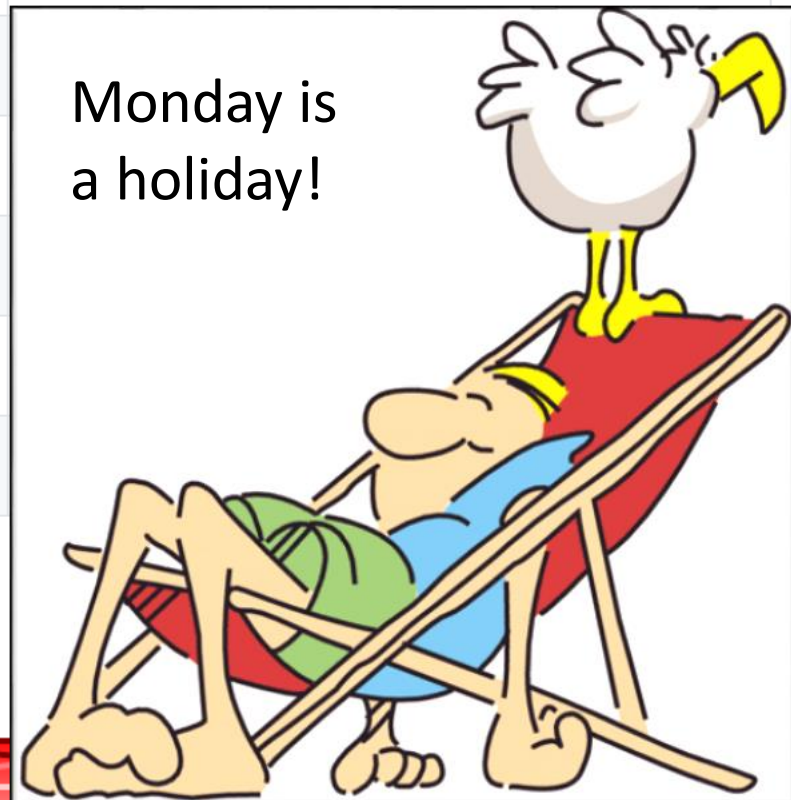
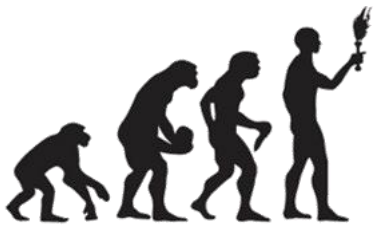


# Intelligent Physical Systems

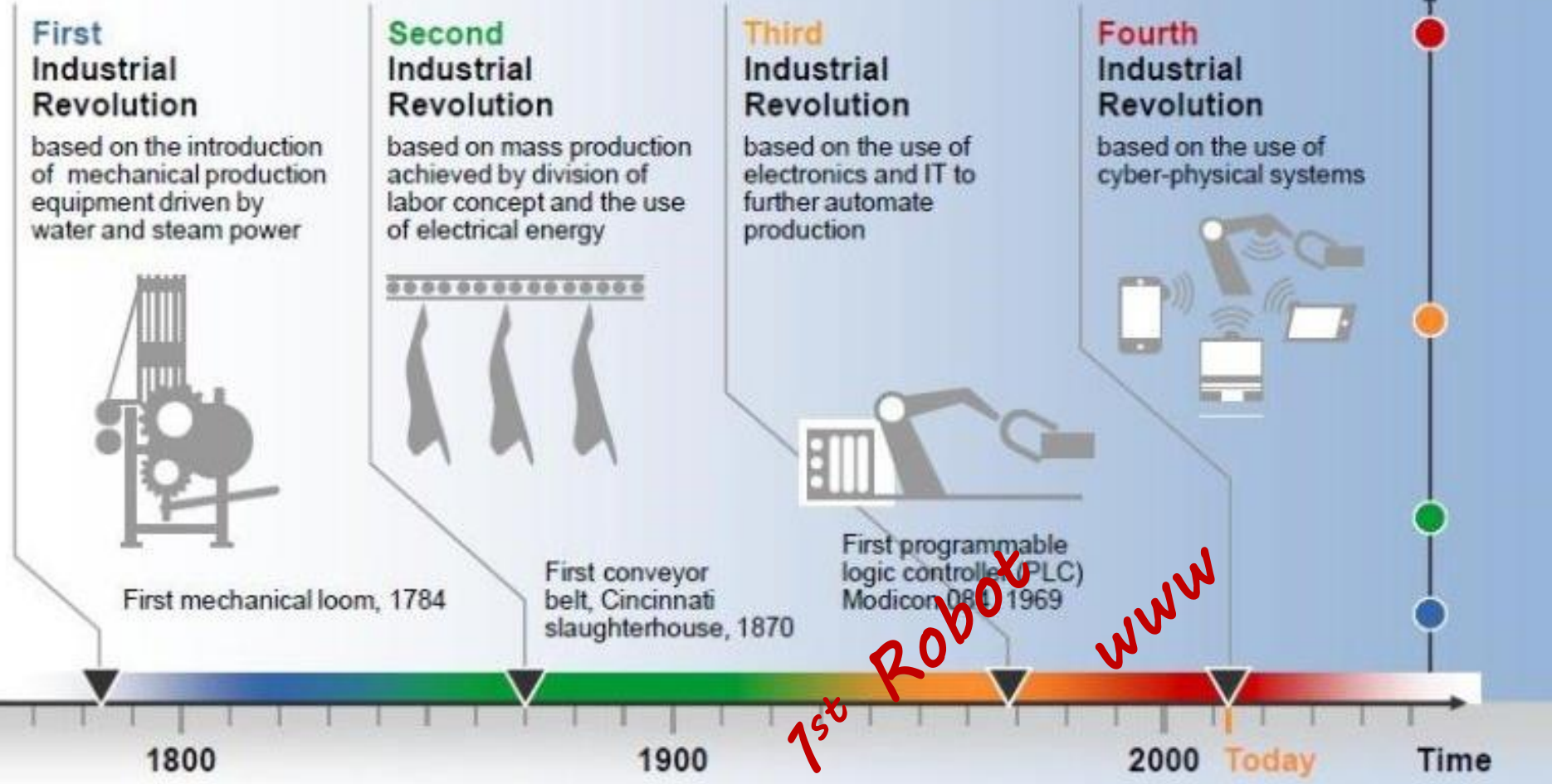
Week	Topic	Week	Topic
1	Intro, Arduino	9	Prototyping EE, <a href="#">LAB 4</a>
2	IPS fundamentals, team work/time management, <a href="#">Website</a> , <a href="#">LAB 1</a>	10	Algorithms
3	Sensors and filters	11	Algorithms, <a href="#">Milestone 3</a>
4	Embedded control, <a href="#">LAB 2</a>	12	
5	Actuators and control, <a href="#">Milestone 1</a>	13	
6	FPGA, VGA, <a href="#">Milestone 2</a>	14	
7	Prototyping ME, <a href="#">LAB 3</a>	15	
8	Wireless communication	16	



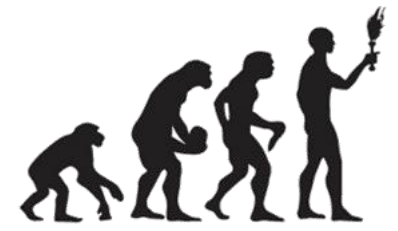
# Intelligent Physical Systems: Historical Context



