

# THE BRAIN AND TECHNOLOGY

*Brain science in interface design*

## LESSON 8. THE FUTURE IS US

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# THE FUTURE IS US

We are the  
architects of our  
digital destiny.

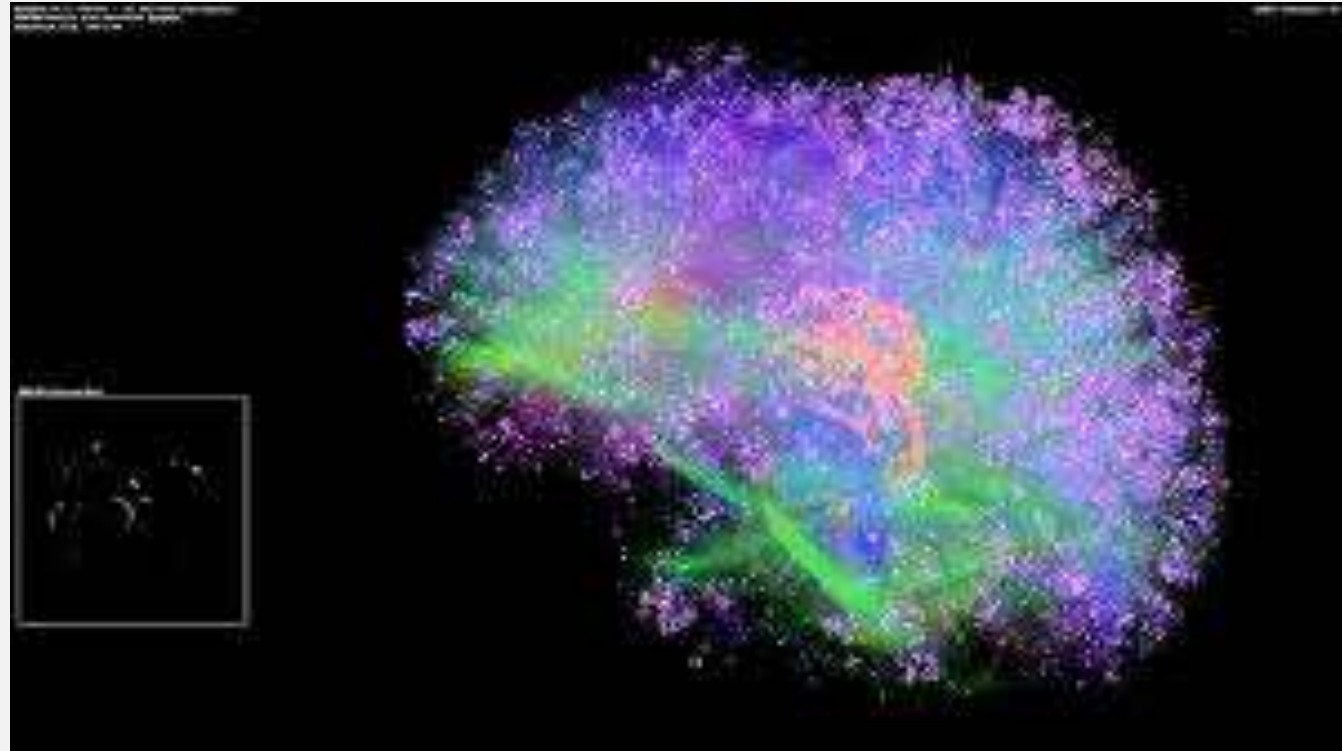


# THE BRAIN

The brain as a biological reality processor evolved:

1. **Shared control:** *Attention*
2. **Massively parallel processing:** *Context*
3. **Overlaid upgrades:** *Intuition*
4. **Processing hierarchy:** *Recognition*
5. **Dynamic storage:** *Thought*
6. **Self-direction:** *Purpose*
7. **Self-change:** *Learning*

It is divided into sense input, state and motor output processing centres we call intellectual, emotional and moving.



# THE BRAIN

*“The brain is an advanced information system that is unpredictable but not random, complex but not slow, adaptable but not unreliable, structured but not unchanging and receptive but not input defined. It analyzes an enormous bandwidth of equivocal data to give both real-time fast responses and long-term acts that may not bear fruit for years. As the information processor our galaxy produced, it is the very definition of chaotic order in processing.”*

– Brian Whitworth

Watch Jill Bolte-Taylor’s  
[“The Ode to the brain”](#)



# THE COMPUTER

*“Computers are no real competition for the human brain in areas such as vision, hearing, pattern recognition and learning. ... And when it comes to operational efficiency there is no contest at all. A typical room-size super-computer weighs roughly 1,000 times more, occupies 10,000 times more space and consumes a millionfold more power ...”*  
(Boahen, 2005)

**Computers process information better,  
but that isn't what the brain evolved to do!**

***Cars are faster.***



***Cranes lift more.***



***Computers  
calculate better.***





# THE SMART COMPUTER MYTH

**Kasparov vs. Deep Blue:** 3 lbs of **wetware** vs. a room-sized super-computer weighing 1.4 tons!

- Kasparov first won 4–2, lost the rematch 3½–2½, then IBM stopped it!
- Kasparov wanted a rematch but IBM refused and dismantled Deep Blue.
  - They let **chess expert coders** alter Deep Blue between games, so Kasparov also played **them!**
  - A closed 8x8 chess board context favours calculation power.

*After the game.*

- Kasparov went home and read the paper.
- Deep Blue was turned off as it **did nothing else.**

AI programs now beat grandmasters but Man-machine pairs beat AI alone!

- See [Centaur Chess Shows Power of Teaming Human and Machine](#)
- After **20 years** AI beat a GO expert, i.e. just another closed board game.

