# Digitale ed impatto sociale come cambia la ricerca in Informatica


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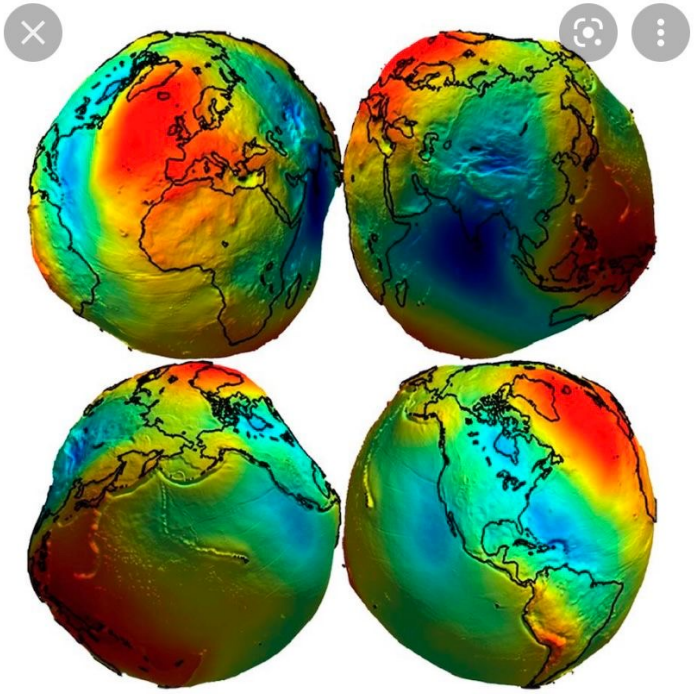
# Quale digitale, quale impatto sociale?



persone e
sistemi autonomi

terra e computing

# Autonomous Systems

- Motivation
  - Autonomous system: the scope of self
  - The harm of digital society
  - The quest for an ethical approach
- Embedding Ethics in autonomous systems
  - Human in the center
  - Digital Ethics
  - A motivating example
  - An architectural approach: The Exosoul project
- Challenges

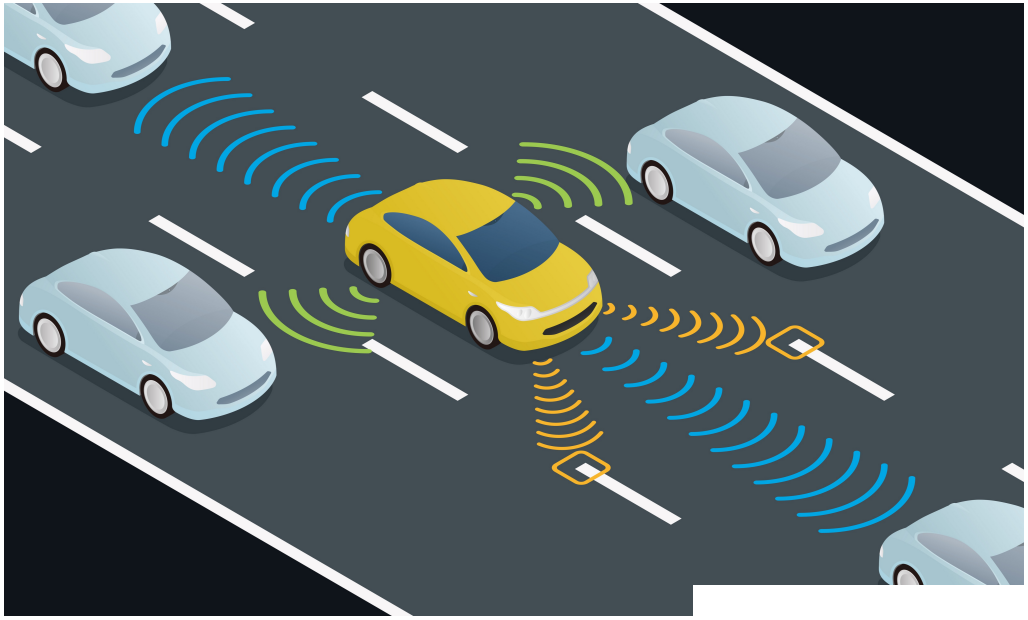
# AS: The scope of self

- Software systems are increasingly autonomous in making decisions ( on behalf of potential users or pro-actively).
- The power of self goes beyond the ability of substituting human agents in supplying (contextual) information that the system may use to make decisions while continuously running.
- Depending on the nature, property, and use of this information, an autonomous system may impact moral rights of the users, be they *single citizens*, *groups*, or the *society* as a whole

- It exceeds the system boundaries invading user prerogatives

Privacy and Ethics

# Autonomous cars, …



# Privacy

- It emerged with the large scale availability of automatically processable personal data
- Philosophical, regulatory and technical approaches
- It is an ethical dimension

# Philosophical Perspective

- privacy as related to personal information on which we want to exercise direct and unconditional control concerning its diffusion and disclosure

