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PANEL

Learning and Knowledge Based Adaptive Human-Machine Interaction

MODERATOR:
Alf C. Zimmer University of Regensburg/Germany Engineering Psychology Unit

Panel

Moderator: Alf C. **Zimmer**, University of Regensburg, Germany

Panelists:

1. Lorenzo **Cominelli**, Università die Pisa, Centro die Ricerca E. Piaggio – Italia
2. Conceicao **Granja**, Norwegian Centre for Integrated Care and Telemedicine, University Hospital of North Norway, Tromso, Norway
3. Ibrahim A. **Hameed**, Norwegian University of Science and Technology, Alesund, Norway
4. Michael **Jäger**, Technische Hochschule Mittelhessen, Germany
5. Akira **Ikuo**, Tokyo Gakugei University, Japan
6. Flaminia **Luccio**, Università Ca‘ Foscari Venezia, Italy
7. Terje **Solvoll**, Norwegian Centre for Integrated Care and Telemedicine, University Hospital of North Norway, Tromso, Norway
8. Guri **Verne**, University of Oslo, Norway

Conclusions and Suggestions

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Suggested Topics

- Critical analysis of automation – focussing on learning the machine‘s reasoning more than on the original task - **Guri Verne**
- Human-Machine Interaction: Let‘s focus on human differences - **Lorenzo Cominelli**
- Supporting users with Autism Spectrum Disorders by dedicated apps for smart phones - **Flaminia Luccio**
- Combining virtual reality and obeservation of real world phenomena in an electronic textbook on chemistry - **Akira Ikuo**
- Understanding the robot personality and how this might support long-term human machine interaction - **Ibrahim A. Hameed**
- Machine learning versus traditional algorithms in smart phone positioning - **Michael Jäger**
- From interface to interaction Space - new developments in cockpit design - **Alf Zimmer**

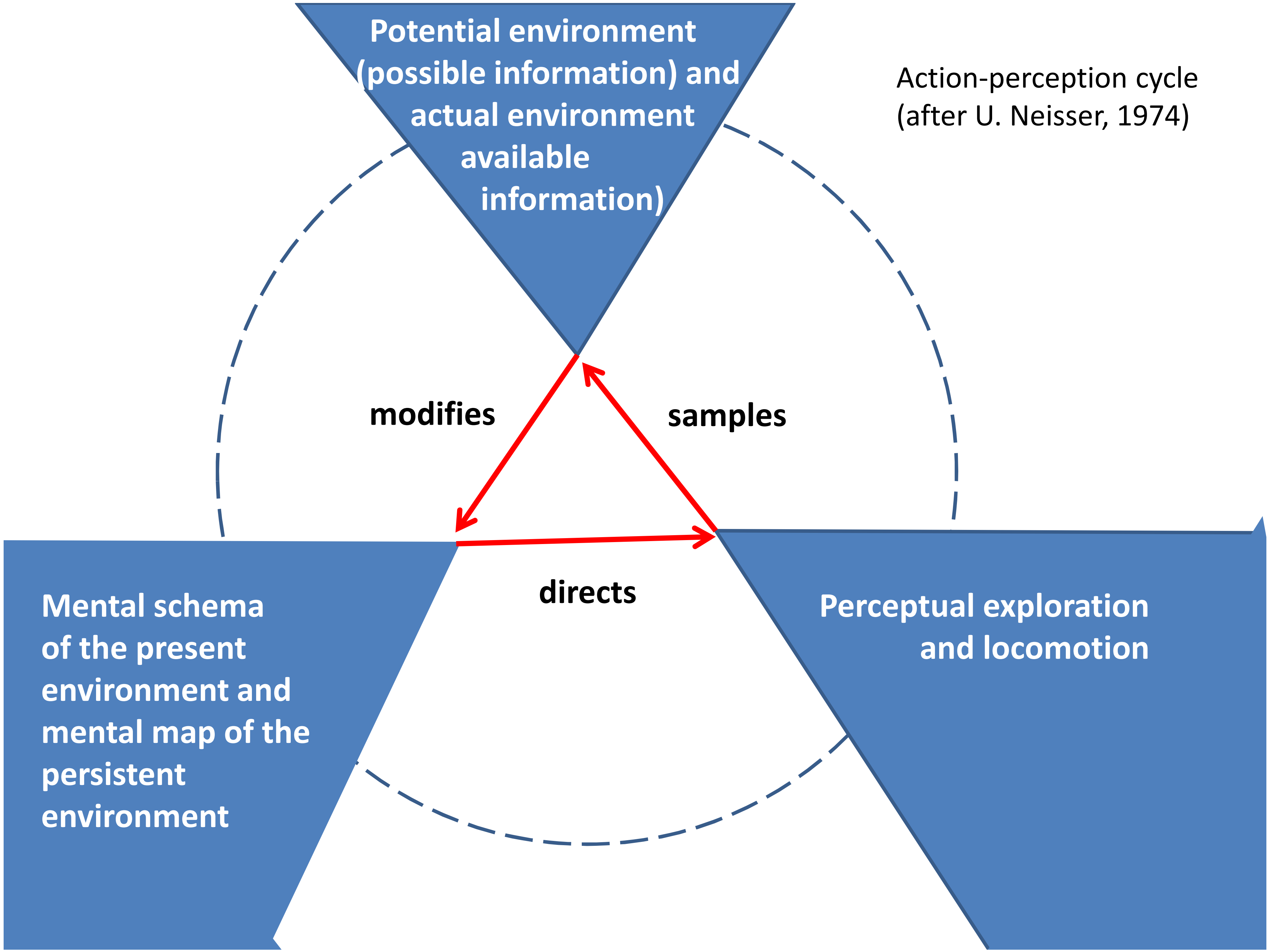
Conclusions and Suggestions

- **It is necessary to find an optimal division of labor between *Human Intelligence and Action* and *Machine Intelligence and Robotics* to avoid the ‚ironies of automation‘**
  1. e.g. Humans are better in ill-defined situations where approximate reasoning and a direct connection between complex event perception and action are necessary
  2. e.g. Machines are better where massive data sets can be analyzed with defined algorithms and repetitive actions can be executed with a high degree of precision
- **Hybrid automation – where machines support and assist humans – has the potential for high reliability and efficiency without loosing the human advantage of high adaptability to novel and ill-defined situations**

From Direct Interaction to Interface to Virtual Interaction Space

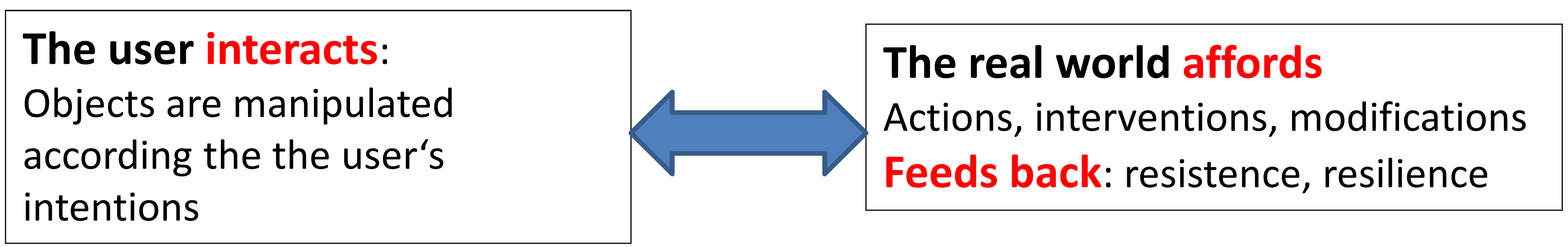
Consequences for Learnability

Alf C. Zimmer
University of Regensburg
Engineering Psychology Unit



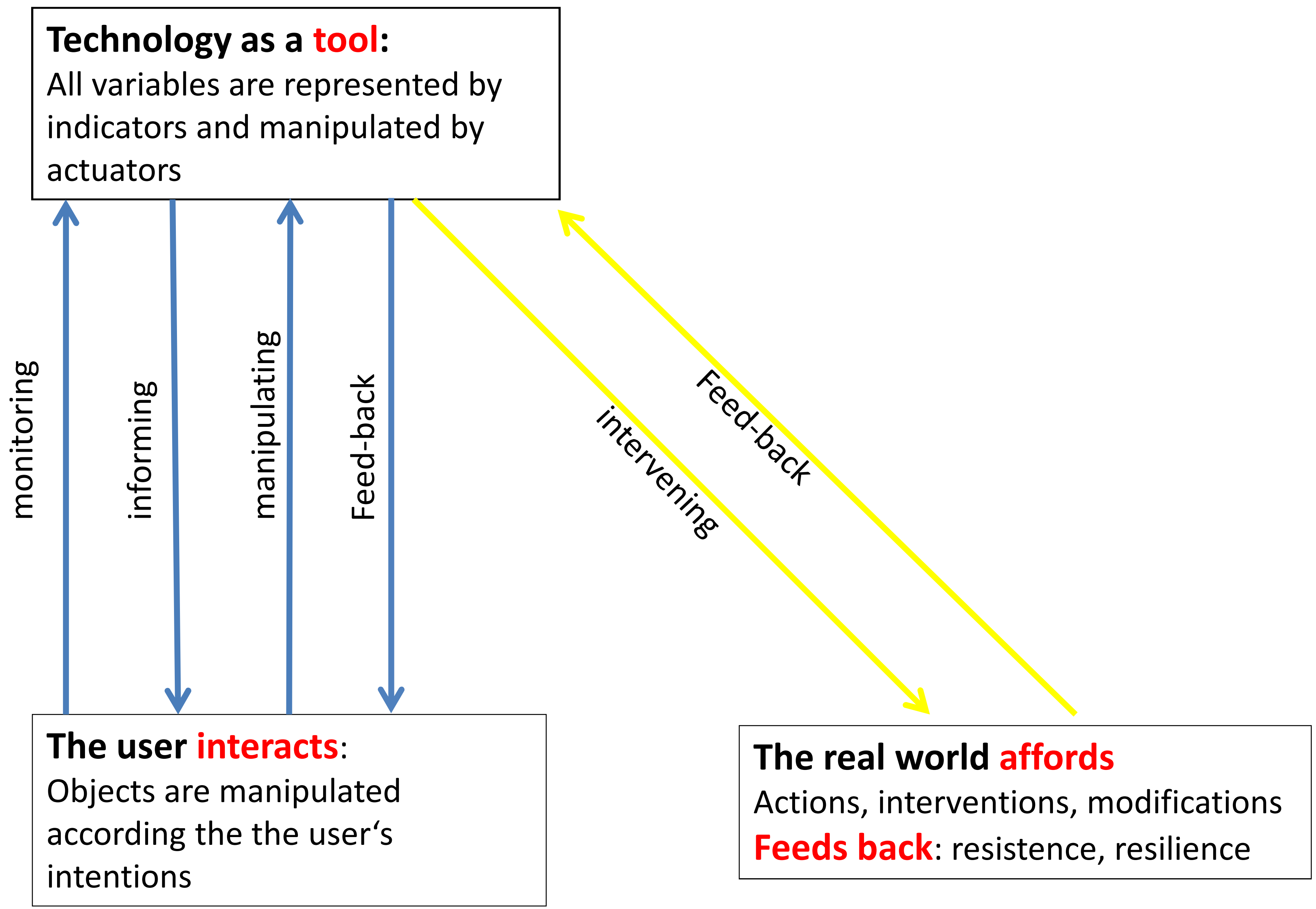
Potential environment (possible information) and actual environment available information)
Action-perception cycle
(after U. Neisser, 1974)
modifies
samples
directs
Mental schema of the present environment and mental map of the persistent environment
Perceptual exploration and locomotion

