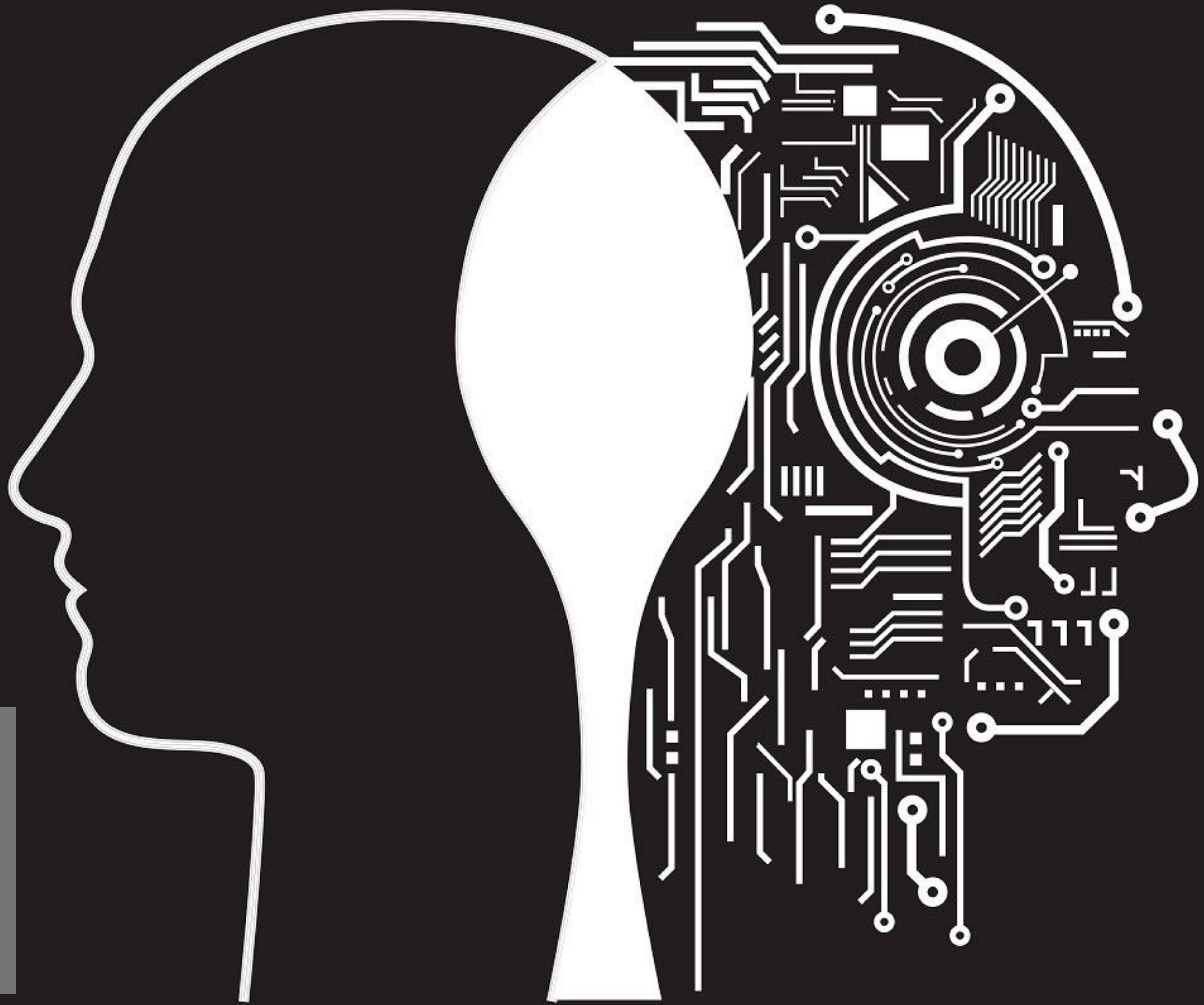
Zur Künstlichkeit von Intelligenz & Realität

