

Ergonomics

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The concept of Ergonomics

- **ergos** (work) + **nomos** (laws) = **ergonomics**

19th century, Wojciech Jastrzebowski

- **Ergonomics = Human Factors**

- Human Factors, Human Engineering, Human Factors Engineering, Man-Machine Engineering, Human-Machine Interface (HMI) Engineering, Human-Machine Interaction Design, Human Centered Design, Usability Engineering, etc.

A definition of Ergonomics

Sanders and McCormick:

„Human factors" (ergonomics)

- **discovers and applies** information about human behavior, abilities, limitations and other characteristics
- **to the design** of tools, machines, systems, tasks, jobs, and environments
- for **safe, comfortable, and efficient** human use.

The goals of Ergonomics

The three main optimization goals of ergonomics:

- *Safety*
- *Comfort*
- *Efficiency*

Course Overview



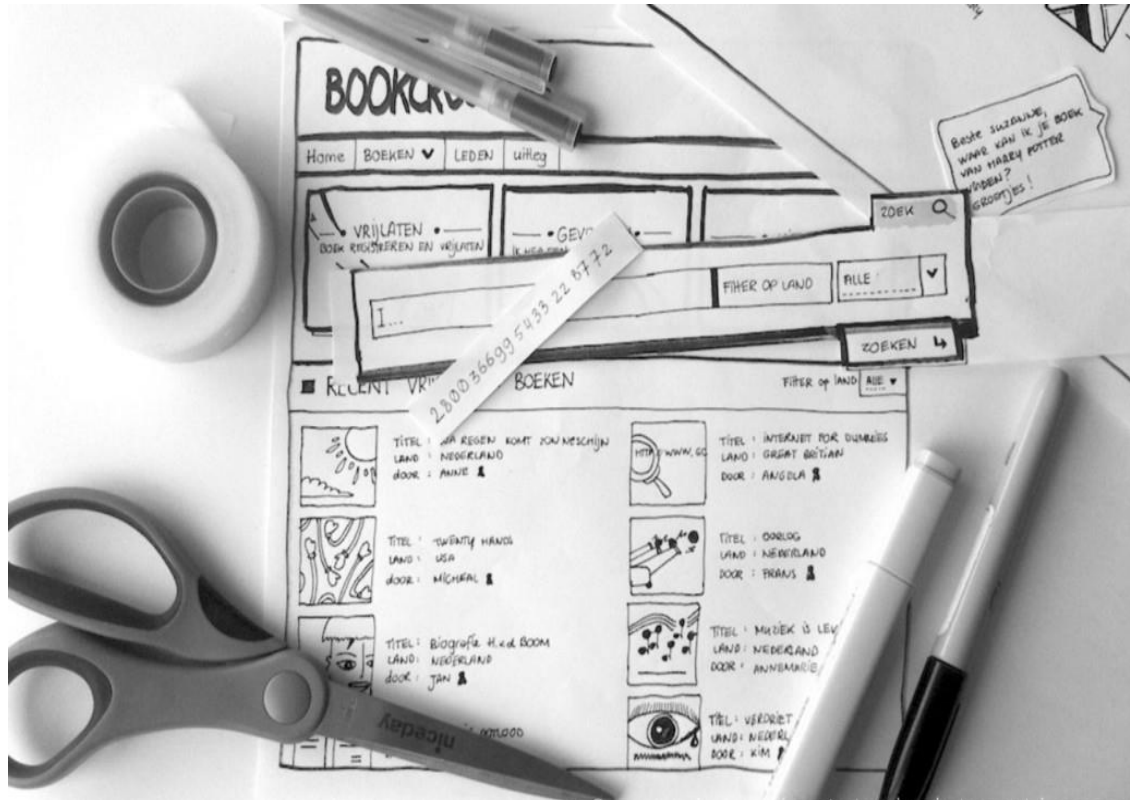
Special users / Design for All



Human-Computer Interaction evaluation



Human-Computer Interaction methods and hands-on experience

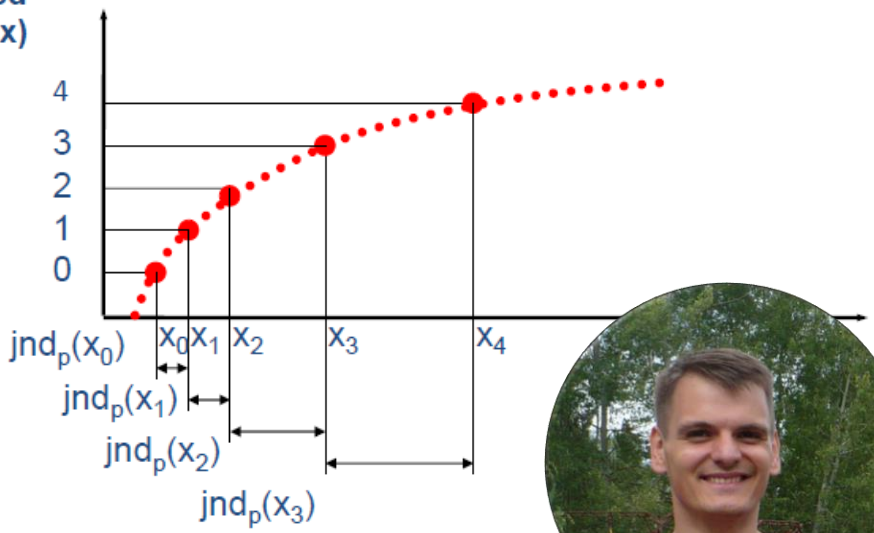
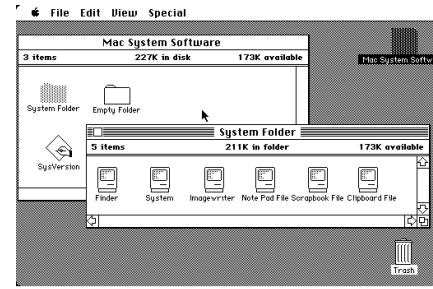