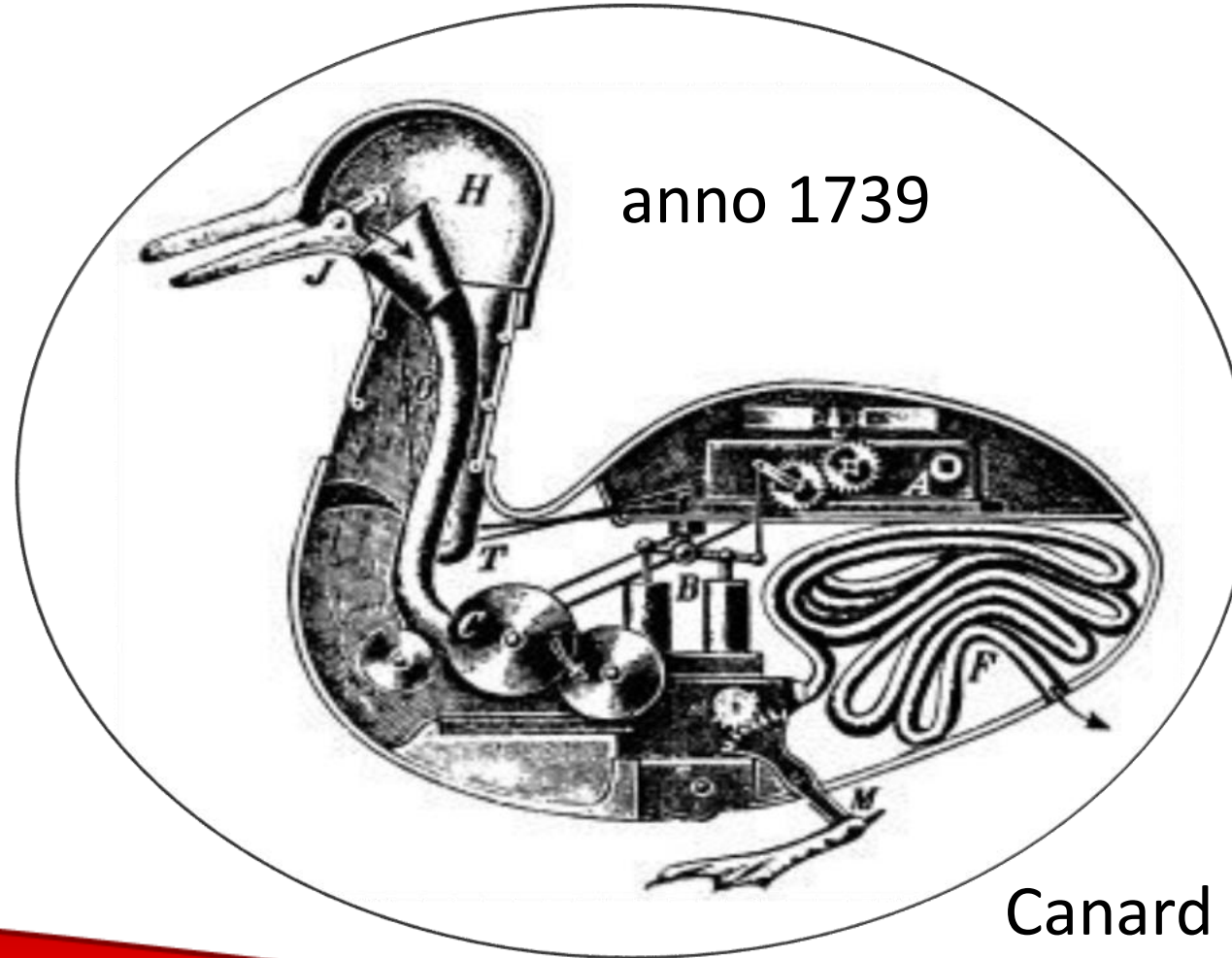
## From Industry 1.0 to Industry 4.0



# Intelligent Physical Systems: Historical Context

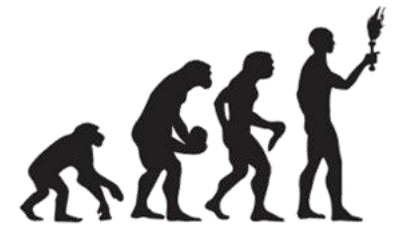


1700's



Canard Digérateur

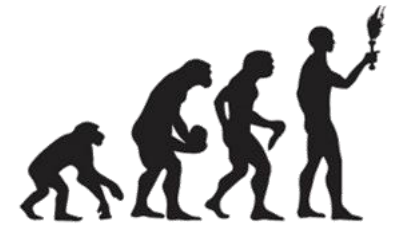
# Intelligent Physical Systems: Historical Context



1700's



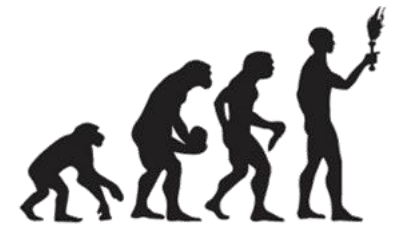
# Intelligent Physical Systems: Historical Context



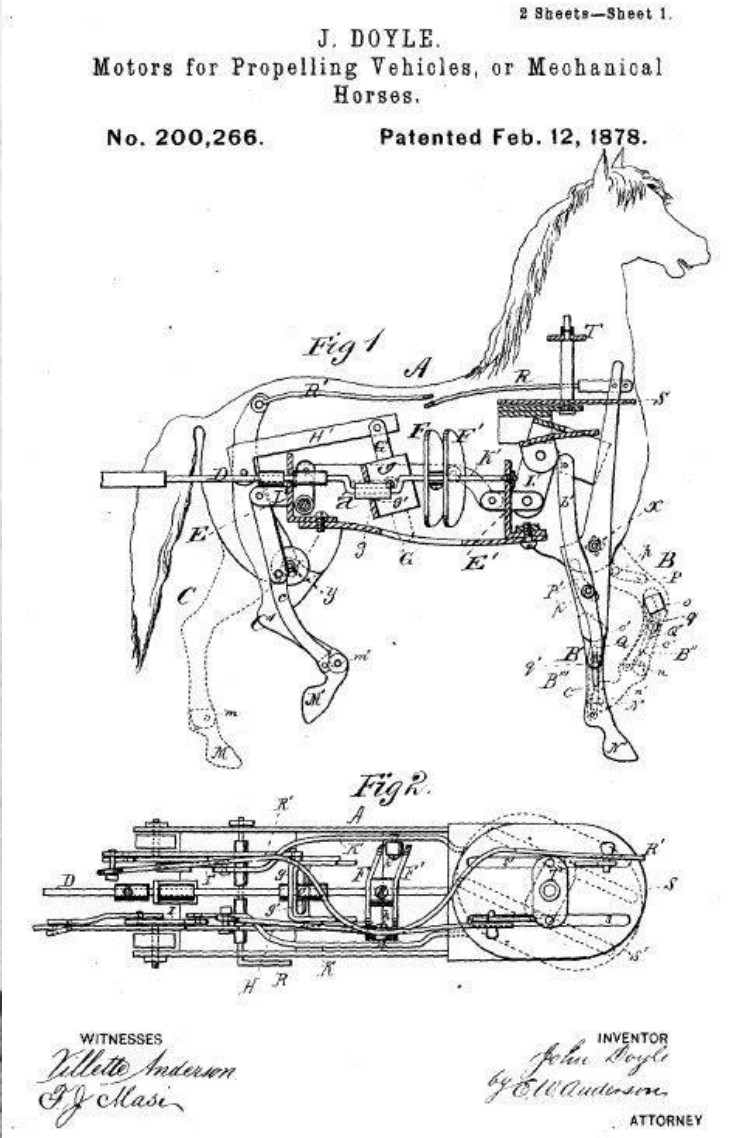
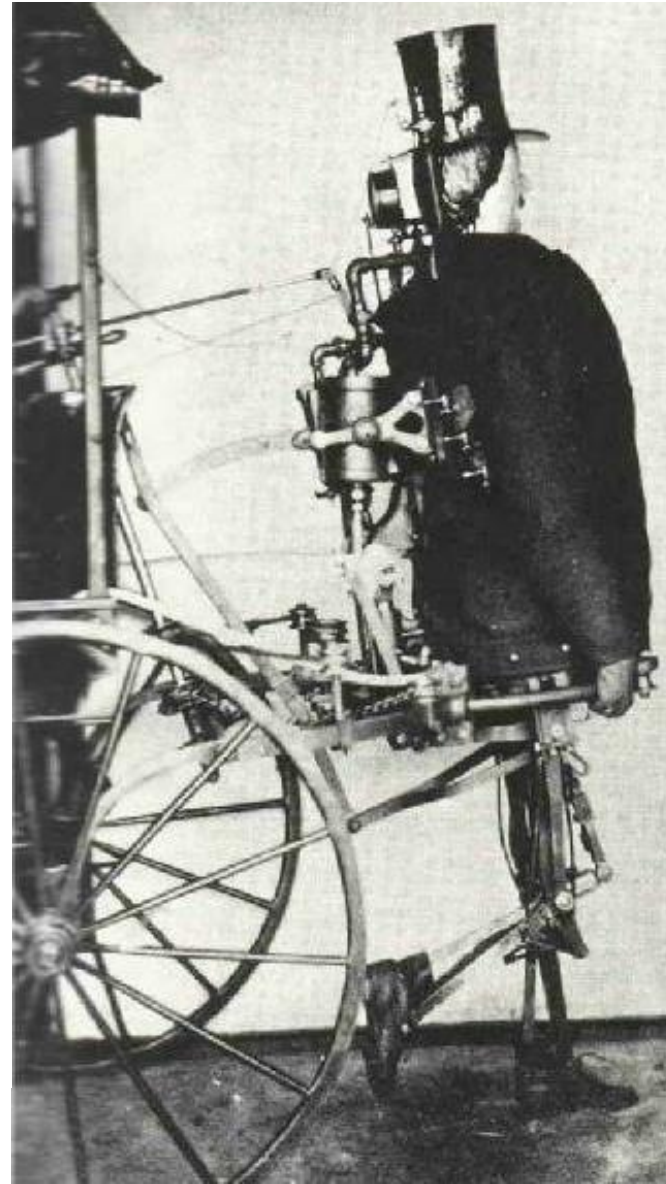
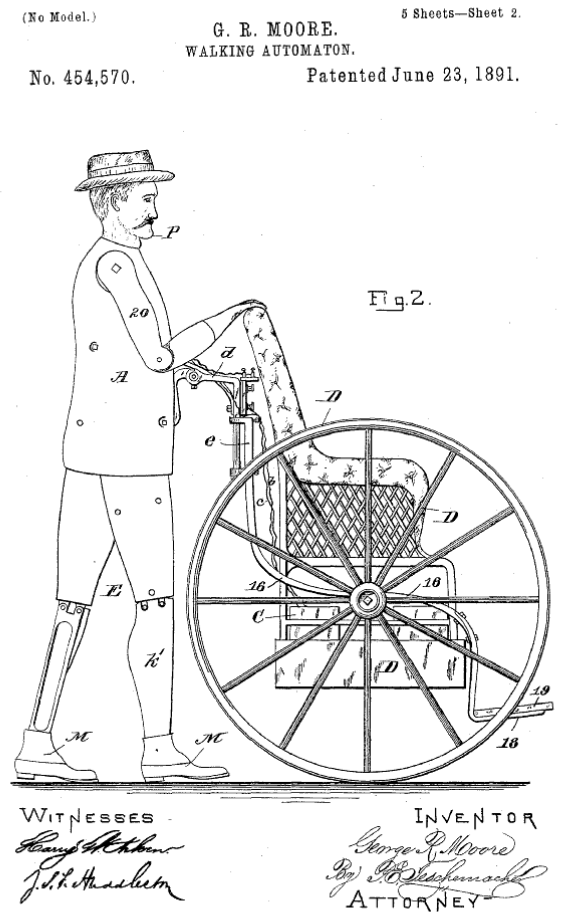
1800's



