



1912 – 1954

# Alan Turing and the Programmable Universe

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# Piero Scaruffi

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- Cognitive Scientist
- Poet
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*Demystifying Machine Intelligence (2013)*  
*A History of Silicon Valley (2011)*  
*Synthesis: Poems and Meditations (2010)*  
*A History of Rock and Dance Music (2009)*  
*A History of Jazz Music (2007)*  
*The Nature of Consciousness (2006)*

Arun Rao and Piero Scaruffi

## A History of Silicon Valley

The Greatest Creation of Wealth  
in the History of the World

## A History of Rock and Dance Music

From the Guitar to the Laptop  
From Chicago to Shanghai

Volume 2 (1990-2008)



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## The Nature of Consciousness

The Structure of Life and the Meaning of Matter



Towards a Unified Understanding  
of Mind, Life and Matter

PIERO SCARUFFI

## A History of Jazz Music

1900-2000



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## Synthesis

Essays, Photographs, Poems



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# The Context

- 1910-1950 Everything changed:
  - Everyday life
  - The foundations of science
  - The concept of art
  - The geopolitical order

# The 1910s

- Electricity
- Refrigerator
- Automobile
- Airplane
- Telegraph
- Telephone
- Phonograph
- Camera
- Cinema
- Radio
- Typewriter
- Calculator
- Skyscraper
- Plastic



# Cultural Context

- 1910s
  - Futurism (1909): machines and noise
  - Carl Jung (1912): the collective subconscious
  - Alfred North Whitehead's and Bertrand Russell's "Principia Mathematica" (1913): math logic
  - Suprematism and Constructivism in Russia (1915)
  - Franz Kafka's "The Trial" (1915)
  - Albert Einstein's General Theory of Relativity (1915)
  - Dadaism (1916): chance, irrationality
  - Jazz (1917): improvisation
  - World War I (1914-18)

# Cultural Context

- The 1910s set the stage for a confrontation between the extremely rational and the extremely irrational



EINSTEIN  
RUSSELL

DADA  
JAZZ  
KAFKA

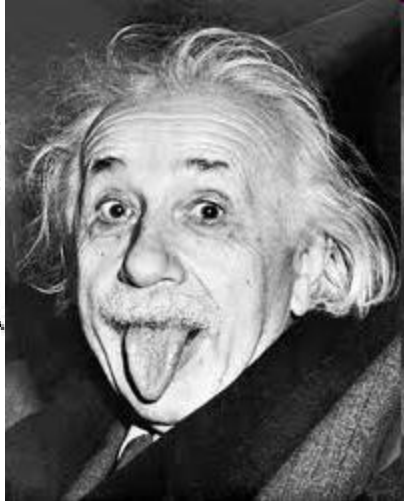


# Cultural Context/ Sciences

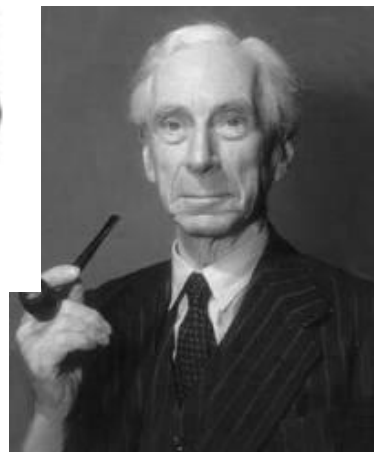
- 1920s
  - Louis De Broglie's particle-wave equivalence (1923)
  - Ivan Pavlov's conditioned reflexes (1926)
  - Erwin Schrödinger's wave equation (1926)
  - Werner Heisenberg's uncertainty principle (1927)
  - Hilbert's challenge: an algorithm capable of solving all the mathematical problems (1928)
  - Edwin Hubble discovers that the universe is expanding (1929)



