30th IEEE International Conference on
Robot and Human Interactive Communication -
RO-MAN Virtual 2021
The 1st Workshop on Design Centred HRI and Governance

https://krinuts7.wixsite.com/hri-design

Value-Centric Design for Robot-Human Interactions

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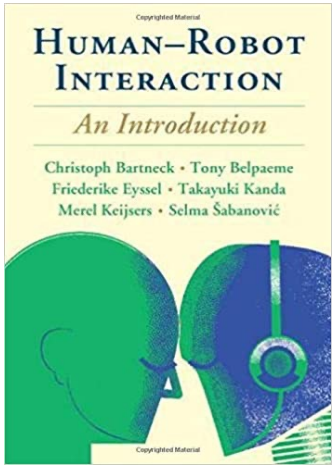
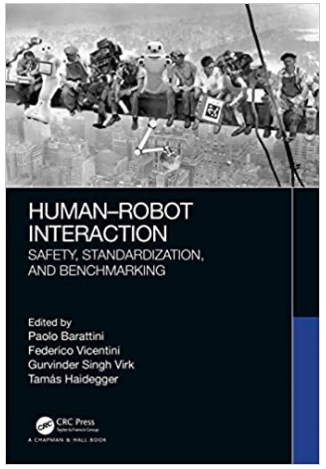
http://gordana.se/

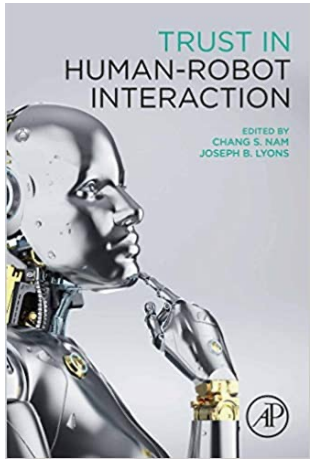
http://www.gordana.se/work/presentations.html



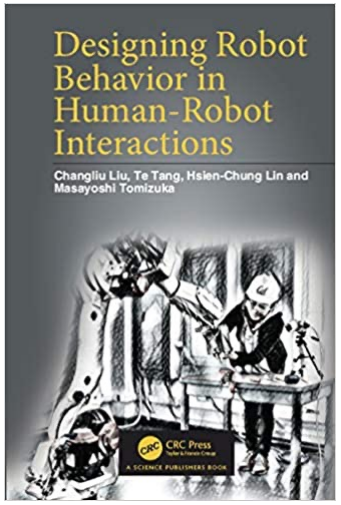
https://www.amazon.com/Human-Robot-Interaction-Introduction-Christoph-Bartneck/dp/1108735401?asin=B0845ZM9M4&revisionId=fixed_format&format=4&depth=2



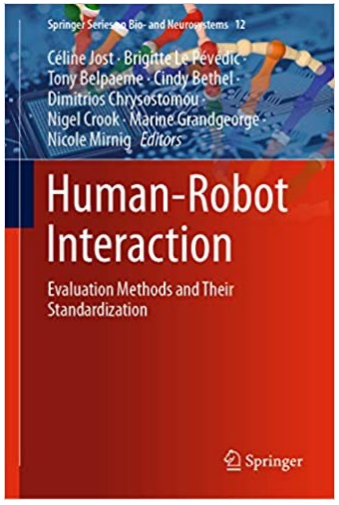
https://www.amazon.com/Human-Robot-Interaction-Safety-Standardization-Benchmarking-ebook-dp-B07QM9VTR8/dp/B07QM9VTR8/ref=mt_other?_encoding=UTF8&me=&qid=1628325169



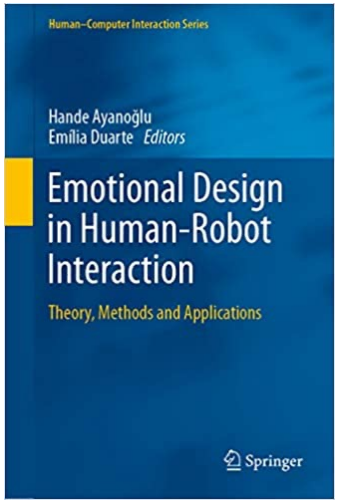
https://www.amazon.com/Trust-Human-Robot-Interaction-Chang-Nam-ebook/dp/B08NVM7SGF/ref=sr_1_3?dchild=1&keywords=Human-Robot+Interaction&qid=1628325169&s=books&sr=1-3



https://www.amazon.com/Designing-Robot-Behavior-Human-Robot-Interactions/dp/0367179695/ref=sr_1_4?dchild=1&keywords=Human-Robot+Interaction&qid=1628325169&s=books&sr=1-4



https://www.amazon.com/Human-Robot-Interaction-Evaluation-Standardization-Neurosystems-ebook/dp/B088LYNPYB/ref=sr_1_7?dchild=1&keywords=Human-Robot+Interaction&qid=1628325169&s=books&sr=1-7



https://www.amazon.com/Emotional-Design-Human-Robot-Interaction-Human-Computer-ebook-dp-B07FR6QZPQ/dp/B07FR6QZPQ/ref=mt_other?_encoding=UTF8&me=&qid=1628325169

