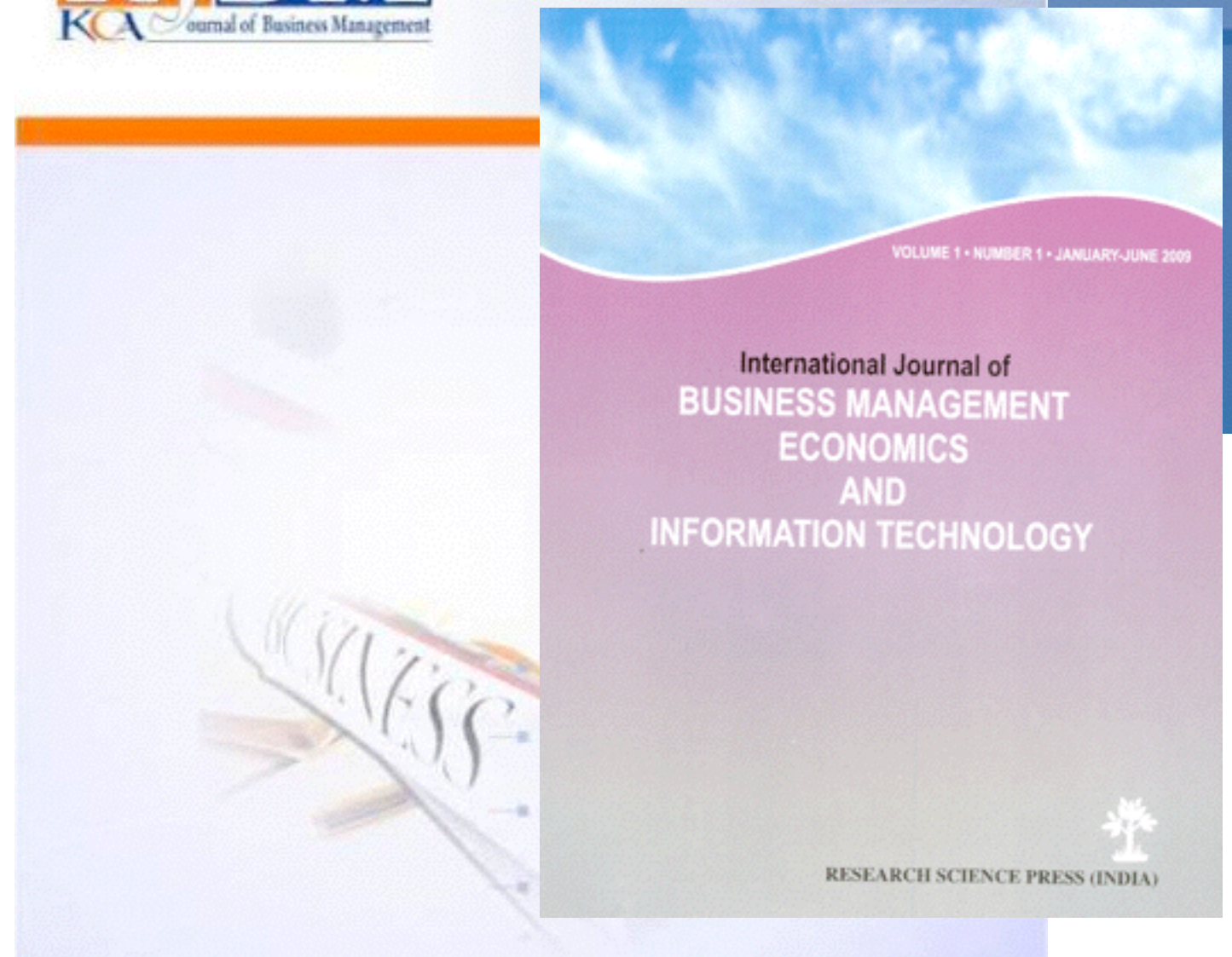
Bottom Line: It Starts with Good Engineers

- Existing trend is to study innovative exceptions (Apple, Google, Fiat, etc.) and try to emulate them.

- Why not emulate an entire **industry** instead? In particular, the one industry known for **innovating** regularly.

- What do startups do? They recognize that engineers are their primary innovators, and they PAY them.