Psychology and Ergonomics

The screenshot shows a game's inventory interface. On the left, a list of items is displayed with columns for NAME, TYPE, WGT, and VAL. The 'SILVER SAPPHIRE NECKLACE' is highlighted. On the right, a detailed view of the necklace is shown with its stats: ARMOR 0, WEIGHT 0.5, and an armor rating of 797. The interface also includes a filter icon and a 'FILTER' dropdown.

NAME	TYPE	WGT	VAL
Silver Sapphire Necklace	Amulet	0.5	580
Arivanya's Silver Ring	Ring	0.25	30
Hunter's Ring	Ring	0.25	2725
Silver Amethyst Ring	Ring	0.25	180
Dragon's Fang (Legendary)	Sword	16	5422
Assassin's Dagger (Legendary)	Dagger	6	2685
Dragon's Talon (Legendary)	Greatsword	23	9995
Assassin's Bow (Legendary)	Bow	18	10409
Pickaxe	Pickaxe	10	5
Ancient Wood Arrow (898)	Arrow	-	1
Dwarven Arrow (221)	Arrow	-	4
Ebony Arrow (42)	Arrow	-	7
Ebony Arrow (81)	Arrow	-	5
Glass Arrow (60)	Arrow	-	6
Orich Arrow (127)	Arrow	-	3
Steel Arrow (189)	Arrow	-	2
Torch (4)	Torch	0.5	2
Amethyst (20)	Gem	0.1	120
Diamond (9)	Gem	0.1	800
Emerald (10)	Gem	0.1	600
Flawless Amethyst (8)	Gem	0.1	180
Flawless Diamond (2)	Gem	0.1	1000

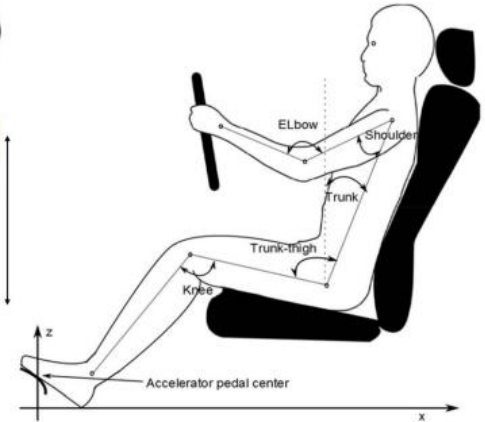
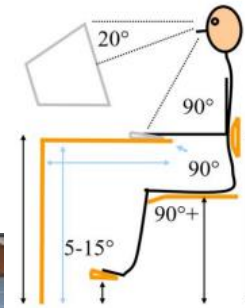
Perceived stimuli (x)



Human-Computer Interaction: Eye-tracking



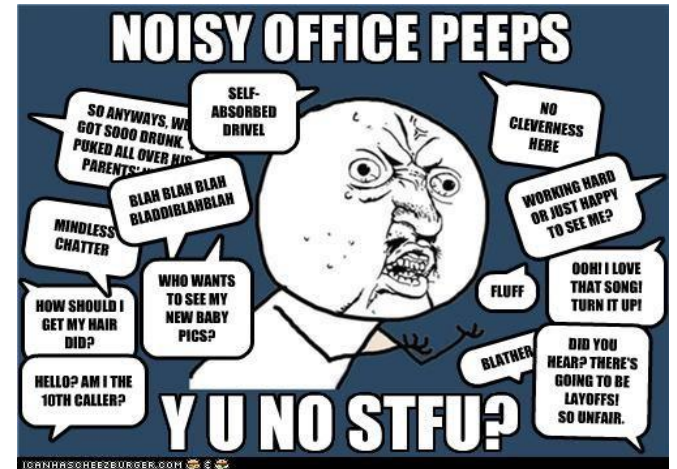
Ergonomics in vehicle design



Evaluation of industrial workplaces with ViveLab

The screenshot displays the ViveLab software interface. The main window shows a 3D model of a female worker in a red and white uniform operating a yellow forklift. The interface includes a top menu bar with options like 'Main', 'Human', and 'Machine'. Below the menu is a toolbar with various analysis tools. On the left, there is a 'Scene Hierarchy' panel showing a tree view of the scene elements. On the right, a 'RULA analysis' window is open, displaying a 'Score: 1' and 'Acceptable' status. The RULA window includes a 'Load' section with a 'Less than 25kg' indicator and a 'New Less Results' section with various posture metrics. Below the RULA window, there are two color-coded score scales: 'on score: 1 2 3 4 5 6 7' and 'Evaluation score: 1 2 3 4 5 6 7'. In the bottom right corner, there is an oval portrait of a smiling woman with dark hair, wearing a white lace-trimmed top.

