Value-based Engineering: What it is and how it is a form of Life Engineering

by Sarah Spiekermann (Business & Information Systems Engineering Journal, 2020, forthcoming)

Today's life is increasingly penetrated by a digital fabric: how we socialize, meet, move, produce, think, speak—every activity in life seems to be interwoven with it. This digitization of life has consequences for the quality of our individual and social lives: for our mental and physical health, our identity formation, our intelligence as well as our future resilience at the personal, organizational and societal level. As digitization evolves with human aspirations that may be more or less wise, humans evolve as a consequence. For this reason, engineering machines means to a certain extent engineering life. If we get it wrong, we degrade and harm humanity, as even some Silicon Valley pioneers now realize (Center for Humane Technology, 2020).

At the moment we are unfortunately getting it wrong, because the IT industry has been ignoring digitization's fundamental impact on life, believing that it is somehow neutral. Notwithstanding the slow recognition of systems' needing to be usable, the embracing of truly positive human and social values—such as transparency, fairness, community, dignity or human autonomy —has remained more of an academic exercise than a matter of priority for corporate practice. It is true of course that security and privacy have recently fought their way onto corporate IT roadmaps. But this is probably not because corporations care so much for the after-effects of their systems, but because Sarbanes Oxley and a flood of security and privacy breaches have forced them to become more compliant with existing laws and international agreements.

That said, the reluctance towards ethics in IT design is dissolving on some fronts. With the rise of AI on Gartner's Hype Cycle a serious debate has been kindled around the values AI should respect (Jobin, Ienca, & Vayena, 2019). No matter how much one believes in the myth of IT bringing the salvation of progress through its mere existence, nobody wants to buy dark science fiction stuff (except the military). As a result, a glimmer of hope is appearing on the horizon that ethics and values might finally find themselves more firmly on the IT industry's agenda. Long-existing branches of academic research, such as Value Sensitive Design, are suddenly being discovered (Friedman & Hendry, 2019). The reductionist monetary meaning of the term "value" in 20th century economics is being challenged. And in its place the original significance of "value" is restored, which denotes that a value bearer has a degree of worthiness, goodness or importance, so that it can be treasured in its own right. In this line of thinking, "Value-based Engineering" has emerged as a vision for a new era in engineering: an era that essentially strives to build systems and software such that they bear true progress for the lives of human beings, for organizations and society beyond profit (Spiekermann & Winkler, 2020 forthcoming). The goal is that systems are worthy of being created not only because they generate profit or are somehow

useful (as the 'Technology-Acceptance-Model' has been emphasizing to utter excess), but because they contribute to a good, true, beautiful, peaceful and worthy life in which human beings can progress as individuals, unfolding their natural potentials instead of stifling them.

To live up to this ambition, Value-based Engineering fully "bases" the IT innovation practice on values and ensures that the resulting systems' configurations are "based" on them. This "basing" of one's system design effort on values is a very strong claim and goes much further than just saying that a system is "sensitive" to values. It requires Value-based Engineering to be more than a philosophy of design or a gentle stakeholder practice. Instead it is a rigorous step-by-step method for companies and public institutions to follow when they innovate: a guidance on how to go from an initial product idea to concrete specifications and deployment. It is a controlled and standardized path that responsible innovators can follow to systematically identify and strengthen the value proposition of their systems-of-interest (SOI) while ensuring that they do not step on stakeholder toes by breaching value expectations, laws or human rights.

When Value-based Engineering was first conceived with this vision (Spiekermann, 2016) it benefited from its roots in German engineering culture, more specifically the Business Informatics discipline, which is respected for its long tradition in system modeling and system development in cooperation with industry. It became the starting point for IEEE's 7000 Model Process for Addressing Ethical Concerns during System Design (IEEE, forthcoming 2021) and in many respects resembles this forthcoming system engineering standard (Spiekermann & Winkler, 2020). However, knowing engineering methods and practical IT dynamics is not enough when it comes to "life engineering," which should be a deeply ethical exercise. Humanity has over 4000 years of records on ethical thinking and guidance on how to foster well-being and human flourishing; guidance, though, that differs widely across cultures. So any ethical or value-related engineering method should scale to the varying preferences of stakeholders using a system across the globe. It should respect and live up to this life diversity, and be ready to configure systems' modes of operation with respect to target markets' specific value preferences. Thinking this culture-specific system beauty to its logical conclusion implies that Value-based Engineering might move us from a quite homogeneous system landscape across the globe today to more heterogeneous system designs in the future. Also, the simplistic effort to work with preset lists of global value-principles is left behind. What is true, good and beautiful differs for every SOI, company and region of the world (except of course for some hygiene factors of responsible system design, such as reliability, privacy, security or transparency).