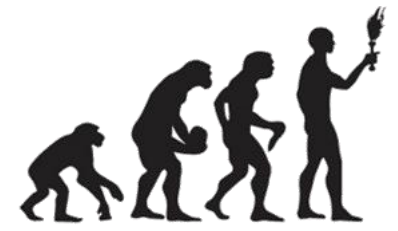
# Intelligent Physical Systems: Historical Context



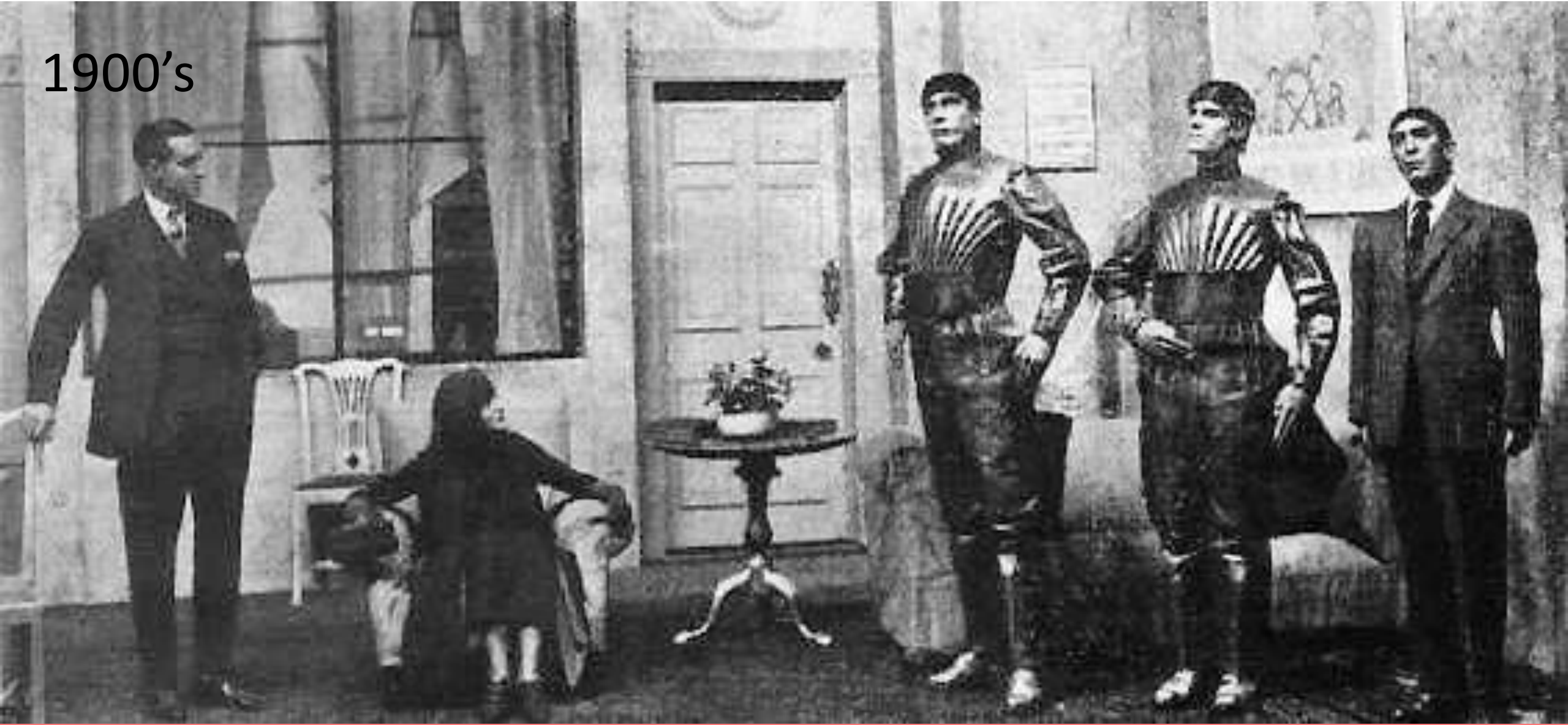
1800's



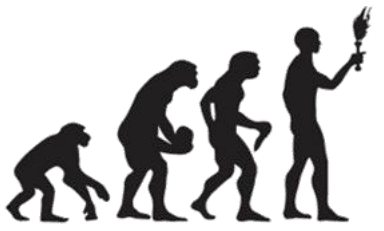
# Intelligent Physical Systems: Historical Context



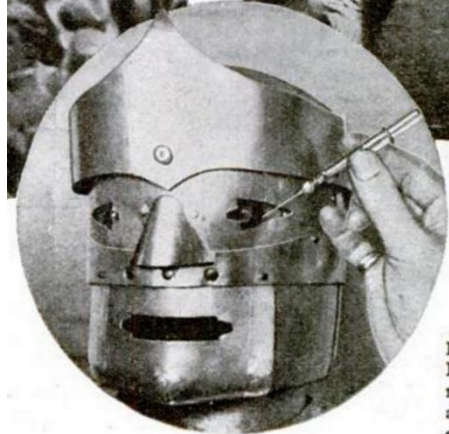
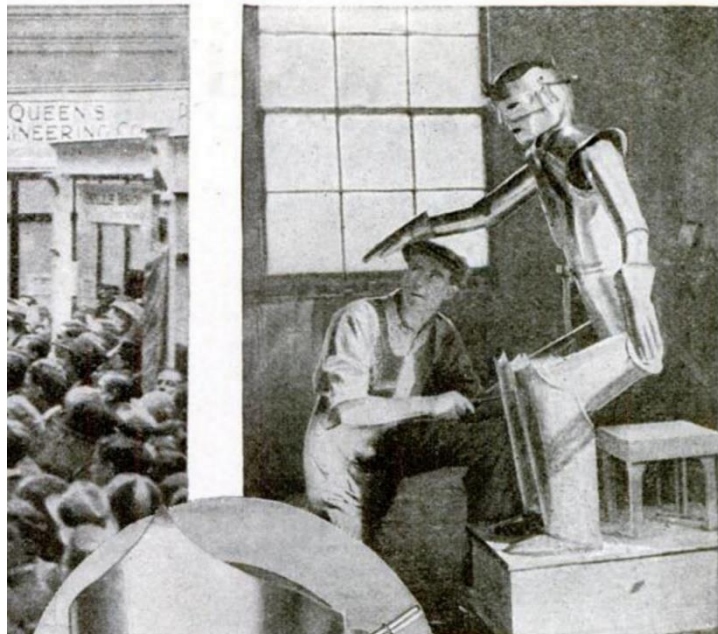
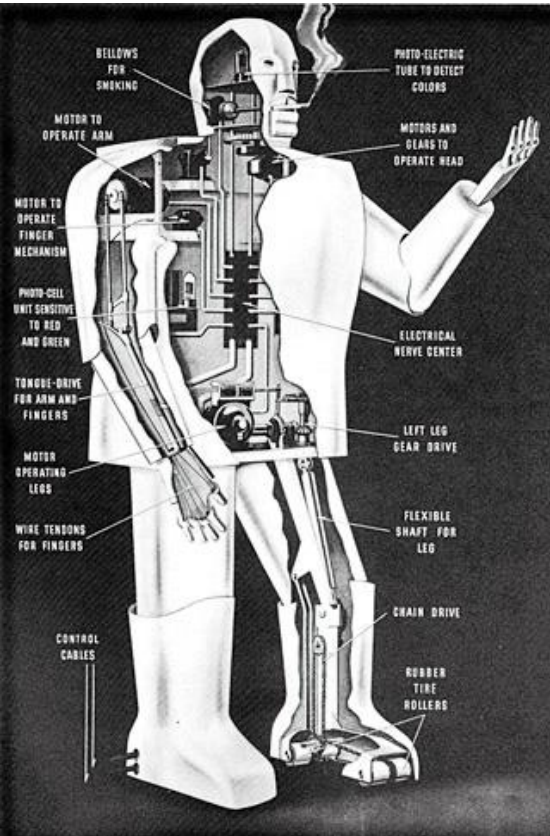
1900's



