Information Problems and Opportunities

"The universe is looking less and less like a great machine and more and more like a great thought."   — Ortega Y Gasset

"Genius is an African who dreams up snow."   — Vladmir Nabokov

Atoms vs. Bits

What do you spend your time doing every day?

Mostly we think of arranging and moving around physical objects — **atoms**. Food, shelter, cars, walking, eating, ...

Another class of activity has the goal of simply moving information around — **bits**. Television, newspaper, books, telephone, newspaper, checks, video, ATM cards, photos, college.

Atoms are expensive and constrained compared to bits. Atoms are constrained by physical location and time. They require energy and more atoms to be arranged and duplicated.

Our "bit" problems are often currently solved with atoms (e.g. newspaper). Using atoms for the solution is costly and constraining. Bits are potentially much cheaper.

We tend to think of a daily life of atoms (objects, location, form) with information being just a means to that end. In fact, just the reverse may be true.

Information Problems — It's The Bits Stupid

Information Problem = a problem where the proper flow of information makes the problem go away. Solving the problem does not require rearranging atoms. All the parties want to cooperate, what's missing is communication.

The following are all pure information problems, requiring only the movement of bits, and yet they are solved with atoms (bits of paper, queue's of people, ...)

- Grocery store check out line -- the grocery store wants to know what you bought and cause the right amount of money to change hands.

- Locked out of your car -- you want the car to let you and the people you authorize in, and not other people.

- You and 200 other people all want to eat at the Hobee's roughly between 10:00 am and noon this Saturday morning. 50 of you can be eating there at any one time. Staggering everyone in is a pure information problem.

- You and a friend arrive separately at a Stanford basketball game. You'd like to sit together, but you can't find each other. Or maybe the friend bailed, but you're not sure. (Before the invention of the cellular phone, this problem would seem just as insoluble as the others. See Nabokov quote above.)

- I have the intake manifold to a '79 VW bug sitting in my garage. They sell for $200 retail, but I would be delighted if someone would give me $30 for it and take it away. There is someone nearby who wants the manifold, but we don't know about each other. (See the Information Opportunity Example below)

- Register your car with the DMV -- just an exchange of bits between you, the DMV, the police, possibly the previous owner, your bank, and the DMV's bank. This is my reference problem for the "paperless world of the future" — when you can register a car with the DMV using only bits ...we will have arrived.

Information Technology Trend: Better and Cheaper

(IMHO) here's a safe prediction about future,...

In the next 50 years, our ability to store, move, and manipulate atoms and energy will increase by a factor or 2 or so. Our ability to store, communicate, and manipulate information will increase by a factor of 1000. The increase in information technology will great affect the complexion of the next 50 years.

The three fundamentally costly things in this world are: materials (atoms), energy, and labor. A highly developed digital information infrastructure does not depend too greatly on any these compared to traditional activities (all atoms or energy oriented) like food, travel, consumerism, warfare...That is why information problems are going to better and more cheaply solved in the future.

Progression of media: spoken word, written word, radio, telephone, TV, video, computer, Internet+computer

Our interesting future: we have many information problems we would enjoy being solved, and the technology to solve information problems is getting exponentially better.

Exercise: Wait until the year 2030. Attempt to explain to a child that in college you had computers, but they weren't all "connected" all the time (at least when *I* was an undergraduate). Like inventing the flashlight, but not homes with AC power.

Information Opportunity

We are surrounded by information problems. We tend to think of them as atom problems because that's how they are traditionally solved : a physical key for you car, forming a line at a restaurant. Learn to recognize the true underlying information problem. Do not be misled by the atoms by which the problem has traditionally been solved.

The "It's an information problem" Game

(This exercise is based on a long-running joke between me and my friend Brian Skinner, for example when I lock us out of my car or when we are standing in line for dinner without reservations) Notice in your life when you are significantly blocked by an Information Problem. Its easy to notice when you are blocked since you typically get to stand around with nothing to do. Whoever recognizes the situation first gets to say "You know what kind of problem this is?" to which the reply is "this is an information problem" with the possible addendum "when we describe to our grandkids that we used to spend time doing this, they are going to laugh their heads off."

Information Example

See the newspaper classified ad business. See the Internet. Opportunity...

Wrong: take the classified ads, and put them online

Right: found ebay.com

Point: classified ads were not ultimately what people wanted, really they wanted to many-to-many connections to exchange goods.

The Internet Niche

Like the telephone system for computers— "enabling" in the extreme

a) Digital is the ultimate information format

> If you were on a desert island and could only get one sort of media, what would you chose? Digital! It can express all the others.
>
> e.g. HDTV evolution to digital -- why hardwire a format?

b) Computers are the ultimate information appliance

> Better than TV, telephone, fax, pager, etc.. all rolled into one

c) The Internet — connecting all the computers. "The telephone system for computers." The final key step.

Internet Challenge

Computers -- all different sorts

Local Networks -- the computers are connected in groups of 2-20 to little Local Area Networks (LANs)

The LANs are connected to each other by Routers

The computers are of all different types

Their operating systems are of all different types

The LANs are of all different types

The routers are of all different types

How do you connect all these things together?

The Information Utopia

Whether or not we want it -- what would it be like?

Lots of information activities since bit traffic is indescribably cheap -- movies, lectures, college, discussion, art, community, education, socialization -- these all happen more and more since they are fundamentally information activities.

Which do you prefer: a world of people spending more and more time watching movies, reading literature, watching lectures, and exchanging ideas (bits), or a world of people buying larger and larger sport utility vehicles (atoms). Which one is cheaper and more sustainable?