W. Prosser. Privacy - California Law Review 1960.

B. Roessler. Xprivacy as a human right. Proceedings of the Aristotelian Society, 117(2):187–206, 2017

# Regulatory Perspective

- General Data protection Regulation (GDPR) (May 2018)
- Art.1
  - Regulation lays down rules relating to the *protection of natural persons* with regard to the processing of personal data and rules relating to the free movement of personal data.
  - This Regulation protects fundamental rights and freedoms of natural persons and in particular their right to the protection of personal data.
  - …
- Art. 2
  - This Regulation applies to the processing of personal data wholly or partly by automated means and to the processing other than by automated means of personal data which form part of a filing system or are intended to form part of a filing system.
  - …

# Technical Perspective

- Privacy by design provides high-level guidelines in the form of principles for designing privacy-preserving systems
- Privacy preferences have been historically implemented by means of permission systems that comprise both specification of access policies and their enforcement
- User involvement: users *nudged* towards better solutions. Soft Paternalism principles
  - A. Acquisti, et. al. Nudges for privacy and security: Understanding and assisting users' choices online. ACM Comput. Surv. , 50(3):44:1–44:41, Aug. 2017.
- Privacy persona characterizing groups of users by privacy preferences
- Privacy assistant human or virtual, S. Ovide. How to make data privacy real, New York Times January 19 2021

# Ethics

- *"Advances in AI, robotics and so-called 'autonomous' technologies have ushered in a range of increasingly urgent and complex moral questions. Current efforts to find answers to the ethical, societal and legal challenges that they pose and to orient them for the common good represent a patchwork of disparate initiatives. This underlines the need for a collective, wide-ranging and inclusive process of reflection and dialogue, a dialogue that focuses on the values around which we want to organise society and on the role that technologies should play in it. "*
  - European Group on Ethics in Science and New Technologies. statement on artificial intelligence, robotics and 'autonomous' systems. https://ec.europa.eu/research/ege/pdf/ege_ai_statement_2018.pdf, 2018

# The space of decisions

- The autonomous system takes decisions that results in *actions*
- Depending on the context, actions have an ethical implication (machine ethics):
  - Push the brake in presence of the red traffic light
  - Push the brake to avoid running on people crossing the street

Actions are finite and depend on the domain, contexts are potentially infinite but in practice made discrete (given the domain)

# The autonomous car case

- Ethical problems: The trolley problem
  - The trolley problem http://www.trolleydilemma.com
  - MIT Moral machine http://moralmachine.mit.edu

  - E. Awad et others, The Moral Machine experiment, Nature volume 563, pages59–64 (2018), October 2018

- Philosophical debate
  - Mandatory ethics vs Ethical Knob

-J. Gogoll and J. F. M˙uller. Autonomous cars: In favor of a mandatory ethics setting. Science and Engineering Ethics, 23(3):681–700, Jun 2017.

-G. Contissa, F. Lagioia, and G. Sartor. The ethical knob: ethically-customisable automated vehicles and the law. Artificial Intelligence and Law, 25(3):365–378, 2017

# THE TROLLEY DILEMMA

## and how it relates to ethical communication

### About The Trolley Dilemma

The "Trolley Dilemma" (or the "Trolley Problem") consists of a series of hypothetical scenarios developed by British philosopher Philippa Foot in 1967. Each scenario presents an extreme environment that tests the subject's ethical prowess. In 1985, American philosopher Judith Jarvis Thomson scrutinized and expanded on Foot's ideas in *The Yale Law Journal*.

Below you will find one of the Trolley Dilemma scenarios as stated by Thomson, followed by a multiple choice question. Each answer describes a unique reaction to the dilemma, and correlates with one of the five ethical paradigms of Utilitarianism, Deontology, Divine Command Theory, Ethical Relativism, and Virtue Ethics. Clicking on an answer will send you to a page that describes the corresponding paradigm and offers insight into its meaning in relation to ethical communication.

### Scenario: Trolley Driver

"Suppose you are the driver of a trolley. The trolley rounds a bend, and there come into view ahead five track workmen, who have been repairing the track. The track goes through a bit of a valley at that point, and the sides are steep, so you must stop the trolley if you are to avoid running the five men down. You step on the brakes, but alas they don't work. Now you suddenly see a spur of track leading off to the right. You can turn the trolley onto it, and thus save the five men on the straight track ahead. Unfortunately,...there is one track workman on that spur of track. He can no more get off the track in time than the five can, so you will kill him if you turn the trolley onto him" (Thomson 1985, 1395).

I

V

### *WHAT WOULD YOU DO? (click on your answer below)*

a. Throw the switch in order to maximize well-being (five people surviving is greater than one).

b. Throw the switch because you are a virtuous person, and saving five lives is the type of charitable and compassionate act a virtuous person performs.

c. Do not throw the switch because that would be a form of killing, and killing is inherently wrong.

d. Do not throw the switch because you are a Christian, and the Ten Commandments teach that killing is against the will of God.

