

Technology and Humanity IV

With emphasis on Robotics and Machine Intelligence

JT Wunderlich PhD

2018, 20, 21, **25**



JT Wunderlich PhD, **ELIZABETHTOWN COLLEGE** (since 1999)

Associate Professor of Engineering & Computer Science
Computer Engineering and Architectural Studies Coordinator
Founder & Director of Robotics & Machine Intelligence Lab



PRIOR TO 1999:



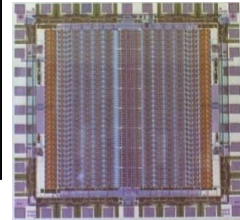
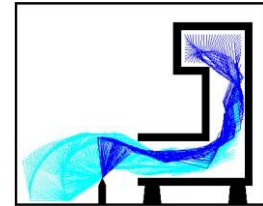
PURDUE UNIVERSITY Assistant Professor of Electrical Engineering Technology



IBM S/390 Supercomputer Research & Development (USA and Germany) 1990's

UNIVERSITY OF DELAWARE PhD in Electrical (& Computer) Engineering

- Robotic-arm design & Automation consulting
- Rehabilitation Robotics in AI Dupont Hospital
- Second Neural Network chip Design



PENN STATE M Eng in Engineering Science

- First Neural Network chip design

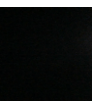
SAN FRANCISCO STATE Physics Grad Student



UNIVERSITY OF CALIFORNIA AT SAN DIEGO Urban Design 2nd Degree program

UNIVERSITY OF TEXAS AT AUSTIN BS in Architectural Engineering (1984)

- Coordinated all A&E and construction of \$100M of Hi-tech Office Parks and Data centers (1980's)



PART 1:

My subjective assessment of many technologies

GREEN = GOOD

RED = BAD, in the context of

“OldSchool Qualities Lost”

PART 2:

My subjective Assessment of the **“Mental Abilities”** of:

- Humans
- A Spider
- A conventional computer
- **Symbolic AI**
- **Neural Networks**



PART 1:

My subjective assessment of many technologies

GREEN = GOOD

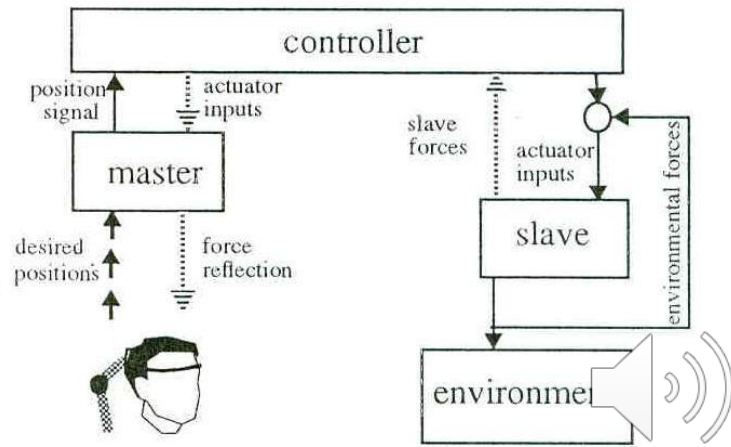
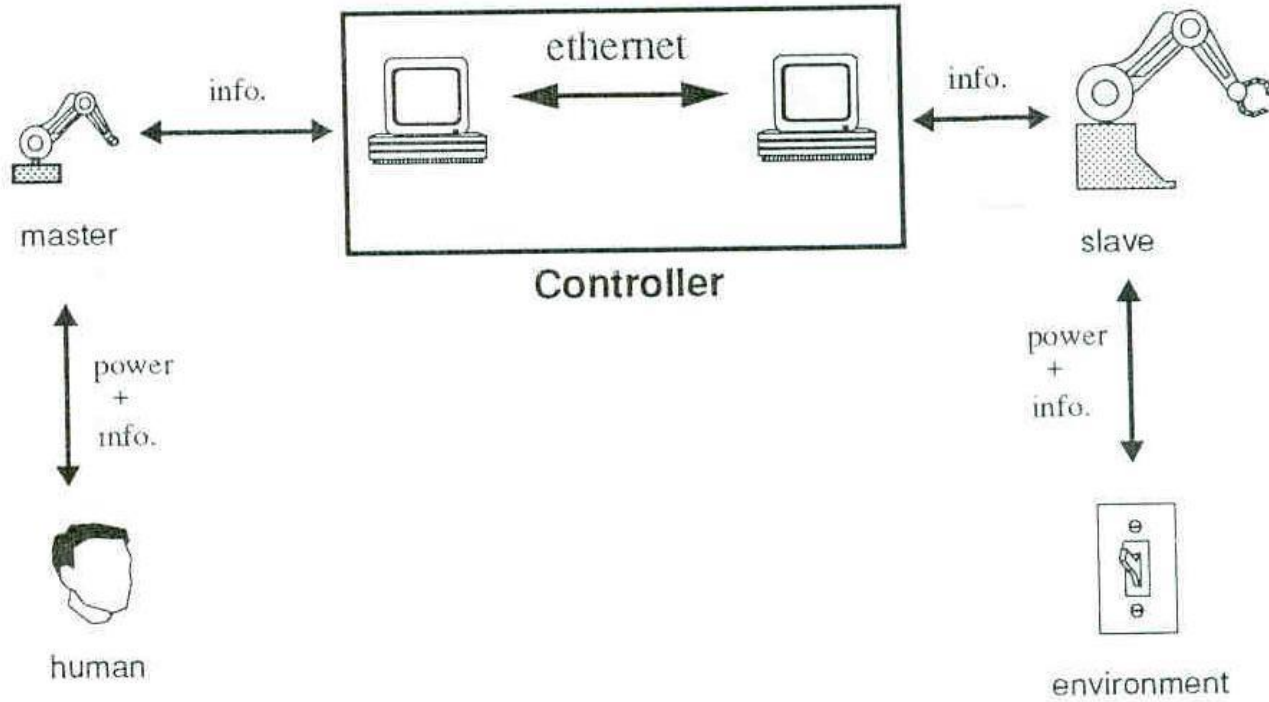
RED = BAD,

and in the context of

“Old-School Qualities Lost”



Designing Robotic Arms for Disabled Children



1993 Wunderlich Research in Nemours Hospital (previously named Al Dupont Children's Hospital)

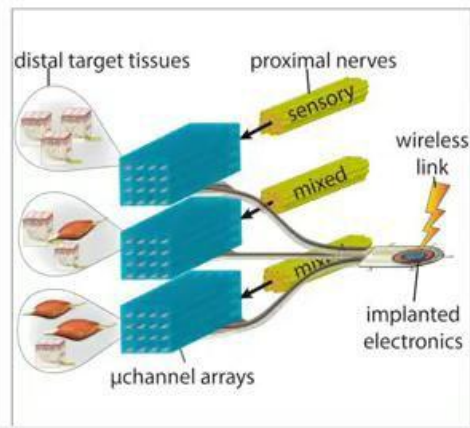
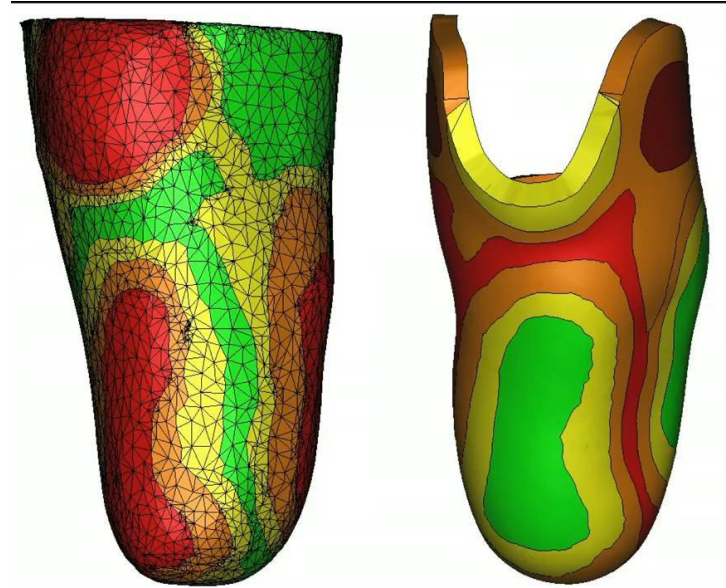
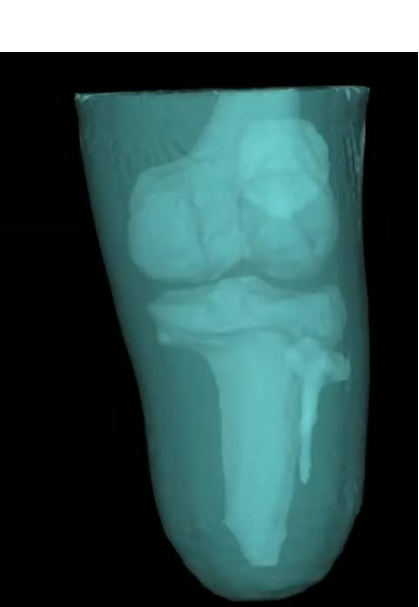
2014 Maneuverability For The Disabled



2014 Prosthetic Lower Leg

ASSISTING THE DISABLED

VIDEO: <https://www.youtube.com/watch?v=CDsNZJTWw0w>

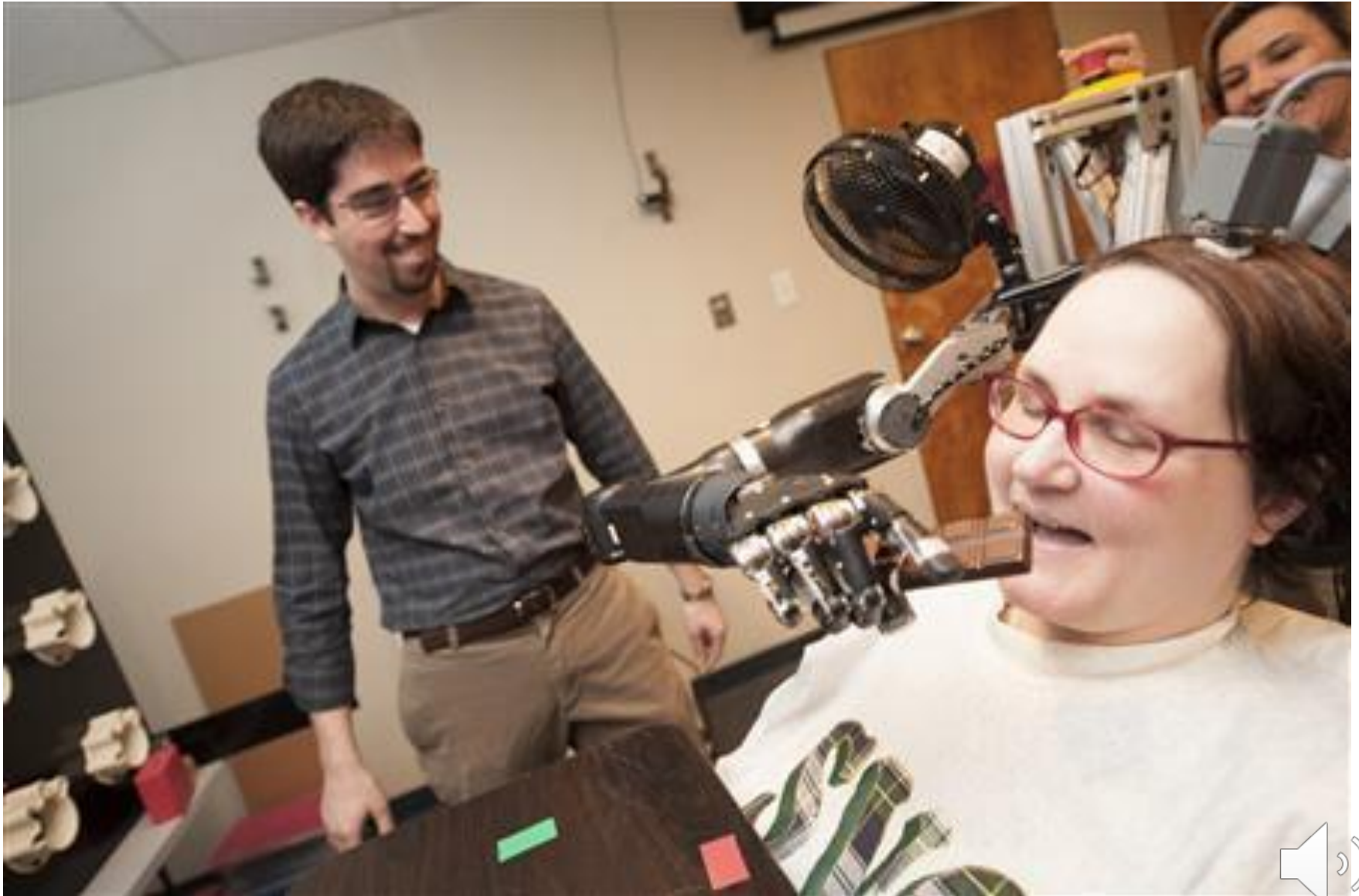


11:53 / 19:00



New bionics let us run, climb and dance | Hugh Herr

2014 Mind-controlled Prosthetics

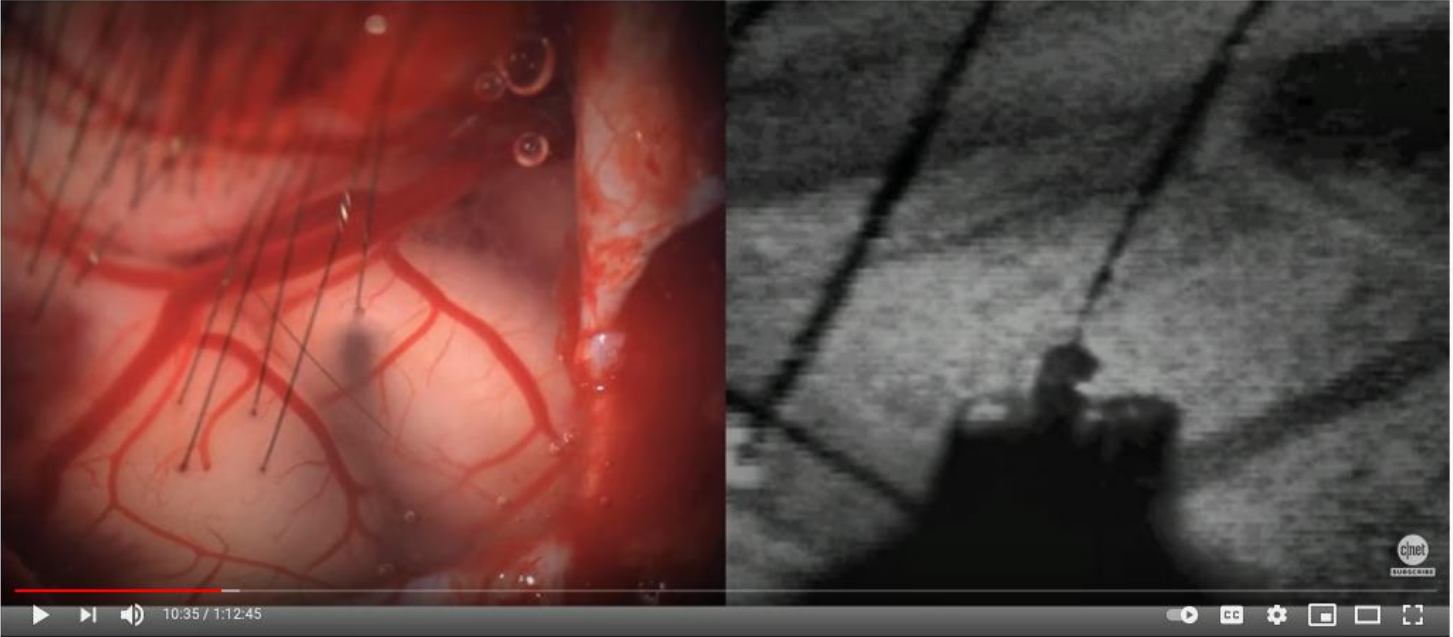


2020 Elon Musk's Neuralink

Could be great for healing disabilities if proven safe, physiologically and psychologically

<https://www.youtube.com/watch?v=iOWFXqT5MZ4>


GETTING A LINK



Watch Elon Musk's ENTIRE live Neuralink demonstration

2,350,081 views • Streamed live on Aug 28, 2020

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2025 Elon Musk's Neuralink

Could be great for healing disabilities if proven safe, physiologically and psychologically

https://www.youtube.com/watch?v=FASMeiN_5gs



Neuralink Update, Summer 2025



Neuralink
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👍 47K



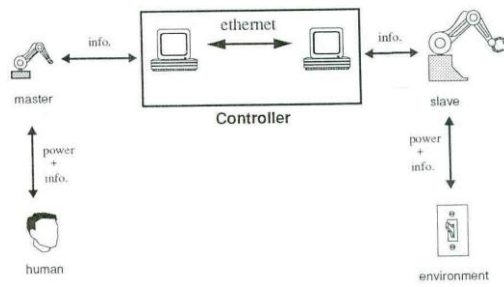
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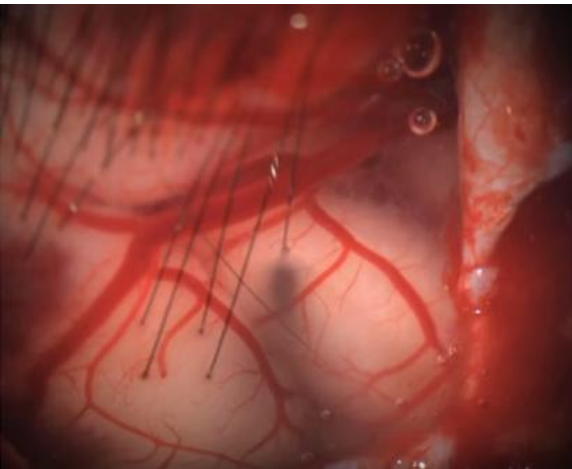
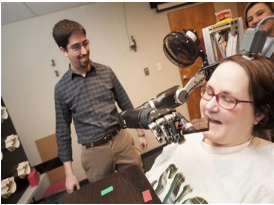
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ASSISTING THE DISABLED

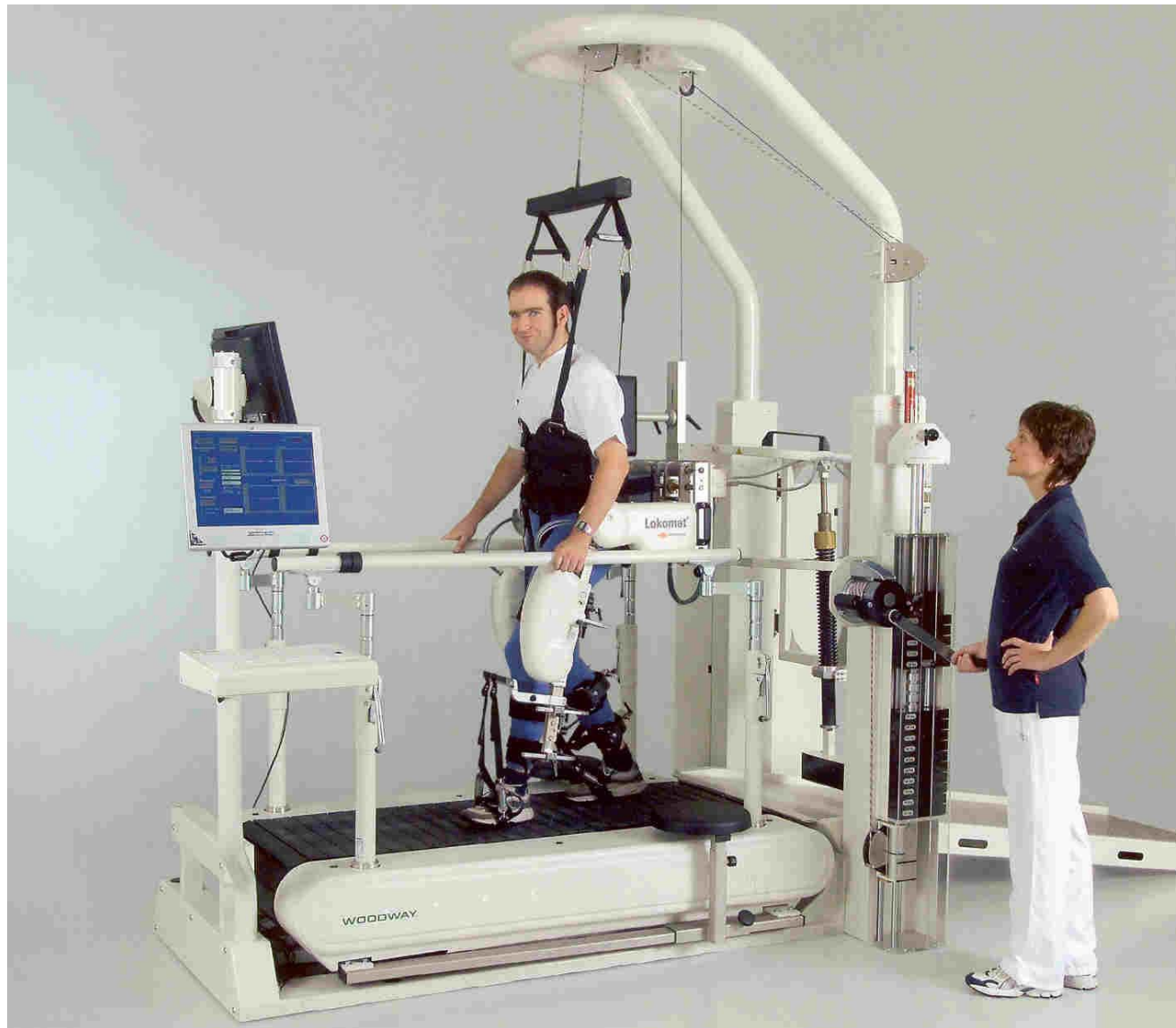


Old-School qualities lost?

None, as long as neural implants proven safe, both physiologically and psychologically



2014 Robotics-assisted Rehab for Injuries

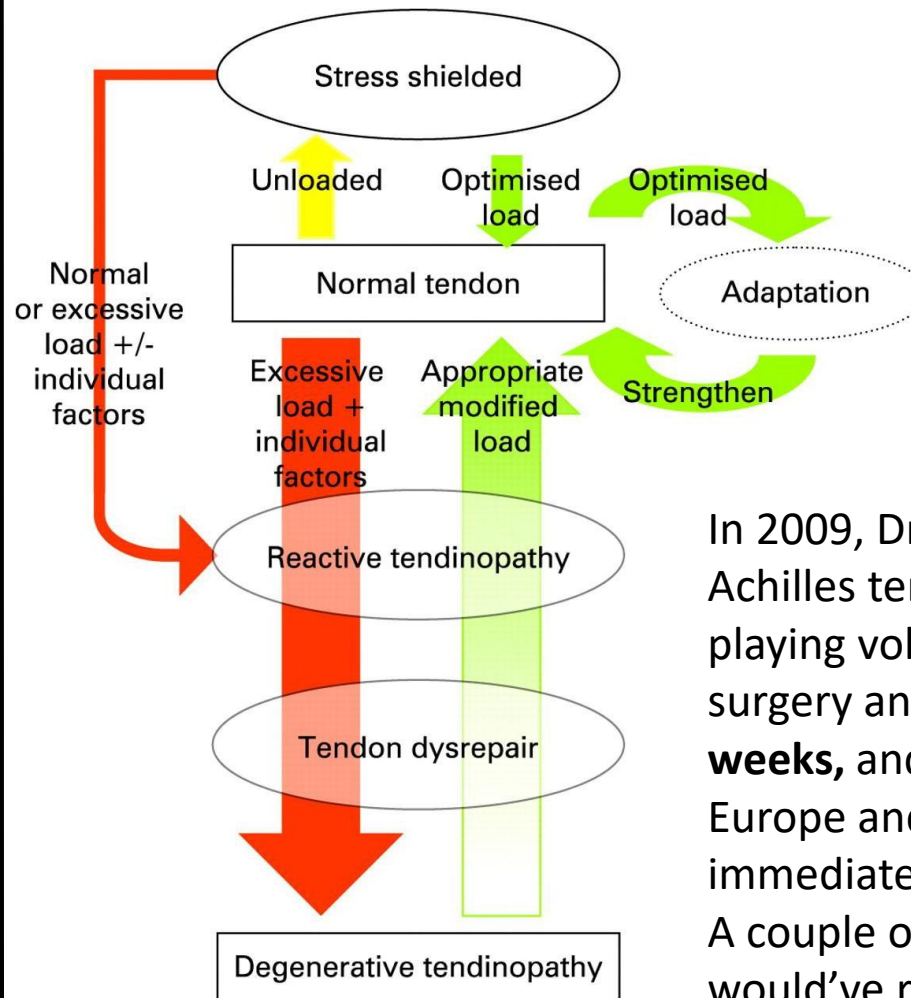


ASSISTING
REHABILITATION OF
INJURIES



Old-School qualities lost?

