

Computers in the Operating Room: A Patient/Customer and Computer Person's View

**The 3rd Congress on Computers &
Robotics in the Operating Room 2000**

July 14, 1999

Gordon Bell

Microsoft Corporation

For Computer Motion Company

Yulan Wang

Technology transitions

***The 3rd REMOTE PRESENCE
CLINICAL INNOVATIONS FORUM
Intouch-Health***

***Technology transitions
seem to take forever***

(technology adoption, telepresence, robots, PHRs, startups)

July 18, 2008

Gordon Bell

Microsoft Research

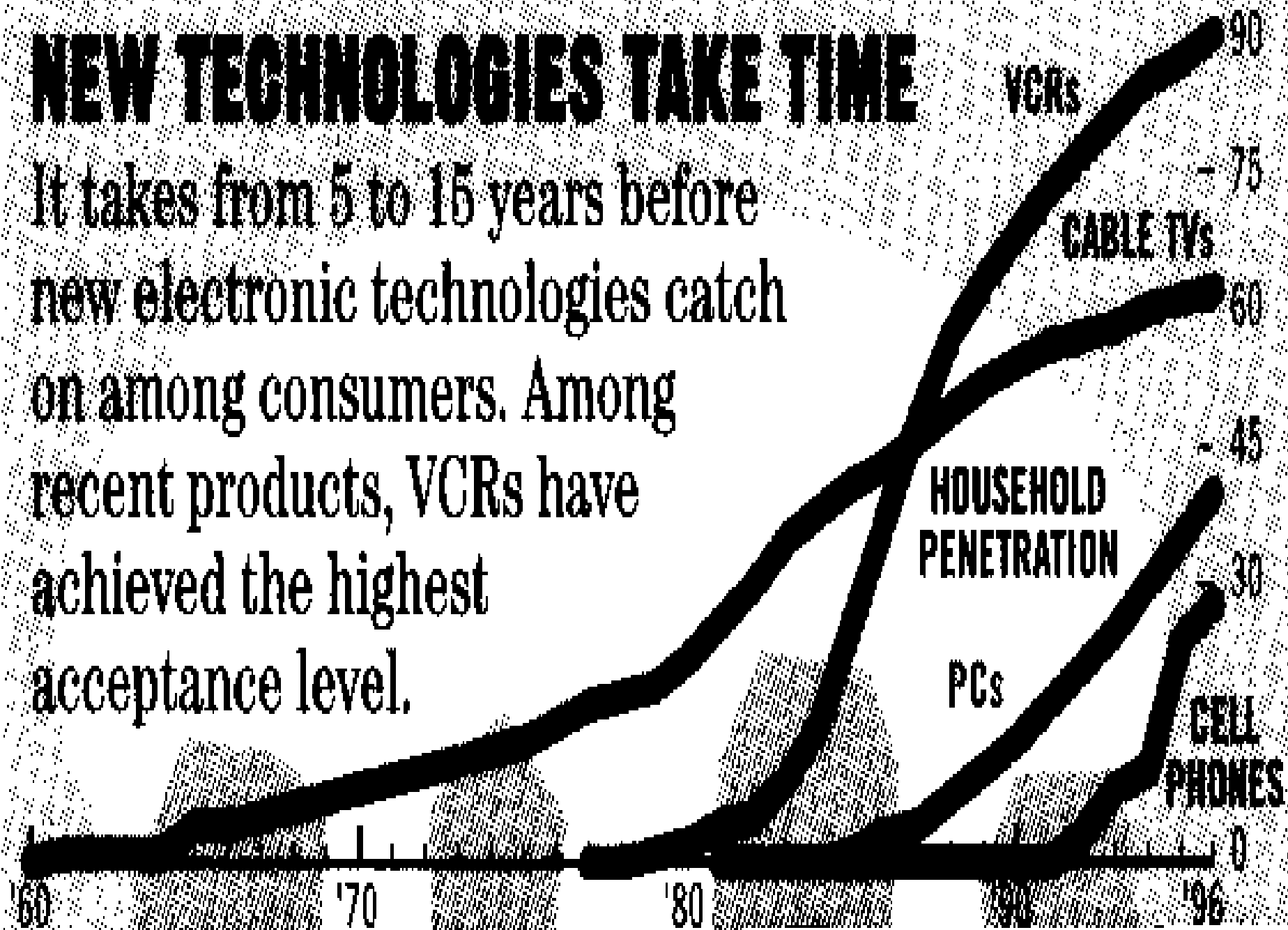
Technology transitions

Outline

- Mead's 11 year rule (transistor, ICs) & Consumer Electronics
- Some examples
 - Teleconferencing, telerobots, ebooks,
 - Why does it take so long?
 - Will MS and Google Health make it?
- Betting against optimists
- No technology before its time bell's law
- A look at startups

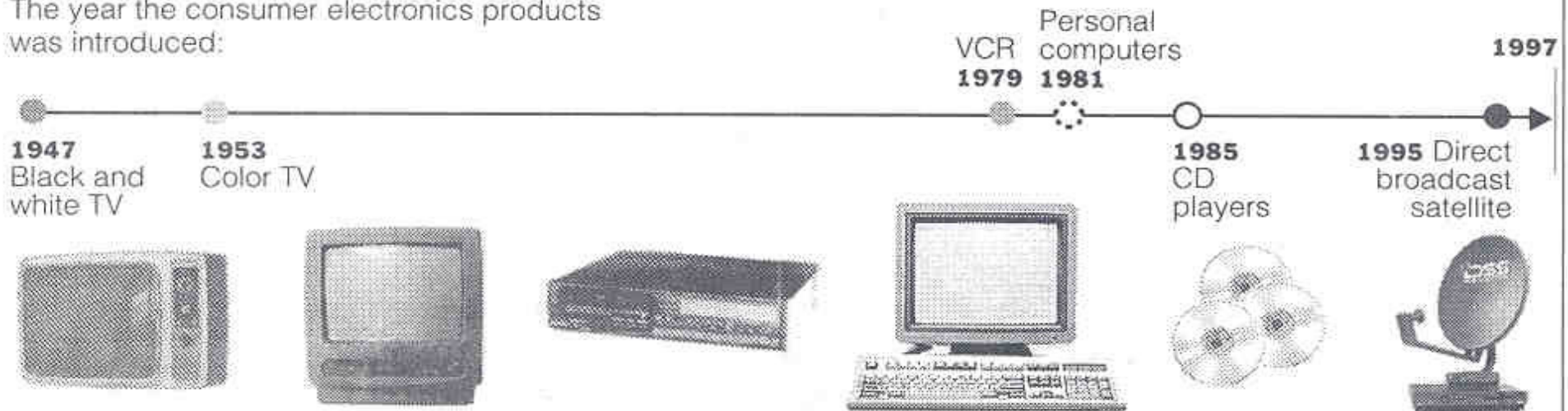
NEW TECHNOLOGIES TAKE TIME

It takes from 5 to 15 years before new electronic technologies catch on among consumers. Among recent products, VCRs have achieved the highest acceptance level.

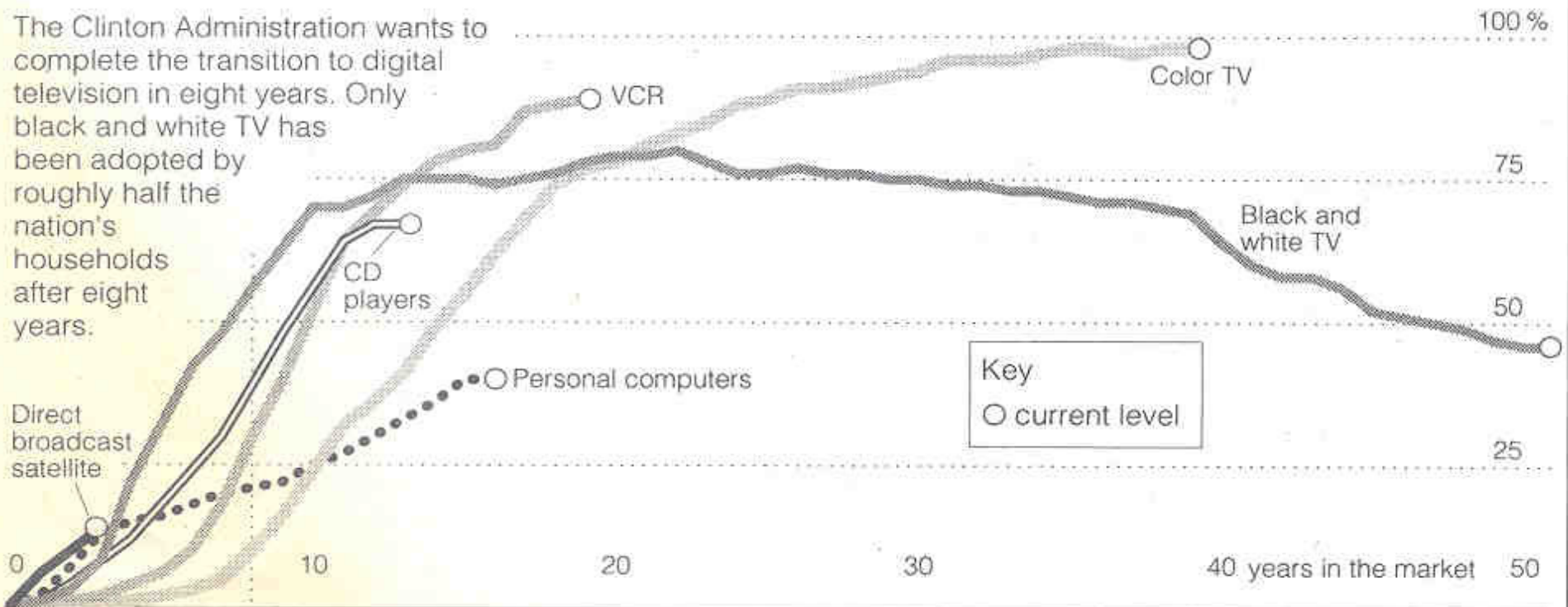


The Journey From the Early Adopters to the Mass Market

The year the consumer electronics products was introduced:



The Clinton Administration wants to complete the transition to digital television in eight years. Only black and white TV has been adopted by roughly half the nation's households after eight years.