Developing intelligent robots that we can trust and like

Workshop on Design Centered HRI and Governance

Developing intelligent autonomous robots that we can trust and enjoy presupposes they meet our expectation on values with anticipated beneficial influence on the societies and individuals, globally with respect to **ELSI (Ethical, Legal and Social Implications)**.

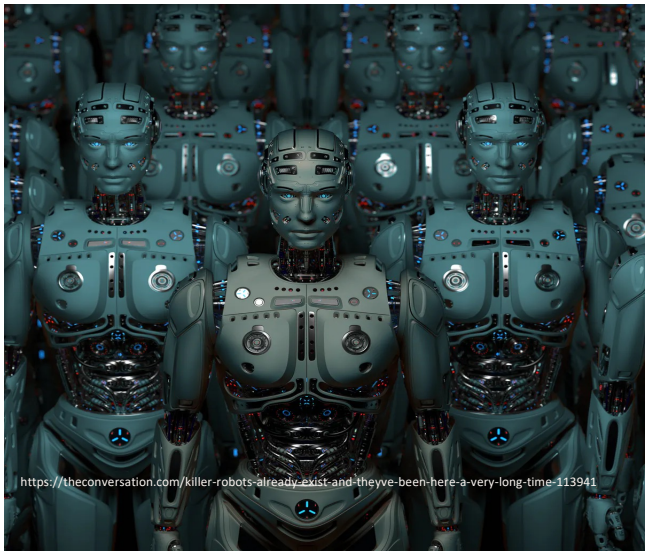
Values with questions of good and bad, right and wrong, and values, in general, are studied within the field of ethics.

The emerging fields of Robotic Ethics, AI ethics and specifically ethics of intelligent autonomous robotic cars are good examples of ethics research with actionable practical value.

In those ethical fields, a variety of stakeholders, including the legal system with other societal and governmental actors, companies and businesses, collaborate bringing about shared view of ELSI.

Drawing from the existing literature on ethics of AI and robotics, and our work on autonomous intelligent robocars, our contribution consists in lessons learned for ethics of autonomous intelligent robots in general.

https://robohub.org/from-disembodied-bytes-to-robots-that-think-and-act-like-humans/



https://theconversation.com/killer-robots-already-exist-and-theyve-been-here-a-very-long-time-113941

Values

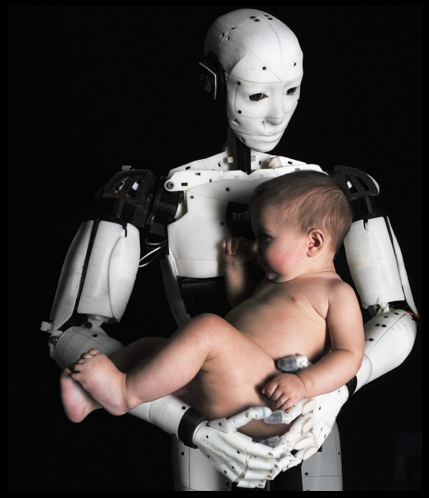
"Value" is defined broadly as property that a person or a group considers important and desirable.

Values serve as a guide to action and knowledge.

They are relevant to all aspects of scientific and engineering practice, including discovery, analysis, and application.

ROBOTS

Humanoid robots
Education robots
Consumer robots
Research robots
Medical robots
Nano robots
Disaster response robots
Industrial robots
Aerospace robots
Underwater robots
Military and Security robots
Telepresence robots
Drones
Autonomous cars



https://www.archpaper.com/event/robot-love/

https://robots.ieee.org/

VALUE-SENSITIVE/ VALUE-BASED DESIGN

- Value-sensitive design (VSD) holds that artefacts are value-laden and design is value-sensitive. Thus there is need to identify early implicit values embedded in new technologies typically by focusing on the use cases.
- "Value" is defined broadly as property that a person or a group considers important and desirable. Designers unintentionally or intentionally inscribe their values in the design objects, thus shaping them accordingly.