Everything is relative



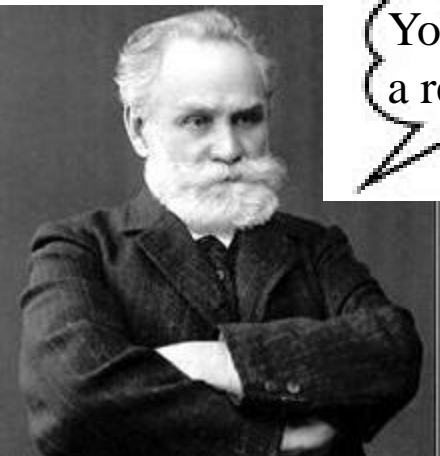
You are a formula



You are and you are not



You are just a reflex

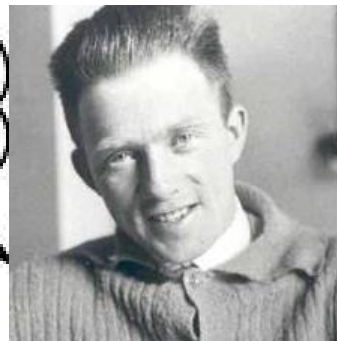


You are a probability



Everything is moving away from you

Everything is uncertain

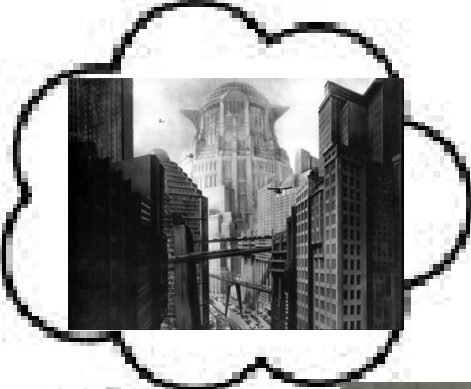


# Cultural Context/ Arts

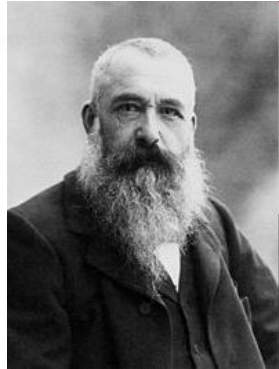
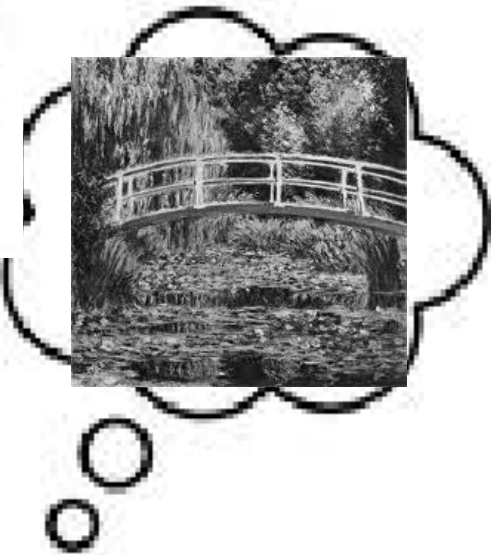
- 1920s
  - Le Corbusier's "Contemporary City" (1922)
  - James Joyce's "Ulysses" (1922)
  - Arnold Schoenberg's "dodekaphonie" (1923)
  - Surrealism (1924)
  - Claude Monet's "Nymphs" (1926)
  - Fritz Lang's "Metropolis" (1926)
  - Antoni Gaudí's "Sagrada Família" (1920s)
  - Martin Heidegger's "Being and Time" (1926)
  - Talking movies (1927)
  - Bertold Brecht's "The Threepenny Opera" (1928)



*The emancipation of the dissonance*



*History is a nightmare from which I am trying to awake.*



# Cultural Context/Sciences

- 1931: Kurt Goedel's theorem of incompleteness
- 1932: John Von Neumann: the observer collapses the quantum wave
- 1934: Karl Popper: Truth is relative to a theory
- 1935: Alfred Tarski: Truth can only be defined in a meta-language
- 1938: Pierre Teilhard de Chardin: Evolution is a general law of nature
- 1938: Charles Morris' Theory of Signs
- 1938: Burrhus Skinner's Behaviorism

# Cultural Context/Sciences

- 1942: Enrico Fermi's nuclear reactor
- 1943: Kenneth Craik: Mind is a machine capable of building internal representations of the world
- 1943: The first computer (Colossus)
- 1944: Erwin Schroedinger: life and (neg)entropy
- 1947: The transistor
- 1947: Norman Wiener's Cybernetics
- 1948: Claude Shannon's Theory of Information
- 1948: George Gamow's Theory of the Big Bang
- 1949: Donald Hebb's model of how the brain works

There will always be something you cannot prove

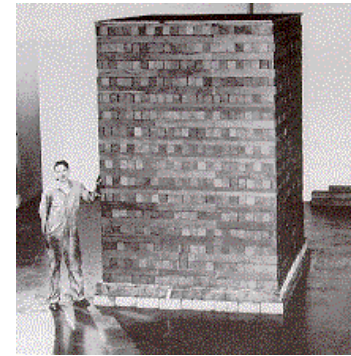
Your mind creates reality

Truth is an opinion



Life and machines obey the same laws of nature

Mind is a symbol processor



Everything comes from just one point

Everything is information



# Cultural Context/Sciences

- Bottom line:
  - The mind is a symbol processor
  - Living beings are machines
  - The universe is evolving
  - New frontiers in the conquest of nature (electronics, nuclear energy, cosmology)
  - There is a limit to scientific knowledge

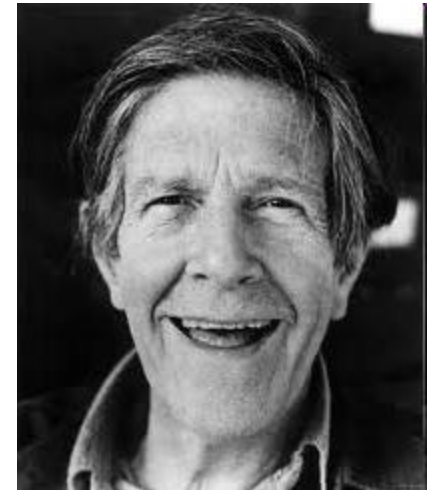
# Cultural Context/Arts

- 1930s
  - Superheroes in comics (Flash Gordon, Superman...)
  - Swing
  - Spanish poetry (Jimenez, Garcia Lorca, ...)
  - Surrealism (Dali, Ernst, Tanguy...)
  - 1936: Charles Chaplin's "Modern Times"
- 1940s
  - Existentialism (Sartre, Camus, ...)
  - Abstract painting (Pollock, Kooning, ...)
  - Electronic music (Cage, Darmstadt school, Schaeffer)
  - Bebop
  - 1949: George Orwell's "1984"



# Cultural Context/Arts

- Bottom line:
  - Nonconformism
  - Anxiety
  - Noise
  - Freedom



# Cultural Context/Politics

- World War II (1939-45)
- The Holocaust
- Hiroshima
- Disintegration of the British Empire
- Rise of the USA and Soviet Union



# Alan Turing

- Hilbert's challenge (1928): an algorithm capable of solving all the mathematical problems
- Turing Machine (1936): a machine whose behavior is determined by a sequence of symbols and whose behavior determines the sequence of symbols
- A universal Turing machine (UTM) is a Turing machine that can simulate an arbitrary Turing machine



$$\forall M[M \in \mathcal{M}] \Leftrightarrow$$

$M: (S_M, I_M, O_M: S_M \times I_M \rightarrow I_M, N_M: S_M \times I_M \rightarrow S_M, D_M: S_M \times I_M \rightarrow d)$	
$\mathcal{N} = \{0, \dots, \infty\}$	(the "natural" numbers)
$\mathcal{J} = \{1, \dots, \infty\}$	(the positive "integers")
$S_M = \{s_0, \dots, s_n\}, n \in \mathcal{J}$	( $\mathcal{M}$ states)
$I_M = \{i_0, \dots, i_j\}, j \in \mathcal{J}$	( $\mathcal{M}$ tape symbols)
where	
$d = \{-1, 0, +1\}$	$\mathcal{M}$ head motions)
$\delta: \mathcal{N} \rightarrow S_M$	( $\mathcal{M}$ state over time)
$\square_M: \mathcal{N} \times \mathcal{N} \rightarrow I_M$	( $\mathcal{M}$ tape contents over time)
$P_M: \mathcal{N} \rightarrow \mathcal{N}$	(current $\mathcal{M}$ cell at each time)