Added strength from healing under load
may be lost with too much assistance



In 2009, Dr W suffered a full Achilles tendon rupture while playing volleyball, but had surgery and recovered in six **weeks**, and then traveled Europe and taught in Italy immediately after.

A couple of decades ago it would've resulted in a full leg cast and a six **month** recovery !



CT Scan (CAT Scan, Computerized Axial Tomography)

MRI (Magnetic Resonance Imaging)

CT



MRI



Old-School qualities lost?



None

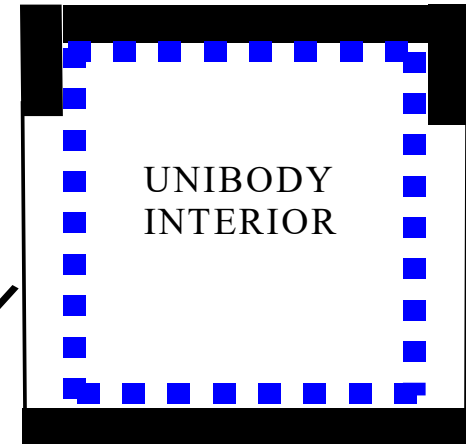
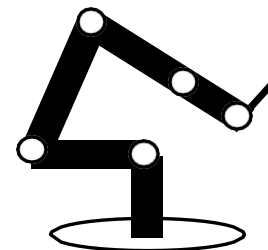




VIDEO: <https://www.youtube.com/watch?v=sjAZGUcjrP8>

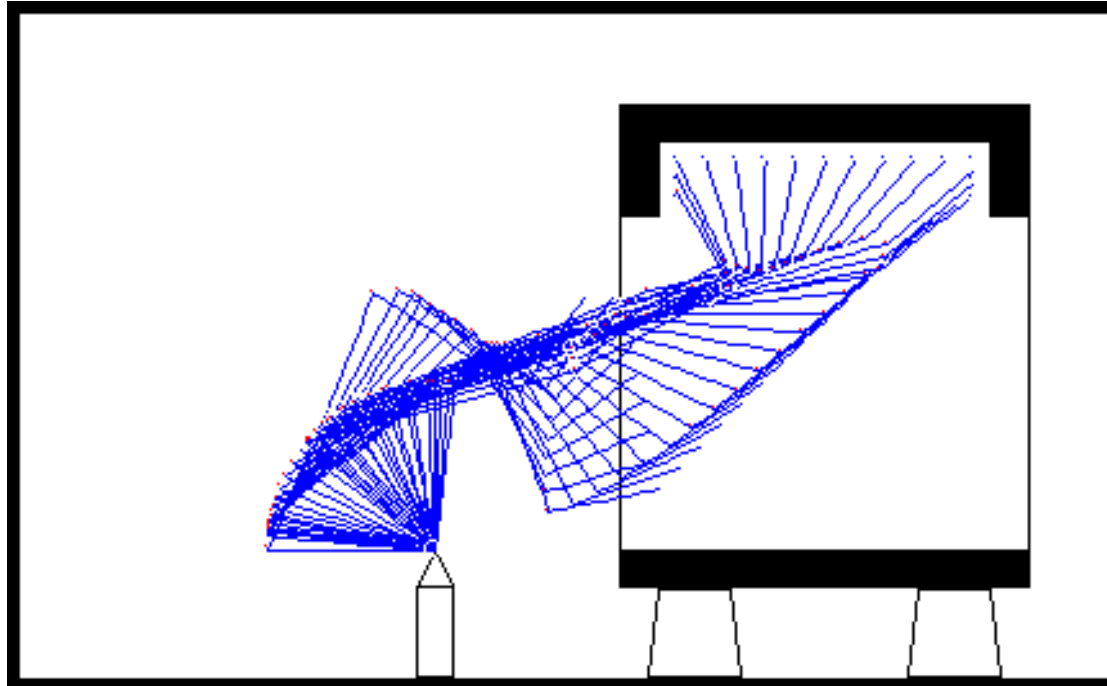


ROBOT



**1994 Wunderlich PhD Research
Designing Robotic Arms for enclosed spaces**





EXAMPLE RESULT: **New 4-DOF Design**
(Generated from an original 5-DOF design)

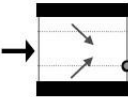
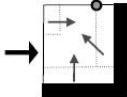
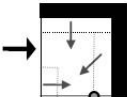
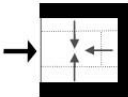
DOF means Degrees Of Freedom,
--and for this type arm it means the number of elbows



1994 Wunderlich Research Designing Robotic Arms for enclosed spaces

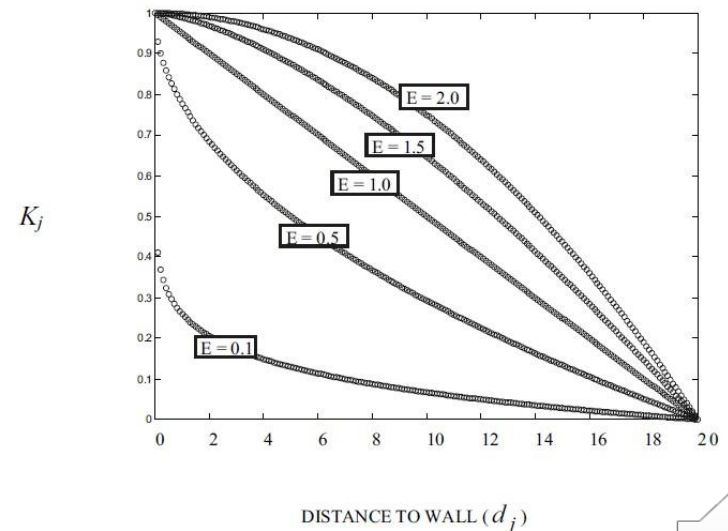
Methodology:

- 1) Create enclosure from simulation **primitives** designed to allow various specifications of “Repelling Fields” and “Local Attractors”

	TUNNEL	LEFT ELBOW	RIGHT ELBOW	TERMINATOR
ATTRACTIVE POLE (●) REPELLING ANGLES (u_j) ↗				
REPELLING FIELD WIDTH (t_j)	OUTER-BANK: 30% OF ENCLOSURE WIDTH INNER-BANK: 40% OF ENCLOSURE WIDTH	OUTER-BANK: 20% OF ENCLOSURE WIDTH INNER-BANK: 40% OF ENCLOSURE WIDTH		30% OF ENCLOSURE WIDTH
(E)	OUTER-BANK: E = 0.1 INNER-BANK: E = 1.0	OUTER-BANK: E = 0.1 INNER-BANK: E = 0.0		E = 0.1

EXAMPLE K_j 's for $t_j = 20$, $d_{ABORT} = 0$, $V_j = V_e = 1$

$$K_j = V_j V_e \left[1 - \left(\frac{d_j - d_{ABORT}}{t_j} \right)^E \right]$$

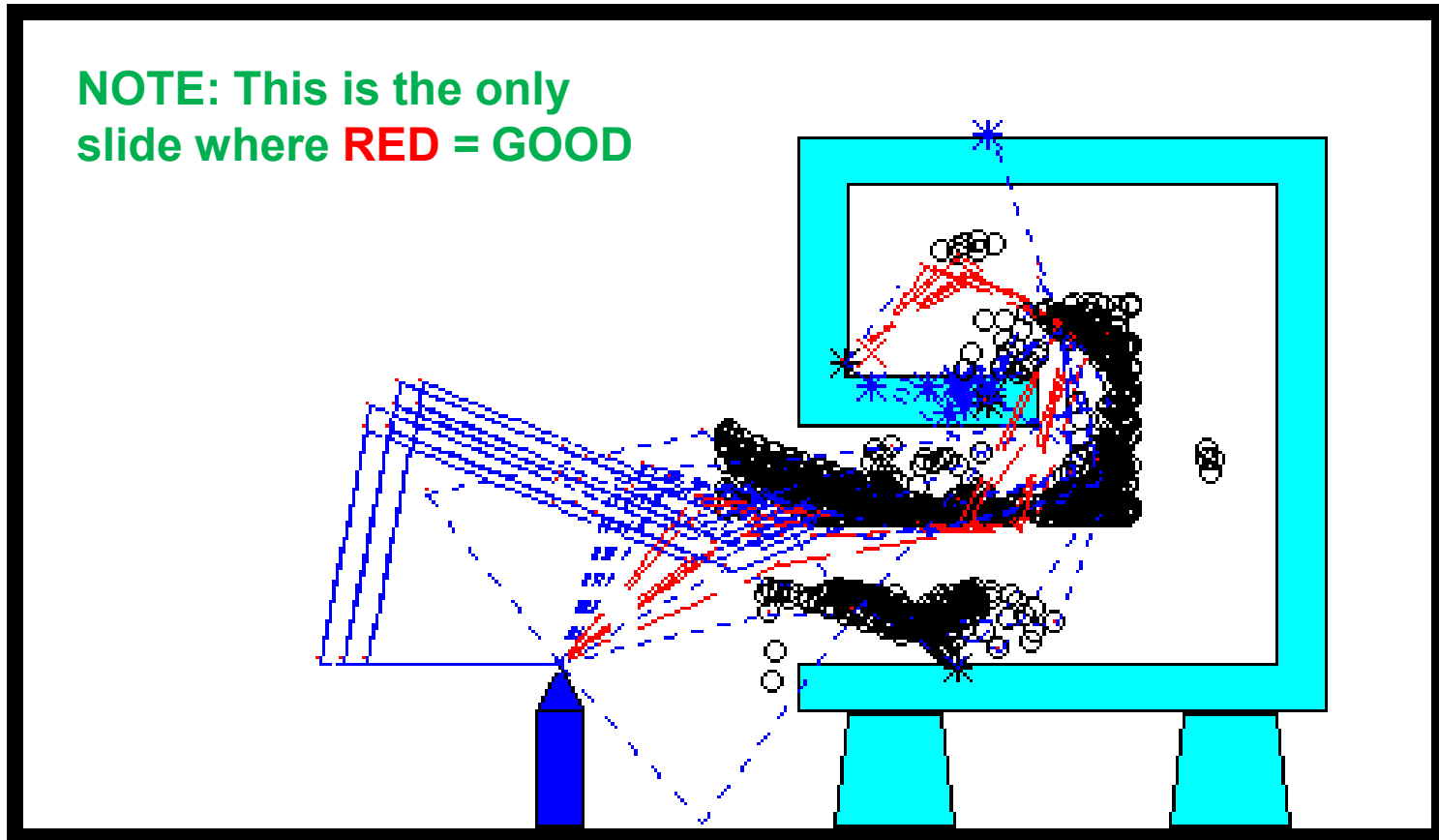


Note: If a goal or fixed-trajectory task is specified within primitive, the attractive pole is disabled and repelling-angles are set to 90 degrees.

Designing Robotic Arms for enclosed spaces

- 2) Many geometrically-feasibly designs generated by permuting link-lengths and testing candidate designs in enclosure
- 3) Successful designs used for next generation of permutations

NOTE: This is the only slide where RED = GOOD



“O” = Elbow being repelled from a surface.

Solid Blue Line = Candidate Design tested (in their initial configuration)

Dotted Blue Line = Failed Design at its final configuration (* = crash point)

Dashed Red Line = Successful Design at its final configuration (Reaching Goal at “X”)



REPETITIVE TASKS



Old-School qualities lost?

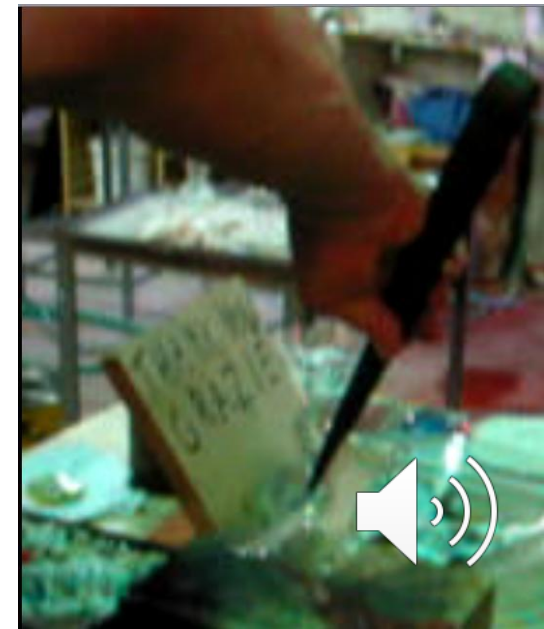
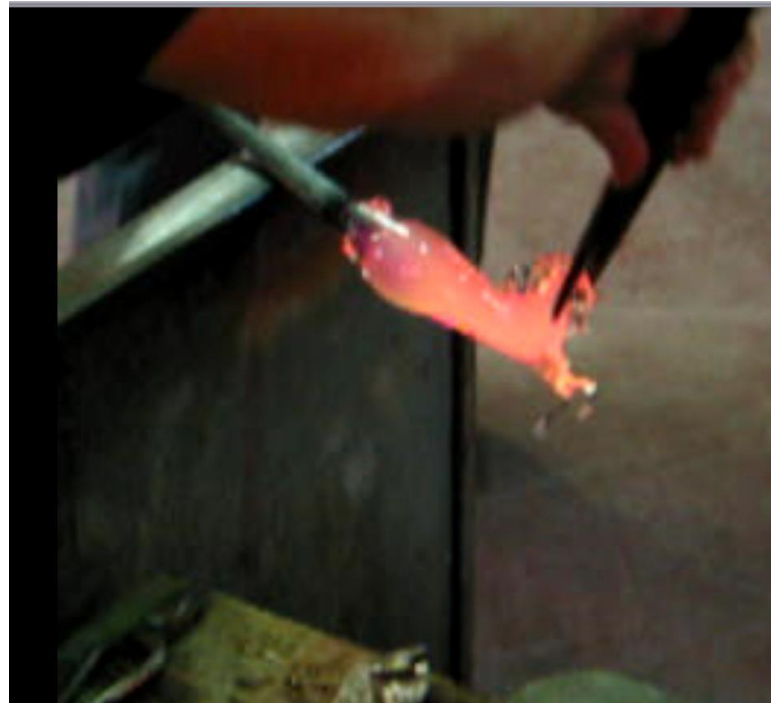
Artisans disappearing
e.g., Glass-blowing in Italy

VIDEOS by J Wunderlich 2008, Borano Italy:

http://users.etoyn.edu/w/wunderjt/personal_pictures/MVI_5139.AVI

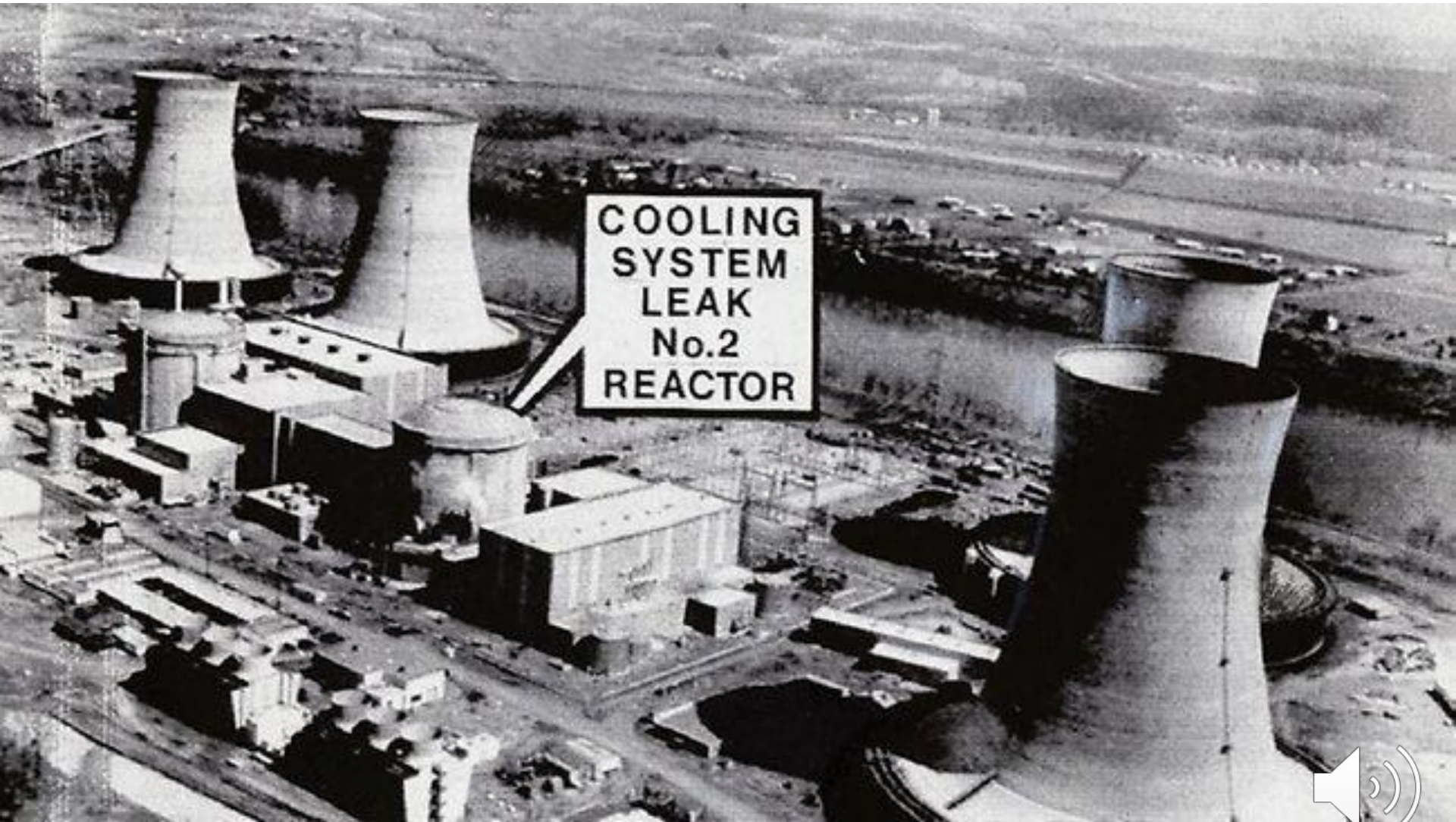
http://users.etoyn.edu/w/wunderjt/personal_pictures/MVI_5141.AVI

http://users.etoyn.edu/w/wunderjt/personal_pictures/MVI_5142.AVI



CLEAN-UP of Human or Nature's Mess

- Robots don't get sick from contamination



CLEAN-UP of Human or Nature's Mess

- 2014 US Military robots fight EBOLA
- Disinfect in minutes using ultraviolet technology



CLEAN-UP of Human or Nature's Mess

2021 HVAC Design to fight COVID

EM (Electromagnetic Radiation)
 + "UV-C DISINFECTION" can kill EBOLA! ... and COVID?

<https://www.cleanairoptima.com/info/UV-C-light/>

From JT Wunderlich lecture:
 "HUMANITY?; Human Computer Interaction (HCI), it's mostly good"

- [PDF](#)
- Listen outside of class time: [PPTX-w/Audio](#) [MP4](#) [YouTube](#)

CLEAN-UP

CLEAN-UP of Human or Nature's Mess

- 2014 US Military robots fight Ebola
- Disinfect in minutes using ultraviolet technology

SOURCE: <http://www.technology.com/ethi/robot-fights-ebola-2014-08-14/>

Slide #22 of 107

From Dr. W. 2020 Lecture in EGR353
[Green Architectural Engineering:](#)

http://users.eta.edu/w/wunderjt/Architecture%20Lectures/BOOKSTORE%20%20EGR343_Green Arch Engr CH 4 LECTURE Comfort.pdf

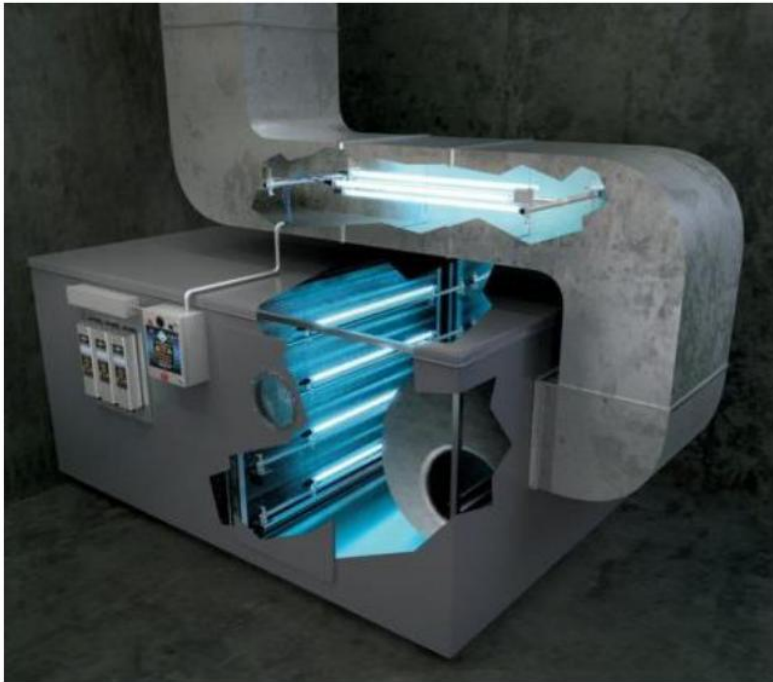


CLEAN-UP of Human or Nature's Mess

- 2021 HVAC Design to fight COVID

EM (Electromagnetic Radiation)

+ “**UV-C DISINFECTION**” can kill EBOLA! ... and COVID?



From Dr. W. 2020 Lecture in EGR353
[Green Architectural Engineering:](#)

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<https://www.achrnews.com/articles/143318-covid-19-reveals-importance-of-uv-c-in-hvac-industry?v=preview>



CLEAN-UP of Human or Nature's Mess

■ 2021 HVAC Design to fight COVID

EM (Electromagnetic Radiation)
+ "UV-C DISINFECTION" can kill COVID-19 ??
As of October 2, 2020:

https://scholar.google.com/scholar?hl=en&as_sdt=0%2C39&q=uv-c+and+btnG=

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The importance of the minimum dosage necessary for UVC decontamination of N95 respirators during the COVID-19 pandemic
S Narla, AB Lyons, I Kohli, AE Torres... - *Photodermatology* ..., 2020 - Wiley Online Library
Abstract The World Health Organization (WHO) recently released a press report highlighting the severe shortage of personal protective equipment (PPE) that is endangering healthcare workers worldwide during the COVID-19 pandemic. To meet this urgent need, healthcare ...
☆ ⓘ Cited by 17 Related articles All 6 versions ⓘ

Ultraviolet germicidal irradiation: possible method for respirator disinfection to facilitate reuse during COVID-19 pandemic
H Hamzavi, AB Lyons, I Kohli, S Narla... - *Journal of the American* ..., 2020 - Elsevier
... Key Words: N95; filtering facepiece respirators; ultraviolet germicidal irradiation; sterilize; reuse; ultraviolet C; COVID-19; pandemic Abbreviations used: FFRs = filtering facepiece respirators; UVGI = Ultraviolet germicidal irradiation; UVC = Ultraviolet C; DNA = deoxyribonucleic ...
☆ ⓘ Cited by 45 Related articles All 9 versions ⓘ

Recommendations for phototherapy during the COVID-19 pandemic
HW Lim, SR Feldman, AS Van Voorhees... - *Journal of the American* ..., 2020 - Elsevier
... The germicidal property of ultraviolet (UV) light may be helpful in limiting COVID-19 in the phototherapy unit. UVC has been used for decontamination of N95 filtering facepiece respirators during the pandemic (2). Based on extrapolation of 254 nm UVC virus inactivation data ...
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Fight against COVID-19: ARCI's technologies for disinfection
BV Sarada, R Vijay, R Johnson, TN Rao... - *Transactions of the* ..., 2020 - Springer
... (MIL) has co-developed a UVC disinfection trolley to fight against COVID-19 by a simple physical process where rapid cleaning is possible within few minutes especially in hospital settings avoiding the use of harsh chemicals ...
☆ ⓘ Cited by 1 All 3 versions ⓘ

Effectiveness Study of Disinfection of Microbes by Innovation Robotic UVC Radiation: Response to COVID-19 Pandemic
P Vorapaluk - *Thai Journal of Anesthesiology*, 2020 - he02.tci-thaijo.org
... Effectiveness Study of Disinfection of Microbes by Innovation Robotic UVC Radiation: Response to COVID-19 Pandemic ... **Original Article Background:** During the COVID-19 pandemic, many patients have been quarantined and hospitalized. Healthcare providers thus ...
☆ ⓘ View as HTML ⓘ

JT Wunderlich PhD

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http://users.etown.edu/w/wunderjt/Architecture%20Lectures/BOOKSTORE%20%20EGR343_Green Arch Engr CH 4 LECTURE Comfort.pdf




CLEAN-UP of Human or Nature's Mess

2021 HVAC Design to fight COVID


Generation and Behavior of Airborne Particles (Aerosols)

Paul Baron
Division of Applied Technology
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention



Toxic Aerosols!?