# Intelligent Physical Systems: Historical Context



1900's



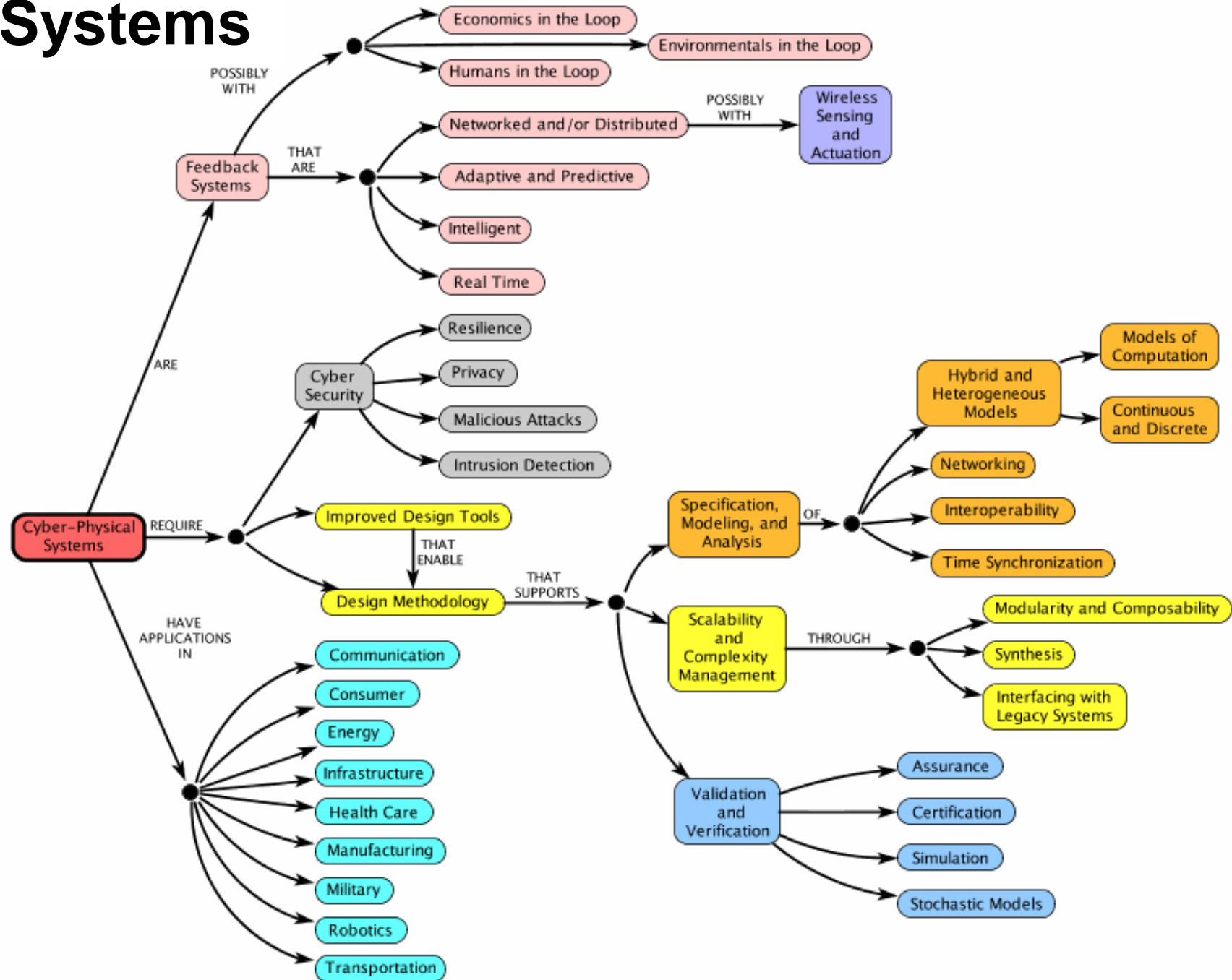
Capt. W. H. Richards, British inventor, puts the finishing touches on Eric, the talking "robot," controlled by electric motors.

Left: Oiling Eric's eyeballs. Because of the delicate mechanism it is done with a hypodermic syringe. The eyes are electric lamps.



# Intelligent Physical Systems

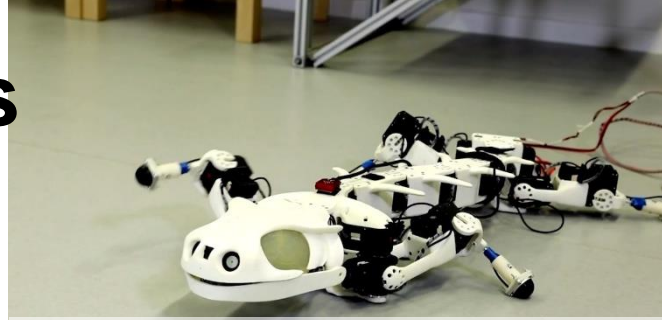
Cyber



# Intelligent Physical Systems

Dull Dangerous

Dirty Distributed



Research robots



Military robots



Medical robots



Home (assisted living) robots



Autonomous cars



Entertainment robots



Space robotics



Aerial robots



Underwater robots

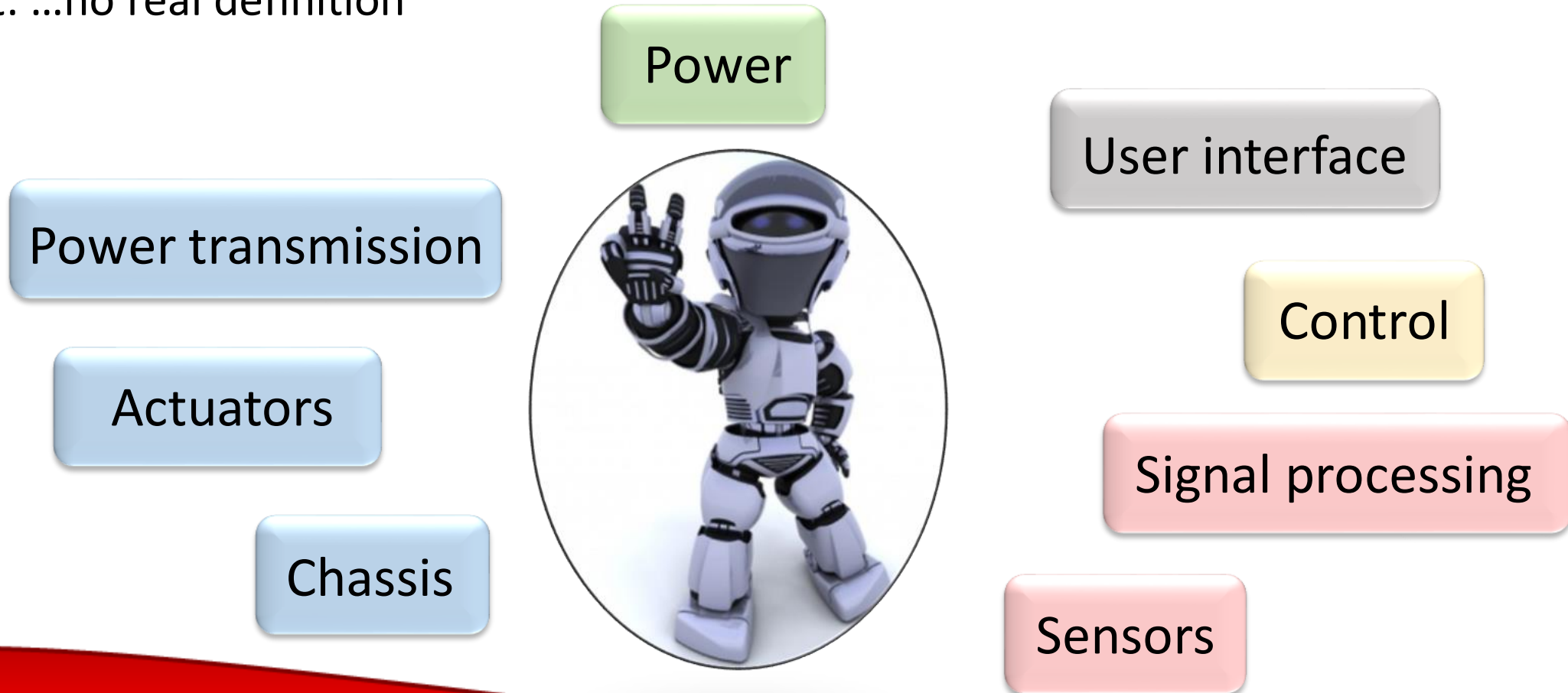


Industrial robots

# Intelligent Physical Systems

## *Definitions*

- Machine: an apparatus consisting of several parts, that uses or applies mechanical power
- Automaton: a machine that performs a predetermined set of coded instructions
- Robot: ...no real definition



# Sensors

## Proprioceptive Sensors

- ✕ Encoders
- ✕ Joint torque sensors
- ✕ Strain sensors
- ✕ Compass
- ✕ Accelerometer
- ✕ Battery level

## Exteroceptive Sensors

- ✕ Camera
- ✕ Distance sensors
- ✕ Light sensors
- ✕ Microphone
- ✕ Humidity
- ✕ Magnetometers

*passive  
sensors*  
*active  
sensors*

### Challenges

- Sensitivity
- Sensitivity to other signals
- Repeatability
- Signal-to-noise ratio
- Signal processing

# Mechanics

## Chassis / power transfer

- Rigid links
- Hinges
- Bearings
- Pulleys
- Gears
- Nuts and bolts

## Actuators

- Motors (DC, AC, brushed/brushless)
- Electromagnets
- Pneumatics/hydraulics
- Tendons/muscle wire
- Electro permanent magnets