Engineers → Innovation → Wealth

Entrepreneurship: DIY, Modern *Engineering 101*

[… a perhaps too-oblique **Peter Gabriel** reference …]

Important development in last two decades:
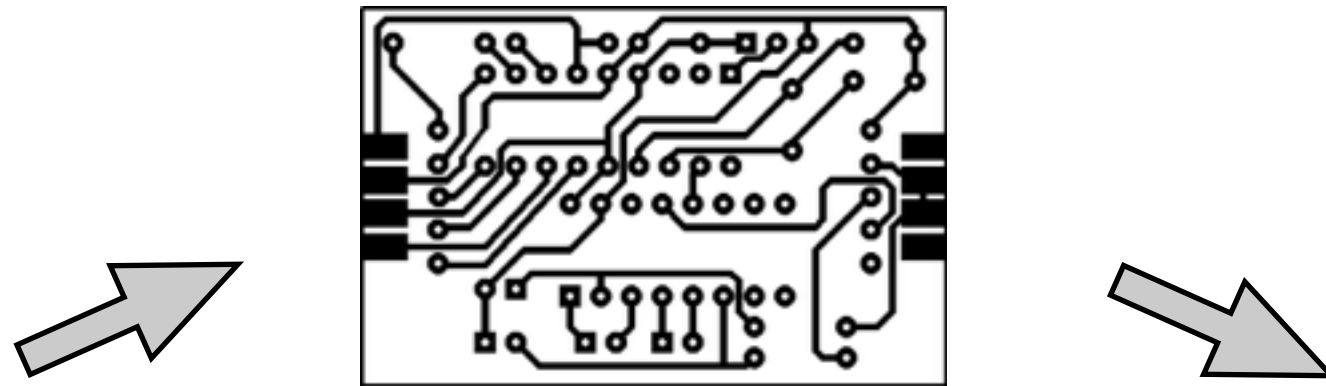
Important development in last two decades:

Important development in last two decades:

