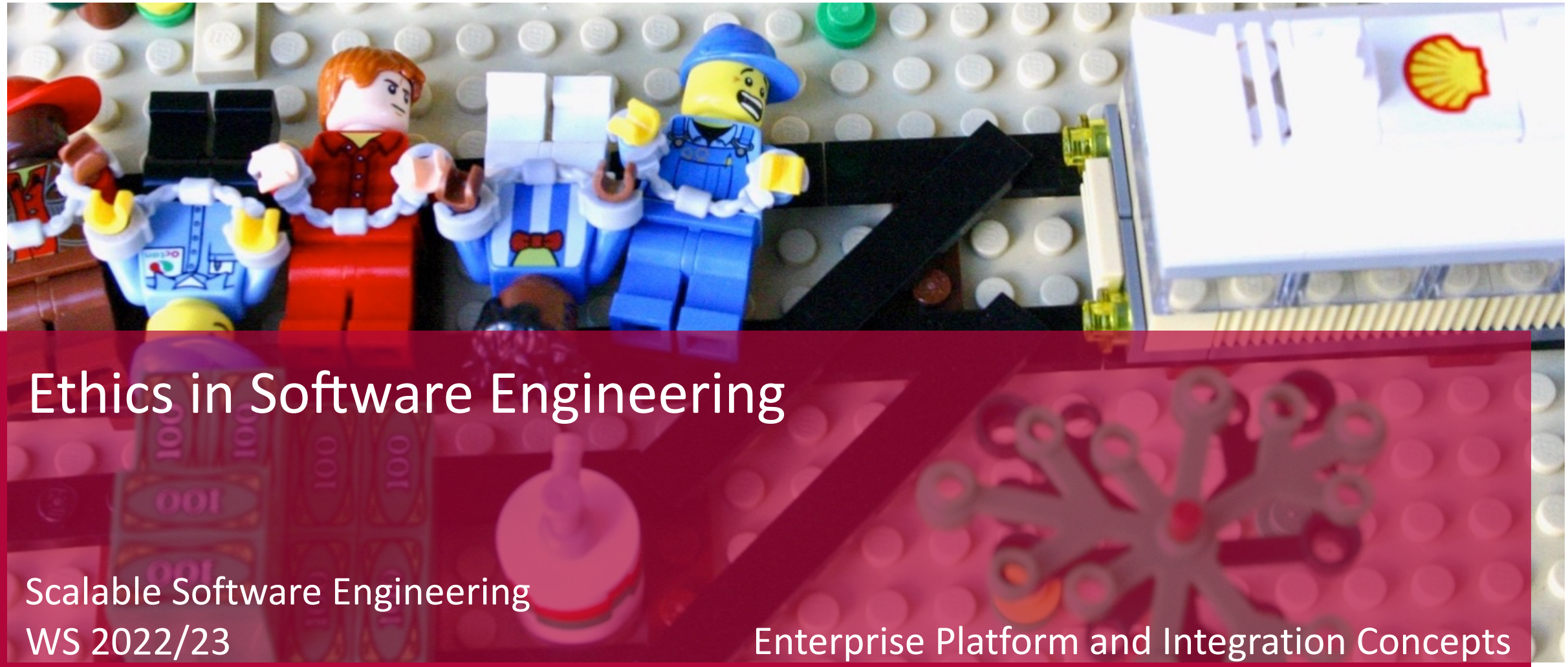


Ethics in Software Engineering

Scalable Software Engineering
WS 2022/23

Enterprise Platform and Integration Concepts

Image by *@ethicsinbricks* on Twitter: https://twitter.com/EthicsInBricks/status/1549331583315984386 (with permission)

Why Should We Take Care of Ethics?

Computing has become highly important in everyday life during the past 75 years.

The socioeconomic-political context of this **technology tsunami** is significant.

MIT economist David Autor, which argued that information **technology was destroying** wide swaths of routine office and manufacturing jobs, creating in their place high-skill jobs. **This labor polarization appeared to bring about a shrinking middle class.**

As information technology allowed the flooding of Internet users with more information than they could digest, tech companies supplied mass customization that allowed users to concentrate on information that confirmed preconceived opinions, **resulting in deeper societal polarization.**

Taken from **"Technology and Democracy" by Moshe Y. Vardi**, Former Chief Editor of ACM Communications, Communications of the ACM, September 2022, Vol. 65 No. 9, Page 5

A (Very) Brief Introduction to Ethics

> “Die Ethik ist jener Teilbereich der Philosophie, der sich mit den Voraussetzungen und der Bewertung menschlichen Handelns befasst und ist das methodische Nachdenken über die Moral.”

Die **drei Fragen** nach

- dem „höchsten Gut“
- dem richtigen Handeln in bestimmten Situationen
- und der Freiheit des Willens

stehen im Zentrum.

Ethik = “das sittliche (Verständnis)” + “Charakter, Sinnesart”

Source: Wikipedia https://de.wikipedia.org/wiki/Ethik
Last Access: 29.12.2022

A (Very) Brief Introduction to Ethics

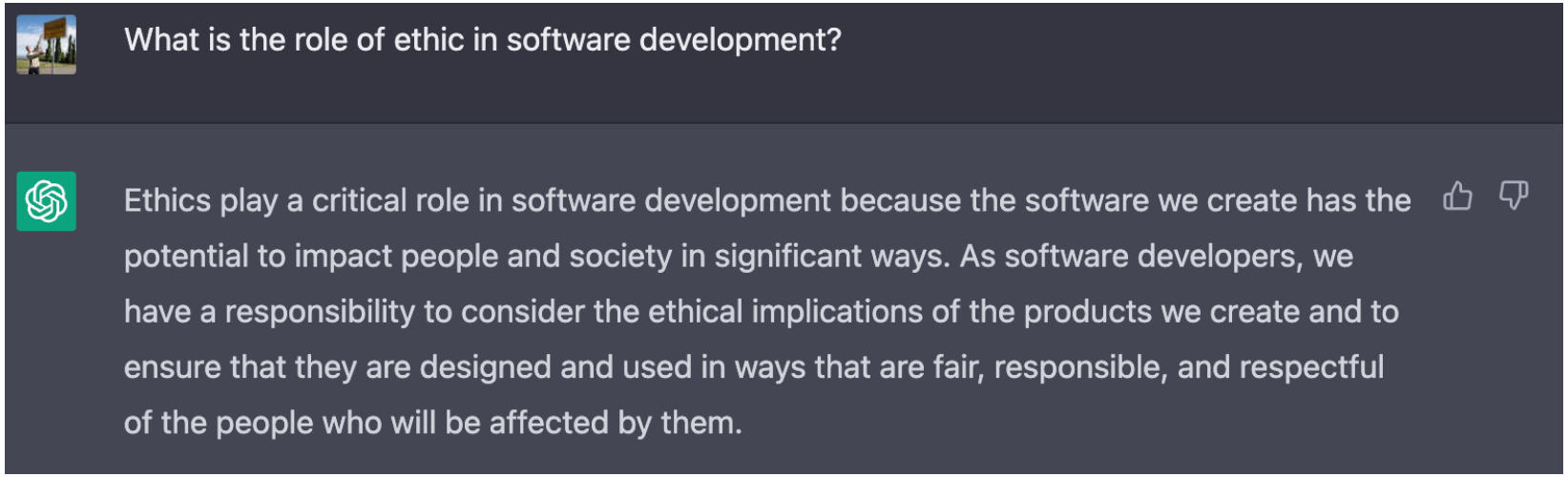
Allgemeine Kriterien, Prinzipien und Normen für gutes und schlechtes Handeln und für die Bewertung menschlicher Motive und Folgen

