

Advancing Technology for Humanity

Value-based Engineering with IEEE 7000TM

Dr. Sarah Spiekermann, IEEE 7000[™] Launch, Vienna, Nov 16th, 2021

C BYAC ND 4.0

When the IEEE "P7000" Project started in 2016 the world was full of doomsday-calls for AI ethics.





Advancing Technology for Humanity





Many value-principle listings have been put forth since 2016...a path 7000 did not take.





machine intelligence

PERSPECTIVE

The global landscape of AI ethics guidelines

Anna Jobin, Marcello lenca and Etty Vayena"

to the past five years, private companies, remark institutions and public sector organizations have insued principles and pathelines for official artificial intelligence (MD, However, despite on opparent agreement that AI should be 'stitual', there is disket shout both what constitutes which AI' and adult official equivorsents, technical students and their pactices are needed be in realization. In investigate an intellity a global agreement on these questions is entroping, see mapped and is analyzed the current corpus of principles and publicans on efficial IA. Our results reveal a global convergence assurging around five effi-tal principles (transportery, justice and fairness, non-mainfacence, responsibility and princy), with substantion discrepance in relation to how these principles are interpreted, why they are deemed important, what issue, deemain or actors they pertain to, and how they should be implemented. Our findings highlight the importance of integrating guideline-development offerts with salistantise ethical analysis and adopate implementation strategies.

etificial and ignore (A2), or the theory and development of ing "revolution" transforming science and society altogether ". While approaches to All such as machine learning, doep learning and artificial causal networks are realisping data precising and andreis', astronomous and sensi autonomous stotens are being increasingly used in a variety of notices including healthcare, interpretation and the production chain". In Table of its power hall transformative times and professed impact across traines suchetid domains. Al his sparked angle debate about the principlos and values that should guide its development and nes". Franthat AJ neight proposition jubs for human workers', be misseed To enderstitut actors', shale accountibility or implectually dis-servicents him and thereby understitut forward, have been at the tradient of the mount scientific throuture and mode constants. Several studies have documed the topic of ethical Al"", deta-My in meta-assessments"" or in relation to instantic miles"" and uniotunded negative consequences such as algorithmic bias or docrimination?

National and international organizations have responded to development of AF 2 fore diverge, what are their differences and these concerns by developing all his experi committees on AL can free differences by reconciled?

Reports and guidance documents for efficial Al an instances , computer systems able to perform tinds surveally require Ving human intelligence, is widely hotelded on an engo. Unlike so-called hard law-that is, legally hinding regulations passed in the legidatarys to defast permitted or prohibited condust-othics guidelines are not legally binding but personance nature. Such documents are airead at assisting with-and have here observed to have significant practical influence on -decision making in certain fields, comparable to that of legislative nermal-Indeed, the internet efforts of such a discover set of sindlebubliets in issuing AJ principles and policies is notesearthy, because they dommatrix are only the cool for ethical galaxies, but also the strong answer of these stateholders to shape the office of AI in ways that meet their sequences prioritize " - specifically, the priority sector's revolvament in the AI efficies areas has been called into question for potentially using each high-level soft policy as a potentiation to either moder a social couldon technical" or to eather resultture absorber". Beyond the composition of the groups that have produced ethical guidance on All, the content of this guidance itself is of interest. Are three various groups converging on what othcall ful should be, and the official principles that will determine the

Over 80 value lists accumulated...

- EU Commission's ALTAI list
- OECD list
- Microsoft, IBM and other corporates
- IEEE 7010 list catalogue

. . .



The IEEE 7000TM pioneers thought differently!





Chair, Ali Hessami, Ph.D London, UK



Annette Reilly Ph.D.



Vice Chair, Prof. Sarah Spiekermann Vienna, Austria



Lewis Gray, Ph.D Washington DC, USA



Gisele Waters Ph.D. Austin, Texas, USA



Lee Barford, Ph.D Silicon Valley, USA



Ruth Lewis Melbourne, Australia



Zviko Murahwi Nairobi, Africa



Rob Schaaf New York, USA



Jake Metcalf, Silicon Valley, USA



Advancing Technology

for Humanity



Challenge 1 Software Quality

non-transparent predictive analytics leads to wrong decisions by machines, unfair treatment of human actors and nonsensical system behavior due to wrong categorizations





Advancing Technology for Humanity



Challenge 2 Hardware Quality

Products are built to just function instead of being really good and reliable Innovations mentality of "problem fixing".