In the beginning: Control by direct pursuit or compensatory tracking



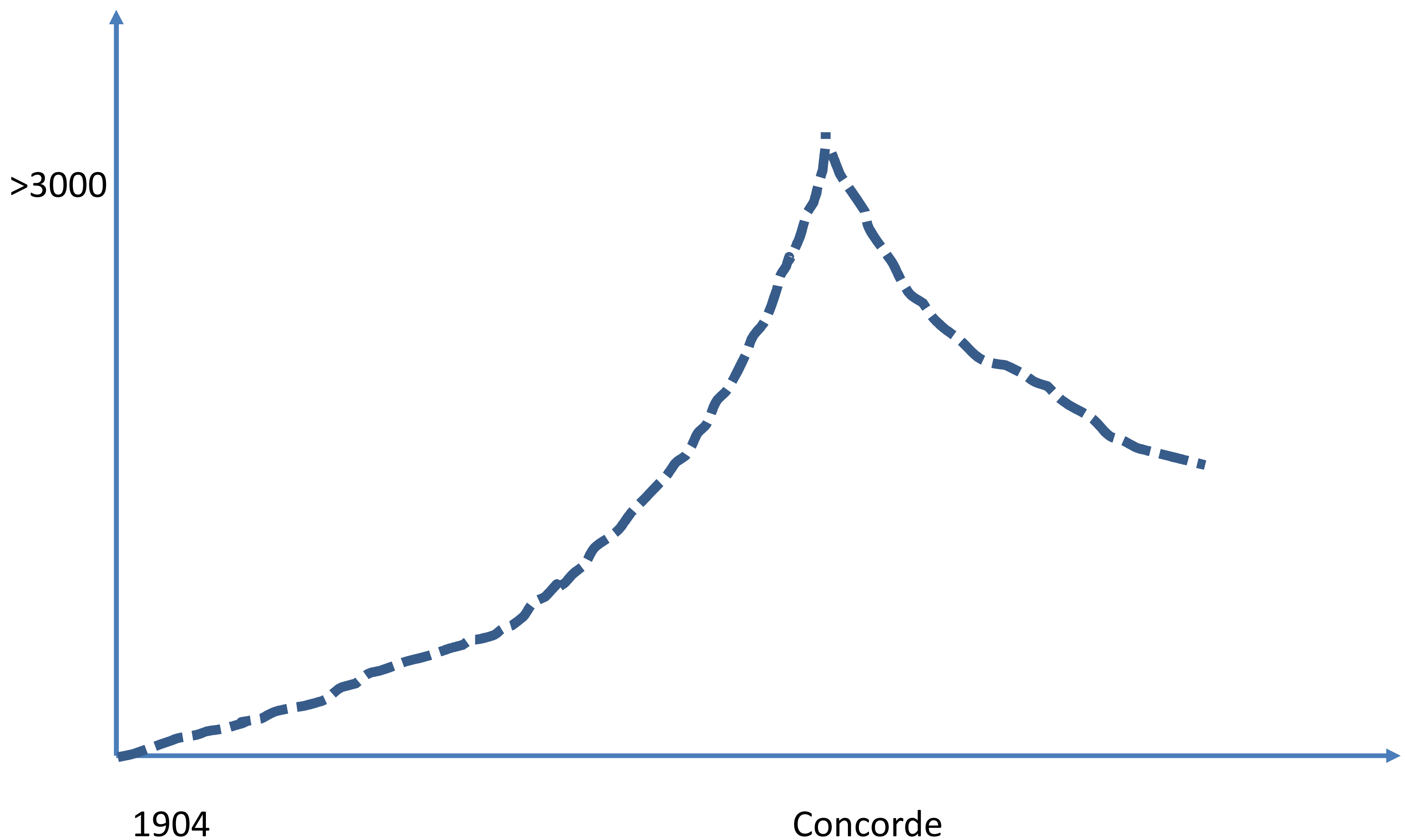

44.0

The first phase: pursuit and compensatory tracking via indicators and actuators



Yellow arrows indicate actions not perceivable by the user

The number of instruments in the cockpit over time



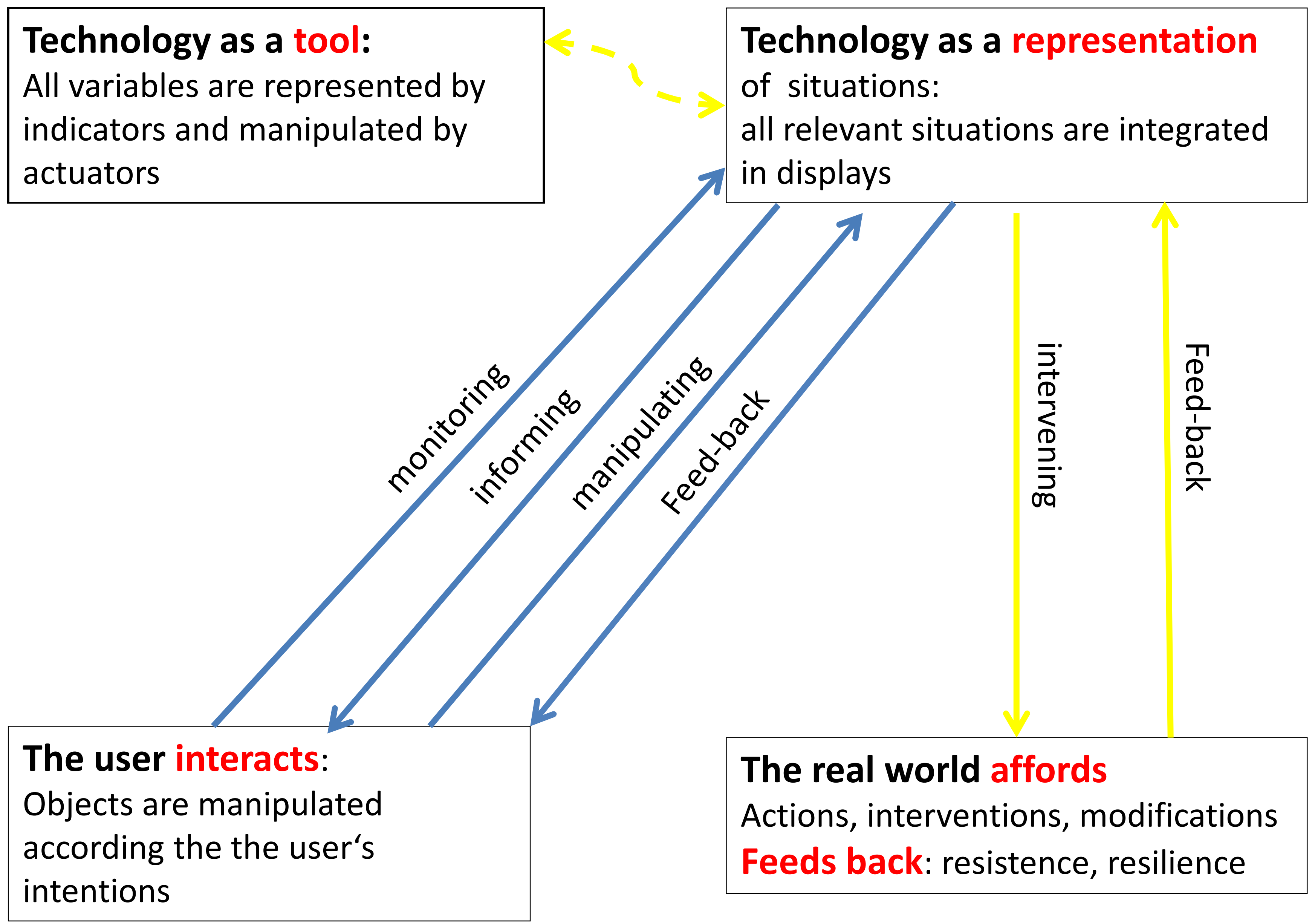
The Paradox of the Artificial Horizon

- In flight, when using the actuators you intend to influence the behavior of the plane

however

- the instrument (artificial horizon) makes you believe that you influence the world outside while the plane remains static

The second phase: pursuit and compensatory tracking via displayed representations