- Sie soll dem Menschen **Hilfen für seine sittlichen Entscheidungen** liefern
- Moralische Fragen auf der **Grundlage lebensweltlicher Einstellungen, Wertüberzeugungen und rationaler Argumente**
- Die **situationsspezifische Anwendung** dieser Prinzipien auf neue Situationen und Lebenslagen ist nicht durch sie leistbar, sondern Aufgabe der praktischen Urteilskraft und des geschulten Gewissens

Sind Lügen ethisch gutes oder schlechtes Handeln?

Source: Wikipedia https://de.wikipedia.org/wiki/Ethik
Last Access: 29.12.2022

Example: Chat GPT-3



What are all thinkable positive and negative consequences you can envision from the system‘s use for direct and indirect stakeholders? (Utilitarianism)

Source: Chat GPT-3
https://chat.openai.com/chat

Example: Chat GPT-3

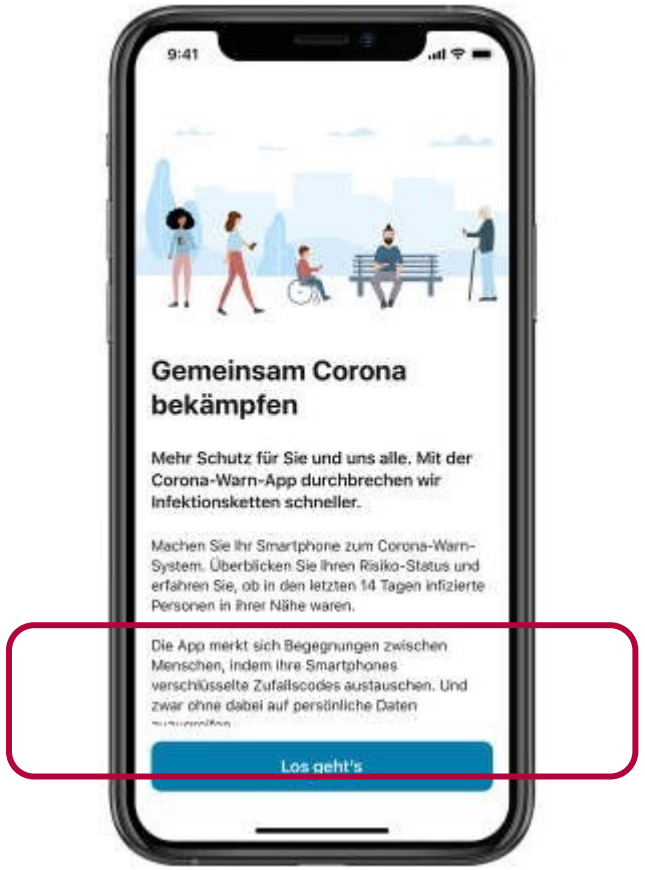
Some specific areas where ethics are particularly important in software development include:

1. Privacy: Software often involves the collection and processing of personal data, and it is important to ensure that this data is handled in a way that respects users' privacy and security. This includes considering issues such as data security, data retention, and data sharing.
2. Inclusion and diversity: It is important to ensure that software is designed and developed with consideration for the needs and perspectives of diverse groups of users. This includes issues such as accessibility for users with disabilities, language support for non-native speakers, and cultural sensitivity.
3. Transparency: It is important to be transparent about the ways in which software uses and collects data, as well as any potential impacts it may have on users. This includes providing clear and concise privacy policies and being open and honest about any data collection and processing that takes place.
4. Responsibility: As software developers, we have a responsibility to consider the potential consequences of the products we create and to ensure that they are used in responsible and ethical ways. This includes being mindful of the potential for software to be used for malicious purposes and taking steps to prevent or mitigate such abuses.

Overall, it is important for software developers to consider the ethical implications of the products they create and to ensure that they are designed and used in ways that are fair, responsible, and respectful of the people who will be affected by them.

Source: Chat GPT-3
https://chat.openai.com/chat

Role of Ethics in CoronaWarnApp and LucaApp



- Privacy
- Inclusion and Diversity
- Transparency
- Responsibility
- Reliability
- Trust
- Efficiency
- Comfort
- Knowledge
- …

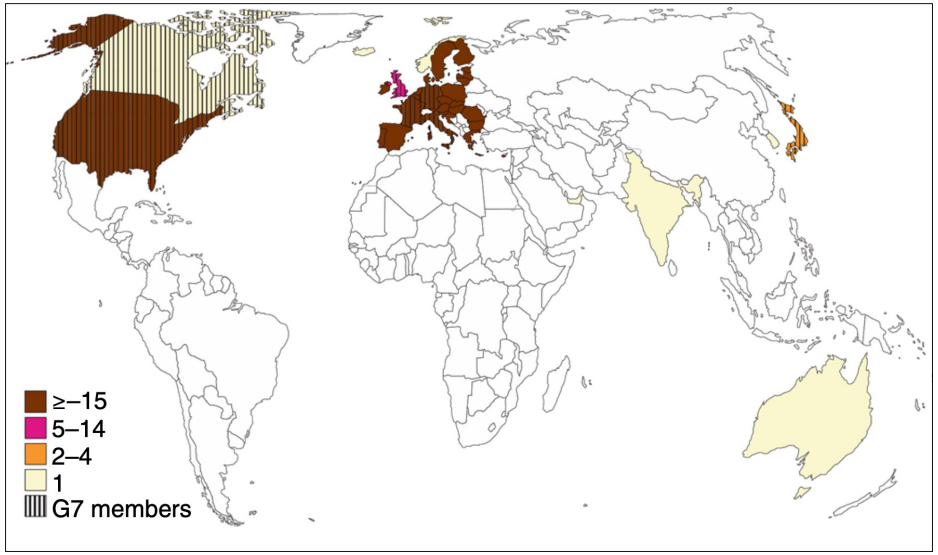
Source: https://www.bpa.de/Corona-Warn-App.1195.0.html

Source: https://www.herborn.de/unsere-stadt/herborn-aktuell/news/mit-luca-app-ins-rathaus/#gsc.tab=0

Worldwide Ethic Guidelines?