Manufacturing
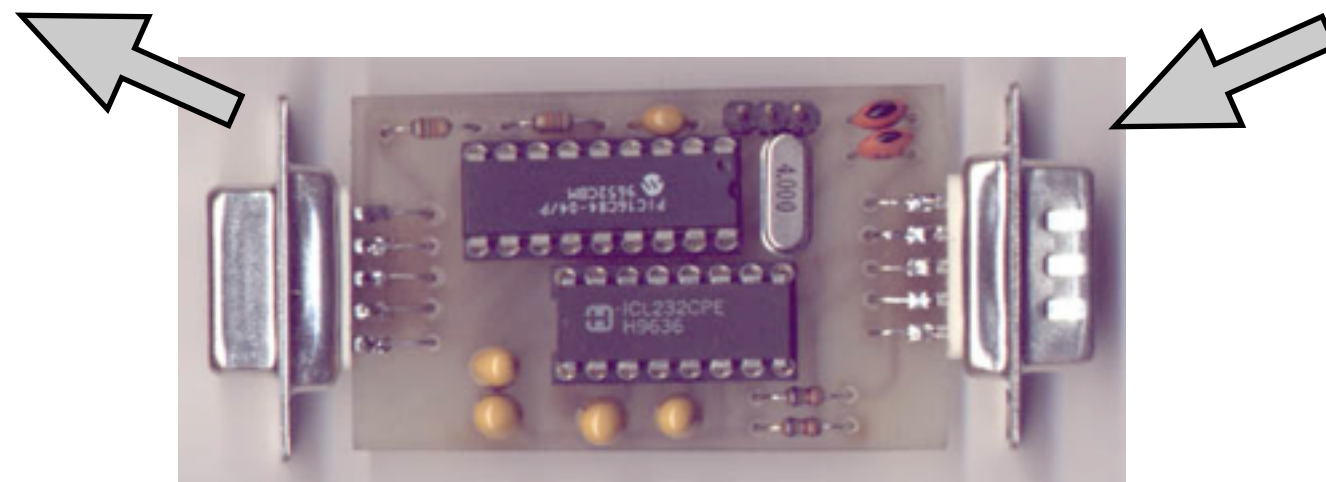as a **Service**

The Basic Idea

Design Blueprint

You