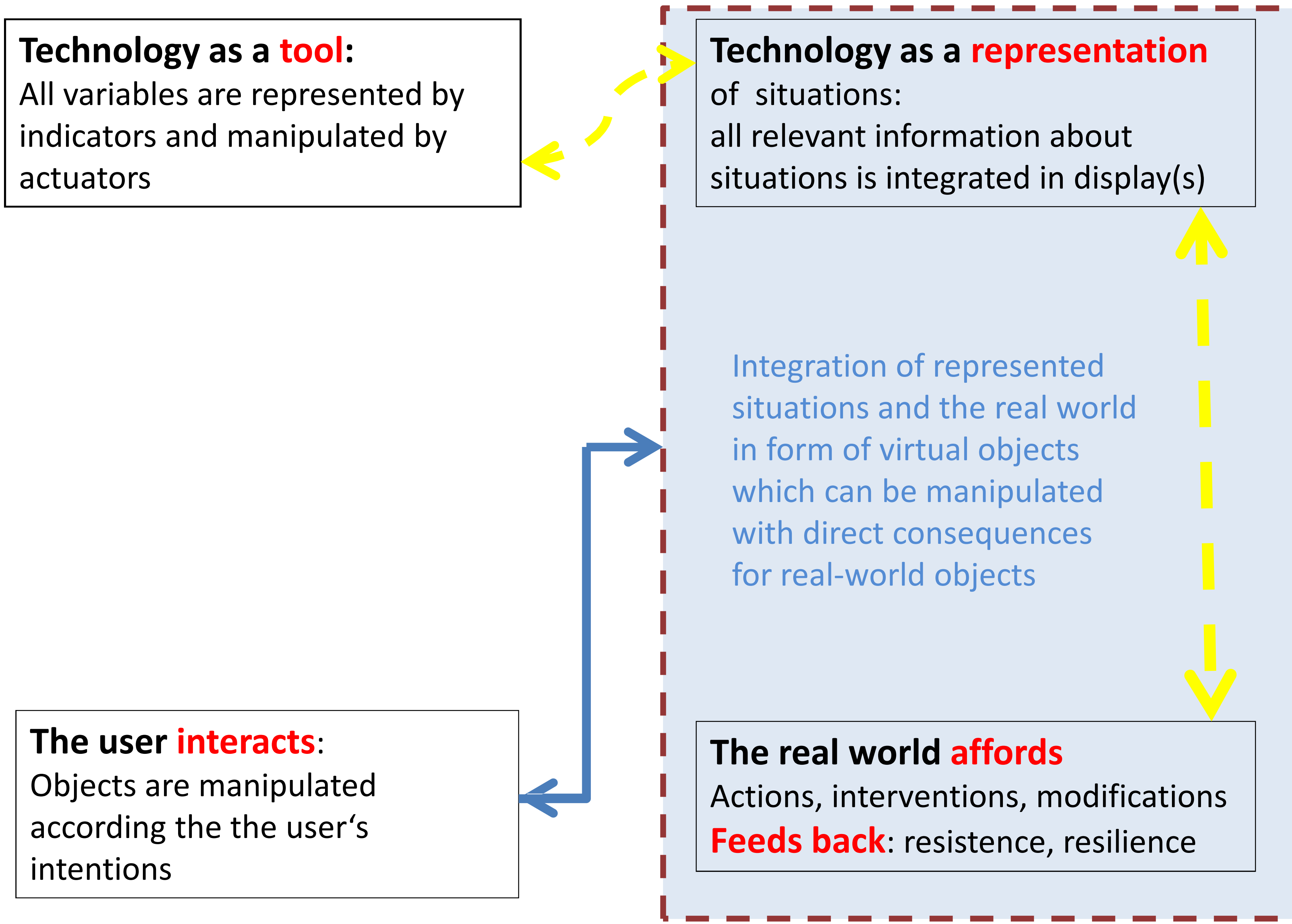


Yellow arrows indicate actions not perceivable by the user

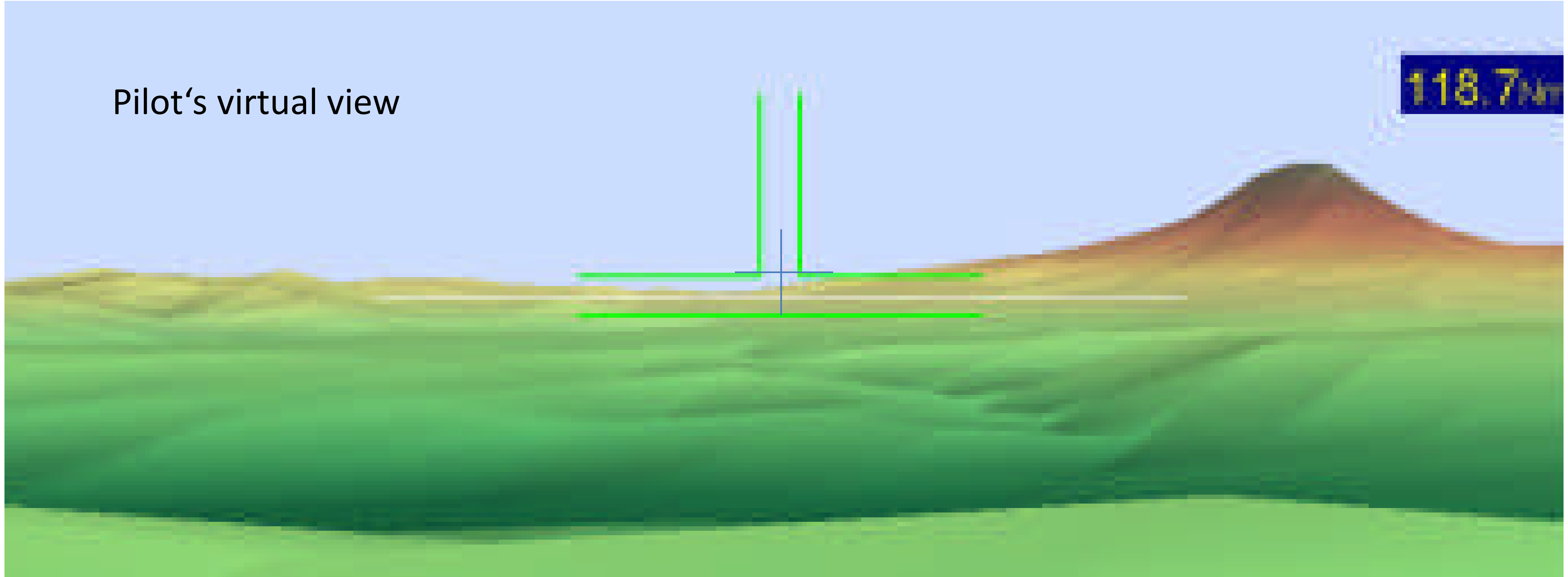

CLM
ATK
APP
TRK
ALT
MIDS
INT
RAD1
RAD2
DAS
MISC
AFLD

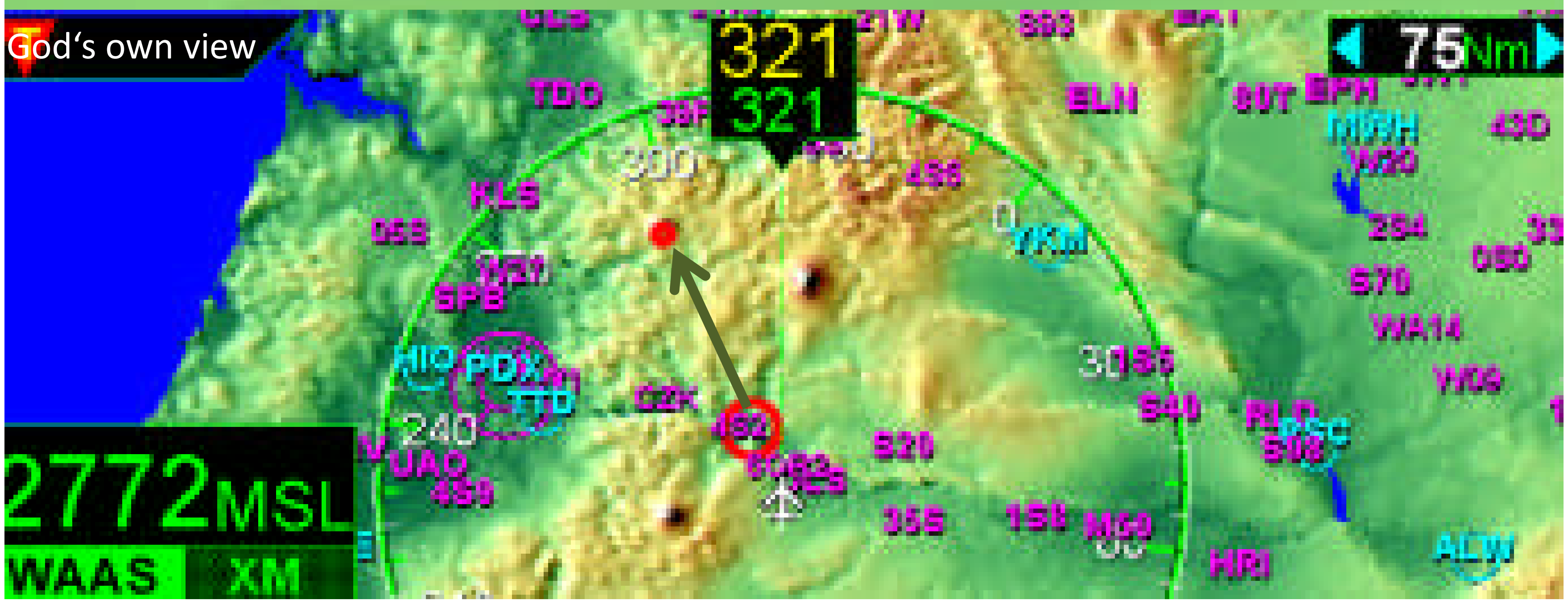

CLM
ATK
APP
ALT
RAD1
RAD2
DAS
MISC
AFLD

The possible future: **direct manipulation of virtual objects in a virtual space**



Yellow arrows indicate actions not perceivable by the user


Pilot‘s virtual view
118.7Nm


God‘s own view
321
321
75Nm
2772MSL
WAAS
XM
TDO
ELN
KLS
SPB
PDX
TTD
HIO
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YKM
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300
240
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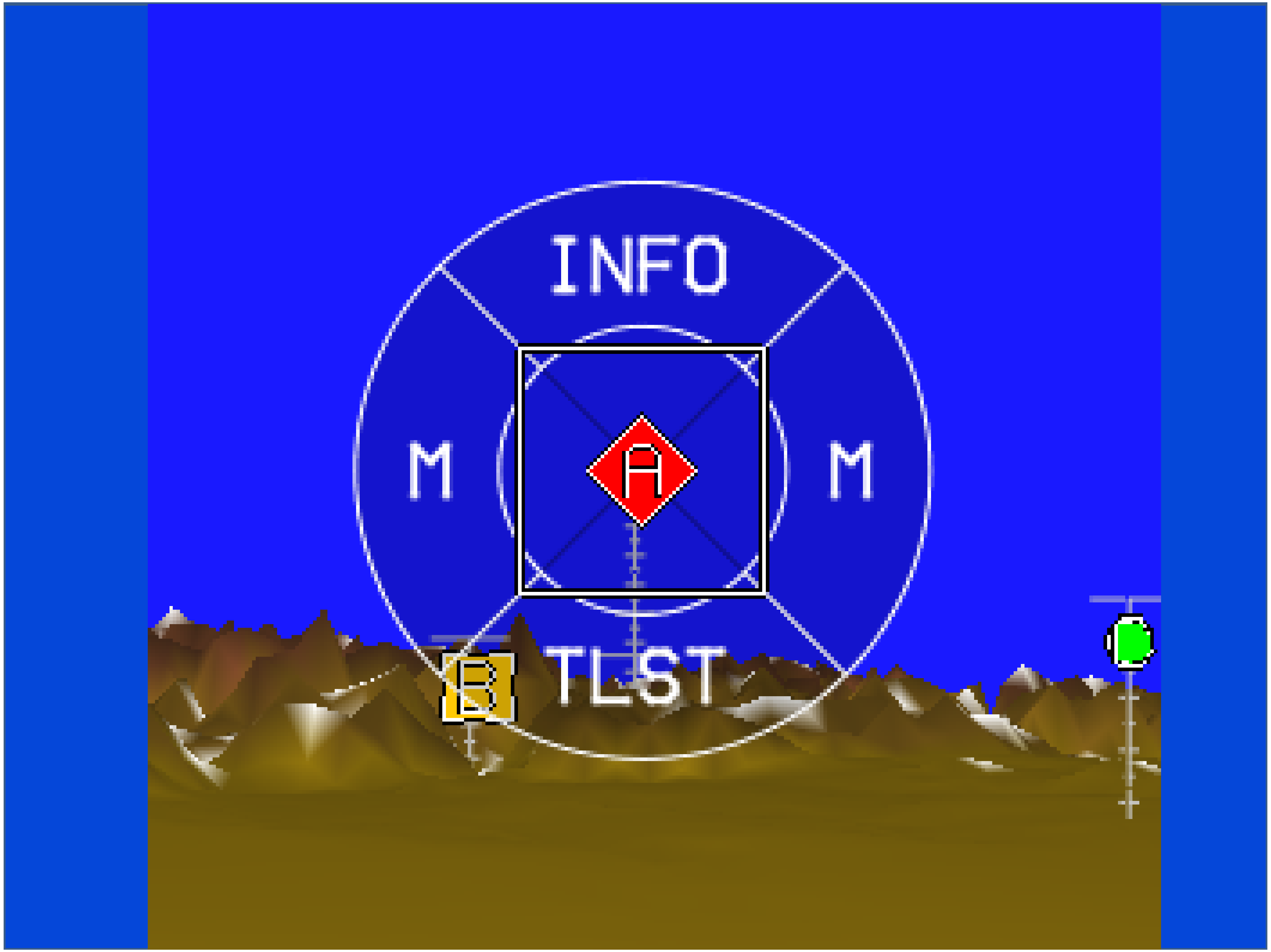
INFO
M
A
M
B
TLST

Consequences for learning

- What you see is what you can act upon
- The actions on your fingertips result in the appropriate actions on the selected objects
- The behavior of the virtual objects in the virtual space correspond to your mental model of the environment
- The effects of your actions are directly fed back by the visual, acoustic and/or tactile channel, that is

learning becomes direct instead of mediated

THANK YOU FOR YOUR ATTENTION

Now, I would appreciate questions or comments

NTNU – Trondheim
Norwegian University of
Science and Technology

New Trends in Social Robots

Panel on ACHI/eLmL/eKNOW
Learning and Knowledge-based Adaptive Human Machine Interactions
16:30 -18:30 April 27th 2016

Panelist
Ibrahim A. Hameed,

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Outline

- What is social robot?
- Possible applications of social robot?
- Challenges
- User profile
- Robot personality
- Conclusions & discussions

What is social robot?

- A social robot is an AI (artificial intelligence) system, such as Android, that is designed to interact with humans and possibly also with other robots.
- Social and personal robots are a type of mobile robots that look like, communicate and interact like humans and are used where people used to live.
- It should be able to verbally and non-verbally (facial expressions, posture, nodding, eye-contact, gesture, waving, etc.) communicate with humans.

Possible applications of social robot?

- They are used to replace – in part – visiting human care givers in elderly/nursing houses in their roles of distributing and ensuring medication is taken and reporting back if they do not see the medicine being swallowed
- As a school teacher for languages and other subjects
- For replacing real assist "seeing" and "hearing" animals for blind people to quickly clarify the situation and provide live feed
- For childcare at homes and kindergartens
- To help people with reduced mobility
- As office receptionist
- Replace real animals with robotic animals
- etc.

Market value of personal and service robots

- By 2030, many households in the developed world will have personal robots in their home.
- Personal robots tomorrow will be like personal computers today.
- According to a Forest & Sullivan's recent study, the future of mobile robots, the market for mobile robots is expected to reach $17.4 billion by 2020.

Challenges

- The challenge is to have robots that can understand human emotions, expectations and needs and react accordingly.
- Integration of artificial intelligence, deep learning, cognitive behavior and sensor fusion is expected to help such types of robots to act and behave like humans, have personality and take right decisions in various situations.

User profile

- The robot should be able to build a user profile for each new user.
- The robot should be equipped with the AI required to continuously update user profiles.
- NLP and other tools can be used to enable the robot to automatically and continuously extract knowledge from users and update their user profiles.
- Knowledge such as personal information, profession, city, country, hobbies, games they like to play, types of books they prefer to read, likes and dislikes, etc.
- Once the robot build user profile for many users, it can start building family and friends networks of users and use information from profiles to check social connections between users

Robot personality

- Do you like your robots subservient and complimentary, or glib and a little bit cheeky?
- you could potentially always choose a specific personality type for your robot that represents the kind of person you enjoy interacting with.
- Robot personality could be achieved by building a user profile for the robot itself.
- The robot should be able to switch between states according to user's mood
- The robot should be humble and kind with kind users and aggressive with aggressive users

Conclusions & discussions

- Robots have unlimited ability to extract knowledge from users and unlimited storage capacity which can help it to track academic progress of students, social skills of patients with dementia and autism.
- These data can be analysed and used to assess teaching methods and treatment and therapeutic approaches.

Some Thoughts about Machine Learning

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Technische Hochschule Mittelhessen
University of Applied Sciences

DigitalWorld, April 2016

Learning- and Knowledge-based Adaptive Human-Machine Interactions

Example 1: Multi-Scheme Smartphone Positioning in known Areas

Basic Methods

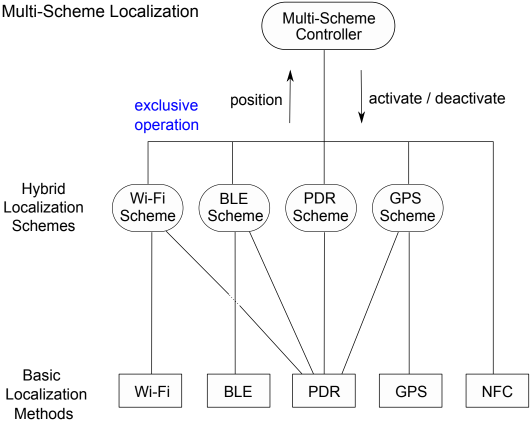
- Wi-Fi Fingerprinting
- Bluetooth Low Energy (BLE)
- Pedestrian Dead Reckoning (PDR) (Sensor-based)
- Global Positioning System
- Nearfield Communiation

Hybrid Scheme:

Absolute positioning fused with PDR

Challenge:

- Automatic Method Selection
- Low power consumption



More Information:

- Multi-Scheme architecture details in [Jaeger.2015]
- Fusion method details in [Becker.2015]

Coarse Positioning: Determination of Building and Floor Level

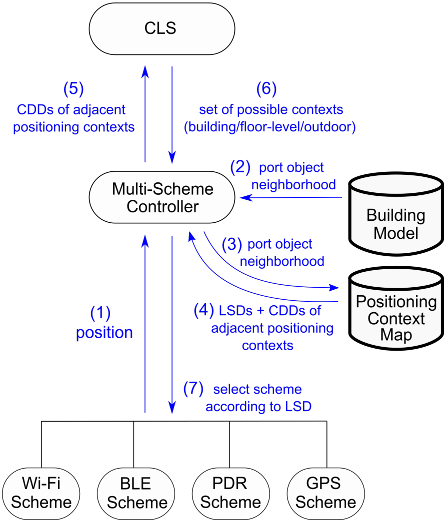
First Solution: Coarse Localization Subsystem (CLS)

Area model allows explicit mapping from observations to coarse location:

- Port Objects: Elevators, Entrance/Exit Doors, Staircases
- Mapping from radio station IDs to locations (WiFi, BLE)
- Mapping from height measurements to floor levels

Drawbacks

- Complexity of area model
- Complexity of coarse localization algorithm



Using Machine Learning for Coarse Positioning

Some Expectations

- CLS can "learn" localization in unknown sub-areas
- Adaptiveness to changes in environment (WiFi/BLE infrastructure)

Preliminary Experiences

- Successful Indoor/Outdoor Classification with semi-supervised learning
  - Co-Training with two Naïve Bayes classifiers
  - Features: GPS-Noise, light intensity, athmosperic pressure, . . .
  - Results: >90% correct classifications
  - Easy implementation using WEKA
  - Concern: Why Naïve Bayes classifiers? In theory, they should not perform well!
- Mapping observations in signal space to locations
  - Successful in small areas: Radio Maps
  - Not transferable to larger areas:
    Observation consists of pairs (sender ID, signal level)
    How to treat signals from unknown radio stations?
  - Machine-learning solutions have been proposed: complicated

Conclusion: Partial success, no 100% reliability, non-trivial problems, dispensable.