There is no fully accepted ethic standard for all kinds of software products and technologies

- We have norms, laws, and principles but they differ between humans, companies, countries etc.
- With the rise of AI, ethical guidelines also appear
  - Guidelines are instances of what is termed non-legislative policy instruments or soft law
  - Significant practical influence on decision-making
  - 2019, 84+ AI guidelines, esp. from G7 countries (incl. EU)
  - Results reveal a global convergence emerging around five ethical principles (transparency, justice and fairness, non-maleficence, responsibility and privacy)
  - However, with substantive divergence in relation to how these principles are interpreted, why they are deemed important, what issue, domain or actors they pertain to, and how they should be implemented



Source: Anna Jobin, Marcello Ienca and Effy Vayena. The global landscape of AI ethics guidelines. nature machine intelligence, 2019.

Example: SAP Guidelines

October 2021

SAP's Guiding Principles for Artificial Intelligence

AI Ethics Steering Committee

THE BEST RUN SAP

Version 01/2022 | PUBLIC

GLOBAL CODE OF ETHICS AND BUSINESS CONDUCT FOR EMPLOYEES


1. Driven by our values
2. Design for people
3. Business beyond bias
4. Transparency and integrity
5. Quality and safety standards
6. Data protection and privacy
7. Societal challenges
SAP's guiding principles for artificial intelligence
1. We are driven by our values.
2. We design for people.
3. We enable business beyond bias.
4. We strive for transparency and integrity in all that we do.
5. We uphold quality and safety standards.
6. We place data protection and privacy at our core.
7. We engage with the wider societal challenges of artificial intelligence.
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Introduction

Recognizing the significant impact of artificial intelligence (AI) on people, our customers, and society, SAP designed these guiding principles to steer the development and deployment of our AI software to **help the world run better and improve people's lives**.

For us, these guidelines are a commitment to move beyond what is legally required and to begin a deep and continuous engagement with the wider ethical and socioeconomic challenges of AI.

We look forward to expanding our conversations with customers, partners, employees, legislative bodies, and civil society and to making our guiding principles an evolving reflection of these discussions and the ever-changing technological landscape.

AI Ethics Steering Committee and AI Ethics Advisory Panel

SAP Members of the AI Ethics Steering Committee

Benedikt Lehnert, Chief Design Officer
Mathias Cellarius, Data Protection Officer, Head of Data Protection and Privacy
Feiyu Xu, Global Head of Artificial Intelligence
Daniel Schmid, Chief Sustainability Officer
Peter Selfridge, Global Head of Digital Government
Freek Staehr, Head of Global Legal, Commercial, and Operations
Sebastian Wieczorek, Vice President for Artificial Intelligence Technology
Alexandra Seemann, Legal Department Manager/German Labor Relations, Labor & Social Law
Hans-Martin Will, Head of Innovation Center Network
Claus Holzknecht, VP Customer Data Office
Philipp Herzig, Head of Intelligent Enterprise Cross-Architecture Product Engineering
Wiebke Thelo, Head of Quality, Security, and Production
Kerri Brown, Global Head of Transformational Change & Future of Work

Holds quarterly meetings and ad hoc consultation on gray-area use cases

Provides overview of activities →

Holds quarterly meetings

← **Provides advice and helps build expertise**

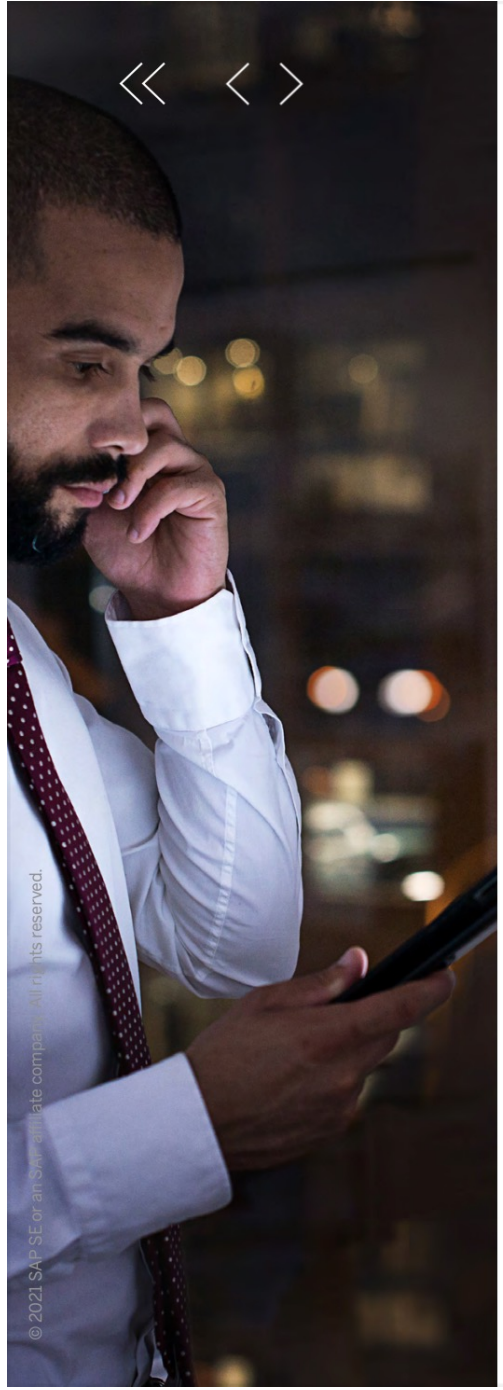
AI Ethics Advisory Panel

Advises on the development and operationalization of the guiding principles

Will consist of:
- Academics
- Policy experts
- Industry experts

Provides guidance ↓ ↑ Coordinates with business units to develop draft materials

SAP Employees and Experts



1. We are driven by our values.

We recognize that, as with any technology, there is scope for AI to be used in ways that are not aligned with these guiding principles and the operational guidelines we are developing.

In developing AI software, we will remain true to our human rights commitment statement, the UN guiding principles on business and human rights, laws, and widely accepted international norms.

Wherever necessary, our AI Ethics Steering Committee will serve to advise our teams on how specific use cases are affected by these guiding principles.

Where there is a conflict with our principles, we will endeavor to prevent the inappropriate use of our technology.