**Supercomputers aren't even close to what a 3-centre brain evolved to deal with – an unpredictable world.**



# DRIVERLESS CARS – HYPE VS REALITY

*A no steering wheel driverless car? Maybe one day?*

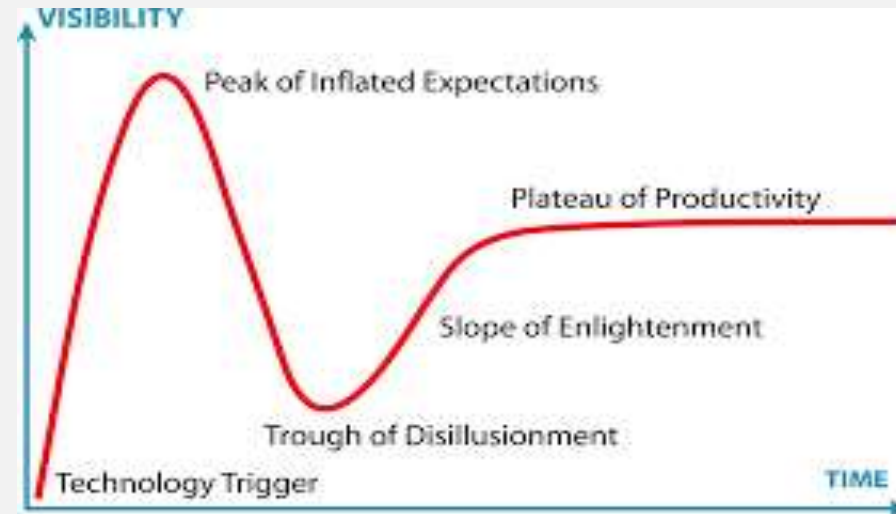
- Who is **responsible** when a crash occurs? The “driver” who has no steering wheel? The software company? Unlikely!
- People will **chicken** driverless cars.
- One accident per year is teenager-level driving.
- Software can always be hacked (Chrysler Jeep fiasco).
- Google cars with **two** minders able to take over **all the time**, 100% maps, ideal roads and fine weather **still have accidents**.
- People **like** driving—“What’s putting the brakes on driverless cars”

*A car that helps the driver? Here today, now!*

- Autobahn self-drive, assisted parking
- Reactive cruise control, range collision sensing
- The driver of a **delegated car** in a traffic jam is still responsible
- Maybe cars should display an “R” sign when in robot mode (social requirement).



Shouldn't driverless planes and trains come before cars?



How hype works

# THE LIKELY FUTURE - COMMUNITY ROBOT CARS

*Community cars with no steering wheel under social control: Here soon*

- **Specially mapped** designated “Autocar only” areas where no human-driven vehicles are allowed, cf. pedestrian only areas
  - Robot cars will compete with buses, trams and subways – not drivers.
- **Publicly owned** robot cars will be in effect a public transport system
  - You can sue people, but **sovereign immunity** protects the state.
  - The robot car average speed of ~20K is faster than walking.
  - The robot car is a more flexible point-to-point transport.
  - The robot car is slow enough to avoid hitting pedestrians.

## Conclusion:

- **Self-driving** cars are a long way off (Stand-alone AI car).
- **Driver delegated** cars that take over sometimes are here now (Human-computer interaction car).
- **Community cars** that self-drive in designated areas are just around the corner (Social-technology car).

The future of AI car technology will depend on social control - the car won't control itself or be allowed to go just anywhere.



Robot cars may work in designated areas where only robot cars are allowed



# TECHNOLOGICAL UTOPIANISM

**Technological Utopianism:** The idea that technology will lead us to a Utopia is a PR stunt

- **Robot drones** without ethics?
- **Automated trade** without trust? (Dotcom bubble)
- **Internet control** without human rights?

**Offers a future of:**

- **Spam:** I sell to you for my owners gain
- **Bots:** I talk to you for my owners gain
- **Spying:** I observe you for my owners gain

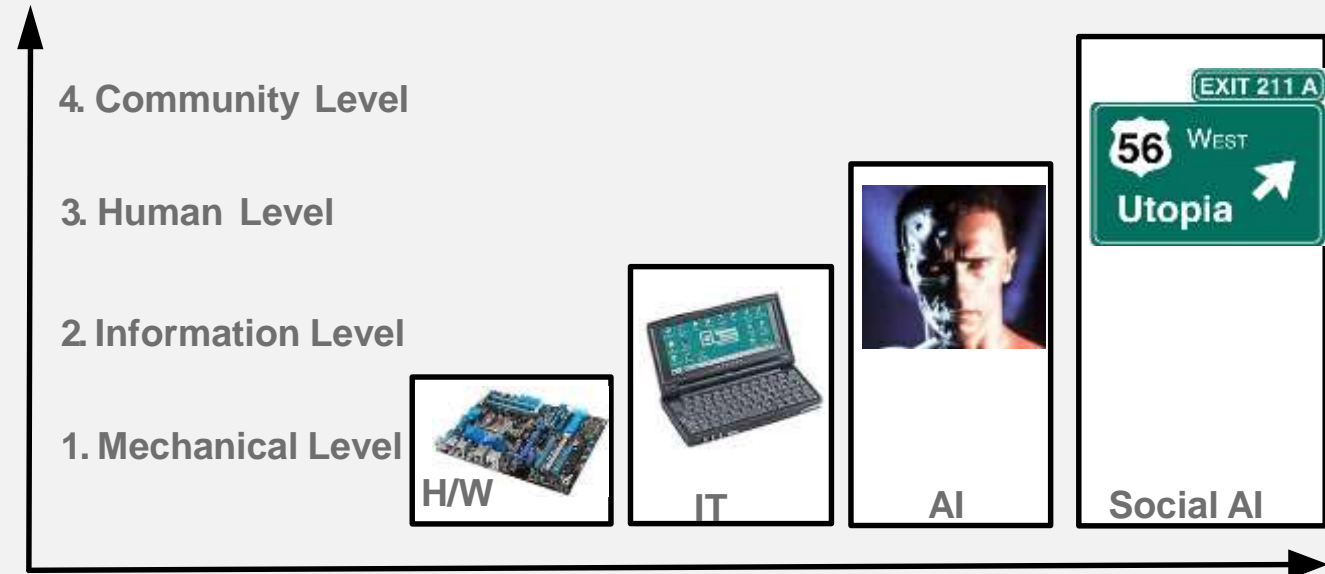
**Assuming that:**

- **Might is right:** My “right” is that I can.
- **Knowledge is power:** Who knows wins.
- **I win by your loss:** Me vs. the world.