Example 2: Self-Driving Cars

Characteristics

- Systems rely on: Advanced Pattern Recognition, Deep Learning, . . .
- AI technologies are crucial, indispendable.
- For several tasks machines are superior to human beings (e.g. Traffic sign recognition)

Concerns

- What about the 100% reliability? My life depends on the system!
- Engineers: *It works fine, but we wonder how*.

We have to trust in machine decisions we don't understand because of their complexity. This is causing discomfort.

Example 3: Car Brake System

Characteristics

- Several functions: ABS, ESP, etc.
- "‘good old"’ traditional engineering, AI-free
- 100% reliability
- C-Code, in part generated from mathematical models
- thoroughly tested
- certified

My perception:

- Trustworthy
- 100% reliability is important: My life depends on the system!

Concerns?

Example 3: Car Brake System

Some more insights

- More than 600.000 lines of code
- More than 600 developers currently
- More than . . . detected inconsistencies
- . . .

Concerns

- What about the 100% reliability? My life depends on the system!
- Engineers: *It works fine, but we wonder how*.

We have to trust in conventional software we don't understand because of their complexity. This is causing discomfort.

Solution?

- Consult a psychologist to mitigate the discomfort?
- Can we do without further technical progress?
- Is further progress possible without more complexity?
- Wait some more years until we can hand over all those problems to a "deep-minded" machine!

[Becker.2015] Nils Becker, Michael Jäger, and Sebastian Süß. Indoor smartphone localization with auto-adaptive dead reckoning. In Proceedings of the 2015 Tenth International Conference on Systems, pages 125–131, 2015.

[Jaeger.2015] Michael Jäger, Sebastian Süß, and Nils Becker. Multi-scheme smartphone localization with auto-adaptive dead reckoning. International Journal on Advances in Systems and Measurements, 8(3 / 4):255–267, 2015.

Learning and Knowledge-based Adaptive Human-Machine Interactions

Conceição Granja, Terje Solvoll

eTelemed 2016, Venice

NST Norwegian Centre for Integrated Care and Telemedicine

TROMSØ TELEMEDICINE LABORATORY

sfi Centre for Research-based Innovation
Established by the Research Council of Norway

Introduction

IT is often presented as a solution to reduce inefficiencies in health care

However, there is substantial evidence on

- Unsuccessful implementation projects
- IT implementation challenges
- Slow diffusion
- Unforeseen consequences

Context-sensitive systems

"Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant for the interaction between a user and an application, including the user and applications themselves."

Context-sensitive systems

- This definition shows the importance of which information is relevant or not in a context-sensitive system.
- A context-sensitive system could, therefore, be defined as a system allowing interactions between multiple entities using relevant information

Context-sensitive systems

- "*A system is context-aware if it uses context to provide relevant information and/or services to the user, where relevancy depends on the user's task*".
- This definition shows that a context-sensitive system can change its behaviour and send some relevant information according to the context
- A context –aware system can also learn from the user interaction with the system to automatically improve his/her experience.
  - In this manner, a context-aware system is able to provide process support by analysing process related data from two categories: (1) what is done; (2) how it is done.

Context-awareness allows health IT to provide process support by manging the complexity inherent to clinical processes while supplying the technology with the process standards required to ensure usability

Thanks for listening

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ACHI 2016

The role of adaptive mobile dedicated applications in the learning process of users with Autism Spectrum Disorders (ASD)

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Venezia, Italy
email: luccio@unive.it

Autism Spectrum Disorders (ASD)

Neurodevelopmental disorder (American Psychiatric Association, 2013) :

- persistent impairments in social communication and social interaction;
- restricted, repetitive patterns of behaviour, interests, or activities;
- **impairments in social communication: Language delays**

Autism Spectrum Disorders (ASD)

Technologies as support tools for persons with ASD:

- Virtual reality applications
- Robots
- Telehealth systems
- Dedicated applications

Reference: Technologies as Support Tools for Persons with Autistic Spectrum Disorder: A Systematic Review.
N. Aresti-Bartolome and B. Garcia-Zapirain, nt. J. Environ. Res. Public Health 2014, 11, 7767-7802

Dedicated applications

Technological tools designed to be used on computers, tablets or mobile telephones for:

(1) Communication
(2) Social learning and imitation skills
(3) Other associated conditions (related to play, immagination …)

Dedicated applications for communication

Users with ASD present **good visual abilities** =>

Tools based on **Augmentative and Alternative Communication (AAC)** techniques, i.e., powerful methods that combine different visual components in order to create syntactically and semantically correct sentences

Dedicated applications for communication

There are **hundreds** of dedicated applications for communication, but ….

1. Which one should we pick?
2. Is it FREE?
3. Is it really ADAPTIVE?
4. If it is adaptive, at what cost (time, effort, technological knowledge, etc.)?

Dedicated applications for communication

Note that if they are not adaptive **low functioning non verbal users with ASD** will not be able to use them!!

Why? They need

-"real known images" (symbolic pictures may not work)
-"known voices" (synthesizers produce "unknown sounds")
-....
just to TEST the tool => too much time/effort

Future challenges

Specific goals:
- can we improve the quality of synthesizers?
- can we produce highly adaptive free mobile dedicated applications?

More in general:
- Should we build totally auto-adaptive applications or should we ask, to a certain extent, for human intervention?

ACHI2016

April 24 - 28, 2016 - Venice, Italy

THE NINTH INTERNATIONAL CONFERENCE ON ADVANCES IN COMPUTER-HUMAN INTERACTIONS

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IARIA

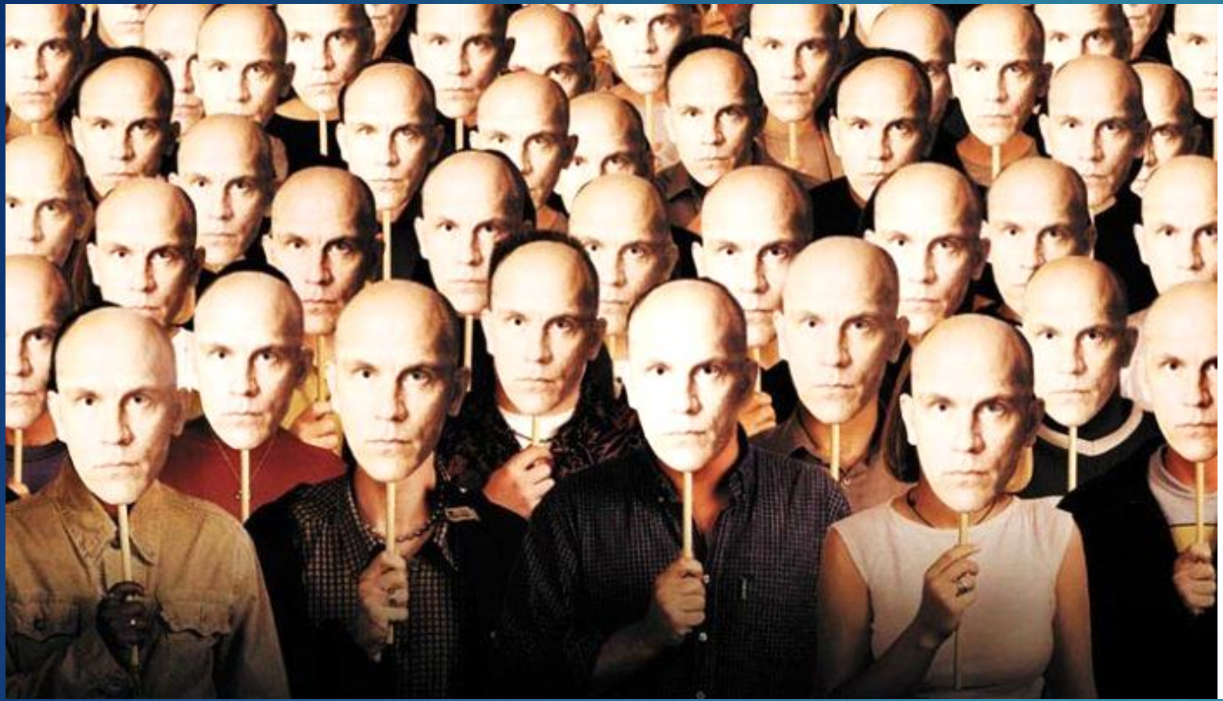
Human-Machine Interaction: let's focus on Humans for a while...

ARE WE ALL THE SAME?

PANEL DISCUSSION

April 27th, 2016 - Venice, Italy

We are not all the same



HOW STANDARD HMI
SEE THE USERS

VS

THE REAL USERS

How to investigate personalities

- Cattell's16 Personality Factors Test
- Millon Clinical Multiaxial Inventory
- **Myer-Briggs Type Indicator**
- Big Five
- Minnesota Multiphasic Personality Inventory

What's Your Personality Type?

Use the questions on the outside of the chart to determine the four letters of your Myers-Briggs type.
For each pair of letters, choose the side that seems most natural to you, even if you don't agree with every description.

1. Are you outwardly or inwardly focused? If you:

- Could be described as talkative, outgoing
- Like to be in a fast-paced environment
- Tend to work out ideas with others, think out loud
- Enjoy being the center of attention

then you prefer
E
Extraversion

- Could be described as reserved, private
- Prefer a slower pace with time for contemplation
- Tend to think things through inside your head
- Would rather observe than be the center of attention

then you prefer
I
Introversion

2. How do you prefer to take in information? If you:

- Focus on the reality of how things are
- Pay attention to concrete facts and details
- Prefer ideas that have practical applications
- Like to describe things in a specific, literal way

then you prefer
S
Sensing

- Imagine the possibilities of how things could be
- Notice the big picture, see how everything connects
- Enjoy ideas and concepts for their own sake
- Like to describe things in a figurative, poetic way

then you prefer
N
Intuition

3. How do you prefer to make decisions? If you:

- Make decisions in an impersonal way, using logical reasoning
- Value justice, fairness
- Enjoy finding the flaws in an argument
- Could be described as reasonable, level-headed

then you prefer
T
Thinking

- Base your decisions on personal values and how your actions affect others
- Value harmony, forgiveness
- Like to please others and point out the best in people
- Could be described as warm, empathetic

then you prefer
F
Feeling

4. How do you prefer to live your outer life? If you:

- Prefer to have matters settled
- Think rules and deadlines should be respected
- Prefer to have detailed, step-by-step instructions
- Make plans, want to know what you're getting into

then you prefer
J
Judging

- Prefer to leave your options open
- See rules and deadlines as flexible
- Like to improvise and make things up as you go
- Are spontaneous, enjoy surprises and new situations

then you prefer
P
Perceiving

The 16 types

ISTJ — Responsible, sincere, analytical, reserved, realistic, systematic. Hardworking and trustworthy with sound practical judgment.

ISFJ — Warm, considerate, gentle, responsible, pragmatic, thorough. Devoted caretakers who enjoy being helpful to others.

INFJ — Idealistic, organized, insightful, dependable, compassionate, gentle. Seek harmony and cooperation, enjoy intellectual stimulation.

INTJ — Innovative, independent, strategic, logical, reserved, insightful. Driven by their own original ideas to achieve improvements.

ISTP — Action-oriented, logical, analytical, spontaneous, reserved, independent. Enjoy adventure, skilled at understanding how mechanical things work.

ISFP — Gentle, sensitive, nurturing, helpful, flexible, realistic. Seek to create a personal environment that is both beautiful and practical.

INFP — Sensitive, creative, idealistic, perceptive, caring, loyal. Value inner harmony and personal growth, focus on dreams and possibilities.

INTP — Intellectual, logical, precise, reserved, flexible, imaginative. Original thinkers who enjoy speculation and creative problem solving.

ESTP — Outgoing, realistic, action-oriented, curious, versatile, spontaneous. Pragmatic problem solvers and skillful negotiators.

ESFP — Playful, enthusiastic, friendly, spontaneous, tactful, flexible. Have strong common sense, enjoy helping people in tangible ways.

ENFP — Enthusiastic, creative, spontaneous, optimistic, supportive, playful. Value inspiration, enjoy starting new projects, see potential in others.

ENTP — Inventive, enthusiastic, strategic, enterprising, inquisitive, versatile. Enjoy new ideas and challenges, value inspiration.

ESTJ — Efficient, outgoing, analytical, systematic, dependable, realistic. Like to run the show and get things done in an orderly fashion.