Prof. Dr. Frank Steinicke
Human-computer Interaction, Universität Hamburg

Natural vs. Artificial



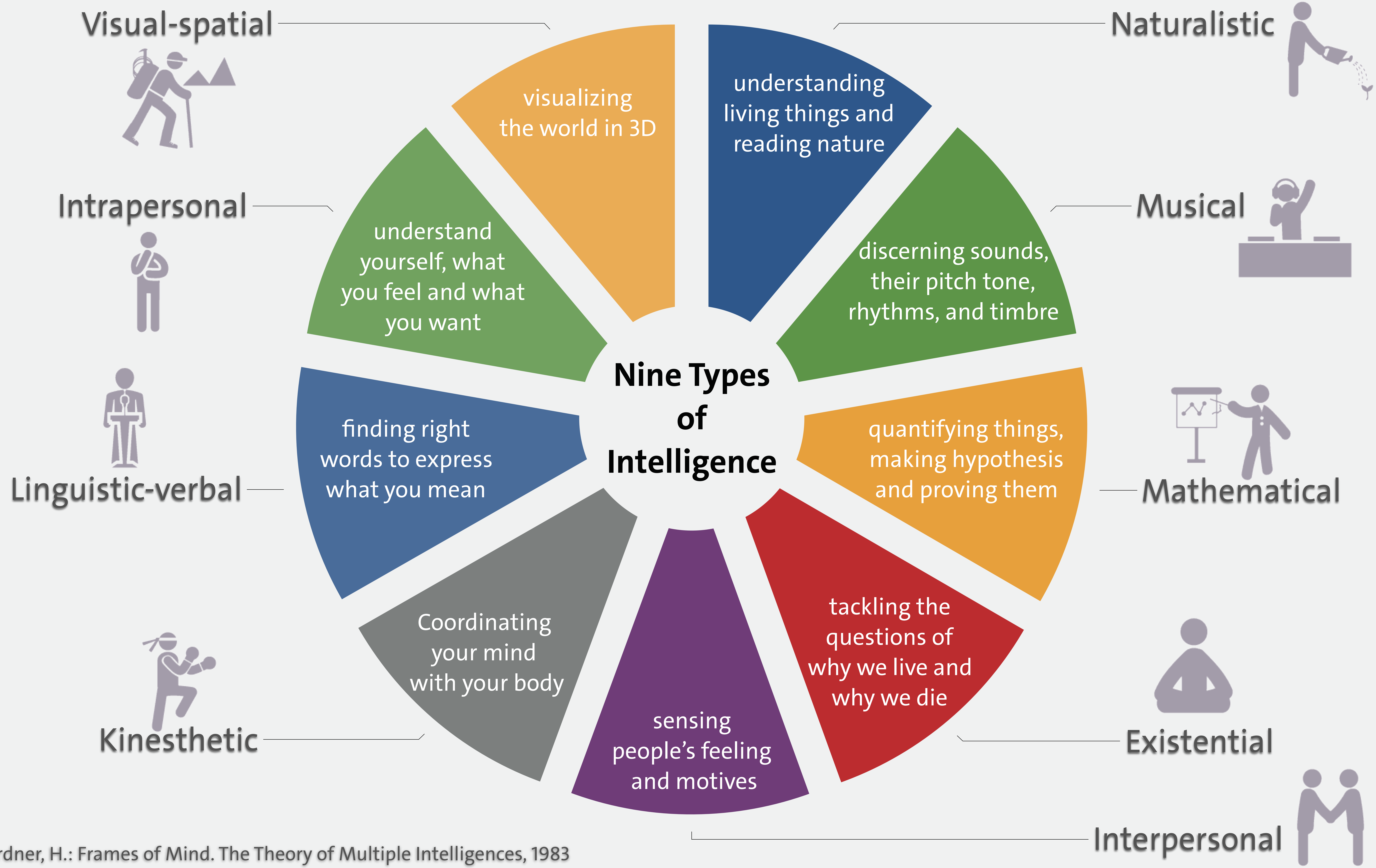
Natural *became* without a human being

Artificial was *made* by human impact

D. Birnbacher: Natürlichkeit, 2006


Natural
Artificial
Natural Reality
Artificial Reality


Human
Artifical
Intelligence
Reality
REACTOR CORE



Gardner, H.: Frames of Mind. The Theory of Multiple Intelligences, 1983

Faces from Dartmouth Summer Research Project on Artificial Intelligence, 1956

John Mccarthy

Marvin Minsky

Alan Turing

Artificial Intelligence

„Human intelligence simulated by machines.“

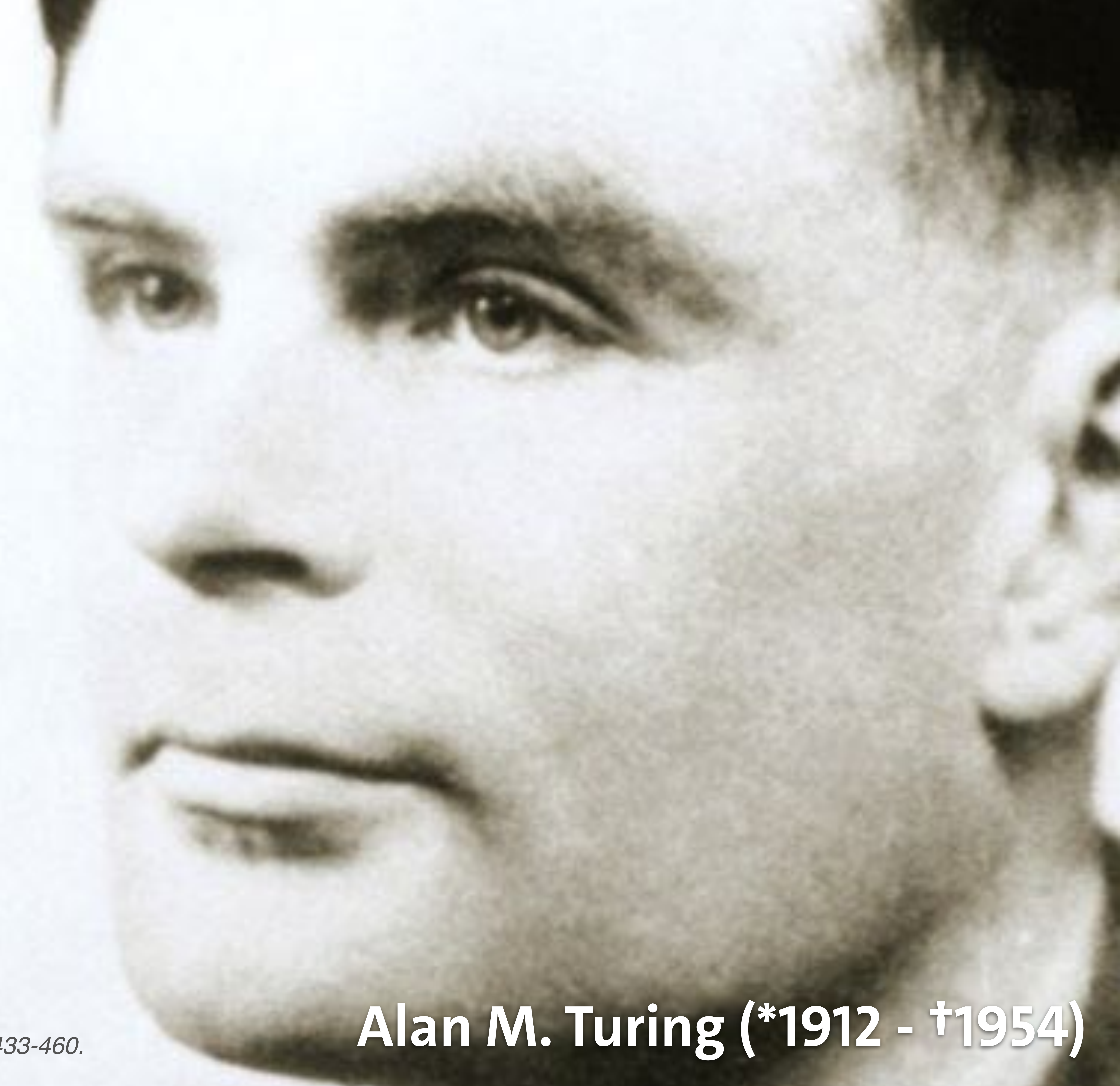
Artificial Intelligence

Artificial Narrow Intelligence (ANI): *Machines can perform one narrow task*

Artificial General Intelligence (AGI): *Machines can think and perform tasks on its own just like a human being*

Artificial Super Intelligence (ASI): *Machines are smarter than collective intellect of smartest humans*

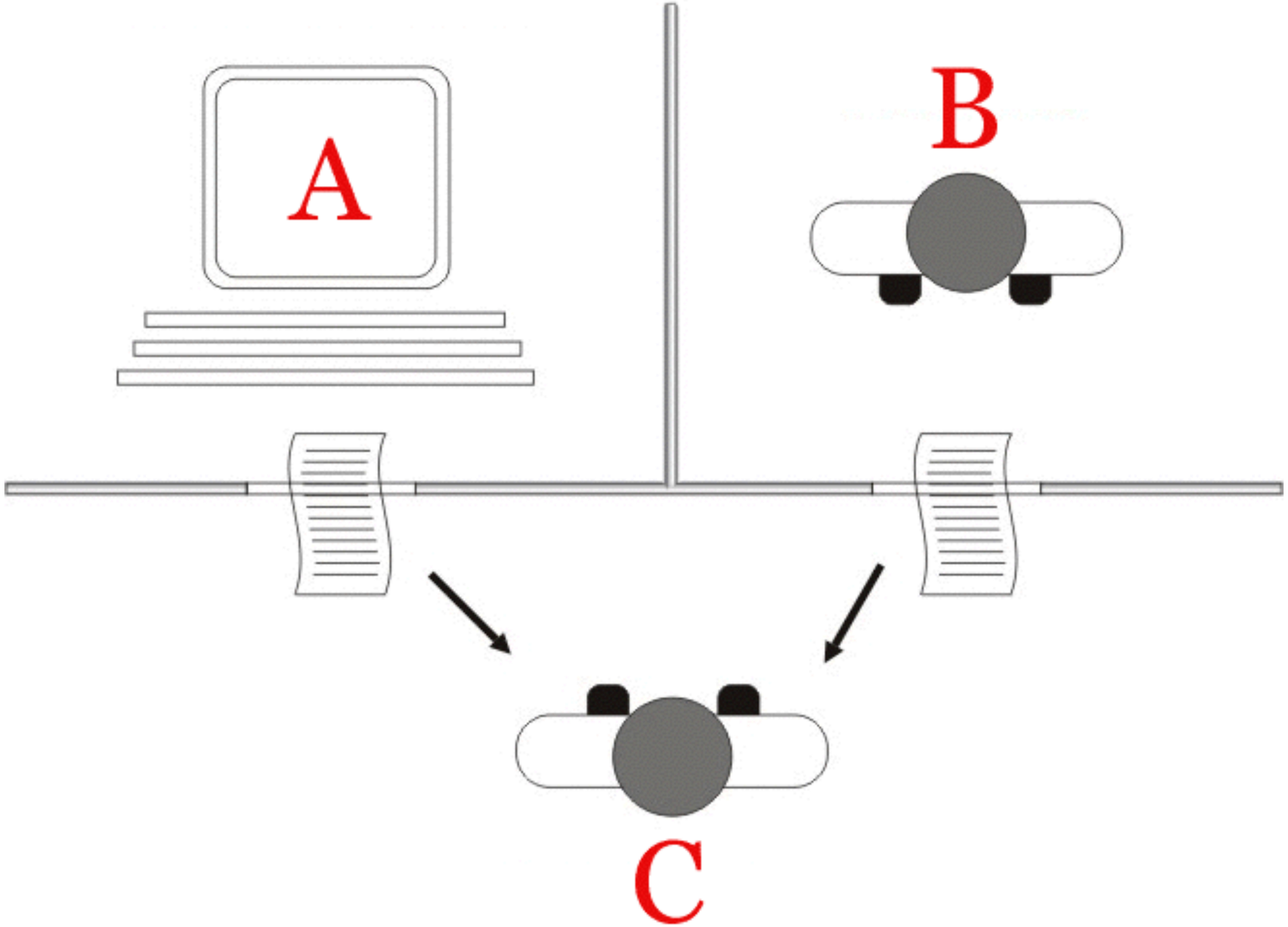
„Can machines ***think***?“



Alan M. Turing (*1912 - †1954)