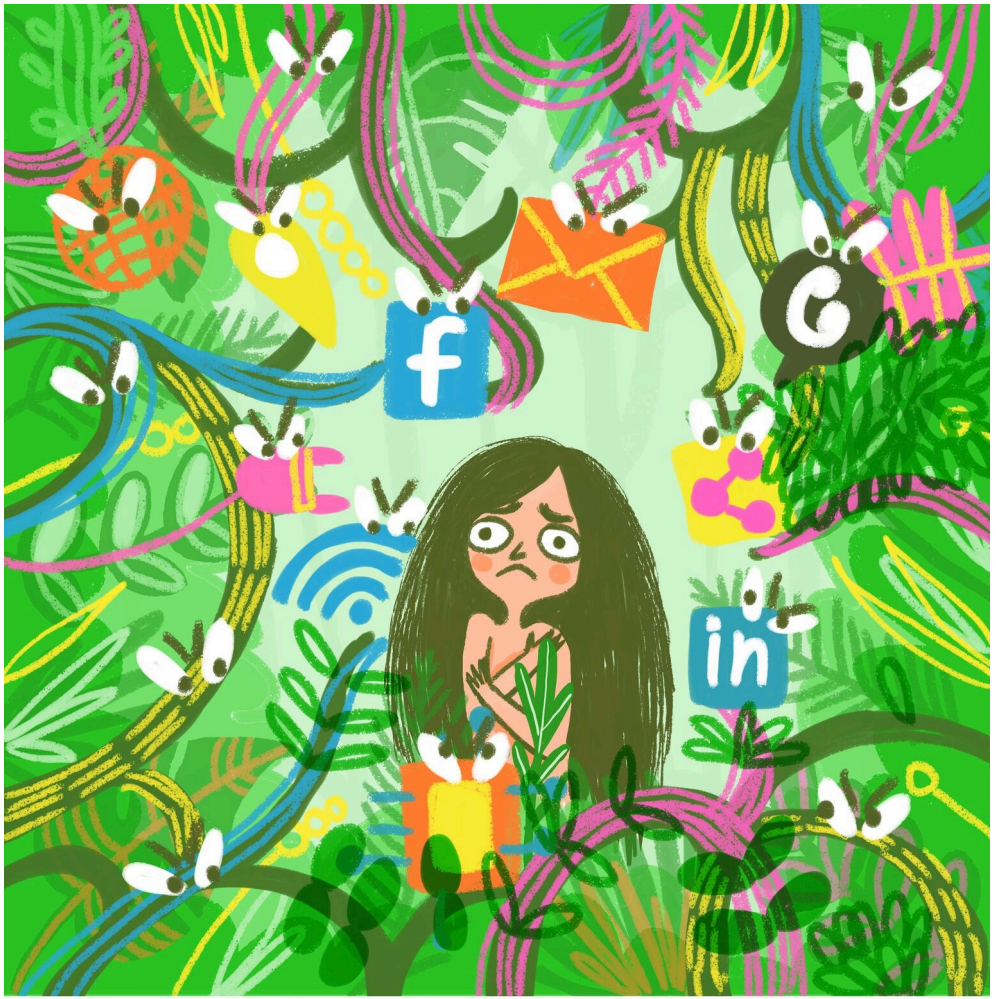
e. Do not throw the switch because you feel aiding in a person's death would be culturally inappropriate and illegal.

# The harm of digital society

Citizens moral rights,
as well as the social,
economic and political
spheres are at danger

But … it is unavoidable

We are in the Mangrove societies, Floridi's metaphore of the digital world



aurora cacciapuoti

# Many initiatives (the patchwork)
## european bias

- Regulatory
  - GDPR, autonomous driving, AI legislation
- Scientific societies
  - USACM: Statement on algorithmic transparency and accountability
  - EUACM: When computers decide: European recommendations on machine-learned automated decision making.
- Institutional
  - European Data Protection Supervisor (EDPS)
  - Ethics Advisory Group: Towards a new Digital Ethics
  - EEC High-Level Expert Group in AI: Draft ethic Guidelines for Trustworthy AI (Apr 2019)
  - White paper on AI. European Commission 2020
  - AI legislation. European Commission forthcoming

# The quest for an ethical approach

- EDPS in his strategy 2015-2019 sets out the goal to address the emerging challenges on data protection with an ethical approach.

- Ethics Advisory Group to steer a reflection on the ethical implications that the digital world emerging from the present technological trends puts forward

- In "Opinion Toward a new digital ethics" (2015) EDPS
  - identifies the fundamental right to privacy and the protection of personal data as *core* elements of the new digital ethics necessary to preserve human dignity.
  - calls for a big data protection ecosystem that shall involve developers, businesses, regulators and individuals in order to provide 'future-oriented regulation', 'accountable controllers', '*privacy-conscious engineering*', and '*empowered individuals*'.