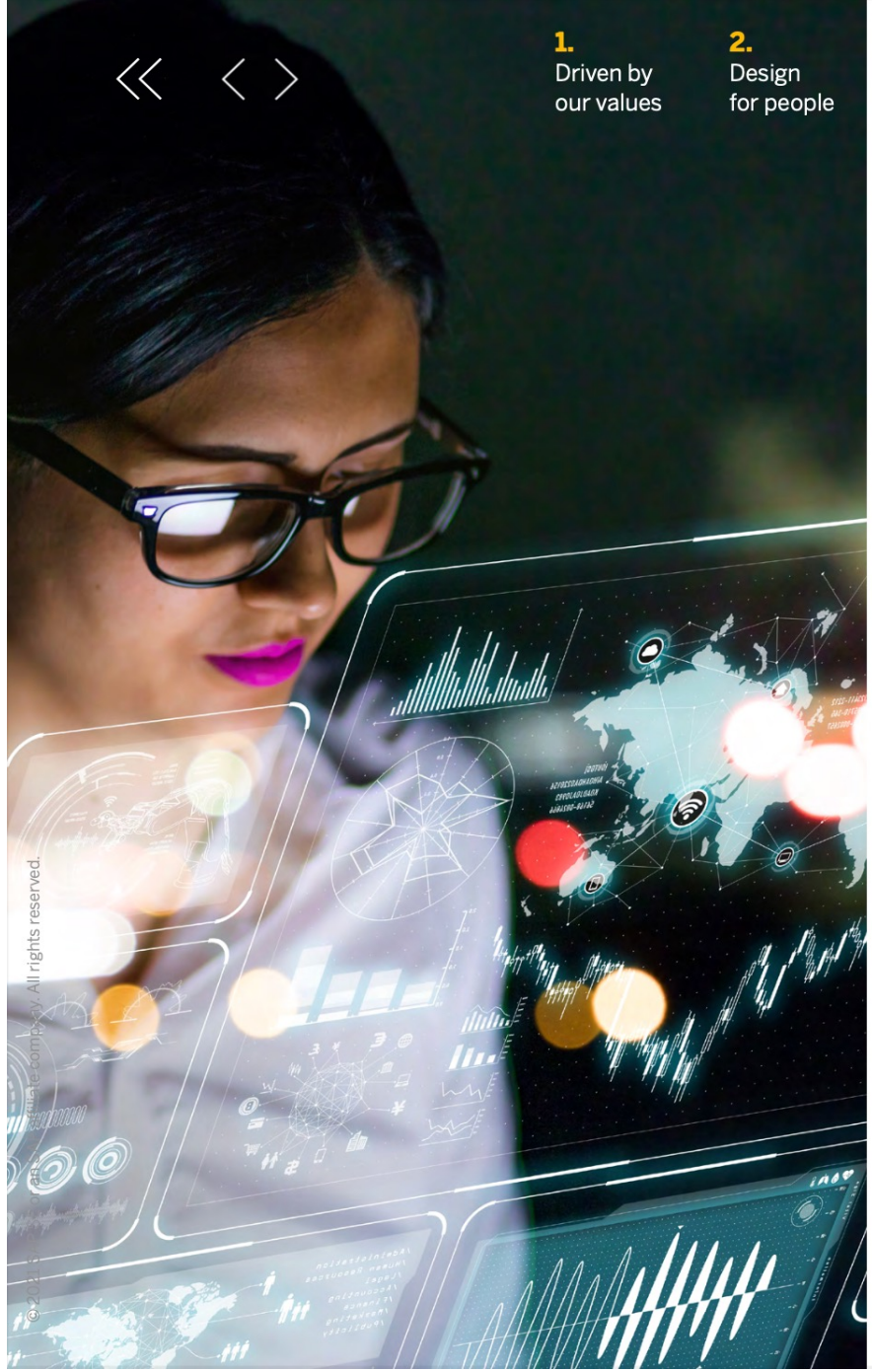
2. We design for people.

We strive to create AI software systems that are inclusive and that seek to empower and augment the talents of our diverse usership. By providing human-centered user experiences through augmented and intuitive technologies, we leverage AI to support people in maximizing their potential.

To achieve this, we design our systems closely with users in a collaborative, multidisciplinary, and demographically diverse environment.

3. We enable business beyond bias.

Bias can negatively impact AI software and, in turn, individuals and our customers. This is particularly the case when there is a risk of causing discrimination or of unjustly impacting underrepresented groups. We therefore require our technical teams to gain a deep understanding of the business problems they are trying to solve and the data quality this demands. We seek to increase the diversity and interdisciplinarity of our teams, and we are investigating new technical methods for mitigating biases. We are also deeply committed to supporting our customers in building even more diverse businesses by leveraging AI to build products that help move **business beyond bias**.



4. We strive for transparency and integrity in all that we do.

Our systems are held to specific standards in accordance with their level of technical ability and intended usage. Their input, capabilities, intended purpose, and limitations will be communicated clearly to our customers, and we provide means for oversight and control by customers and users. They are, and will always remain, in control of the deployment of our products. We actively support industry collaboration and will conduct research to further system transparency.

We operate with integrity through our code of business conduct, our internal AI Ethics Steering Committee, and our external AI Ethics Advisory Panel.

Aside: SAP Ethics and Business Conduct for Employees

Dear Colleagues,

In the past few years, the world has faced exceptional challenges, uncertainties, and complexity. The way we live, the way we do business, and the way we work has been profoundly affected. Technology has become crucial to handling these challenges and changes.

This fast rate of change has increased the focus on building and maintaining trust as the foundation for growth and innovation. As such, the interplay between technology and trust will be one of the key drivers of economic growth in the future.

TRUST MATTERS.

Being a trusted partner for our customers, partners, suppliers, and colleagues has always been at the heart of our business, but in today's uncertain environment, it is more important than ever.

At SAP, we always undertake our business efforts with integrity. Our Global Code of Ethics and Business Conduct for Employees is our guide, and helps us protect our colleagues, business, reputation, and ecosystem. It demonstrates that SAP is committed to the highest standards of ethical business and that we expect the same high standards from our partners and suppliers.

It is upon each and every one of us to uphold these standards, adhere to this Code, and speak out if or when we feel something is not right. Our global team of ethics and compliance experts is here for you, to provide the support and guidance needed to make strong, ethical, and compliant choices.

LET'S WIN THE RIGHT WAY.