Office ergonomics



Shopping experience



Course requirements

- A **written exam** and an **Assignment** (homework)
- Mark: 50% written exam 50% assignment
- Course homepage: <http://goo.gl/br4TRM> (Moodle)

Written exam

- Some test questions (a, b, c or d)
- Questions requiring short answers (1-2 paragraphs and/or drawing)
- Have to reach at least 40% of maximum points to pass

Course requirements

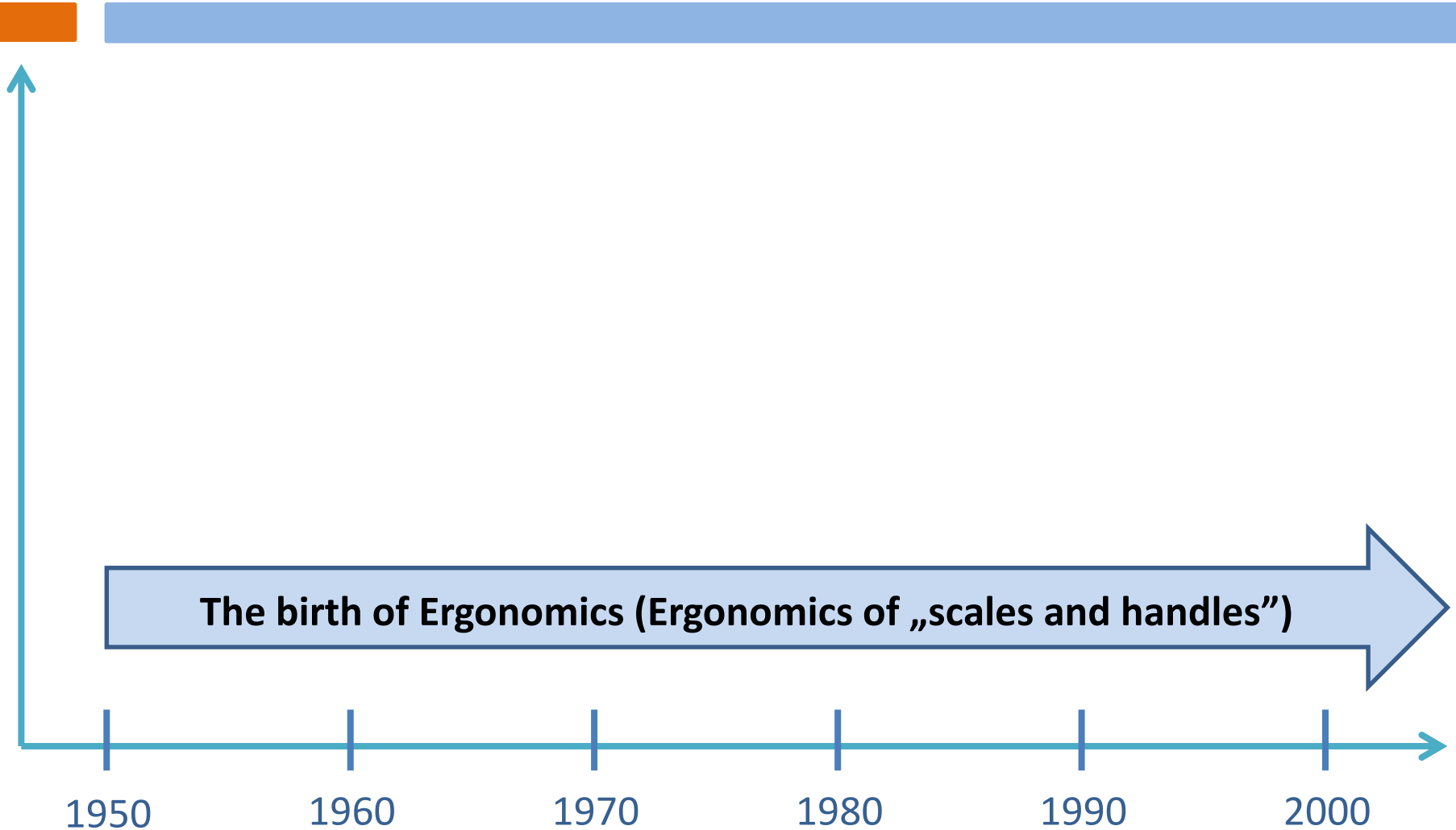
Assignment (homework)