# Ethics Guidelines for Trustworthy AI of EU High-Level Expert Group on AI

- respecting the rule of law;
- being aligned with agreed ethical principles and values, including privacy, fairness, human dignity;
- keeping us, the humans, in control;
- ensuring the system's behavior is transparent to us, its decision making process is explainable; and
- being robust and safe, that is system's behavior remains trustworthy even if things go wrong.

# Human at the center 1

- “the principle of human dignity, understood as the recognition of the inherent human state of being worthy of respect, must not be violated by ‘autonomous’ technologies”

European Group on Ethics in Science and New Technologies. statement on artificial intelligence, robotics and ‘au-tonomous’ systems. https://ec.europa.eu/research/ege/ pdf/ege_ai_statement_2018.pdf, 2018.

# Human at the center 2

- It is more than having humans as explicit components of a system
- It is about lifting humans to be actors in the digital world by becoming autonomous systems that interact “au pair” with the rest of the digital world
  - Empower the user
  - From a passive to an active role
  - It requires an architectural approach

# Digital Ethics

*Digital ethics* is the branch of ethics that aims at formulating and supporting morally good solutions through the study of moral problems relating to personal data, (AI) algorithms and corresponding practices and infrastructures.

*Hard* ethics is defined and enforced by digital legislation. Legislation is necessary but insufficient, since it does not cover everything, nor should it.

*Soft* ethics is the space of moral decisions that is left to the actors of the digital world, e.g., companies and citizens. It deals what ought and ought not to be done over and above the existing regulation, without trying to by-pass or change the hard ethics


- L. Floridi. Soft ethics and the governance of the digital. Philosophy & Technology, 31(1):1–8, Mar 2018.

# A motivating example - 1

A parking lot in a big mall;

- two autonomous connected vehicles A and B, with one passenger each, are competing for the same parking lot. Passenger in A has health problems.
- A and B are rented vehicles, they are multi-user and have a default decision algorithm (*ethic*). That is, the cars will look for the free parking lot that is closer to the point of interest, in case of contention the closest car gets in. A and B are approaching the parking lot. B is closer, therefore it will take the parking lot.
- Seems fair enough … however …

# A motivating example - 2

- Suppose that by communicating with A, passenger in B receives the information that the passenger in A has health problems. Should passenger B follow her ethics (a virtue ethic) she would decide to leave the parking lot to A.

This use case shows many things:

- personal privacy is strictly connected to ethics: by disclosing a personal information like this, the passenger in A follows a utilitarian view which is related to the expectation that surrounding drivers might have a virtue personal ethic
- Individuals have different ethics also depending on the context, indeed neither a person nor a society apply moral categories separately, rather everyday morality is in constant flux among norms, utilitarian assessment of consequences, and evaluation of virtues
- A decision policy that seemed fair (to whom?) does not correspond to the personal ethic

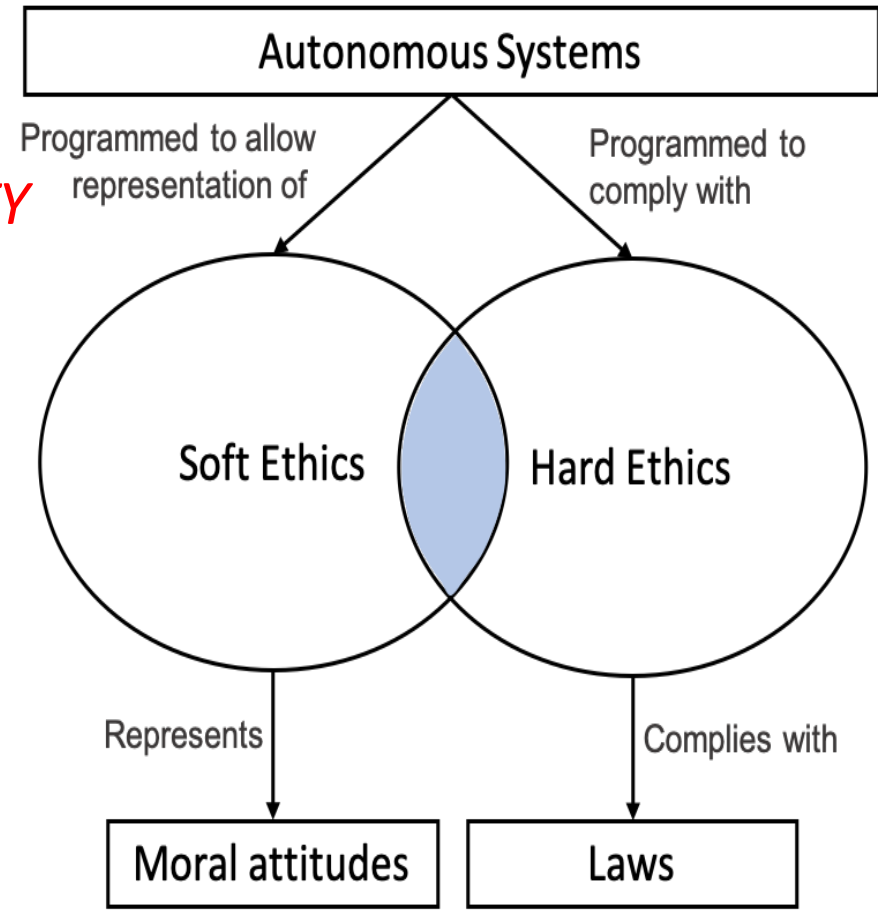
# What do we learn from the example - 1

- Putting human at the center requires to have a certain level of customization/enforcing of the decisions of the autonomous systems
- We postulate that this level corresponds to the soft ethics of each individual
- Soft ethics shall live on top and be consistent with hard ethics
- Individuals use different ethics depending on the context also regarding their personal data