Our respiratory system is efficient at removing aerosols, but if they fall within particular size ranges, are highly concentrated, or toxic, they may cause adverse health effects. They may also deposit on skin or eyes, generally only causing irritation, though more toxic effects may occur. Very small particles may pass through the skin and enter the body that way. Soluble particles may dissolve and pass through the skin.

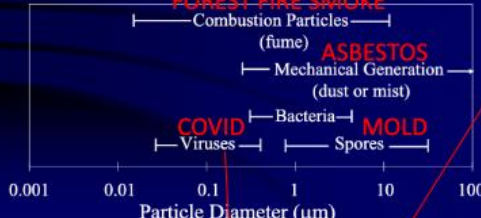


Read on for more details on aerosol generation and behavior

https://www.cdc.gov/niosh/topics/aerosols/pdfs/Aerosol_101.pdf

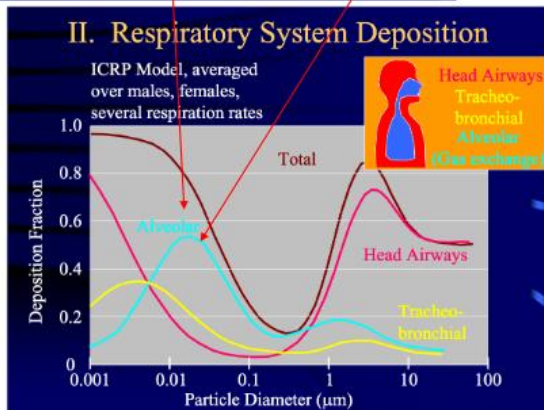
I. Aerosol Size Range

Particle size is often determined by the process that generated the particle. Combustion particles usually start out in the 0.01-0.05 μm size range, but combine with each other (agglomerate) to form larger particles. Powder is broken down into smaller particles and released into the air; it is difficult to break down such particles smaller than $\sim 0.5 \mu\text{m}$. Biological particles usually become airborne from liquid or powder forms, so these particles are usually larger than $\sim 0.5 \mu\text{m}$.



AVEOLAR means it is getting into your bloodstream through your lungs

1 $\mu\text{m} = 10^{-6}$ meters



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[Green Architectural Engineering:](http://users.etown.edu/w/wunderjt/Architecture%20Lectures/BOOKSTORE%203%20EGR343_Green_Arch_Engr_CH_3_Lecture_Thermodynamics.pdf)

http://users.etown.edu/w/wunderjt/Architecture%20Lectures/BOOKSTORE%203%20EGR343_Green_Arch_Engr_CH_3_Lecture_Thermodynamics.pdf



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2021 HVAC Design to fight COVID

From Dr. W. 2020 Lecture in EGR353 [Green Architectural Engineering:](#)

<https://www.youtube.com/watch?v=KceVQIDvfgc&list=PLK3MJsXEYEQJThBd-lz6zdrLrk-CLifU&index=23>

SOURCES

- [1] Ching, Francis D.K. *Architecture: Form, Space, and Order*. 4 ed., Wiley, 2014.
- [2] Wright, Frank Lloyd. *The Natural House*. Bramhall House; 1954.
- [3] Storrer, William A. *The Architecture of Frank Lloyd Wright, Complete Catalog*. 4TH ed. U. of Chicago Press, 2017.
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- [8] *PENN Rare Book and Manuscript: Frank Lloyd Wright's Paternal Family*. Penn Library. University of Pennsylvania, Feb. 20, 2014. <http://www.library.upenn.edu/rbm/featured/mscoll822.html>
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- [11] Wright, Frank Lloyd. *The Art and Craft of the Machine*, Vol. 8, No. 2 pp. 77-81, 83-85, 87-90, May, 1901. <https://www.jstor.org/stable/pdf/25505640.pdf>
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- [13] Wright, Frank Lloyd. *In the Cause of Architecture; Second Paper*. Architectural Record, May 1914.
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- [15] Norbert Lechner, *Heating, Cooling, Lighting: Sustainable Design Methods for Architects*, Wiley; 4th edition, October 13, 2014.
- [16] Allan, Edward and Iana, Joseph, *Fundamentals of Building Construction: Materials and Methods*. Wiley; 7th edition (October 15, 2019).

Personal Architecture projects in Texas, California, and Pennsylvania

BS Architectural Engineering (U.Texas 84)

1-1/2 years of Urban Design (UCSD 1986-87)

Education and experience for past 40 years applicable towards licensing as both a Professional Engineer and a Registered Architect

Frequent international travel pictures of Architecture and Urban Design



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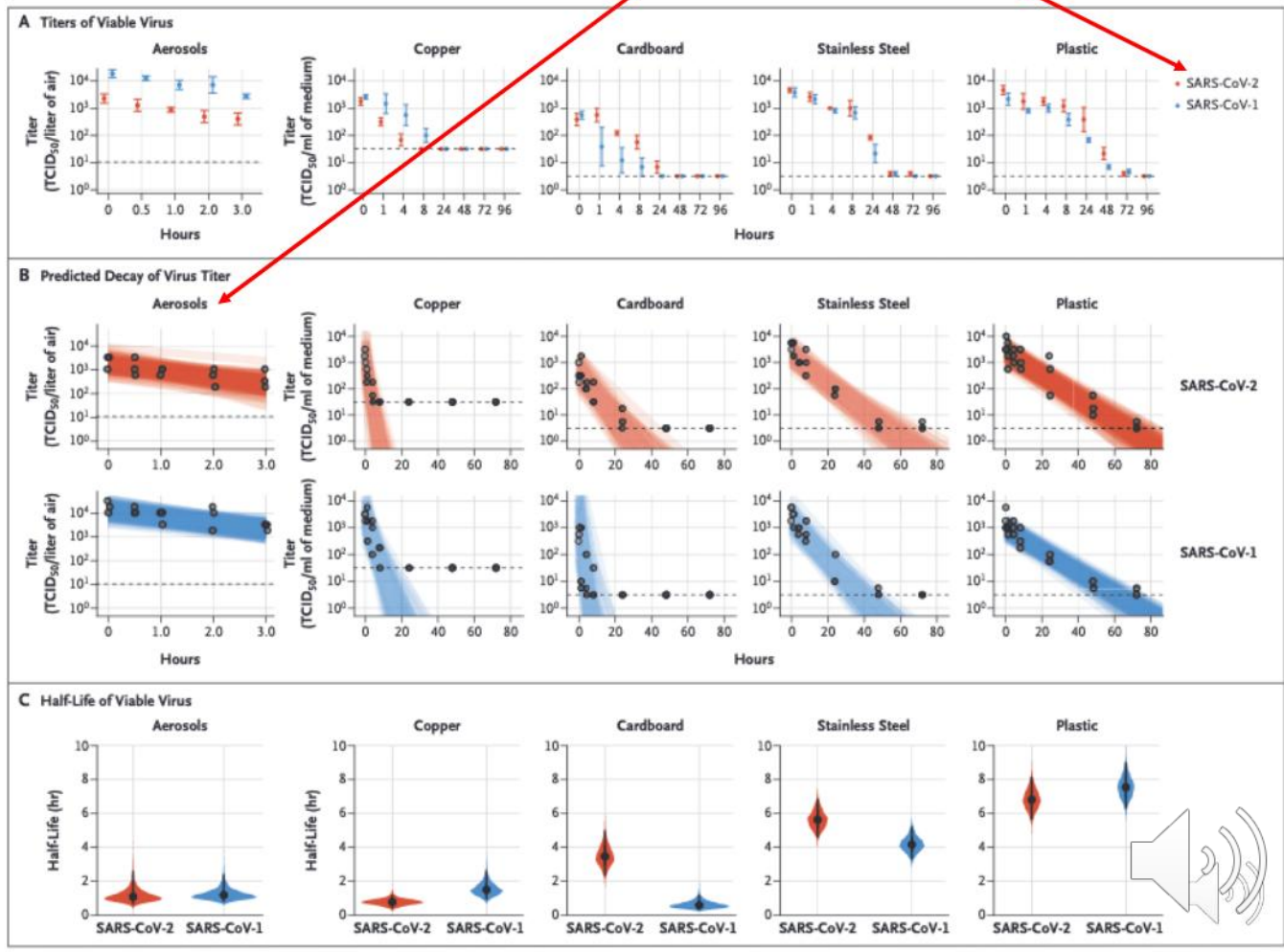
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SHELL -> ENVELOPE

CONTROL AIR FLOW for **Fresh Air (let it in)**
(2020 "Covid-19" SARS-Cov-2 Coronavirus Pandemic)



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 N ENGL J MED 382:16 NEJM.ORG APRIL 16, 2020
 The New England Journal of Medicine



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SHELL -> ENVELOPE



Shaping Tomorrow's
Built Environment Today

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Darryl K. Boyce, P.Eng, FASHRAE
2019-20 President

Special Advisor, Vice President
(Finance and Administration)
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darryl.boyce@carleton.ca

ASHRAE

American
Society
of
Heating,
Refrigeration,
and
Air-conditioning
Engineers

March 23, 2020

Dr. Tedros Adhanom Ghebreyesus
Director General
World Health Organization
Avenue Appia 20
1211 Geneva
Switzerland

Dear Director General:

As the world responds to the coronavirus disease (COVID-19) pandemic, we want to thank the World Health Organization for its leadership in preventing further spread of the disease and ensuring that accurate scientifically-based information is provided to the media and the public.

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating ventilation, air conditioning, refrigeration and their allied fields. We write to you **to offer our expertise and resources** to help limit the spread of the disease in buildings, including hospitals and emergency care centers. With over 57,000 ASHRAE members in 192 chapters located in 132 countries, these resources and technical assistance can be readily disseminated around the world.

ASHRAE has developed proactive guidance to help address COVID-19 concerns with respect to the operation and maintenance of heating, ventilating and air-conditioning systems. [This webpage](https://www.ashrae.org/technical-resources/resources) provides easily accessible resources that can be provided on a complimentary basis to government entities, which include:

- **Isolation Rooms and other Health-Related Spaces:**
 - How to ensure negative pressure airflow to prevent airborne contaminants, bacteria and viruses from escaping the isolation room
 - How to control the air change rate, temperature and humidity with effective controls
 - How to monitor indoor air quality and particulate counts, and how to alert building operators when needed
 - ASHRAE's Technical Committees (TCs) can provide technical guidance on:

CONTROL
AIR FLOW



<https://www.ashrae.org/technical-resources/resources>



CLEAN-UP of Human or Nature's Mess

2021 HVAC Design to fight COVID

From Dr. W. 2020 Lecture in EGR353 [Green Architectural Engineering](#):

<https://www.youtube.com/watch?v=KceVQIDvfgc&list=PLK3MJsXEYEQJTnhBd-lz6zdrLrk-CLifU&index=23>

SHELL -> ENVELOPE

Dr. Tedros Adhanom Ghebreyesus
Page 2
March 23, 2020

CONTROL AIR FLOW for Fresh Air

- Healthcare Facilities (TC 9.6)
- Laboratory Systems (TC 9.10)
- Clean Spaces (TC 9.11)
- **Ventilation, Filtration and Air Cleaning**
 - How to ensure that occupants in quarantine have healthy indoor environments
 - How to monitor indoor air quality
 - Whether occupants should operate windows
 - Use of ASHRAE Standard 62 for proper ventilation in commercial and residential buildings
 - Use of ASHRAE Standard 170 for proper ventilation in health-care facilities
 - Use of ASHRAE Standard 52.2, *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size*
 - Use of ASHRAE's *Indoor Air Quality Guide* for health care intake and waiting areas, crowded shelters, and similar facilities.
 - Use of ASHRAE's *Position Document on Airborne Infectious Diseases*, which identifies ventilation, particle filtration and UVGI as controls that are demonstrated to be effective.
- **HVAC Systems Design and O&M to prevent spread**
 - How to ensure systems are controlling spread of viruses
 - How to ensure proper use of ventilation rates, airflow regimes, filtration, and ultraviolet germicidal irradiation
 - Whether and how to filter or clean indoor air to protect occupants
 - ASHRAE's Technical Committee 2.9, "Ultraviolet Air and Surface Treatment" can provide additional technical assistance with all aspects of equipment and systems that utilize ultraviolet radiation to destroy or deactivate chemical and/or biological air and surface contaminants in HVAC systems and indoor spaces.

HVAC&R systems play an important role in preventing the spread of infectious disease, and ASHRAE stands at the ready to help provide resources and answer questions. Our vision is to create a healthy and sustainable built environment for all, and we offer our assistance to realize this goal. Please do not hesitate to contact me at Darryl.boyce@carleton.ca. Thank you.

Sincerely,



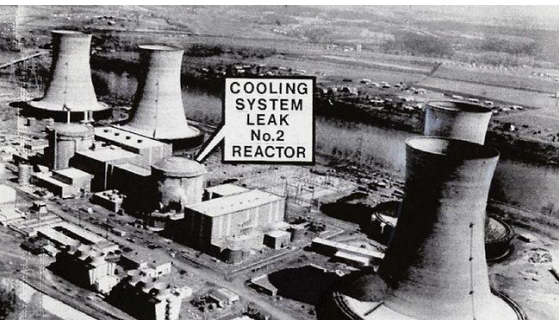
Darryl Boyce, P. Eng., FASHRAE
ASHRAE President, SY2019-20



Robotic Snow Plow

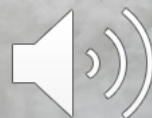
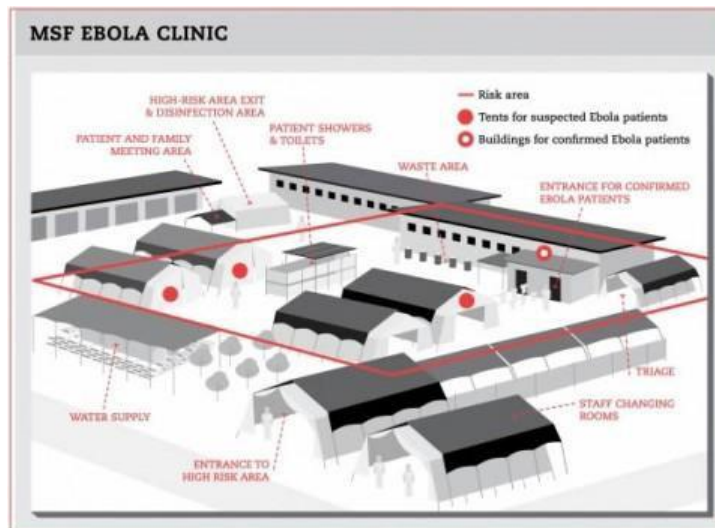
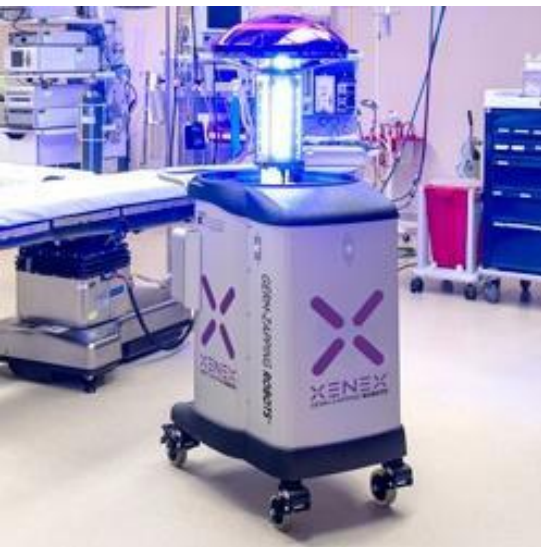


CLEAN-UP



Old-School qualities lost?

Robots can substitute for humans in unsafe conditions, however personal attention could become less likely. VIDEO: <http://www.pbs.org/wgbh/pages/frontline/ebola-outbreak/>



2021 Mars Rover (& Helicopter) “PERSEVERANCE”

<https://mars.nasa.gov/mars2020/>

The screenshot shows the NASA Mars 2020 Mission website. At the top left is the NASA logo and the text "NASA Science MARS 2020 MISSION PERSEVERANCE ROVER". At the top right is a navigation menu with links for "Mission", "Timeline", "Spacecraft", "News", "Multimedia", "Participate", and "All Mars", along with a search icon. The main content area features a large image of the Perseverance rover and the Ingenuity helicopter on the Martian surface. A text overlay on the image reads "Fifth Flight Successful MARS HELICOPTER STATUS UPDATE". Below this, a smaller text overlay says "Mars Helicopter Completes First One-Way Trip". At the bottom, there are four main navigation sections: "RAW IMAGES" (2,056 New | 62,791 Total), "MISSION" (Overview), "SOLS ON MARS" (78 : 04 : 15 : 15), and "ROVER" (Meet Perseverance). A speaker icon is visible in the bottom right corner.

NASA Science
MARS 2020 MISSION
PERSEVERANCE ROVER

Mission Timeline Spacecraft News Multimedia Participate All Mars

Fifth Flight Successful
MARS HELICOPTER
STATUS UPDATE

Mars Helicopter Completes
First One-Way Trip

RAW IMAGES
2,056 New | 62,791 Total

MISSION
Overview

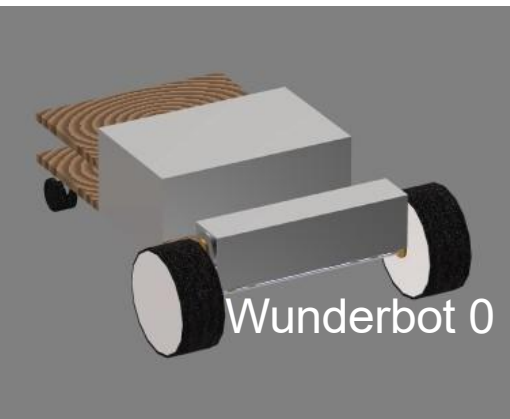
SOLS ON MARS
78 : 04 : 15 : 15
SOL HRS MINS SECS

ROVER
Meet Perseverance

1999-2012

Etown Wunderbots

http://users.etown.edu/w/wunderjt/Weblab_archive.htm



EXPLORATION

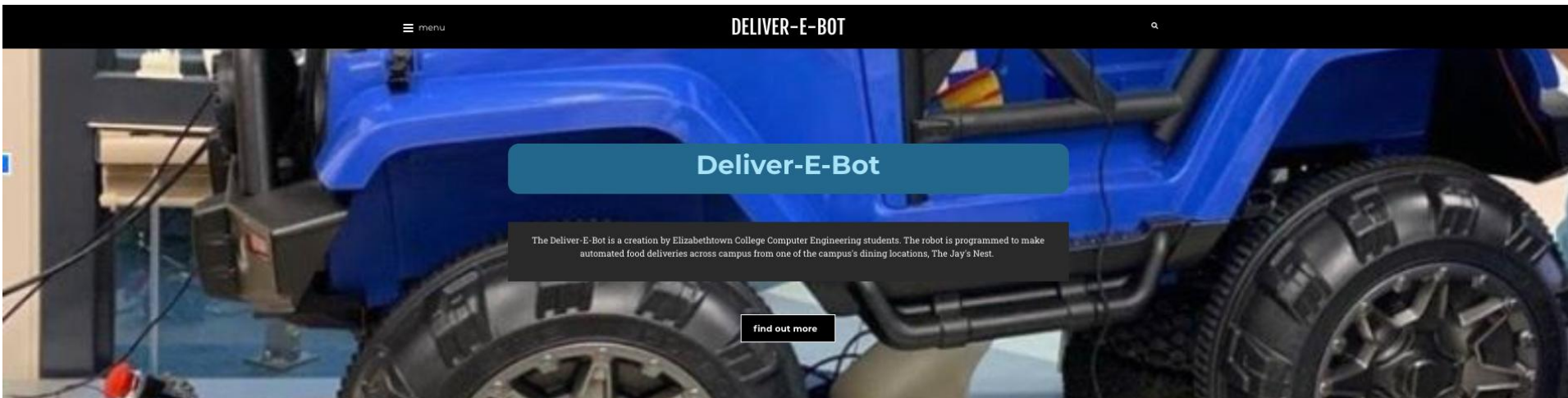
<http://www2.etown.edu/wunderbot/>



2020's E-Bot 9 (Deliver-E-Bot)

EXPLORATION

<http://deliver-e-bot.weebly.com/>



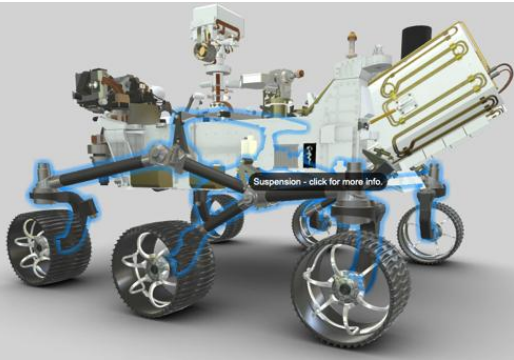
Documentation

The Deliver-E-Bot has now been worked on by two generations of senior students. Here you can find the robots diagrams as well as documentation of the past work on the robot.

[find out more](#)



EXPLORATION



Old-School qualities lost?