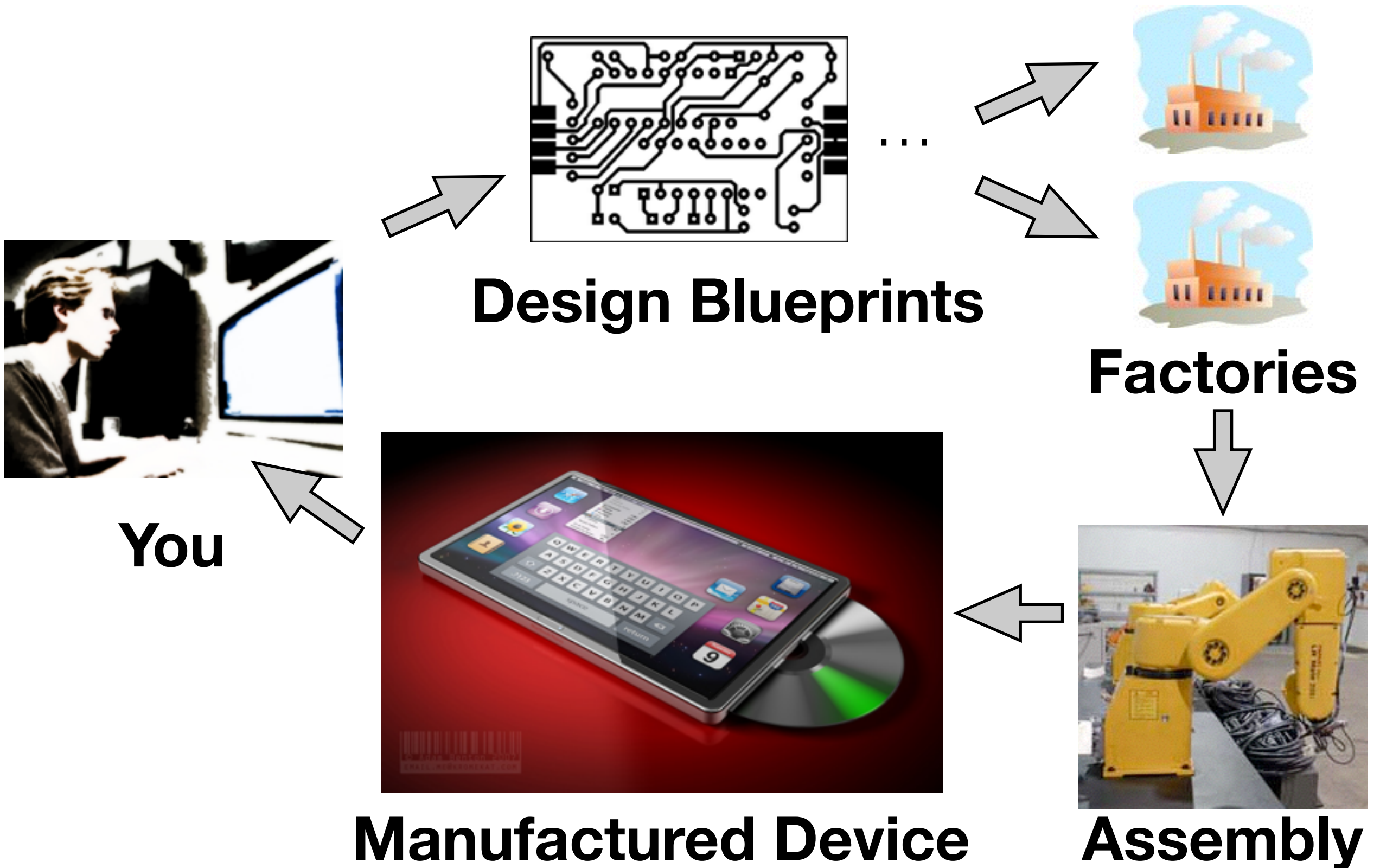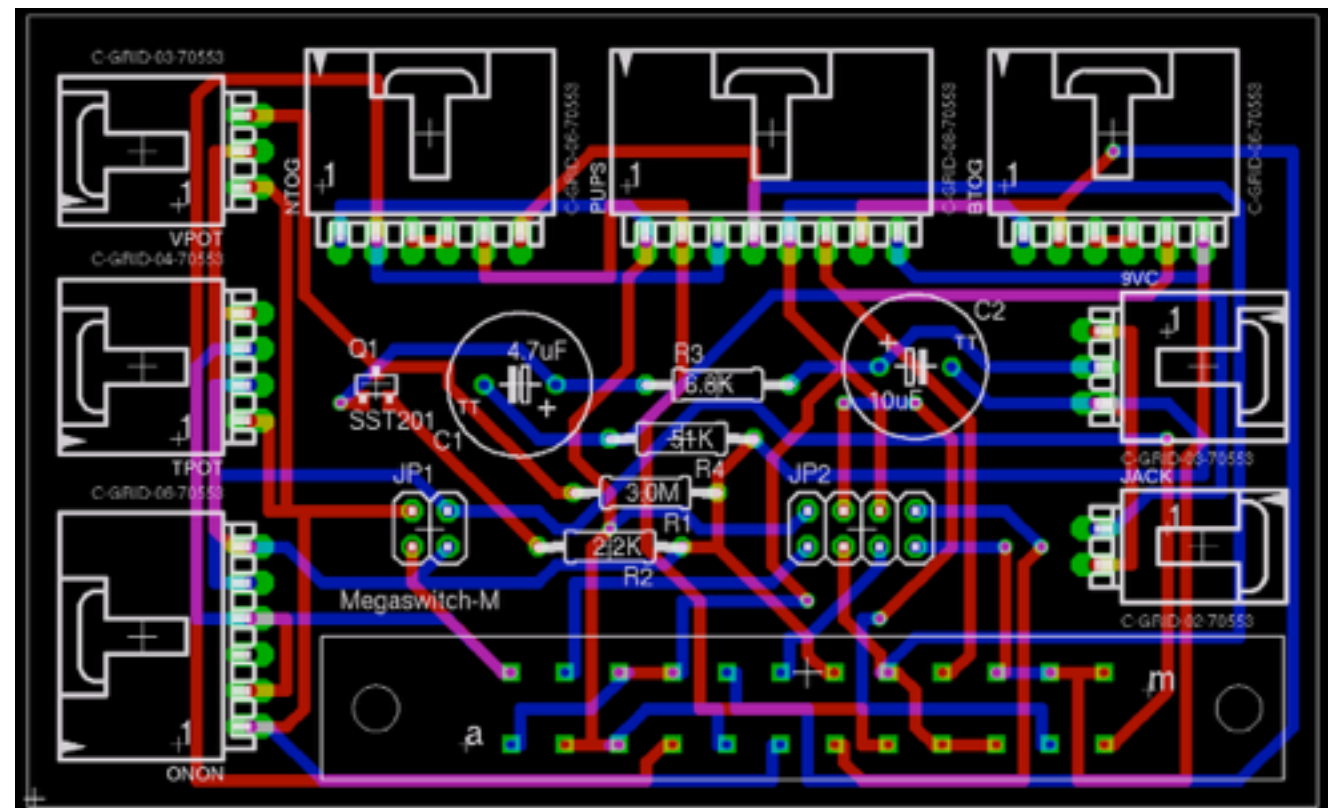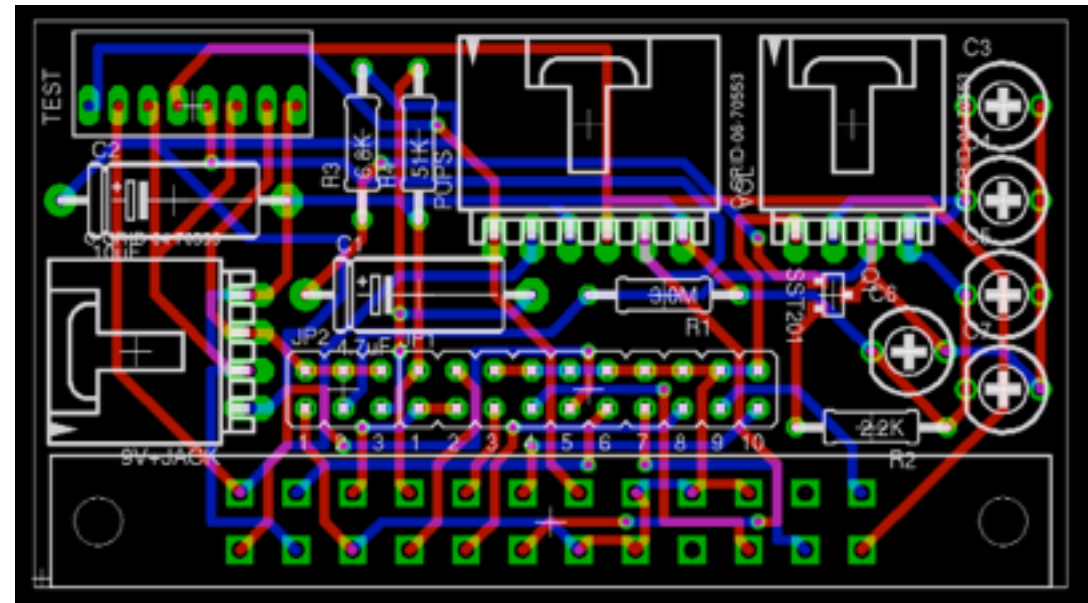
Factory