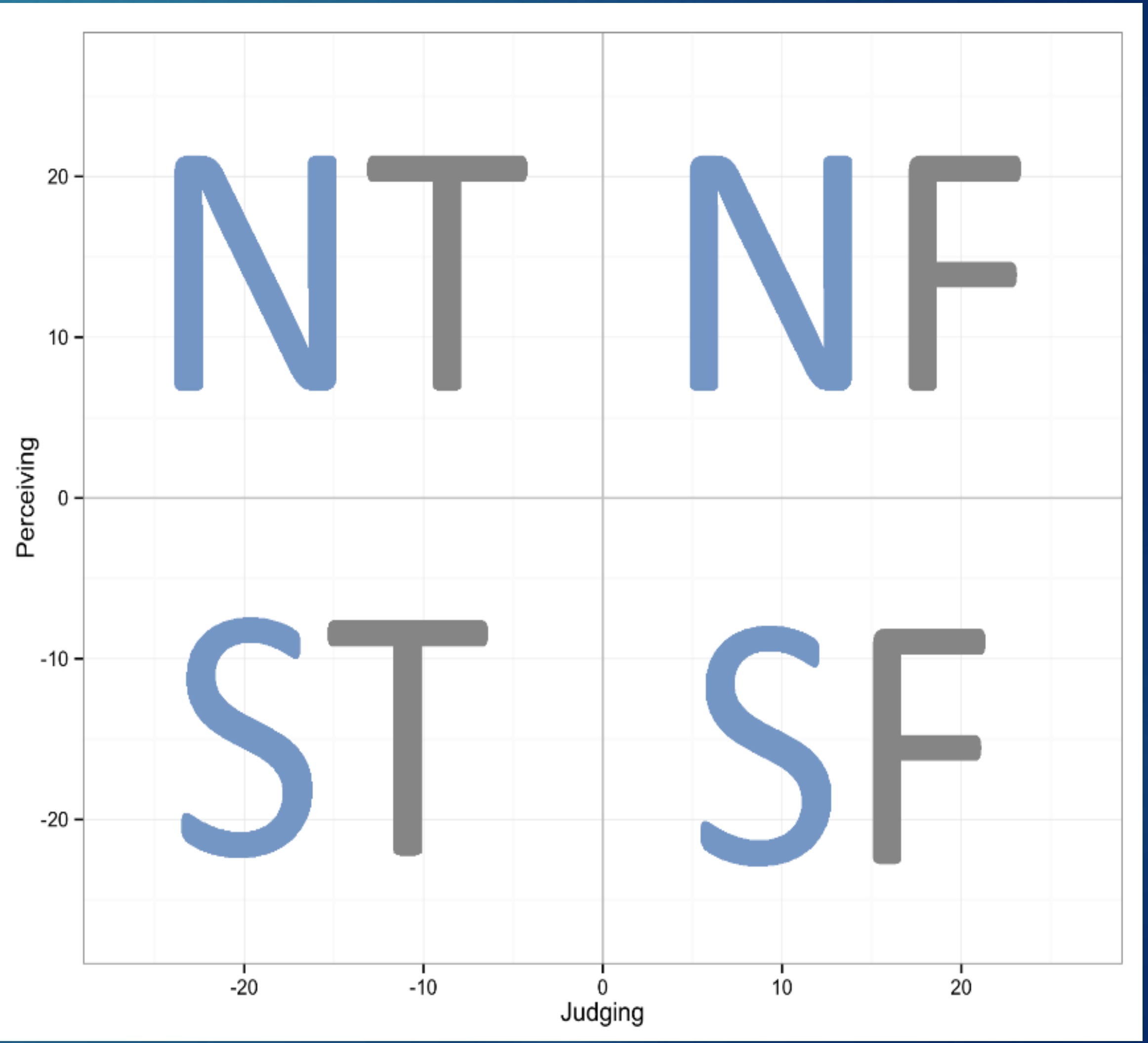
ESFJ — Friendly, outgoing, reliable, conscientious, organized, practical. Seek to be helpful and please others, enjoy being active and productive.

ENFJ — Caring, enthusiastic, idealistic, organized, diplomatic, responsible. Skilled communicators who value connection with people.

ENTJ — Strategic, logical, efficient, outgoing, ambitious, independent. Effective organizers of people and long-range planners.

The Questionnaire and the J-P Plan

- **The Framework**
  - The **J-P Plan** is a reductive model of the MBTI



The Questionnaire and the J-P Plan

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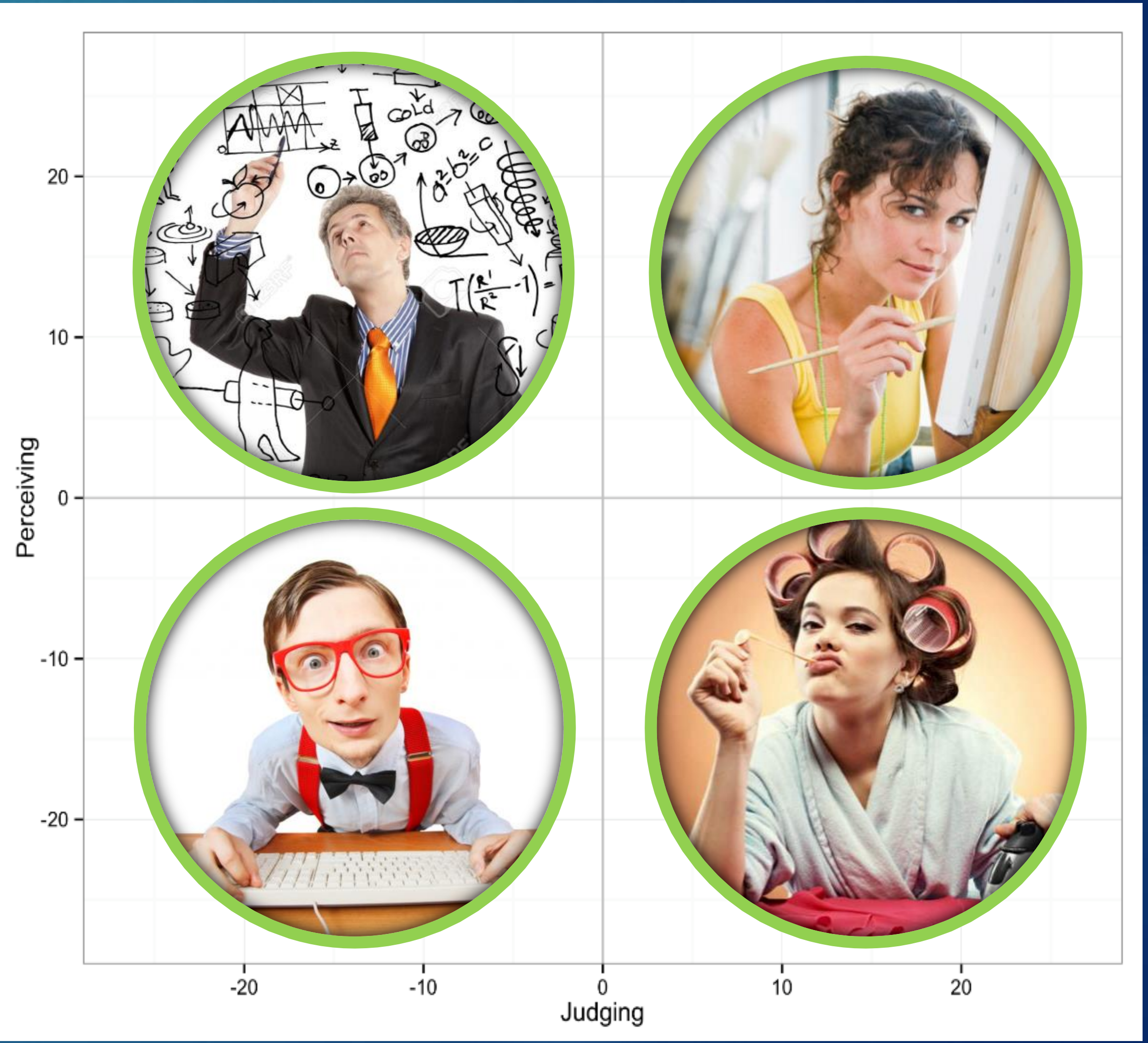
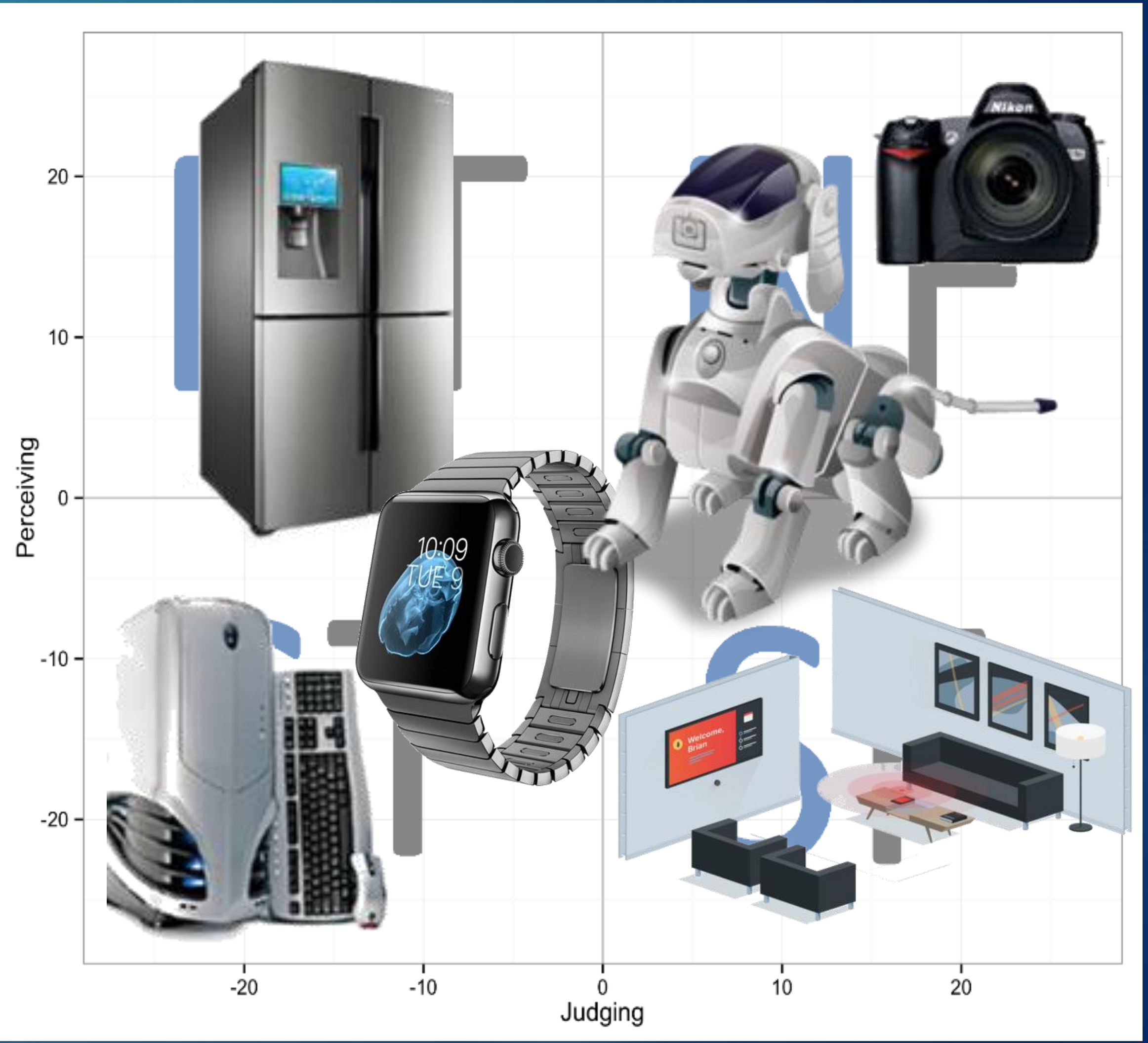


The Questionnaire and the J-P Plan

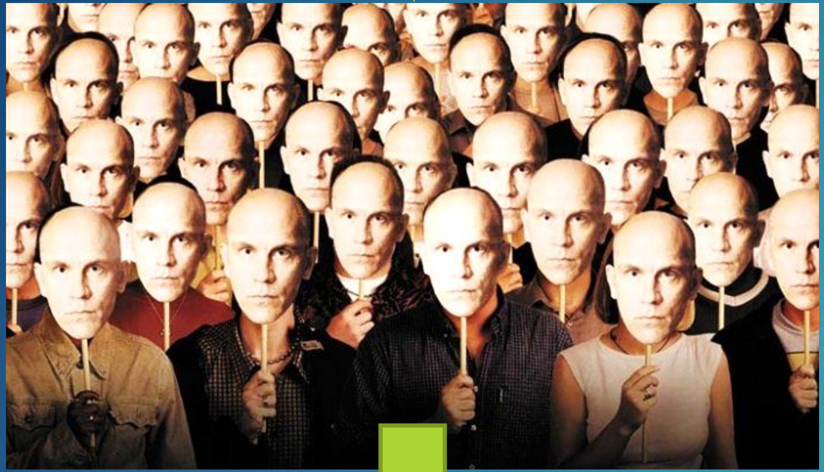
- **The Framework**
  - The **J-P Plan** is a reductive model of the MBTI

- We don't use the test for classifying **people** but **objects**!