Source: Consumer Electronics Manufacturers Association

The New York Times

Teleconferencing

Technology transitions

Cisco Telepresence System 3200: \$340,000 '08



Technology transitions

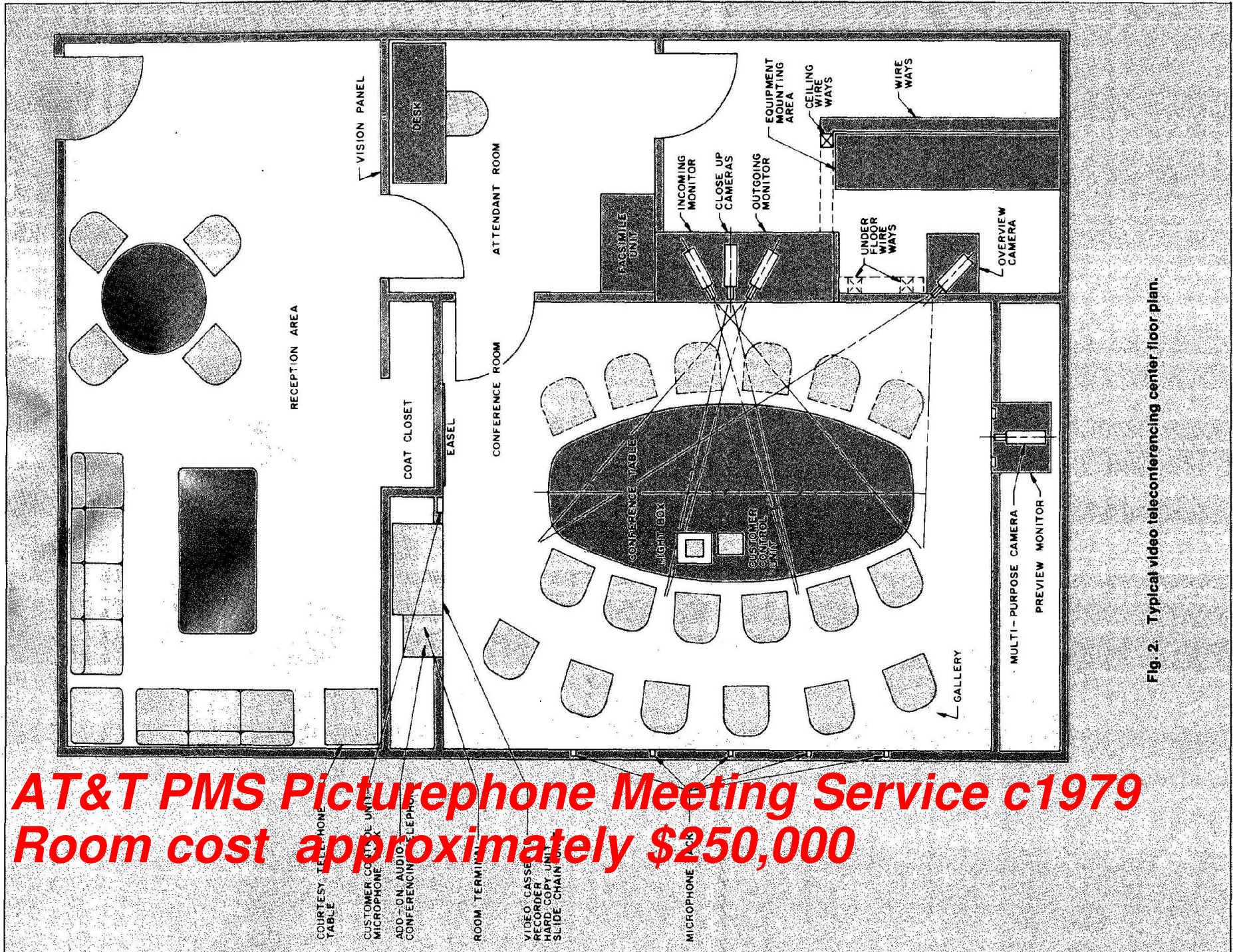


Fig. 2. Typical video teleconferencing center floor plan.

**AT&T PMS Picturephone Meeting Service c1979
Room cost approximately \$250,000**

COURTESY TELEPHONE TABLE
 CUSTOMER CONTROL UNIT MICROPHONE
 ADD-ON AUDIO TELEPHONE CONFERENCE TELEPHONE
 ROOM TERMINAL
 VIDEO CASSETTE RECORDER HARD COPY UNIT SLIDE CHAIN UNIT
 MICROPHONE

Teleconferencing

- 1979: AT&T PMS Picturephone Meeting Service
- 2008: Cisco Telepresence System

The Promise of Videoconferencing

- **AT&T introduced Picturephone at the 1964 World's fair**
- **1980's: PMS room-based systems**
- **1990's Desktop/internet systems (Cu-SeeMe, MBONE, NetMeeting) – cheap!**
- **2008 Cisco Telepresence system (room)**
- **Why isn't videoconferencing much bigger than it is???**

Technology transitions

Conference Rooms with video c1995



sitions

Telepresentations: The Killer App



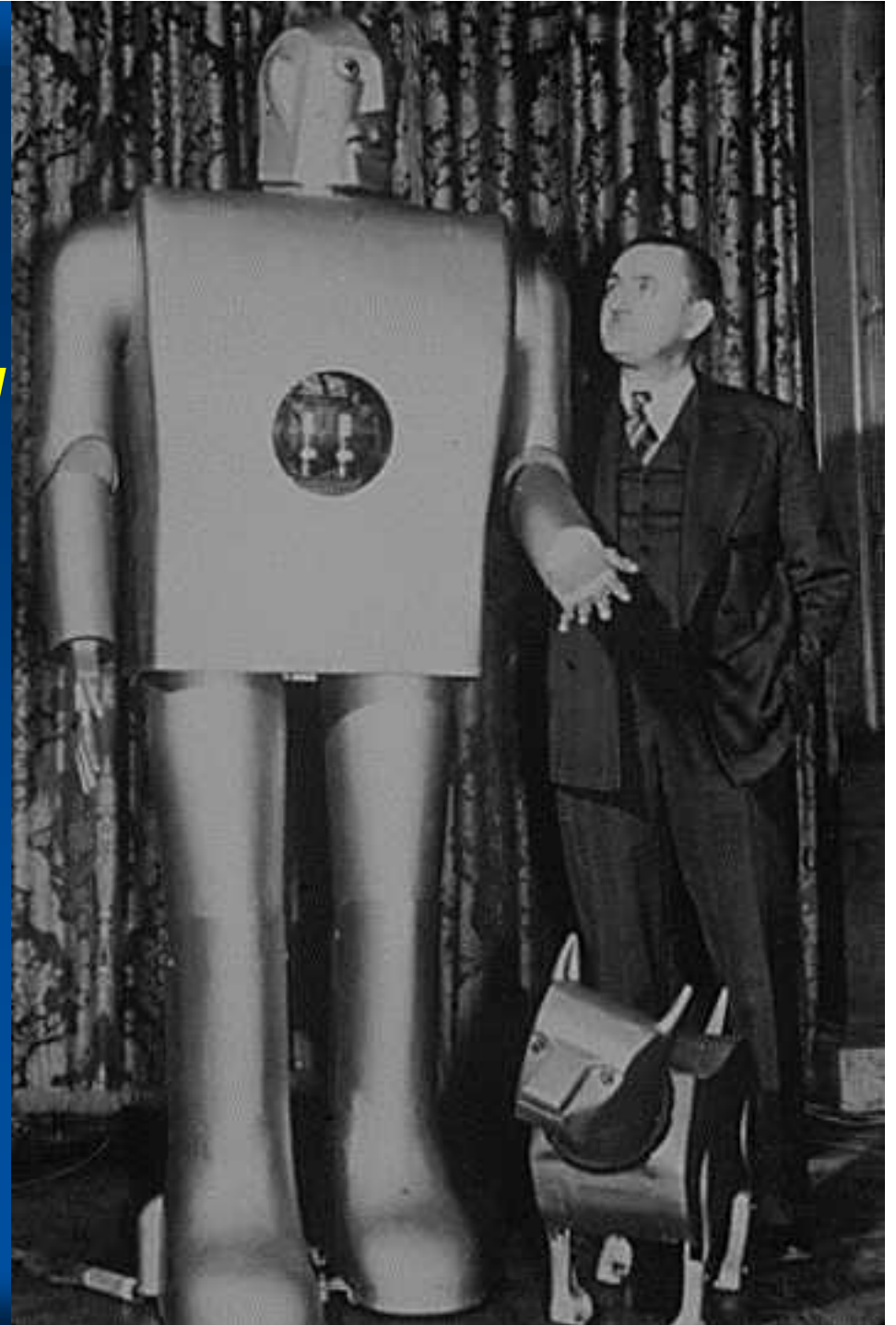
- Increased attendance & lower travel costs
- Practical and low-cost NOW
- e.g. ACM97 - 2,000 visitors in real space, 20,000 visitors on Internet
<http://research.microsoft.com/acm97>

Technology transitions

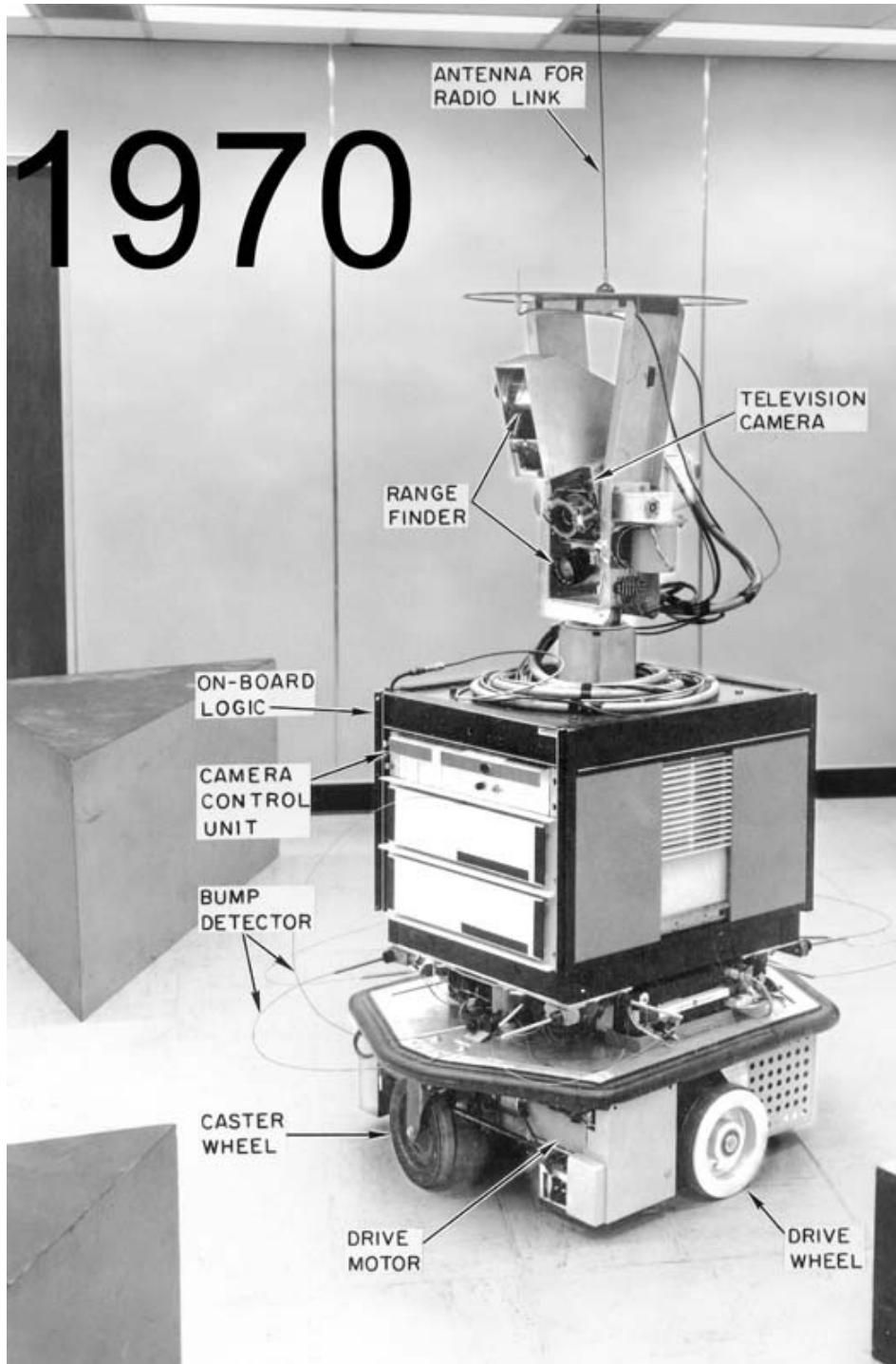
How to Fail at Videoconferencing

- Audio latency high + quality poor
- No gaze awareness/screen area/2-D only.
- Lack of ubiquity
- Hard to set up call
- Note: phone is the competitor (ubiquitous, easy calling, low latency).
- **Critical: audio quality, 3-D space, and gaze awareness**