Manufactured Device

The Basic Idea

Design Blueprints

Factories

You

Manufactured Device

Assembly

Some Blueprints

… and what they became

Some (other) Blueprints

Drawing scale: full size

24th fret

162
136.2
5.5

Coil Guitars © 2007
Model: Hammer 25
6-string 25.5" scale

RONIN

Coil

Pickup cavities are just deep enough to hold pickups.
Pickups are screwed tightly into the neck wood.
Their heights are not adjustable (thus there are no
adjustment screws on the pickup surrounds).

large bushings (e.g. 0.25")

24th fret

HAMMER

Coil

Coil Guitars © 2006
Model: Angel 625
...string 25.5" scale
Drawing scale: full size

… and what **they** became

Pros & Cons: High-Tech Cottage Industry

- Can't Possibly compete with big companies

- Might fail

- Can't afford it

- Window of opportunity?

- Idea already proven in marketplace (shareware, boutique electronics)

- Win/win situation (even company failure is good résumé material)

- Low risk/reward ratio

- Start soon

Bottom line: a path well worth exploring

Pros & Cons: High-Tech Cottage Ind

- Can't Possibly compete with big companies

- Might fail

- Can't afford

- W

- Idea al
  (sh

  aterial)

  reward ratio

  Start soon

line: a path well worth exploring

KICKSTARTER

Design, the Teaching of: Epic Fail   *(so far)*

[… and, yes, that is an oblique **Bachman-Turner Overdrive** reference …]

What is Design? What is Innovation?

- Can't define it, but you know it when you see it …

- Close interaction with **burnout** phenomenon in start-ups

- An inability to eat, think, sleep, care for one's self while technical problem remains

- Much "innovation" is just good design (… interesting)

- Requires staring at one problem for extended period (much like Ph.D. in that regard)

Image search for "burnout"

Let's think more on that last point …

Innovation and design: Requires staring at one problem for an extended period

Academia: Attention flits from topic to topic in a scheduled, often frenetic pace.

Semester concept is both arbitrary and contrived/artificial — false sense of progress

(innovation recognizes no schedule)

We're **training** our students to be poor designers.

But, wait, there's more …

Students calculate the effort needed to get
the desired (or lowest acceptable) grade.
They do the minimum work required.
We (unconsciously) **train them** to do this.

Needless to say, this doesn't fly for **design**.
In design, anything less than full attention = failure.

Put Simply

Design & Innovation — what it demands of you:

- Focus: 100%

- Time: **extended** period

The Academic Environment — what it demands of you:

- Focus << 100%

- Time ≤ 1 semester (typically, ≤ 1 <u>week</u>)

Conclusion: *Education is counter-productive at the society level?*

It Has Been Borne Out in Reality

- *Innovation and design requires staring at one problem for extended period*

- Contrast that with academia (undergrad in particular):

  - Attention flits from topic to topic in a scheduled, often frenetic pace

  - Semester concept is both arbitrary and contrived/artificial (innovation recognizes no schedule)

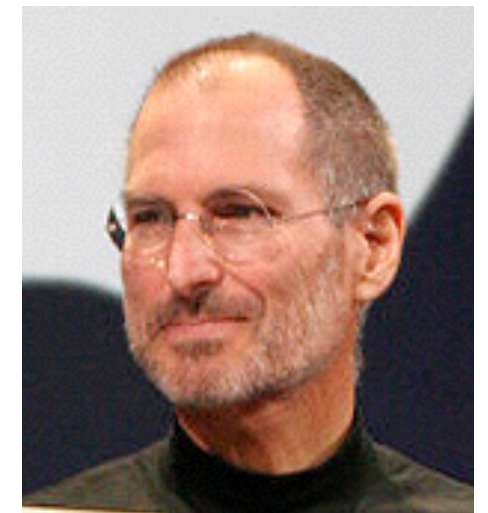Larry Ellison

Bill Gates

Stephen Spielberg

Richard Branson

Michael Dell

Steve Jobs

Is it any wonder that SO MANY successful entrepreneurs/innovators dropped out of school?