**Yet civilization** teaches that might is not right

- **Reality does not reduce to information**
- **Synergy is the key to modern success**

**As physical wars** destroy physical landscapes, **Information wars** destroy information landscapes: spam wars, censorship wars, copyright wars...



**Technological utopianism is the idea that technology will lead us to Utopia!**

# THE SORCERER'S APPRENTICE

A **wizard** left his apprentice in charge of the lab.

- Thinking he knew what he was doing, the apprentice started casting spells, but they soon got out of hand.
- Only the wizard's return saved the day.
- Will humanity give its future to its software apprentices?
  - Or the organizations that write them?

The **myth that computers can take charge** is based on the assumption that **reality is calculable**:

- **If only** we had all the data (big data)
- **If only** we had bigger computers (big hardware)
- **If only** we had more complicated software (AI)

**Yet**, classical computers take months to simulate **one photon!**

- The clockwork universe is a myth - reality never was calculable
- The brain evolved to handle complex uncertainty
- Calculation, *however powerful*, is not the answer

**Humanity has to lead and direct technology, not follow it.**



**Technology as the sorcerer's apprentice**



**IF TECHNOLOGY LEADS, HUMAN EVOLUTION WILL FAIL.**

*fuzzy*

# HUMAN EVOLUTION

## Mechanical:

- **Tools** (2 million BC)
  - Stone tools, fire, domestication of dogs, ornaments
- **Agriculture** (10,000 BC)
  - Hunter-gatherers settled
- **Industry and Science**(19<sup>th</sup> century)

## Informational:

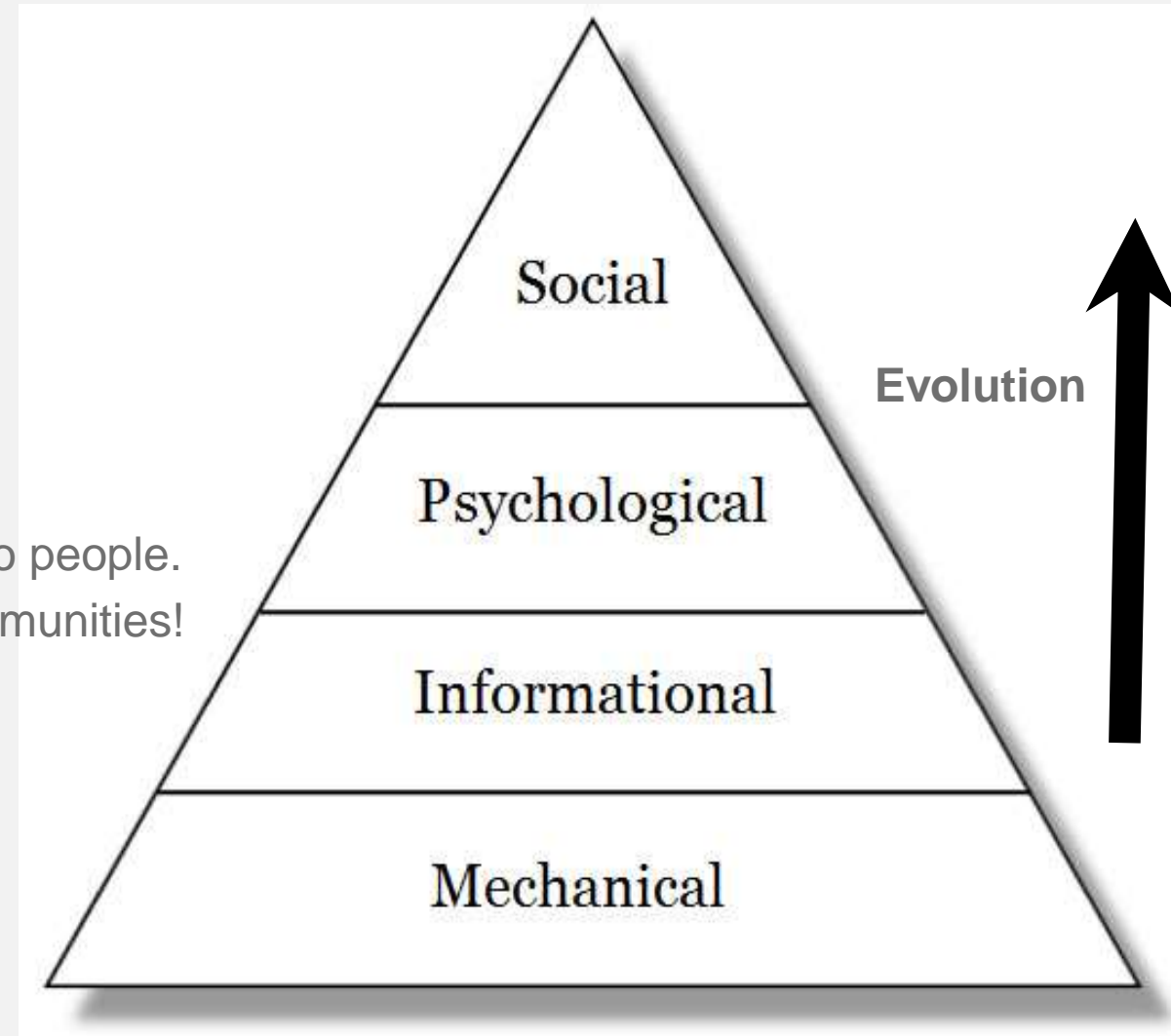
- **Digital (1960)**: Hardware listens to software.
- **Human-computer interaction (HCI) (2000)**: IT listens to people.
- **Socio-technical system (STS) (Now)**: IT listens to communities!