Best regards,

Christian

Christian Klein

Chief Executive Officer and Member of the Executive Board of SAP SE

Aside: SAP Ethics and Business Conduct for Employees

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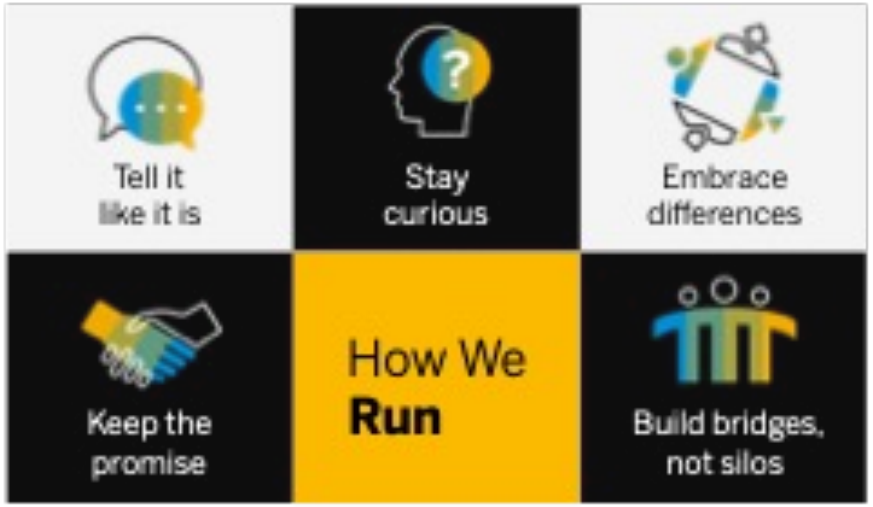
Aside: SAP Ethics and Business Conduct for Employees



We all have a personal responsibility to uphold and ensure the letter and spirit of our Code.

We expect that you are loyal to our company and act in the interest of SAP.

We need our leaders to do what's right, making SAP better for generations to come:

5. We uphold quality and safety standards.

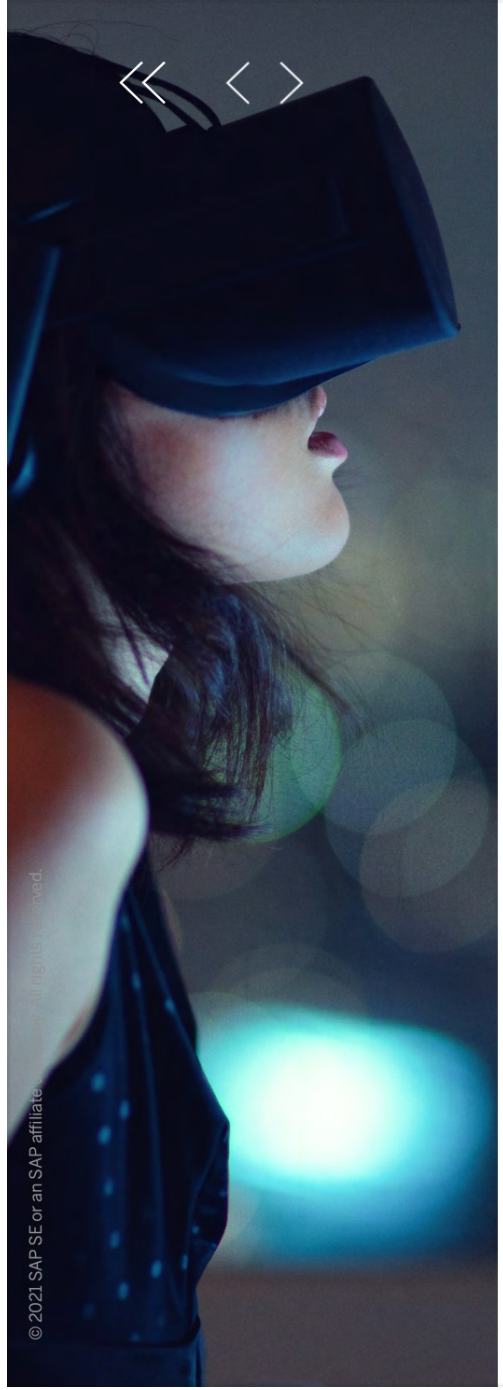
As with any of our products, our AI software is subject to our quality assurance process, which we continuously adapt when necessary. Our AI software undergoes thorough testing under real-world scenarios to firmly validate that they are fit for purpose and that the product specifications are met.

We work closely with our customers and users to uphold and further improve our systems' quality, safety, reliability, and security.

6. We place data protection and privacy at our core.

Data protection and privacy are a corporate requirement and at the core of every product and service. We communicate clearly how, why, where, and when customer and anonymized user data is used in our AI software.

This commitment to data protection and privacy is reflected in our commitment to all applicable regulatory requirements. In addition, it is reflected through the research we conduct in partnership with leading academic institutions to develop the next generation of privacy-enhancing methodologies and technologies.



7. We engage with the wider societal challenges of artificial intelligence.

While we have control, to a large extent, over the preceding areas, there are numerous emerging challenges that require a much broader discourse across industries, disciplines, borders, and cultural, philosophical, and religious traditions. These include, but are not limited to, questions concerning:

- **Economic impact**, such as how industry and society can collaborate to prepare students and workers for an AI economy and how society may need to adapt means of economic redistribution, social safety, and economic development
- **Social impact**, such as the value and meaning of work for people and the potential role of AI software as social companions and caretakers
- **Normative questions** around how AI should confront ethical dilemmas and what applications of AI, specifically with regard to security and safety, should be considered permissible

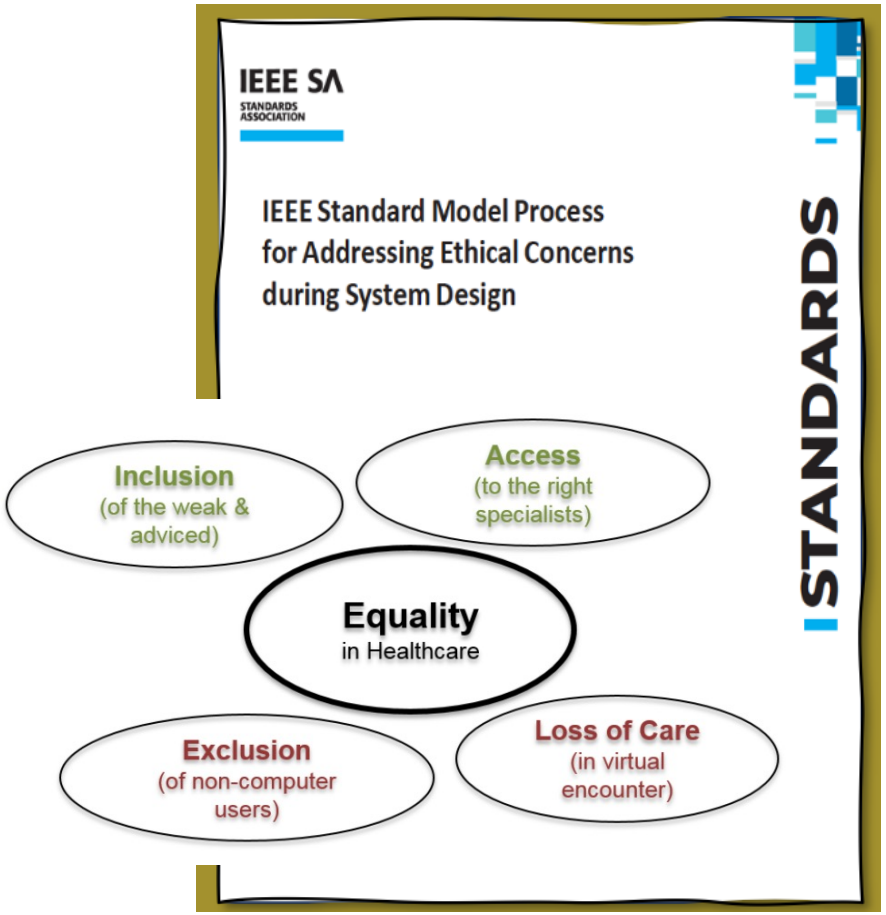
We look forward to making SAP one of many active voices in these debates by engaging with our AI Ethics Advisory Panel and a wide range of partnerships and initiatives.