A. Turing (1950): Computing Machinery and Intelligence. Mind 49: 433-460.

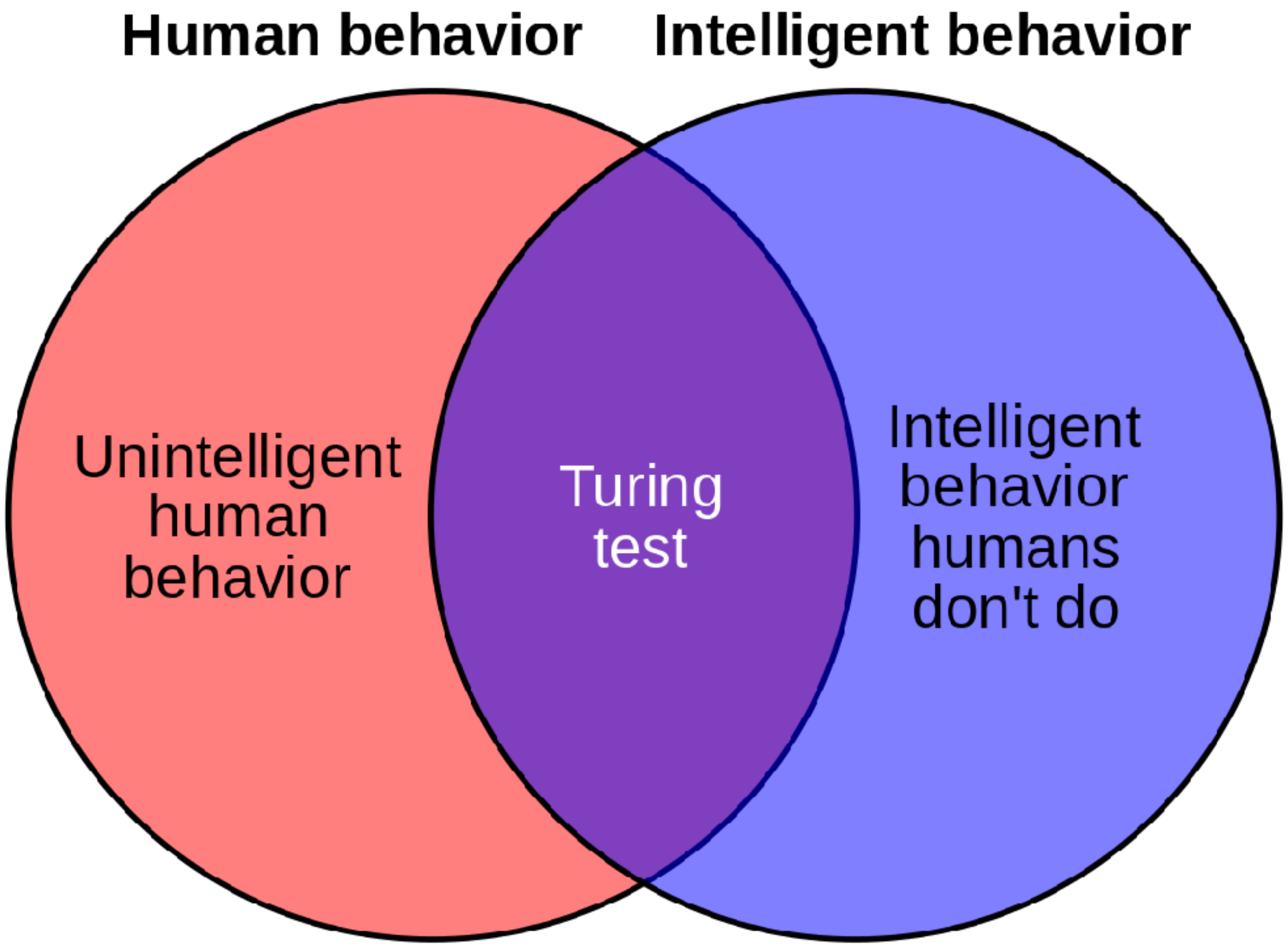
Imitation Game



A. M. Turing (1950) Computing Machinery and Intelligence. Mind 49: 433-460.

“Perfection itself is Imperfection“

-Vladimir Horowitz

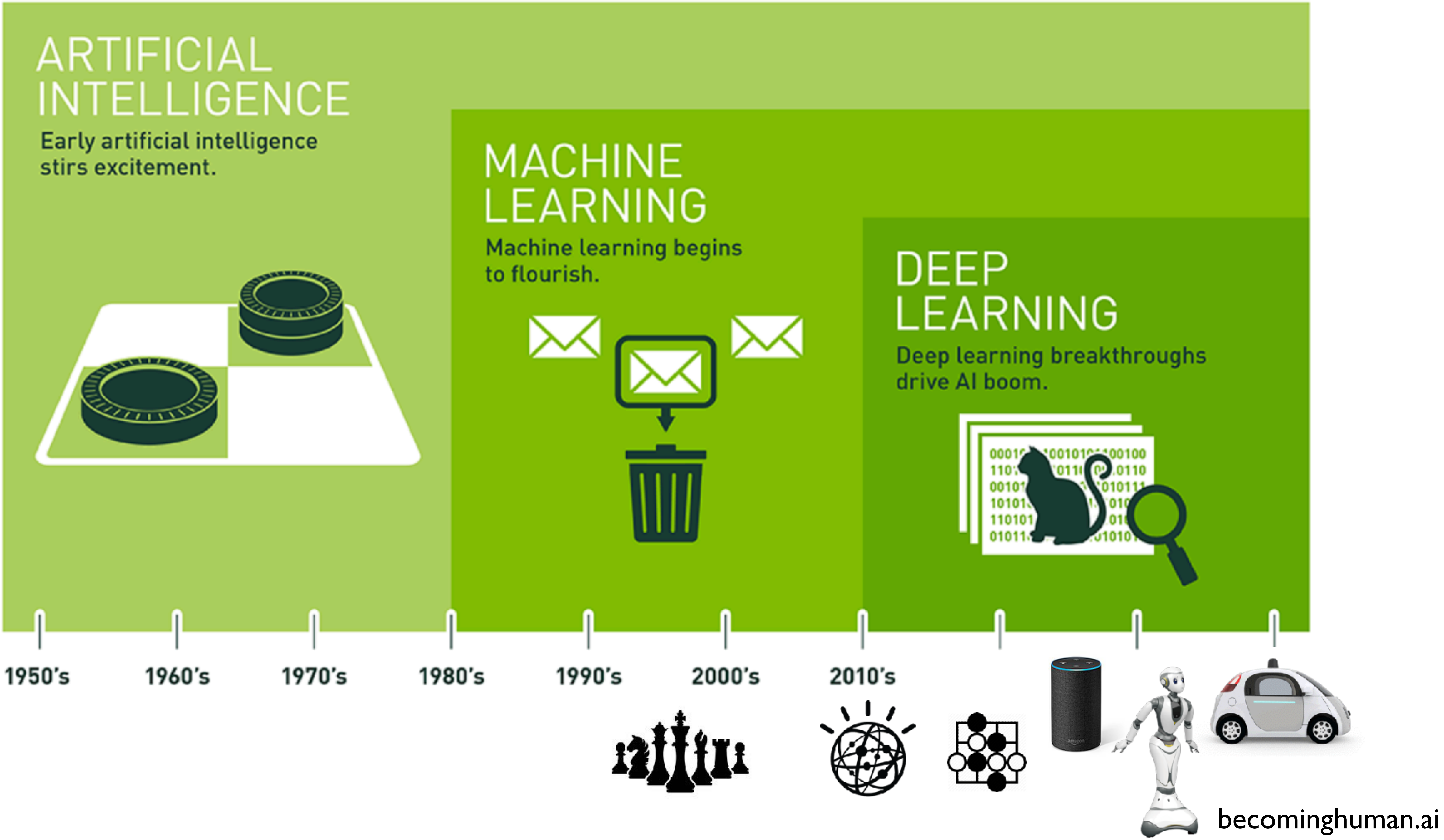


A. M. Turing (1950) Computing Machinery and Intelligence. Mind 49: 433-460.

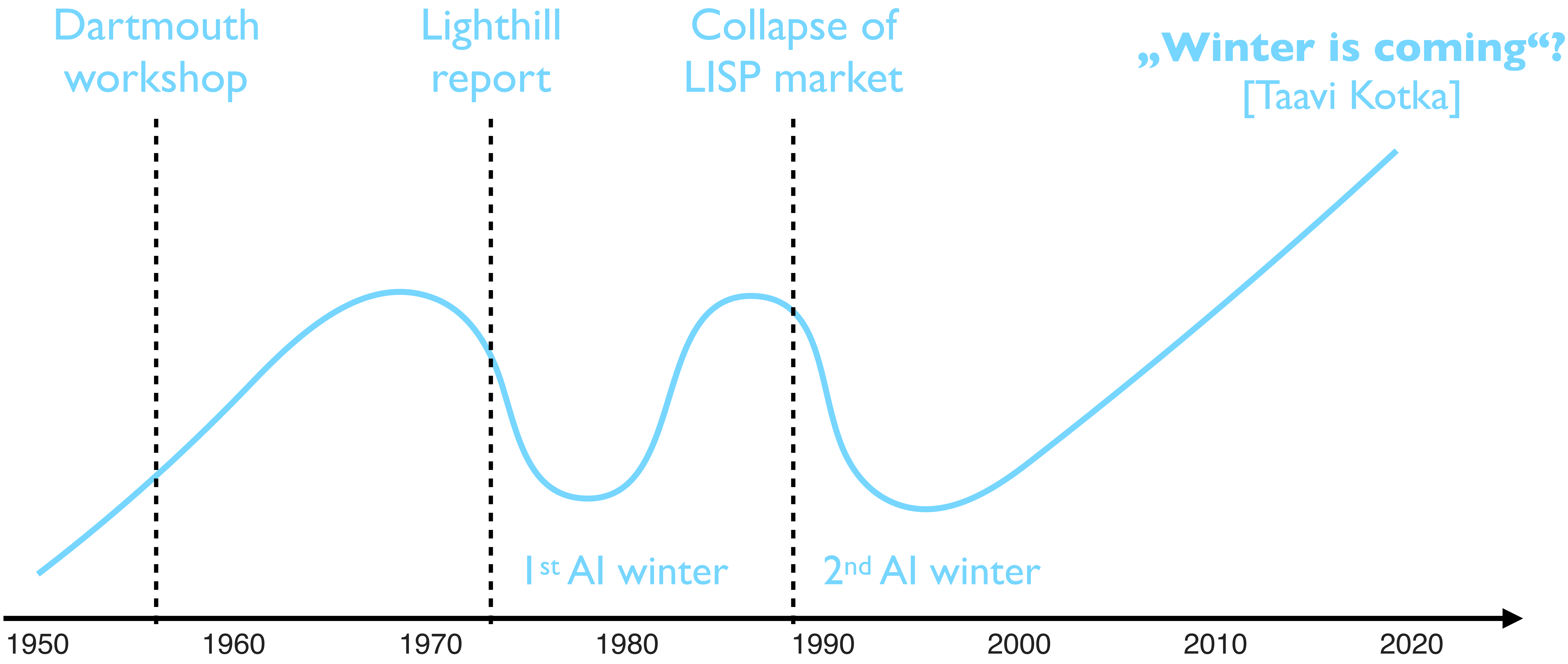
“Perfection itself is Imperfection“

-Vladimir Horowitz

Google Duplex, 2018


ARTIFICIAL INTELLIGENCE
Early artificial intelligence stirs excitement.
MACHINE LEARNING
Machine learning begins to flourish.
DEEP LEARNING
Deep learning breakthroughs drive AI boom.
1950's
1960's
1970's
1980's
1990's
2000's
2010's
becominghuman.ai

Ups & Downs of AI




Human
Artifical
Intelligence
Reality

Virtuelle Realität
(engl. Virtual Reality)

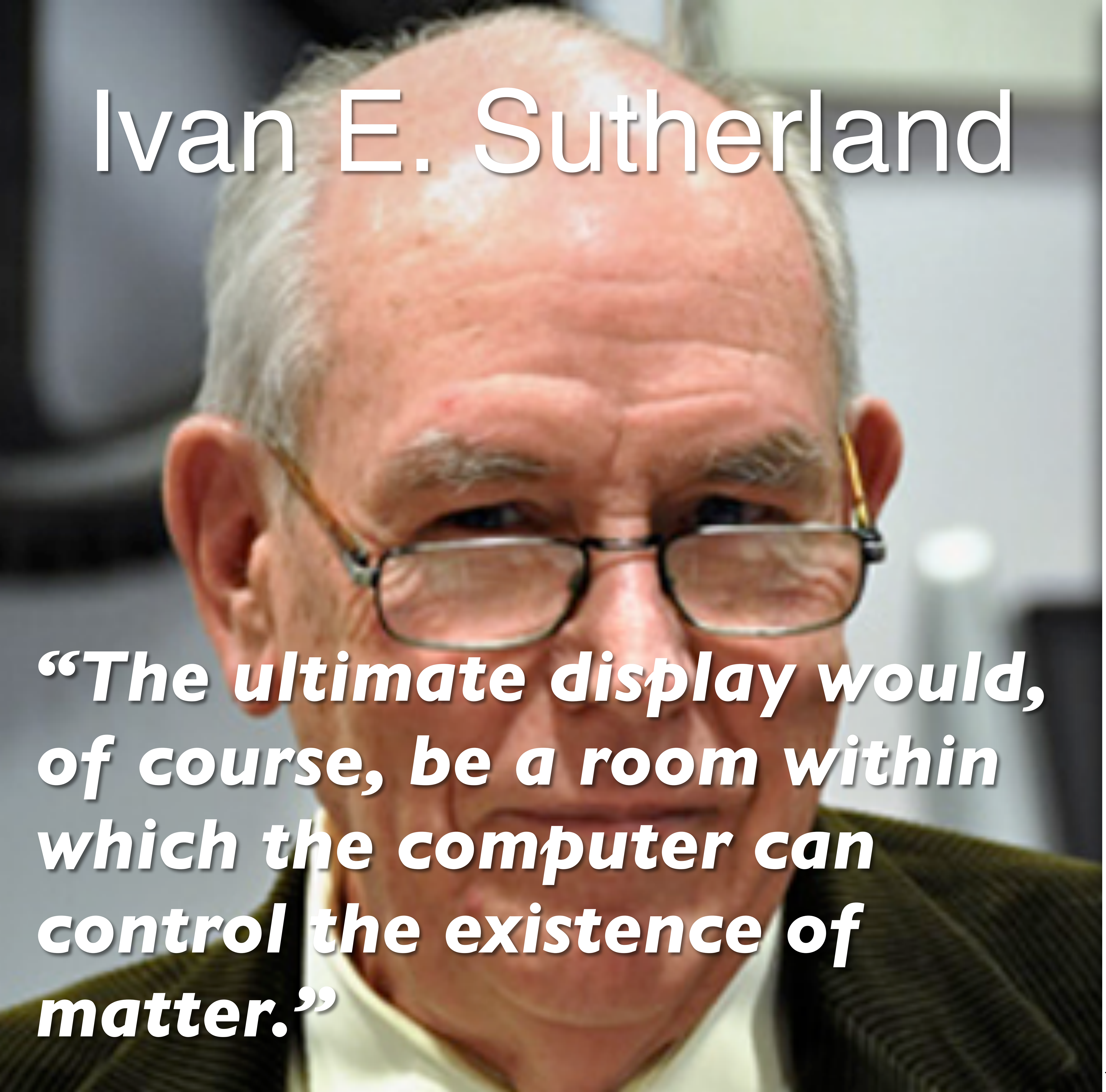
Virtual reality is an artificial environment, which is presented using immersive technology