All Is Not Lost, However …

Necessary Elements:

- Look at one problem
  for extended period (years?)

- Personal investment
  in outcome (reward, pride, etc.)

- Time commitment need not be
  large on per-week basis

- Need to see **real examples**
  of both success and failure

- Must be guided by innovators
  (not academicians, not MBAs)

- Failure is acceptable (grades)

Olin College, est. 1997

Okay, Let's Bring It On Home …

[… a not-so-oblique **Led Zeppelin** reference …]

The Argument

Wealth: Comes from making something that other people want (please!)

Innovation & Design: Absolutely **will not** happen without good engineers

Economic Growth: Your vision will succeed if you bring people something that they need but do not have

Entrepreneurship: What kick-starts it all

Again — the Point of Innovation

To Create Wealth

For you
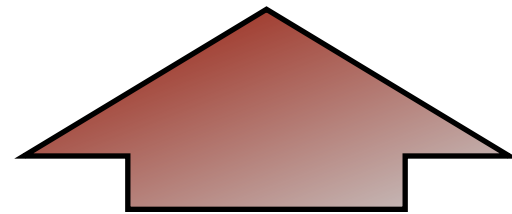For others (beneficiaries of your innovations)
For the economy

Wealth is **not** like energy;
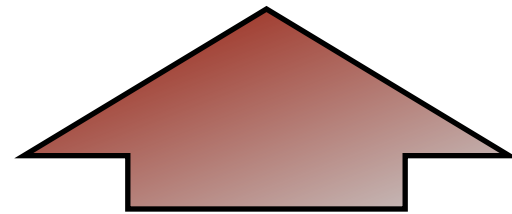## **it obeys no laws of conservation**
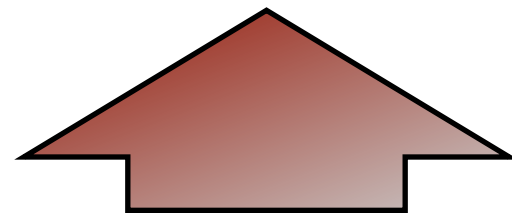
To Recapitulate Yet Again

all individuals in society become wealthier

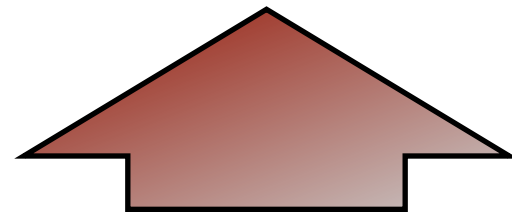
economic growth

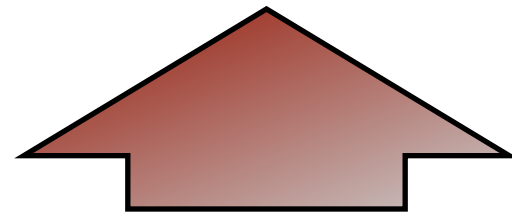

innovation & good design

entrepreneurship
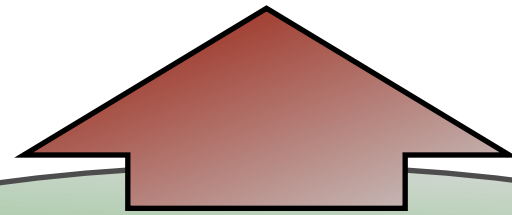
To Recapitulate Yet Again

all individuals in society become wealthier

economic growth

innovation & good design

entrepreneurship Your Part

To Recapitulate Yet Again

Never has it been easier for a designer to get his/her designs into the hands of thousands, millions of people.

The tools are there; the costs are low; and you don't need anyone's permission.

Questions?

(thank you for your kind attention)

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… or just Google "professor guitar maryland"