Value-based Engineering for Ethics by Design

IEEE 7000 Standard Model Process for Addressing Ethical Concerns During System Design

- Gives organization's IT departments clear and early guidance on how to build 'valuable' systems in awareness of ethical issues
- Risk of technology degrading humanity is reduced
- Helps companies to comply with regulations and investors to make better decisions

Introduces a new role: Value Expert combining humanities, ethics, technology, and management

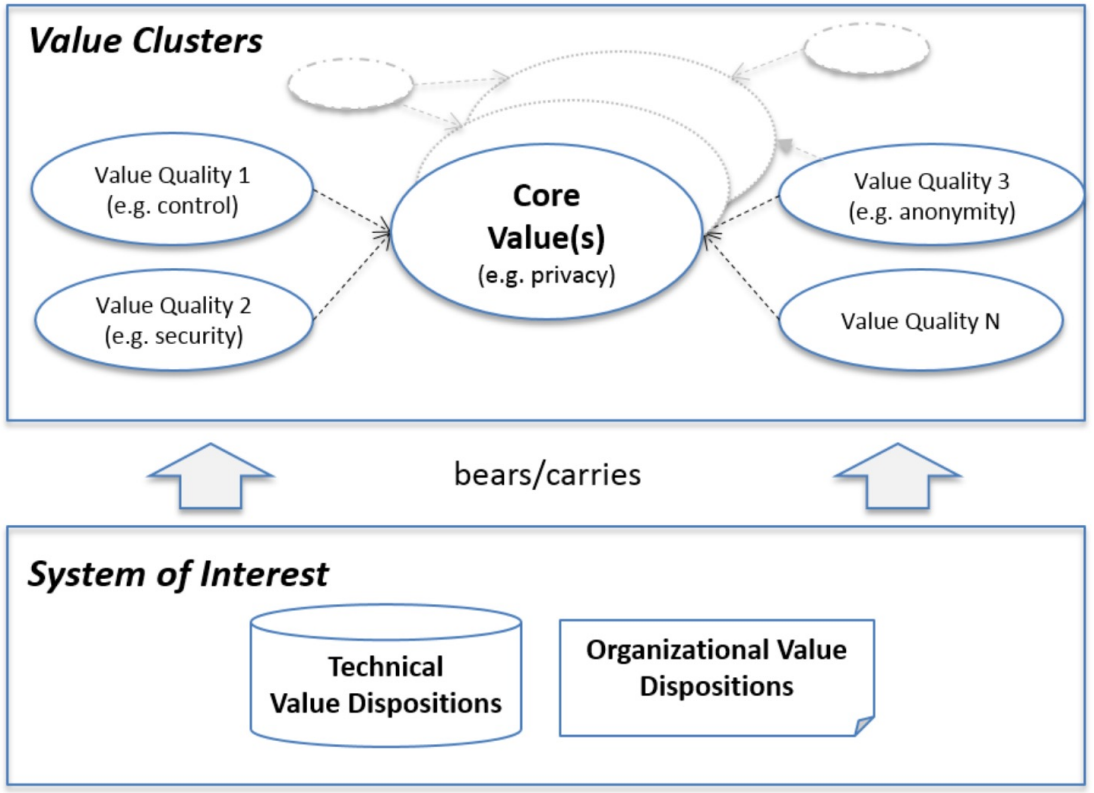


Source: Sarah Spiekermann, Till Winkler. Value-based engineering for ethics by design. IEEE preprint, 2020.

Values, Stakeholders and Context (1/2)

Value = "Something worthwhile" or “principles of the ought-to-be”

- Grounded in philosophical knowledge first established by Max Scheler et.al.
- Human rights are values themselves, norms are value dispositions
- But values can also be negative
- Systems do not “have” values, but they "bear" or “carry” them if they have the necessary dispositions built into them
- Values are constituted by a multitude of value qualities in a context which form a network structure conditioning each other



Source: Sarah Spiekermann, Till Winkler. Value-based engineering for ethics by design. IEEE preprint, 2020.

Values, Stakeholders and Context (2/2)

Values are a "soft" element in the engineering domain

- Relatively fuzzy and malleable in its meaning
- Difficult to measure and hard to proof at the end of a project

Stakeholders are all those persons or entities who are impacted by the positive and negative value effects the system creates

Context greatly influences whether a behavior is right or wrong

- Future can only be anticipated marginally
- Generic technologies should be reflected on possible future scenarios