- The design is typically carried out iteratively by combining the following approaches supporting the values:
  - conceptual (conceptions of values for users and stakeholders)
  - empirical (how values are realized in practice)
  - technical (design of technology),
  - research all of which is followed by
  - assessment

Luciano Floridi, Josh Cowls, Thomas C. King, Mariarosaria Taddeo (2020) How to Design AI for Social Good: Seven Essential Factors. Science and Engineering Ethics. https://doi.org/10.1007/s11948-020-00213-5

Ethical values and principles in European discussion Value-sensitive/Value-based design - Publications

Ethical values and principles in European discussion			
Expert Group/ Publication	**Ethical Value/Principle**	**Context**	**Technology**
Friedman et al. (2003; 2006) [1,2]	Human welfare Ownership and property Freedom from bias Universal usability Courtesy Identity Calmness Accountability (Environmental) sustainability	Value-sensitive design	ICT
Ethically Aligned Design (EAD) IEEE Global initiative (2016, 2017) [3,4]	Human benefit Responsibility Transparency Education and Awareness	Global Initiative for Ethical Considerations in Artificial Intelligence and Autonomous Systems: Insights and recommendations for the AI/AS technologists and for IEEE standards	AI/AS

Ethical values and principles in European discussion Value-sensitive/Value-based design - Publications

Ethical values and principles in European discussion			
Asilomar AI Principles (2017) [5]	Safety Failure and juridical transparency Responsibility Values, alignment Privacy and liberty Shared benefit and prosperity Human control Non-supervision Avoiding arms race	Beneficial AI to guide the development of AI	AI
The European Group on Ethics in Science and New Technologies (EGE) (2017) [6]	Human dignity Autonomy Responsibility, Accountability Security, Safety Justice, Equality and solidarity Democracy Bodily and mental integrity Data protection and privacy Sustainability	Statement on Artificial Intelligence, Robotics and Autonomous Systems	AI, Robotics, AS

Ethical values and principles in European discussion Value-sensitive/Value-based design - Publications

Ethical values and principles in European discussion			
European Commission's High-Level Expert Group on Artificial Intelligence (AI HLEG) (2018) [7]	Respect for human dignity Freedom of the individual Respect for democracy, justice and the rule of law Equality, non-discrimination and solidarity Citizens rightsBeneficence: "Do Good" Non maleficence: "Do no Harm" Autonomy: "Preserve Human Agency" Justice: "Be Fair" Explicability: "Operate transparently"	Trustworthy AI made in Europe	AI
AI4People (2018) [8]	Beneficence Non-maleficence Autonomy Justice Explicability	An ethical framework for a good AI society	AI

A preliminary set of ethical values for Autonomous Intelligent Systems

A preliminary set of ethical values for the context of Autonomous Intelligent Systems	
Integrity and Human Dignity	Individuals should be respected, and AIS solutions should not violate their dignity as human beings, their rights, freedoms and cultural diversity. AIS (Autonomous Intelligent Systems) should not threaten a user's physical or mental health.
Autonomy	Individual freedom and choice. Users should have the ability to control, cope with and make personal decisions about how to live on a day-to-day basis, according to one's own rules and preferences.
Human control	Humans should choose how or whether to delegate decisions to AIS, to accomplish human-chosen objectives.
Responsibility	Concerns the role of people and the capability of AIS to answer for the decisions and to identify errors or unexpected results. AIS should be designed so that their affects align with a plurality of fundamental human values and rights.

A preliminary set of ethical values for Autonomous Intelligent Systems

A preliminary set of ethical values for the context of Autonomous Intelligent Systems	
Justice, equality, fairness and solidarity	AIS should contribute to global justice and equal access. Services should be accessible to all user groups irrespective any physical or mental deficiencies. This principle of (social) justice goes hand in hand with the principle of beneficence: AIS should benefit and empower as many people as possible.
Transparency	If an AIS causes harm, it should be possible to ascertain why. The mechanisms through which the AIS makes decisions and learns to adapt to its environment should be described, inspected and reproduced. Key decision processes should be transparent and decisions should be the result of democratic debate and public engagement.
Privacy	People should have the right to access, manage and control the data they generate.

A preliminary set of ethical values for Autonomous Intelligent Systems

A preliminary set of ethical values for the context of Autonomous Intelligent Systems	
Reliability	AIS solutions should be sufficiently reliable for the purposes for which they are being used. Users need to be confident that the collected data is reliable, and that the system does not forward the data to anyone who should not have it.
Safety	Safety is an emerging property of a socio-technical system, which is created daily by decisions and activities. Safety of a system should be verified where applicable and feasible. Need to consider possible liability and insurance implications.
Security	AI should be secure in terms of malicious acts and intentional violations (unauthorized access, illegal transfer, sabotage, terrorism, etc.). Security of a system should be verified where applicable and feasible.
Accountability	Decisions and actions should be explained and justified to users and other stakeholders with whom the system interacts.