***Robots
my first was a
GE tele-operated
refrigerator
c1948***

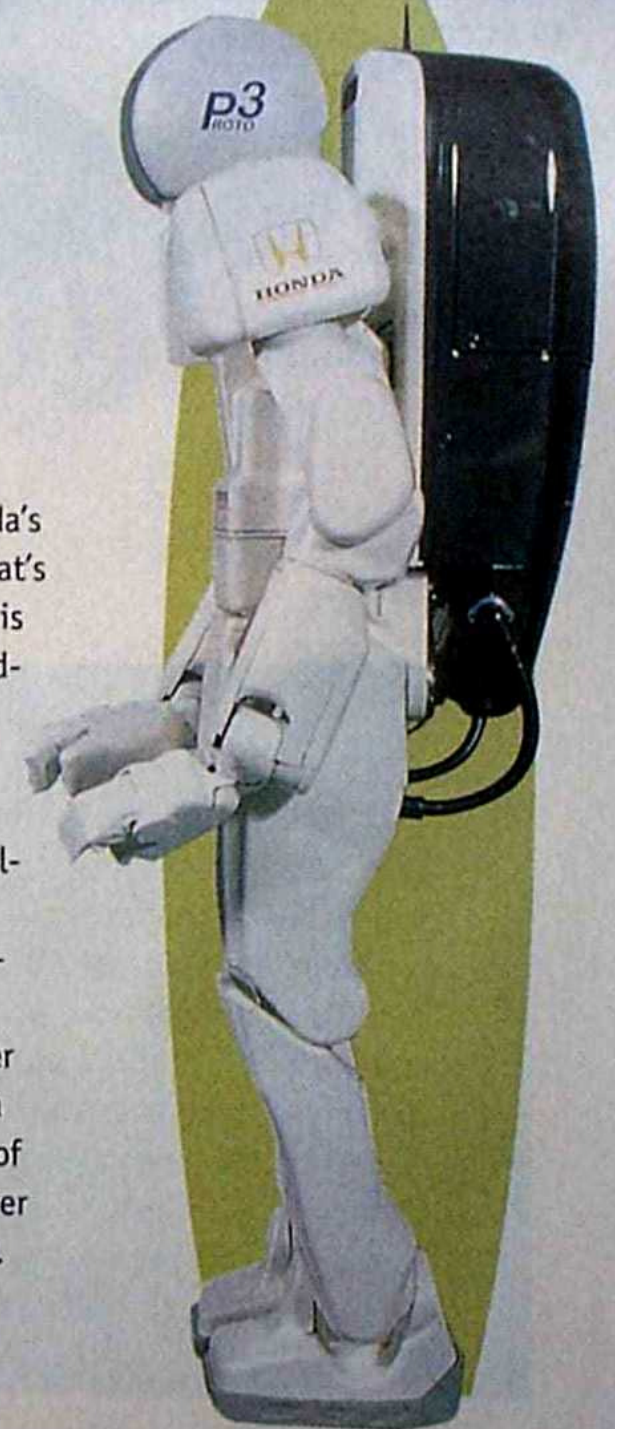


1970



Robot's Next Steps

THE SUCCESSOR to Honda's P2 humanoid robot [What's New, June '97], the P3, is more coordinated. Standing at about 5 feet, it adds 3-D vision to move more independently, correcting its balance while changing direction. The P3 is dexterous enough to climb through a manhole cover and it is stronger than a human—so it could be of service in a nuclear power plant or medical facility.



Denning Mobile Robots c1983-1999

TV Navigation by wall mounted beacons



RoboPad
TV

Modular
Robotic

Sentry

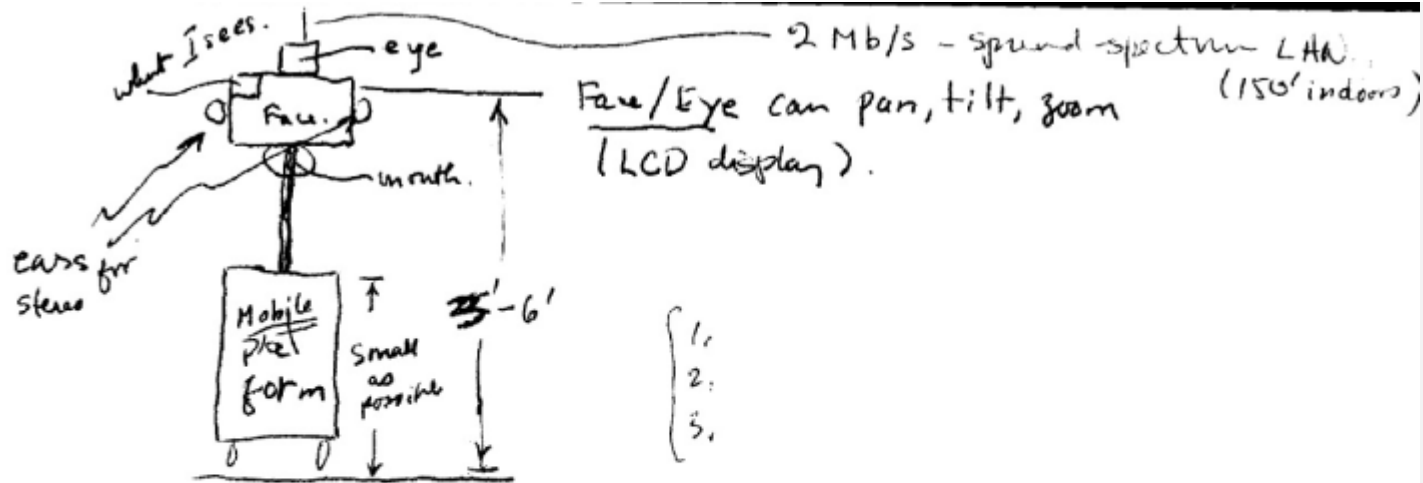
Trike

RoboScrub



Mobile videophone

Technology transitions



Pelesite (Mobile Robot-based)

Tele site (Table top)

Operator-site



need feedback so ~~what~~ to control/show who one is looking at ... to get presence.

Stages

1. P2
2. P2 in a window
3. Special monitor - Tilt, etc.
4. Mobile

Walking Video K \Rightarrow WVK

Gordon's Telerobot c1991 updated 5/6/08




Technology transitions

Robot Driver's License

ITH ROBOT ITH
DRIVER LICENSE


ISSUED 09-01-04

CLASS:R



A9321451

GORDON BELL
Microsoft
455 Market St. Suite 1690
San Francisco, CA 94105



ISSUED BY: INTOUCH HEALTH
WWW.INTOUCHHEALTH.COM
805-562-8686

Gordon Bell

08/22/2003 548 18 FD/03

Technology transitions



Technology transitions



Realizing Memex... Digital Capture, Storage, and Utilization of All Personal Information

www.MyLifeBits.com

Gordon Bell, Jim Gemmell, Roger Lueder

Technology transitions

Microsoft®

Research

The “killer app”... Health?



Technology transitions


Capturing every heartbeat

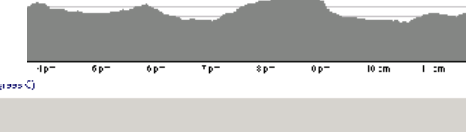
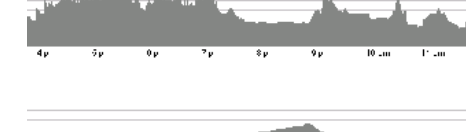
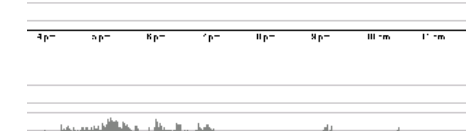
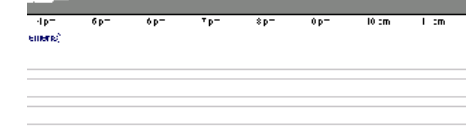
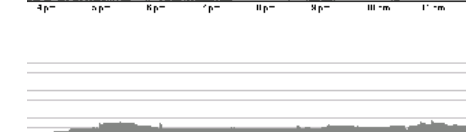
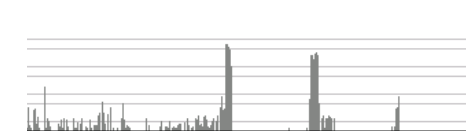
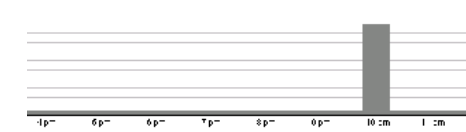
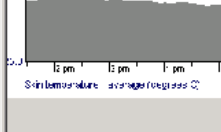
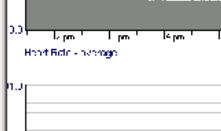
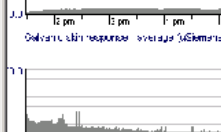
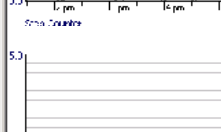
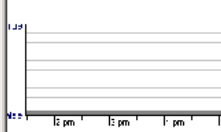
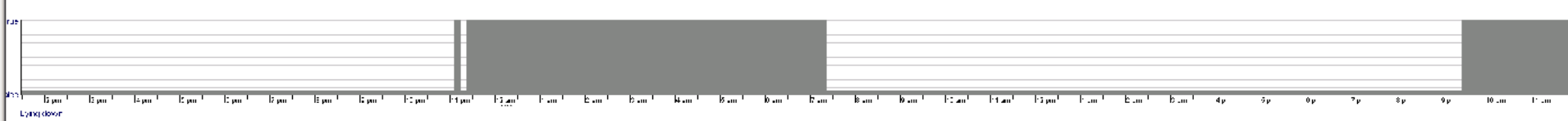
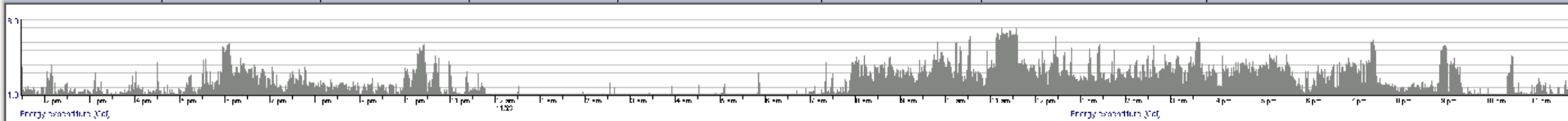
- 72.6 beats/min; 38.16 Million beats/year
- 3.13 billion beats year
- The important number is 4-4.5 years, or ETS
- Battery life: the expected trip to surgery!