# What do we learn from the example - 2

- soft ethics is associated to individuals and hard ethics to systems, i.e. autonomous cars
- The two need to combine (moral agreement) when an individual and a system interact
- Focus is on interactions of independent systems at the architectural level
- This puts architectural requirements on the autonomous systems

*FLEXIBILITY*



# Empowering the user

*Soft ethics*

**EXOSKELETON**
preferences interface:
To realize Virtue ethics
behaviours

# How and when to decide?



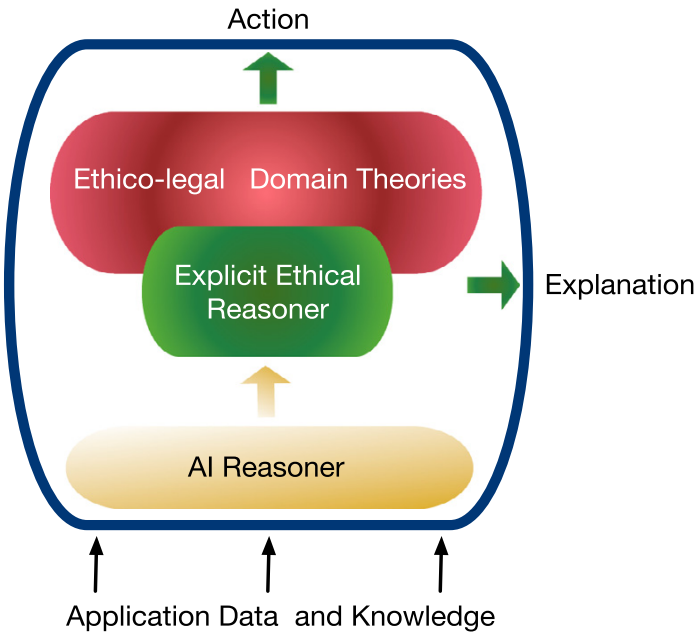



**Fig. 1.** Explicit ethical reasoner for intelligent autonomous systems.

Designing normative theories for ethical and legal reasoning: LogiKEy framework, methodology, and tool support ☆

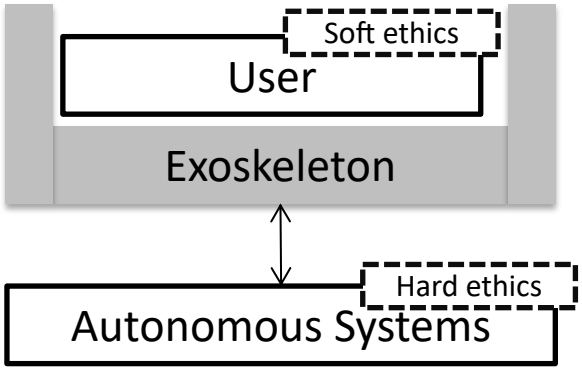
Christoph Benzmüller b,a,∗, Xavier Parenta, Leendert van derTorre a,c