Advancing Technology

for Humanity



Challenge 3 Business Models

Monetary value is pursued without any regard for human dignity or human rights

- Participation in the data economy
- It is all about cost minimization instead of quality
- A derogatory image of humans as suboptimal beings that have to be 'developed' or 'manipulated' through technology shows a lucrative trend (e.g., humans are "predictably irration" or characterized by "mental inertia")



Advancing Technology for Humanity



Challenge 4 Complexity

Uncontrolled system-of-systems partners share opaque data and services





Advancing Technology for Humanity



Challenge 5 Corporate Culture

- Priority of profit instead of values
- Support of intransparencyNo time for diligence
- No room for • conscientiousness





Advancing Technology

for Humanity



Challenge 6 Sustainability

- Enormous energy costs are required to build and operate digital infrastructure, but this is ignored
- Resource availability of components is overestimated
- Potential global conflicts over dwindling resources are not seen





Advancing Technology for Humanity

Challenge 7 "Degrading Humanity"

Addiction and dependence on digital services leads to a change in social behavior, learning and thinking skills in children and adults.



The 7000 standard embodies a path to better system design, anticipating impacts and addressing them IN the product or service.





Advancing Technology for Humanity



- IEEE 7000[™] gives organization's IT departments clear guidance on how to build 'valuable' technology in awareness of ethical issues.
- IT's value issues are seen and addressed early on in the innovation process. Risk of building technology degrading humanity is greatly reduced.
- Value-based Engineering with IEEE 7000[™] helps innovation teams to build social and human-friendly IT narratives departing from science fiction and transhumanism.
- IEEE 7000[™] is challenging organizations to find Alpartners that give them access and sufficient control over their service.
- IEEE 7000[™] can help companies to comply with the EU AI Regulation.
- IEEE 7000[™] can help investors make better investment decisions.

How does VBE relate to IEEE 7000^{TM} ?



NIVERSITÄT /IEN VIENNA

UNIVERSITY OF ECONOMICS AND BUSINESS



VBE with IEEE 7000TM has 3 phases.



VIRTSCHAFTS JNIVERSITÄT VIEN VIENNA

UNIVERSITY OF ECONOMICS AND BUSINESS

VBE's 1st phase tries to understand the reality out there.



Advancing Technology for Humanity



SOI = System of Interest SOS = System of Systems

- IEEE 7000[™] starts with a SOI, not *needs*!
- The real-world deployment space is explored
- Contextual diagrams visualize data flows to analyze SOI boundaries and vulnerabilities
- The SOS partners need to be scrutinized; especially potential AI components
- Relevant direct and indirect stakeholders are identified in their various roles



So far the epitome of modern thinking is to design the world as we deem fit.





7-12 year olds...



Pipi Langstrumpf

"I'm making the world, widdle widdle wid, how i like it..."

"Ich mach' mir die Welt Widdewidde wie sie mir gefällt …"

Dr. Sarah Spiekermann



Advancing Technology for Humanity

12-18 years old ...





Dr. Sarah Spiekermann



IEEE

Advancing Technology for Humanity With over 3 million patents a year awaiting commercialization, we continue designing.



lvancing Technology for Humanity





If Louis XIV had known VBE, his garden would have looked differently...





CC S C Dr. Sarah Spiekermann

IEEE 7000TM also starts with a concept of operations...



IRTSCHAFTS INIVERSITÄT

VIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS

CC IS Dr. Sarah Spiekermann

Today's architectures are extremely distributed and data is like water: If you don't control it, you lose it.

UNIVERSITÄT WIEN VIENNA

ECONOMICS

Advancing Technology for Humanity



Partner scrutiny ...

- The normative part of IEEE 7000TM requires organizations to only line up with partners who are willing to give access to their systems.
- Acknowledged or directed form of partnership are recommended (see ISO 15288).





10

AI component selection





IEEE

Advancing Technology

For an external AI service to be integrable into a "good" system, the IEEE 7000[™] standard outlines that the necessary control over an AI system should only be presumed where there is

"control over the following:

- The quality of the data used in the AI system;
- The selection processes feeding the AI;
- The algorithm design;
- The evolution of the Al's logic; and
- The best available techniques (BATs) for a sufficient level of transparency of how the AI is learning and reaching its conclusions."