The Method

❷ Compile the same Questionnaire

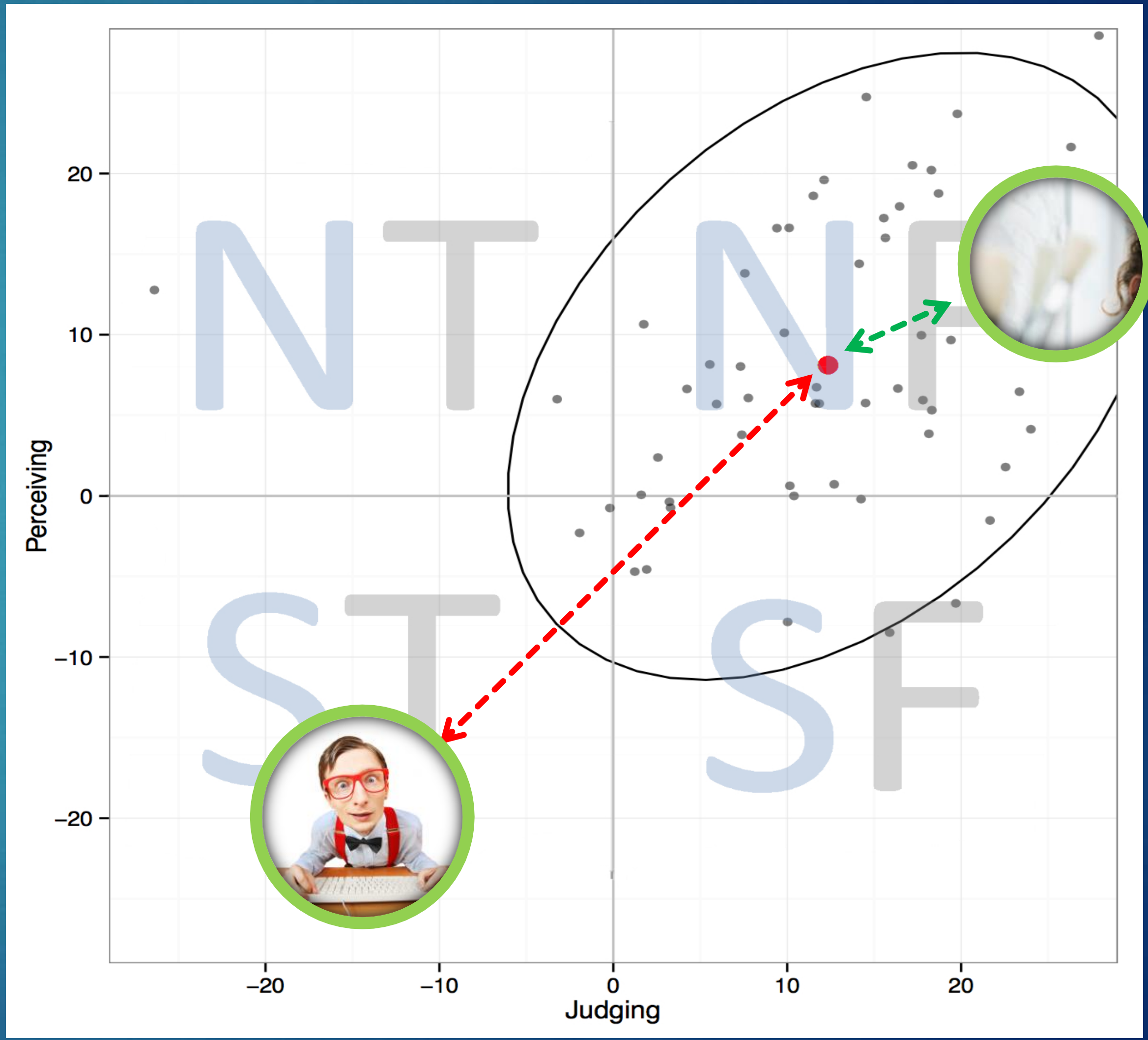


❶ People with different personalities

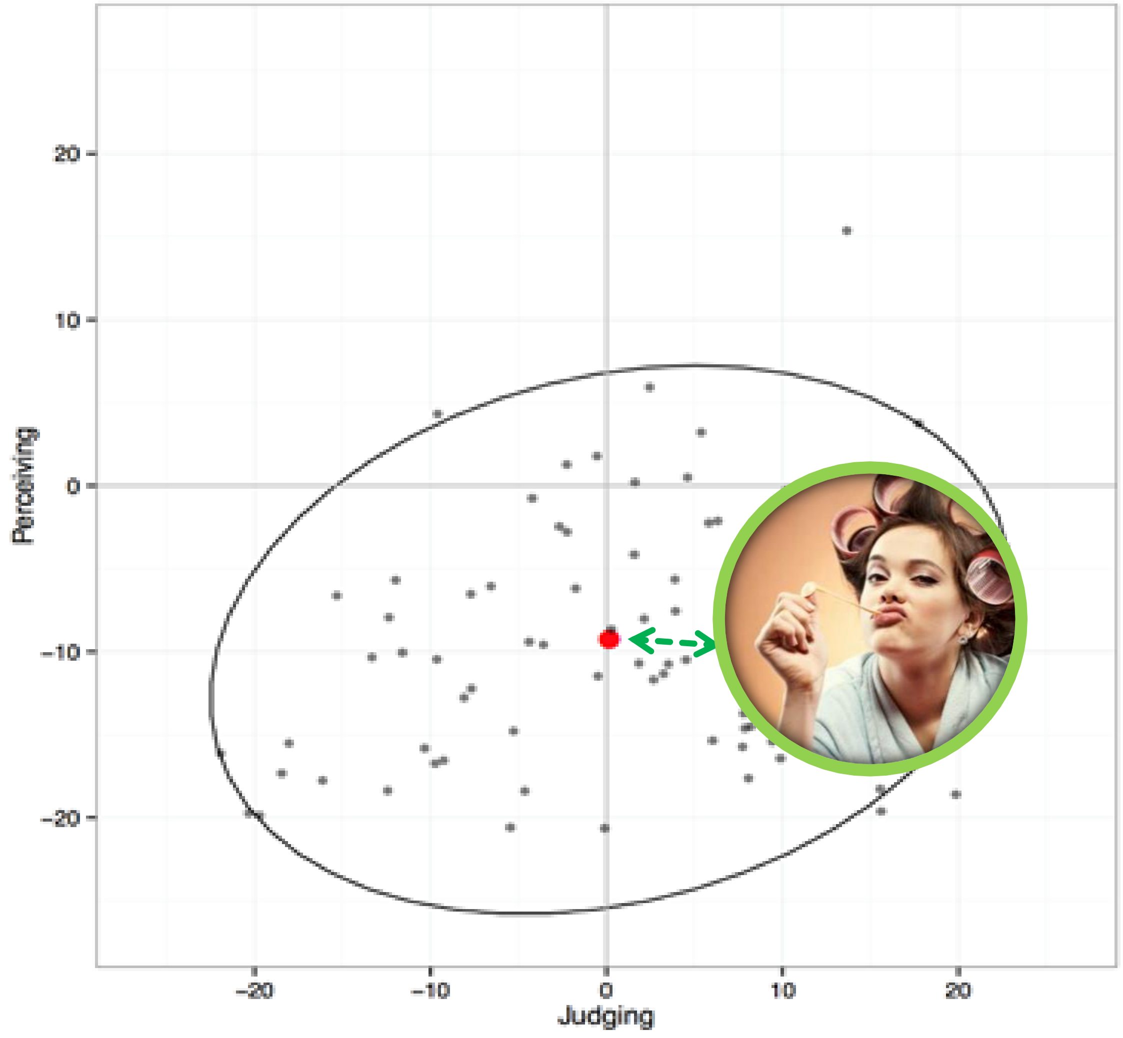
❸ Perceived Personality of Objects

❹ Compatibility with specific Users' Personalities

Use Case: The Design Installation

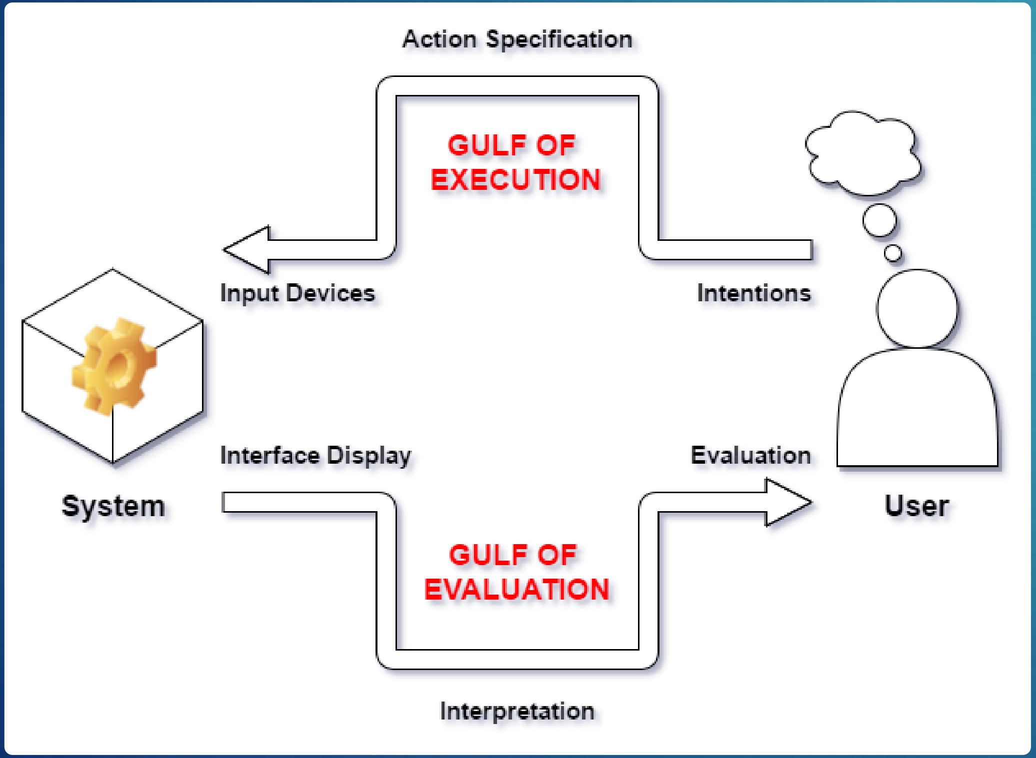


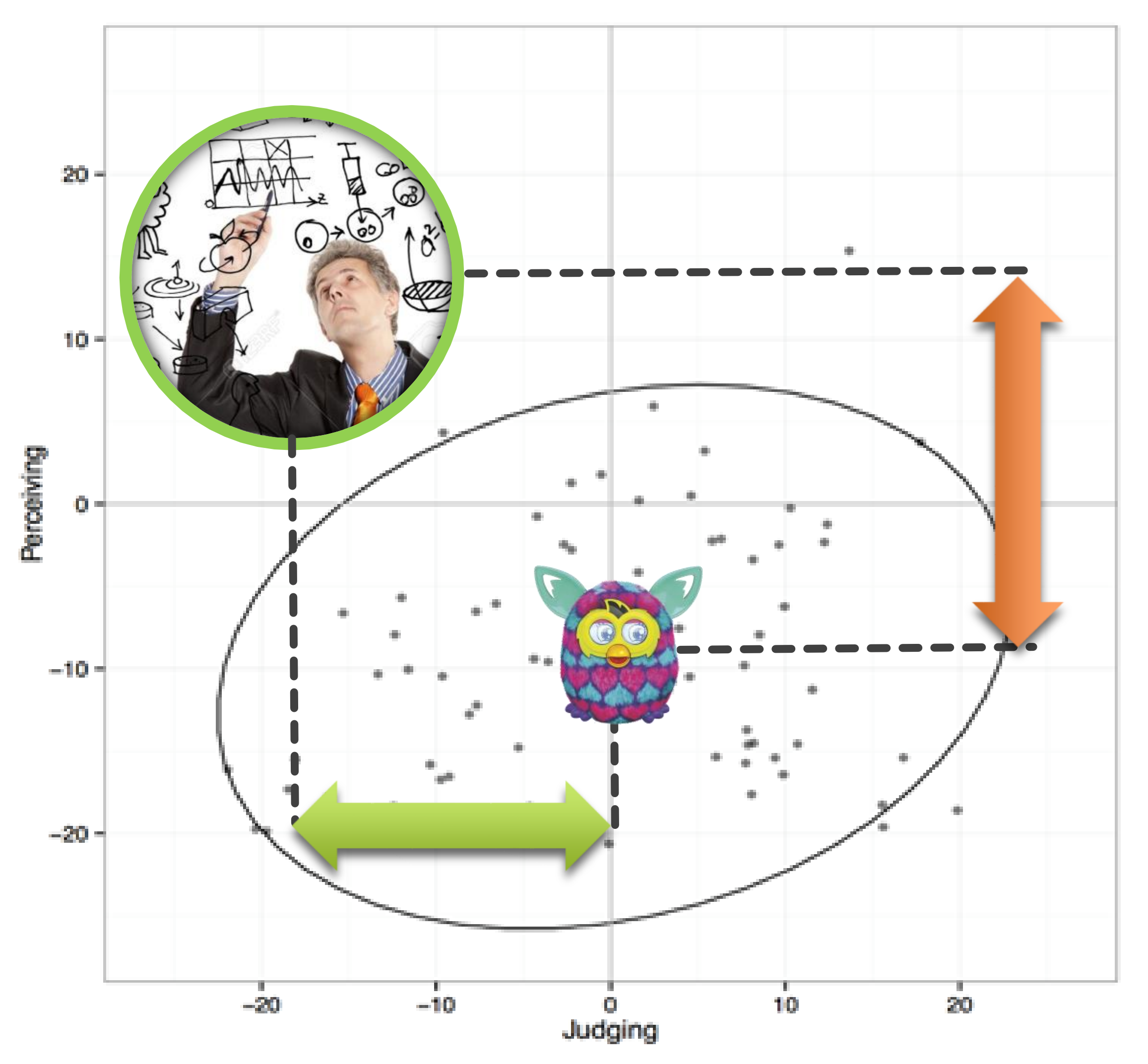
Use Case: The Housewife and the Furby



JP and the Gulfs

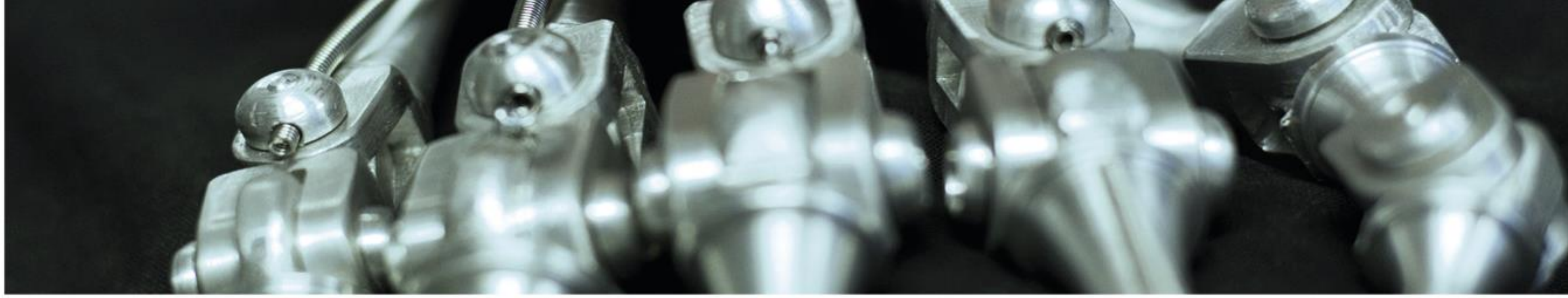
- J and the **Execution Gulf**
- P and the **Evaluation Gulf**





Ambitions

- Help designers in **improving User Experience** of Interactive Objects
- Test this method for **targeting** or **expanding** a market
- **Auto-adjustment behavior** / **Personality modeling** Objects
- What would happen if we endow a **Humanoid Robot** with such a ‘psycholigical’ capabilitiy?...