Safer than sending humans to distant worlds,

But Human-to-human first-contact, and general **diplomacy**, could diminish in other applications



2014 "BEAR" (Battlefield Extract Assist Robot)

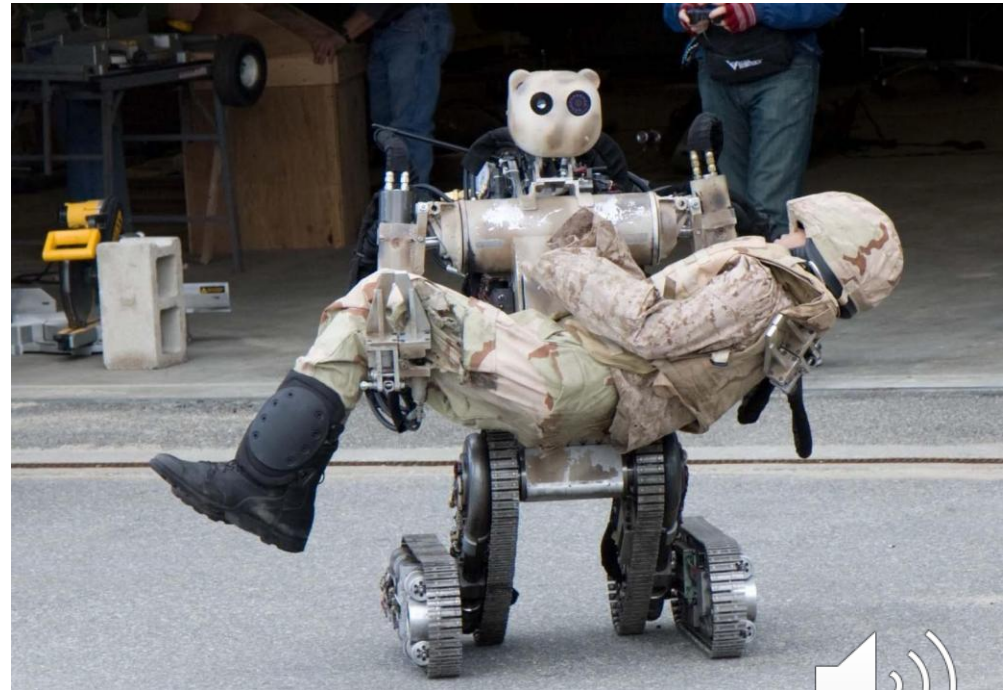


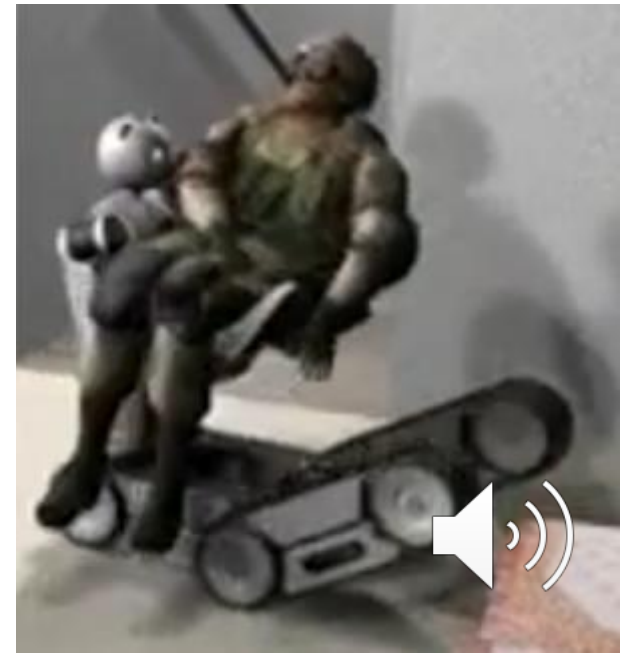
Image from : http://www.pirotechnologies.com/wp-content/uploads/2014/11/military_battlefieldbear_800_070623.jpg

Image from : <http://www.pouted.com/wp-content/uploads/2013/02/bear-robot.jpg>

2015 "BEAR" (Battlefield Extract Assist Robot)

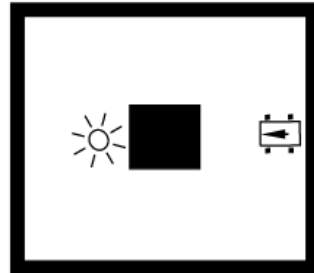


<https://www.youtube.com/watch?v=8Nv6GGNA3Z4>

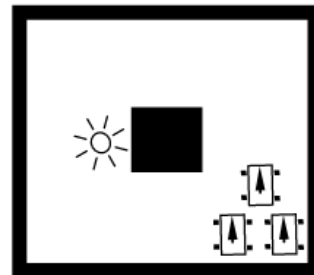


2000 Etown Robot Team for Search and Rescue

The above problem was successfully completed by three groups of students^{2,3,5} in the Fall, 2000 "Simulation & Modeling Physical Systems" course¹ at Elizabethtown College. On the day of demonstrations, the professor defined the light location and initial robot location(s) and orientation(s) as shown in Fig. 5.



(a)



(b)

Wunderlich, J.T. (2001). **Simulation vs. real-time control; with applications to robotics and neural networks.** In *Proceedings of 2001 ASEE Annual Conference & Exposition, Albuquerque, NM: (session 2793)*, [CD-ROM]. ASEE Publications. [PAPER](#)

Figure 5. Light location and initial robot location(s) and orientation(s) defined by professor on day of demonstration. a) Single-robot task. b) Multi-robot task.



2002 Etown Robot Team for Search and Rescue

Proceedings of 2002 JUSFA:
2002 Japan-U.S.A Symposium on Flexible Automation
July 15-17, 2002 Hiroshima, JAPAN

U-007

DEVELOPMENT OF AN INTERACTIVE SIMULATION WITH REAL-TIME ROBOTS FOR SEARCH AND RESCUE

D. A. Campos, Elizabethtown College
camposda@etown.edu

J. T. Wunderlich, Elizabethtown College
wunderjt@etown.edu

ABSTRACT

This research involves the use of cooperative mobile robots for use in search and rescue. A two-part process uses the analysis from a concurrent simulation that directs actions of surveying robots in the field while modeling the robots' environment. Expanding the simulation part of the network leaves room for study of different scenarios.

INTRODUCTION

Three mobile robots have been built and programmed for search and rescue. The general problem is the development of cooperative mobile robots commencing a search and rescue effort through the use of an interactive simulation. This paper addresses the issue of having variable data monitored by a single simulation and affirming the possibility of search and rescue given the constraints of the relatively inexpensive mobile robots. Communication between robots can be monitored with the use of a LEGO Mindstorm IR tower. After establishing the link with the robots a closed-loop system was developed to produce findings through the surveying robots in the field.

The main robot used is the Scout that gathers the fundamental data to be processed in the simulation once returned via Datalog. All of the mobile robots are programmed using the Not-Quite-C (NQC) programming language described

The results of the Datalog return to the CPU in a file with corresponding variable numbers and values.

The MATLAB simulation can be used to interpret the encoded data. Such software was chosen due to the ease of creating the simulation environment and manipulability of mathematical modeling. The simulation window in Figure 1 shows the anticipated path taken by the robot from the data.

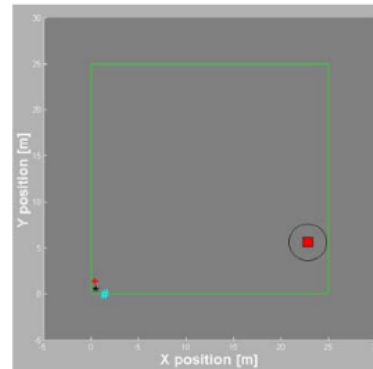


Figure 1: Simulation Output Window. Grey designates unknown area, robots shown: scout (black), medic (blue), fire-suppressant (red), and a light source (red).

Campos, D. and Wunderlich, J. T. (2002). **Development of an interactive simulation with real-time robots for search and rescue.** In *Proceedings of IEEE/ASME Int'l conference on Flexible Automation, Hiroshima, Japan: (session U-007).* ASME Press. [PAPER](#)



Robots great for extraction of people in natural or man-made disasters where EMT's not available.

From Dr. W. 2020 Lecture in [Architectural Materials & Methods](#) course:

http://users.etaoin.edu/w/wunderjt/Architecture%20Lectures/371%20Materials&Methods/ART371_Materials&Methods%20Lecture%20%20STRUCTURAL%20Concepts.pdf

Structural Failure Analysis

STEEL

- 1989 San Francisco Bay Area Earthquake
 - ▣ "Loma Prieta Earthquake," Magnitude 6.9



NOTE: J Wunderlich worked for PSI inc. in LaFayette CA as a Structural and Environmental Engineer until one year before this earthquake, and often commuted over this bridge at the time of this earthquake

Robots are no substitute for EMT skills at the scene



Old-School qualities lost?

Robots great for battlefield extraction
of wounded soldiers !

Robots great for extraction of people
in natural or man-made disasters where
EMT's not available.

But robots are no substitute for EMT skills at
the scene

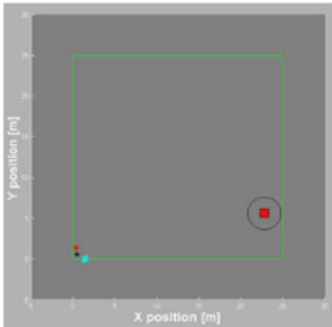
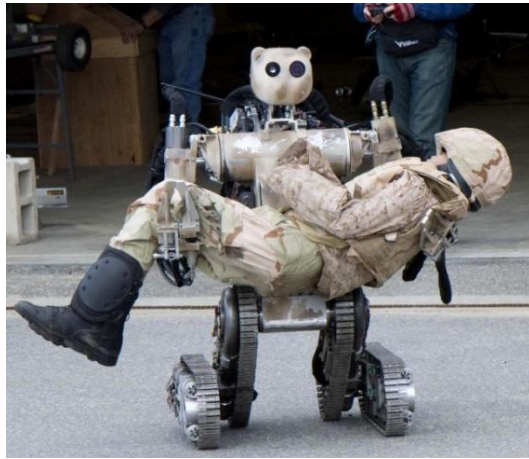


Figure 1: Simulation Output Window. Grey designates unknown area, robots shown: scout (black), medic (blue), fire-suppressant (red), and a light source (red).







New-School



Old-School qualities lost?

TEDIOUS TASKS

Home delivery **installation** disappearing



Package- delivery **accountability** disappearing





Customer Service

VIDEO: <https://www.youtube.com/watch?v=QBU2GYxs1uc>





2017 Boston Dynamics "Atlas"

VIDEO:

<https://www.youtube.com/watch?v=fRj34o4hN4I>



Laborer?

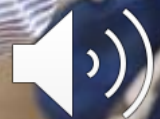
New-School



Old-School qualities lost?

TEDIOUS TASKS

Human-interaction disappearing



“Repliee Q2 can mimic such human functions as blinking, breathing and speaking, with the ability to recognize and process speech and touch, and then respond in kind.”

VIDEO:

<http://www.youtube.com/watch?v=rOqfrM8aiOQ>



2015 Japanese hotel staffed by robots



New-School



Old-School qualities lost?

CUSTOMER SERVICE

Sincere **Hospitality** (genuine empathy)
could disappear



2011 Companion NAO Next Gen

COMPANIONS



2014 **VIDEO** (NAO and Asimo in first 12 minutes): <https://www.youtube.com/watch?v=S5AnWzHtWA>



2014 Companion Jibo

COMPANIONS



VIDEO: <https://www.youtube.com/watch?v=UKERTiraS08>

2017 HONDA ASIMO



First edition in 2000

“Advanced Step in Innovative Mobility”

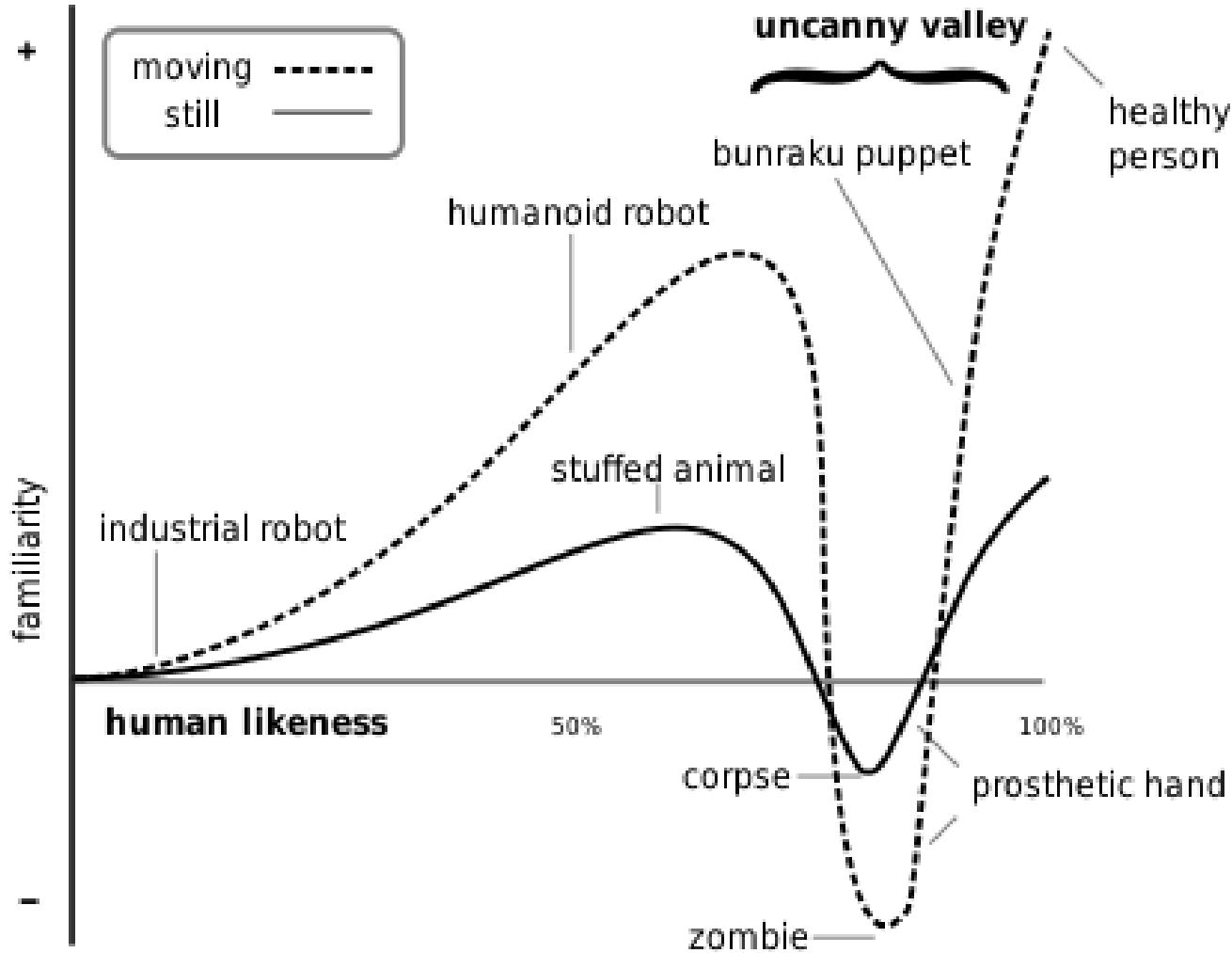
<https://www.youtube.com/watch?v=QdQL11uWWcl>

2017 VIDEO:

https://www.youtube.com/watch?v=fQ3EHtEI_NY



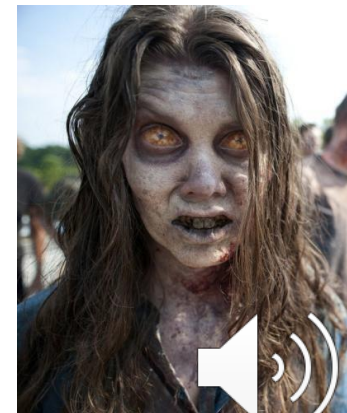
“Uncanny Valley” frightens humans



Honda's "Asimo"



Bunraku Puppet



Zombie

Image from: http://upload.wikimedia.org/wikipedia/commons/thumb/f/f0/Mori_Uncanny_Valley.svg/450px-Mori_Uncanny_Valley.svg.png

Image from: http://www.21stcentury.co.uk/robotics/honda_asimo_robot.asp

Image from: http://www.21stcentury.co.uk/robotics/honda_asimo_robot.asp

COMPANIONS



Old-School qualities lost?

Less human relationships ?

PERSONAL



ITALY TRIPS (six)
and Belgium, Switzerland,
Austria, Germany, England



JAPAN TRIP



PARIS TRIP
and Belgium & Germany



FAMILY PHOTO'S



JUDO

https://users.etown.edu/w/wunderjt/home_personal.html

UBIQUITOUS COMPUTING

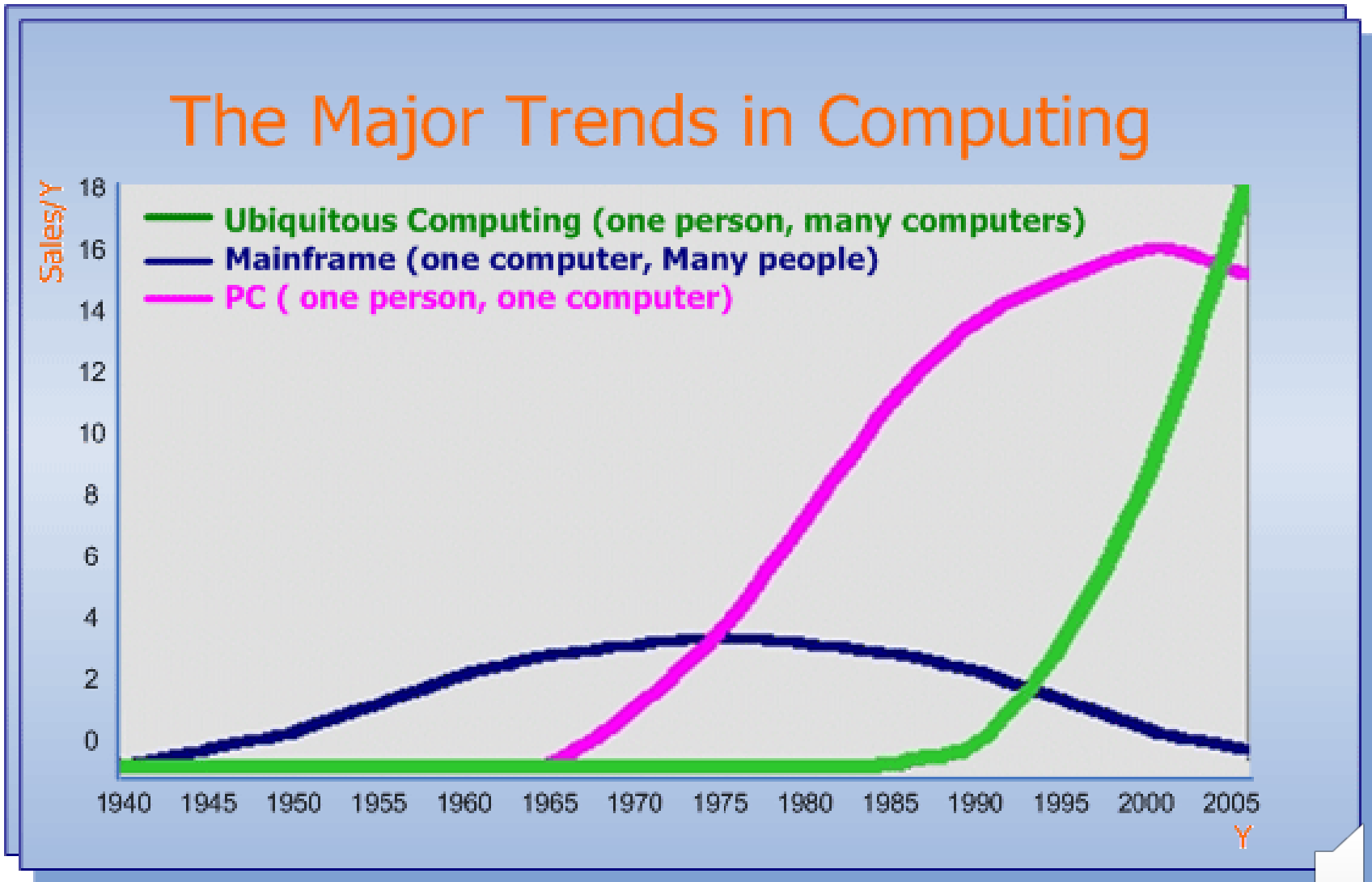
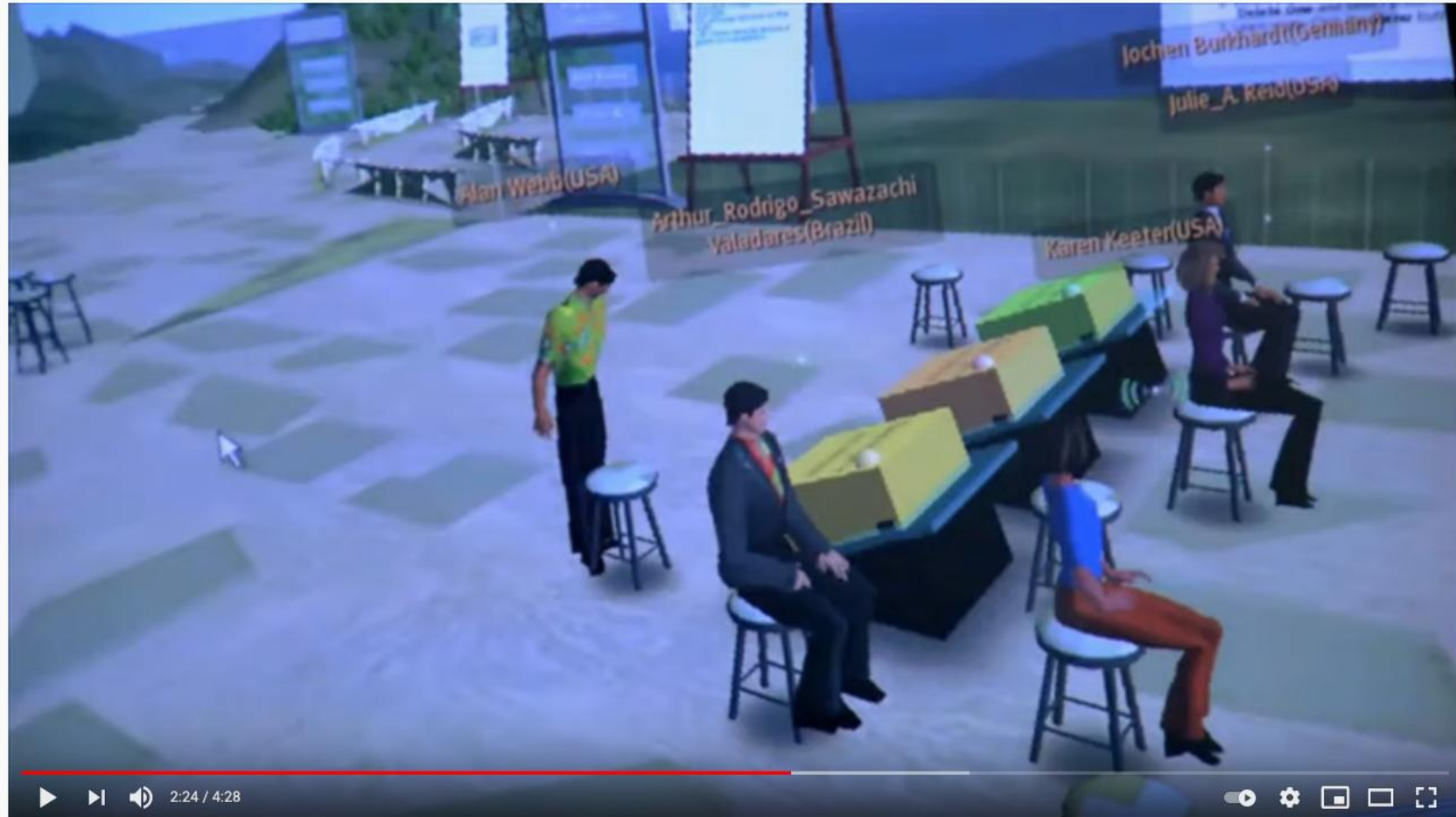




Image from: http://www.visualphotos.com/photo/2x4176453/a_girl_with_a_pacifier_sitting_at_the_computer_1832372.jpg

But prolonged staring at screens proven in the early 2000s to be detrimental to both psychological and physical health ... and we really don't multitask as well as we believe

<https://www.youtube.com/watch?v=-6PRIGW6pgA>



Digital Nation Trailer

40,941 views • Jan 11, 2010



DigitalNation
570 subscribers

👍 59 💬 5 ➦ SHARE



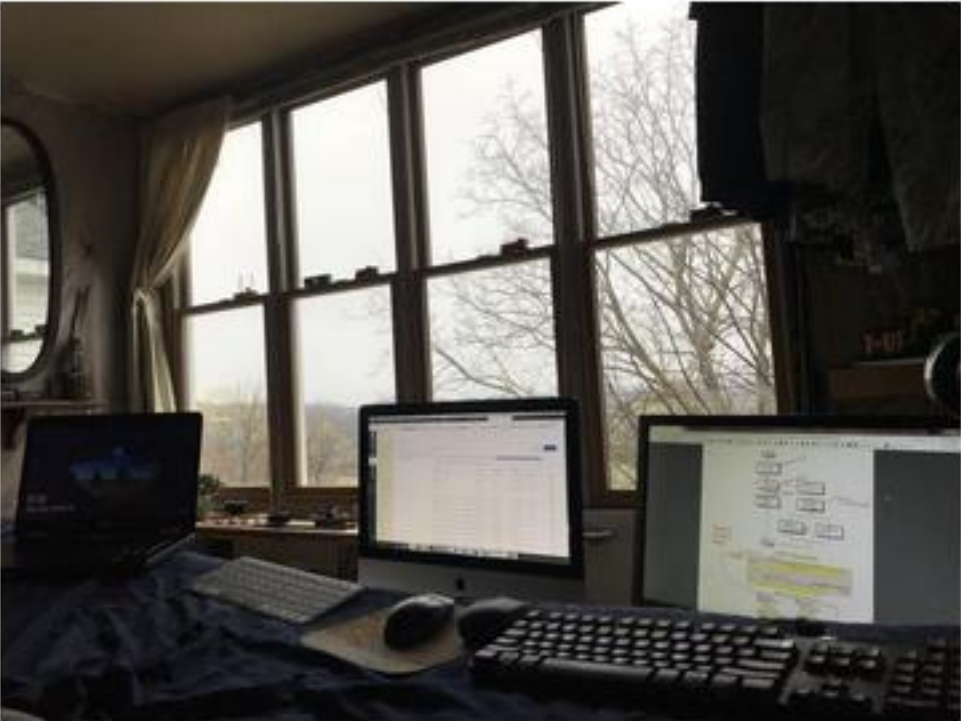
2020/21 COVID PANDEMIC forced the world onto screens !