### Challenges

- Price
- Weight
- Durability
- Accuracy
- Backlash
- Power consumption

# Controller

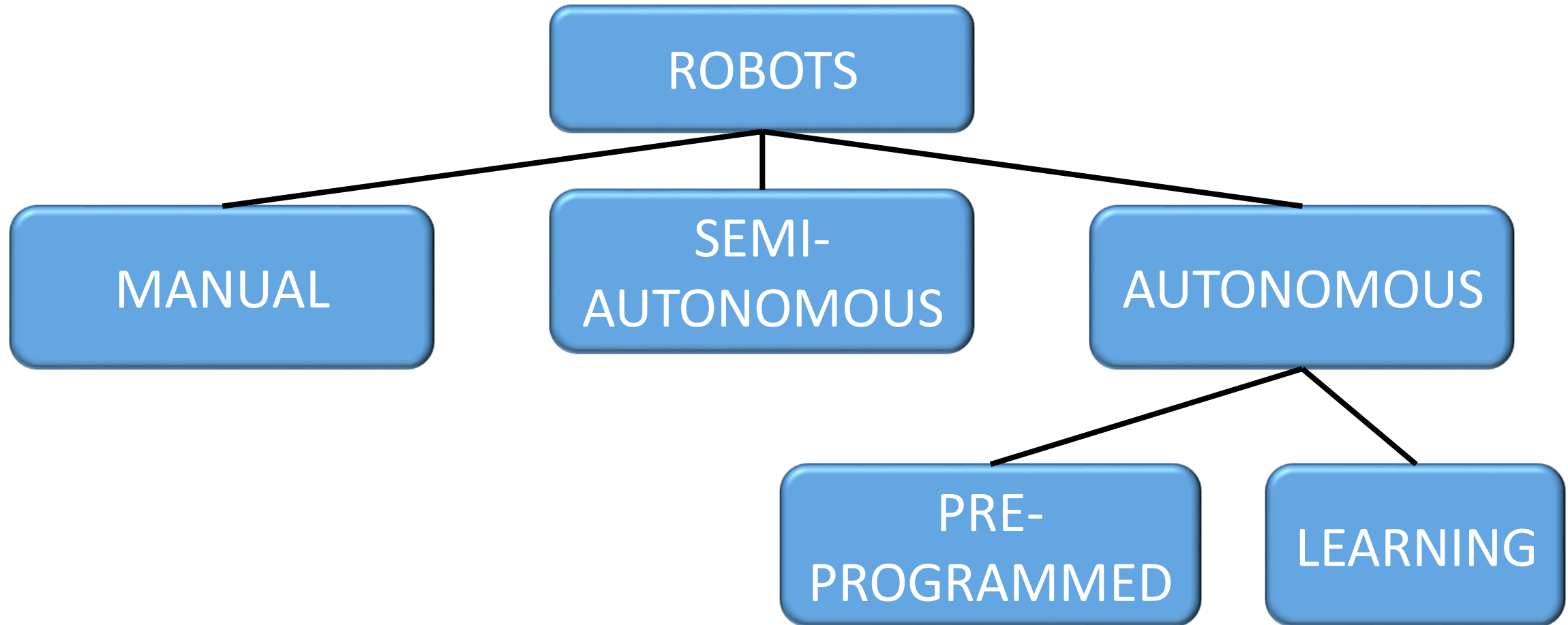
- Microprocessor
- Microcontroller
- Digital Signal Processor
- Programmable Logic Controller
- Field Programmable Gate Array
- ASICs

- Driver electronics
- Power circuitry
- Filters
- ADC / DAC
- Memory
- Communication
- Shielding
- Batteries

## Challenges

- Price
- Processing power
- Real-time OS
- Pin-outs
- Memory
- Power consumption

# Control



# Artificial Intelligence

- *A device that can do something, that, if people did it, we would consider intelligent*
- *A device that perceives the environment and takes actions to maximize its chance of success at some goal*
- *A device that can learn the optimal strategy to achieve its goal*