UiO : Department of Informatics
University of Oslo

Users Need to Learn the Automation

Panel: Learning- and Knowledge-based Adaptive Human-Machine Interactions

ACHI 2016, Venice,

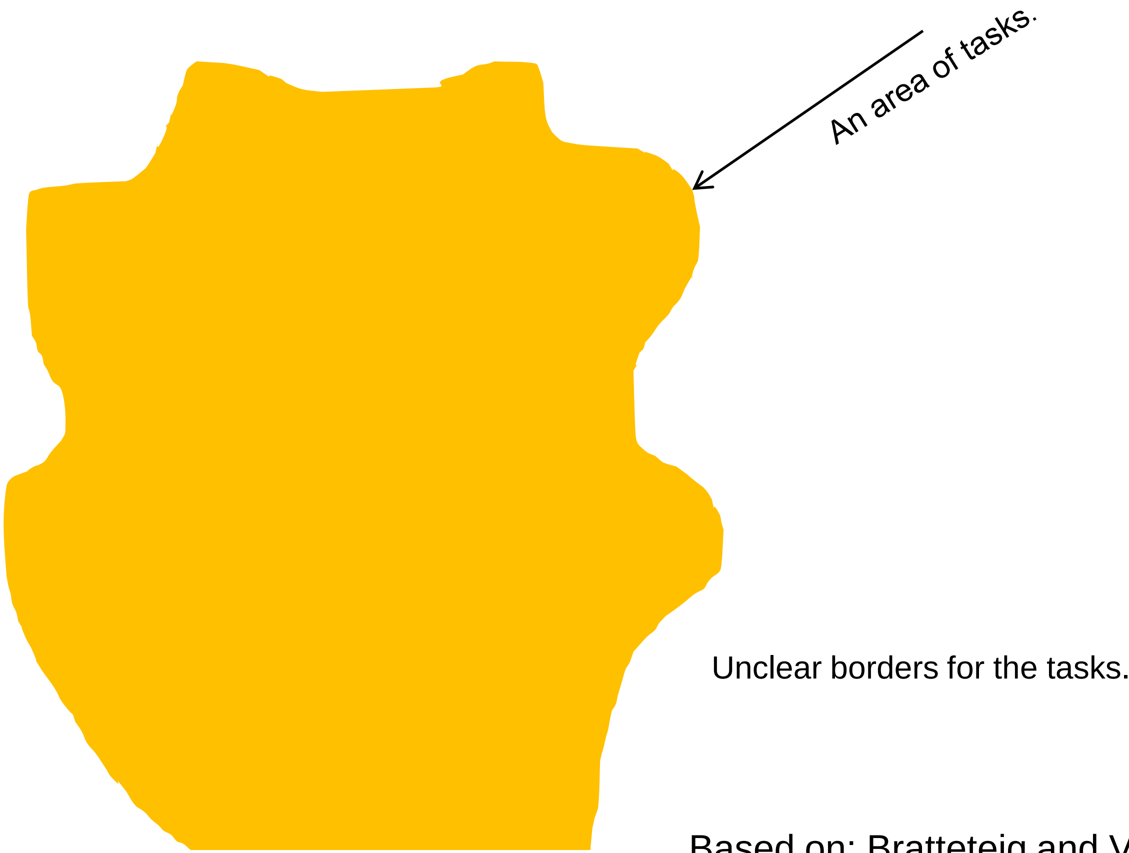
Guri Verne
University of Oslo, Norway
guribv@ifi.uio.no

Technology influences the users' tasks

What does automation do?

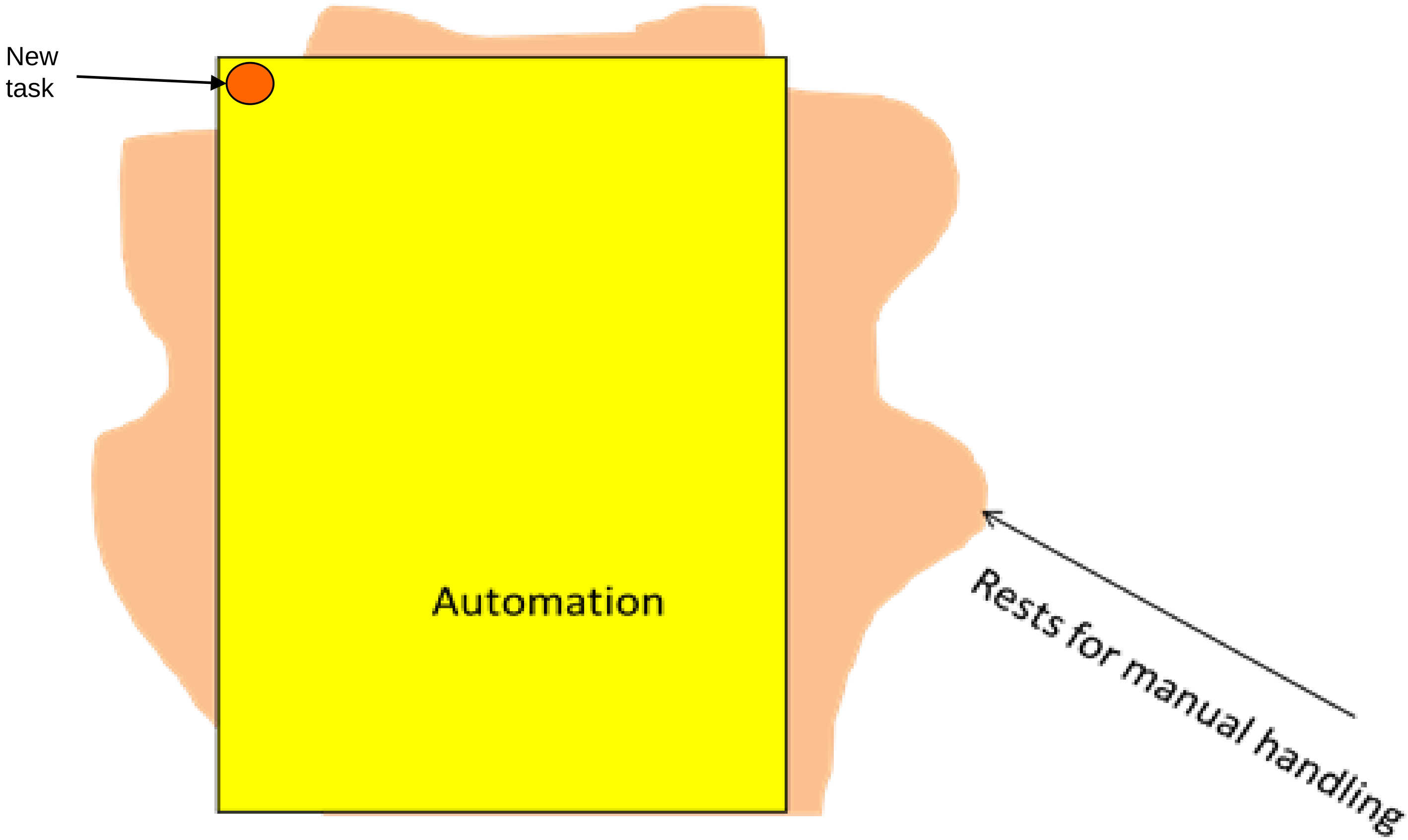
How does it change the task(s) that are left for the user?

Before automation

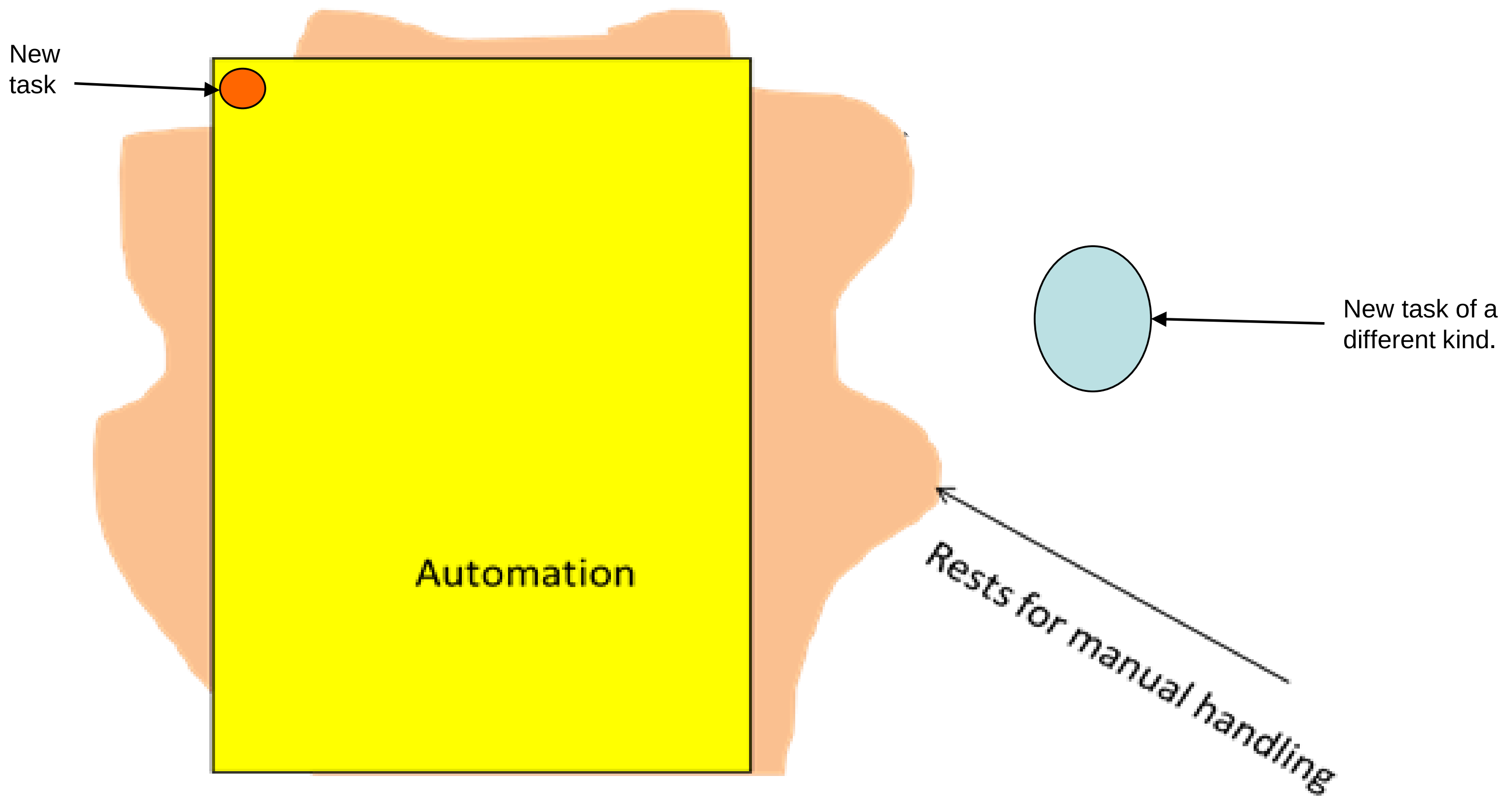


Based on: Bratteteig and Verne (2016), Verne (2015)
Inspired by: Bainbridge (1983) «Ironies of Automation»