- Done individually or in pairs
- You should aim for 2-3 pages. If needed for reasons of clarity (additional screenshots or pictures of the flat) it can exceed these page limits
- 4 topics to choose from:
 1. Evaluation of a flat's room from ergonomic aspects
 2. Evaluation of a workroom (e.g. classroom) from ergonomic aspects
 3. Evaluation of a website from ergonomic aspects
 4. Any other ergonomics related topic you can think of (consult with Dr. Sarolta Tóvolgyi first!!)
- Exactly the same topic can only be done by one pair or a single individual:
<http://goo.gl/Cz5Yzo> (link also in syllabus on Moodle)
- **Deadline:** 25th April 2019 via email: tovolgyi@erg.bme.hu

The history of Ergonomics



The history of Ergonomics



1950

1960

1970

1980

1990

2000

The birth of Ergonomics (Ergonomics of „scales and handles”)

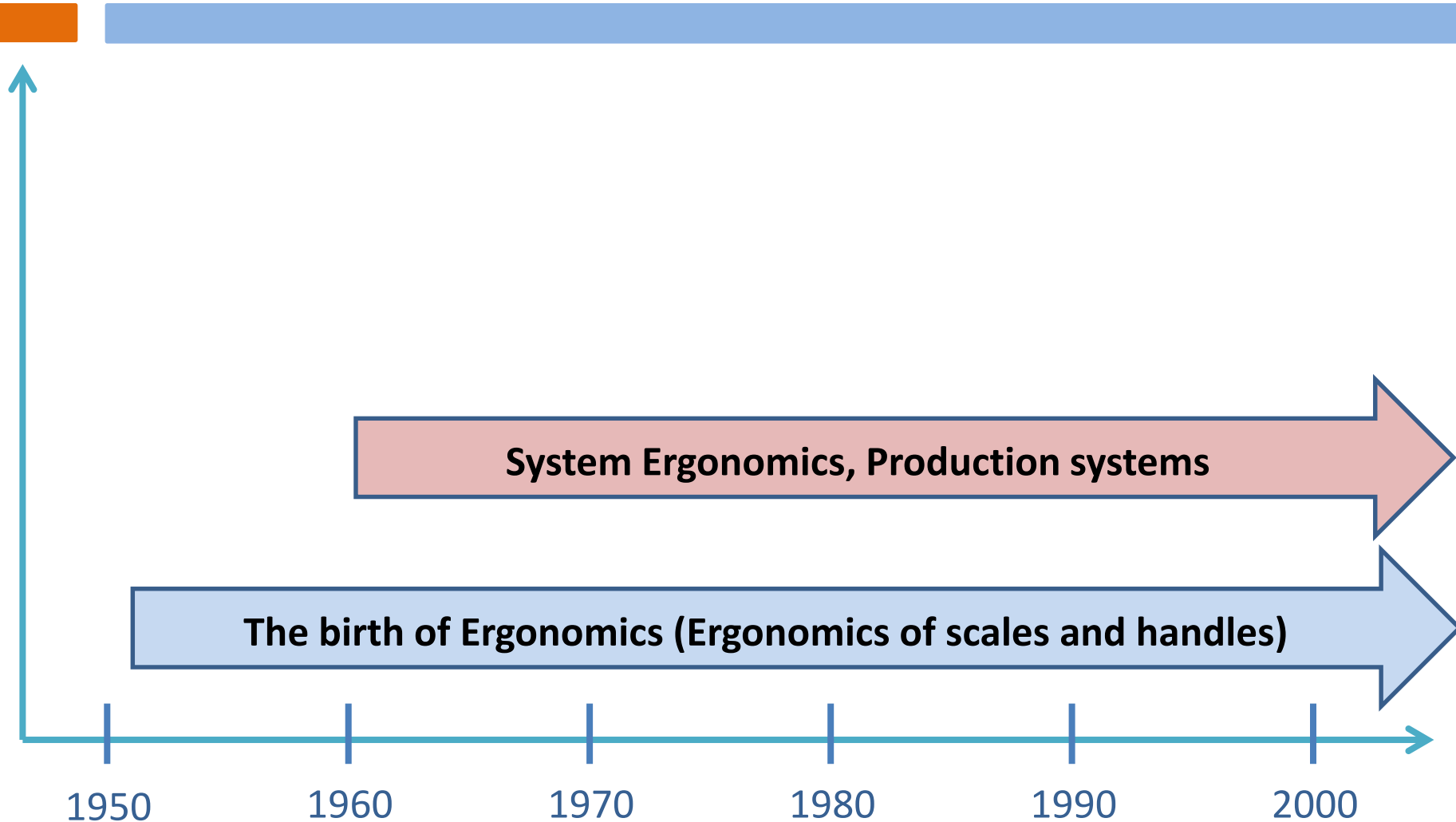
1. Ergonomics of „scales and handles”



- World War II: at least 400 aircraft losses due to bad cockpit design (mostly due to upgrades during the war)
- Engineering Psychology labs are established

- Research is focused on designing the best interface based on anthropometric data and a few sensory thresholds
- Next big boost: space race
- [Handle design checklist](#)