Immersion ⇒ **Presence**

Place Illusion + *Plausibility Illusion* + *Social Presence*

M. Slater. Place illusion and plausibility can lead to realistic behaviour in IVEs. Phil. Trans. of the RS Biological Science, 364(1535), 2009


MEN
WEST ENG
NVIDIA
SIGGRAPH2018
FRANK
STEINICKE
HARVARD



The Ultimate Display

Ivan E. Sutherland

Information Processing Techniques
Office, ARPA, OSD

We live in a physical world whose properties we have come to know well through long familiarity. We sense an involvement with this physical world which gives us the ability to predict its properties well. For example, we can predict where objects will fall, how well-known shapes look from other angles, and how much force is required to push objects against friction. We lack corresponding familiarity with the forces on charged particles, forces in non-uniform fields, the effects of nonprojective geometric transformations, and high-inertia, low friction motion. A display connected to a digital computer gives us a chance to gain familiarity with concepts not realizable in the physical world. It is a looking glass into a mathematical wonderland.

Computer displays today cover a variety of capabilities. Some have only the fundamental ability to plot dots. Displays being sold now generally have built in line-drawing capability. An ability to draw simple curves would be useful. Some available displays are able to plot very short line segments in arbitrary directions, to form characters or more complex curves. Each of these abilities has a history and a known utility.

It is equally possible for a computer to construct a picture made up of colored areas. Knowlton's movie language, BEFLIX [1], is an excellent example of how computers can produce area-filling pictures. No display available commercially today has the ability to present such area-filling pictures for direct human use. It is likely that new display equipment will have area-filling capability. We have much to learn about how to make good use of this new ability.

The most common direct computer input today is the typewriter keyboard. Typewriters are inexpensive, reliable, and produce easily transmitted signals. As more and more on-line systems are used, it is likely that many more typewriter consoles will come into use. Tomorrow's computer user will interact with a computer through a typewriter. He ought to know how to touch type.

A variety of other manual-input devices are possible. The light pen or RAND Tablet stylus serve a very useful function in pointing to displayed items and in drawing or printing For input to the computer. The possibilities for very smooth interaction with the computer through these devices is only just beginning to be exploited. RAND Corporation has in operation today a debugging tool which recognizes printed changes of register contents, and simple pointing and moving motions for format relocation. Using RAND's techniques you can change a digit printed on the screen by merely writing what you want on top of it. If you want to move the contents of one displayed register into another, merely point to the first and "drag" it over to the second. The facility with which such an interaction system lets its user interact with the computer is remarkable.

Knobs and joysticks of various kinds serve a useful function in adjusting parameters of some computation going on. For example, adjustment of the viewing angle of a perspective view is conveniently handled through a three-rotation joystick. Push buttons with lights are often useful. Syllable voice input should not be ignored.

In many cases the computer program needs to know which part of a picture the man is pointing at. The two-dimensional nature of pictures makes it impossible to order the parts of a picture by neighborhood. Converting from display coordinates to find the object pointed at is, therefore, a time-consuming process. A light pen can interrupt at the time that the display circuits transfer the item being pointed at, thus automatically indicating its address and coordinates. Special circuits on the RAND Tablet or other position input device can make it serve the same function.

What the program actually needs to know is where in memory is the structure which the man is pointing to. In a display with its own memory, a light pen return tells where in the display file the thing pointed to is, but not necessarily where in main memory. Worse yet, the program really needs to know which sub part of which part the man is pointing to. No existing display equipment computes the depths of recursions that are needed. New displays with analog memories may well lose the pointing ability altogether.

Other Types of Display

If the task of the display is to serve as a looking-glass into the mathematical wonderland constructed in computer memory, it should serve as many senses as possible. So far as I know, no one seriously proposes computer displays of smell, or taste. Excellent audio displays exist, but unfortunately we have little ability to have the computer produce meaningful sounds. I want to describe for you a kinesthetic display.

The force required to move a joystick could be computer controlled, just as the actuation force on the controls of a Link Trainer are changed to give the feel of a real airplane. With such a display, a computer model of particles in an electric field could combine manual control of the position, of a moving charge, replete with the sensation of forces on the charge, with visual presentation of the charge's position. Quite complicated "joysticks" with force feedback capability exist. For example, the controls on the General Electric "handyman" are nothing but joysticks with nearly as many degrees of freedom as the human arm. By use of such an input/output device, we can add a force display to our sight and sound capability.

L. & A. Wachowski: The Matrix, 1999

R.W. Fassbinder: World on a Wire, 1973

I.E. Sutherland: Head-mounted 3D display, Fall Joint Computer Conference, 1968

Losing my VRginity (~1993s)

“VR is dead …”

Really?