Event Counts

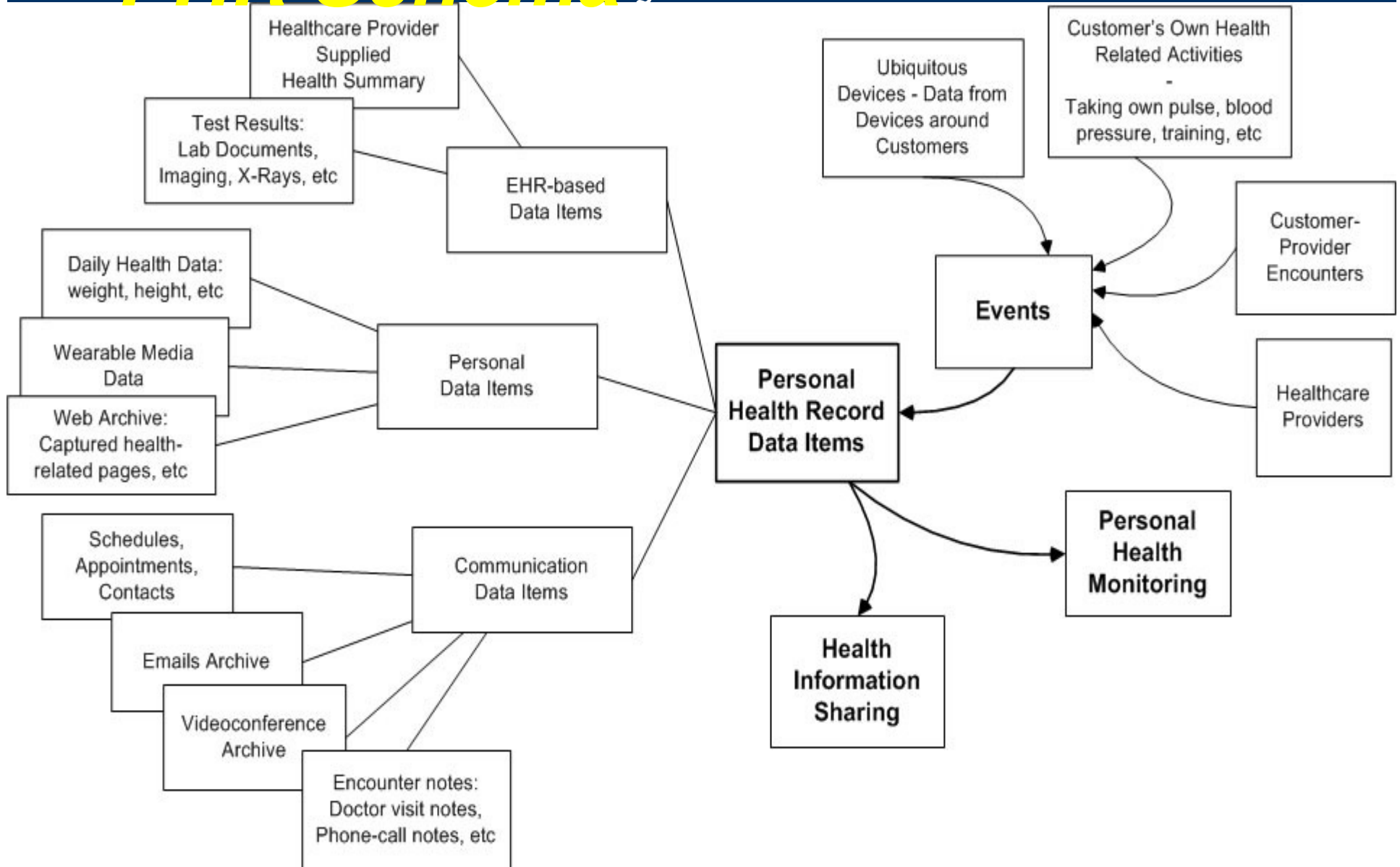
Rate (ppm)	PV	PR	AV	AR	PVE
30 - 54	411,860	4	28,630	1	0
55 - 69	6,824,410	195	4,614	3,609	12
70 - 89	8,113,024	1,359	0	0	274
90 - 109	2,516,074	524	0	0	386
110 - 129	451,814	212	0	0	180
130 - 149	12,599	104	0	0	114
150 - 179	292	46	0	0	112
180 - 224	0	1	0	0	6
225 - 249	0	2	0	0	2
> 250	0	0	0	0	3
Total:	18,330,073	2,447	33,244	3,610	1,089

Total Event Count: 18,370,463

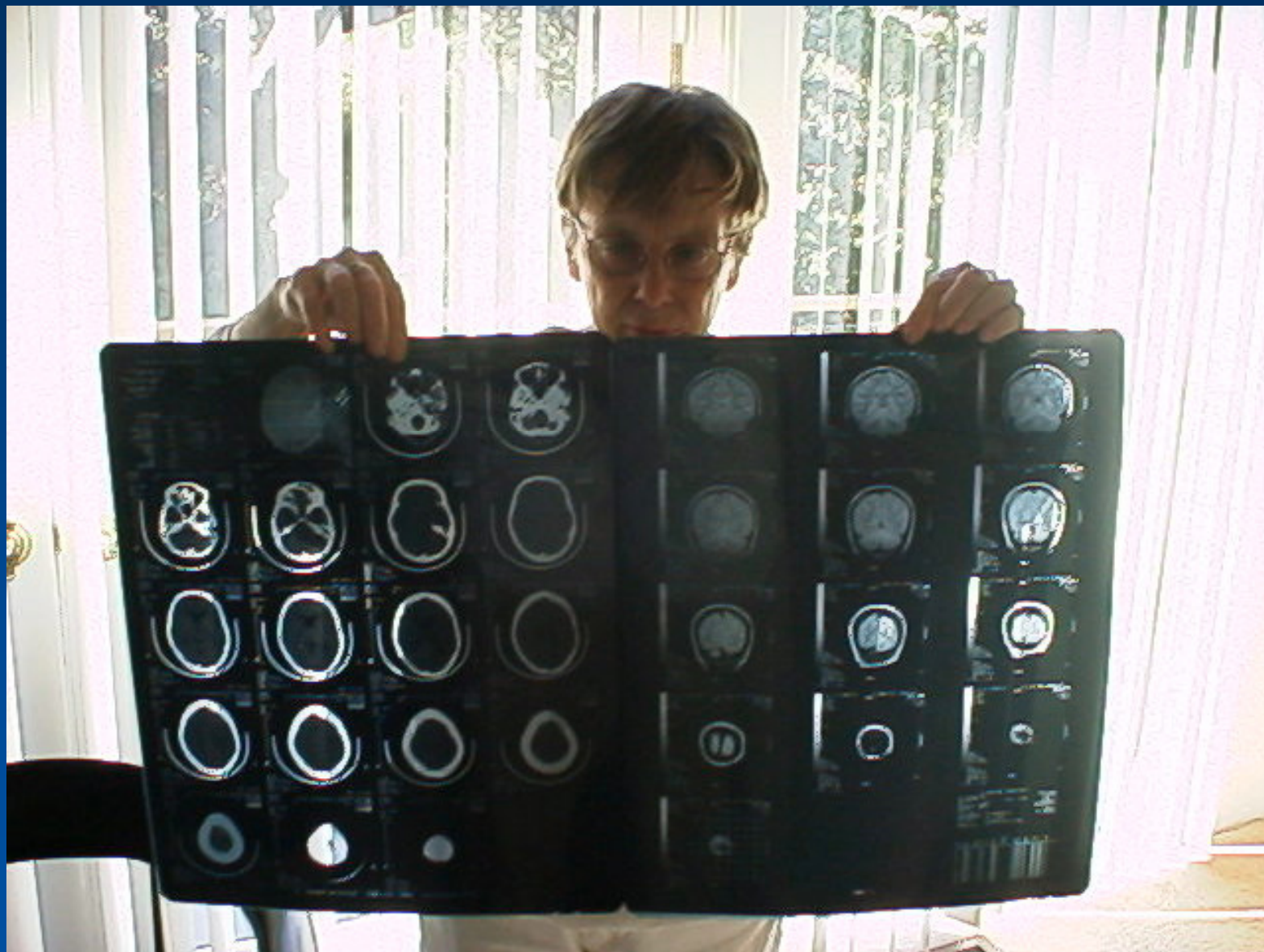
Total EE 9025 calories	Active EE 3395 calories	Physical Activity 16 hrs 8 min	Step Count 28506 steps	Lying Down 1 day 3 hrs 19 min	Sleep Duration 22 hrs 32 min	Duration of View 2 days 23 hrs 20 min	 SenseWear not being worn
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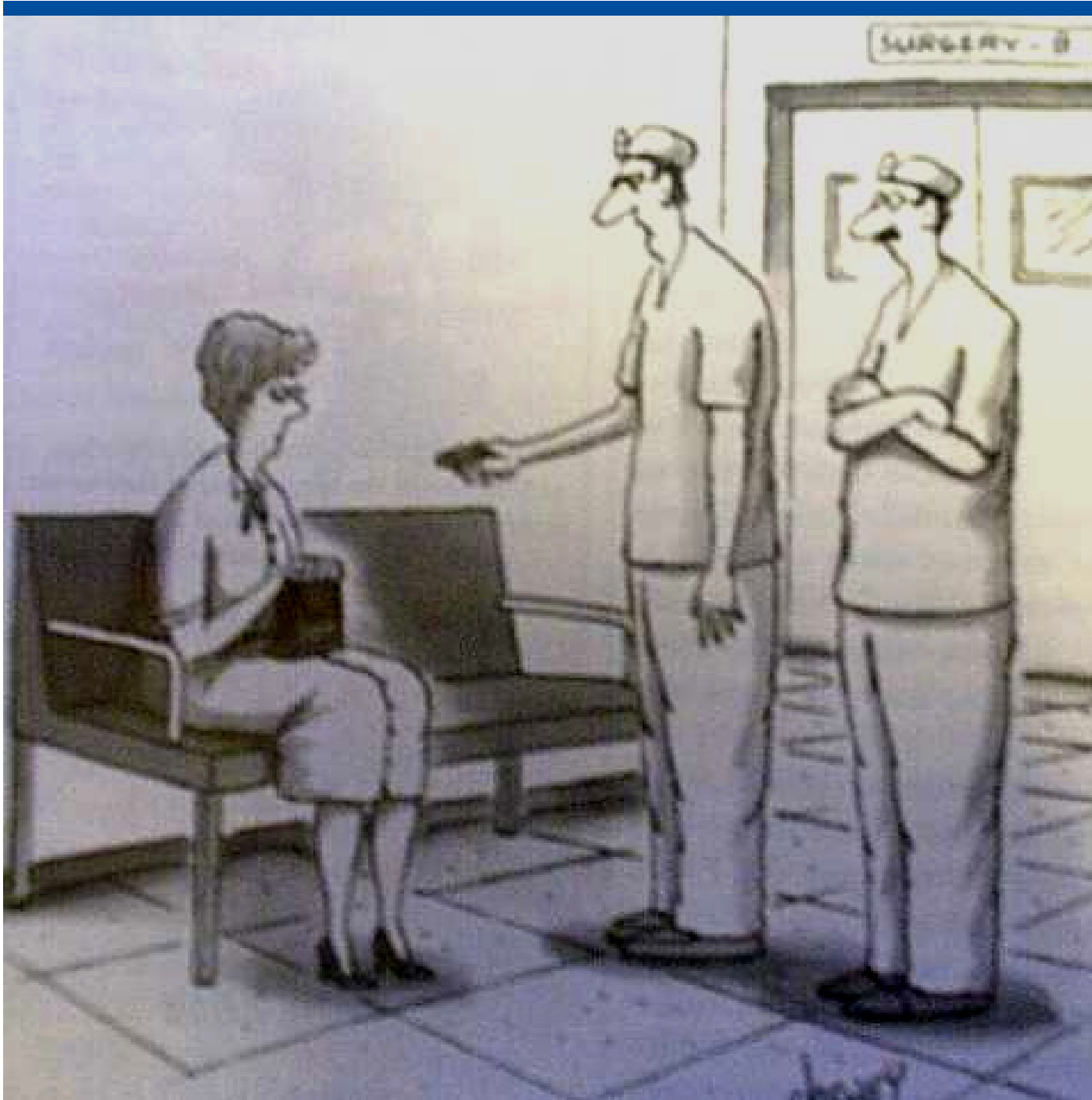