Box 1

$$\forall M \forall V(M, V) \in \mathcal{V} \Leftrightarrow$$

$[V \subset I^*] \text{ and } [M \in \mathcal{M}] \text{ and } \forall v \in V \forall H \forall t, j \in \mathcal{N}$	
$[P_t = j] \text{ and } [S_t = S_0] \text{ and } [\square_{t,j}, \dots, \square_{t,j+ v -1}] = v \Rightarrow$	
$\exists v' \in V, \exists t', t'' \in \mathcal{N} \text{ and } t' > t$	
(1) $[(j' +  v  \leq j) \text{ or } [(j +  v ) \leq j']] \text{ and}$	
(2) $[\square_{t',j}, \dots, \square_{t',j'+ v -1}] = v' \text{ and}$	
(3) $[\exists t'' [t < t'' < t'] \text{ and } [P_{t''} \in j', \dots, j' +  v  - 1]]$	

Box 2

# Alan Turing

“It is of fundamental importance for the character of this problem that only mechanical calculations according to given instructions [...] are admitted as tools for the proof.”

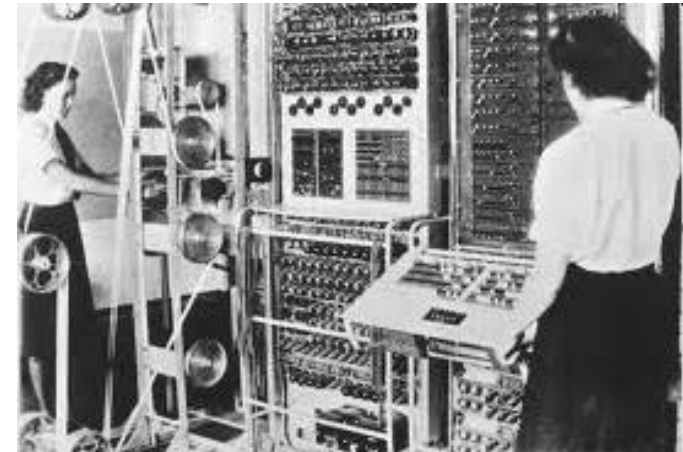
(BTW, the halting problem is undecidable, i.e. Hilbert's Entscheidungsproblem is impossible)

# Alan Turing

- World War II:
  - Breaking the Enigma code (Bombe)
  - Turing worked at Bletchley Park where the Colossus was built but it was not a universal Turing machine (not general purpose)



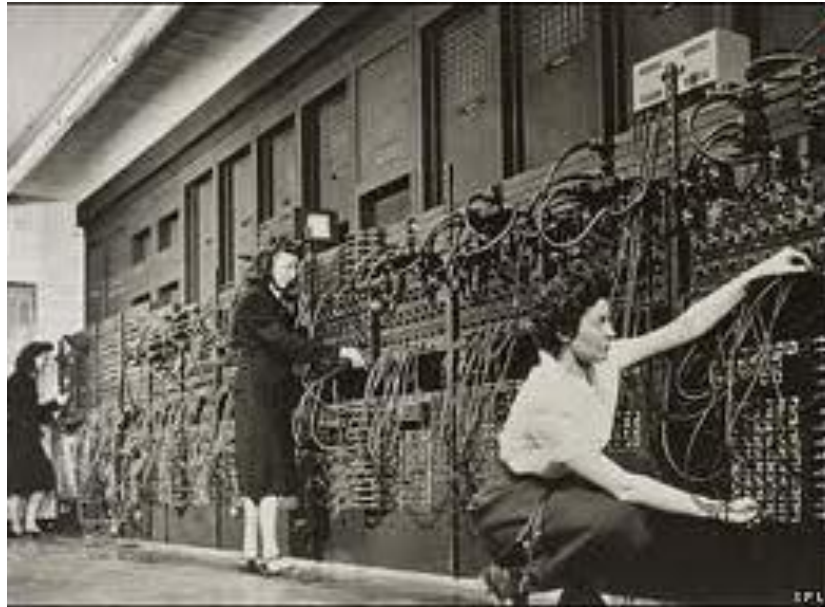
Replica of the Bombe





# Alan Turing

- World War II:
  - First Turing-complete computer: ENIAC (1946)



# Alan Turing

- Post-War:
  - February 1946: Automatic Computing Engine (ACE), the design for a stored-program computer
  - Unfinished: Morphogenesis (eg Mathematical Biology)
  - Nonlinear equations, eg Chaos Theory
  - The first geek!

# Alan Turing

- Homosexuality (convicted of the crime of homosexuality: chooses chemical castration over prison)
- Commits suicide in 1954