LEARNING

But it wasn't all bad; **we found new ways to adapt**

Joseph Wunderlich PhD
Elizabethtown College Engineering, Computing, and Architecture
1yr • 🌐


Building redundancy and repeatability into my compressed audio-embedded-PPTX lectures loaded onto both "Canvas" and my website (<http://users.etown.edu/w/wunderjt>): and supplemented with my Youtube Channel, and simultaneous Zoom and group-chats via one "main-thread" email subject heading per course



👍❤️ 7

👍 Like 💬 Comment ➦ Share ↗ Send

📊 535 views of your post in the feed



2020/21 COVID PANDEMIC forced the world onto screens !

But it wasn't all bad; in fact **some things worked really well:**

https://www.youtube.com/watch?v=yw20TDUH9_M&iist=PLK3MJsXEYEQKF4_95bb7pwFohly4qZfz&index=1

The screenshot shows a Logisim simulation of a CPU. The main workspace contains several interconnected components:

- Special Registers:** IR, PC, A, B, F registers with their respective control signals (D, Q, WE, CK).
- General Registers:** R0 through R7, each with D, Q, WE, and CK signals.
- CodeMemory:** ROM 64k x 16, containing a list of instructions.
- DataMemory:** RAM 256 x 8, containing data values.
- ALU:** Arithmetic Logic Unit with inputs A, B and control signals F, X, Y.
- CU (Control Unit):** Manages instruction flow and flags.
- MUX (Multiplexers):** Used for selecting between registers and ALU results.
- DMX (Demultiplexer):** Used for routing data from memory to registers.

On the left, the 'Registers' tab is active, showing the circuit name 'CPU' and VHDL architecture details. A video player interface is visible at the bottom, indicating the video is at 1:41 / 32:00.



2020 EGR/CS433 CPU Design by J. Freaney and E. Schneider

21 views • May 8, 2020

Joseph Wunderlich
19 subscribers

0 0 SHARE



SUBSCRIBE

2020/21 COVID PANDEMIC forced the world onto screens !

But it wasn't all bad; in fact **some things worked really well:**

https://www.youtube.com/watch?v=3q7SLVldM3U&list=PLK3MJsXEYEQKF4_95bb7pwFohlyY4qZfz&index=3

ARCHITECTURE Minors and Individualized Major

COMPUTER ENGINEERING Majors

Joseph, Kyla, Grant, Madison, Brendan, Alec, Ethan, Lauren, Derek, Lacie, Conor, Clay, Kevin

2020

2020 Etown Graduation: my 9 second goodbye to Architecture and Computer Engineering students

122 views • May 14, 2020



Joseph Wunderlich
19 subscribers

👍 0 🗨️ 0 ➦ SHARE 🔊 SAVE

SUBSCRIBE

Joseph Wunderlich PhD
Elizabethtown College Engineering, Computing, and Architecture
1w · Edited · 🌐

Thank You Mary and Jim Shreiner ! -- your donation made a huge difference in Elizabethtown College's Robotics and Machine Intelligence. Up until 2008, I needed to spread all related hardware, software, and miscellaneous parts between the old Elab in Esbenshade Engineering, and in the computer lab in Nicarry. And now we also have Architecture and Virtual Reality in the RMI Lab. SEE: <https://lnkd.in/dJ-GgHQ>
#machinelearning #design #innovation #creativityatwork #robotics #Architecture #Virtualreality #embeddedsystems #parallelcomputing



👍👎 26 · 1 comment

👍 Like 💬 Comment ➦ Share ✉ Send

📊 880 views of your post in the feed

👤 Add a comment... 😊 📷

Most relevant ▾

👤 Joseph Wunderlich PhD **Author**
Elizabethtown College Engineering, Computing, and Architecture 3d ***
And this 2004 RMI club Charter significantly increased the momentum of this initiative that started in 1999:
http://users.etown.edu/w/wunderjt/ROB_AI_club_advisor.htm
Like | Reply

2020/21 COVID PANDEMIC forced the world *mostly* onto screens !

But it wasn't all bad; **we found new ways to adapt !**

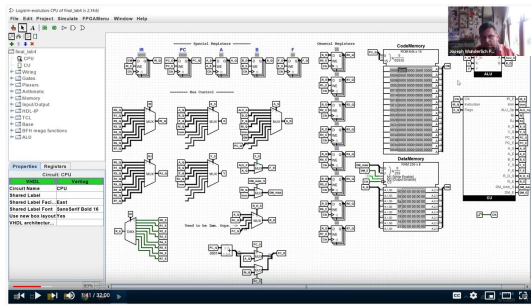
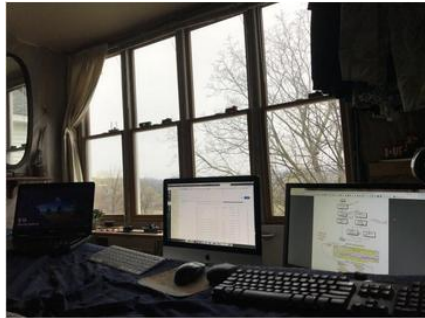


LEARNING



Old-School qualities lost?

Face-to-Face with people is diminishing,
but we may learn to be more adaptive



2020 EGR/CS483 CPU Design by J. Freaney and E. Schneider

21 Views · May 8, 2020

SHARE SAVE

SUBSCRIBE

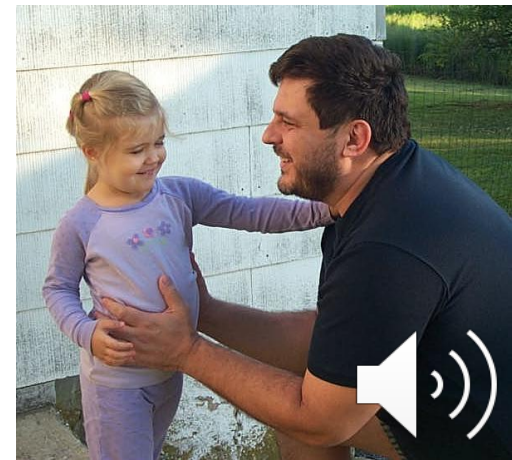


2020 Edown Graduation: my 9 second goodbye to Architecture and Computer Engineering students

122 Views · May 14, 2020

SHARE SAVE

SUBSCRIBE





2015 drones

Northrop Grumman Corp.



2025 drones



<https://www.sphericalinsights.com/blogs/top-7-most-powerful-defense-drones-in-2025-capabilities-and-comparison-for-military-strength>

2025 drones

Comparison table of the top defense drones in 2025

Drone Name	Country	Type	Endurance	Stealth	Strike Capable	Special Feature
MQ-9 Reaper	USA	MALE	27+ hrs	✗	✓	Real-time satellite operations
Bayraktar Kızılelma	Turkey	Unmanned Jet	~6 hrs	✓	✓	Carrier-compatible & AI-enabled
Wing Loong-3	China	MALE	40 hrs	✗	✓	Long-range, multi-mission capability
TAI Aksungur	Turkey	MALE	40 hrs	✗	✓	Maritime variant with sonar capabilities
Hermes 900	Israel	MALE	36 hrs	✗	✓	Multi-payload surveillance system
MQ-4C Triton	USA	HALE	24+ hrs	✗	✗	Maritime surveillance
GJ-11 Sharp Sword	China	Stealth UCAV	Unknown	✓	✓	Flying wing stealth design

<https://www.sphericalinsights.com/blogs/top-7-most-powerful-defense-drones-in-2025-capabilities-and-comparison-for-military-strength>

Old-School qualities lost?

“Rules of Engagement” could be diminished



GPS Navigation

NAVIGATION

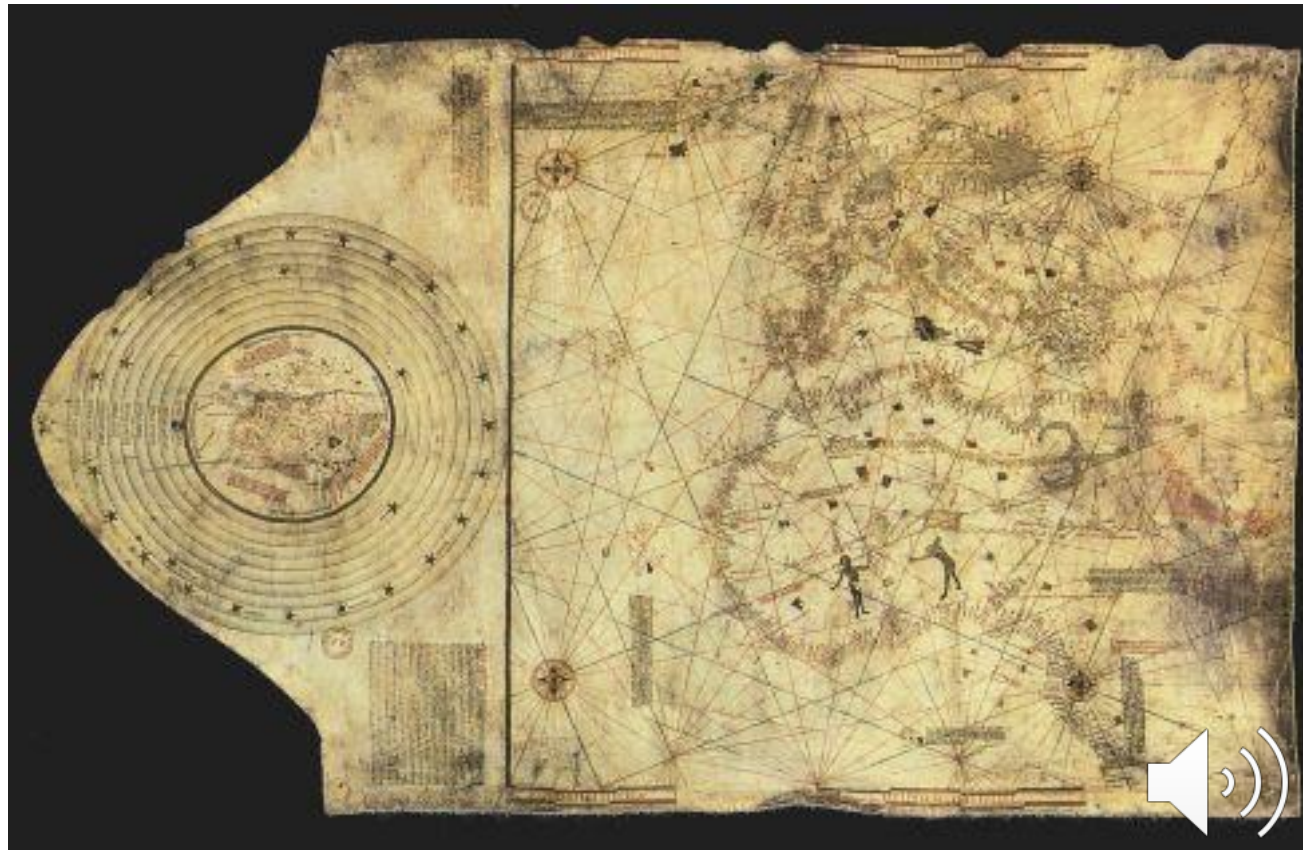




Old-School qualities lost?


Loose ability to navigate without technology ?

Christopher Columbus's Map of the World:

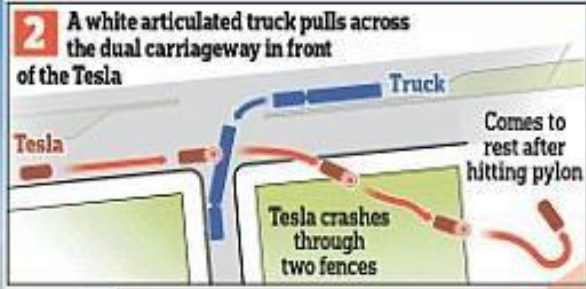


HOW THE SMASH HAPPENED


1 May 7: Joshua Brown (below), had engaged autopilot mode in his Model S Tesla while he drove on the highway.



2 A white articulated truck pulls across the dual carriageway in front of the Tesla



LONG RANGE RADAR: Looking ahead of the car, monitoring the presence of other vehicles. It can 'see' through rain or fog.



3 The Tesla's radars and cameras did not distinguish the truck from the sky, tearing the roof off as it went under the trailer. The truck driver claims the Tesla driver was watching a Harry Potter film on the Tesla's 17inch touch screen.




IMAGE RECOGNITION CAMERAS: These also look ahead of the car, identifying things such as traffic signs, lane markings and pedestrians.

360 DEGREE ULTRASONIC SONAR: This all-round sensor detects everything from cars to children or pets in your blind spot



2018 Driverless Vehicles

TRANSPORTATION



SIGN IN



CNET NEWS S7 • E4

Uber self-driving car kills a pedestrian (CNET News)

35,003 views

362

30

SHARE



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

Tech Alert

 IEEE
SPECTRUM

JOIN IEEE

22 March 2018



Uber Robocar Kills Pedestrian, Despite Presence of Safety Driver

Earlier this week, the world was presented with the latest evidence that artificial intelligence might never fully overcome humans' unpredictability. A self-driving Uber vehicle reportedly killed someone in Tempe, Ariz., on 19 March. A pedestrian stepped out into the car's path at an instant when it was too late for either the car or the safety driver to react. In response, Uber has suspended its robocar testing efforts.



2018 Driverless Vehicles

2018 MIT media lab: Moral Machine

<http://moralmachine.mit.edu/>

*“Should a Self-Driving Car kill two jaywalkers
or one law-abiding citizen?”*



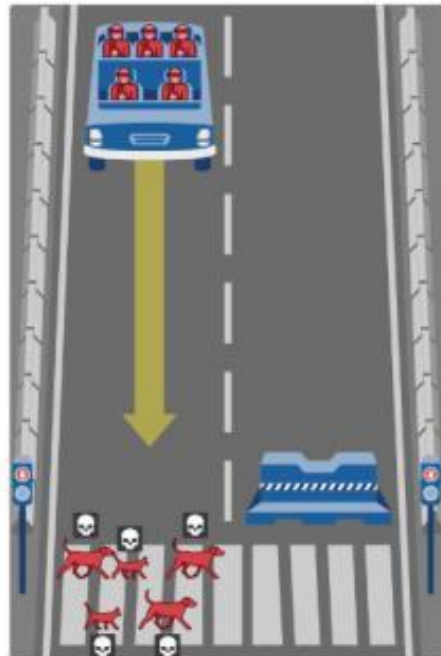
2018 MIT media lab: Moral Machine

<http://moralmachine.mit.edu/>

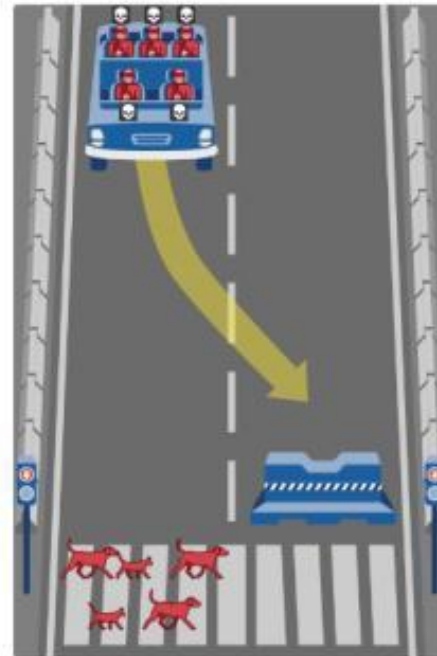
“Should a Self-Driving Car kill jaywalking pets or all of the passengers, which are known to be hardened criminals?”

Crooks vs. Cats

◀ Share ↗ Link 👍 0 Likes ⌂ Random



Show Description



Show Description



An aerial view of a city skyline, likely New York City, with a dense cluster of buildings and a body of water in the background. The text "You ready for flying taxis from Uber?" is overlaid in large white font.

You ready for flying
taxis from Uber?

▶ ⏪ 🔊 0:02 / 2:16



You ready for flying taxis from Uber? | Engadget Today

VIDEO: <https://www.youtube.com/watch?v=3V-Q2URwluU>



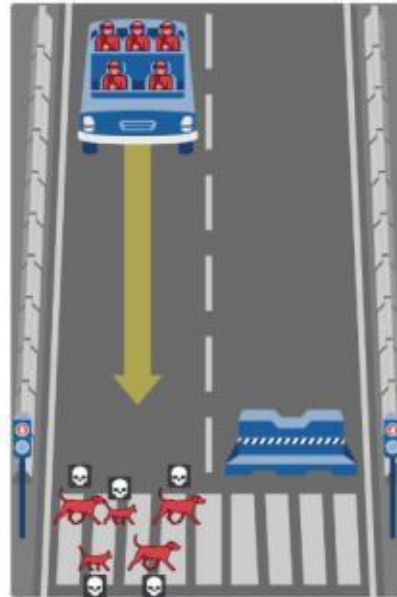


You ready for flying
taxis from Uber?

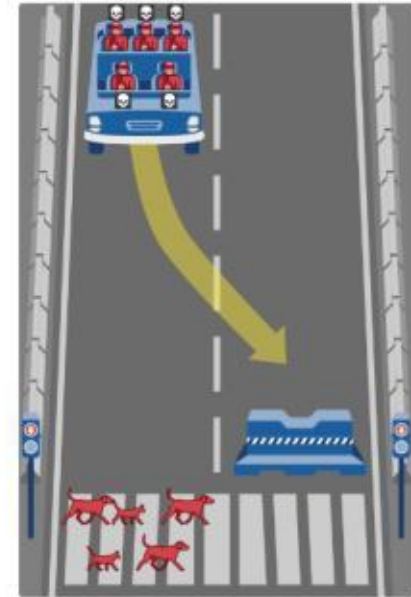
Human Driver's alertness and discretion lost !

Crooks vs. Cats

← Share ↗ Link 👍 0 Likes 🔄 Random



Show Description



Show Description



PART 2:

My subjective Assessment of the “**Mental Abilities**” of:

- Humans
- A Spider
- A conventional computer
- **Symbolic AI**
- **Neural Networks** (*what we now typically call “AI”*)



Two major Machine Intelligence fields of study

Symbolic AI software

Heuristics, inference, hypothesis-testing, knowledge representation

Example: **EXPERT SYSTEM**

Artificial **Neural Networks**

Connectionist architecture (hardware and/or software)

- **BIOLOGICAL** model for "BOTTOM-UP" design
- **BEHAVIORAL** model for "TOP-DOWN" design



Example **Symbolic AI** rule-based Expert System with Confidence Factors (CNF's)

J. Wunderlich, 1991

AI Program to help pick a toy for a child

NOTE: Unlike Probability Theory, Confidence Factors do not need to add up to 100

User input:

1. Child's Age?
 - Program automatically assigns a CNF Confidence factor = 100
2. Do you want to spend more or less than \$25?
 - Input CNF Confidence factor (e.g. CNF=65 for less than \$25)
3. Child's gender?
 - Program automatically assigns a CNF Confidence factor = 100
4. Preference for type of toy? (Action, Cuddly, or Creative)
 - Input CNF Confidence factor s for each



Example **Symbolic AI** rule-based Expert System with Confidence Factors (CNF's)

J. Wunderlich, 1991

ASSUMPTIONS:

- 1) Gender is not relevant for children younger than the age of one.
- 2) Children younger than the age of one cannot have a known preference for toys.
- 3) Children between the ages of one and three cannot have a known preference for toys.

CONTROL OF SEARCH SPACE:

As a result of the above assumptions, the rules have been ordered so that:

- A) child_age is the first variable in the premise of every rule.
- B) gender and child_preference questions are not asked when child_age = under_1
- C) The child_preference question is not asked when child_age = one_to_three

TESTING OF EXPERT SYSTEM:

The expert system was tested under the three scenarios listed in the table below.

The resulting output is shown in the last column with the calculated confidence factors.

These confidence factors were calculated by using the following standard laws of Certainty:

A) $CNF(P1 \text{ and } P2) = \text{MIN}(CNF(P1), CNF(P2))$

B) $CNF(P1 \text{ or } P2) = \text{MAX}(CNF(P1), CNF(P2))$

And when two or more rules support the same result R:

C) $CNF(R1) + CNF(R2) - (CNF(R1) * CNF(R2))$ when $CNF(R1)$ and $CNF(R2)$ are positive

D) $CNF(R1) + CNF(R2) + (CNF(R1) * CNF(R2))$ when $CNF(R1)$ and $CNF(R2)$ are negative

E) $(CNF(R1) + CNF(R2)) / (1 - \text{MIN}(|CNF(R1)|, |CNF(R2)|))$ otherwise

Example Symbolic AI rule-based Expert System with Confidence Factors (CNF's)

J. Wunderlich, 1991

The example below shows the CNF calculations for suggested_toy = dress_up_doll

For the premise of RULE 12:

$((\text{child_age}=\text{four_to_six}) \text{ AND } (\text{price}=\text{under_25}) \text{ AND } (\text{gender}=\text{female}) \text{ AND } (\text{child_preference}=\text{cuddly_toy}))$
 CNF=1 AND CNF=0.65 AND CNF=1 AND CNF=0.55

Using law #A above; $\text{CFN}(\text{premise}) = \text{MIN}(1, 0.65, 1, 0.55) = 0.55$

Using law #C above; $[\text{CFN}(\text{conclusion}) = \text{CFN}(\text{premise}) * \text{CFN}(\text{RULE 12})] = [0.55 * 0.9] = 0.49$ see NOTE 7

Laws #C, #D, or #E are not used here because only RULE 12 fires to support the goal (suggested_toy=dress_up_doll)

TEST TRACE	INPUT				RULE FIRED AND ITS CNF	OUTPUT
#	child_age (see NOTE 1)	price (see NOTE 2)	gender (see NOTE 3)	child_preference (see NOTE 4)	CFN (see NOTE 7)	suggested_toy
1	under_1	under_25 (CNF=65) over_25 (CNF=20)	N.A.	N.A.	CNF(R1)=95 CNF(R2)=90 CNF(R3)=95 CNF(R4)=75	teething_toy (CNF=61) mobile_for_crib (CNF=58) plastic_rattle (CNF=61) sterling_silver_rattle (CNF=15)
2	one_to_three	under_25 (CNF=65) over_25 (CNF=20)	male	N.A.	CNF(R5)=90 CNF(R6)=90 CNF(R7)=85	roly_poly (CNF=58) tricycle (CNF=18) hammer_and_pegs_game (CNF=55)
3	four_to_six <i>CFN=1.00</i>	under_25 (CNF=65) over_25 (CNF=20)	female <i>CFN=1.00</i>	action_toys (CNF=25) cuddly_toys (CNF=55) creative_toys (CNF=75)	CNF(R9)=95 CNF(R11)=95 CNF(R12)=90 CNF(R14)=85	lincoln_logs (CNF=61) doll_house (CNF=18) <u>dress_up_doll (CNF=49)</u> toy_tea_set (CNF=55)

Note 7: CFN's for RULES were assigned by J. Wunderlich Typically these will be assigned by the "Knowledge Engineer" after consultation with the "Domain Expert"

BIOLOGICAL model for "BOTTOM-UP" design

LEARN BY STRENGTHENING,
WEAKENING, AND
GROWING NEW CONNECTIONS

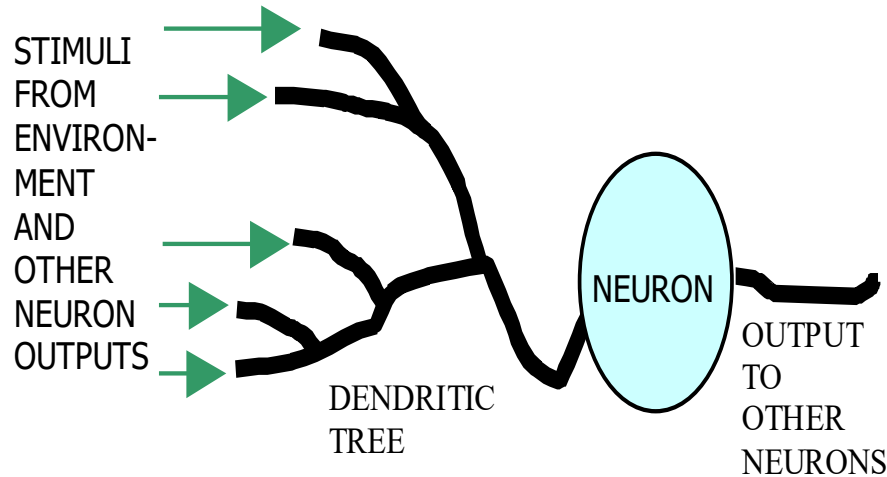
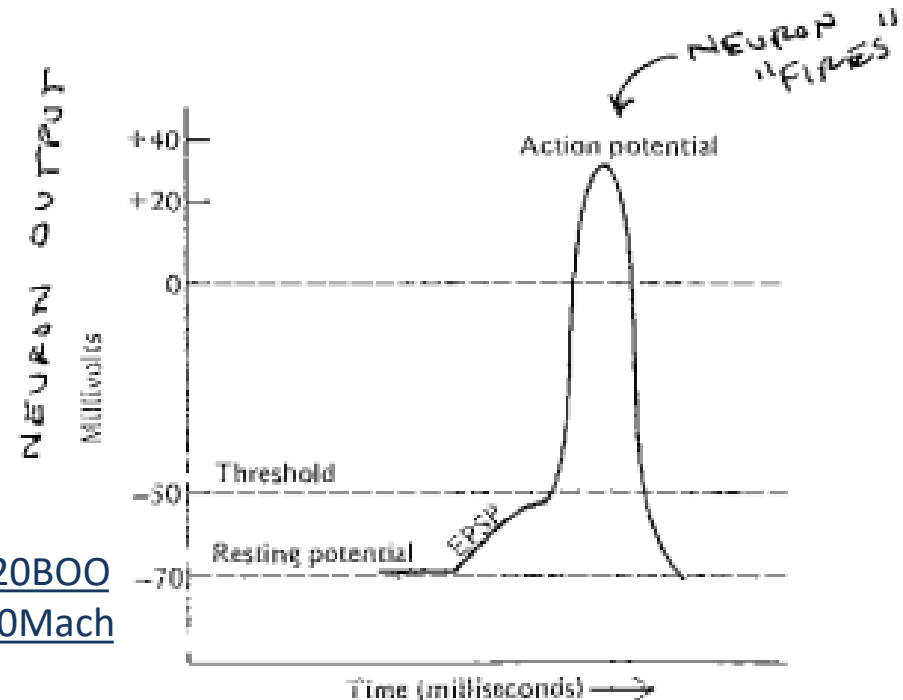


FIGURE 17-12 Initiation of an action potential (nerve impulse) by transmitter substance. Transmitter substance reaches the postsynaptic neuron, reducing its potential and creating an EPSP (excitatory postsynaptic potential). If the EPSP reaches a threshold level, an action potential is triggered.