PHR Schema MyHealthBits



Especially cyber-ready images





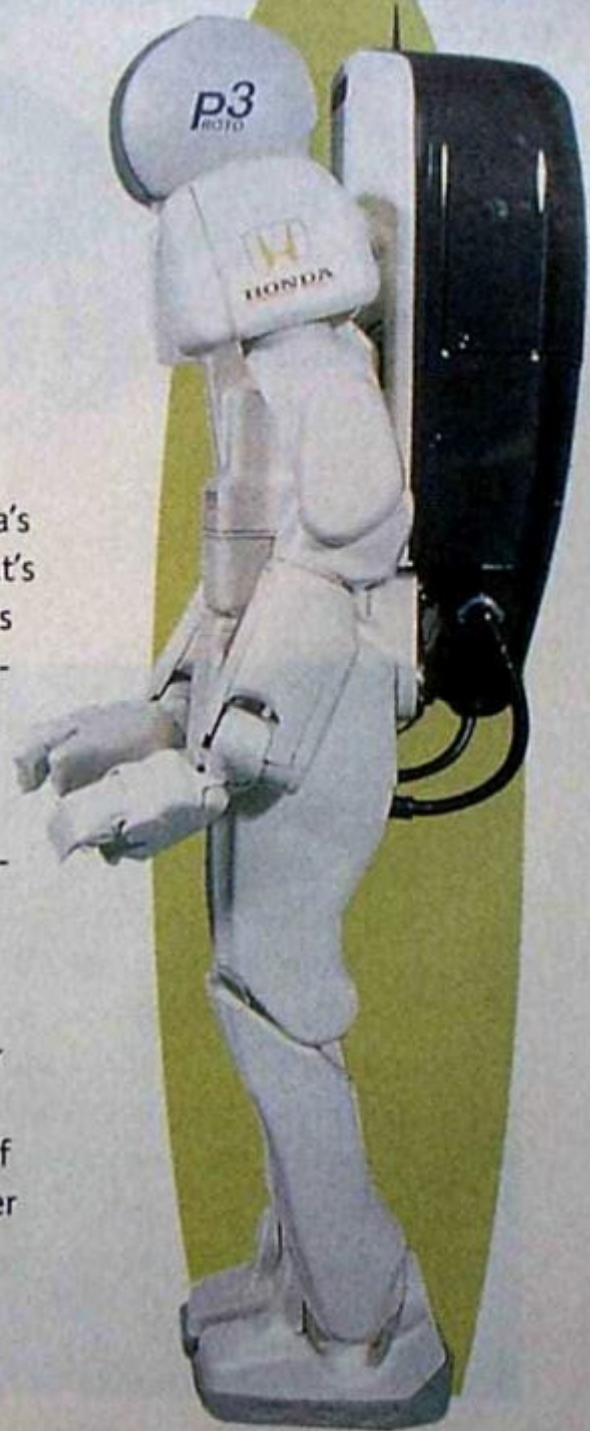
***Your
husband
just died,
... here's
his black
box***

nology transitions

Honda Robot

Robot's Next Steps

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Technology transitions

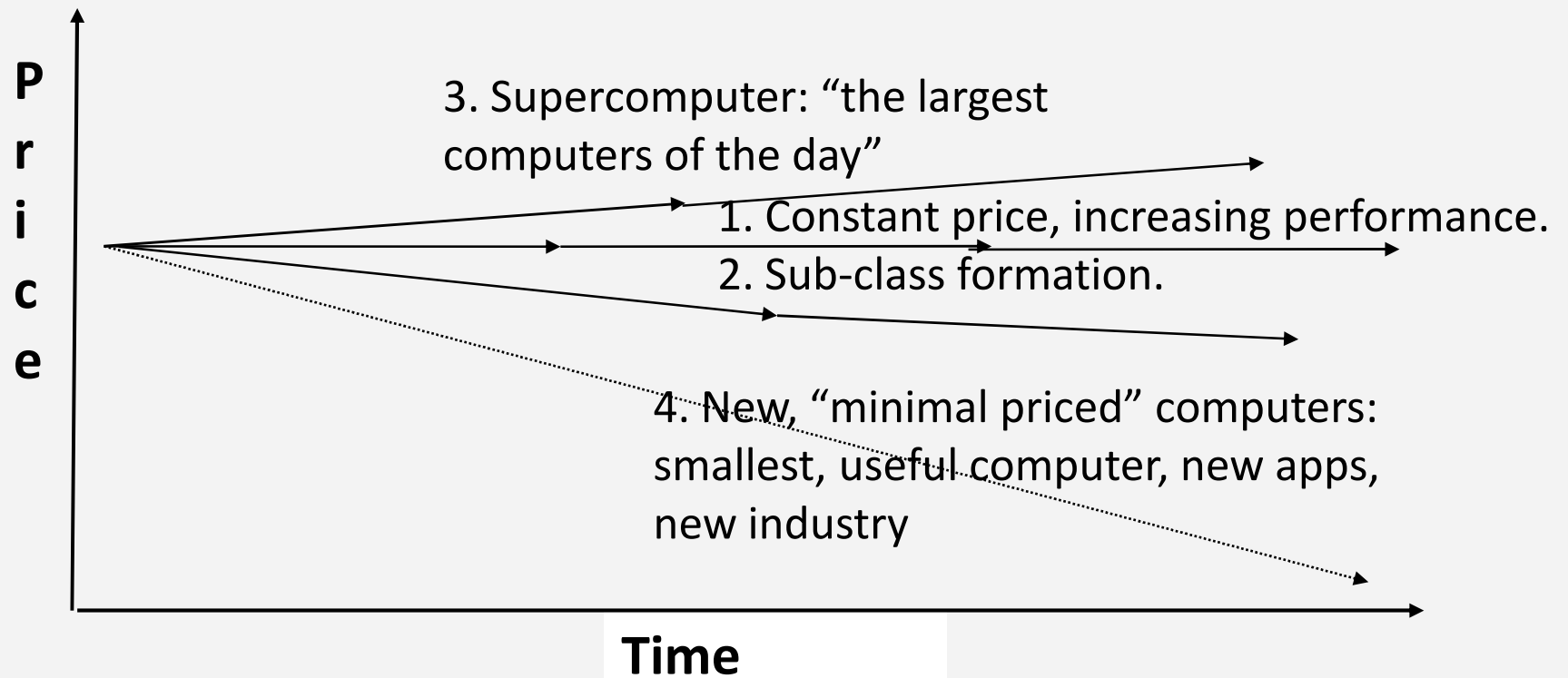
Teleconferencing

It is happening!