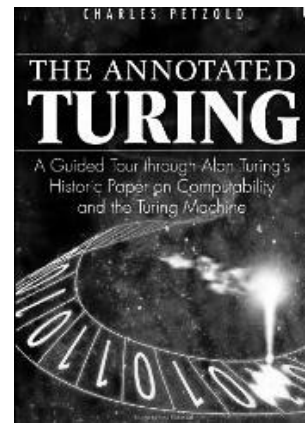
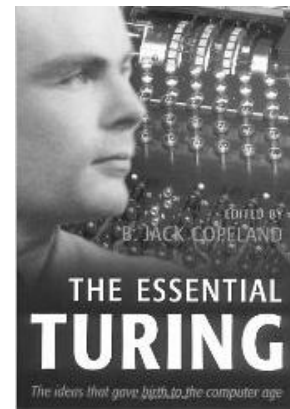
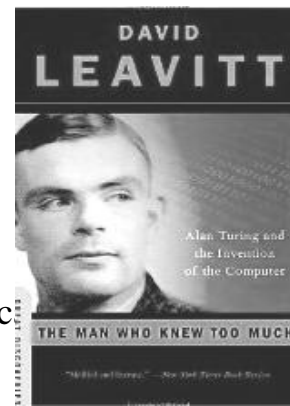
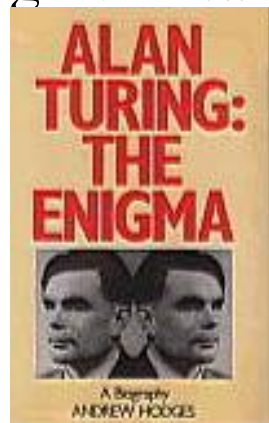
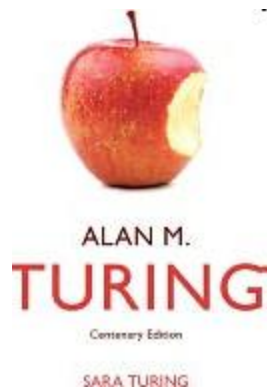
Alan Turing  
and his mother





# To learn more...

- David Leavitt's biography "*The Man Who Knew Too Much*" (2006)
- "*The Essential Turing: Seminal Writings in Computing, Logic, Philosophy, Artificial Intelligence, and Artificial Life plus The Secrets of Enigma*" (2004)
- Charles Petzold: "*The Annotated Turing: A Guided Tour Through Alan Turing's Historic Paper on Computability and the Turing Machine*" (2008)
- Sara Turing: "*Alan Turing*" (1959)
- Andrew Hodges: "*Alan Turing: the Enigma*"



# The Turing Century

- Can you name any achievement of the last 50 years (from the Moon landing to animal cloning) that would have happened even without programmable computers?

# The Turing Test (1947-50)

- A machine can be said to be “intelligent” if it behaves exactly like a human being
- Hide a human in a room and a machine in another room and type them questions: if you cannot find out which one is which based on their answers, then the machine is intelligent

VOL. LIX. No. 236.]

[October, 1950

MIND  
A QUARTERLY REVIEW  
OF  
PSYCHOLOGY AND PHILOSOPHY  
—  
I.—COMPUTING MACHINERY AND  
INTELLIGENCE  
By A. M. TURING

[www.scaruffi.com](http://www.scaruffi.com)



# The Turing Test

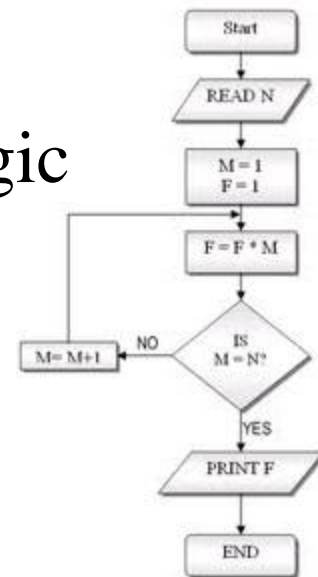
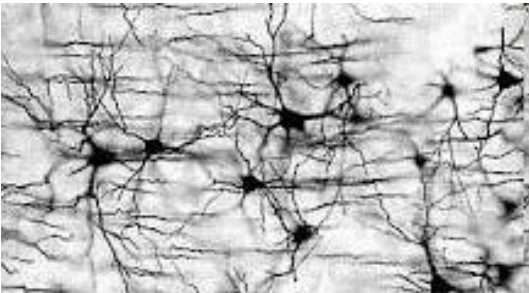
- The birth of Artificial Intelligence
- Artificial Intelligence (1956): the discipline of building machines that are as intelligent as humans



*John McCarthy (1927 –2011)*

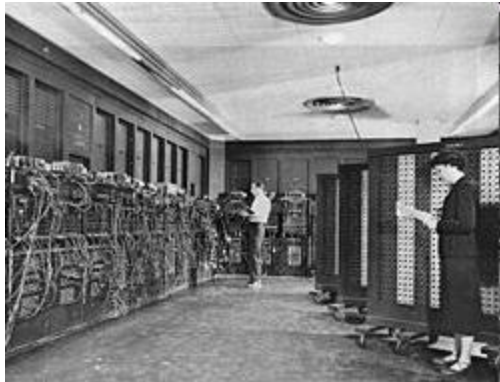
# The fundamental critique

- The computer cannot (qualitatively) do what the human brain does because the brain
  - does parallel processing rather than sequential processing
  - uses pattern matching rather than binary logic
  - is a connectionist network rather than a Turing machine



# What would Turing say today?

- The ENIAC (first Turing machine) vs the iPad



**NOT IN SCALE!**

	<b>ENIAC</b>	<b>A4</b>
<b>Components</b>	18,000 tubes	177.6 million transistors *
<b>Footprint</b>	240 square feet	53 square millimeters
<b>Clock speed</b>	100 KHz	1 GHz
<b>Power Consumption</b>	174 Kilowatts*	500-800 milliwatts *
<b>Cost</b>	\$500,000 (1946)	\$500 (for a complete iPad)

# What would Turing say today?



What took you  
guys so long???