A preliminary set of ethical values for Autonomous Intelligent Systems

A preliminary set of ethical values for the context of Autonomous Intelligent Systems	
Explicability	Also ‘explainability’; necessary in building and maintaining citizen’s trust (captures the need for accountability and transparency), and the precondition for achieving informed consent from individuals.
Sustainability	The risks of AIS being misused should be minimized: Awareness and education. “Precautionary principle”: Scientific uncertainty of risk or danger should not hinder to start actions of protecting the environment or to stop usage of harmful technology.
Role of technology in society	Governance: Society should use AIS in a way that increases the quality of life and does not cause harm to anyone. Depending on what type of theory of justice a society is committed to, it may stress e.g., the principle of social justice (equality and solidarity), or the principle of autonomy (and values of individual freedom and choice).

Wicked Problems in Design Thinking: Values are Context-dependent

Design Unbound. Designing for Emergence in a White Water World

Ann Pendleton-Jullian and John Seely Brown, two volume set, MIT Press 2018

https://mitpress.mit.edu/books/design-unbound-designing-emergence-white-water-world-volume-1

Richard Buchanan (1992) Wicked Problems in Design Thinking. Design Issues, Vol. 8, No. 2, pp. 5-21. The MIT Press

http://www.jstor.org/stable/1511637

REAL-WORLD ENGINEERING ETHICS CASE STUDY: WHAT CAN WE LEARN FROM AUTONOMOUS CARS ABOUT ETHICS ASPECTS OF OTHER ROBOTS?

Autonomous Cars

Based on:

Holstein, T., Dodig-Crnkovic, G., & Pelliccione, P. (2021). Steps Towards Real-world Ethics for Self-driving Cars: Beyond the Trolley Problem. In Steven John Thompson (Ed.), Machine Law, Ethics, and Morality in the Age of Artificial Intelligence. IGI Global

Picture: https://www.aarete.com/insights/what-is-the-business-case-for-autonomous-vehicles-in-the-supply-chain/

Self-Driving (Autonomous) Cars as Intelligent Robotic System

We take Self-driving cars as an example of emerging technology that is combining advances in several underlying emergent technologies such as electric mobility and artificial intelligence (with connected driving, intelligent cities, intelligent infrastructure, etc.)

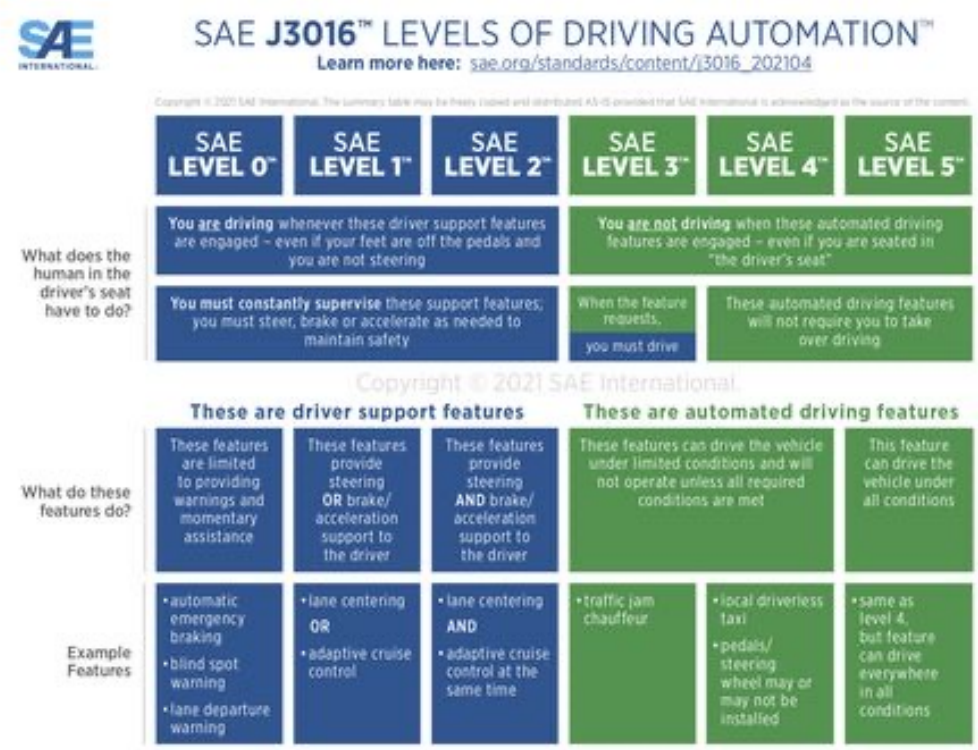
Technology emerges not in vaccuum but in its social context that today is global technosocial environment