## Psychological:

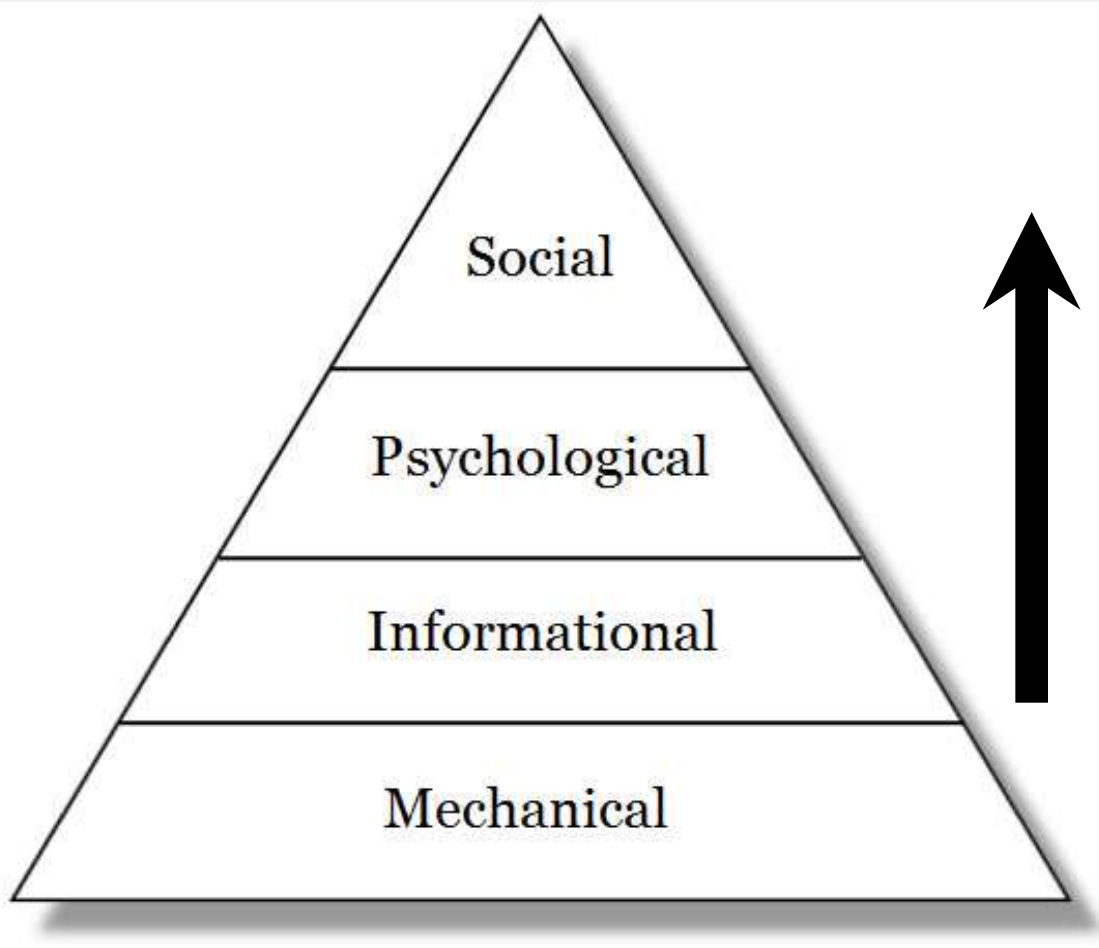
- **Morality**: *Good and Evil* - The first Zoroaster ~7000 BC
- **Science**: *We don't know* - Socrates ~600 BC

## Social:

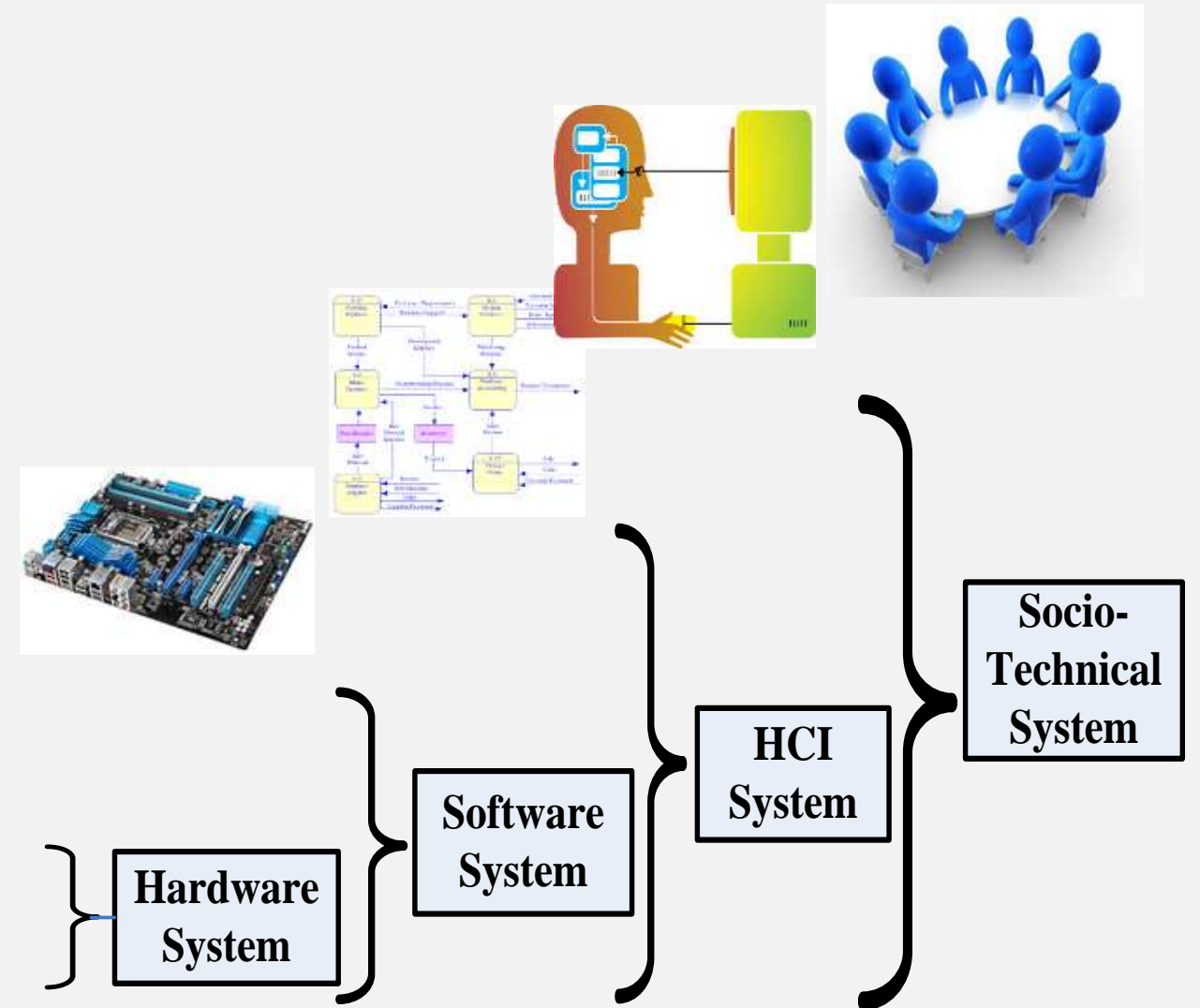
- **Autocracy**: Kings, pharaohs, emperors
- **Aristocracy**: Greek and Roman **republics**
- **Democracy**: French, English, Russian, American, Chinese?