# What would Turing say today?

- Why did it take you so long?
  - The Hubble telescope transmits 0.1 terabytes of data a week, about **one million times** more data than the Palomar telescope of 1936
  - In 1940 the highest point ever reached by an aviator was 10 kms. In 1969 Neil Armstrong traveled 380 million kms up in the sky, i.e. **38 million times** higher.
  - In 60 years the speed of computers has increased “only” **ten thousand times**



# What would Turing say today?

- Hardware: other than miniaturization, what has really changed?
  - It still runs on electricity
  - It still uses binary logic
  - It is still a Turing machine (e.g., wildly different in nature and structure from a human brain)

# What would Turing say today?

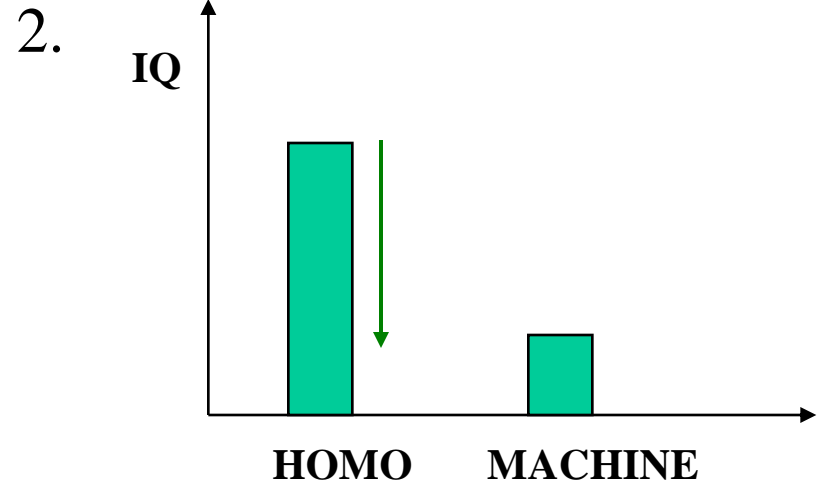
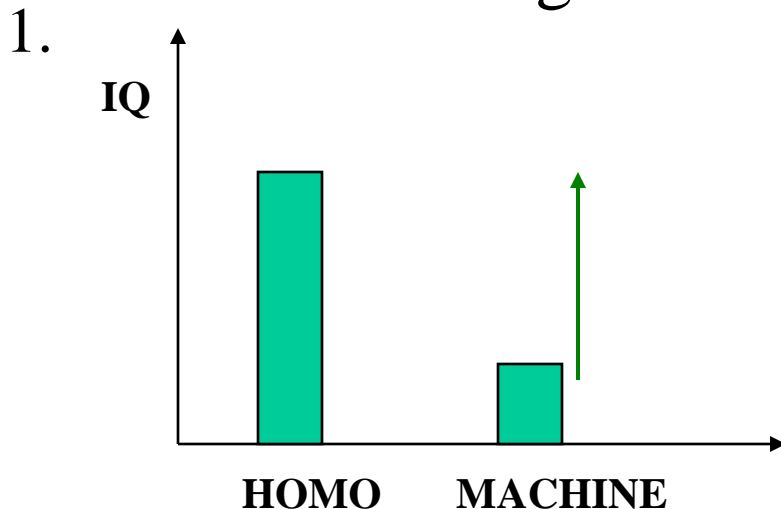
- Software: other than having 12 million programmers work on thousands of programs (instead of the six who programmed the ENIAC), what has really changed?
  - It is still written in an artificial language that is difficult to understand
  - It is still full of bugs
  - It still changes all the time
  - It is still sequential processing (e.g., wildly different in nature and structure from a human brain)

# What would Turing say today?



# The Turing Point

- The Turing Test was asking “when can machines be said to be as intelligent as humans?”
- This “Turing point” can be achieved by
  1. Making machines smarter, or
  2. Making humans dumber



# What can machines do now that they could not do 50 years ago?

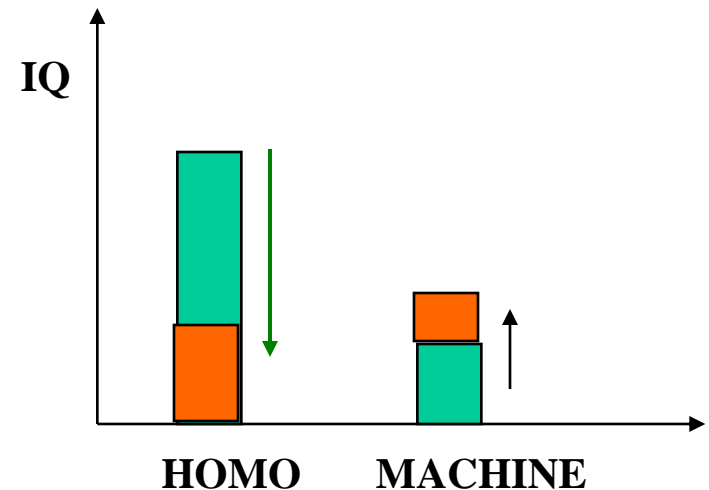
- They are faster, cheaper, can store larger amounts of information and can use telecommunication lines

# What can humans do now that they could not do 50 years ago?

- Use the new machines
- On the other hand, they are not capable of doing a lot of things that they were capable of doing 50 years ago from arithmetic to finding a place not to mention attention span and social skills (and some of these skills may be vital for survival)
- Survival skills are higher in low-tech societies (this has been true for a while)
- General knowledge (history, geography, math) is higher in low-tech societies (coming soon)

# The Post-Turing Thesis

- If machines are not getting much smarter while humans are getting dumber...
- ... then eventually we will have machines that are smarter than humans
- The Turing Point (the Singularity?) is coming



# A Simple Example

- A Facebook app automatically sends "happy birthday" messages to your Facebook friends on their birthday. Both the message and the time of the day are randomly selected, so if three of your friends use this same app you will not be able to tell that the three posts are coming from an app. They look and feel like handmade.
- The reason they look and feel handmade is not that the program has become very sophisticated in crafting the messages but that humans don't craft sophisticated happy-birthday wishes anymore: people used to send long letters or make long phone calls on a birthday but now people send a one-line "Happy birthday" message which can be easily simulated by a very simple program.



# A Simple Example

- (Last but not least, complex important topics are dumbed down to Powerpoint presentations like this one)

# Google it...

- Artificial Intelligence was trying to develop “expert systems” capable of finding a solution to every problem in a given domain, just like a human expert in that domain
- Overt assumption: Domain knowledge is the key to finding solutions
- Hidden assumption: Logical inference is the key to finding the solution

# Google it...

- Artificial Intelligence never delivered on the promises of “expert systems”...
- ...but search engines did: there is at least one webpage somewhere that has the solution to a given problem, and it’s just a matter of finding it

# Google it...

- Logical inference (intelligence) is irrelevant.
- It's the quantity of information (not the quality of inference) that matters
- All we needed is a (digital) library big enough and computers powerful enough to search it
- What those computers don't need is: intelligence

# Google it...

- A person can solve any problem as long as she is capable of searching the Web for the solution
- No other skills required beyond reading skills
- No large, expensive supercomputer required: just a (relatively dumb) smartphone

# Google it...

- The Web plus the search engine does what AI wanted to do: it gives an answer to every possible question that a human can answer (in fact, many more than any one person can answer).
- Soon it will be accessed from a wristwatch-like device that recognizes voice and answers with a regular voice.