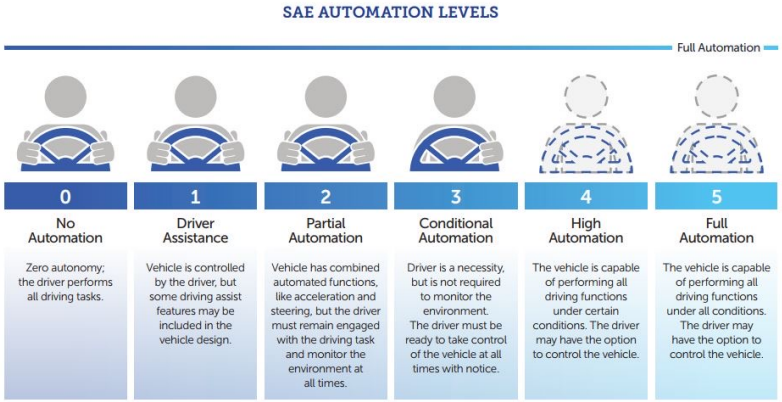
How can we contribute in different roles as stakeholders to the development of good society with help of new powerful technologies. Who are the main actors/stakeholders and how do they affect the development? Autonompus cars have been studied a lot and we can learn from the development so far.

AUTONOMOUS CARS DEVELOPMENT

LEVELS OF AUTOMATION/ AUTONOMY OF AV

EQUIVALENT FOR INTELLIGENT AUTONOMOUS ROBOTS?





TECHNICAL VALUES & PRIORITIES IN DEVELOPMENT WITH ETHICAL CONSEQUENCES.

AUTONOMOUS CARS CASE

Equivalent for Intelligent Robots needed!

Requirements	Technical Challenges	Approaches
Safety	Hardware and software adequacy. Vulnerabilities of machine-learning algorithms. Trade-offs between safety and other factors (like economic). Possibility of intervention in self-driving cars (including for the Police). Systemic solutions to guarantee safety in organizations (regulations, authorities, safety culture).	Setting safety as the first priority. Learning from the history of automation. Learning from driving experience - perception and input interpretation processes. Specification of how a self-driving car will behave in cases when the car is not able to operate autonomously. Clarification of the role of the police. Regulations, guidelines, standards being developed as the technology develops.
Security	Minimal necessary security requirements for deployment of self-driving cars. Security in systems and connections. Deployment of software updates. Storing and using received and generated data in a secure way.	Technical solutions that will guarantee minimum security under all foreseeable circumstances. Anticipation and prevention of the worst-case scenarios regarding security breaches. Provide active security. Accessibility of all data, even in the case of accidents, has to be provided, so that it can be analysed to foster knowledge and to provide facts for next generation developments.
Privacy	Trade-offs between privacy and data collection/recording and storage/sharing.	Following/applying legal frameworks to protect personal data, such as GDPR.
Transparency	Information disclosure, what and to whom. Transparency of algorithmic decision making. Transparency in the techno-social ecosystem.	Assurance of transparency and insight into decision making. Active sharing of knowledge to ensure the interoperability of systems and services.
Algorithmic Fairness	Algorithmic decision making is required to be fair and not to discriminate on the grounds of race, gender, age, wealth, social status etc.	This requirement is related to transparency of decision making and expectation of explainability of the ground for decision making.
Reliability	Reliability of sensors and software and need for redundancy. Reliability of required networks and solution for the case when the network is unavailable.	Definition of different levels for reliability, such as diagnostics, vehicle input sensors, software, and external services, set the ground for reliability measures of the car as a system and its components. Standardized process required to shift from fail-safe to fail-operational architecture.
Environmental Sustainability	Environmental sustainability ethics refers to new ways of production, use, and recycling for autonomous vehicles.	Production, use, and disposal/recycling of technology rises sustainability issues (batteries, car sharing) that must be addressed.
Intelligent behavior control	Intelligent behaviour may lead to unpredictable situations resulting from learning and autonomous decision making.	Development of self-explaining capability and other features ensuring desired behavior in intelligent software.
Transdisciplinarity -Systemic approach	Ethics in design, requirements engineering, software-hardware development, learning, legal and social aspects, software-hardware interplay.	Adoption of transdisciplinarity and system approaches is increasing and should be given even more prominent role.
Quality	Quality of components. Quality of decision making. Lifetime and maintenance. QA process. Adherence to ethical principles/guidelines	Ethical deliberations included in the whole process starting with design and development. Ethics-aware decision making to ensure ethically justified decisions.

Table 1 Summary of the technical challenges and approaches, grouped by requirement

Holstein, T., Dodig-Crnkovic, G., & Pelliccione, P. (2021). Steps Towards Real-world Ethics for Self-driving Cars: Beyond the Trolley Problem. In S. J. Thompson (Ed.), Machine Law, Ethics, and Morality in the Age of Artificial Intelligence. IGI Global

SOCIAL VALUES & PRIORITIES IN DEVELOPMENT WITH ETHICAL CONSEQUENCES IN AUTONOMOUS CARS

Equivalent for Intelligent Social Robots will be central!