# TECHNICAL EVOLUTION



Each reality level changes the rules.

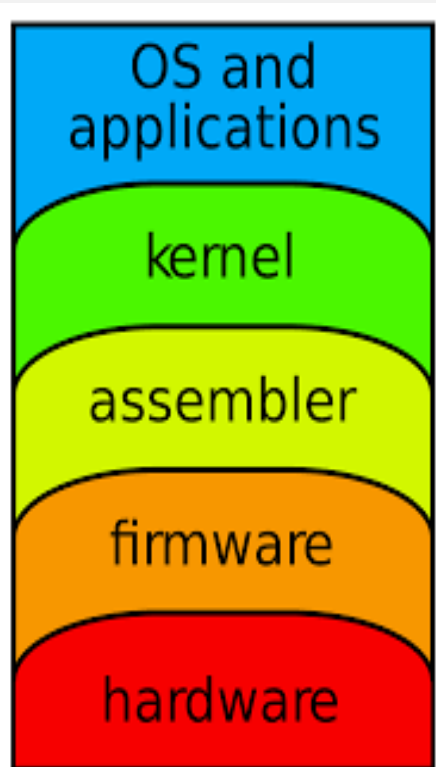


Technology now also works on human and social levels.

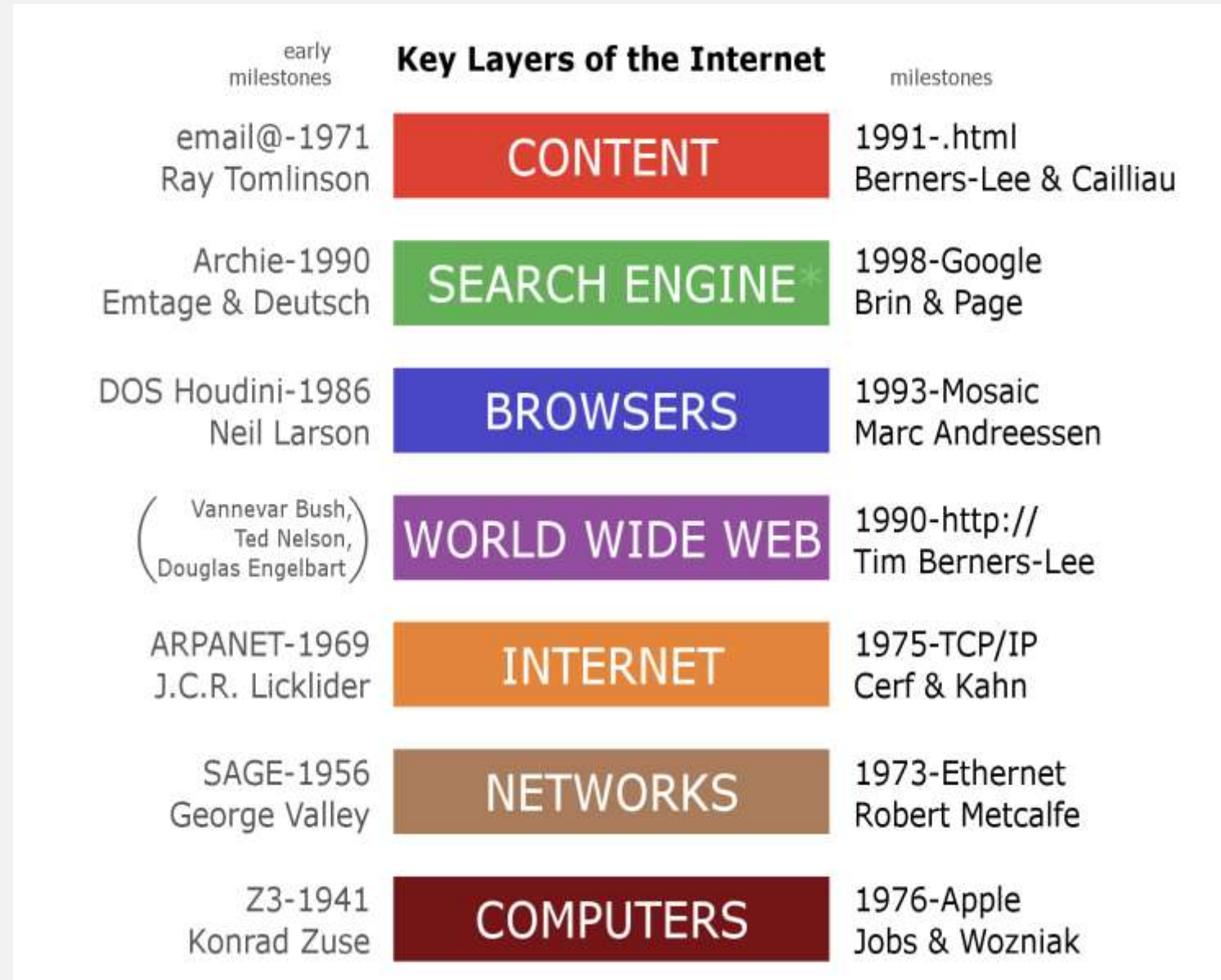


# IN THE BEGINNING...

In the beginning was hardware,  
Hardware begat software,  
Software begat meaning,  
Meaning begat social networks,  
and it was good.