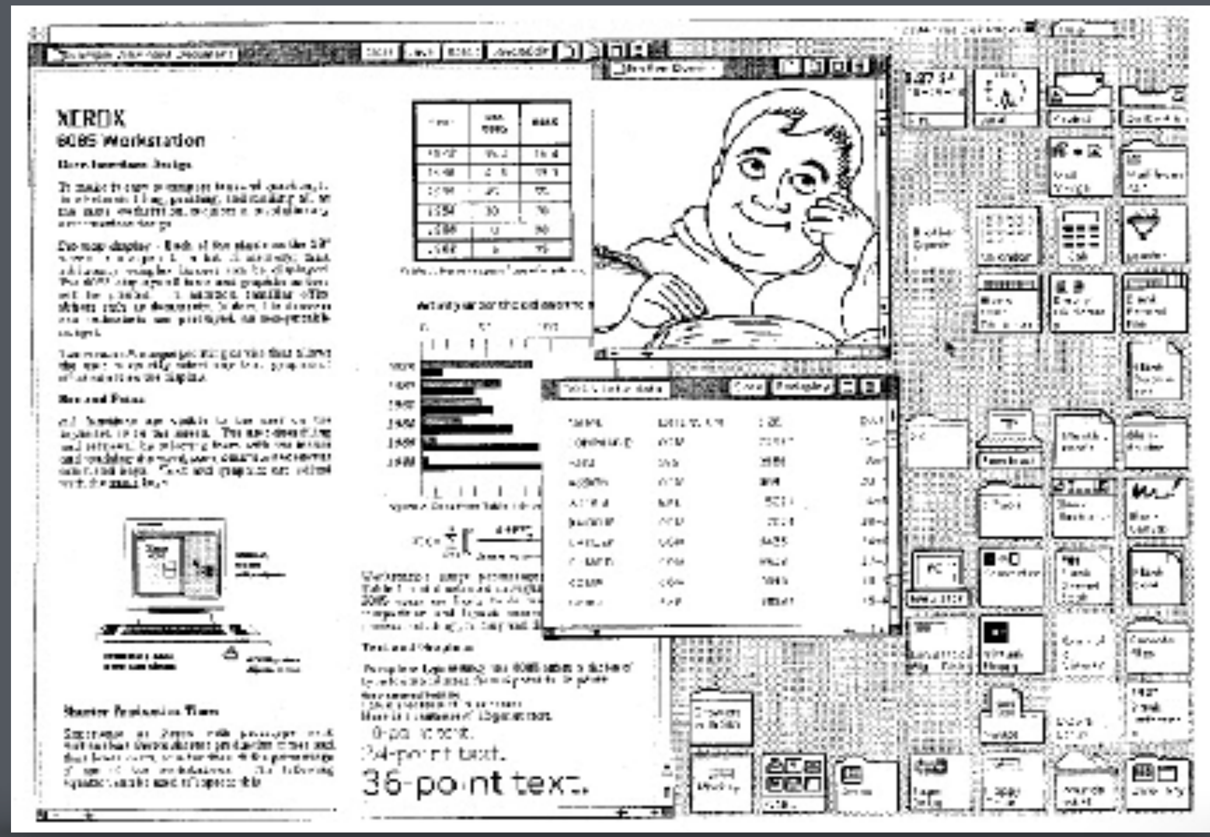

SAMSUNG
SAMSUNG
Gear VR
Oculus

Evolvement of UI Paradigms

1960s - CLI

Comand Line Interface

Keyboard



1980s - GUI

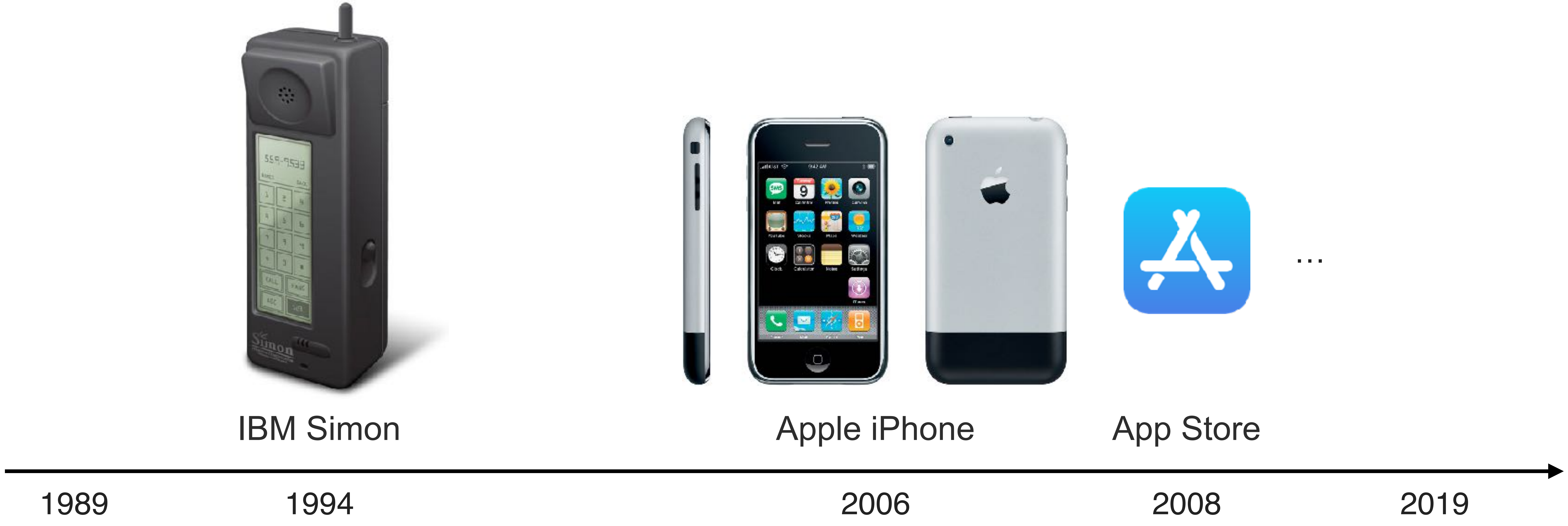
Graphical User Interface

Keyboard + Mouse

2000s - NUI

Natural User Interface

Touch + Voice + Gesture



IBM Simon
Apple iPhone
App Store
...
1989
1994
2006
2008
2019

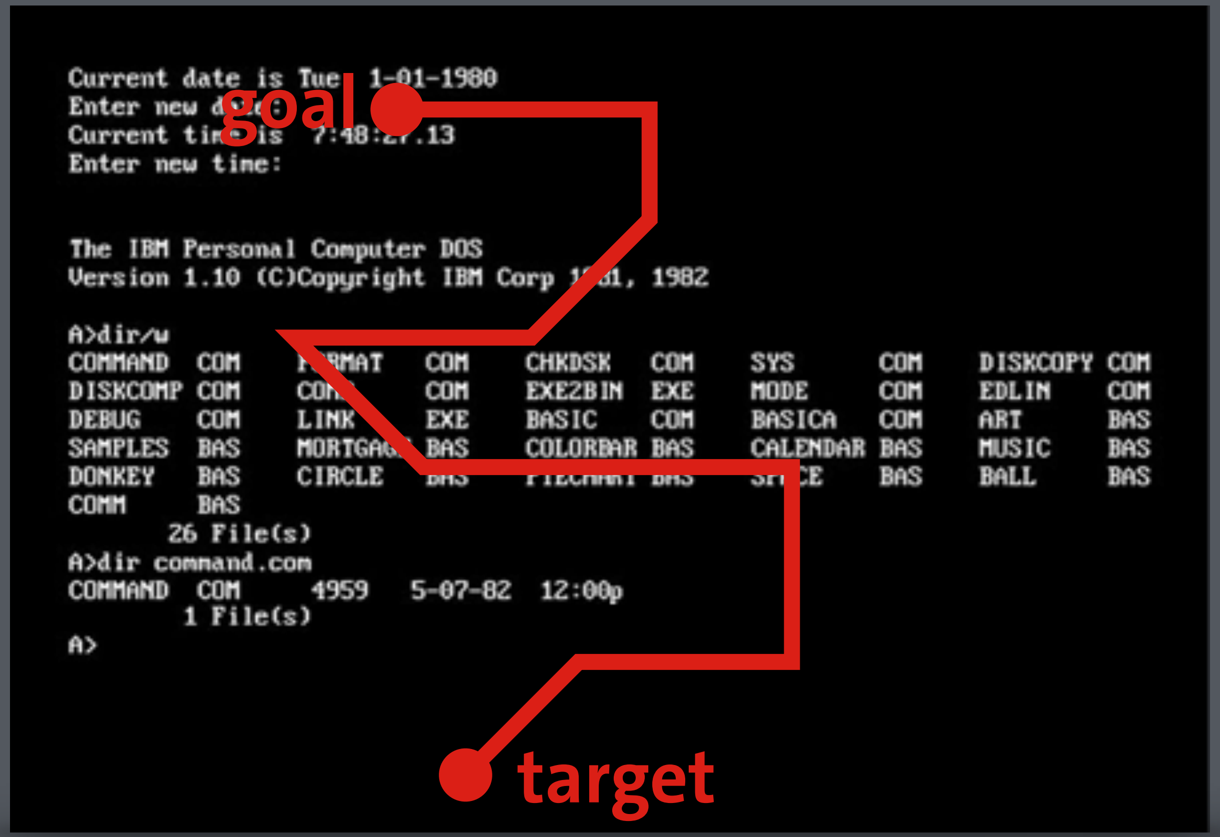
B. Leonard: Lawnmower Man, 1992


IBM Simon
Apple iPhone
App Store
...
1989
1994
2006
2008
2019
VPL EyePhone
Oculus Quest
...