Requirements	Social Challenges	Approaches
Non-maleficence	Technology not causing harm. Disruptive changes on the labor market. Change of related markets and business models (e.g., insurances, manufacturers).	Partly covered by technical solutions. Preparation of strategic solutions for people losing jobs. Learning from historic parallels to industrialization and automatization.
Stakeholders involvement	In this field different stakeholders are involved – from professionals designing, developing, maintaining cars, to their users, and general public.	Active involvement of stakeholders in the process of design and requirements specification as well as decisions of their use.
Beneficence	Values and priorities: Ensure that general public values will be embodied in the technology, with interests of minorities taken into account.	Initiatives as "AI for good" exemplify this expectation that new technology not only do not cause harm, but actively do good for its stakeholders.
Responsibility and Accountability	Assignment and distribution of responsibility and accountability are among central regulative mechanisms for the development of new technology. They should follow ethical principles.	The Accountability, Responsibility and Transparency (ART) principle based on a Design for Values approach includes human values and ethical principles in the design processes (Dignum, 2019).
Freedom and Autonomy	Freedom of choice hindered by the system (e.g. it may not allow to drive into a certain area)	The freedom of choice determined by regulations. Determination and communication of the amount of control a human has in context of the self-driving car
Social Sustainability	In the domain of business, social sustainability is about identifying and managing business impacts on people	Pursuing social equity, community development, social support, human rights, labour rights, social responsibility, social justice, etc.
Social Fairness	Ascertaining fairness of the socio-technological system.	Fairness of the decision-making. Related to transparency and explainability.
Dignity and Solidarity	This requirement refers to the entire socio-technological system.	Challenges come from the lack of common wholistic view.
Social Trust	Establishing trust between humans and highly automated vehicles as well as within the social system.	Further research on how to implement trust across multiple systems. Provision of trusted connections between components as well as external services
Justice: legislation, standards, norms, policies and guidelines	Keeping legislation up to date with current level of automated driving, and emergence of self-driving cars. Creating and defining global legislation frameworks. Including ethical guidelines in design and development processes	Legislative support and contribution to global frameworks. Ethics training for involved engineers. Establishment and maintenance of a functioning socio-technological system in addition to functional safety standards

Table 2 Summary of the social challenges and approaches, grouped by requirement

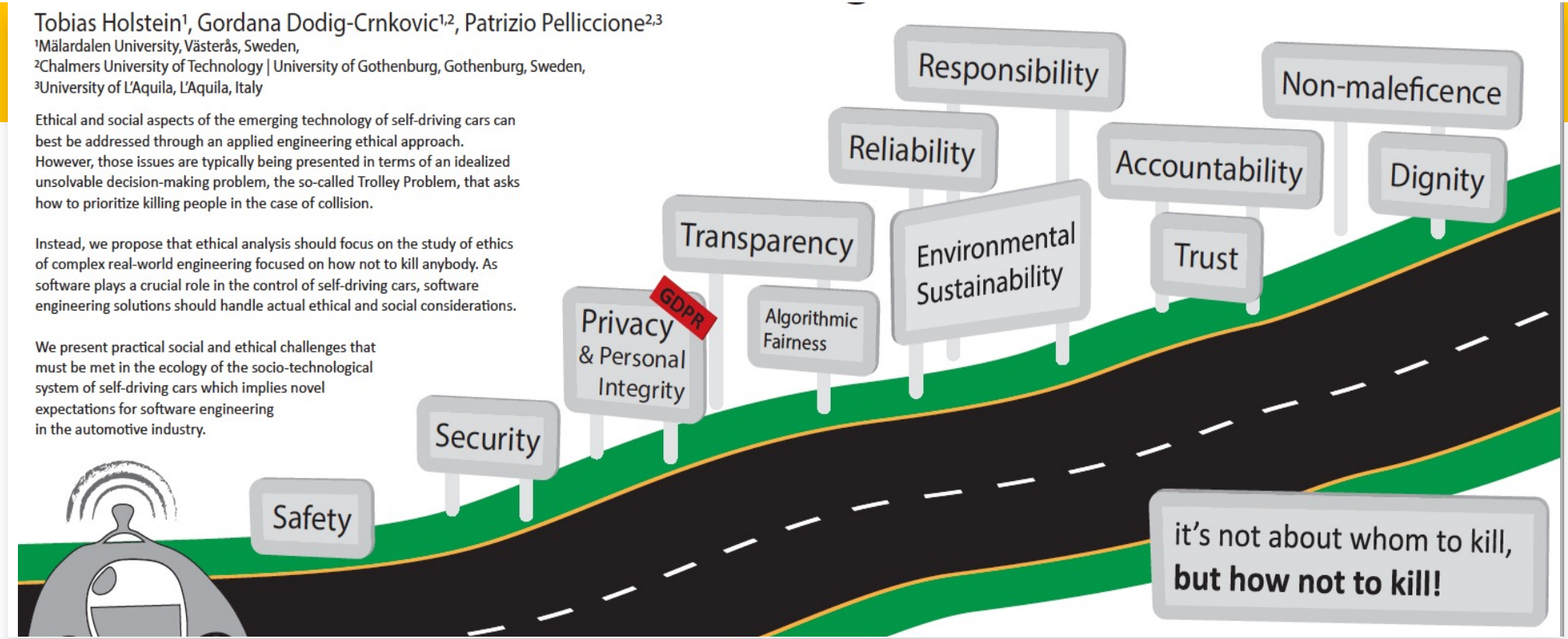
Holstein, T., Dodig-Crnkovic, G., & Pelliccione, P. (2021). Steps Towards Real-world Ethics for Self-driving Cars: Beyond the Trolley Problem. In S. J. Thompson (Ed.), Machine Law, Ethics, and Morality in the Age of Artificial Intelligence. IGI Global