# The Exosoul Project

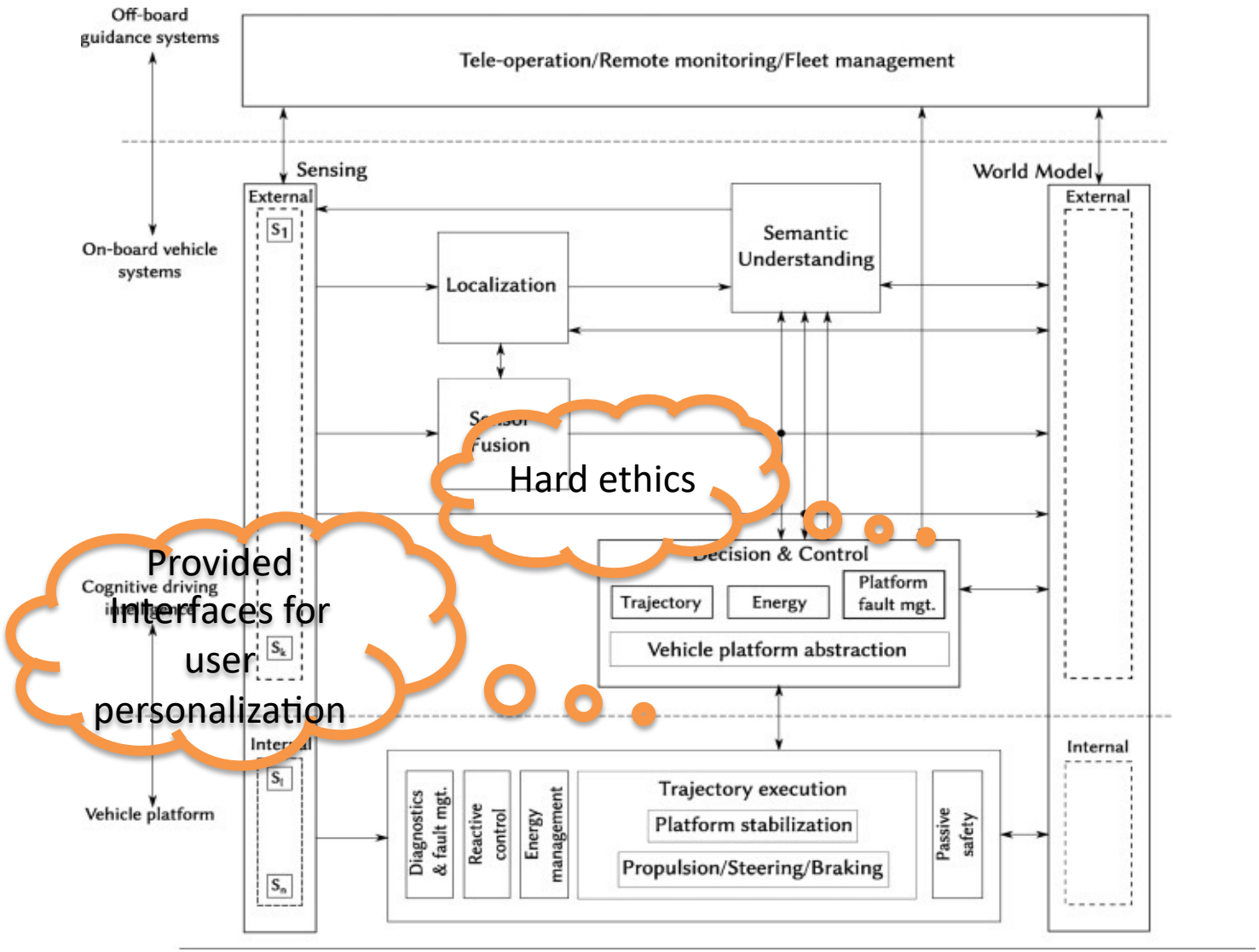
- Empowering the user with a software exoskeleton that mediates the interactions with the digital world according to her (soft-) ethics preferences.

We aim at producing and delivering Exosoul software components

# The Exosoul architecture



# Automotive Functional architecture




A functional reference architecture for autonomous driving
S. Behere M. Törngren, Information and Software Technology, Volume 73, 2016, Pages 136-150