Software evolves  
from the hardware  
layer.



# COMPUTING LEVELS

**Socio-technical system (STS):** IT that works by interacting with a community.

- Wikipedia is IT supporting a community.
- Normal city is a socio-physical system.

**Human-computer interaction (HCI):** IT that works by interacting with a person

- A mobile phone used by a person.

**Information technology (IT):** Technology that processes information

- A mobile phone ringing.

**Technology:** A physical tool that people use

- A spade or a chair is technology.

**Social Level**

**Online Community**  
+ Person  
+ S/W  
+ Device



**Personal Level**

**Person**  
+ S/W  
+ Device



**Software Level**

**S/W Code**  
+ Device



**Hardware Level**

**Devices**

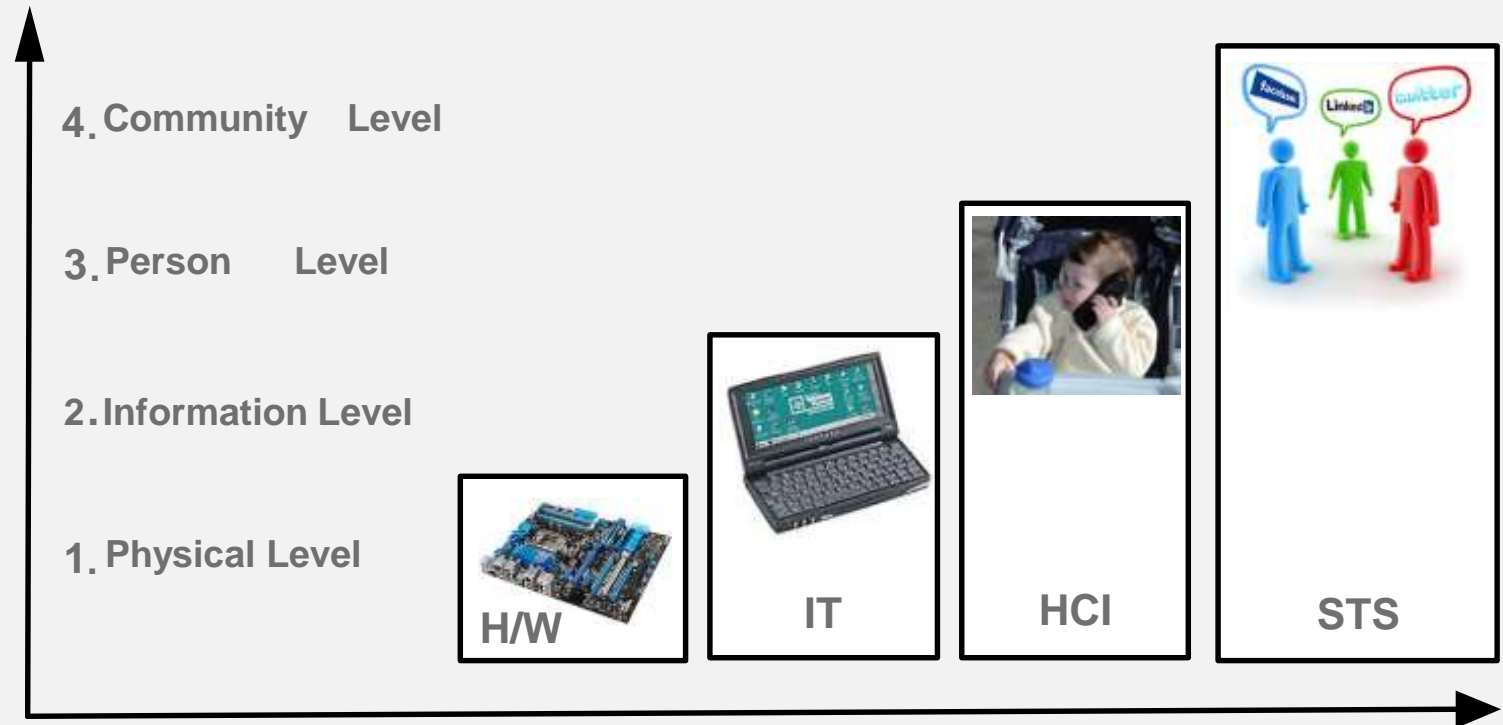


# THE SOCIO-TECHNICAL VISION

Each reality level is a new way of seeing reality – the physical level is only the simplest way

Each level:

- **Emerges** from the previous level but still **depends** on it:
  - *If the hardware fails, the system fails.*
  - *If the software fails and the hardware doesn't, the information system still fails —e.g., it **hangs**.*
- **Higher levels redefine** success.
  - *If no one visits a website, it fails even if the h/w and s/w work.*
  - *If a community rejects a website by making it illegal it fails, even if people like it and the h/w and s/w work.*