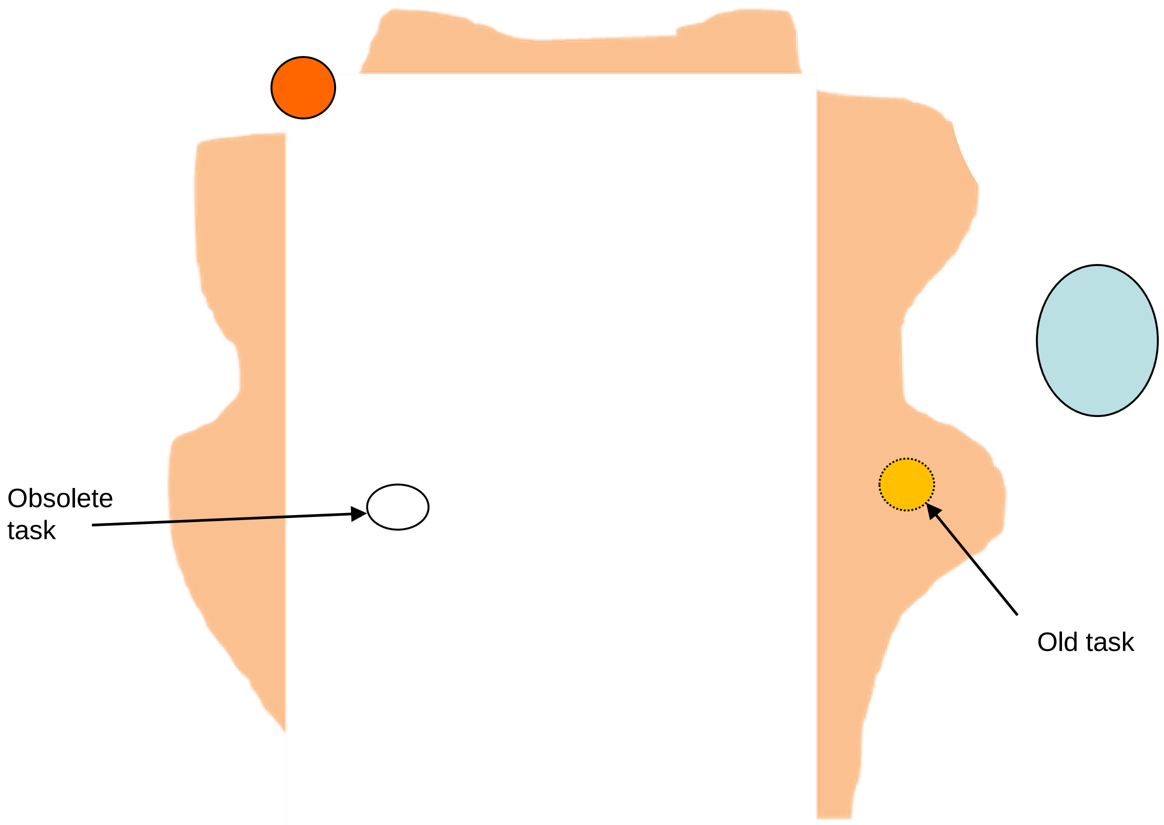
Automation introduces new tasks



Some of a different kind

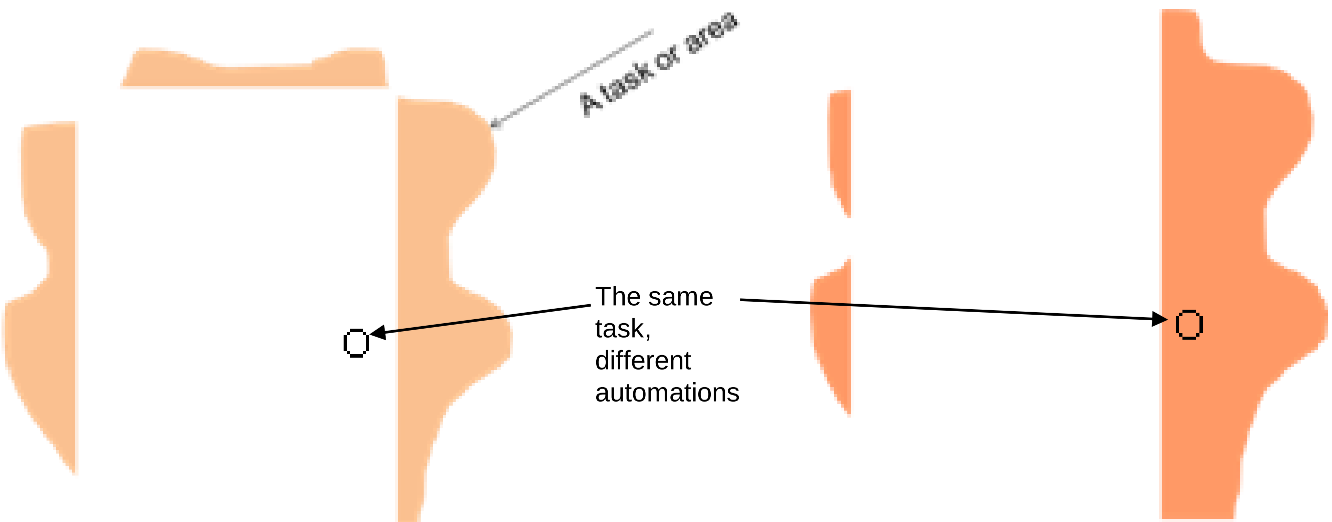


Old and new tasks



Incoherence and fragmentation seen from the user.

To differentiate between old and new, users must understand the automation



To know which tasks that a user need to do, he or she will need to know how the automation works to be able to handle the tasks left with autonomy and competence.

Applied to Adaptive Human-Machine Interactions

Challenges when the system/interface adapts:

- Users /learners need to know the automation to understand what is happening?
- Users need to understand the automation to use the system in a knowledgeable way?
- Design for transparency

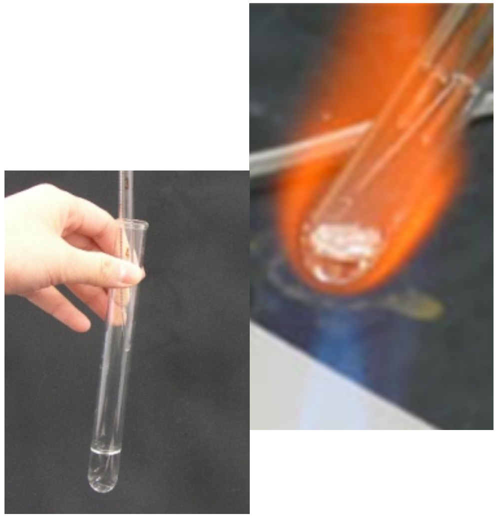
Trying to make an electronic lab-book: Observation of chemical reaction and visualized image of molecular world

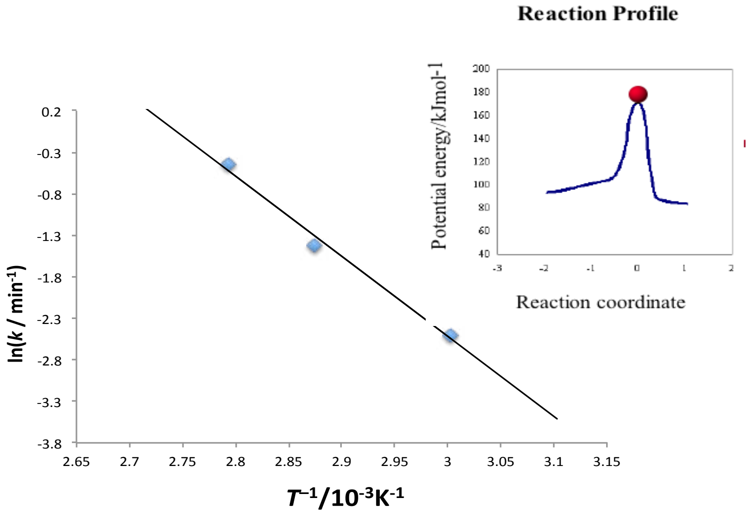
Akira Ikuo

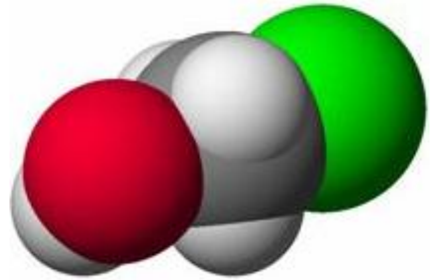
Department of Chemistry,

Tokyo Gakugei University

$$OH^- + CH_3Cl \rightarrow CH_3OH + Cl^-$$







Observable Level ⟺ Symbolic Level ⟺ Molecular Level

(Macro Level ⟺ Symbols & Equations ⟺ Micro Level)

Phenomena **Chemical concepts** **Molecular world**

Figure. Dividing the image into the three thinking levels

Figure was modified from A. Ikuo, Y. Yoshinaga, and H. Ogawa, in C.-C. Liu, et al. (Eds.), Proceedings of the 22nd International Conference on Computers in Education. Japan: Asia-Pacific Society for Computers in Education, pp. 489-493, 2014.

References therein:

[1] J. K. Gilbert and D. F. Treagust, in J. K. Gilbert, (Ed.), MODELS AND MODELING IN SCIENCE EDUCATION Multiple Representations in Chemical Education, Springer, pp. 333-350, 2009.

[2] R. Tasker, and R. Dalton in J. K. Gilbert, M. Reiner, and M. Nakhleh, (Eds.), MODELS AND MODELING IN SCIENCE EDUCATION Visualization: Theory and Practice in Science Education, Springer, 103-131, 2010.

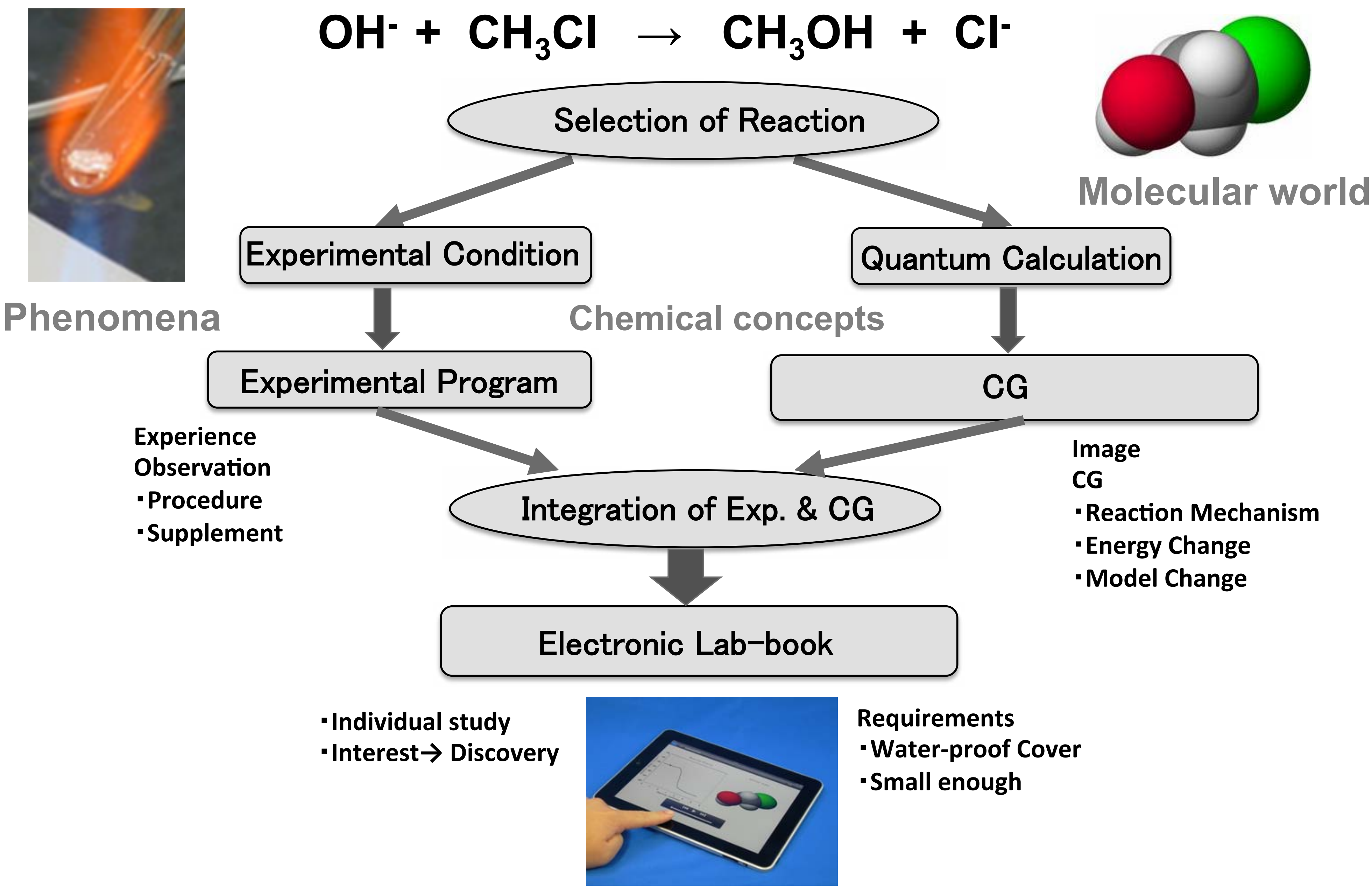


Figure. Developing Experimental Program and Electronic Lab-book

Figure was modified from A. Ikuo, Y. Yoshinaga, and H. Ogawa, in S. White, H. Mannaert, and J. L. Mauri, (Eds.), Proceedings of the eighth International Conference on Mobile, Hybrid, and On-line Learning, pp. 26-27, 2016.

NEXT STEP?

From DigitalWorld 2016:

"A Training-assistance System using Mobile Augmented Reality for Outdoor-facility Inspection"
Yoshiki Yumbe, Osamu Segawa, Makoto Yamakita
ACHI 6

"Augmented Reality as a Tutorial Tool for Construction Tasks"
Ana Regina M. Cuperschmid, Marina G. Grachet, Márcio M. Fabricio
ACHI 9