The history of Ergonomics



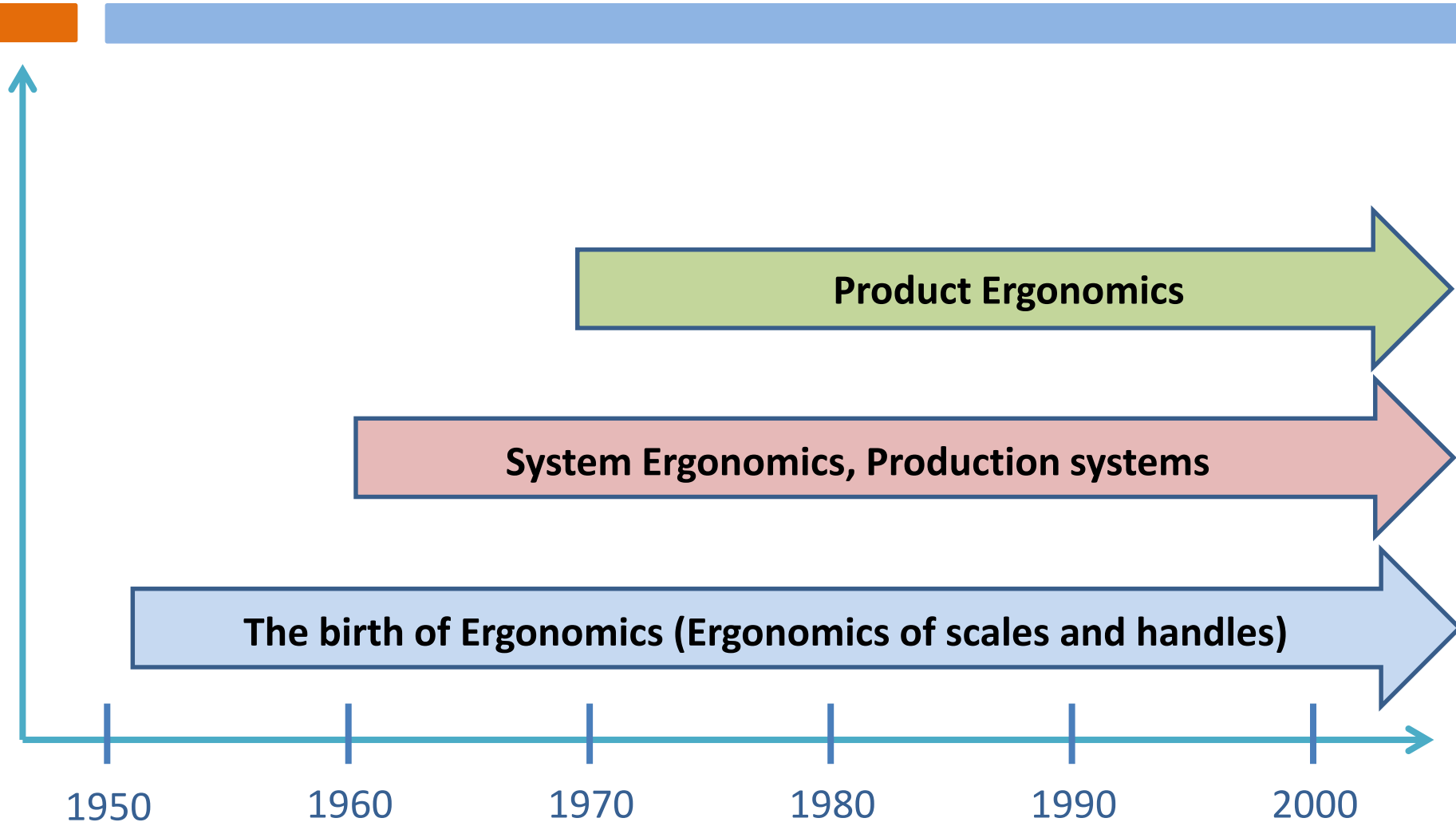
2. System ergonomics (industrial ergonomics)



- Corporations „discover” ergonomics
- Optimization of **tools, work processes** and the **environment** itself lead to increased efficiency, safety and comfort
- Everything designed for the „average user”

- Research is focused on whole systems not only „handles” – man-machine system optimization
- Ergonomics „breaks free” of exclusive military founding