Bundesministerium
für Bildung
und Forschung

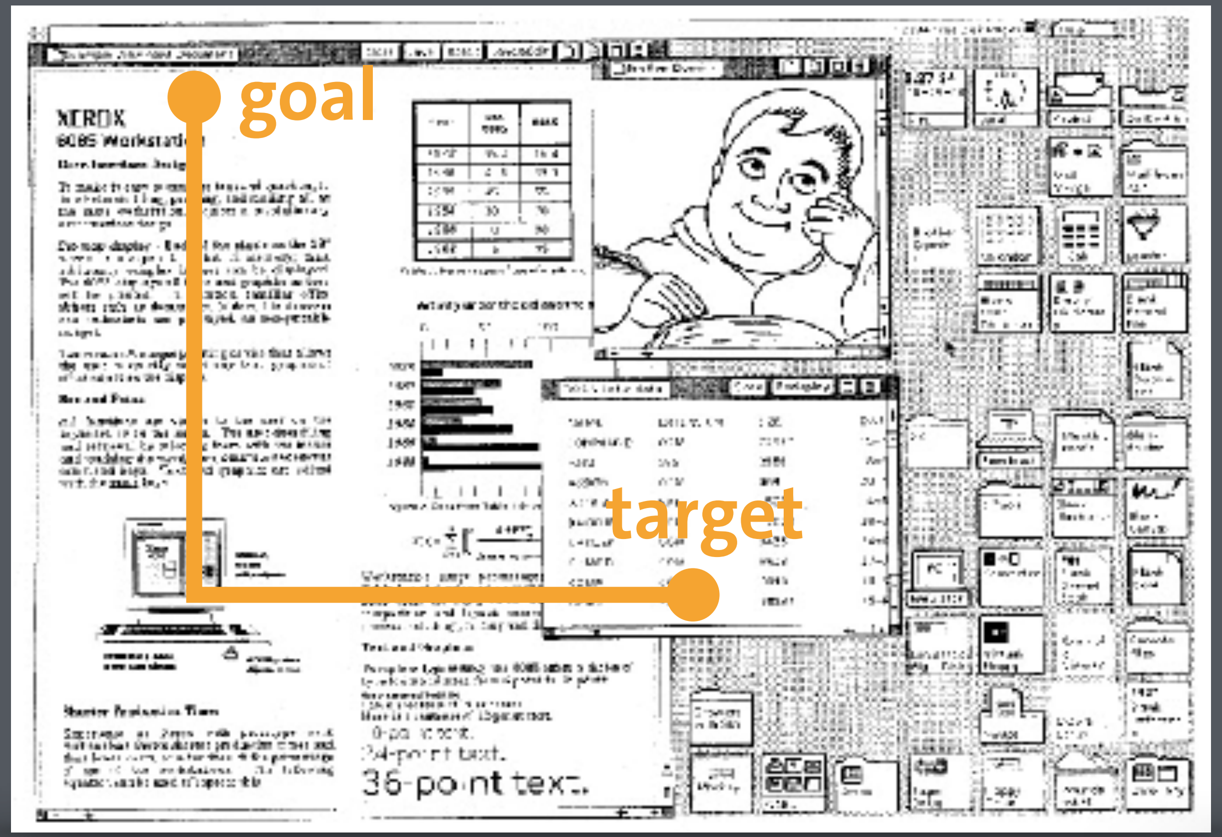
EXGAVINE

Evolvement of UI Paradigms



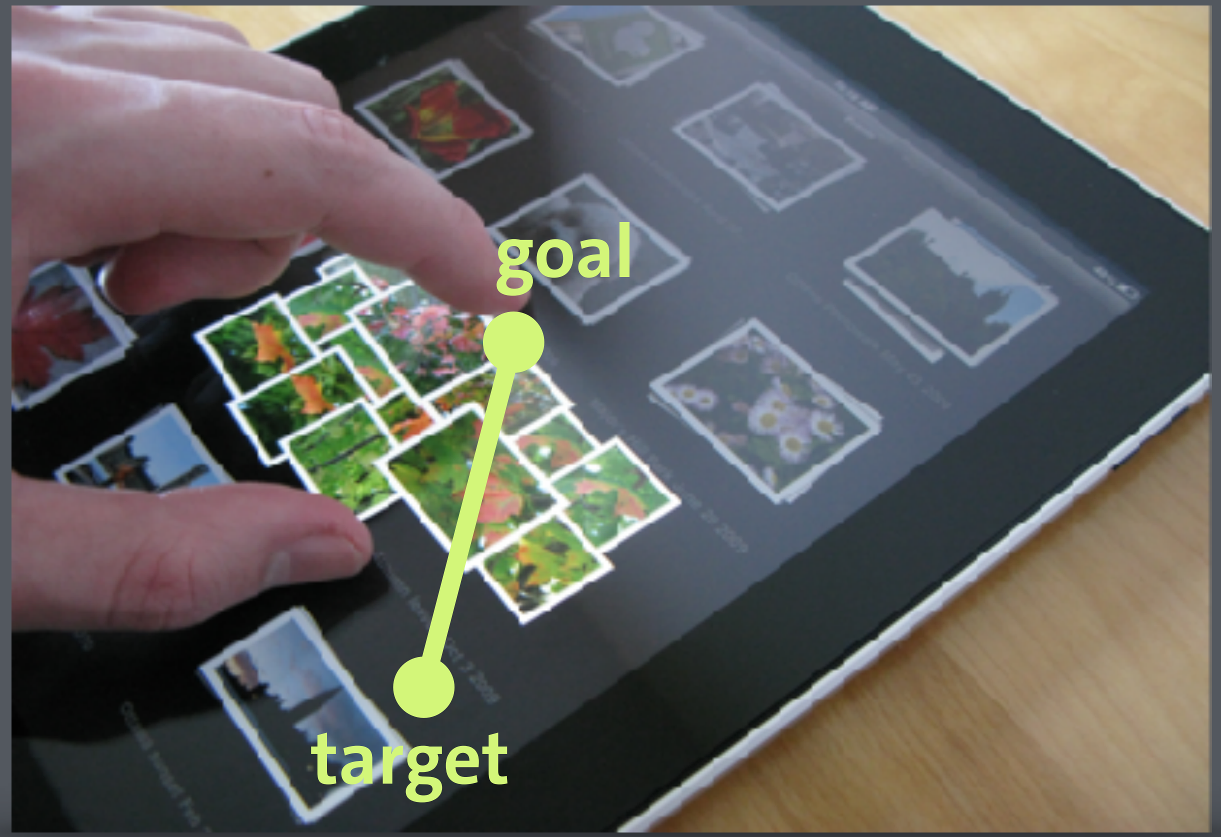
1960s - CLI
Comand Line Interface

Keyboard



1980s - GUI
Graphical User Interface

Keyboard + Mouse



2000s - NUI
Natural User Interface

Touch + Voice + Gesture

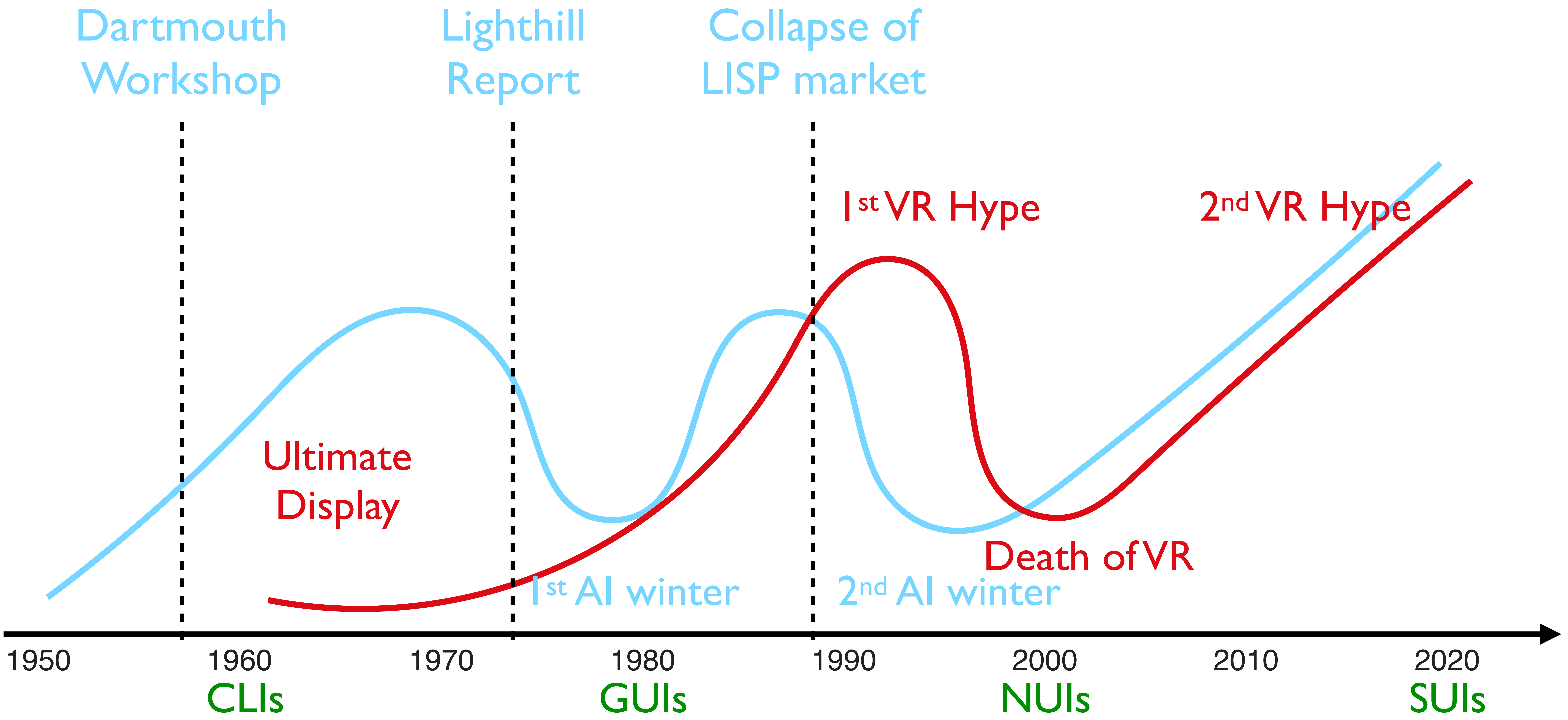
2020s - SUI
Smart User Interfaces

Multimodal

	1960s - CLI	1980s - GUI	2000s - NUI	2020s - SUI
time to learn	weeks	days	minutes	seconds
usability	lower	low	high	higher
UX	lower	low	high	higher


1980s - GUI
2000s - NUI
2020s - SUI
Smart
Social
Spatial
Graphical
Natural
Supernatural

Ups & Downs of AI & VR



Smart UIs…

…combine AI and HCI for intelligent human-machine interaction

Natural Gestures?

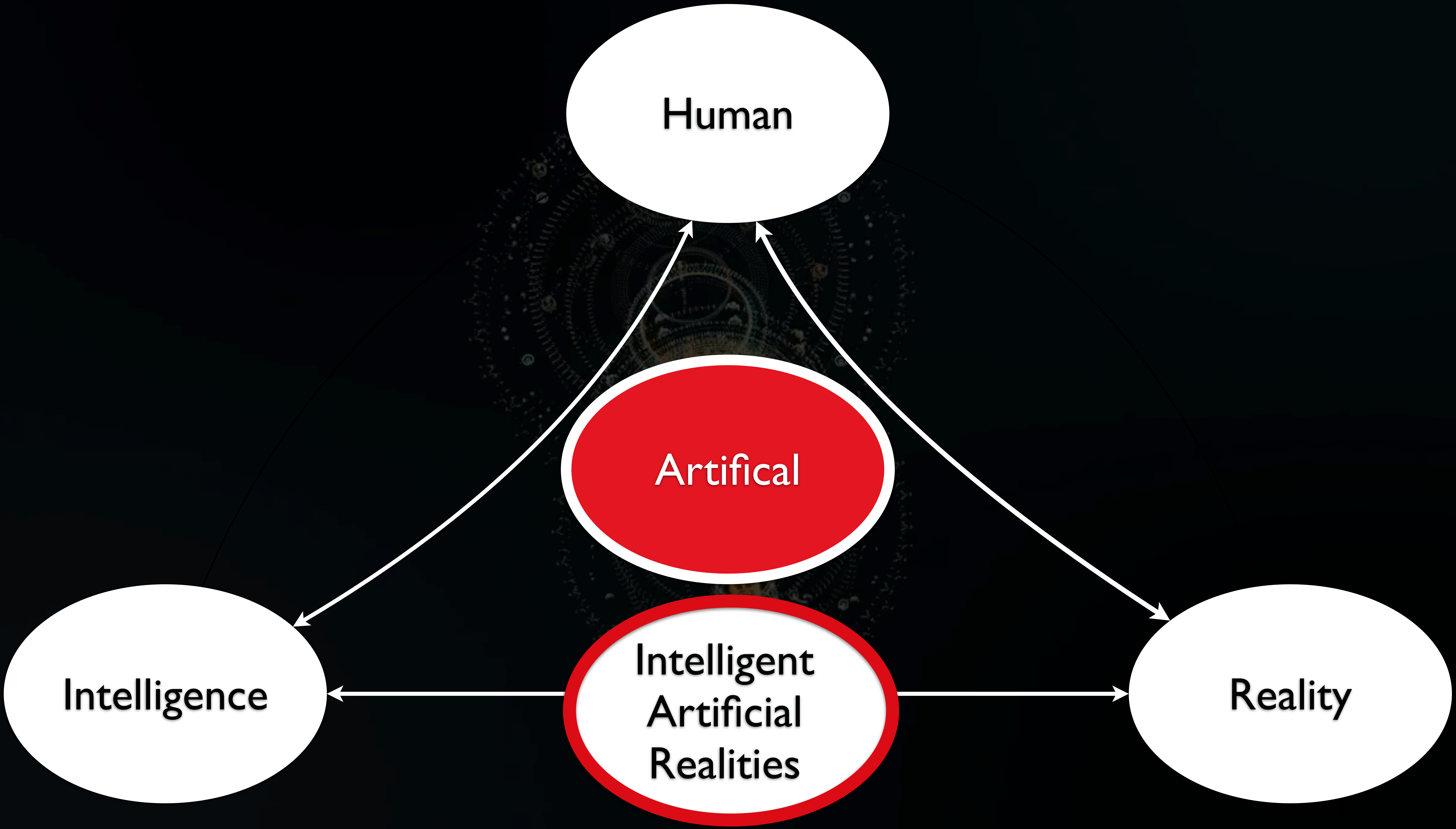
https://www.microsoft.com/microsoft-hololens/en-us