Technology is evolving towards social-technical systems



# THE FUTURE OF COMPUTING?



**Krypto**, the fantasy Super-Dog, who **might appear** to save the world?



**Max**, my actual dog, who **actually** helps me but also ate a bucket?

# THE INFORMATION REVOLUTIONS

## PC revolution:

- **Anyone can compute:**
  - Windows
  - Mouse
  - Preferences

## WWW revolution:

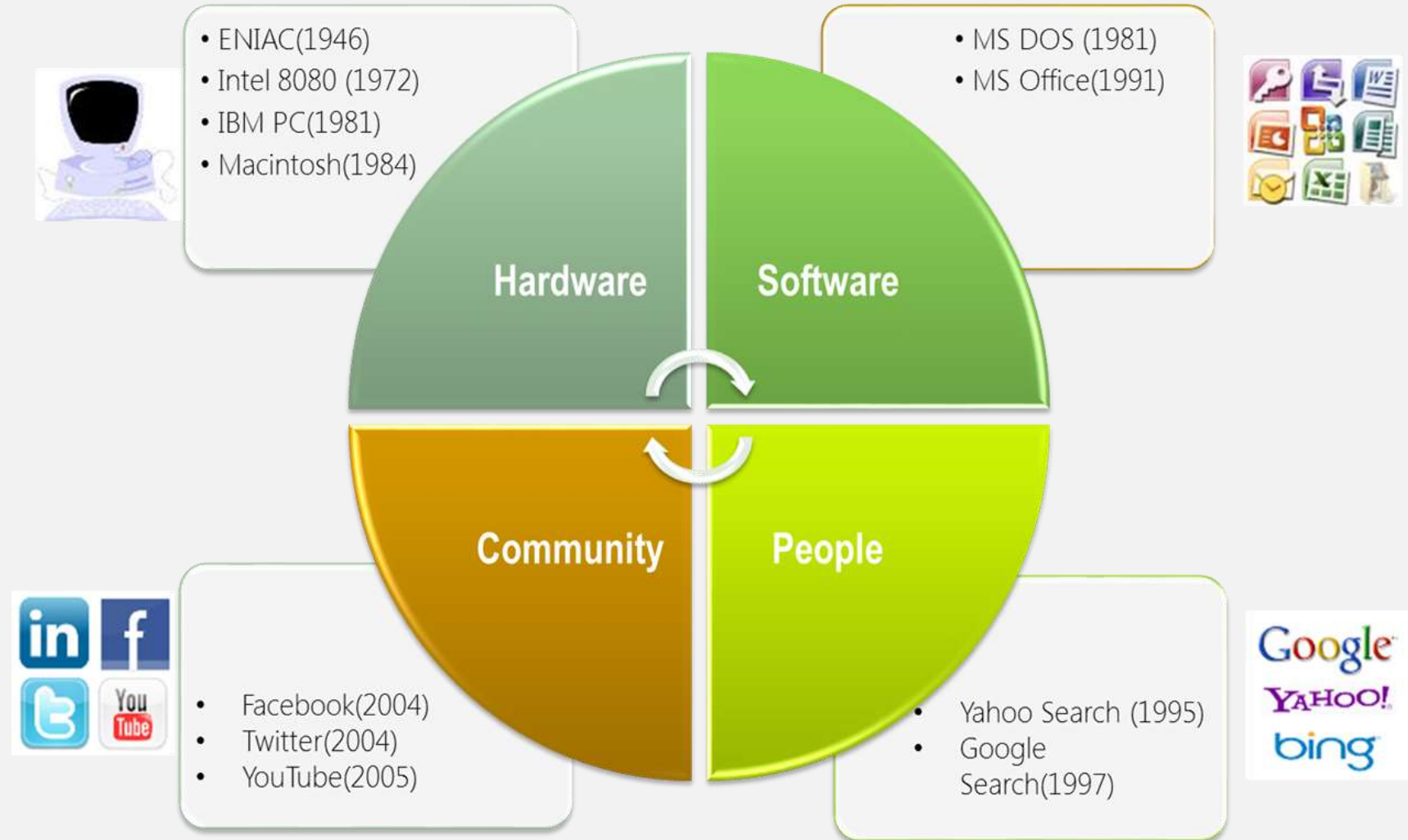
- **Anyone can connect:**
  - URLs and HTML
  - Google
  - The Back button

## Mobile revolution:

- **Anywhere, anytime**
  - Touch screens
  - Context menus
  - Vibrate, whistle and swipe

## Social network revolution

People talking to people





# IT AND SOCIAL REVOLUTION

## Voting:

- **Tag clouds:** A click is a vote!
- **Social bookmarks:** Reveal community trends
- **Vote comments up/down:** Slashdot
- **Repeat voting:** Avoids Condorcet's voting paradox

## Naming/shaming:

- **Twitter outrage, Facebook condemnation**
- **A shame on you icon?**
- **Apologies app:** Publicly records an apology



## Physical effects:

- **Arab spring:** Freedom online instigates freedom offline.
- **Public elections:** The Obama campaign

## Social functionality:

- **Banish:** Ostracize, censor, exile, imprison
- **Ridicule:** Deny, diminish
- **Support:** Kickstarter, Peoplefundit



*“Think it's safe to say that dentist Walter Palmer of lion killing "fame" is the most hated man in the world right now. Good stuff.” — Pamela Paterson (@Pamelatte14)*

# THE SOCIAL FUTURE OF TECHNOLOGY

Imagine a **physical** shopping mall where staff:

- Jumped out with placards in front of you (**popups**)
- Put placards on your back (**popunders**)
- Put **encrypted cards** in your pocket (**cookies**) for later
- Took photos when you looked at (**clicked**) a product
  - Then sold that data to other shops along with your ID