VBE's 2nd phase explores and analyzes the value space by going into "philosophical mode".





- VBE & IEEE 7000[™] wonder what value qualities a technology might contribute to a context & what value qualities might be destroyed
- VBE & IEEE 7000[™] have a 'value ontology'
- The approach uses multiple moral philosophies to elicit relevant values & is sensitive to locality
- Values are not traded-off, but ranked
- Prioritized values are conceptually analyzed



How can we use technology for advancing, enriching, beautifying humanity?





Advancing Technology for Humanity









Objects' value dispositions enable positive value qualities, actualizing ideal core values in our relationship with things.





INIVERSITĂT

IEEE 7000[™] has a built-in value ontology taken from Scheler's Material Value Ethics.





Advancing Technology for Humanity





CC S C Dr. Sarah Spiekermann

Engineers responsibility is to build appropriate value dispositions into systems.





CC () () Cr. Sarah Spiekermann

A factor often underestimated is the negative value qualities fostered by systems in people.



JNIVERSITÄT VIEN VIENNA JNIVERSITY O

CC () (S C Dr. Sarah Spiekermann

At the moment our poorly build systems foster hate, envy and e-personalities.

Advancing Technology for Humanity

CC C Sarah Spiekermann

This is why a central building block of value elicitation is the use of virtue ethics.

Core virtue ethical question in VBE with IEEE 7000:

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 if the system was implemented at scale?

In addition to virtue ethics, VBE with IEEE 7000^{TM} uses Utilitarianism and Duty Ethics for guidance.

UNIVERSITÄT

ECONOMIC

Advancing Technology

for Humanity

 Utilitarianism
 Virtue Ethics
 Duty Ethics

In addition to virtue ethics, VBE with IEEE 7000TM uses Utilitarianism and Duty Ethics for guidance.

INIVERSITÄT INIVERSITY C

Advancing Technology for Humanity

Duty Ethics:

What personal maxims or value priorities does the project team see affected by the service that the project team members believe are so important that they want to preserve them in society?

social,

Our research shows that SOIs expected to become monopolies can sensitize for additional non-functional requirements.

Does the choice of construct and market power influence the number of non-functional requirements seen?

Source: Till Winkler, Ph.D Thesis

- It makes a difference whether one asks for "needs", "values" or "goals" for requirements engineering
- asking for values will lead to more nuanced non-functional requirements elicitation.
- There is a (non-significant) trend that

 a "monopoly assumption" (system scale
 assumption) leads to a slightly more
 fruitful elicitation of non-functional requirements

The ConOps gain continuous shape as ethical reflections are made.

Utilitarian Value Reflection ConOps Ideas

UNIVERSITĂT WIEN VIENNA UNIVERSITY O

AND BUSINES

Using VBE/IEEE 7000TM participants* generate significantly more product ideas in response to moral challenges than in preparing a classical product roadmap. INIVERSITY O

Advancing Technology

for Humanity

** C Bednar, K., & Spiekermann, S. (2021). On the power of ethics: How value-based thinking fosters creative and sustainable IT innovation; Working Paper: https://epub.wu.ac.at/7841/

5 generations of WU students were involved in various case studies.

WU Master Class in Innovation Mgt.

UNICEF Yoma Stakeholders

Our case studies show that depending on the number of participants* involved hundreds of value qualities can play a role for a system, which are cleaned and clustered.

Advancing Technology for Humanity

Number of value ideas mentioned

- 1. Digital Toy*: 534
- 2. Foodora Delivery*: 263
- 3. Telemedicine (TM) Case**: 467
- 4. UNICEF Case : 56 Value/Qualities

*40 + students treated the case in a lab context; TM being a real company

Value Cluster Development

Using VBE/IEEE 7000 participants* saw significantly more value potentials involved in a new product than in preparing a classical product roadmap.

NIVERSITÄT

UNIVERSITY OF

Advancing Technology

for Humanity

**© Bednar, K., & Spiekermann, S. (2021). On the power of ethics: How value-based thinking fosters creative and sustainable IT innovation; Working Paper: https://epub.wu.ac.at/7841

Current product roadmapping practices can easily overlook negative technology effects.