Smart Glasses Example

typical AR UI

smart AR UI

S. Feiner et al.: 2D windows for 3D AR, ACM UIST, 1993


Human
Artifical
Intelligence
Intelligent Artificial Realities
Reality

Sci Fy Intelligent Artificial Reality

Her, 2014

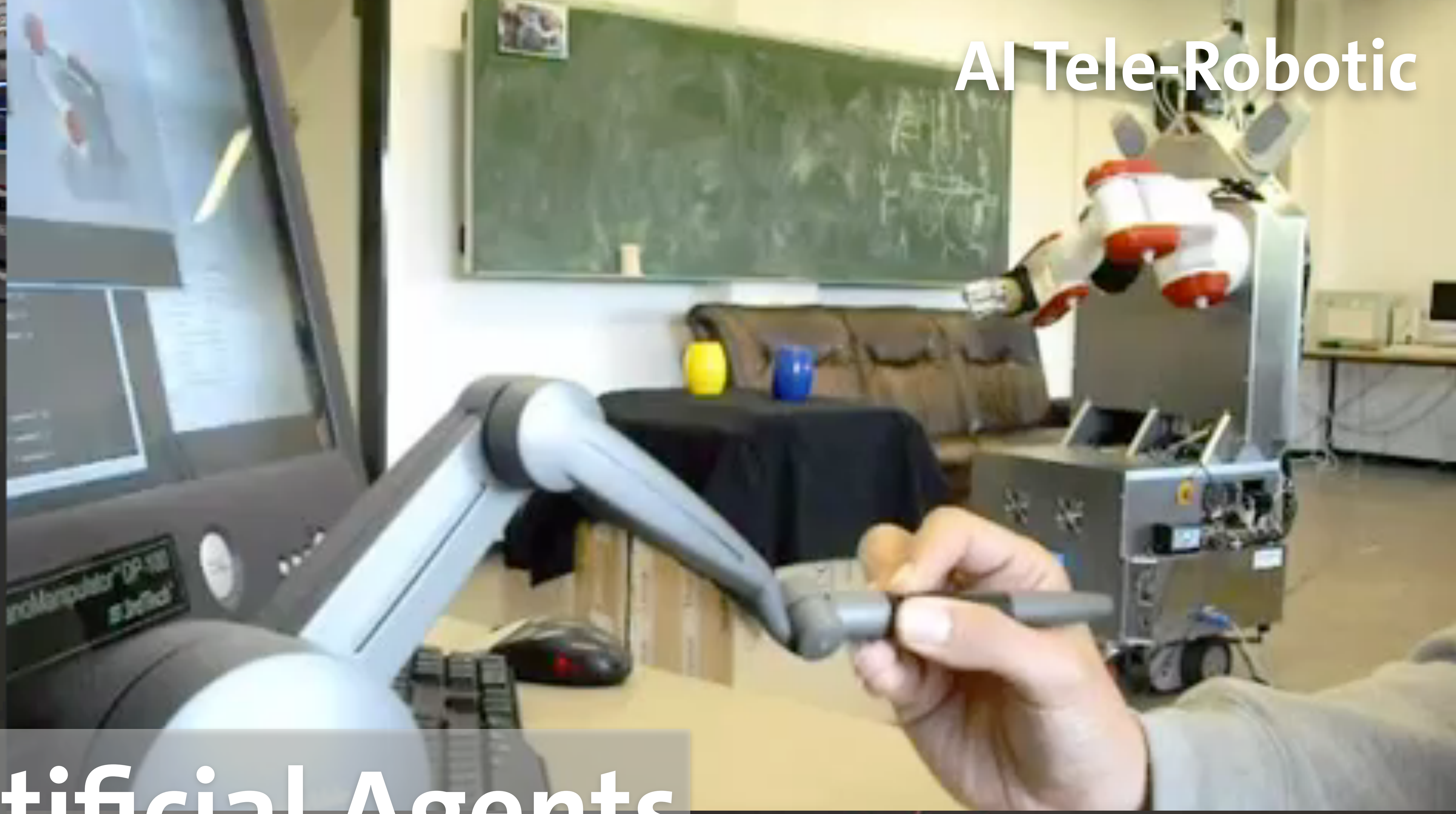
Ex-Machina, 2014

A.I., 2001

i, Robot, 2004


Realistic Avatars
Realistic Agents
Intelligent Virtual Agents
Virtual Prejudices
Virtual TSST

Intelligent Artificial Agents

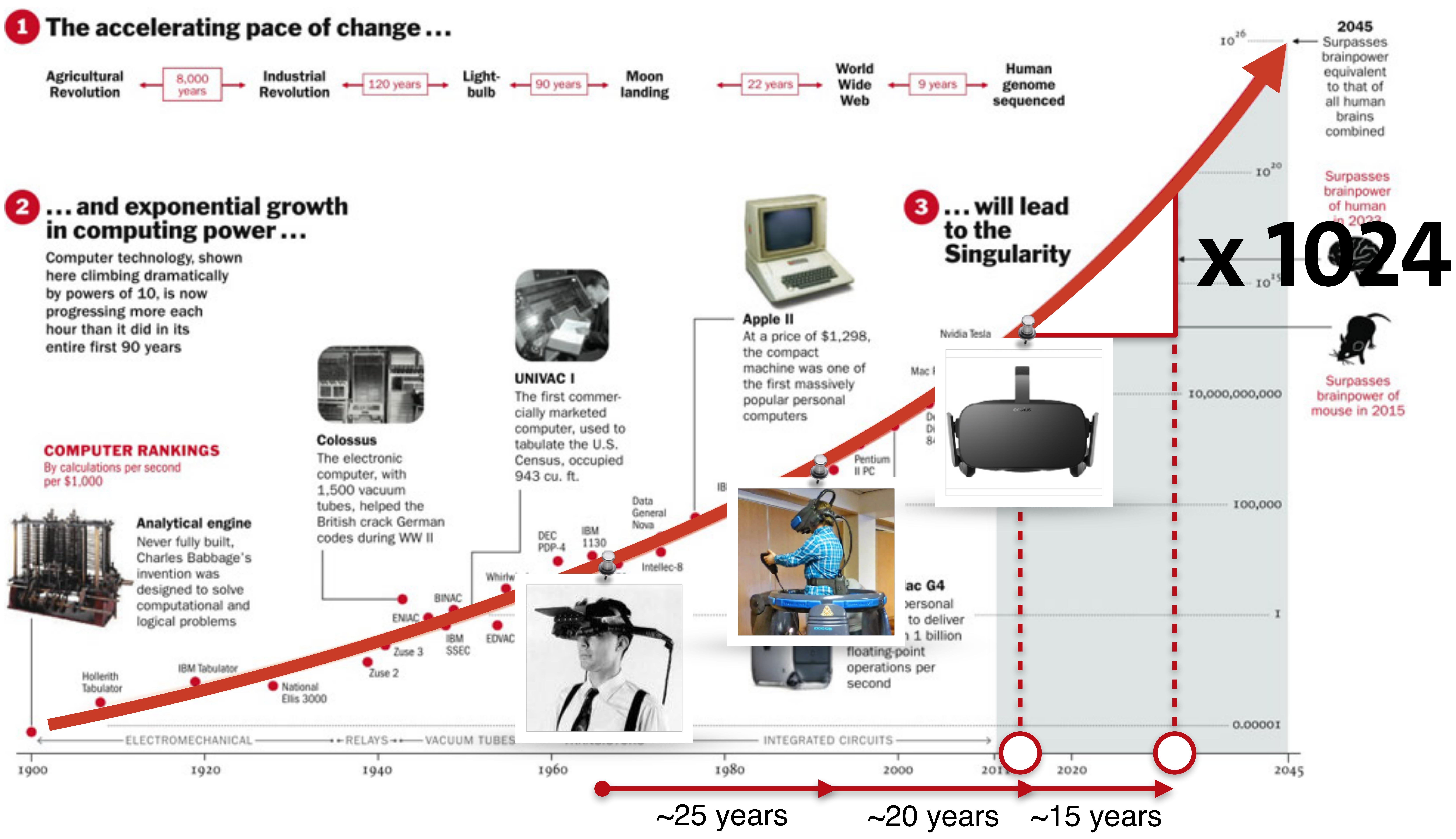


S. Lombardi: Deep appearance models for face rendering, 2018

Future of the

Ultimate Display

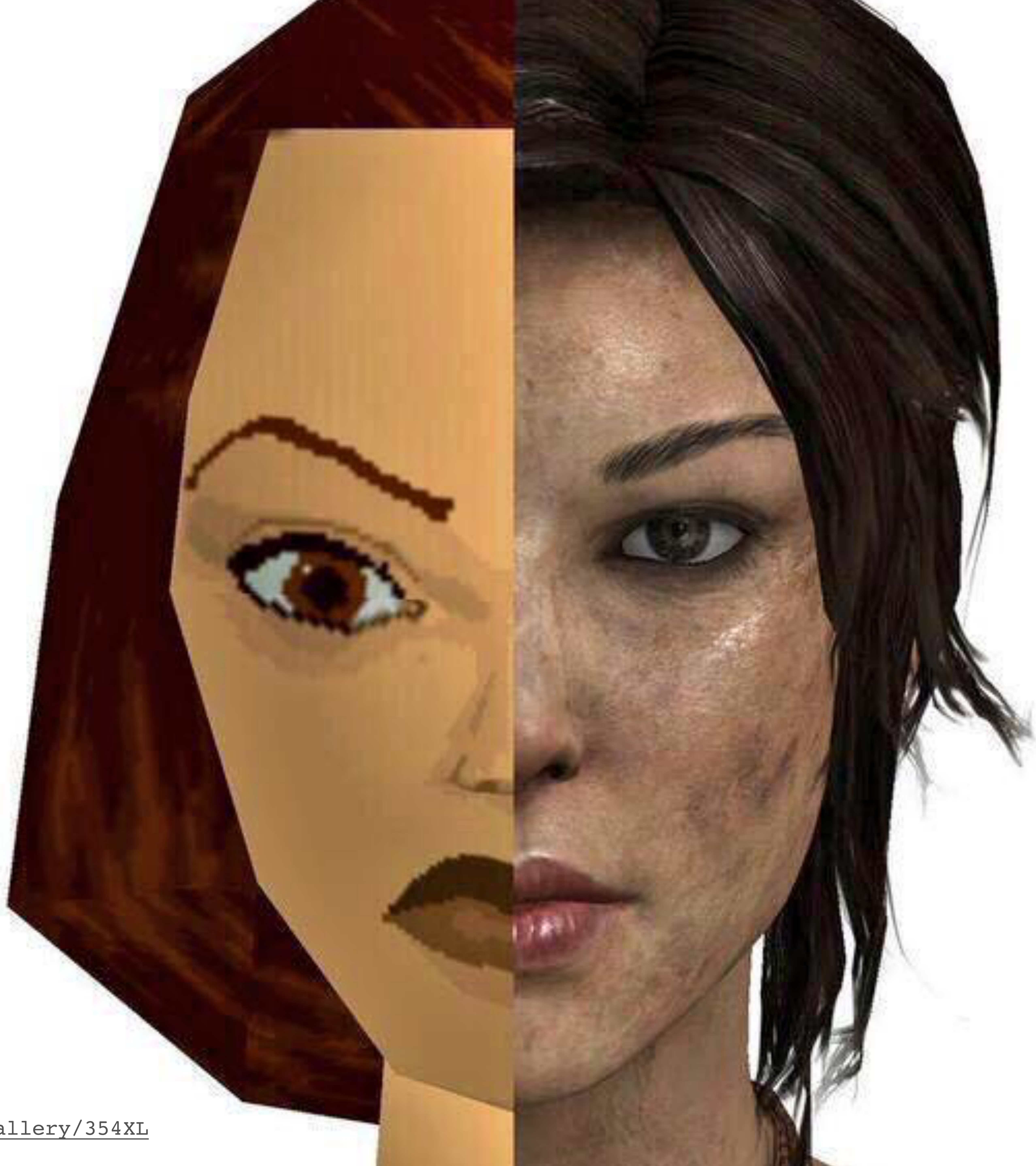
TIME: The Year Man Becomes Immortal, 2011