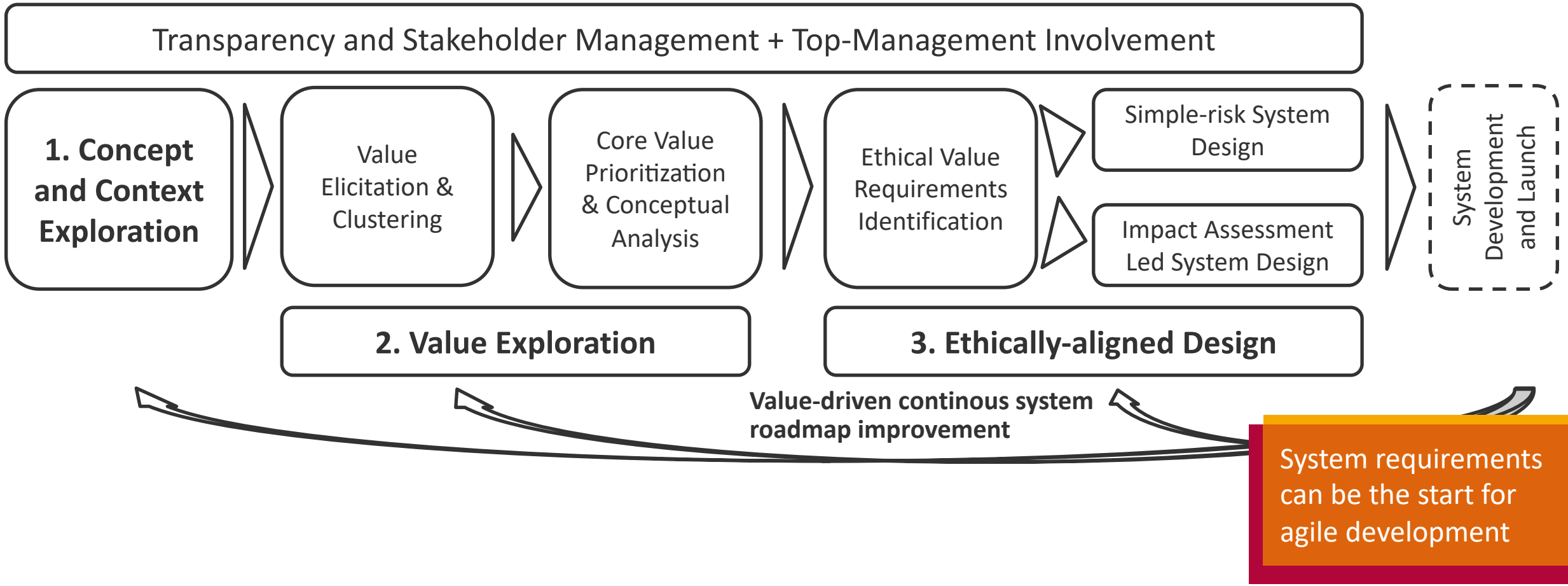
Source: Sarah Spiekermann, Till Winkler. Value-based engineering for ethics by design. IEEE preprint, 2020.

Value-based Engineering for Ethics by Design

> **“Engineers deserve to be called “ethical” if they regard their systems as “value bearers” and then genuinely intent to create controllable and transparent systems by embedding respective positive “value dispositions” into them”**

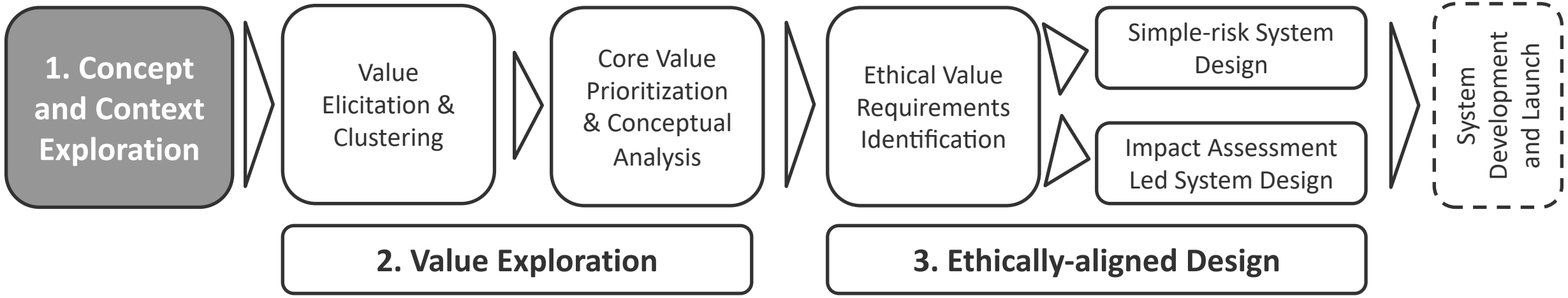
Source: Sarah Spiekermann, Till Winkler. Value-based engineering for ethics by design. IEEE preprint, 2020.

Value-based Engineering Has Three Phases



Source: Sarah Spiekermann, Till Winkler. Value-based engineering for ethics by design. IEEE preprint, 2020.

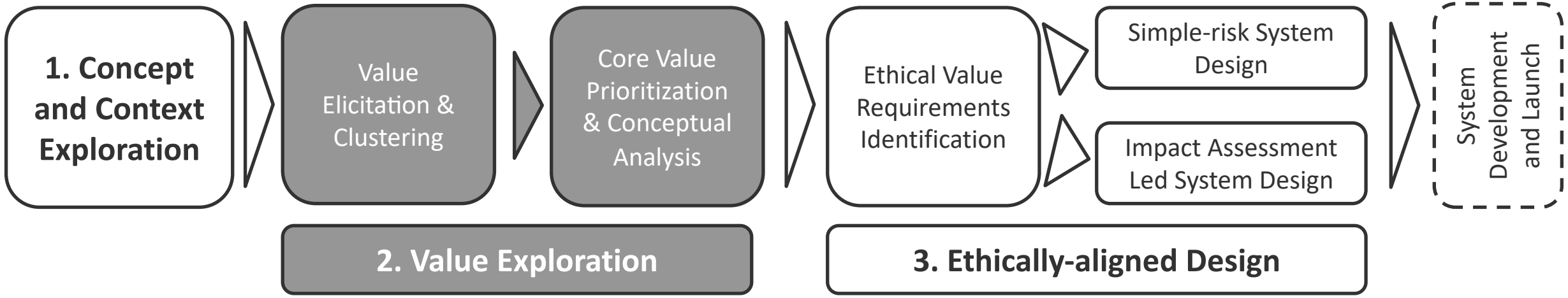
1. Concept and Context Exploration



Starts with a System of Interest (SOI), not needs!

- The real-world deployment space is explored
- Contextual diagrams visualize data flows to analyze System of Interest boundaries and vulnerabilities
- The System of Systems (SOS) partners need to be reviewed as well
- Relevant direct and indirect stakeholders are identified in their various roles

2. Value Exploration



Explore and analyze the value space by going into "philosophical mode"

- What value qualities a technology might contribute to a context & what value qualities might be destroyed
- Have a 'value ontology'
- Multiple moral philosophies to elicit relevant values and being sensitive to locality
- Values are not traded-off, but clustered and ranked
- Prioritized values are conceptually analyzed

Source: Sarah Spiekermann, Till Winkler. Value-based engineering for ethics by design. IEEE preprint, 2020.

2. Value Exploration: Philosophical Mode

Stakeholders try to envision everything that might go wrong with the system and also all that the SOI could do good for the world in which it will become effective

1. What are all thinkable positive and negative consequences you can envision from the system's use for direct and indirect stakeholders? (Utilitarianism)
2. What are the negative implications of the system for the character and/or personality of direct and indirect stakeholders; that is, which virtue harms or vices could result from widespread use? (Virtue Ethics)
3. Which of the identified values and virtues would you consider as so important in terms of your personal maxims that you would want their protection to be recognized as a universal law? (Duty Ethics)

Source: Sarah Spiekermann, Till Winkler. Value-based engineering for ethics by design. IEEE preprint, 2020.