Advancing Technology for Humanity

**© Bednar, K., & Spiekermann, S. (2021). On the power of ethics: How value-based thinking fosters creative and sustainable IT innovation; Working Paper: https://boch.wu-wien.ac.at/d/research/results/ris/export/97385/. Ethical Analysis is making investment decisions more rational. Example: Digital Toy

UNIVERSITĂT WIEN VIENNA UNIVERSITY O

AND BUSINES

Advancing Technology

for Humanity

Yoma went from an AI-driven talent calculation machine to a community platform for mutual and local support of African youth

Before (very first idea November 2019): AI focus

- Young peoples' data is combined and aggregated to calculate individuals' 'talent scores' with an AI engine hosted in Germany
- Young people are represented through its AI-based talent score and homogenized, comparable profiles are created
- All data providers can pull talent scores from young people.
- "Diamonds in the rough" are contacted to be channeled into innovation hubs to support African business

After (summer 2021): Bottom-up Youth support

- Youth gets richest possible self-presentation opportunity and no talent score is calculated, but young people can participate in local challenges and education and can build up a CV (**self-development**)
- Young people have maximum **privacy and control** over CV data (using a self-sovereign identity framework)
- Only those can get access to the young people who the young people want to be in touch with
- "Diamonds in the rough" become mentors for other young people to provide local community support AND can respond to African businesses if they want

A new professional is identified in IEEE 7000^{TM} : A Value Lead who analyzes the value structure.

UNIVERSITĂT WIEN VIENNA UNIVERSITY O

ND BUSINES

Values are prioritized. Here regional laws, agreements, CSR principles come in.

UNIVERSITÄT WIEN VIENNA UNIVERSITY O

ND BUSINESS

Value leads help companies understand the conceptual details of each prioritized value cluster.

WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA

ND BUSINESS

Advancing Technology

for Humanity

CC S C Dr. Sarah Spiekermann

VBE's 3rd phase generates system requirements for prioritized value clusters from each value cluster.

- Prioritized value clusters are analyzed as to their ethical value (quality) requirements (EVRs)
- EVRs are subject to a threat-control analysis
- Core values of highest risk are made subject to impact assessment led system design
- Traceability and transparency is created in a Value Register following a numbering scheme.

IEEE 7000TM goes "from principles to practice" with the help of EVRs and a risk-based design.

Value Principles

Practice: Risk Logic identifies System Requirements

System requirements can be the start for agile sprints or other forms of iterative development.

for Humanity

Here is what the YOMA CTO said after the project

Advancing Technology for Humanity

A great thanks to the VBE team @ the Institute!

Art & Illustration: Marie-Therese Sekwenz

Chief Evangelist: Sarah Spiekermann

Advocatus Diaboli: Till Winkler

WIRTSCHAFT UNIVERSITAT WIEN VIENNA UNIVERSITY O ECONOMICS AND BUSINES

Advancing Technology for Humanity

Case Study Analyst: Kathrin Bednar

More information on IEEE 7000 site & VBE portal!

BERLANDS PROPERTY.

https://www.wu.ac.at/value-based-engineering

� IEEE

Advancing Technology for Humanity

Value-based Engineering with IEEE 7000

w/

Add the property of the Solid Paris

IN PROPERTY. IN CO.

The set of our production of the set of t

IEEE 7000TM-2021 Standard

Addressing Othical Concerns During Systems Design

IEEE 7000**-2021

TRADE CANDIDORS

Antoinarian is includence

Read in Lot of

Integrating which and functional requirements to mitigate risk and increase innovation in systems engineering design and development

An Unintended link in Engineering Design: Ignoring the Values of Your Users

Another productions for any regeneration burchesing solary in product forms and provide a following one of another requests of advances and according to a specific terms of a dark in the specific terms of a dark interview. The specific terms of a dark is the specific terms of a dark interview of terms of a dark interview of terms of a dark interview of a dark interview of terms of a dark interview of a dark interview of a dark interview of terms of ter

1882 7999-3921 Standard Access Options

Hane for Free to Dis Furthease the 1888 Reading Room 1888 7000 Electrony

HER Aplace Hand Street

https://engagestandards.ieee.o rg/ieee-7000-2021-for-systemsdesign-ethical-concerns.html

Value-based Engineering/IEEE 7000TM Training?

If you are interested to receive information on a 4-day intensive training @WU Executive Academy, please leave a note or card.