The history of Ergonomics



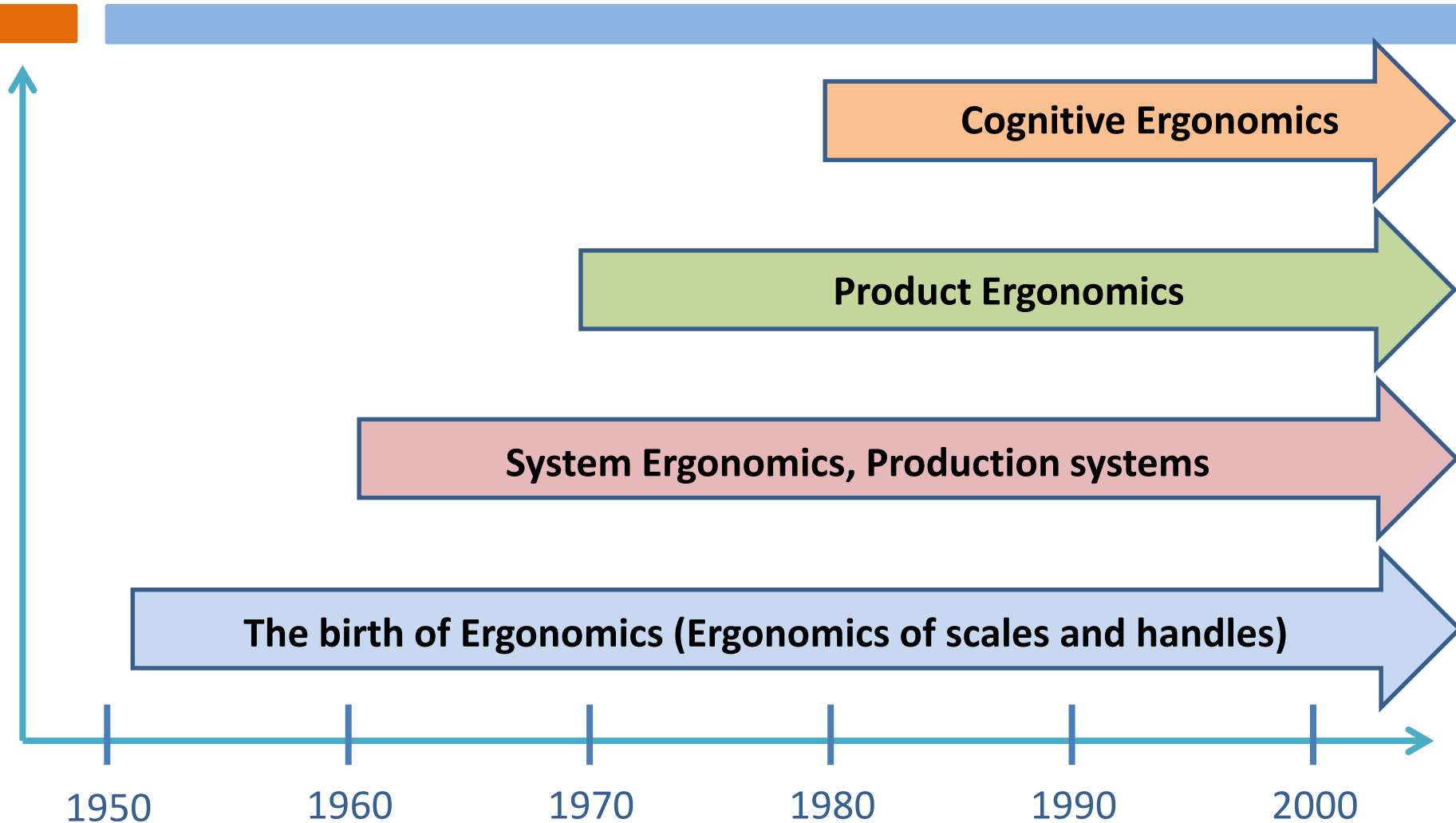
3. Product Ergonomics



- The ergonomic approach spreads to other areas: education, sports, transportation
- The product itself is in the center of attention

•Products are not only designed for a hypothetical average user – diversification starts to happen – user groups (rich, poor, disabled, gender, ethnicity)