# A Tool is not a Skill

- Humans have always become dependent on the tools they invented.
- When they invented writing, they lost memory skills. On the other hand, they gained a way to store a lot more knowledge and to broadcast it a lot faster.
- We assumed that this was for the better.

# A Tool is not a Skill

- In practice, however, we cannot replay history backwards and we will never know what the world would be like if humans had not lost those memory skills (and all the other skills that they lost whenever a new technology was introduced).



# A Tool is not a Skill

- Over the centuries the weaker memory skills have been driving an explosion of tools to deal with our weak memory (the latest being the navigator in your car).
- Each tool, in turn, caused the decline of another skill. For example, the typewriter caused the decline of calligraphy; voice recognition may cause the decline of writing itself.

# A Tool is not a Skill

- In a sense, technology is about giving people the tools to become dumber and still continue to perform
- People make tools that make people obsolete, redundant and dumb

# What would Turing say today?

- The success of many high-tech projects depends not on making smarter technology but on making dumber users
- Users must change behavior in order to make a new device or application appear more useful than it is.

# Turning People into Machines

- “They” increasingly expect us to behave like machines in order to interact efficiently with machines: we have to speak a “machine language” to phone customer support, automatic teller machines, gas pumps, etc.
- In most phone and web transactions the first question you are asked is a number (account #, frequent flyer#...) and you are talking to a machine
- Rules and regulations (driving a car, eating at restaurants, crossing a street) increasingly turn us into machines that must follow simple sequential steps in order to get what we need

# Turning People into Machines

- A conversation with customer support...



# Turning People into Machines

- Customer support...



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**From:** scaruffi  
**Subject:** URGENT  
**Date:** November 17, 2011 7:08 EST

---

You closed my account. Are you OUT OF YOUR MIND. All i did was to buy bus tickets. I am in Brazil and i have no clue how to call the 800 number from Brazil which is probably impossible anyway. I check email every other day. I INFORMED YOU BEFORE LEAVING THAT I WOULD BE USING THIS CARD IN BRAZIL!!!

---

**From:** message.center@citicorp.com  
**Subject:** Re: URGENT  
**Date:** November 17, 2011 8:35 EST

---

We regret your decision to cancel your account. However, we do understand that certain choices have to be made in order to maintain a positive financial portfolio.

Thank you for using our website.

# Turning People into Machines

- Rules to hike in the \*wilderness\* (there is even a rule for peeing)

## Inyo National Forest Wilderness Regulations

### The following acts are prohibited in wilderness:

- Camping within 100 feet of lakes, streams or trails (terrain permitting) & never within 50 feet of lakes, streams or trails.
- Possessing or storing food, toiletries or refuse in a manner that allows bears or animals access to it.
- Washing and/or discharging soap waste within 100 feet of lakes or streams.
- Depositing bodily waste within 100 feet of lakes, streams, campsites or trails.
- Leaving any debris, garbage or refuse within the wilderness.
- Entering or using the wilderness in a group larger than 15 persons or with more than 25 head of pack or saddlestock.
- Storing or leaving unattended equipment, personal property or supplies for more than 24 hours.
- Hitching, tethering or tying pack or saddle stock within 100 feet of lakes, streams, trails or campsites except while loading or unloading.
- Camping overnight in the wilderness without a valid wilderness permit.
- Discharging a firearm, except for emergencies and the taking of game as permitted by California State law.
- Possessing or using any wheeled or mechanical device, except for persons requiring wheelchairs.
- Shortcutting a switchback on any forest trail.