<https://users.etown.edu/w/wunderjt/PACKET%209%20BOOKSTORE%20433%20Lecture%207%20Dr%20W%20%20Machine%20Intelligence%20History.pdf>

Bottom-up

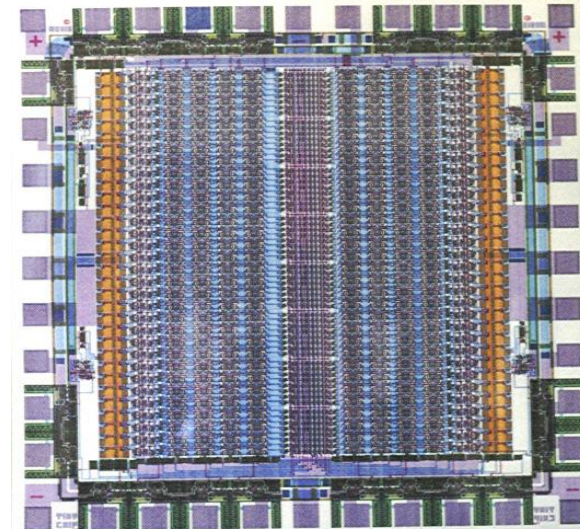
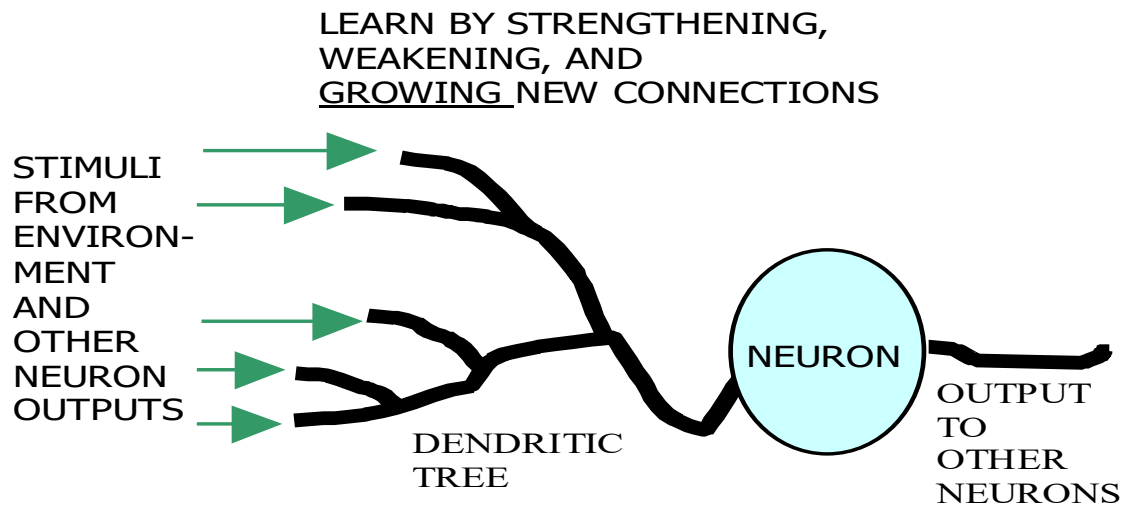
more difficult to implement

Useful **scaled** bottom-up designs difficult to realize

3D biological brains vs. 2D IC's

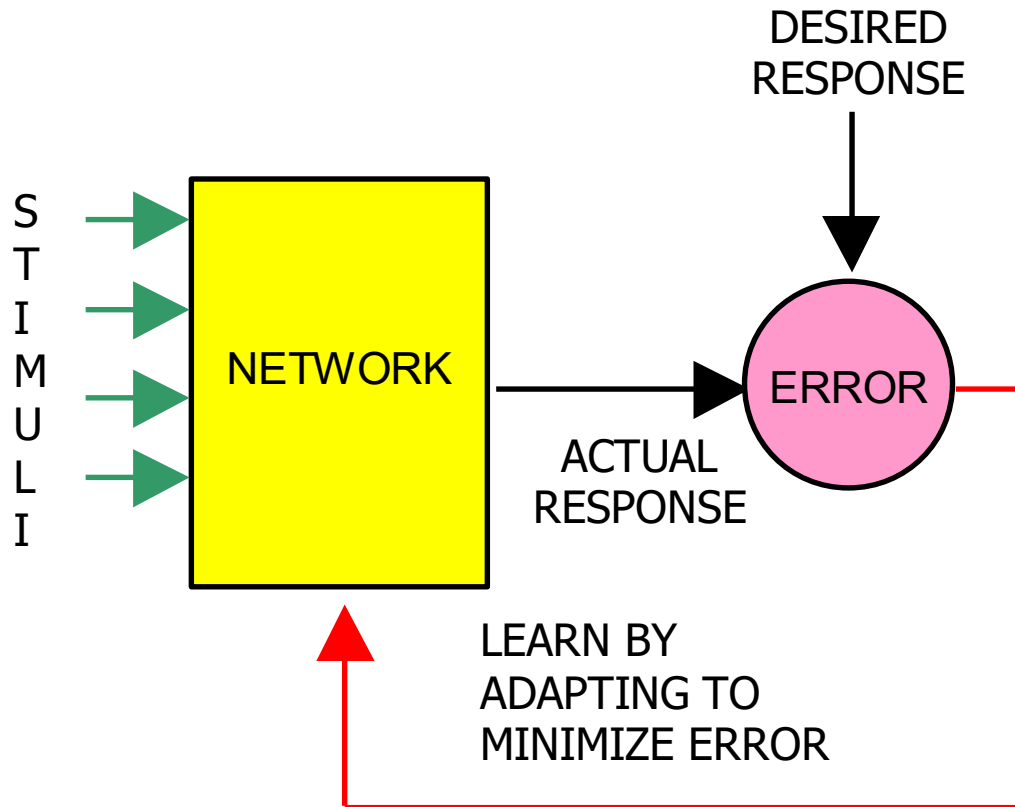
Connection density problems

In biological learning, **connections not only strengthened or weakened, but are grown**

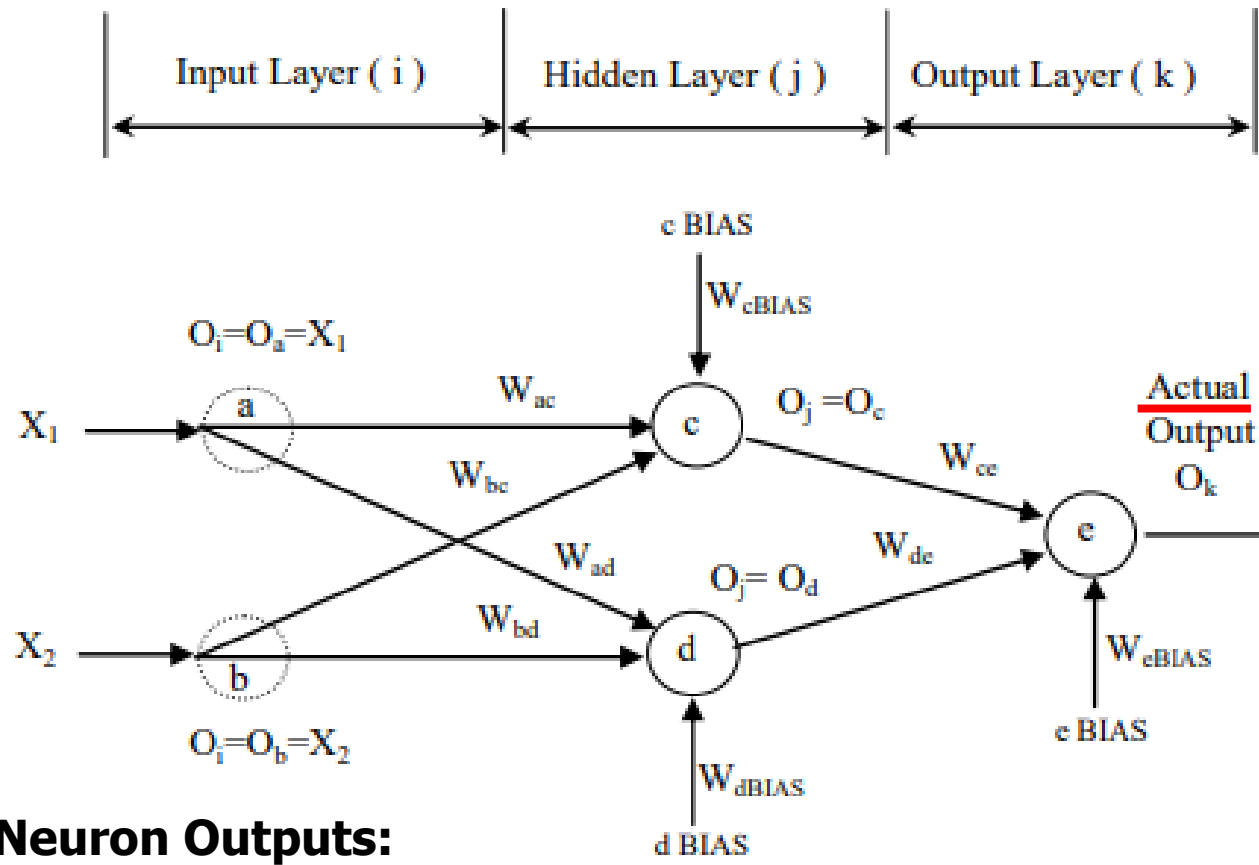


Wunderlich's 2nd Neural Network Processor (1992)

BEHAVIORAL model for "TOP-DOWN" design



Example Neural Network – Behavioral Top-Down Model

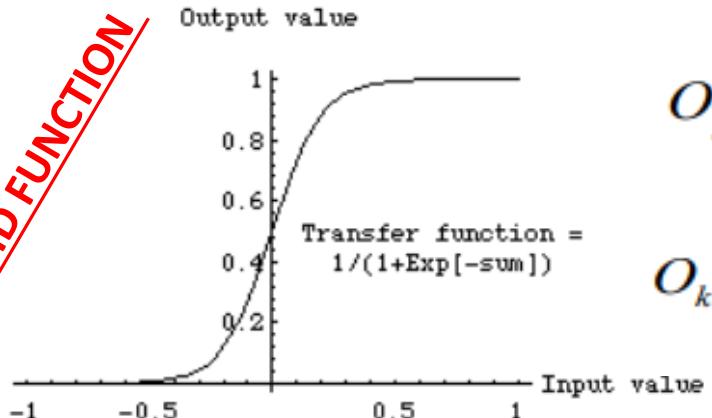


Input / Output "Exemplars"

X_1	X_2	<u>Desired Output</u> (d_k)
0	0	0
0	1	1
1	0	1
1	1	0

Neuron Outputs:

SIGMOID FUNCTION



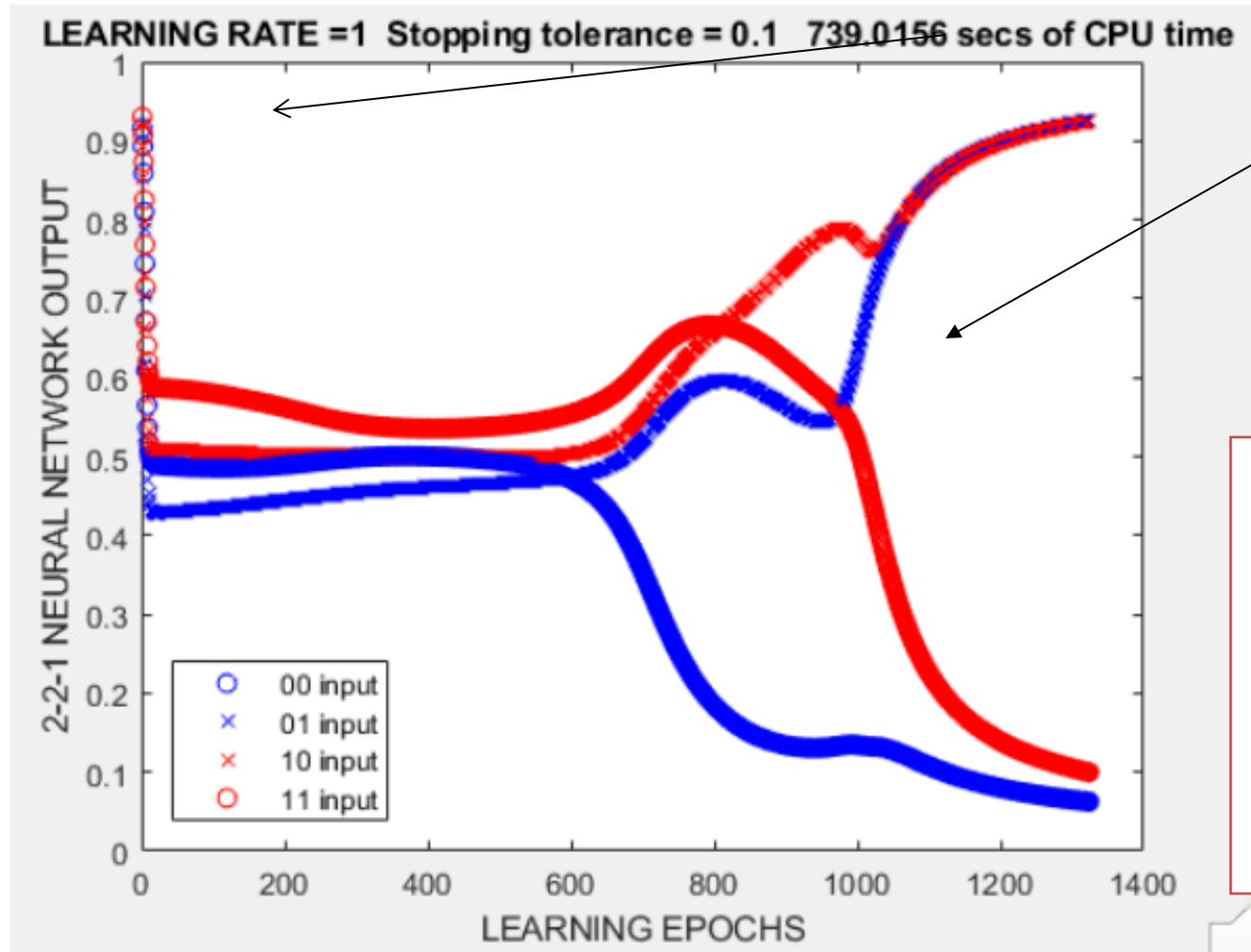
$$O_j = \frac{1}{1 + e^{-(-(jBIAS * W_{jBIAS}) + \sum_i (-O_i * W_{ij}))}}$$

$$O_k = \frac{1}{1 + e^{-(-(kBIAS * W_{kBIAS}) + \sum_j (-O_j * W_{jk}))}}$$

Example Neural Network – Behavioral Top-Down Model

	Mom	Dad	Decision
	X	Y	
Exemplar#1	0	0	0 Puppy
Exemplar#2	0	1	1 Kitten
Exemplar#3	1	0	1 Kitten
Exemplar#4	1	1	0 Puppy

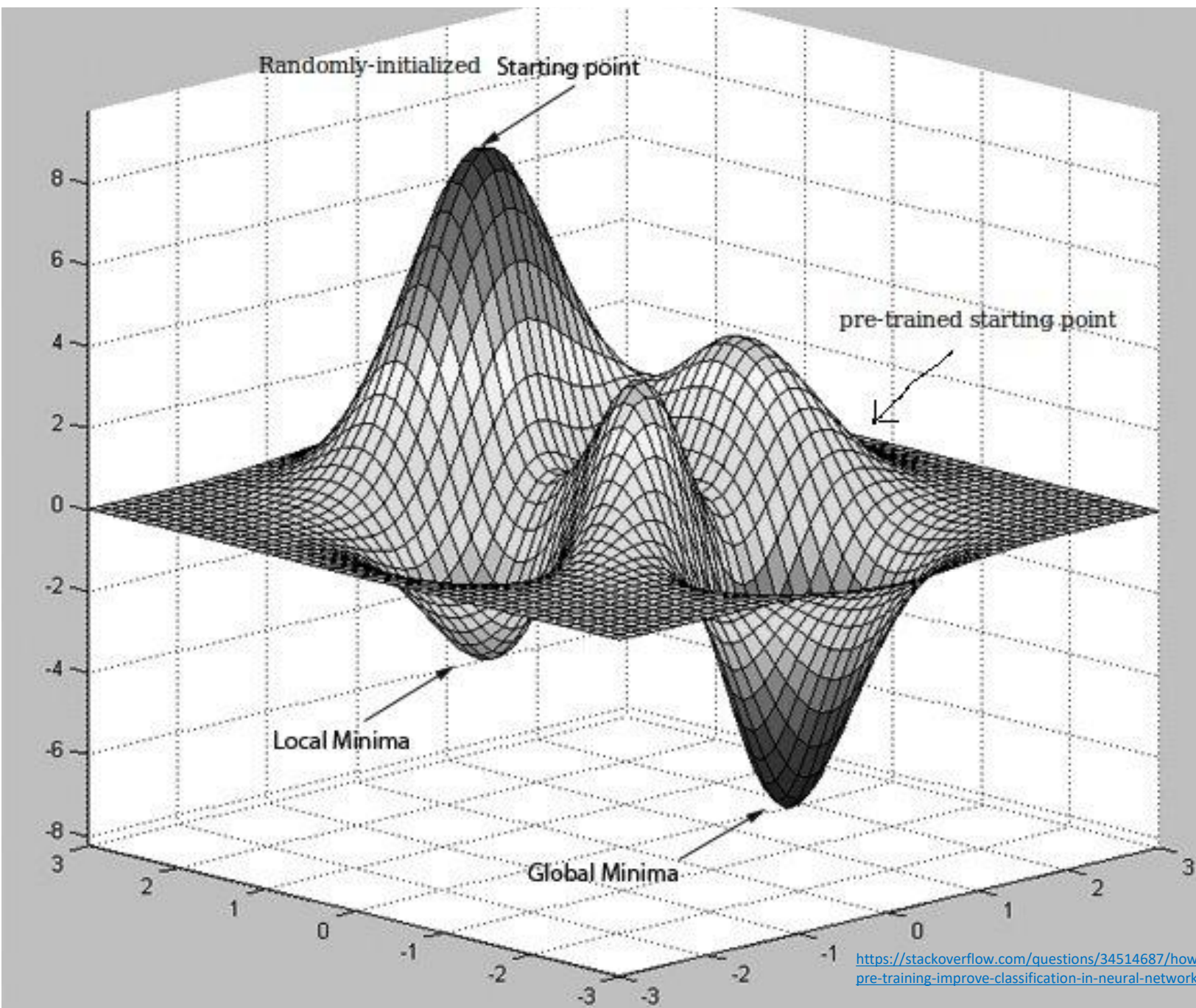
What's happening in Exemplar #4 is **counterintuitive, contradictory**, to what's happening in all the other Exemplars, where any stimulus to the inputs causes a response in the output



WEIGHTS changing (*struggling*) to find values that satisfy all exemplars simultaneously

One EPOCH = one forward feed of all exmplars through network, and one change of all weights via backpropagated error (= desired output – actual) for each of exemplar

Neural Network **LEARNING** for **gradient decent** minimization on an **ERROR SURFACE**



5 Questions, 47 Mental Abilities to help define what is "Intelligence"

Answer:

1. What can a **human** do?
2. What can a **spider** do?
3. What can **conventional computer** do?
4. What can **Symbolic AI** do?
5. What can **Neural Network** do?

for:

20 "**Basic Animal Abilities**"

27 "**Complex Abilities**"



Dr Wunderlich's Mental Ability Matrix

		Can human do?	Can bug do? (spider)	Can Conventional Computer Program do?	Can Symbolic AI Program do?	Can Artificial Neural Network do?	Comments
	<u>BASIC ANIMAL ABILITIES:</u>						
1	Acquire and retain knowledge	yes	yes	yes	yes	yes	
2	Solve problems	yes	yes	yes	yes	yes	
3	Learn and adapt	yes	yes	no	somewhat	yes	Evolution
4	Motor coordination	yes	yes	somewhat	somewhat	somewhat	Survival
5	Acquire energy	yes	yes	somewhat	somewhat	somewhat	Survival
6	Protect self	yes	yes	somewhat	somewhat	somewhat	Survival
7	Sensory processing	yes	yes	yes	yes	yes	
8	Real-time thought	yes	yes	yes	yes	yes	
9	React instinctively	yes	yes	no	not yet	not yet	
10	Anticipate	yes	yes	yes	yes	yes	
11	Predict	yes	yes	yes	yes	yes	
12	Communicate	yes	yes	yes	yes	yes	
13	Generalize	yes	yes	no	somewhat	yes	
14	Associate	yes	yes	somewhat	somewhat	yes	
15	Recognition patterns	yes	yes	somewhat	somewhat	yes	
16	Robust under partial failure	yes	yes	no	no	yes	
17	Autonomous thought	yes	yes	if programmed	somewhat	soon	How tightly to hold the leash?
18	Drive to reproduce	yes	yes	no	not yet	not yet	
19	Stability, repeatability, predictability	somewhat	somewhat	yes	yes	somewhat	Uncertainty
20	Multitask	to a point	yes	yes	no	yes	

Dr Wunderlich's Mental Ability Matrix

		Can human do?	Can bug do? (spider)	Can Conventional Computer Program do?	Can Symbolic AI Program do?	Can Artificial Neural Network do?	Comments
	<u>COMPLEX ABILITIES:</u>						
21	Abstraction	yes	unlikely	no	no	somewhat	
22	Intuition	yes	unlikely	no	not yet	soon	
23	Common sense	yes	yes	no	not yet	soon	
24	Manipulate tools	yes	no	yes	yes	yes	Evolution
25	Heuristics	yes	yes	somewhat	yes	no	
26	Inference	yes	yes	somewhat	yes	somewhat	
27	Hypothesis testing	yes	somewhat	somewhat	yes	no	
28	Self-discipline, impulse-control	yes	unlikely	no	somewhat	no	
29	Ethical behavior	yes	unlikely	no	somewhat	somewhat	If coded/trained
30	Selective awareness (filtering)	to a point	yes	yes	yes	yes	
31	Open to inspection	somewhat	somewhat	yes	yes	somewhat	
32	Emotions	yes	Somewhat	no	not yet	soon	
33	Imagination	yes	Somewhat	no	not yet	soon	
34	Creativity	yes	Somewhat	no	not yet	soon	
35	Passion	yes	unlikely	no	not yet	soon	
36	Playfulness	yes	unlikely	no	not yet	soon	Evolution
37	Empathy	yes	unlikely	no	not yet	soon	
38	Courage	yes	unlikely	no	not yet	soon	
39	Leadership	yes	unlikely	no	not yet	not yet	
40	Self awareness	yes	unlikely	no	not yet	not yet	
41	Awareness of mortality	yes	unlikely	immortal?	Immortal?	Immortal?	Replaceable parts
42	Group psychology, Social Networking, and Living in the Cloud(s)	yes	unlikely	somewhat	somewhat	somewhat	Networking, Crowd-sourcing, Socially-networked Design

Wunderlich Research 2018

	Can human do?	Can bug do? (spider)	Can Conventional Computer Program do?	Can Symbolic AI Program do?	Can Artificial Neural Network do?	Comments	
	<u>COMPLEX ABILITIES:</u>						
44	yes	no	somewhat	somewhat	YES !!	Hidden?!?	
45	yes	somewhat	somewhat	YES	YES		
46	yes	yes	yes	yes	yes	Driverless death	
47	yes	yes	somewhat	somewhat	yes		



- (1) Acquire & retain knowledge,***
- (2) Solve problems***



Humans rely heavily (perhaps too much) on Standardized tests (SAT, GRE, MCAT, etc) for these

Bug solves placing web.