The history of Ergonomics



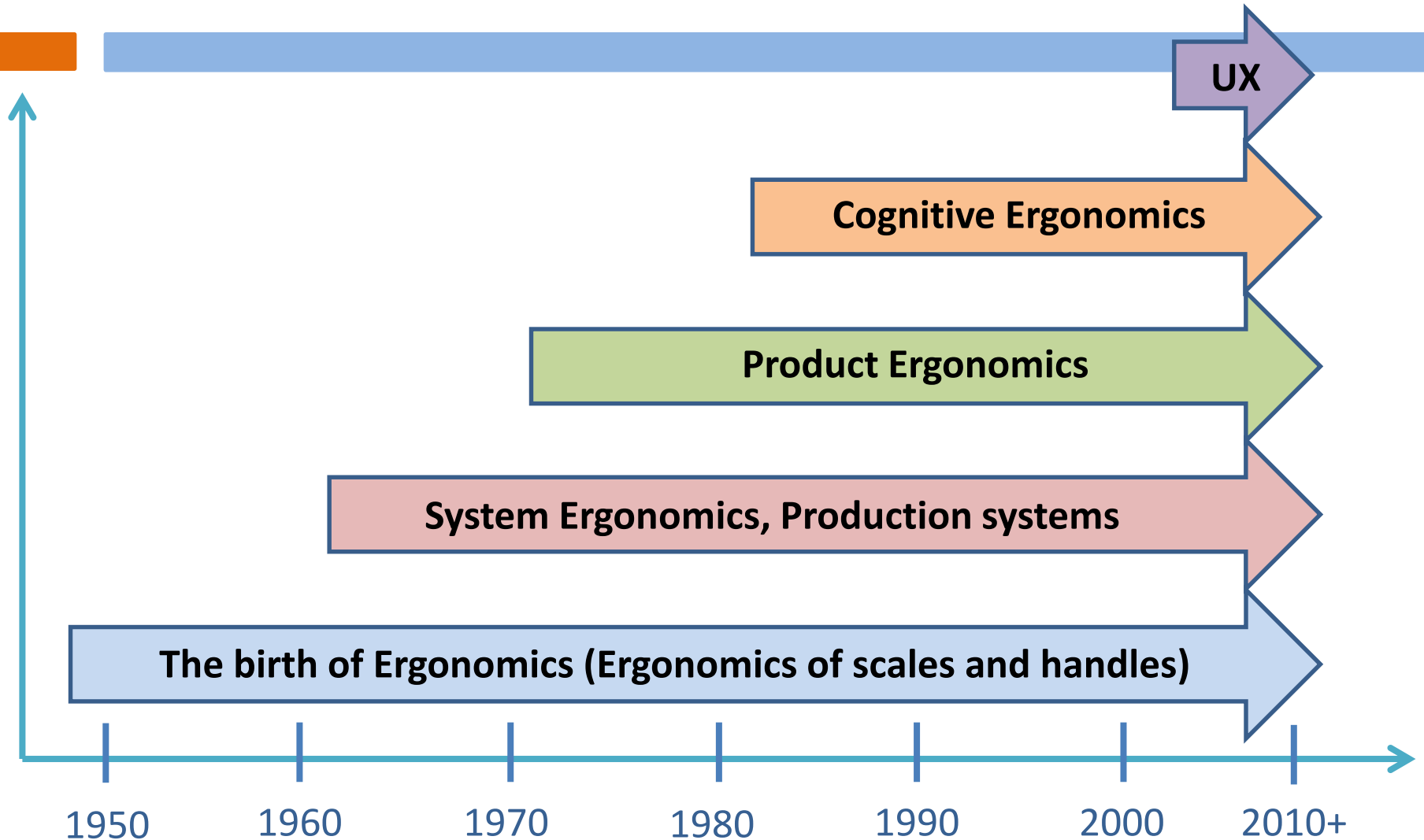
4. Cognitive Ergonomics



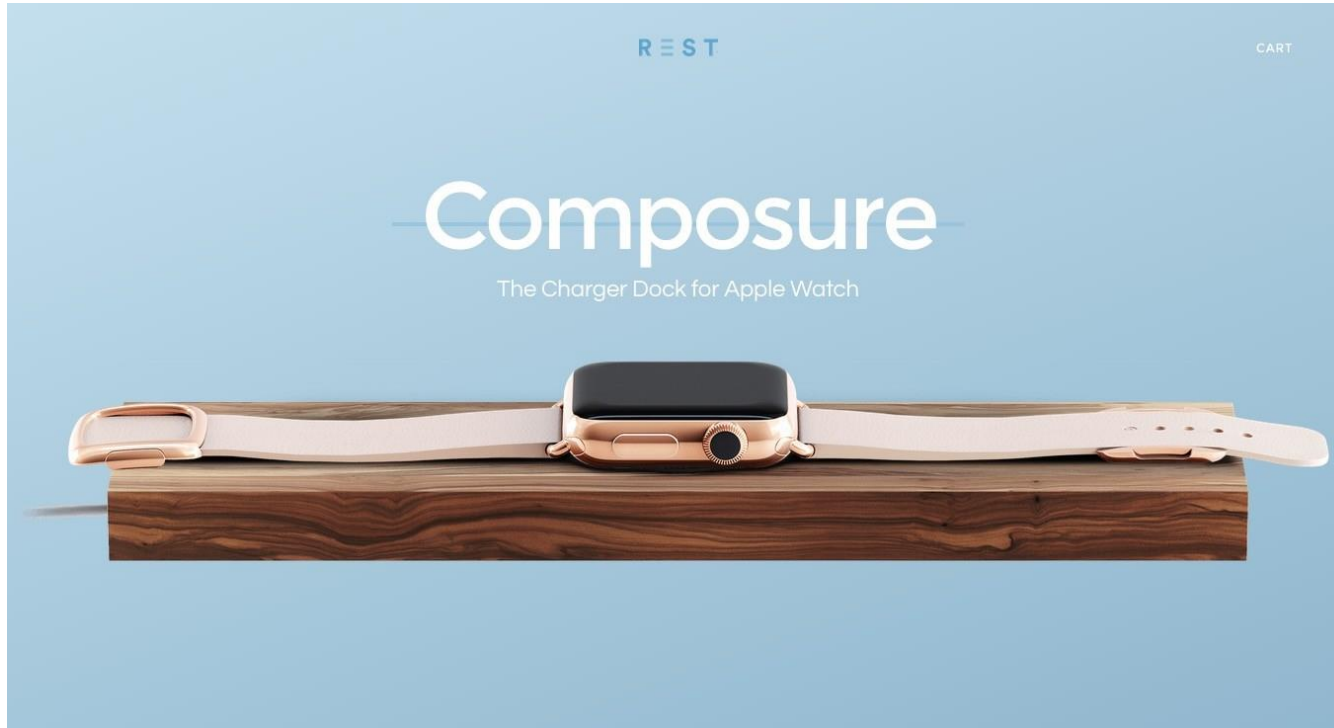
- Catastrophes that were caused by human error: Three Mile Island, Chernobyl, Challenger
- Personal Computers become common – software ergonomics