Revised 08-2010

### Refer to Site Specific Area Maps for Specific Regulations

<p><b>Bear Canister Use:</b> specific required areas Bishop Pass area includes Treasure Lakes, Cottonwood Lakes &amp; Cottonwood Pass area, Kearsarge Pass area, Little Lakes Valley area includes to crest of Mono Pass, Mammoth Lakes area includes Rush Creek &amp; John Muir Trail corridor from Yosemite to south of Lake Virginia, trails affected include Beck, Coldwater/Duck, Fern, Fish, High (PCT), JMT, North &amp; South, Kings Creek, Minaret, Red Cones, River, Rush Creek, and Shadow. Canisters required for Mt. Whitney Trail overnight use.</p>	<p><b>Campfire and Camping regulations:</b> <b>Hoxo Wilderness</b> <b>Campfires prohibited:</b> 20 Lakes Basin northwest of Saddlebag Lake. <b>Ansel Adams Wilderness</b> <b>Campfires prohibited:</b> for all areas above 10,000 ft. in elevation. Additional areas are closed to campfires below 10,000 ft. near: Badger Lakes, Clark Lakes, Lower Davis Lake, Ediza Lake, Emerald Lake, Garnet Lake, Gem Lake (north side), Iceberg Lake, King Creek (includes Ashley, Anona, Beck, Fern, Holcomb and Noname Lakes), Minaret Lakes, Parker Lake, Ruby Lake, Rush Forks, Lower Sardinia Lake, Shadow Lake &amp; Creek, Sullivan Lake, Thousand Island Lake, Waugh Lake, Weber Lake.</p>
<p><b>Big Horn Sheep Protective Areas:</b> <b>Mt. Williamson access:</b> Mt. Williamson vicinity is open to wilderness travel December 15 to July 15 via Shepherd Pass; and is open April 15 to May 15, and December 15 to January 1 via George Creek.</p>	<p><b>Camping prohibited:</b> At site specific areas near Shadow Lake/Ediza, within 1/4 mile of the outlet of Garnet Lake; within 1/4 mile of the outlet of Thousand Island Lake.</p>
<p><b>Sierra Nevada Bighorn Sheep Habitat:</b> Travel with goats is prohibited; dogs must be under control at all times. <b>California Bighorn Sheep Zoological Areas:</b> Travel with goats or dogs prohibited.</p>	<p><b>John Muir Wilderness</b> <b>Campfires prohibited:</b> for all areas above 10,000 ft. north of Mt. Emerson/ Glacier Divide; and above 10,400 ft. south of the divide. Additional areas in lower elevations are closed to campfires near: Big Pine Creek (North and South forks), Coldwater Canyon, Duck Creek, Hilton Lakes &amp; Creek, Lower Horton Lake, Kearsarge Pass/ Onion Valley (includes GoldenTrout Lakes and Robinson Lake), McGee Canyon, Meysan Canyon, Midred Lake, Mt Whitney Zone, Pine Creek, Purple Creek, Sabrina, Shepherd Pass (within 1,000 ft. of Anvil Camp), Taboose Creek, and Tye Lakes.</p>
<p><b>Pack and Saddle Stock:</b> <b>Stock prohibited:</b> Whitney Portal to Trail Crest. <b>Grazing prohibited:</b> Cascade Valley meadows, Pioneer Basin, Hilgard Meadow, east of Shepherd Pass. <b>Camping prohibited:</b> with pack or saddle stock east of Shepherd Pass.</p>	<p><b>Camping prohibited:</b> Within 300 ft. of the outlet of Duck Lake and Purple Lake, at Mirror Lake and Trailside Meadow on the Mt. Whitney Trail; within 500 feet of Lower Golden Trout Lake (Plute Pass area).</p>
<p><b>National Park Regulations:</b> When you enter park boundaries National Park regulations apply. Pets are not allowed. Group size is limited for cross country travel. Please refer to the National Park's minimum impact handout for specific information on fires, food storage and other regulations.</p>	<p><b>Golden Trout Wilderness</b> <b>Campfires prohibited:</b> Chicken Spring Lake and Rocky Basin Lakes.</p>

Please return with actual itinerary completed

USDA Forest Service  
Inyo National Forest  
Attn: Wilderness Permit Office  
351 Pacu Lane, Suite 200  
Bishop, CA 93514

# Turning People into Machines

- “Technological progress is like an axe in the hands of a pathological criminal” (Albert Einstein)



# What would Turing say today?

- Humans have moved a lot closer towards machines than machines have moved towards humans

# The Silicon Valley Paradigm

- “They” increasingly expect us to study lengthy manuals and to guess how a machine works rather than design machines that do what we want the way we like it
- A study by the Technical University of Eindhoven found that half of the returned electronic devices are not malfunctioning: the consumer just couldn't figure out how to use them

# Who Needs to be Intelligent?

- Machines are becoming ubiquitous because of lower prices and greater usefulness
- It is not only that this enables humans (many more humans) to use them; but also that this enables humans (many more humans) to digitize huge amounts of their knowledge.

# Who Needs to be Intelligent?

- That knowledge originally came from someone who was "intelligent" in whichever field.
- Now it can be used by just about anybody who is not "intelligent" in that field.
- This "user" has no motivation to actually "learn": it can just "use" somebody else's intelligence.
- The "intelligence" of the user (and of the human race in general) decreases, not increases.

# Who Needs to be Intelligent?

- Worse: humans become ever more dependent on the machines that become the only way to access that knowledge.
- What is intelligent is not the machine, but the combination of the machine and the user.

# The Singularity

- The Turing Test is a self-fulfilling prophecy: as we (claim to) build “smarter” machines, we make dumber people.
- Eventually there will be an army of greater-than-human intelligence

# The Future is not You

- The combination of smartphones and websites offers a glimpse of a day when one will not need to know anything because it will be possible to find everything in a second anywhere at any time by using just one omnipowerful tool.
- An individual will only need to be good at operating that one tool. That tool will be able to access an almost infinite library of knowledge and... intelligence.

# The Future is not You

- The tool per se will not be particularly intelligent.
- The user of the tool will be even less intelligent.



# The Difference: You vs It

- The human mind is not particularly good at
  - Reason
  - Memory
  - Computation
  - Communication
- Machines are better at these

# The Difference: You vs It

- Human minds are better at
  - Improvisation
  - Imagination
  - (in a word: "creative improvisation")
- Human minds can manage dangerous and unpredictable situations
- Human minds can be “irrational”

# The Difference: You vs It

- Modern society organizes our lives to remove danger and unpredictability.
- Modern society empowers us with tools that eliminate the need for improvisation and imagination
- Modern society dislikes (and sometimes outlaws) irrationality

# The Difference: You vs It

- We build
  - Redundancy
  - Backups
  - Distributed systems
- to make sure that machines can do their job 24/7 in any conditions.
- We do not build anything to make sure that minds can still do their job of creative improvisation

# The Difference: You vs It

- Humans are becoming not only useless (for the survival of their world) but even meaningless

# Historical Perspective: From A.I. to your Smartphone

- A.I. made computers famous in the 1950s and fueled progress in the field and encouraged thousands of young scientists to study Computer Science; the idea of a thinking computer, not their usefulness, drove initial development;
- but progress since then has been scant: computers still can't understand the simplest conversation, they cannot see, hear, touch.
- Your tablet and your smartphone are accidental byproducts of a failed scientific experiment.

# Hope from the Slums

- The top of creativity is encountered in the slums and villages of the world.
- The slums and the poor rural villages are veritable laboratories where almost every single individual (of a population of millions) is a living experiment (in finding new ways of surviving and prospering).