Big Hero 6





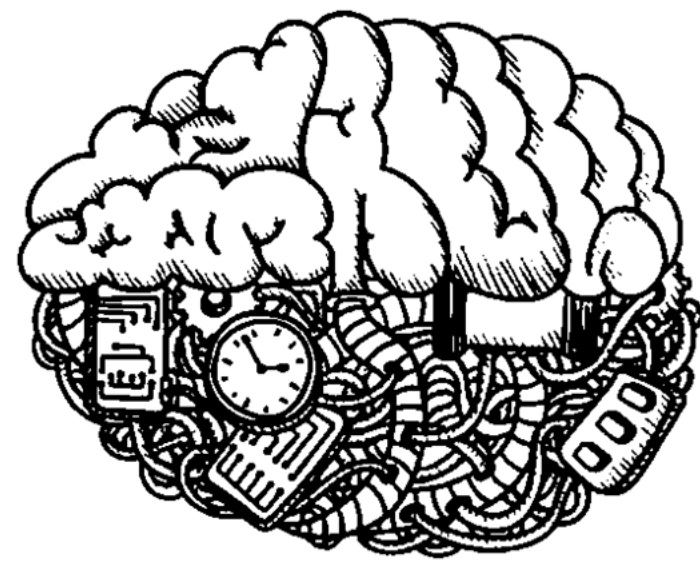
Source: Peter Pastor



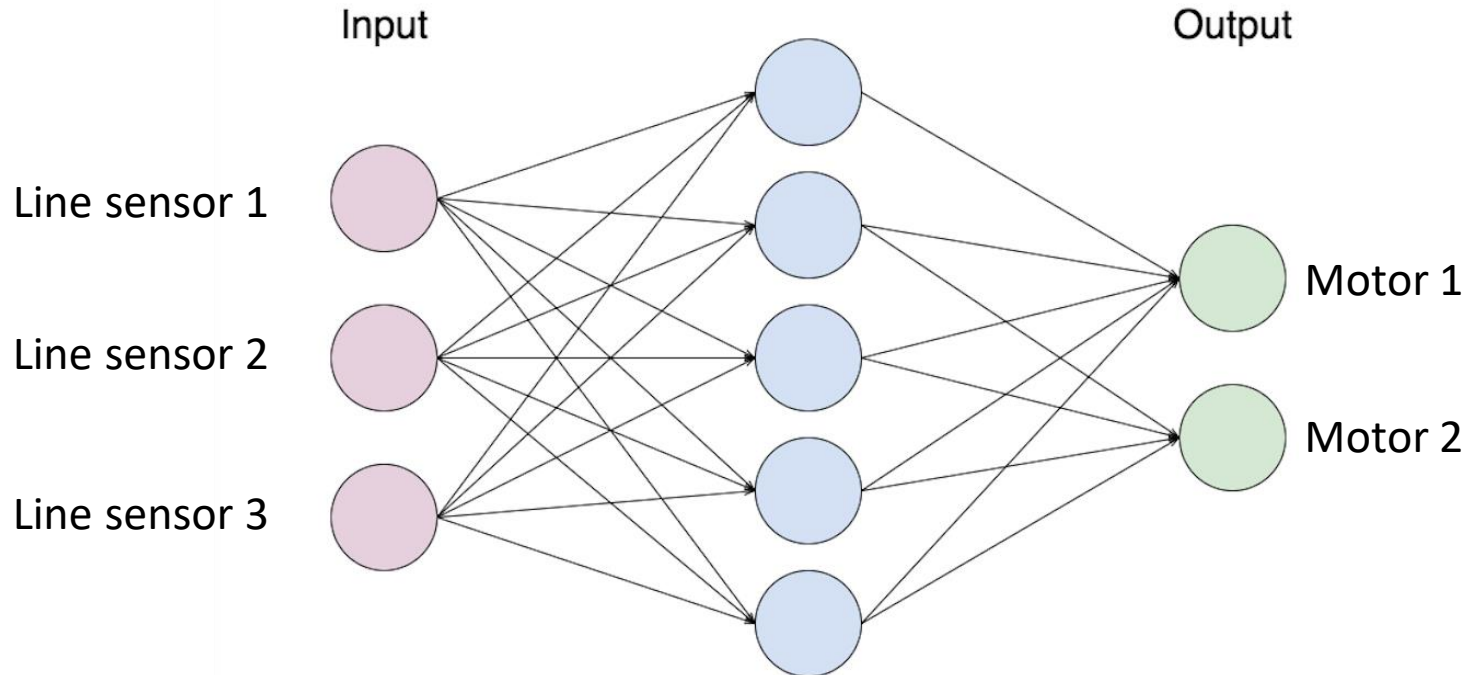
# Supervised Learning

## *Sub-symbolic AI*

- Scales to big data, robust to noise
- Great for perceptual problems



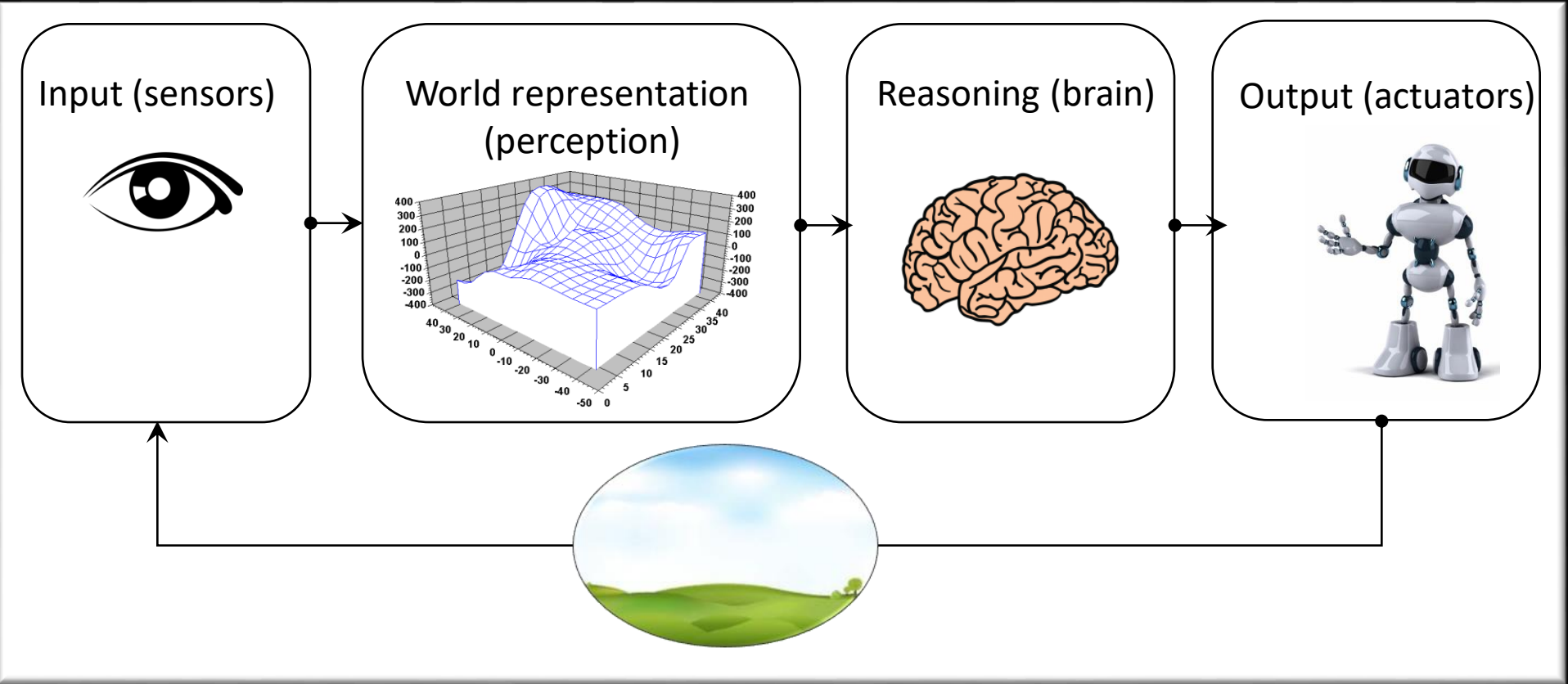
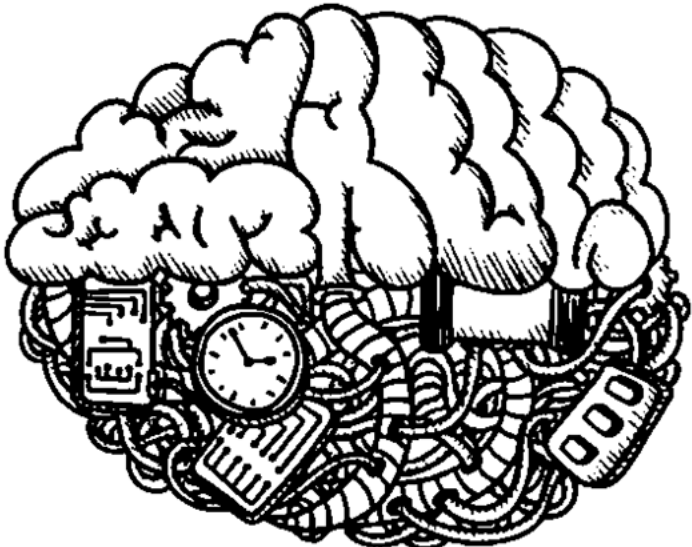
Line following robot:



# Traditional Artificial Intelligence

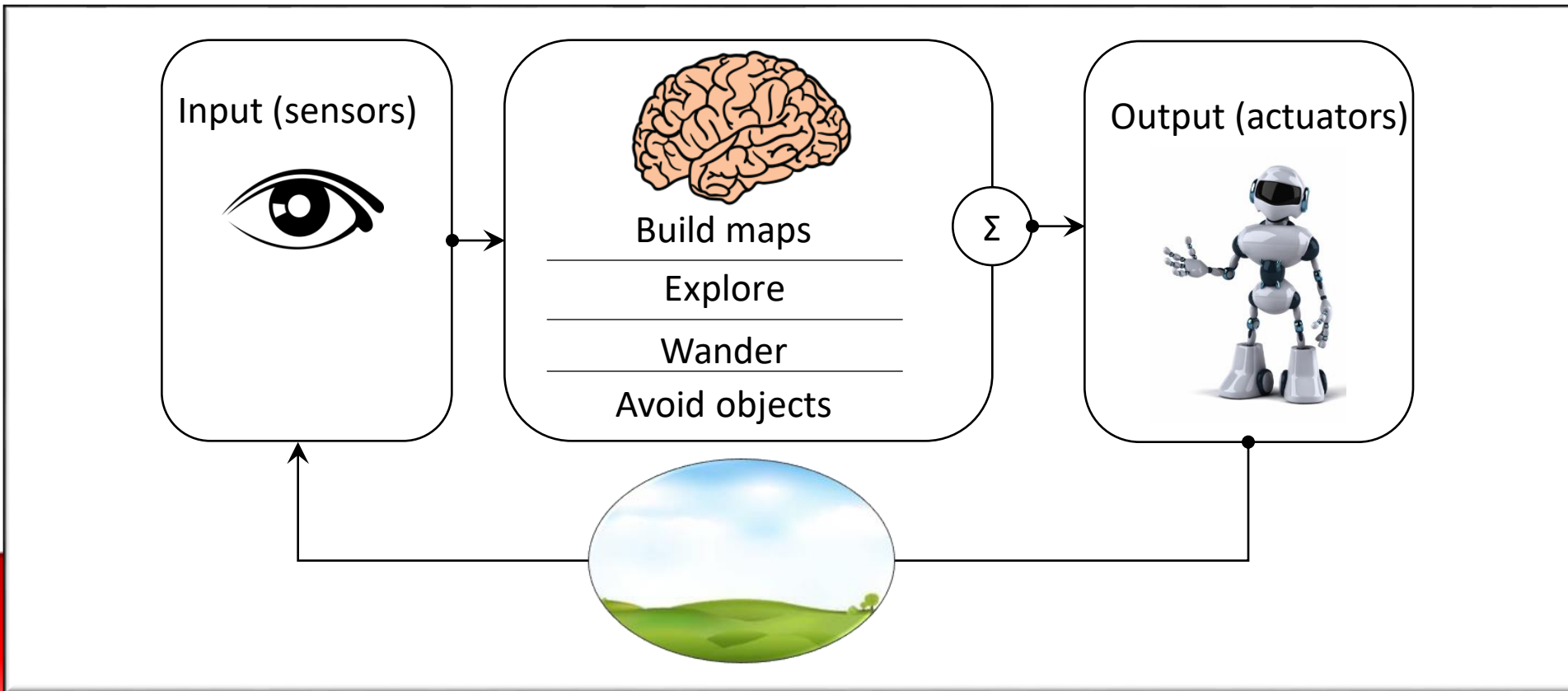
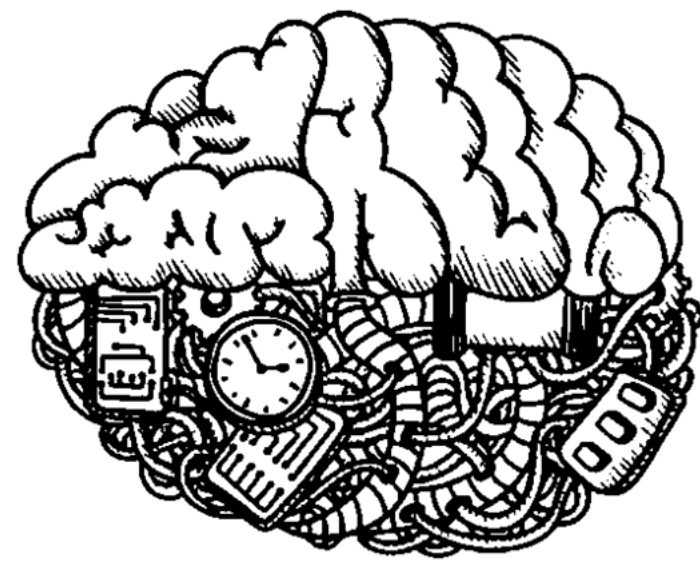
*Symbolic AI*

- Intuitive to debug, explain, and control



# Behavior-based Artificial Intelligence

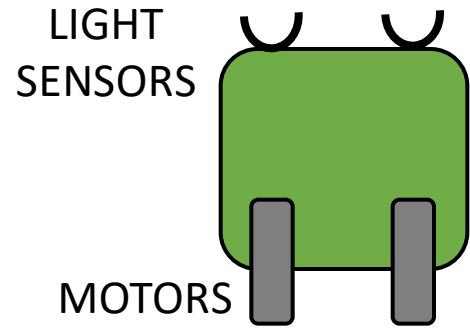
- Reactive Intelligence
- Good for time-critical behaviors



# Embodied Intelligence



# Embodied Intelligence



BRAITENBURG VEHICLE  
(1984)

# Online Communication

*Make your work count!*

- Refer back to them when you build new systems
- Public repositories
- Refer back to them when you interview
- (and it's part of your grade!)

# Online Communication

*Make your work count!*

- Clear, concise text
  - Add team number, name, team members, class and year.
- Easy access to links
- Descriptive photos
  - Compress size!
- Descriptive videos
  - Phone cameras, Screen capture, overlay informative text/speech
- Code *snippets* (with comments)



# Online Communication - Cultural differences



## *Hofstede's Cultural Dimensions Theory:*

- Power Distance
- Individualism vs. collectivism
- Masculinity vs. Femininity
- Uncertainty Avoidance
- Long-term vs. Short term orientation

# Online Communication - Cultural differences

## *Hofstede's Cultural Dimensions Theory:*

- Power Distance
- Individualism vs. collectivism
- Masculinity vs. Femininity
- Uncertainty Avoidance
- Long-term vs. Short term orientation



<http://corporate.mcdonalds.com/mcd/country/map.html>

Source: <http://blog.usabilla.com/designing-for-a-cross-cultural-user-experience-part1/>

# Online Communication – Power Distance



# Online Communication – Power Distance

Holland

The screenshot shows the McDonald's website for the Netherlands. At the top, the navigation menu includes: **PRODUCTEN**, **ACTUEEL**, **FAMILIE**, **JOUW RESTAURANT**, **OVER McDonald's**, and **WEEKEN BIJ**. A search bar is located on the right. The main banner features a **Chicken Saté** burger on a wooden background with the text "Hij is weer terug!" (He is back!). Below the banner are four category buttons: **CHICKEN SATÉ**, **WELKOM BIJ**, **ELDERWALLEN**, and **HAPPY MEAL**.