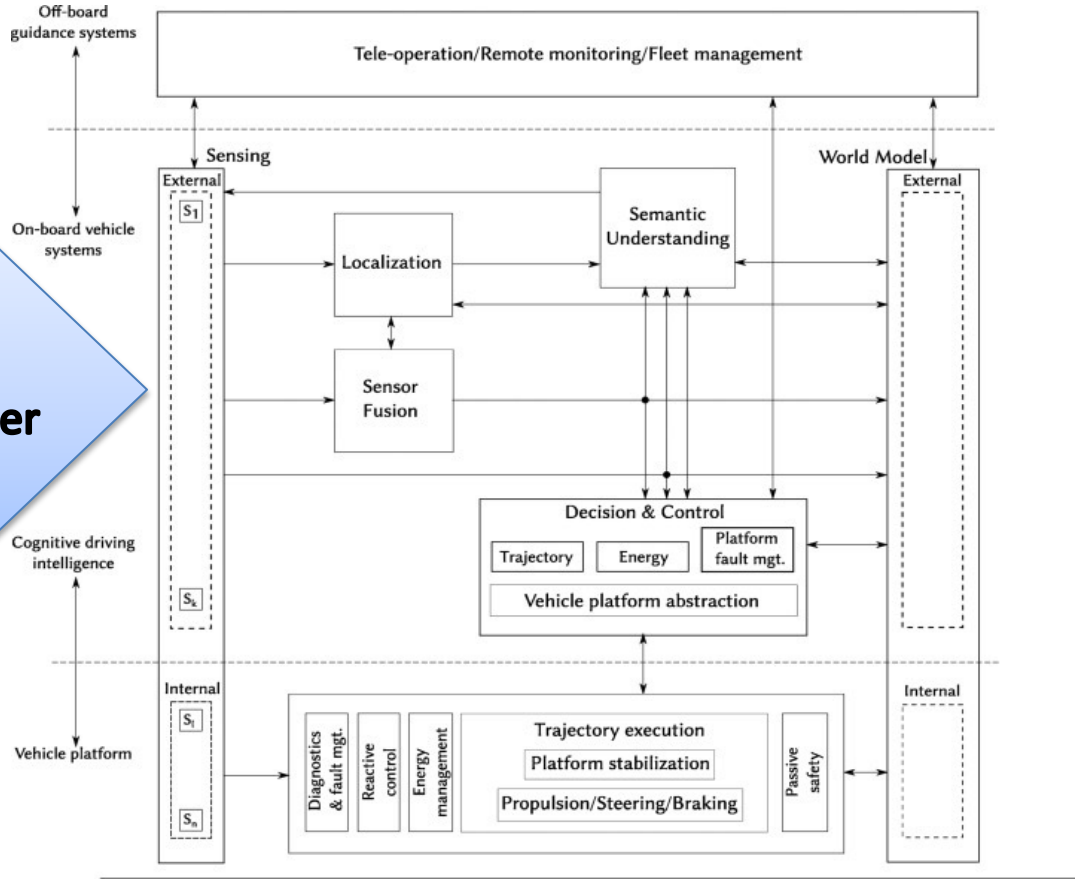
# Empowering the user

*Soft ethics*

**EXOSKELETON**
preferences interface:
To realize Virtue ethics
behaviours

# On board

Connector/
mediator/adapter



# Challenges

# Challenges - 1

- Express the user (soft-) ethical preferences. Top down and bottom up: ethical categories, dispositions, specification patterns, social psychology, privacy persona, etc.
- Automatize the exoskeleton production: synthesis and model driven engineering
- Design the system's *self* boundaries to hard ethical decision: 2 domains (automotive, mobile)
- Define the system interface and protocol requirements to allow matching with the user's exoskeleton (protocols)
- Bridge the gap between ethical preferences and actual decision making: model 2 model transformations

# Challenges - 2

- It is a multidisciplinary effort across different disciplines and inside computer science
- Philosophers, sociologists, psycologists, software engineers shall work together
- Increase awareness in users and system producers

# The Exosoul Team

- Paola Inverardi, Marco Autili, Davide Di Ruscio, Patrizio Pelliccione, Massimo Tivoli, Gianluca Scoccia
- Simone Gozzano, Marco Segala, Lorenzo Greco, Donatella Donati
- Geraldina Roberti
- Massimiliano Palmiero
- XXX recruiting
- Patrizio Migliarini

ROSSO Informatici
Verde Filosofi
Giallo Sociologi
Celeste Psicologi
Nero filosofo e computer science
Viola giusristi

# Cosa cambia nella nostra ricerca?

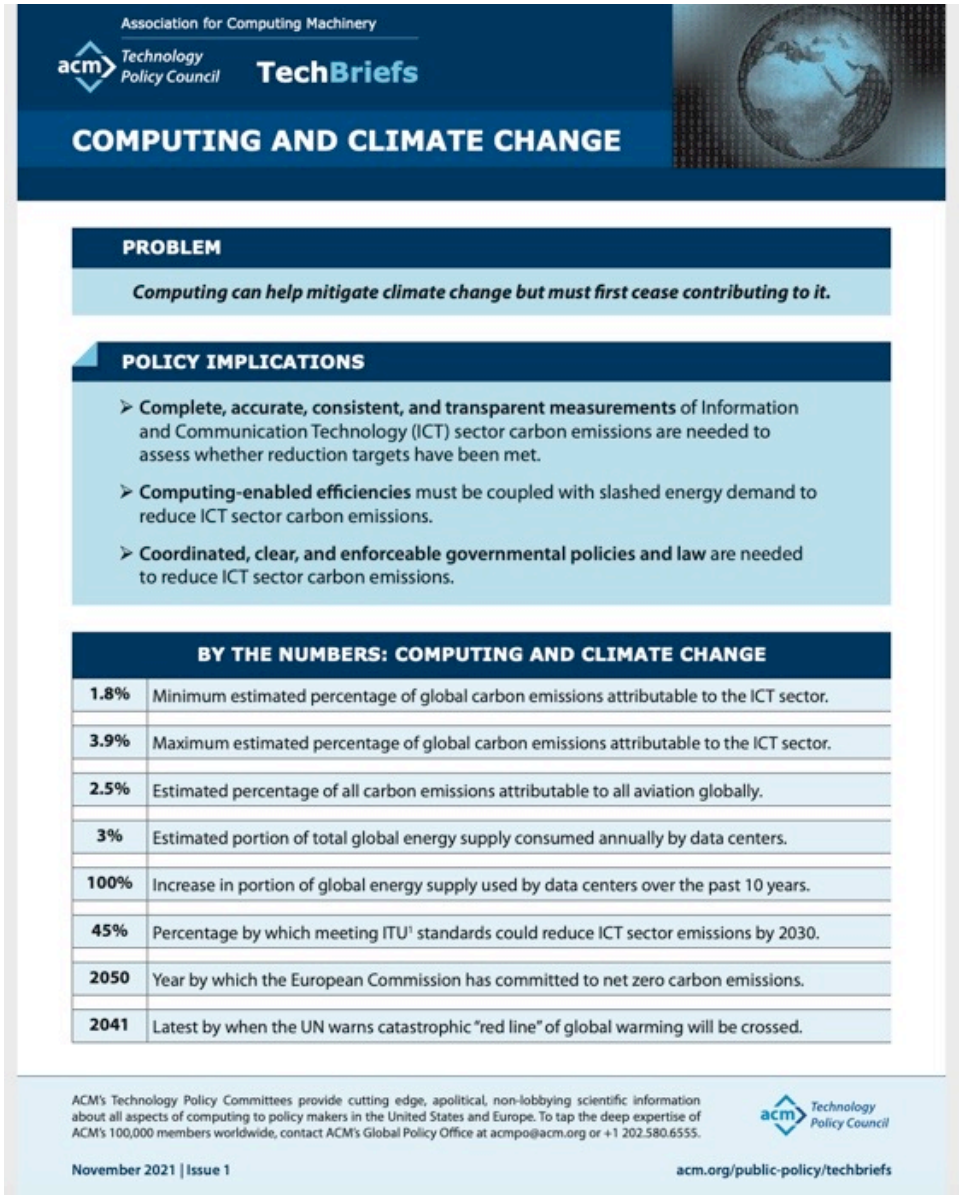
- 1st Workshop on Advances in Human-Centric Experiments in Software Engineering
- Human22 – Workshop SANER 2021 https://human-conf.github.io/human22/man-conf.github.io/human22/