Graphics
Turing Test

M. McGuigan, Graphics Turing Test, 2006

Steinicke et al.: Realistic Perspective Projections, ACM SIGGRAPH, 2011

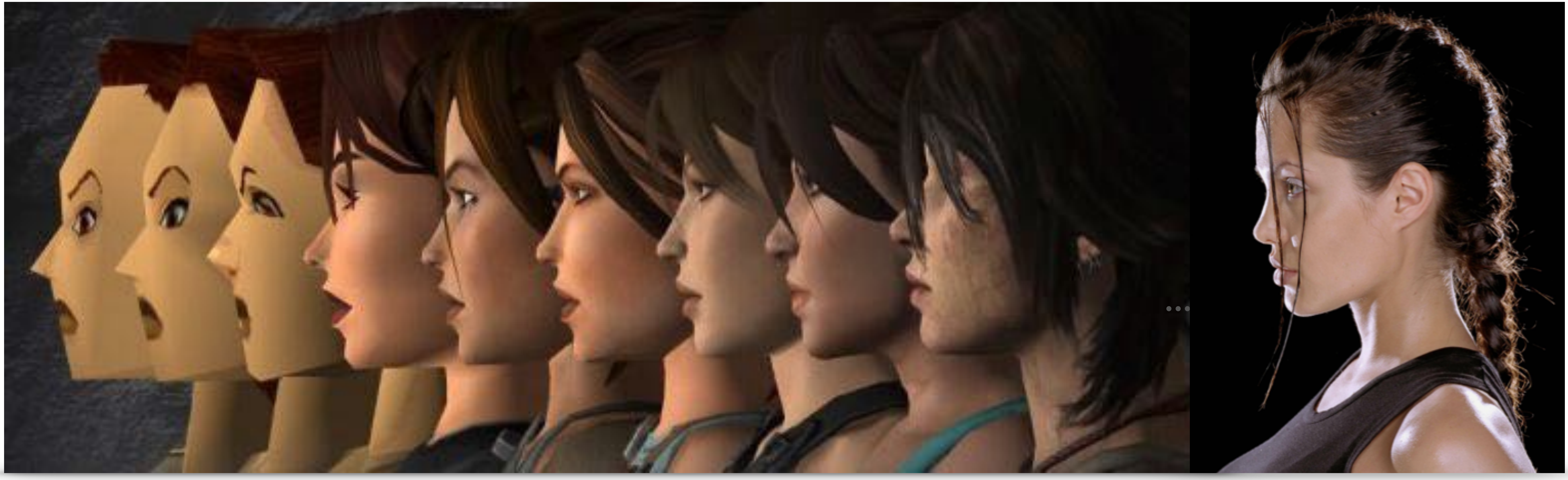


http://imgur.com/gallery/354XL

2016

2013

http://imgur.com/gallery/354XL

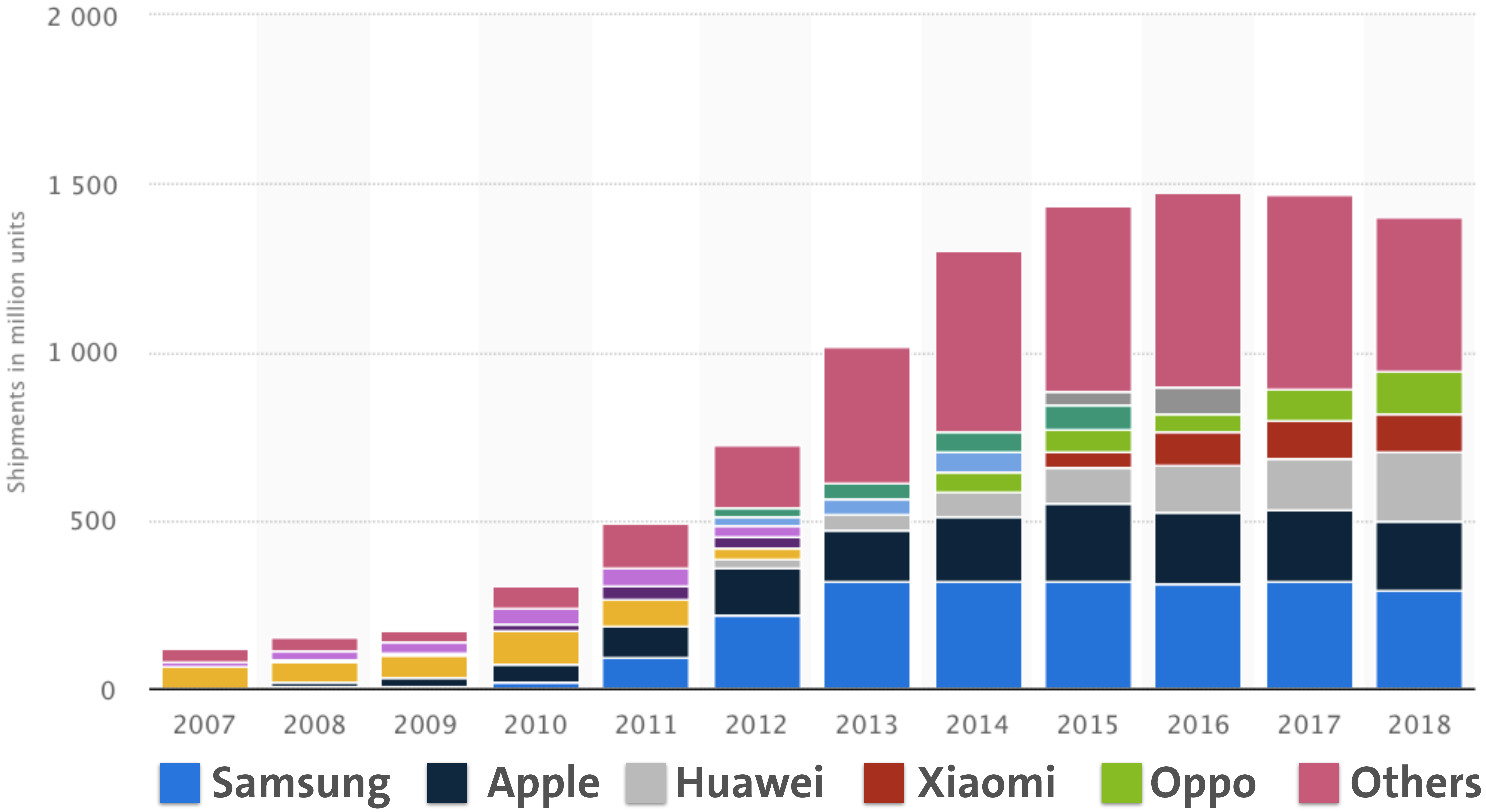


1996 → 2013 … → 2030

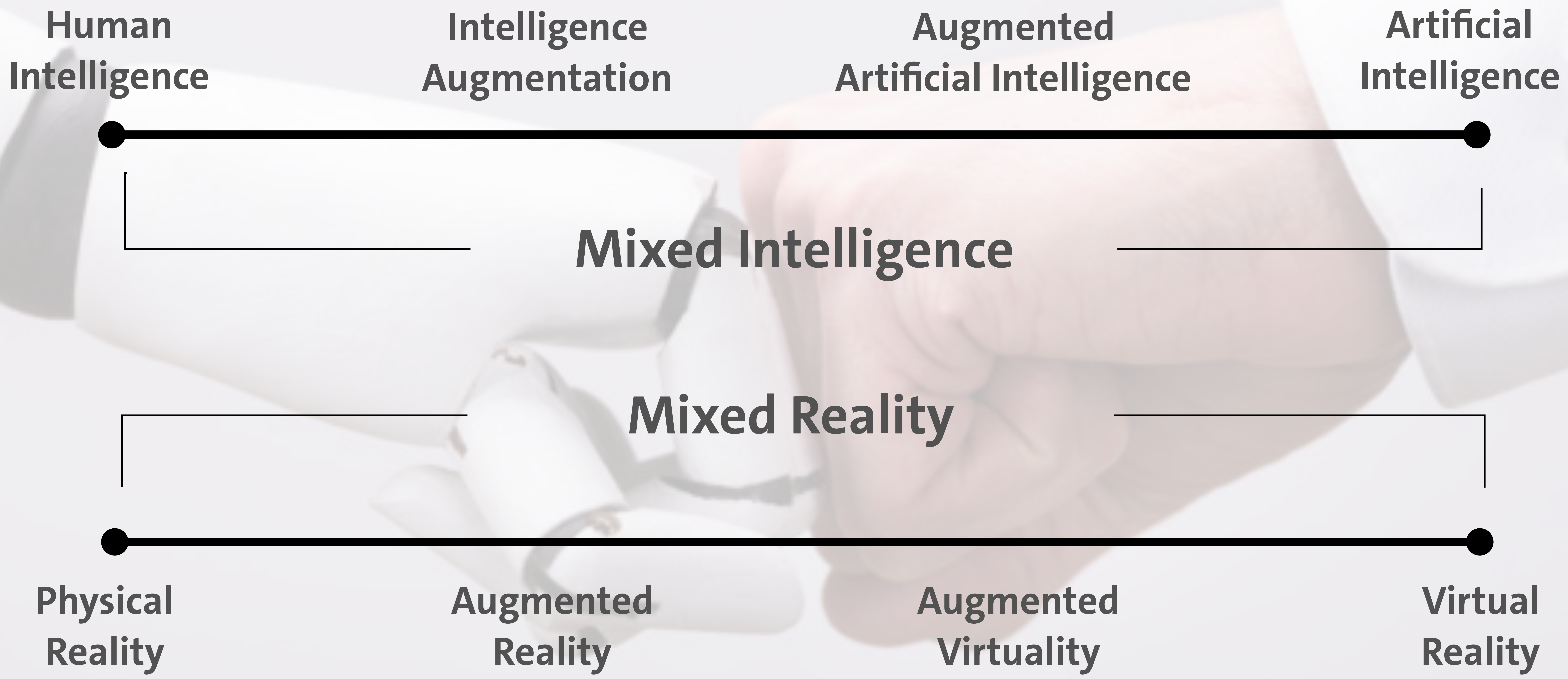
http://imgur.com/gallery/354XL

Smart glasses of ~2030

Global smartphone shipments from 2007 to 2018



Mixed Intelligence-Reality Continuum



P. Milgram, F. Kishino: A taxonomy of mixed reality visual displays, IEICE Transactions on Information and Systems, Special issue on Networked Reality, 1994

Thank you!

human-computer interaction

twitter.com/uhhhci

youtube.com/user/uhhhci

hci.informatik.uni-hamburg.de