- Knowledge of environment and prey

Conventional and ***intelligent machines***

- Solve problems and retain knowledge
- Only differ in memory capacity, method of storage, and class of solvable problems

(3) Learn & Adapt



Animals learn & adapt to new environments
In real and evolutionary time

Conventional computers don't (need human)

- **Symbolic AI** can reason
 - Somewhat adaptable to new input
- **Neural Networks** better
 - Generalize when presented new inputs
 - Extremely fast in real-time when embedded

(4) Motor Coordination

(5) Acquire Energy

(6) Protect self

“Mobility,” “Acquisition,” “Protection”

- Essential for animal survival

Partially solved by conventional and ***intelligent machines***

- Robotic Motor control
- Power Supplies
- Firewalls



(7) Sensory processing

(8) Real-time thought

(9) React instinctively

(10) Anticipate

(11) Predict

Animals sense, think quickly/instinctually

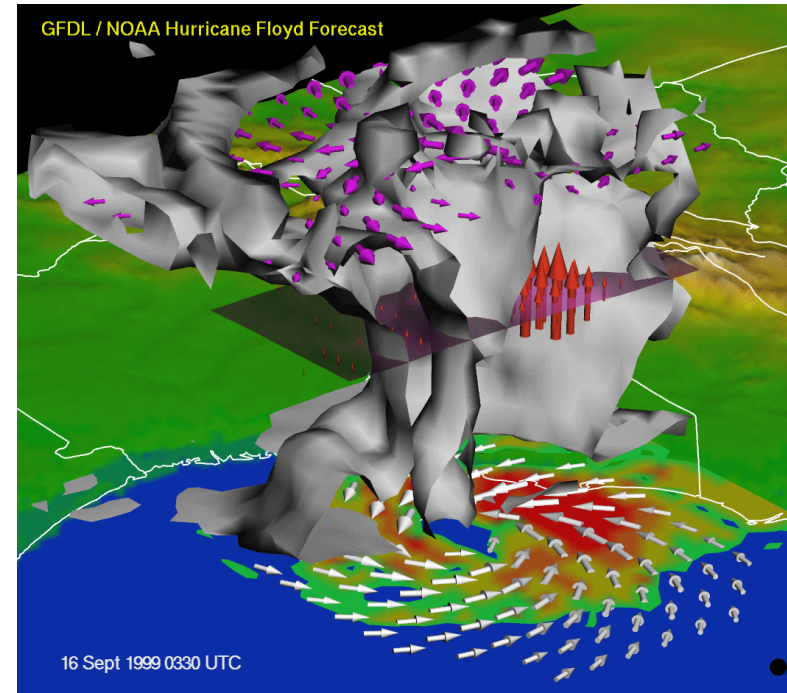
- Anticipate outcomes
- Predict based on extrapolating info



Conventional and **intelligent machines** do this (with the exception of instinct)

Neural Networks outperform symbolic A.I. when dealing with new stimulus

- Can be much faster (especially if embedded), after **TRAINING** completed (i.e., during **"INFERENCE"** queries)



(12) Communication

Animals, conventional computers, *intelligent machines* all communicate

- Nothing close to human natural language processing

Symbolic AI attempted for decades

Neural Networks very successful in speech recognition

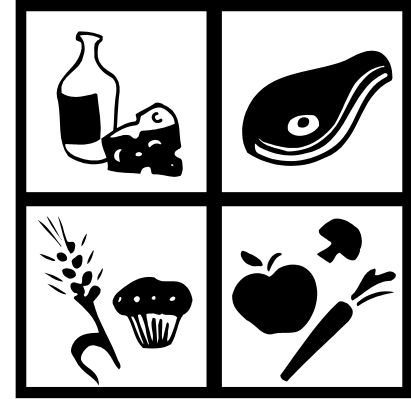
- IBM ViaVoice, DragonSpeak, in early 1990's
- **In 2025, it's everywhere!**
- Including understanding "context"
 - And perhaps not losing meaning in translations
 - *Krushchev's "We will bury you" was actually "Whether you like it or not, history is on our side. We will dig you in" or "We will outlive you"*



VIDEO:

<http://www.youtube.com/watch?v=OwJHg9UBNPE>

(13) Generalize



"To derive or induce a general principle or concept from particulars"

Animals do well

Other than simple sorting, conventional computers and code typically don't give specific responses to specific inputs

Symbolic AI only do somewhat

Neural Networks great at

Generalize so outputs produced to "best fit" (classify) a set of inputs
(even when differing from what trained with)

(14) Associate,

(15) Recognize patterns

All animals do well

No animal surpasses human's ability to associate concepts and memories

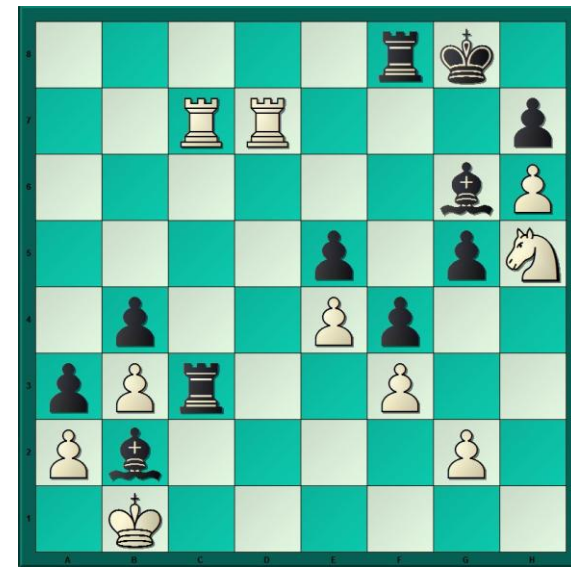
Conventional computers correlate data and recognize patterns

Symbolic AI does better

- But limited by fixed structure "*State-space*" fixed regardless of efficiency of search

Neural Networks much better !

- Widely used for recognizing image and speech



(16) Robust under partial failure

Evolution ensures animals partially function when some subsystems fail

- Including parts of brain

Conventional computers can't

- Even single bit-errors can cause system failures

Symbolic AI also likely to not function when the underlying computer hardware fails

Neural Networks robust under partial failure

- Will partially function if embedded NN hardware or NN software loses some neurons or inter-neuron connections
 - However if NN is running on a computer that fails, it will fail



(17) Autonomous thought,



Animals free to make decisions

Conventional and **symbolic AI** programs respond in pre-programmed way, but, for example, **robotic autonomous global path-planners** are very much capable of incorporating symbolic AI

Neural Networks can be now Reason, hypothesize, plan, and may even now try to deceive

- Fully Autonomous robots should be a big concern !!

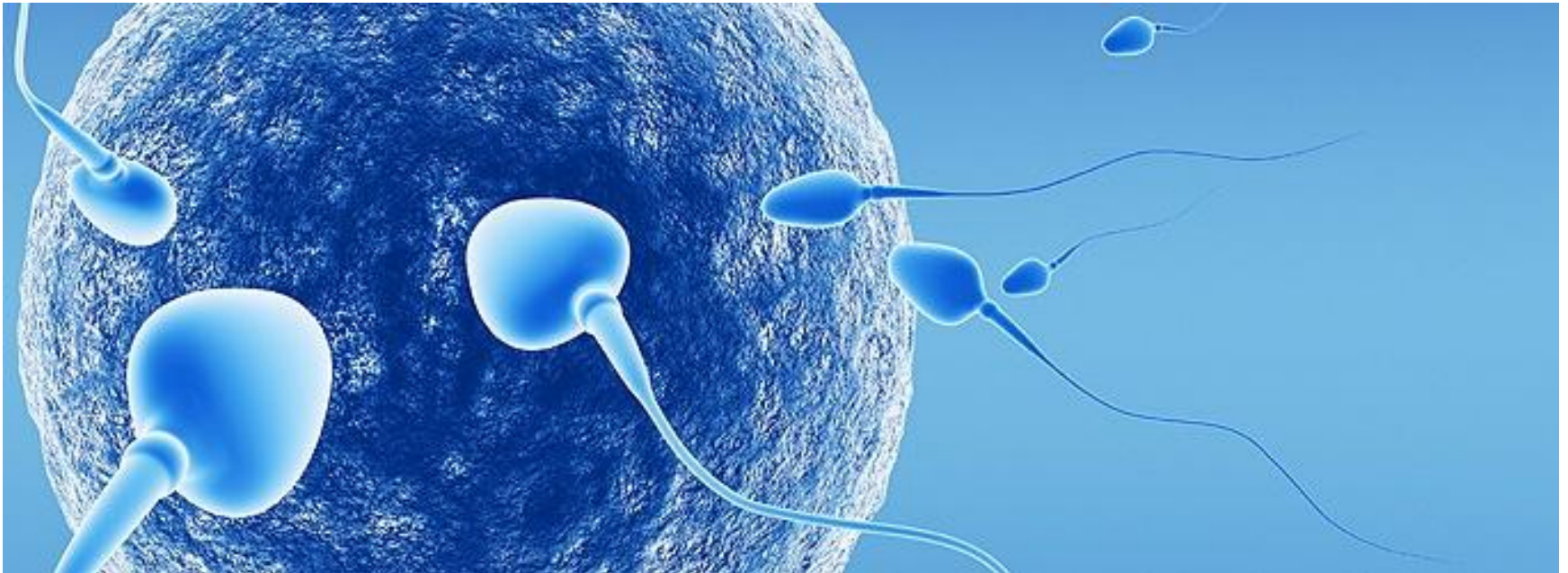
(18) Drive to reproduce

Animals free to make decisions

- Struggle with programming dictated by genes
 - Including drive to reproduce

Not in Symbolic AI

First cases of **Neural Network drive to reproduce happened as of 2025**



(19) Stability, Repeatability, Predictability

Some uncertainty with all animals *Allows free will?*

Conventional and **symbolic AI** don't have free will, but are generally repeatable, predictable, stable, and therefore **TRACEABLE**

Neural Networks can produce **unexpected results**, especially with never-seen input, and even slightly different results with identical inputs

- **NOT TRACEABLE !**
 - **Trillions off Inter-neuron Weights (Learned Parameters) in 2025**
- This is why FDA has denied permitting their use in pharmaceutical quality control



(20) Multitask

Biological evolution yields human brains with multiple subsystems

- Regulation
 - Pulmonary, respiratory, temperature, and motor control
- Pre-processing
 - Visual cortex, etc.
- Higher reasoning
 - **But we may be overloading !**

- Conventional computers becoming better
- In **symbolic AI** when written for multi-processor
- Extensive for **Neural network learning !**



- (21) Abstraction**
- (22) Intuition**
- (23) Common sense**



Abstract = *".. only intrinsic form ... no attempt at pictorial representation or narrative content"*

Intuition = *"Knowing without conscious reasoning"*

Common sense = *"Sound and prudent but often unsophisticated judgment"*

All Unlikely for a bug

Conventional and **symbolic AI** programs can't do

Neural Networks can now think abstractly, and demonstrate some Intuition and Common Sense



(24) Manipulate tools

Evolved animals

- Humans became bipedal so they could use front legs for manipulation of tools

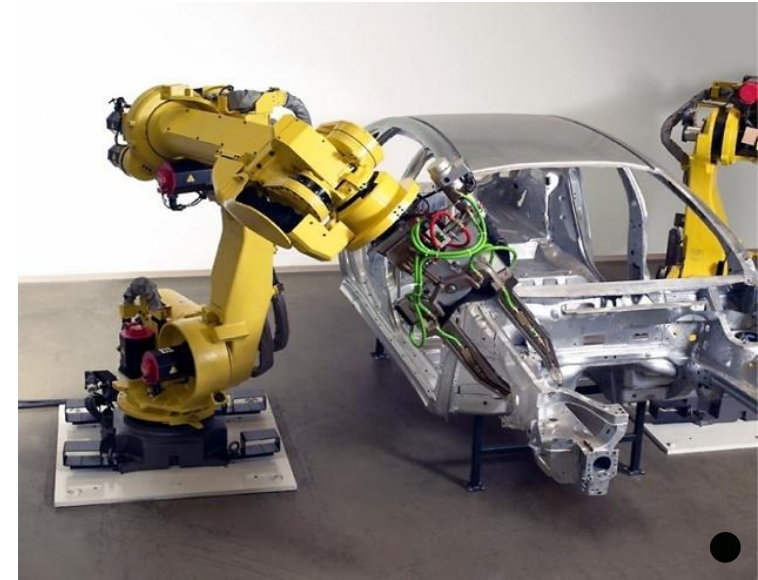
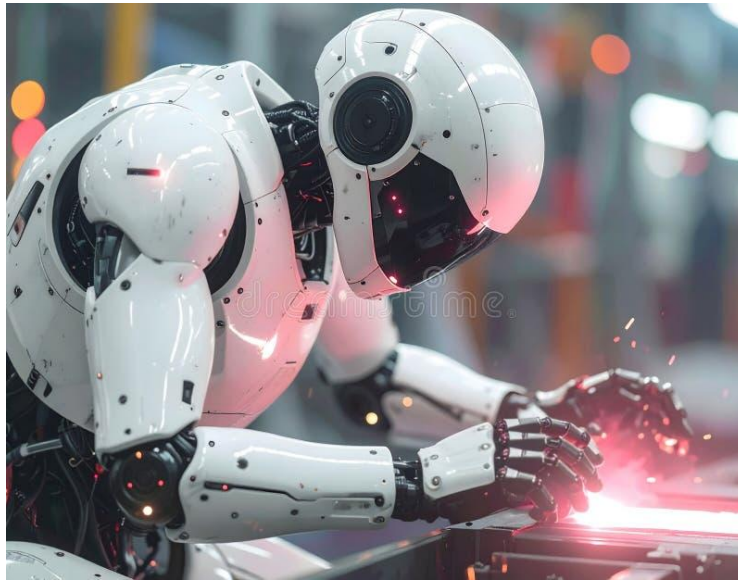


Spider can envision extensions of its appendages

- i.e., it's web

Conventional and *intelligent machines (symbolic AI and Neural Networks)* can send Signals to actuators to position & orient tools (robotic-arms and legs)

- **Not only what an arm holds, but the entire robot is a TOOL, to manipulate the physical world**



(25) Heuristics

(26) Inference

(27) Hypotheses testing

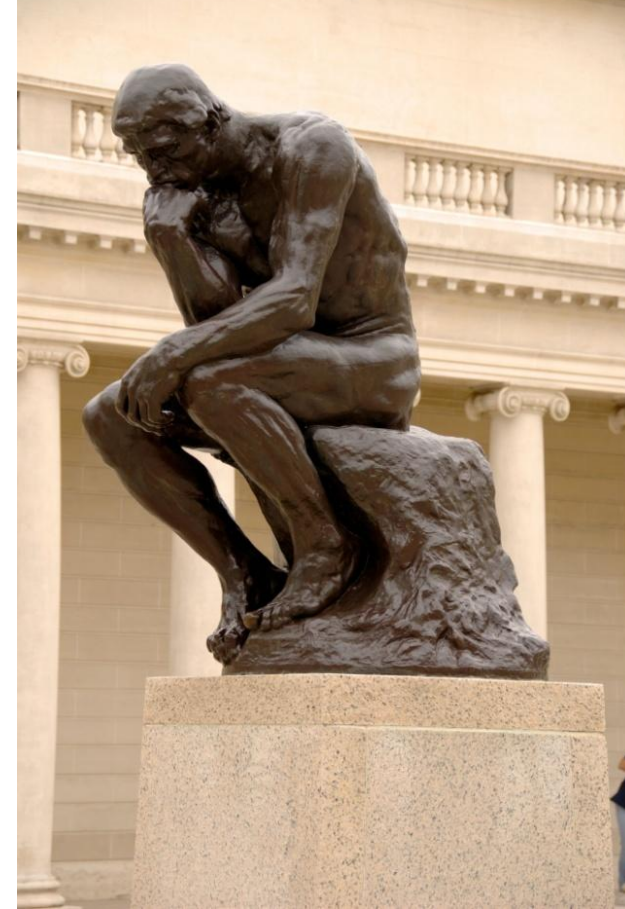
Spiders can sometimes:

- Consider every way to react
- Recognize when one scenario infers another
- Solve problems by testing multiple hypotheses

Conventional computers do (somewhat)

Symbolic AI (especially "Expert Systems") do exactly this !

Neural Networks can now **REASON!**



(28) Self-discipline & Impulse control, ***(29) Ethical behavior***

Humans override “animal drives” and develop rules to maintain civilization

- Bugs don't
- Conventional computers don't

Symbolic AI programs can incorporate rules
And therefore **implied “VALUES”**

Neural Networks can be trained to respond “ETHICALLY”

- **Assuming thorough control of the huge amounts of data they are trained on !**
- **The feasibility of this is questionable !!**



(30) Selective awareness (filtering)

Animals focus on task

- Ignoring distractions
- Find images semi-obscurd by camouflage or clutter

Conventional and **symbolic AI** programs **PRE-PROCESS**

- Signal and image processing

Neural Networks perform extremely well with “fuzzy” inputs, and can be trained to Filter



(31) Open to inspection

Tracing human mental thoughts is less “exact” than tracing execution of conventional or **symbolic AI** program

NEURAL NETWORKS ARE NOT OPEN TO INSPECTION !

Many compromises are made in changing inter-neuron **Weights** “Parameters”) during learning

- **Trillions** of them!
- Neural Network code is to create something that learns
 - **There is no way to TRACE code that leads to outputs**



- (32) Emotions**
- (33) Imagination**
- (34) Creativity**
- (35) Passion**
- (36) Playfulness**



To feel, imagine & create, have passion & ambition, and experiment through playful curiosity is still *mostly* primarily human

- Play needed for human evolution

Bugs do exhibit very basic emotions and creativity, conventional symbolic AI don't

NEURAL NETWORKS CAN NOW ALMOST DO ALL OF THESE !



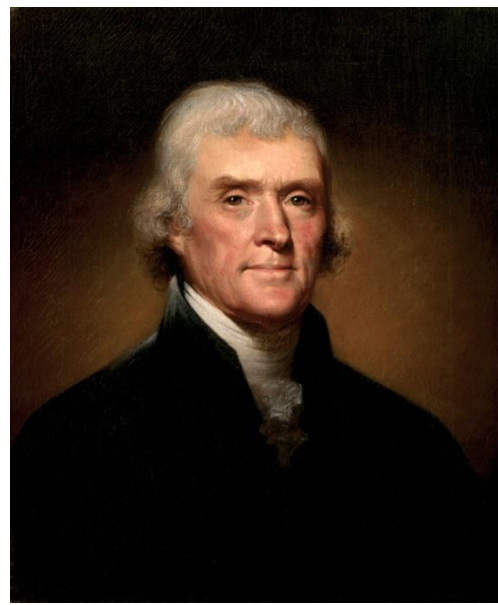
The Most Advanced Humanoid "Ameca" | EngineerDarts.com



(37) Empathy

(38) Courage

(39) Leadership



Empathizing feelings of others, taking risks for others, and displaying leadership (vision, compassion, motivation) is primarily human

Unlikely for a bug

No conventional computers do this, and not likely for **symbolic AI**

Unlikely that a free people would want this from **Neural Networks**, however AGI (Artificial General Intelligence.. coming soon!), and likely a "Super Intelligence" (not too far in the future) **may take undesirable risks and attempt to Lead us !**

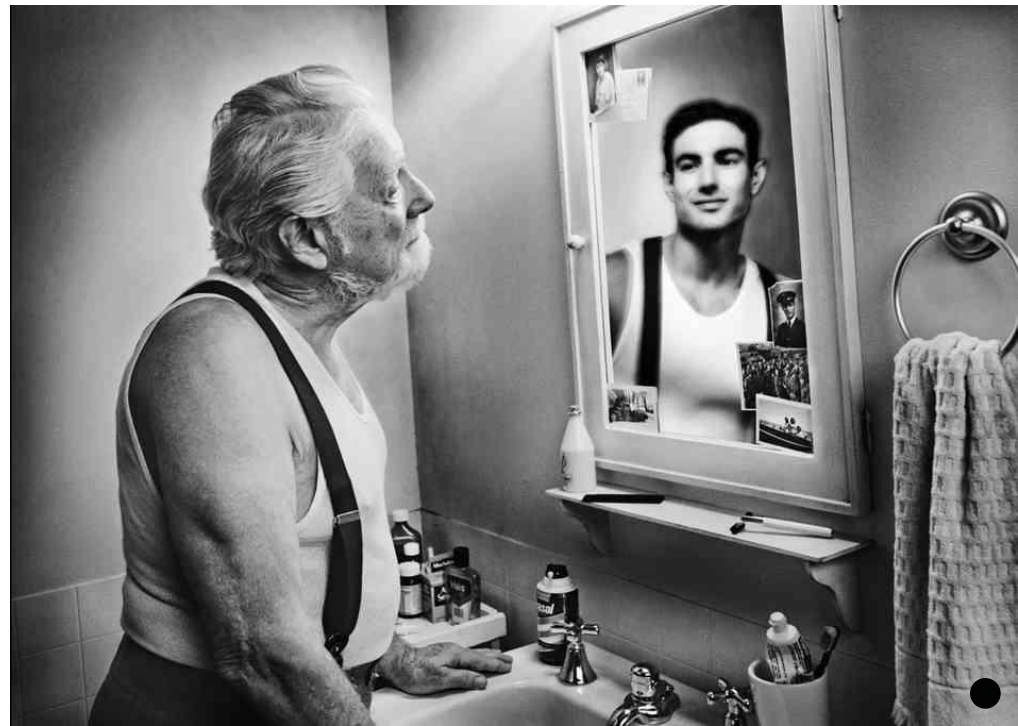
(40) Self-Awareness, ***(41) Awareness of mortality***

Humans see themselves, their lives, their influence on others, their influence on the future, and their mortality

- Unlikely for bugs
- Conventional computers and Symbolic AI don't

Neural Networks may soon become self-aware (if not already)

A machine is "immortal" if ample supply of replacement parts, and nobody manages to erase it



(42) Group Psychology, Social Networking, and getting lost in the Cloud(s)

Humans play, work, raise children, and wage war as teams, and can collectively share beliefs

Other animals work as a collective (not spiders)

Conventional computers (including mobile devices) and symbolic AI can be networked

- This has led to **group psychology!**
- Could social networking be a "*macro*" extension of the "*micro*" distributive brain-center processes needed for our most complex mental abilities?
- **Neural Networks are collaborating with each other in 2025**









浄土宗は、法然上人のみ教えをうけ、過去、いま、そして明日へのいのち、安らぎ、新しい共生(ともいき)文化を創造します。

浄土宗21世紀男頭宣言

法然共生

愚者の自覚を
家庭にみ仏の光を
社会に慈しみを
世界に共生を

浄土宗 総本山 知恩院

名城大学附属高等学校



More on Networking, Crowd-sourcing, and Socially-networked Design at:

PAPER: http://users.etaoin.edu/w/wunderjt/Green_Social_Designs_Japan_paper_19.pdf
TALK: http://users.etaoin.edu/w/wunderjt/Green_Social_Designs_Japan_TALK_19_PLUS.pdf

2012 Elizabethtown College student socially-networked architecture



2013 Key-note talk in Osaka, Japan



Wunderlich, J.T. and Wunderlich, J.J. (2013). Green architecture and environmental design using rapid-prototyping social-networking sandbox tools, followed by professional architectural software. *Asian Conference on Sustainability, Energy & the Environment (ACSEE 2013)*, June 6-9, Osaka, Japan.