New for Intelligent Robots – Cognitive and Psychological Effects of Social/Companion Robots

Cognitive and psychological effects of social/ companion robots on humans	Personal integrity Cognitive load Deception	Further research on how social robots and especially increasingly intelligent and human-like robot companions affect users. Solid understanding of effects, after stakeholders interests are taken into consideration should be followed by regulation/legislation. Humanoid or zoomorphic robots may cause emotional attachment to some users. "Robots should not be designed in a deceptive way to exploit vulnerable users" (Boden et al. 2017)

Boden, Margaret, Joanna Bryson, Darwin Caldwell, Kerstin Dautenhahn, Lilian Edwards, Sarah Kember, Paul Newman, et al. 2017. "Principles of Robotics: Regulating Robots in the Real World." Connection Science. https://doi.org/10.1080/09540091.2016.1271400.

Value-based Ethical Guidelines for Self-Driving Cars



Ehics of Self-Driving Cars

Presented at major SE conference ICSE2020 as poster

Extended version in a book chapter:

Holstein, T., Dodig-Crnkovic, G., & Pelliccione, P. (2021). Steps Towards Real-world Ethics for Self-driving Cars: Beyond the Trolley Problem. In Steven John Thompson (Ed.), Machine Law, Ethics, and Morality in the Age of Artificial Intelligence. IGI Global

Ehics Of Self-driving Cars Paper* Method

1. A list of ethical values (requirements) for autonomous cars compiled from an extensive literature study and connected to challenges together with approaches for their fulfilment.
2. The proposed analysis with values, challenges and approaches for technical and social aspects was presented to different stakeholders and discussed via seminars.
3. Finally number of experts invited to review the results.

* Holstein, T., Dodig-Crnkovic, G., & Pelliccione, P. (2021). Steps Towards Real-world Ethics for Self-driving Cars: Beyond the Trolley Problem. In Steven John Thompson (Ed.), Machine Law, Ethics, and Morality in the Age of Artificial Intelligence. IGI Global

Practical Use of the Proposed Ethical Framework

Ethical requirements must be fulfilled in all phases in the life-cycle of a product (autonomous car/robot) The context of:

1. Conceptualization/Design/Prototyping/ Construction/Development/Testing/Production
2. Deployment/Application/
3. Maintenance/Support
4. Oversight/Regulation

https://www.indiamart.com/kaynes-tecnology-india-pvt-ltd/product-life-cycle-management.html

Conclusions on Design Centered HRI with Ethical, Legal and Social Implications

We need a broad inter-disciplinary discussion about the values of the future intelligent, autonomous and social robotics .

Discuss the real-world ethical challenges and opportunities of emerging technologies.

Assure transparency to support evaluations by independent organisations/experts

Address context-dependencies of a given technology in order to identify value preferences. Stakeholder's involvement is essential as well as agreed upon values. Systemic view is vital

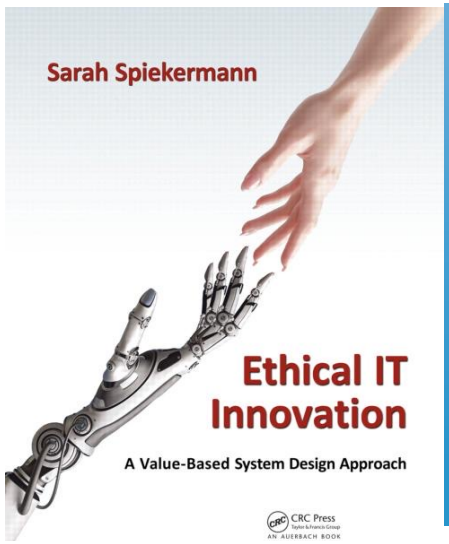
We propose Ethicality as non-functional property in requirements engineering.