Below the banner are three main navigation options:

- Gastenpanel**: Represented by a green square with a glowing lightbulb icon containing the golden arches.
- Kwaliteit**: Represented by a photograph of a long, straight path through a green field.
- HAPPY STUDIO**: A vertical menu with the following items:
  - Direct toegang** (Direct access)
  - VIND EEN RESTAURANT BIJ JOU IN DE BUURT** (Find a restaurant near you) with a map of the Netherlands and an "OK" button.
  - SOLLICITEER IN EEN RESTAURANT** (Apply for a restaurant) with a chef's hat icon.

# Online Communication – Power Distance

China

The screenshot shows the McDonald's China website homepage. At the top, there is a navigation bar with the McDonald's logo and several menu items: 美食与营养 (Food & Nutrition), 随时随地麦当劳 (McDonald's Everywhere), 开心家庭派对 (Happy Family Party), 加入麦当劳 (Join McDonald's), 公益动向 (Public Welfare), 麦当劳俱乐部 (McDonald's Club), and 特许经营 (Franchise). Below the navigation bar, the main content area is divided into three sections. The left section features a large image of a Bacon Potato Mashed Double Cheeseburger and a cup of fries. The middle section contains text: 培根土豆泥 双层牛堡 (Bacon Potato Mashed Double Cheeseburger), 超值午餐 (Super Value Lunch), 配薯条(中)+可口可乐(中) (With Medium Fries + Medium Coca-Cola), and a large price tag of ¥20起 (Starting from ¥20). The right section shows a video player with a thumbnail of a soccer player and the text 麦当劳特别声明 (McDonald's Special Statement). Below the main content area, there are three promotional banners: 天天超值早餐 ¥6起 (Daily Super Value Breakfast Starting from ¥6), 天天超值午餐 ¥15起 (Daily Super Value Lunch Starting from ¥15), and 麦乐茶点优惠 ¥7起 (McDonald's Dessert Promotion Starting from ¥7). To the right of these banners are four buttons: 优惠券下载 (Download Coupons), 最新档玩具 (Latest Toys), 妈妈的标准 我们的标准 (Mom's Standard, Our Standard), and 全国餐厅查询 (Search for Restaurants Nationwide). At the bottom, there are links for 麦乐送 网上订餐 (McDonald's Delivery Online Ordering), McCafe, 麦当劳得来速餐厅 (McDonald's Drive-Thru Restaurants), and 24小时营业餐厅 (24-hour Restaurants). The footer contains the text 关注我们 | 主页 | TVC | 新闻发布区 | 业主投资热点 | 隐私权申明 | COPYRIGHT 2008 ALL RIGHTS RESERVED BY McDONALD'S | 沪ICP备08117539号.

# Online Communication – Individualism vs Collectivism



<http://www.targetmap.com/viewer.aspx?reportId=9826>

# Online Communication – Individualism vs Collectivism

USA

The image shows a screenshot of the McDonald's USA website. On the left is a red navigation menu with the following items: Home, I'm lovin' it, FOOD, PROMOTIONS, OUR STORY, CAREERS, LOCATIONS, SEARCH, CONTACT US, SERVICES, and 10 WEBSITES. The main content area has a dark wood-grain background. At the top center is a wooden sign that reads "FISH McBites". Below it is another wooden sign featuring a fish and the text "GET UP & TASTY TIME" with an arrow pointing right. In the foreground, three containers of Fish McBites are displayed on a white napkin: a small white container, a medium green container, and a large blue container. At the bottom of the page, there are three promotional banners. The first banner on the left says "Dollar Menu" and "There's a lot to love for a little at McDonald's" with images of a burger and cookies. The middle banner features a smiling man and says "HE PICKS THE APPLES PICKED FOR HAPPY MEALS". The right banner says "2013 McDONALD'S ALL AMERICAN TEAM" with the McDonald's logo. At the very bottom, there are social media links for "Follow" and "Like", and a footer with "Corporate + Privacy + Terms & Conditions + Unsubscribe + ©2010-2013 McDonald's. All Rights Reserved".

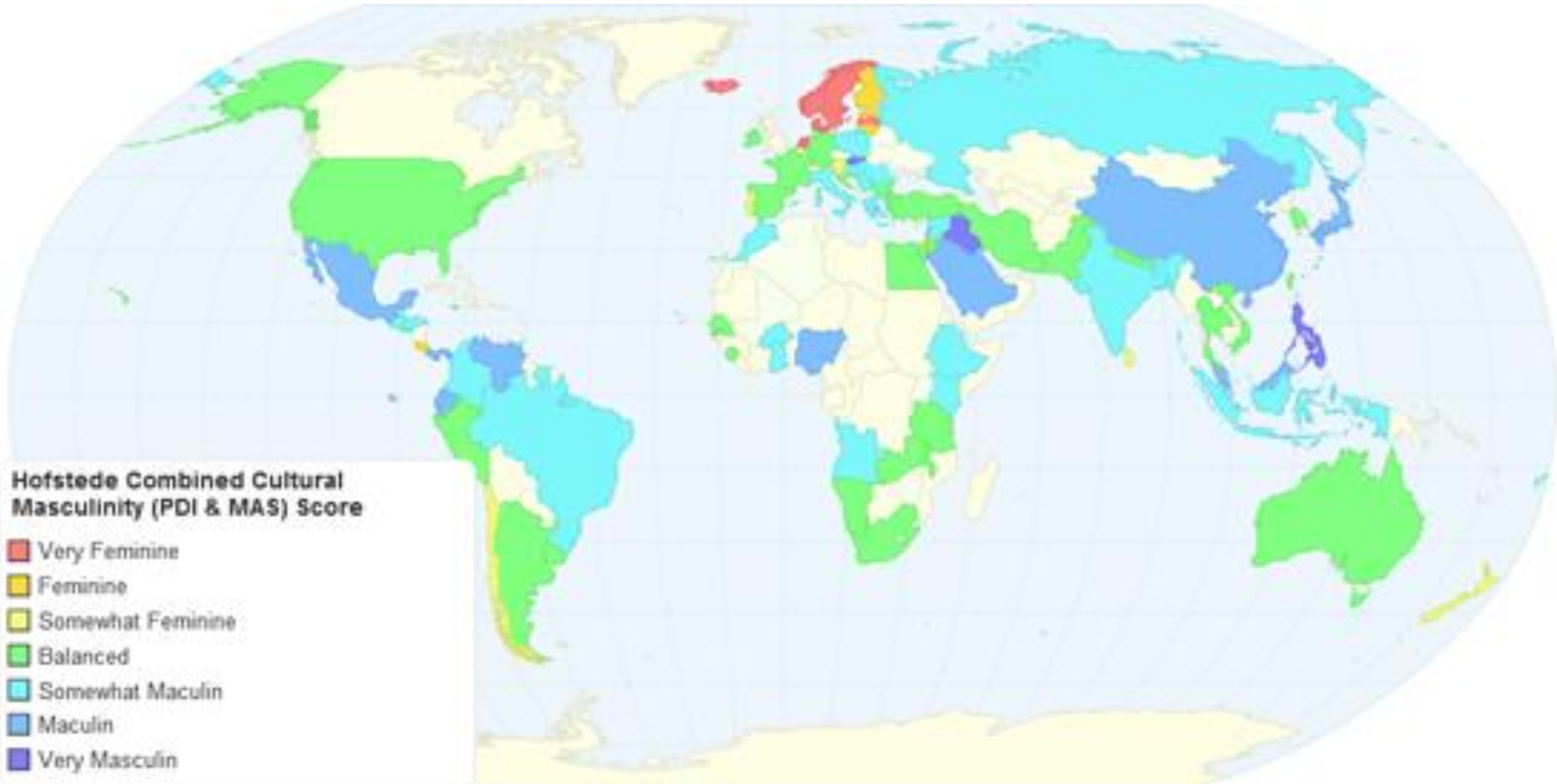
# Online Communication – Individualism vs Collectivism

Turkey

The image shows a screenshot of the McDonald's Turkey website. At the top, there is a navigation bar with the McDonald's logo, links for 'ÜRÜNLER', 'KURUMSAL', 'YENİLER', 'DENGELİ BESLENME', 'McD Cafe', 'HAPPY MEAL', and 'Restoranlar'. A search bar is on the right. Below the navigation bar, there are buttons for 'Giriş', 'Üye Girişi', and 'Kayıt Ol'. The main content area features a chef in a white uniform standing behind a counter with two plates of food. The text reads: 'İKİSİ DE ÇOK LEZZETLİ... AMA McChicken® DAHA DÜŞÜK KALORİLİ:'. Below this, it says: 'Dünyanın en deneyimli uzman şeflerinden Tolga Atalay da kalitemizin ve şeffaflığımızın altına imzasını atıyor, McDonald's menülerini öneriyor.' There are two buttons: 'Detaylı Bilgi' and 'Tandem Filmleri'. Below the chef, there are two plates of food labeled 'McChicken® Menü' and 'Sarımsaklı, Cheddarlı Tavuk Tortası'. At the bottom, there are four promotional banners: 'McDonald's Akademi' with the phone number 444 62 62 and website www.mcdonalds.com.tr; 'McDonald's Facebook'ta!'; 'Yaşam Çocuklar' featuring a child; and 'Bugün günü partileri'. The footer contains a list of services, social media icons, and copyright information.