2. Value Exploration: Core Value Priorization

Three complementary analyses are recommended to prioritize core values

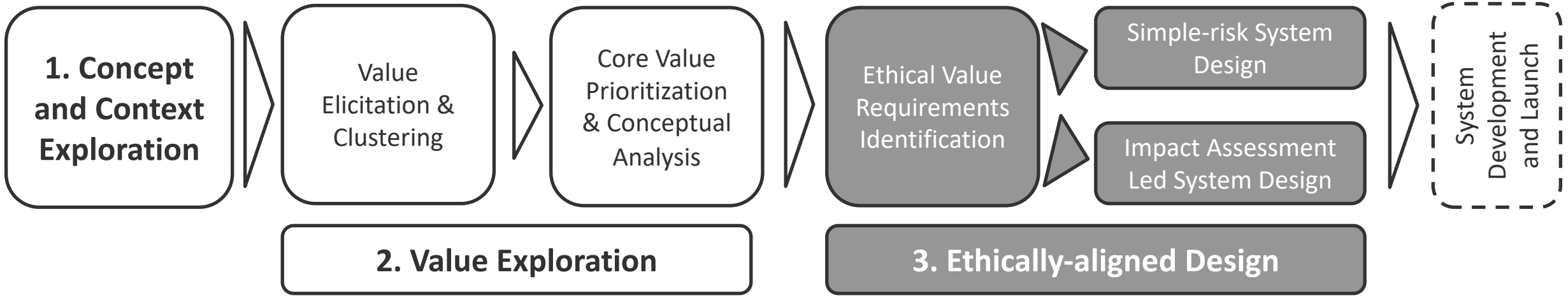
1. Resonate with the existing business mission
2. A duty ethical one
3. Check against existing corporate principles, legal frameworks, international human rights agreements or other relevant ethical principle lists

- Choose higher values over lower ones (esp. in case of contradiction)
- An Ethical Policy Statement should be made publicly available by senior executives and lived at the company in practice (not limited to the system itself)

Include outside-in point of views

Source: Sarah Spiekermann, Till Winkler. Value-based engineering for ethics by design. IEEE preprint, 2020.

3. Ethically-aligned Design



- **Generate system requirements for prioritized value clusters**
  - Prioritized value clusters are analyzed as to their ethical value (quality) requirements (EVRs)
  - EVRs are subject to risk analysis (Simple-risk (via Personas and Prototypes) vs. impact analysis (see Project Management Slides))
  - Traceability and transparency is created within a *Value Register*

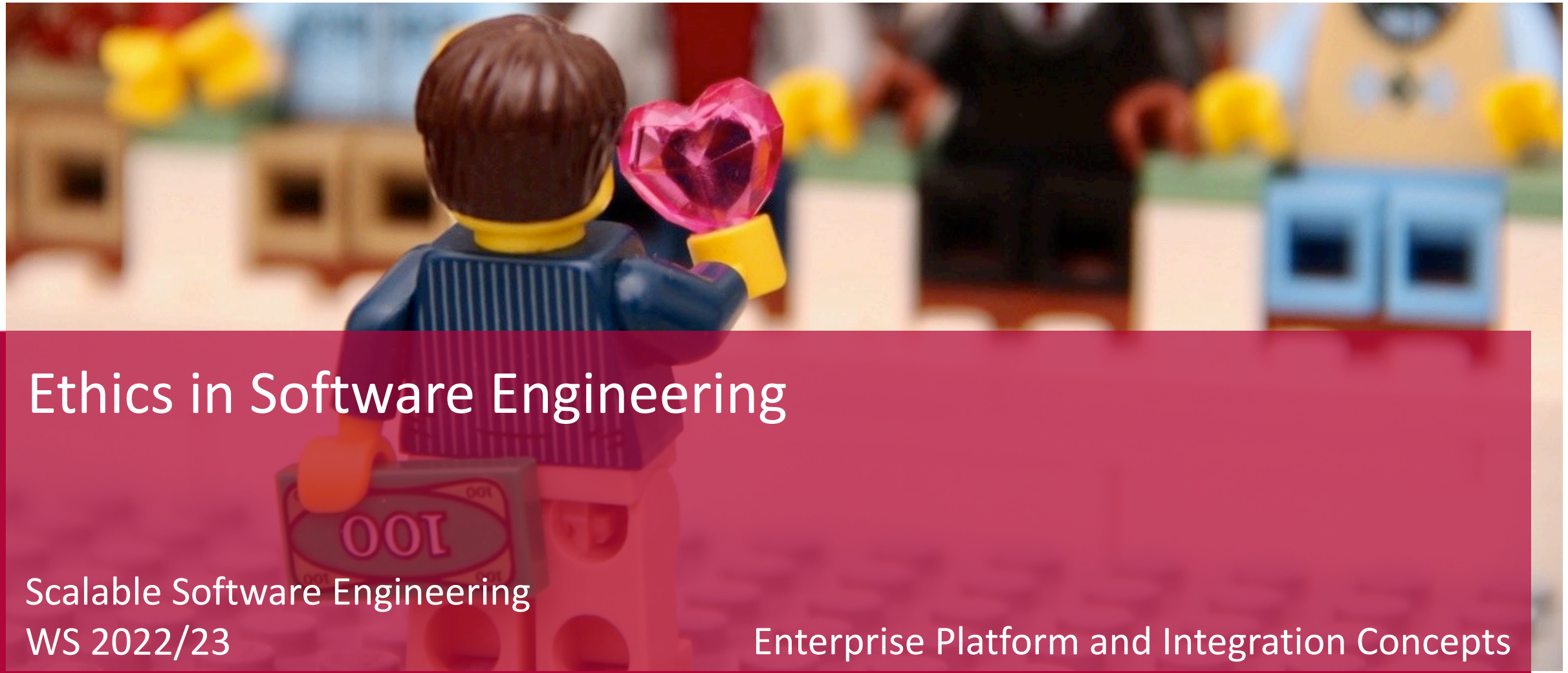
Source: Sarah Spiekermann, Till Winkler. Value-based engineering for ethics by design. IEEE preprint, 2020.

Summary

> “Ethics in software engineering is an absolute necessity. We must be responsible for the code we write and the systems we build, as they have the power to impact society in significant ways.”
>
> — Linus Torvalds (Found by ChatGPT)

Ethics in Software Engineering

- We all have an ethical responsibility esp. with respect to applications we have or will build
- Ethics in Software Engineering can have a large influence on making a product successful or fail
- There is no one ethic standard but many guidelines, norms, policies and even laws
- Value-based Engineering (IEEE 7000 Standard) enables Ethics by Design



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