# Demystifying A.I.

- The reality is that most machine intelligence is being employed to couple real-time customization and machine learning in order to understand who you are and tailor situations in real time that will prompt you to buy some products (custom advertising)
- A.I. has not created better doctors or engineers, but better traveling salesmen
- (P.S.: we are not only trying to turn you into a machine, but into a little more than a slot machine)



# Demystifying Computers

- The premise: computers are fast and have huge memory.
- But do they?
  - The computer remembers what I want to remember. I remember what I was doing five months ago, but the computer has no “memory” of what it was doing five seconds ago.
  - What we call “memory” in the case of a computer is something completely different from what we call “memory” in the case of animals.

# Demystifying Computers

- The premise: computers are fast and have huge memory.
- But do they?
  - Someone is “fast” at crossing the street, at cooking a meal, at planting tomatoes, at dusting shelves, at walking up and down the stairs.
  - The computer is actually extremely slow at any of these. It is in fact slower than any animal that ever existed.
- It is just syntax: we called them “speed” and “memory” to reuse existing words but they are neither speed nor memory.

# And anyway...

- We think of the singularity as inevitable and imminent because progress in making “smarter” machines has been so dramatic
- After the Moon landing of 1969 we thought that colonizing the entire Solar System was inevitable and imminent because progress in space exploration had been so dramatic

# The Art of Machine Intelligence

- Artists imagine how to coexist with machines that are getting smarter than us (or we are getting dumber than them)
- Artists imagine multiple futures for intelligence
- Usually a strong component of social commentary
- Not science-fiction about hypothetical technologies in hypothetical worlds but science-art about today's technologies in today's world

# The Art of Machine Intelligence

- 1957: A computer composes the Illiac Suite (Illinois)
- 1963: **The first public showing of computer art** (San Jose)
- 1968: "Cybernetic Serendipity" (London)
- 1971: **"Art and Technology"** (Los Angeles)

# The Art of Machine Intelligence

- Digital technology neither as a tool nor as a medium
  - Joseph Nechvatal (NY, computer viruses)
  - Ken Feingold (NY, artificial intelligence)
  - **Ken Goldberg** (telerobotics)
  - **Lynn Hershman Leeson** (virtual reality, telerobotics)
  - Eduardo Kac (Chicago, telerobotics, cyborg)
  - Stelarc (Australia, cyborgs)
  - **Victoria Vesna** (cyborgs)
  - **George Legrady** (dataverse)
  - **Warren Sack** (dataverse)
  - **Camille Utterback**
  - **Natalie Bookchin** (gaming)

# Sociopolitical Corollary

- Rules help make society stable and predictable. Each rule makes it easy for people to do what they do with their lives.
- But it also restricts what they can think of doing.
- There are now so many rules about driving a car (and about building a car) that accidents have been greatly reduced. At the same time, people have become much less skilled at driving: they don't need to be skilled drivers.

# Sociopolitical Corollary

- What is the relationship between machines and rules? They are both designed to make you think less.
- High-tech builds rules “inside” everyday's life so they don't have to be enforced from the outside



# Sociopolitical Corollary

- Why do we have computers that play chess (and beat the world champion) but not computers that (who) are philosophers, art critics, politicians, historians?

# PART 2

## Let's get serious: A Critique of the Turing Test

(while we're still intelligent)

# The Turing Test

- Someone has hidden a person in a room and a computer in the other room.
- We are allowed to ask any questions.
- The person and the computer reply in their own way.
- If we cannot tell which one is the person and which one is the computer, then the computer has become intelligent.

# Who is Testing

- Someone has to determine whether the answers to her questions come from a human or a machine
- Who is the judge who decides if the Turing Test succeeds? What instrument does this test use?
- A human? A machine?
- How “intelligent” is the judge?

# Who is Testing

- Can a mentally retarded person judge the test?
- Can somebody under the influence of drugs perform it?
- ...a priest, an attorney, an Australian aborigine, a farmer, a librarian, a physician, an economist...?
- ...the most intelligent human?
- The result of the test can vary wildly depending on who is the judge

# Who are we Testing?

- If a machine fails the test (i.e. the judge thinks the machine is a machine), then Turing concludes that the machine is not intelligent
- What does Turing conclude if a human fails the test (if the judge thinks that the human is a machine)? That humans are not intelligent?

# What are we Testing?

- The Turing Test is about behavior
- The Turing test measures how good a machine is at answering questions, nothing more.
- “Can a machine be built that will fool a human being into believing it is another human being?” is not identical to “Can a machine think?”
- If we answer “yes” to the first question, we don’t necessarily answer “yes” to the second.

# What are we Testing?

- The real test is consciousness, not intelligence
- An “intelligent” machine is not necessarily conscious
- Conversely: a machine does not need to be too intelligent in order to be conscious (many people are not intelligent)



# Who Are You?

- Can one be conscious without being alive? Before we ask whether machines can think, we should ask whether they can be alive
- In biological systems the "mind" grows (and decays) with the rest of the body. A mind is just an organ to operate a body. The body came first. A mind without a body is not a mind.

# What Can be Conscious

- If we make a machine conscious, can we also make a chimp conscious? An ant? A plant? A stone?

# Nature's Opinion

- Computers don't grow up, from childhood to adulthood. They are expected to be adults right away.
- Nature does it differently.
- The Turing Test for the age of Facebook: When can a social network be said to have become a society?

# The Turing Test for the age of Social Networking

- When can a social network be said to have become a society?

# Technicalities

- Turing does not claim that passing the Turing test is a necessary condition for machine intelligence. Turing conceives the imitation game not as a criterion for machine intelligence, but to discuss a technological prediction.

# Turing Test Trivia

- The Turing Test was modeled after a popular parlor game of the time in which a man and a woman would hide and answer questions in writing (each trying to impersonate the other in order to confuse the audience that had to guess which was which)

# The Turing Machine

- Turing's most lasting legacy might actually be the Turing Machine
- Turing discovered the “universality” of the human mind: because the human mind can process symbols, the human mind can solve any problem
- The way to universality is digital: there can exist no universal analog machine (because of measurement errors that would pile up and that instead don't matter in digital machines)

# The End (for now)

*“A man provided with paper, pencil, and rubber  
(and subject to strict discipline) is in effect a  
universal machine” (Alan Turing, 1948)*