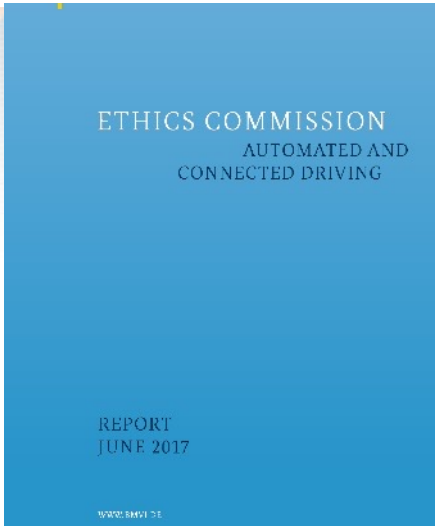
Education in ELSI for engineering students and adequate information of all stakeholders is essential.

ELSI are wicked problems that typically have no "final solution" but the best current solution given constraints, that is constantly adapted to technological and social development.

FURTHER READING

A Value-Based Design Approach





Sarah Spiekermann

Ethical IT Innovation:
A Value-Based System Design Approach

Ethics Commission: Automated and connected driving (Report by Federal Ministry of Transport and Digital Infrastructure of Germany [BMVI])

BMVI = Bundesministerium für Verkehr und digitale Infrastruktur

https://ethicsinaction.ieee.org/

Soma Design – Intertwining Aesthetics, Ethics and Movement - Kristina Höök

Values explored from within somaesthetics

Connecting socially grounded, negotiated understanding of values with the individual perspective from the point of view of soma – individual body. This connection is important. How do values feel on the individual somatic level?

Soma design — examines and improves connections between sensation, feeling, emotion, subjective understanding and **values**.

Soma design builds on **somaesthetics** by Shusterman.

It combines soma as in our first-person experience of the world through our senses, with ***aesthetics*** *as deepening knowledge of our sensory experiences to* ***live a better life***.

Our cultural practices and digitally-enabled objects enforce a form of sedimented, agreed-upon movements, enabling variation, but with *certain prescribed ways to act, feel and think*.

Höök argues that by engaging in a soma design process we can better probe which movements lead to deepened **somatic awareness**; **social awareness of others** in the environment and how they are affected by the human-technology assemblage;

enactments of bodily freedoms rather than limitations; making norms explicit;

engaging with a *pluralist feminist position* on who we are designing for; and

aesthetic experience and expression.

https://dl.acm.org/doi/10.1145/3313831.3376678 Ethics in Movement: Shaping and Being Shaped in Human-Drone Interaction
SOMA - the body as distinct from the soul, mind, or psyche.

Legislation and Standards

Legislation implemented with rigorous monitoring the behavior of technology.

Implementation is within the responsibility of producers. That means that design and implementation of software should follow ethical guidelines.

Ethics & Law Aspects Equivalent for Robotics Needed!

Ryan Jenkins (2016) Autonomous Vehicles Ethics & Law: Towards an Overlapping Consensus

https://www.academia.edu/29332066/Autonomous_Vehicles_Ethics_and_Law_Towards_an_Overlapping_Consensus

Patrick Lin (2015) Why Ethics Matters for Autonomous Cars.

In: Autonomes Fahren Technische, rechtlische und gesellschaftliche Aspekte

https://www.springerprofessional.de/en/why-ethics-matters-for-autonomous-cars/4397684

Ethically Aligned Design

A Vision for Prioritizing Human Well-being With Autonomous and Intelligent Systems

https://ethicsinaction.ieee.org/

Embedding Values into Autonomous Intelligent Systems - The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems

https://standards.ieee.org/develop/indconn/ec/ead_embedding_values.pdf

An example of ethical guidelines thinking one step further is described in the book:

Sarah Spiekermann. Ethical IT Innovation: A Value-Based System Design Approach. Taylor & Francis, 2015.

Policy Concerning Automated Vehicles (US DOT) Equivalent for Robotics Needed!

"DOT/NHTSA Policy statement concerning Automated Vehicles" 2016 update to "Preliminary statement of policy concerning automated vehicles".

Technical report, National Highway Traffic Safety Administration (NHTSA).

http://www.nhtsa. gov/staticfiles/rulemaking/pdf/Autonomous-Vehicles-Policy-Update-2016.pdf

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