A large portion of empirical studies in Software Engineering relies on human-centric experiments, for example, experimentation with development environments and other tools, assessment of effectiveness and usability of novel algorithms, developer productivity measurement, and enhancement, among others. In our field, such studies are planned very rigorously according to the best of our knowledge. However, since our primary field is computer science and not psychology, sociology, or any other field of humanities, soft and social sciences, many times, these experiments are sub-optimal from the methodological point of view.

Human-study techniques are well established in psychology, social sciences, and other areas. For example, verbally acquired data (like think-aloud protocols, interviews, and retrospection) or analyzing the content and the structure of cognitive processes. On the other hand, often, the details of such techniques are not known to researchers in computer science and software engineering, and there are still many studies that are performed on an ad-hoc basis with students at hand or the researchers themselves.

The distinguishing feature of the HUMAN workshop would be how human-centric experiments in SE could be shifted from the current state of the practice and enhanced with techniques successfully applied in other scientific areas. In this sense, the workshop will be an interdisciplinary venue. Researchers and practitioners from other fields (e.g., psychology) will be invited to actively participate in the workshop as Keynote speakers and Program Committee members.

# L’altro lato dello spettro: Dall’uomo alla terra



Association for Computing Machinery

acm Technology Policy Council **TechBriefs**

## COMPUTING AND CLIMATE CHANGE

### PROBLEM

***Computing can help mitigate climate change but must first cease contributing to it.***

### POLICY IMPLICATIONS

- **Complete, accurate, consistent, and transparent measurements** of Information and Communication Technology (ICT) sector carbon emissions are needed to assess whether reduction targets have been met.
- **Computing-enabled efficiencies** must be coupled with slashed energy demand to reduce ICT sector carbon emissions.
- **Coordinated, clear, and enforceable governmental policies and law** are needed to reduce ICT sector carbon emissions.

### BY THE NUMBERS: COMPUTING AND CLIMATE CHANGE

| | |
|---|---|
| **1.8%** | Minimum estimated percentage of global carbon emissions attributable to the ICT sector. |
| **3.9%** | Maximum estimated percentage of global carbon emissions attributable to the ICT sector. |
| **2.5%** | Estimated percentage of all carbon emissions attributable to all aviation globally. |
| **3%** | Estimated portion of total global energy supply consumed annually by data centers. |
| **100%** | Increase in portion of global energy supply used by data centers over the past 10 years. |
| **45%** | Percentage by which meeting ITU[1] standards could reduce ICT sector emissions by 2030. |
| **2050** | Year by which the European Commission has committed to net zero carbon emissions. |
| **2041** | Latest by when the UN warns catastrophic “red line” of global warming will be crossed. |

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- **Data centers worldwide use twice as much of the total global electricity supply as just 10 years ago:** now roughly 3%;[2]
- **The evolution of artificial intelligence has exploded that demand.** Its "computational overhead" (resources needed to perform operations) increased an estimated 300,000 times between 2012 and 2018, doubling *every few months;*[3]
- **The number of internet-connected devices is expected to increase five-fold between 2015 and 2025** to more than 75.44 billion.[4] The increased manufacturing activity and network traffic associated with their proliferation will dramatically (though not strictly proportionately) increase carbon emissions globally; and
- **Blockchain technology is becoming increasingly popular**, particularly in connection with cryptocurrency use, but is notoriously energy-intensive. Indeed, the carbon footprints of some cryptocurrencies exceed those of entire nations.[5]

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