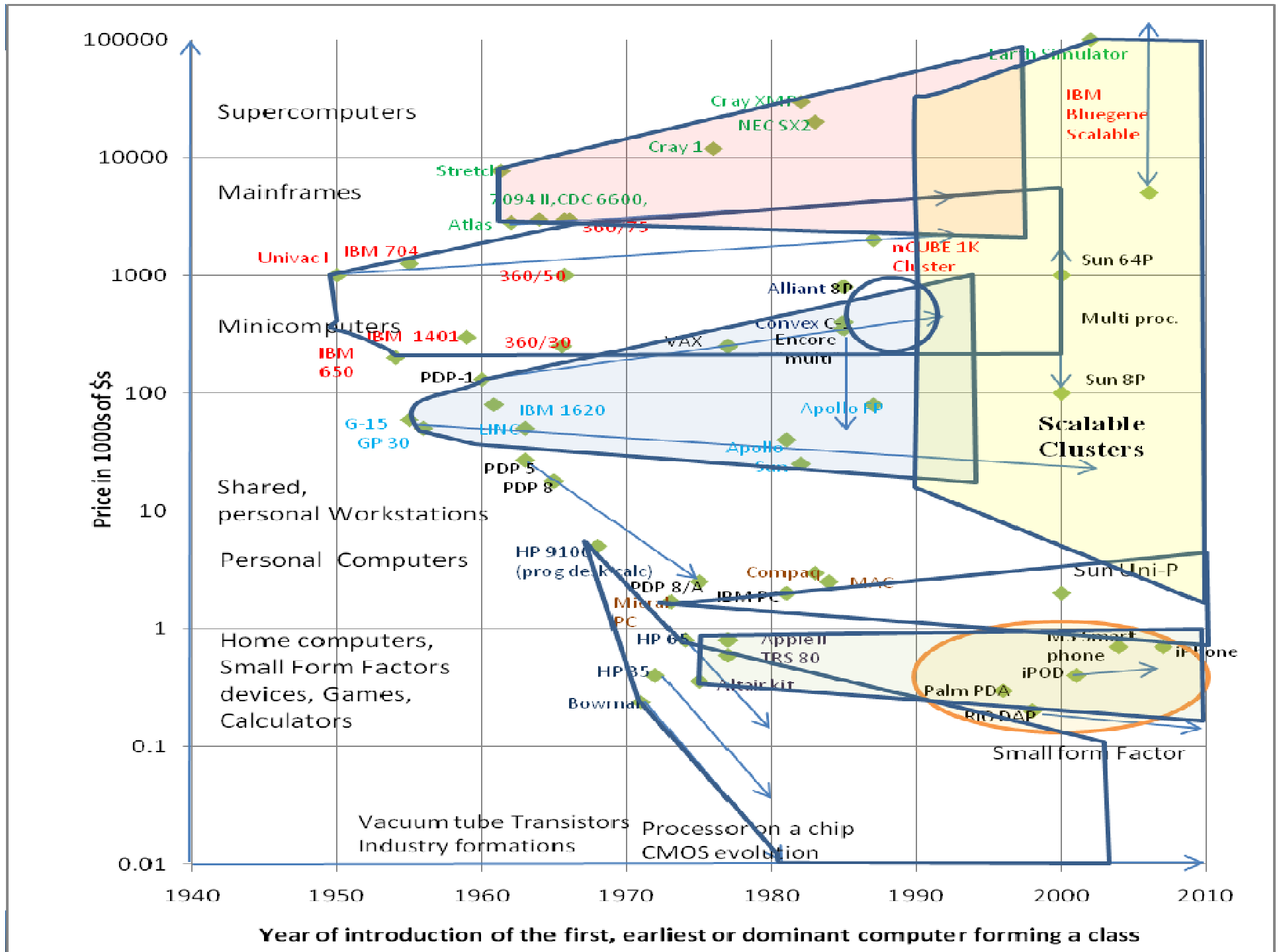
... slowly

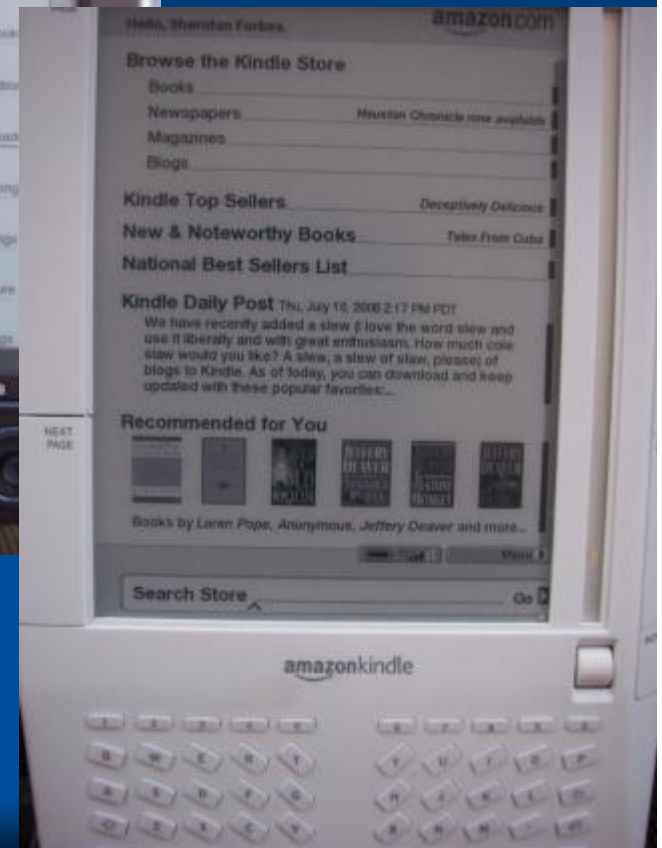
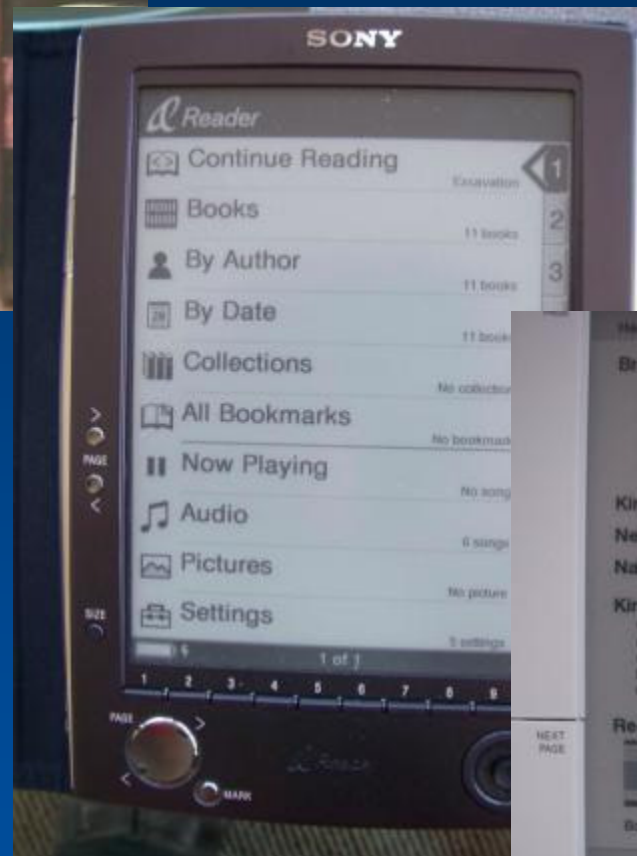
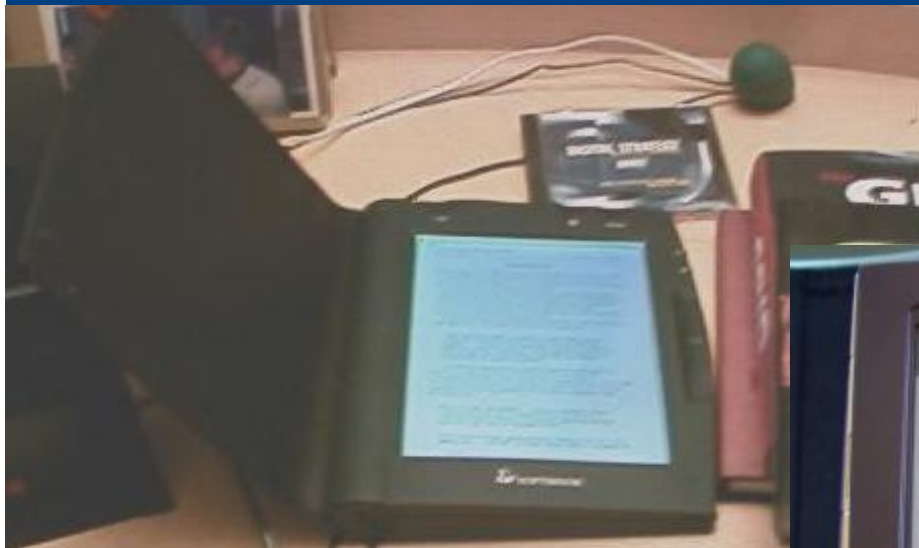
Skype and video telephony are critical

Bell's Law... it should apply to telepresence



Technology transitions





eBook Readers
Softbook c1998
Sony c2006
Amazon c2008

***Publishers: recall
music, video***

***Entrepreneurs have to make
outlandish claims... to be funded***

Technology transitions

Bell Bets... *or the optimist always loses!*

When	What	Who
1987-Presen	Gordon Bell Annual Prizes for Parallelism: performance, parallelism, and cost-effective computation illustrate the power of "betting" or "prizes" to achieve goals.	3 annual teams
1990	AT&T would NOT either destroy or divest itself of NCR within 5 years	Wilmot
1991	By 1996 supercomputing would be done predominately with >1000 processors.	Hillis*
1994	In 1994 a Microunity multimedia processor would be delivered	Mousouris*
1993	By 1996 video-on-demand would have 500,000 subscribers.	Reddy et al
1993	In 2003 AI would be thought more important than the transistor.	Reddy et al
1993	In 2003 Cars that drive themselves would be available by sale.	Reddy
1995	DEC would NOT come last after SUN, HP, and IBM in the Internet sales By 2006 there will be at most, 3 general purpose computing platforms (down from the six from DEC, HP, IBM, Intel, MIPS, SUN;	Richardson; Report
1996	By 2001, video cameras would NOT be shipped and in use on most PCs.	Gray
1997	By 2002, 10,000 workstations would communicate at Gbits/sec.	Reddy et al*
1998	By 2001, and 2002 One billion Internet users worldwide.	Negroponte*
1999	By 2004, Light Emitting Polymer unit sales exceed those of Liquid Crystal Displays	Hauser
1999	In 2004, Electronic Ink will out-ship LCDs as measured by unit area.	Wilcox
11/'00	In Q3 2004, there will be more, consumer <u>paid</u> for music content delivered by some atomic media than via some electronic channels in the US market.	Sviokla
2001	Video On Demand will be available by 2011	??
2002	2012 Light Emitting Polymer Displays 60+" will NOT be available as consumer electronic products* in 10 years	Ling, Reddy, van Dam
2002	If he runs for governor of CA, Arnold Schwarzenegger will NOT win.	Newton, Reddy

Bell Heuristics aka message on entrepreneurship and trying

- Bet against the technological optimist
 - Projects always take longer than predicted
 - A technology may not take off at all
- Betting against a new horse in a 2 horse race: is easy money... legacy aka status quo wins.
- Play! This is a participant sport

At MS, getting research into products is like catching a train

- Usually the train is overloaded
- It is too far down the track
- Researchers get in front of it, get run over.
- Sometimes the train is on the wrong track ...
- More notables: there is no track or train yet.

Why does it take so long?

- People and institutions and infrastructure
- Technology isn't right...
- Plans have to be optimistic to be funded. Entrepreneurs have to believe them
- Medical Records
 - Privacy... versus death. Privacy vs. insurability.
 - Standards, legacy, and proprietary
 - Conflict of interest. Friction of clerks >> profit.
 - UI. Who wants to type?... clear generational issues
 - It isn't quite right. It's has to take less time & be more accurate.
 - Nurses were all heads down!

Nurses station: computers for everyone except me





***Health:
Number
one
market
need...
must
be
open!***

Technology transitions



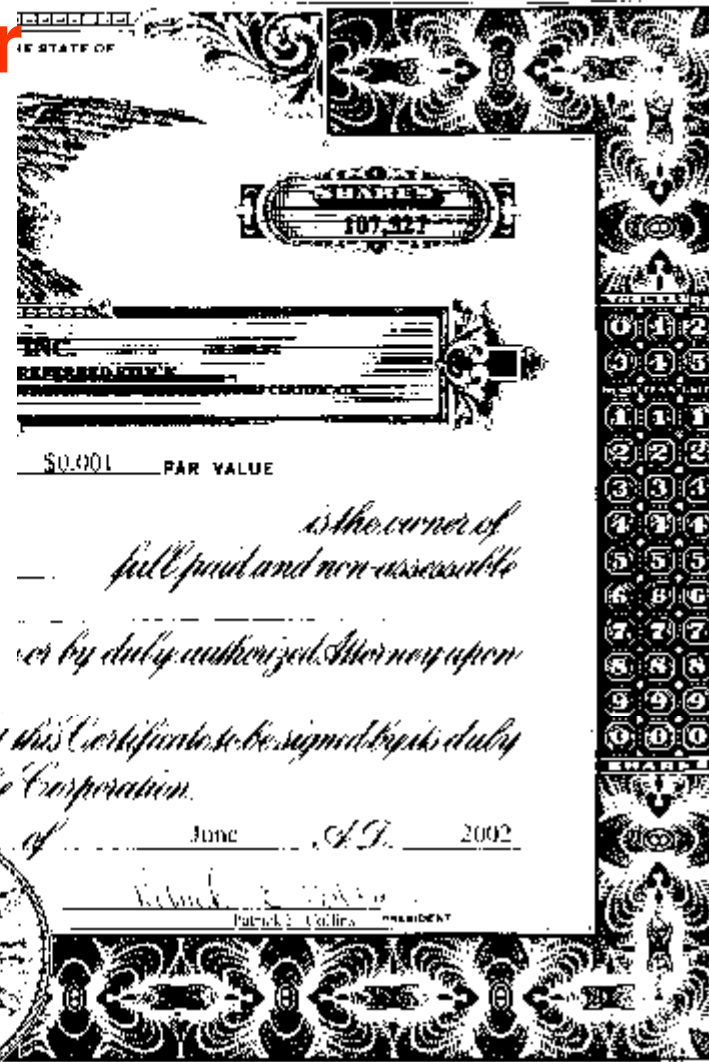
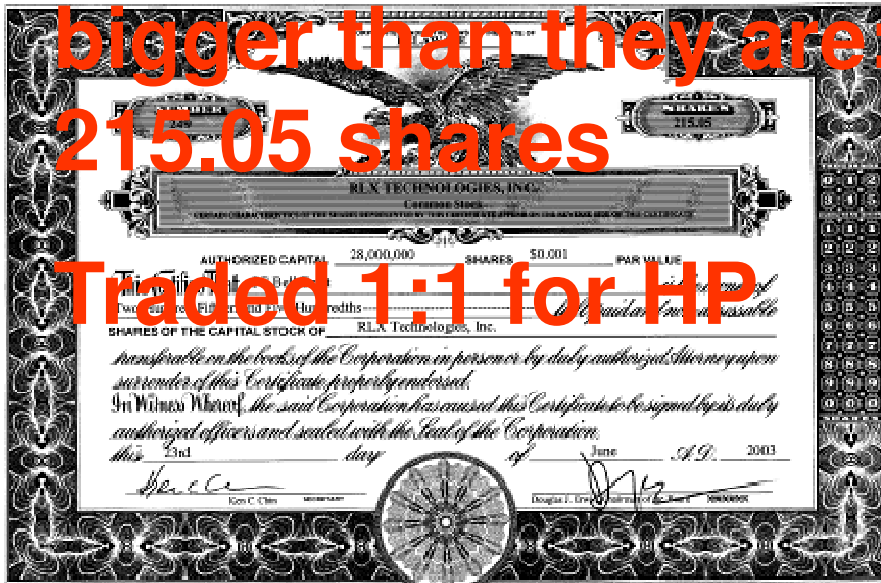
**Gordon the Angel...
before a “real” job at
Microsoft Research!**