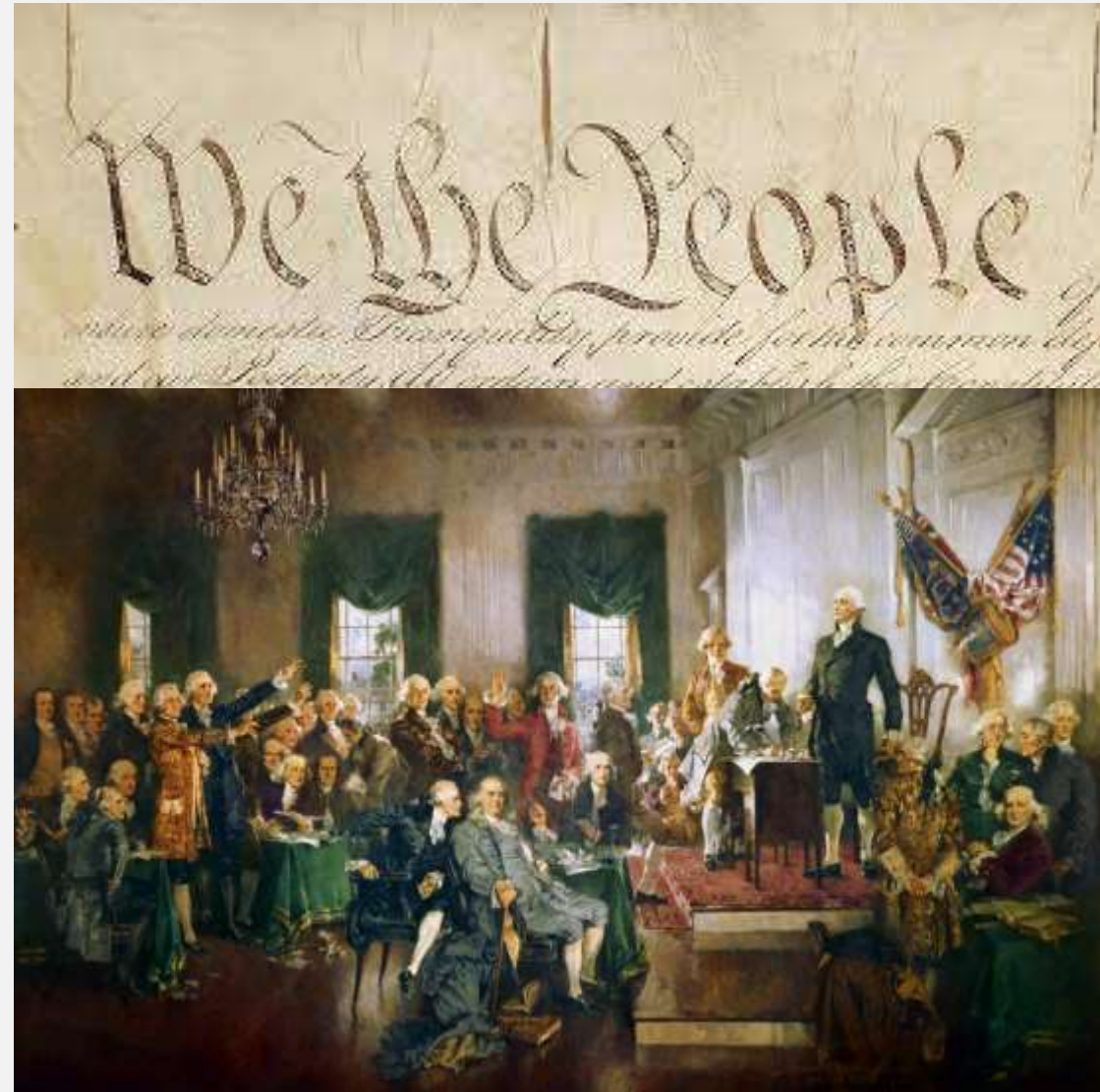
What physical society would tolerate that?

- Why tolerate it online? See “*Can I be your friend?*”

<https://www.youtube.com/watch?v=aDycZH0CA4I>

Let's not throw away centuries of social struggle!

- **Fairness works:** Cheating doesn't.
- **The Golden Rule applies:** Do unto others as you would they do unto you.
- **Human rights** are just **socio-technical standards**.
- **Democracy:** The struggle of “We the people”



Technology reflects the age-old struggles of humanity

# WE THE ONLINE PEOPLE

Imagine a future where:

- *Everything is known*
  - **Businesses** know you are pregnant before you do
- *Everything is recorded*
  - **Every online click** is on your record forever
- *Everything is secure and under control*
  - The government controls the present information that defines our story of the past.”

Now imagine a future where:

- *Everything is known*
  - **Wikipedia** records all that humanity knows
- *Everything is recorded*
  - **No need for receipts:** Shops know what you bought
- *Everything is secure and under control*
  - **Blockchains** prevent information theft.

The difference is **who is in charge!**

- The technology doesn't care – but we do!
- Who controls the information revolution, the 1% who in 2016 own over half the wealth or **we the people?**

A world in which every single  
**human** being can freely  
share in the sum of **all**  
**knowledge.**





# IMAGINE

- **Online constituencies:** Find a group to represent **you**.
- **Everything is locatable:** Keys, remote, phone, dog, kid ...
- **No wallets:** Mobile device does it all; coupons are automatic.
- **Personal filters:** Train your browser to avoid offensive sites.
- **Anonymous accountability:** Sites can banish anonymous participants.
- **Universal health record:** Under my control based on dog tags or card
- **A citizen account:** Displays your yearly paid (tax...) & received (benefits...) money to the state *privately* to you each year, so you know the balance, e.g. the real cost of healthcare.
- *Public spending* that is visible to the public.
  - Politician's pay, health, benefits, disability
  - If you don't like your pension being public, don't take it.



**Dogs are now chipped. Kids, husbands?**

# IMAGINE ALSO

As the profit motive diminishes:

- **Rich list will become a list of shame:** List the 1% of people *who can't give back* by name
- The Internet will become **pull not push**, as people struggle to join private groups
- People give to the public domain (creative commons)

**Global services** increase:

- **Buy anyone** a local coffee – thanks for your advice!
- **People donate** their excess solar electricity to others.
- **Someone is always watching** (body cameras).
- [Internet passport](#) linked to existing passports (Kaspersky CEO)
- **Personal speed limits**, based on **my** accident history

**Technology mediates communities**

- **Automatic Voting Machines** installed next to ATMs?
- **Group browsers** allow family Internet tours.
- **Group Skype** based on voice tagging