# Online Communication – Masculinity vs Femininity



# Online Communication – Masculinity vs Femininity

*Saudi Arabia*

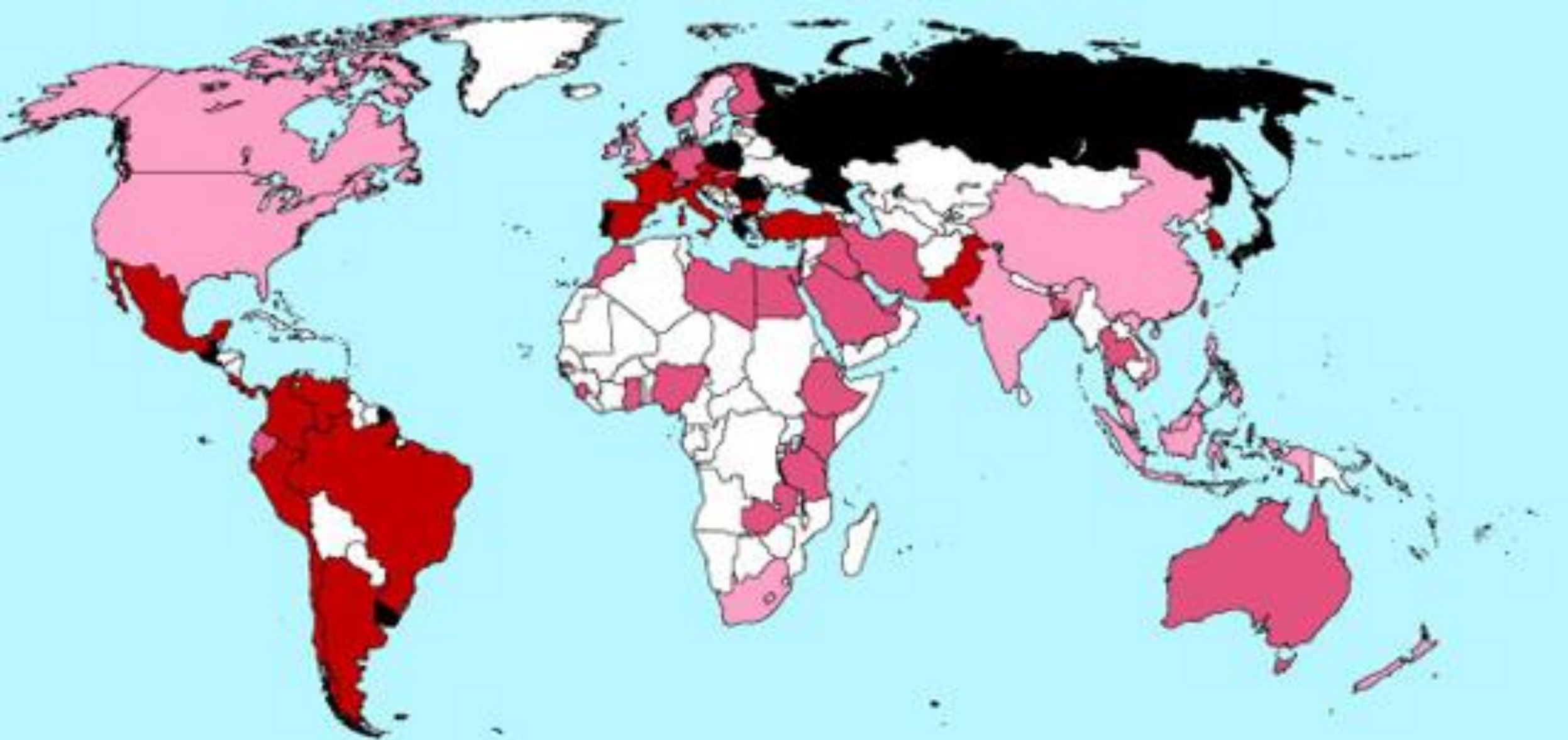
The screenshot shows the McDonald's UAE website. At the top, there is a navigation menu with the following items: Home, Menu, Promotions, The Truth, Locations, News, Careers, Contact Us, and My McDonald's. The main content area features a large golden arches graphic on the left. The central text reads: "Hear it from us. We know many of you are curious about who owns McDonald's in the UAE, where profits go, where the food comes from; or whether or not the food is Halal, etc. We want to make it easy for you to get honest, straightforward answers filled with facts. Therefore, we offer you straightforward answers to questions you may have now, or in the future about McDonald's. Read on to discover the Truth about McDonald's." Below this text are three sections: "Our Food" with a photo of a burger and fries, "Our Business" with a photo of a restaurant interior, and "The Truth" with a list of links: "Our History", "Our Commitment", "See What We're Made Of", "Numbers", "Hear It From Us" (highlighted in red), "Our Food", and "Our Business". At the bottom, there are social media icons for Facebook and LinkedIn, and a footer with the text "Privacy | Terms & Conditions | ©2015-2016 McDonald's. All Rights Reserved".

# Online Communication – Masculinity vs Femininity

Norway



# Online Communication – Uncertainty Avoidance



# Online Communication – Uncertainty Avoidance

Russia

The image shows a screenshot of the McDonald's website for Russia. At the top left is the golden arches logo with the slogan "еще что в сафине". To the right is a navigation menu with links: "Для прессы", "Для Ресурсов McDonald's", "Неоднократность в стрелочности", "Принимая на работу", "Контакты", and "Почта ресторанов".

The main content area is divided into several sections:

- Вот что я люблю**: A large image of a woman in a winter jacket and hat sticking her tongue out in the snow.
- Что я ем**: A collage of two burgers. Text above reads "Тот же Макдоналдс, только погорчее". Text on the sides reads "Вкус сезона ЦЕ-ЗАРЬ РОЛЛ" and "Вкус сезона БИФ РОЛЛ".
- И как живу**: A woman in a blue jacket sitting on a bicycle in a field of yellow flowers.
- Мир Макдоналдс**: An interior view of a McDonald's restaurant.
- Веселье начинается здесь!**: Two smiling red Happy Meal characters.

At the bottom left, there is a copyright notice: "© 2017 by McDonald's. Политика | Legal". At the bottom right, the website address "www.mcdonalds.ru" is visible.

# Online Communication – Uncertainty Avoidance

India

The screenshot shows the McDonald's India website homepage. At the top left is the golden arches logo with the slogan "I'm lovin' it". To the right, there are links for "ABOUT US", "LOCATE US", and "CONTACT US", along with the phone number "Call Us 66 000 666" and the text "Order Online mcdelivery.co.in". A horizontal navigation bar contains links for "HOME", "MENU", "KIDS ZONE", "REAL ESTATE", "CONVENIENCE", "NUTRITION", and "WORK @ MCDONALD'S". A vertical "View it in" menu is on the left, and a "facebook" link is on the right. The main banner features a "Super Lunch Super Deals" promotion with an image of a burger, fries, and a drink. A price tag indicates "BURGER + FRIES + COKE STARTS ₹ 55 ONLY". To the right of the banner, it says "NEW McVALUE LUNCH EVERYDAY 12PM-3PM". Below the banner, there are five service icons: "STORES FIND THE NEAREST STORE", "TOYS GRAB THEM ALL SOON" (with Spider-Man and Hulk characters), "NUTRITION INFORMATION DOWNLOAD PDF" (with a burger icon), and "McDELIVERY ONLINE MCDelivery.CO.IN" (with a delivery bag icon). The footer contains copyright information for 2012, a logo for "McDonald's India", and links for "Media Centre", "Corporate Office", and "In India @ | | |".

# Online Communication – Long-term vs Short-term orientation



<http://www.targetmap.com/viewer.aspx?reportId=6691>

# Online Communication – Long-term vs Short-term orientation

*Germany*





# Online Communication – Long-term vs Short-term orientation

Hong  
Kong

McDonald's | Eat Smart | McCafé | 24 hour McDelivery | McDonald's Party | Member Information | Brand Trust | Healthy Living | Ronald McDonald House Charities

Balanced Diet | Regular Exercise

## Healthy Living

If you want to have a healthy body, you must build up a habit of having balanced diet and regular exercises. What McDonald's strongly believes is that food should be both beneficial and delicious, so we always devote ourselves to provide nutritious and high quality food. We have also prepared some exercise tips for you to maintain a healthy body by doing exercises regularly. Let's keep ourselves "Healthy Living"!

### Balanced Diet

Balanced Diet is the key of maintaining one's health. McDonald's® customers are encouraged to plan meals according to the food pyramid, which stipulates a range of recommended servings from each of the five food groups. No single food or group of foods provides all the nutrients a person needs.

### Food Pyramid

- Least amount: fat, sugar and salt
- Suitable amount: milk products, meat, fish, eggs and beans
- More suitable: fruits and vegetables
- Most suitable: grains and cereals

Remember to drink up to eight glasses of liquids a day (including water, tea and soup)

About McDonald's | Privacy Policy | Text Only | © McDonald's Corporation. All rights reserved.

# Online Communication - Cultural differences

*Your Target Group:  
Makers of all ages!*

# Practical Information

- Friday 11.15-12.05am, mandatory team meetings!
  - Sit anywhere
  - Fill out team contract
  - Take meeting minutes
  - Make website with team number, name, team member names
  - Upload the contract and meeting minutes
  - Send a link to your TA's and Kirstin
  - Due Saturday @8am!
- Lab 1 will be graded one week after your lab session!
  - Monday is a holiday 😊

*Go Build Robots!*