Shares... may appear

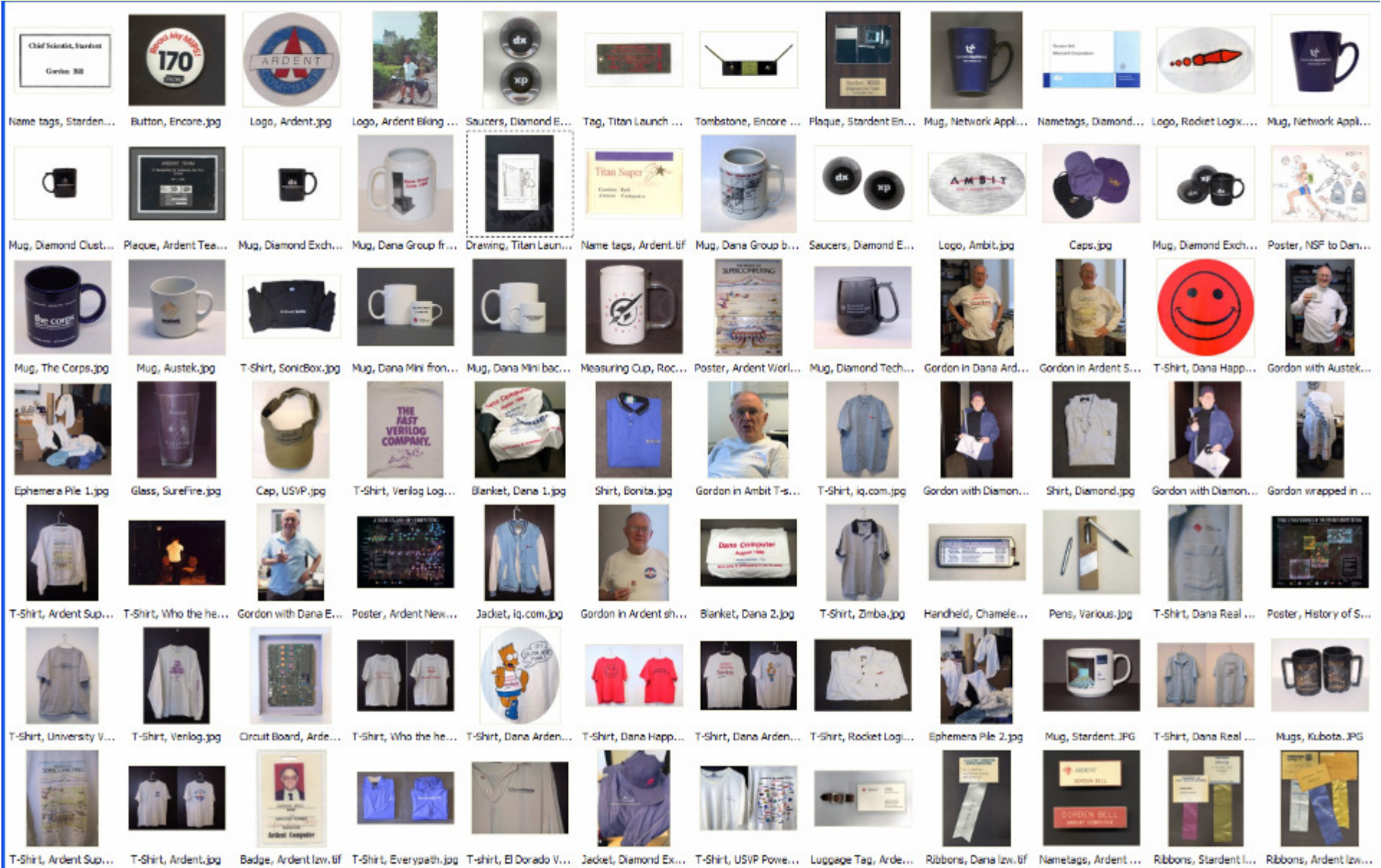
bigger than they are:

215.05 shares

Traded 1:1 for HP



Bell Startup Ephemera. Cost: -\$300K...Value: +\$7,000K



Name tags, Starden... Button, Encore.jpg Logo, Ardent.jpg Logo, Ardent Biking... Saucers, Diamond E... Tag, Titan Launch... Tombstone, Encore... Plaque, Starden En... Mug, Network Appl... Nametags, Diamond... Logo, Rocket Logix... Mug, Network Appl...

Mug, Diamond Cust... Plaque, Ardent Tea... Mug, Diamond Exch... Mug, Dana Group fr... Drawing, Titan Laun... Name tags, Ardent.tif Mug, Dana Group b... Saucers, Diamond E... Logo, Ambit.jpg Caps.jpg Mug, Diamond Exch... Poster, NSF to Dana...

Mug, The Corps.jpg Mug, Austek.jpg T-Shirt, SonicBox.jpg Mug, Dana Mini fron... Mug, Dana Mini bac... Measuring Cup, Roc... Poster, Ardent Worl... Mug, Diamond Tech... Gordon in Dana Ard... Gordon in Ardent S... T-Shirt, Dana Happ... Gordon with Austek...

Ephemera Pile 1.jpg Glass, SureFire.jpg Cap, USVP.jpg T-Shirt, Verilog Log... Blanket, Dana 1.jpg Shirt, Bonita.jpg Gordon in Ambit T-s... T-Shirt, iq.com.jpg Gordon with Diamon... Shirt, Diamond.jpg Gordon with Diamon... Gordon wrapped in ...

T-Shirt, Ardent Sup... T-Shirt, Who the he... Gordon with Dana E... Poster, Ardent New... Jacket, iq.com.jpg Gordon in Ardent sh... Blanket, Dana 2.jpg T-Shirt, Zimba.jpg Handheld, Chamele... Pens, Various.jpg T-Shirt, Dana Real ... Poster, History of S...

T-Shirt, University V... T-Shirt, Verilog.jpg Circuit Board, Arde... T-Shirt, Who the he... T-Shirt, Dana Arden... T-Shirt, Dana Happ... T-Shirt, Dana Arden... T-Shirt, Rocket Logi... Ephemera Pile 2.jpg Mug, Stardent.JPG T-Shirt, Dana Real ... Mugs, Kubota.JPG

T-Shirt, Ardent Sup... T-Shirt, Ardent.jpg Badge, Ardent Izw.tif T-Shirt, Everypath.jpg T-shirt, El Dorado V... Jacket, Diamond Ex... T-Shirt, USVP Powe... Luggage Tag, Arde... Ribbons, Dana Izw.tif Nametags, Ardent ... Ribbons, Stardent I... Ribbons, Ardent Izw...

Angel Investor's Per\$pective

- **I don't propose or suggest that I'm a typical angel...**
- **In 1983, my rationale:**
 - It was cheaper and more efficient than Las Vegas visits**
- **Interesting technology and/or products are motivators**
- **Investing for “greed” has not been very profitable**
- **Amateurs do it for fun... not my “day job”**
- **Don't consider it work**

Five year bets I've won: An indication of entrepreneurial optimism

- **-Processing with over 1 K processors by 1995**
- **-1 Billion users by 1/2001 or 2002. -\$1T commerce**
- **-Gigabit to the desktop by 2001**
- **-VOD by 1997. +VOD by 2010.**
- **-AI would be significant. -Car would drive itself.**
- **+Videophone by April 1, 2002 (first lost bet+)**
- **-LEP and -E-ink by 2004; + OLED by 2010.**
- **-AT&T / NCR merger.**
- **+(1995) By 2006, a maximum of 3 platforms.**
- **-A multimedia processor vs. custom etc..**



**First Graphics
Supercomputer:
Dana aka Ardent
aka Stardent aka
Kubota
T-shirt**

**Don't put your
business plan on a
T-shirt**

Coffee Cup:
\$185,000

Headache:
Priceless



Gordon Bell \$ and/or time Investments c1983-2005

Return > 0	34	32%
Return <0	54	51%
Still out	17	16%
Total	105	
Public/acquire	20	19%

Algorithm, no product	3	
Computers & chips	13	5 <0
Consultancies	6	3 <0
eCAD	8	2 still out
Friends, classmates	9	7 <0
Interesting tech.	10	e.g. Geovector, Gyration
Mobile web & web	6	2 still out

That said... some opportunities I missed

- **Ask Jeeves...**
because: Who would trade:
 - a few hours of time as a Microsoft researcher
for
 - a few hours in a board meeting and
a hundred million dollars?
- **A share of China's largest ISP... for 75K**

On the Bell Collection of \$50K-\$150K cups & T-shirts

•Investment in “bad” industries: phone manufacturers X phone companies

•Missing Product

- Buying a dream or idea; NO product|team|plan.
- A lone ranger’s algorithm, isn’t a product or company
- Cute feature: UI’s just aren’t products, let alone company!
- Point product to exploit Moore’s Law or something else. No follow-on

•Plan

- No viable biz plan... just an idea or demo that one could exist.
- Consultancy or feature: unclear path to monetize...

•People

- Gut > logic... just like the idea or team in spite of missing factors
- Great idea; B team. Inability to hire and to do it. *Locale can be a problem.*
- CEO problems or Sociopath on the team? Man & wife
- Team turns on each other. Won’t|can’t hire CEO or x.
- Never underestimate the ability of the BOD to screw things up!

•GB problems:

- Failure to use the BMD! NO due diligence...use 2 sec. Gut!
- Friendship based-- “helping” in some capacity!
- Flattery|need: “We need you on the BOD!”
- Greed. Go with flow. Ride bandwagon. NO time.

Public...