•The focus of research is similar to that of „scales and handles”, but this time the most important aspects of interface design are cognitive factors (e.g. memory and attention span) not sensorimotoric properties

The history of Ergonomics extended



?5.? User Experience

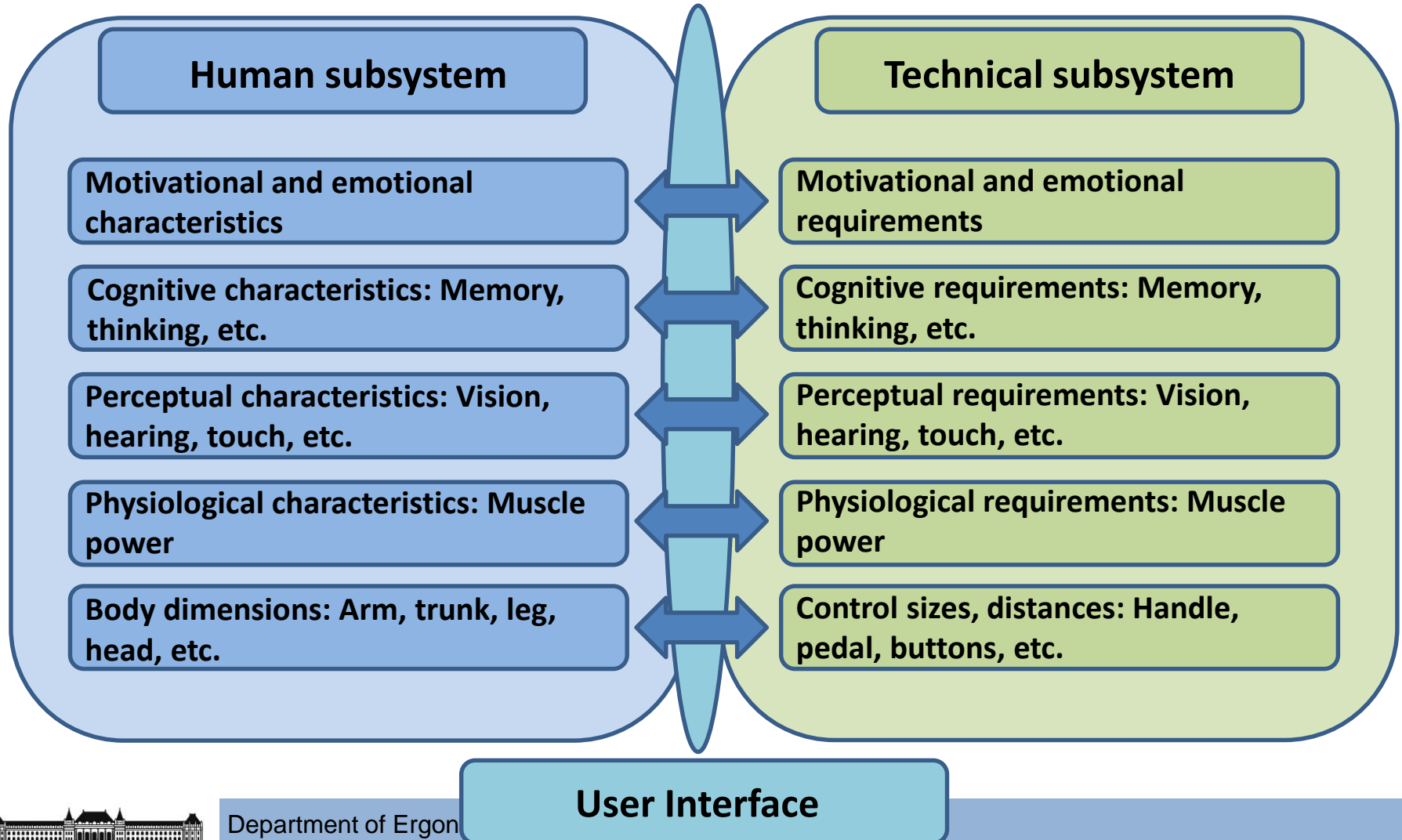


- **Emotional response** comes first in every situation (read at: Zajonc). If that first emotion is good, more likely the customer will buy our product.

Human-Machine System analysis



Human-Machine System analysis



Human-Machine Systems

A HMS always has

- a **human subsystem**,
 - a **technical subsystem**,
 - and a **user interface(UI)**.
-
- These subsystems can further be divided into smaller and even smaller elements as necessary depending on the particular **aim of the analysis**.
 - If the human subsystem and the technical subsystem are not compatible, the particular activity may **not be safe, comfortable and efficient** and therefore the user may experience increased stress (more about stress in a later lecture)

Human-Machine Systems analysis



- **Motivational and emotional requirements**
- **Cognitive requirements** (memory, attention, etc.)
- **Perceptual requirements** (vision, hearing, etc.)
- **Physiological requirements** (e.g. muscle strength or motoric finesse)
- **Control sizes, distances**
- **User Interface**

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