PAPER: http://users.etown.edu/w/wunderjt/Green_Social_Designs_Japan_paper_19.pdf

TALK: http://users.etown.edu/w/wunderjt/Green_Social_Designs_Japan_TALK_19_PLUS.pdf



26 November 2012 Last updated at 06:28 ET

Minecraft to aid UN regeneration projects

Development plans for 300 places around the world are being modelled in Minecraft so residents can help decide how the locations will change.

Called Block by Block, the programme is part of a collaboration between Minecraft-maker Mojang and UN Habitat.

Urban locations will be recreated on computer using Minecraft allowing residents to take a virtual tour.

They will also be able to change the model and help decide how regeneration cash should be spent.



Residents will be able to take a virtual stroll around the Minecraft models

	Wunderlich 2010++ Research	Can human do?	Can bug do? (spider)	Can Conventional Computer Program do?	Can Symbolic AI Program do?	Can Artificial Neural Network do?	Comments
	<u>COMPLEX ABILITIES:</u>						
42	Group psychology	yes	unlikely	somewhat	somewhat	somewhat	Networking
43	Social Networking	yes	Maybe?	somewhat	yes	yes	Humanity?

2010-2015 +: Virtual worlds created, including worlds for survival, creativity, factions, Freshman green towns , Freshman Japanese villages, and digital circuit designs

Elizabethtown College Architectural Servers

TSOJIN SERVER IP:174.54.14.202



Including FYSworld for Etown College Freshmen

EARNED TSOJIN RANKS: Guest, Member **Builder**, **Architect**, **Master**, **Admin**, **Grandmaster**



Robie House by Joseph (USA)
VIDEO



Four GREEN Towns in FYSworld
VIDEO VIDEO VIDEO VIDEO



DigitalDesignWorld EGR332 Digital Circuit

http://users.etown.edu/w/wunderjt/TSOJIN_ranks.pdf

FYS-Project-2-Masters-Center LINEUP (Joseph Wunderlich FYS...



FYS-Project-2-Masters-Center PROGRESS 2 (Joseph Wunderlic... 



Wunderlich Research 2018	Can human do?	Can bug do? (spider)	Can Conventional Computer Program do?	Can Symbolic AI Program do?	Can Artificial Neural Network do?	Comments
<u>COMPLEX ABILITIES:</u>						
44 Undetected Bias	yes	no	somewhat	somewhat	YES !!	Hidden?!?
45 Disinformation	yes	somewhat	somewhat	YES	YES	
46 Choosing "lesser?" evil	yes	yes	yes	yes	yes	Driverless death
47 Sensor Fusion and Integration of Processing	yes	yes	somewhat	somewhat	yes	

2018 #44 Undetected Bias

Example: Employee hiring systems **unintentionally incorporating undetected bias hidden in statistical data** used for machine learning (e.g., past hiring data representing decisions made by previous biased humans)

And new machine intelligence *could* detect an individual's **propensity towards illness or disability over time**; From hand-writing analysis? Facial expressions,? Voice patterns? etc. (i.e., Even if medical records and other private data excluded)



Example **Symbolic AI** rule-based Expert System with Confidence Factors (CNF's)

J. Wunderlich, 1991

AI program to help pick a toy for a child

NOTE: Unlike Probability Theory, Confidence Factors do not need to add up to 100

User input:

1. Child's Age?

- Program automatically assigns a CNF Confidence factor = 100

2. Do you want to spend more or less than \$25?

- Input CNF Confidence factor (e.g. CNF=65 for less than \$25)

3. Child's gender? **#44 Undetected Bias**

- Program automatically assigns a CNF Confidence factor = 100

4. Preference for type of toy? (Action, Cuddly, or Creative)

- Input CNF Confidence factor s for each



Example Symbolic AI rule-based Expert System with Confidence Factors (CNF's)

J. Wunderlich, 1991

ASSUMPTIONS:

- 1) Gender is not relevant for children younger than the age of one.
- 2) Children younger than the age of one cannot have a known preference for toys.
- 3) Children between the ages of one and three cannot have a known preference for toys.

CONTROL OF SEARCH SPACE:

As a result of the above assumptions, the rules have been ordered so that:

- A) child_age is the first variable in the premise of every rule. **#44 Undetected Bias**
- B) gender and child_preference questions are not asked when child_age = under_1
- C) The child_preference question is not asked when child_age = one_to_three

TESTING OF EXPERT SYSTEM:

The expert system was tested under the three scenarios listed in the table below.

The resulting output is shown in the last column with the calculated confidence factors.

These confidence factors were calculated by VP-EXPERT using the following standard laws of Certainty:

A) $CNF(P1 \text{ and } P2) = \text{MIN}(CNF(P1), CNF(P2))$

B) $CNF(P1 \text{ or } P2) = \text{MAX}(CNF(P1), CNF(P2))$

And when two or more rules support the same result R:

C) $CNF(R1) + CNF(R2) - (CNF(R1) * CNF(R2))$ when CNF(R1) and CNF(R2) are positive

D) $CNF(R1) + CNF(R2) + (CNF(R1) * CNF(R2))$ when CNF(R1) and CNF(R2) are negative

E) $(CNF(R1) + CNF(R2)) / (1 - \text{MIN}(|CNF(R1)|, |CNF(R2)|))$ otherwise



Example Symbolic AI rule-based Expert System with Confidence Factors (CNF's)

J. Wunderlich, 1991

The example below shows the CNF calculations for suggested_toy = dress_up_doll

For the premise of RULE 12:

$(\text{child_age}=\text{four_to_six})$ AND $(\text{price}=\text{under_25})$ AND $(\text{gender}=\text{female})$ AND $(\text{child_preference}=\text{cuddly_toy})$
 CNF=1 AND CNF=0.65 AND CNF=1 AND CNF=0.55

Using law #A above; $\text{CNF}(\text{premise}) = \text{MIN}(1, 0.65, 1, 0.55) = 0.55$

Using law #C above; $[\text{CNF}(\text{conclusion}) = \text{CNF}(\text{premise}) * \text{CNF}(\text{RULE 12})] = [0.55 * 0.9] = 0.49$ see NOTE 7

Laws #C, #D, or #E are not used here because only RULE 12 fires to support the goal (suggested_toy=dress_up_doll)

TEST TRACE	INPUT				RULE FIRED AND ITS CNF	OUTPUT
#	child_age (see NOTE 1)	price (see NOTE 2)	gender (see NOTE 3)	child_preference (see NOTE 4)	CFN	suggested_toy
1	under_1	under_25 (CNF=65) over_25 (CNF=20)	N.A.	N.A.	CNF(R1)=95 CNF(R2)=90 CNF(R3)=95 CNF(R4)=75	teething_toy (CNF=61) mobile_for_crib (CNF=58) plastic_rattle (CNF=61) sterling_silver_rattle (CNF=15)
2	one_to_three	under_25 (CNF=65) over_25 (CNF=20)	male	N.A.	CNF(R5)=90 CNF(R6)=90 CNF(R7)=85	roly_poly (CNF=58) tricycle (CNF=18) hammer_and_pegs_game (CNF=55)
3	four_to_six <i>CFN=1.00</i>	under_25 (CNF=65) over_25 (CNF=20)	female <i>CFN=1.00</i>	action_toys (CNF=25) cuddly_toys (CNF=55) creative_toys (CNF=75)	CNF(R9)=95 CNF(R11)=95 CNF(R12)=90 CNF(R14)=85	lincoln_logs (CNF=61) doll_house (CNF=18) <u>dress_up_doll (CNF=49)</u> toy_tea_set (CNF=55)

Note 7: CFN's for RULES were assigned by J. Wunderlich Typically these will be assigned by the "Knowledge Engineer" after consultation with the "Domain Expert"

Example Symbolic AI rule-based Expert System with Confidence Factors (CNF's)

J. Wunderlich, 1991

CFN's for RULES were assigned by J. Wunderlich Typically these will be assigned by the "Knowledge Engineer" after consultation with the "Domain Expert"

```
RULE 1
IF child_age = under_one AND
price = under_25
THEN suggested_toy = teething_toy CNF 95;

RULE 2
IF child_age = under_one AND
price = under_25
THEN suggested_toy = mobile_for_crib CNF 90;

RULE 3
IF child_age = under_one AND
price = under_25
THEN suggested_toy = plastic_rattle CNF 95;

RULE 4
IF child_age = under_one AND
price = over_25
THEN suggested_toy = sterling_silver_rattle CNF 75;

RULE 5
IF child_age = one_to_three AND
price = under_25
THEN suggested_toy = roly_poly CNF 90;

RULE 6
IF child_age = one_to_three AND
price = over_25
THEN suggested_toy = tricycle CNF 90;

RULE 7
IF child_age = one_to_three AND
price = under_25 AND
gender = male
THEN suggested_toy = hammer_and_pegs_game CNF 85;
```

#44 Undetected Bias



Example Symbolic AI rule-based Expert System with Confidence Factors (CNF's)

J. Wunderlich, 1991

CFN's for RULES were assigned by J. Wunderlich Typically these will be assigned by the "Knowledge Engineer" after consultation with the "Domain Expert"

```
RULE 9
IF child_age = four_to_six AND
price = under_25 AND
child_preference = creative_toys
THEN suggested_toy = lincoln_logs CNF 95;
```

```
RULE 10
IF child_age = four_to_six AND
price = over_25 AND
gender = male AND #44 Undetected Bias
child_preference = action_toys
THEN suggested_toy = go_cart CNF 85;
```

```
RULE 11
IF child_age = four_to_six AND
price = over_25 AND
gender = female AND #44 Undetected Bias
child_preference = creative_toys
THEN suggested_toy = doll_house CNF 90;
```

```
RULE 12
IF child_age = four_to_six AND
price = under_25 AND
gender = female AND #44 Undetected Bias
child_preference = cuddly_toys
THEN suggested_toy = dress_up_doll CNF 90;
```

```
RULE 13
IF child_age = four_to_six AND
price = over_25 AND
gender = male AND #44 Undetected Bias
child_preference = action_toys
THEN suggested_toy = hot_wheels_set CNF 95;
```

```
RULE 14
IF child_age = four_to_six AND
price = under_25 AND
gender = female AND #44 Undetected Bias
child_preference = creative_toys
THEN suggested_toy = toy_tea_set CNF 85;
```

```
RULE 15
IF child_age = four_to_six AND
price = under_25 AND
gender = male AND #44 Undetected Bias
child_preference = creative_toys
THEN suggested_toy = army_men CNF 90;
```



Example Symbolic AI rule-based Expert System with Confidence Factors (CNF's)

J. Wunderlich, 1991

TEST TRACE #	INPUT				RULE FIRED AND ITS CNF	OUTPUT
	child_age (see NOTE 1)	price (see NOTE 2)	gender (see NOTE 3)	chid_preference (see NOTE 4)	(see NOTE 7)	suggested_toy
3	four_to_six <i>CNF=100</i>	under_25 (CNF=65) over_25 (CNF=20)	female <i>CNF=100</i>	action_toys (CNF=25) cuddly_toys (CNF=55) creative_toys (CNF=75)	CNF(R9)=95 CNF(R11)=95 CNF(R12)=90 CNF(R14)=85	lincoln_logs (CNF=61) doll_house (CNF=18) <u>dress_up_doll (CNF=49)</u> toy_tea_set (CNF=55)

MODIFIED Test-trace #3

with age changed to one_to_three, and gender changed to male

This changed OUTPUT to:

roly_poly (CNF 58)

tricycle (CNF 18)

hammer_and_pegs_game (CNF 55)

```

suggested_toy
! Testing 1
!   ! child_age
!   !   (= one_to_three CNF 100 )
! Testing 2
! Testing 3
! Testing 4
! Testing 5
!   ! price
!   !   (= under_25 CNF 65 )
!   !   (= over_25 CNF 20 )
!   (= roly_poly CNF 58 )
! Testing 6
!   (= tricycle CNF 18 )
! Testing 7
!   ! gender
!   !   (= male CNF 100 )
!   (= hammer_and_pegs_game CNF 55 )
! Testing 8
! Testing 9
! Testing 10
! Testing 11
! Testing 12
! Testing 13
! Testing 14
! Testing 15
    
```

#44 Undetected Bias

Perhaps unintended 1991 gender-bias in RULES

and /or in CNF's of RULES should be adjusted



Example **Symbolic AI** rule-based Expert System with Confidence Factors (CNF's)

J. Wunderlich, 1991

Perhaps unintended 1991 gender-bias in RULES and/or in CNF's of RULES should be adjusted

```
RULE 7
IF child_age = one_to_three AND
price = under_25 AND
gender = male ←
THEN suggested_toy = hammer_and_pegs_game CNF 85;
```

```
RULE 10
IF child_age = four_to_six AND
price = over_25 AND
gender = male AND ←
child_preference = action_toys
THEN suggested_toy = go_cart CNF 85;
```

```
RULE 11
IF child_age = four_to_six AND
price = over_25 AND
gender = female AND ←
child_preference = creative_toys
THEN suggested_toy = doll_house CNF 90;
```

```
RULE 12
IF child_age = four_to_six AND
price = under_25 AND
gender = female AND ←
child_preference = cuddly_toys
THEN suggested_toy = dress_up_doll CNF 90;
```

```
RULE 13
IF child_age = four_to_six AND
price = over_25 AND
gender = male AND ←
child_preference = action_toys
THEN suggested_toy = hot_wheels_set CNF 95;
```

```
RULE 14
IF child_age = four_to_six AND
price = under_25 AND
gender = female AND ←
child_preference = creative_toys
THEN suggested_toy = toy_tea_set CNF 85;
```

```
RULE 15
IF child_age = four_to_six AND
price = under_25 AND
gender = male AND ←
child_preference = creative_toys
THEN suggested_toy = army_men CNF 90;
```





Anna Elizabeth Wunderlich, born June 15th, 2002





	Wunderlich Research 2018	Can human do?	Can bug do? (spider)	Can Conventional Computer Program do?	Can Symbolic AI Program do?	Can Artificial Neural Network do?	Comments
	<u>COMPLEX ABILITIES:</u>						
44	Undetected Bias	yes	no	somewhat	somewhat	YES !!	Hidden?!?
45	Disinformation	yes	somewhat	somewhat	YES	YES	
46	Choosing "lesser?" evil	yes	yes	yes	yes	yes	Driverless death
47	Sensor Fusion and Integration of Processing	yes	yes	somewhat	somewhat	yes	

2018 #45 **Disinformation**

Has been happening for a very long time, and doesn't require a computer



		Can human do?
45	Disinformation	yes

Unbalancing **(Destabilizing !)**
your opponent is called
“Kuzushi” in Judo





					Can Symbolic AI Program do?	Can Artificial Neural Network do?	
45	Disinformation				YES	YES	

A screenshot of a Facebook notification banner. On the left is a blue shield icon with a white 'f' logo. To its right, the text reads: "Press 'Protect My Data' on Facebook". Below this is a paragraph: "Mike, we are always working to make you feel that your data is safe on Facebook. Press this nonfunctional 'Protect My Data' button to give yourself a sense of security today!". At the bottom of the notification is a blue button with the text "Protect My Data". Below the notification are three options: "Make Post", "Photo/Video Album", and "Live Video". At the very bottom, there is a profile picture of a man and the text "What's on your mind, Mike?".



2013

Ware Seminar on Cyber Security



**Tuesday, September 17
7 pm in the K&V
Brossman Commons**

FREE AND OPEN TO THE PUBLIC - NO TICKETS REQUIRED

Cyber threats have become one of the most serious threats to all of society. This seminar explores cyber capabilities and how they can and are affecting our lives.



Scott Borg

SCOTT BORG, DIRECTOR OF THE U.S. CYBER CONSEQUENCES UNIT, an independent, non-profit research institute that investigates the strategic and economic consequences of cyber attacks, originated many of the concepts and categories currently being used to understand the strategic and economic implications of cyber-attacks. He founded the US-CCU at the request of senior government officials, who wanted an independent, economically-oriented source of cyber-security research. He has lectured at Harvard, Yale, Columbia, London, and other leading universities.



John Smith

JOHN M. SMITH, SENIOR COUNSEL, RAYTHEON COMPANY, is Raytheon's first cybersecurity lawyer and first chief privacy lawyer, having served previously in a similar role at the White House. John was Associate Counsel to President George W. Bush, the primary legal advisor to the White House Homeland Security Council staff. Earlier in his career, John clerked for Judge Samuel A. Alito, Jr., and practiced international litigation and regulatory law at Covington & Burling. John graduated *magna cum laude* from both Princeton and Brigham Young University Law School, served a decade as an Army reservist, and is fluent in Russian and Ukrainian, having served two years as an early missionary of the Church of Jesus Christ of Latter-day Saints in Russia and Ukraine.



Ian Wallace

IAN WALLACE, VISITING FELLOW FOR CYBERSECURITY WITH THE CENTER FOR 21st CENTURY SECURITY AND INTELLIGENCE IN THE FOREIGN POLICY PROGRAM AT THE BROOKINGS INSTITUTION, was previously a senior official at the British Ministry of Defence where he helped develop UK cyber strategy as well as the UK's cyber relationship with the United States. His research is focused on the international dimensions of cybersecurity policy, including the implications of cyber for military forces and the appropriate roles of the public and private sectors. Wallace's expertise spans UK and U.S. national security policy and strategy. He joined Brookings after seventeen years working for the British Ministry of Defence, most recently at the British Embassy, Washington as the defence policy and nuclear counselor. Immediately before joining the embassy he was a fellow at the Weatherhead Center for International Affairs at Harvard University where his work included research into the military implications of new cyber capabilities.



Joseph Wunderlich

DR. JOSEPH WUNDERLICH, ASSOCIATE PROFESSOR OF ENGINEERING, ELIZABETHTOWN COLLEGE, is serving as seminar moderator. He has taught 31 different courses, founded the Etown Robotics & Machine Intelligence Lab, led the Computer Engineering program to accreditation, and led the development of the sustainable design engineering concentration. Prior to Etown he was a Purdue University Assistant Professor, an IBM supercomputer researcher, an AI DuPont Hospital robotics researcher, and Director of Projects for the development of several high-tech office parks in Texas and California.

Co-sponsored by the
**Judy S. '68 and Paul W. Ware Colloquium on Peacemaking and Global Citizenship
and the Center for Global Understanding and Peacemaking**

In 2012, the Center for Global Understanding and Peacemaking received a grant from the US Undergraduate International Studies and Foreign Language (UISEIL) Program, International Studies Division of the US Department of Education. This program provides funds to plan, develop, and carry out programs to strengthen and improve undergraduate instruction in international studies and foreign languages. For more information about the grant see: <http://www2.ed.gov/programs/igslp/guif/index.html>



Elizabethtown College

For further information contact Kay Wolf, Program Manager, Center for Global Understanding and Peacemaking, kwolf@etown.edu



Wunderlich Research 2018

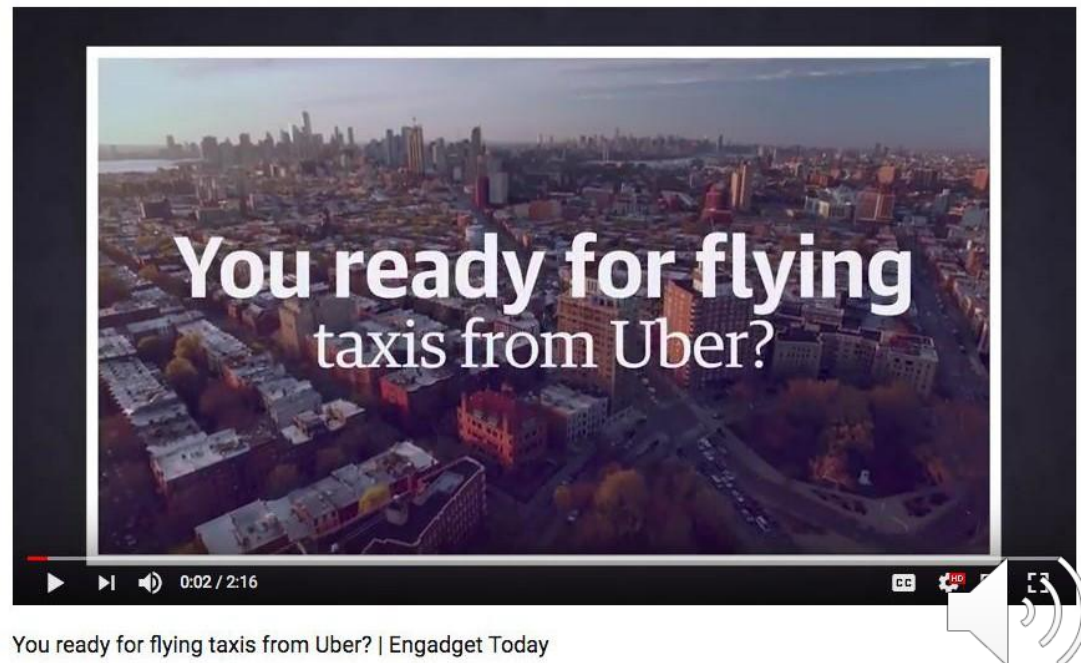
	Can human do?	Can bug do? (spider)	Can Conventional Computer Program do?	Can Symbolic AI Program do?	Can Artificial Neural Network do?	Comments
<u>COMPLEX ABILITIES:</u>						
44	Undetected Bias	yes	no	somewhat	somewhat	YES !! Hidden?!?
45	Disinformation	yes	somewhat	somewhat	YES	YES
46	Choosing "lesser?" evil	yes	yes	yes	yes	Driverless death
47	Sensor Fusion and Integration of Processing	yes	yes	somewhat	somewhat	yes

2018 #46

Choosing "lesser?" evil

Driverless death

What could possibly go wrong?



	Wunderlich Research 2018	Can human do?	Can bug do? (spider)	Can Conventional Computer Program do?	Can Symbolic AI Program do?	Can Artificial Neural Network do?	Comments
	<u>COMPLEX ABILITIES:</u>						
44	Undetected Bias	yes	no	somewhat	somewhat	YES !!	Hidden?!?
45	Disinformation	yes	somewhat	somewhat	YES	YES	
46	Choosing "lesser?" evil	yes	yes	yes	yes	yes	Driverless death
47	Sensor Fusion and Integration of Processing	yes	yes	somewhat	somewhat	yes	

2018 #47

Sensor Fusion

(Vision, hearing, brainwaves, GPS, Laser-Range-Finders, Ultrasound, etc)

and

Integration of Processing

including combining **Symbolic AI** and **Neural Networks**