- **New product – new market**
 - **Cybercash**
 - **Gensym –AI for proc. cont.**
 - **Immersion – UI patents/products**
 - **Mathsoft**
 - **Si Compilers > Mentor Graph.**
 - **Symbolics**
 - **Teknowledge -- early AI**
 - **Vital Signs > ... > Lucent**
- **New product – existing market**
 - **Encore > SUN (IP)**
 - **KSR**
 - **MIPS**
- **Being second with a standard**
 - **Altamira => Microsoft acq.**
 - **Ambit => Cadence**
 - **Cacheflow => Bluecoat**
 - **Chronologic => Gateway**
 - **Network Appliances**
 - **Magma**
- **Chips -- a design methodology**
 - **Cirrus Logic**
- **Chips -- niche**
 - **Weitek**
- **Consulting**
 - **Diamond > DiamondCluster**
- **Database**
 - **Zimba > Informatica**
 - **Epiphany**

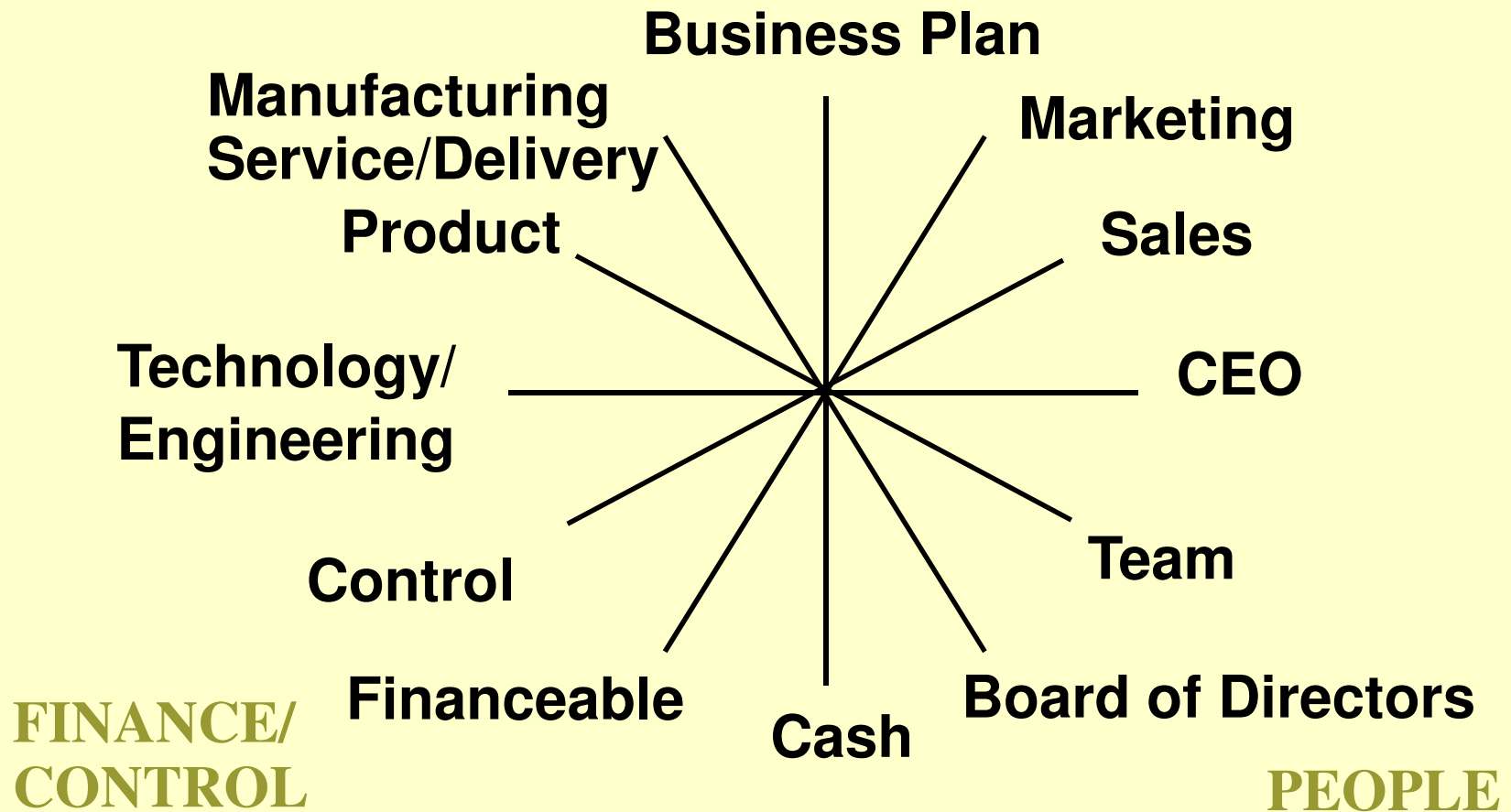
The Bell-Mason Diagnostic

- **Space**
Twelve standard dimensions characterize a venture (a chapter of *High-Tech Ventures*).
- **Time**
Four, well-defined stages of company development with 7 sub-stages of product and market development.
- **Quantification**
Clear, yes/no questions (i.e. rules) encapsulate knowledge for evaluating a company.
- **Visualization**
A relational graph shows company position.

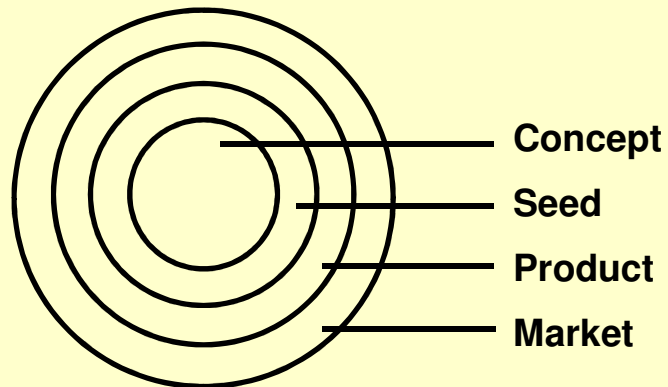
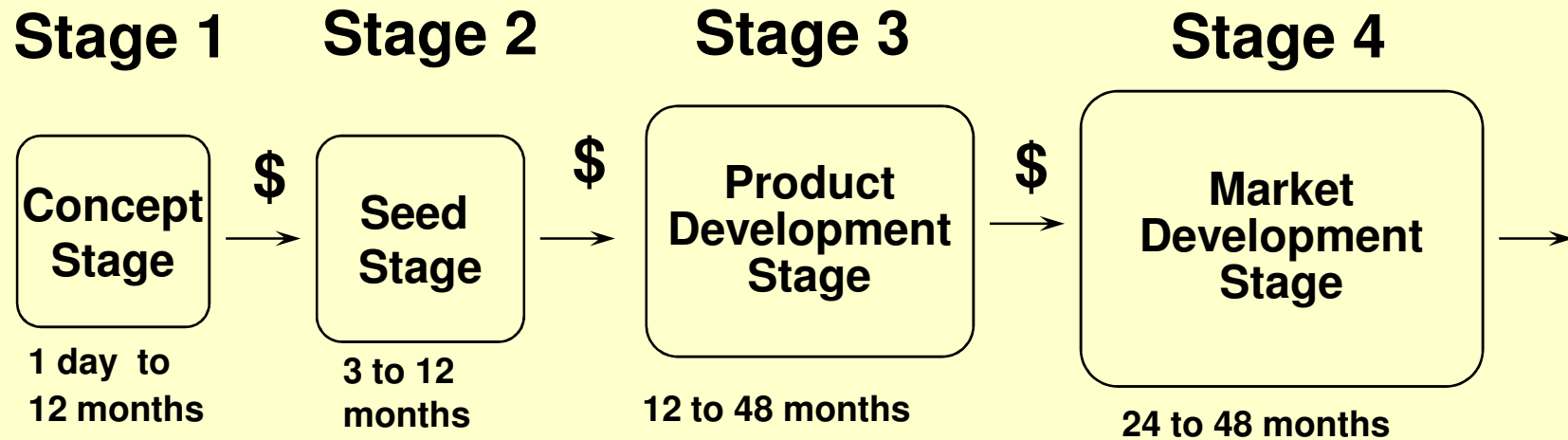
12 Dimensions of Analysis

PRODUCT

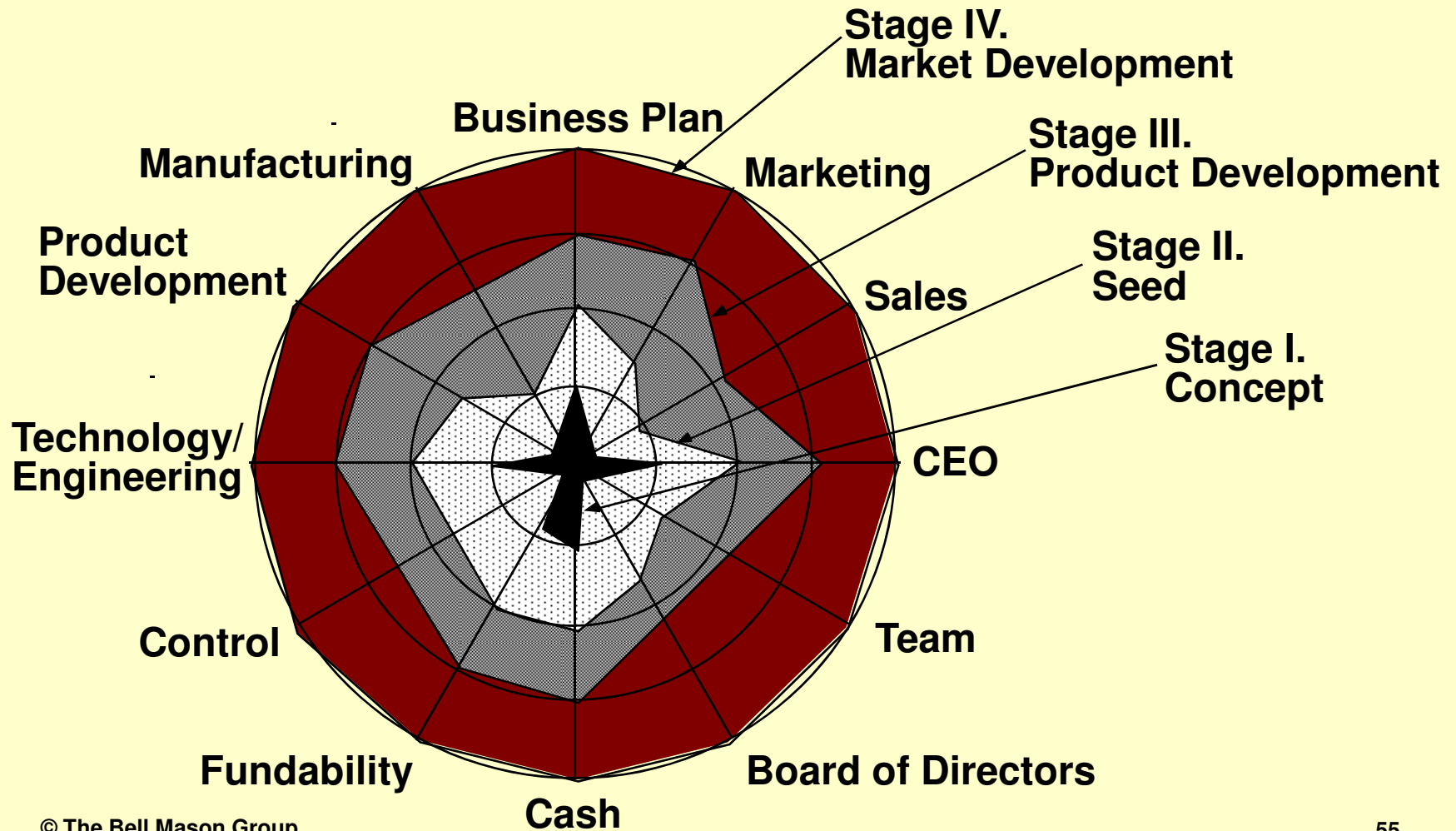
MARKET



Four Stages of Growth



Evolution of the “Ideal State” at Each Stage: Entrepreneurials



Bottom line

- **The startup process can be codified and measured according to a model**
- **Deviating from “best practices” is a risk to company and investors**
- **There’s rarely a shortcut for starting a successful venture**

The Cyber Admin or the prosthetic memory...

*When we can store
everything we've:
read/written,
heard/said,
seen/acted, plus
physical parameters.*

The end

Technology transitions