To explicitly respect the diversity of value configurations in different contexts, Value-based Engineering is grounded in "Material Ethics of Value", a stream of philosophy that is uniquely able to account for the phenomena an SOI incurs in its long-term real-life usage contexts (Scheler, 1921 (1973)) (Hartmann, 1932; Kelly, 2011). Despite many contemporary efforts to study value dynamics, this 20th century stream of philosophy seems to be not only the most elaborate one in existence to date, but one that resonates with timely advances in other "life-disciplines," such as

neuroscience/psychiatry (Fuchs, 2017) and sociology (Rosa, 2019). In line with the Material Ethics of Value, IT systems do not “have” values, and it will not be possible to build values “into” them. Instead engineers strive to build *value dispositions* into systems, so that in a subsequent second step *value qualities* can unfold in the eye of beholders (stakeholders). An example to clarify this ontologically important finesse is the value of security: An engineer will not build security “into” a system, but instead will create one or more value dispositions, such as the encryption of data. This encryption then *bears* the value quality of confidentiality. A human being––for example, a security expert—can appreciate this value quality. He or she might even *resonate* with a number of other positive value qualities, such as the integrity of the data and availability of the system, which exist due to other value dispositions built into it. Such a multitude of extrinsic value qualities appreciated by humans constitutes the higher intrinsic *core value* of security borne by the system. Figure 1 summarizes this ontological and terminological core of Value-based Engineering.

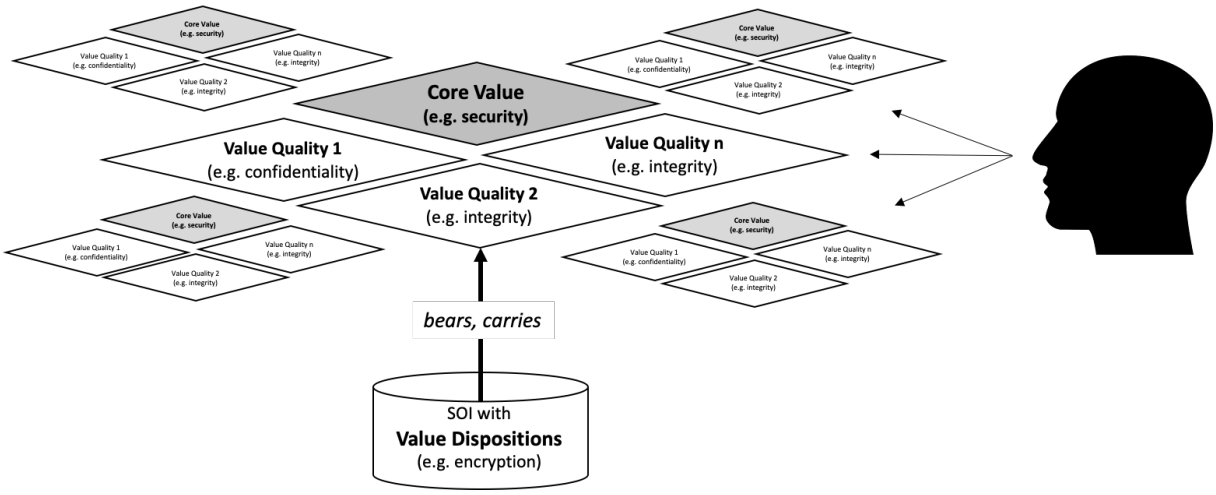

Figure 1: Value Ontology and Terms used in Value-based Engineering

While proper terminology with philosophical grounding is an important prerequisite for any replicable ethical engineering method, it is not enough. Value-based Engineering is required to also offer a trustworthy way to overcome many additional challenges recognized by experts, two of which should be mentioned here: the first is to identify the right initial value priorities for an SOI; the second is to ensure that these value priorities are then traceably respected in the SOI design and deployment.

The first challenge, to determine what is right or wrong in a desirable future, is not done out of the blue, but is supported by the heterogeneous richness ethical theories have to offer. Note that in choosing these ethical theories, Value-based Engineering goes beyond the utilitarian tradition originating in Anglo-Saxon culture. Instead it embraces the classical virtue ethical forms of

thinking as described by Aristotle (Aristotle, 2000). And it also uses the duty ethical forms of reflecting about good behavior in order to identify and determine value priorities for system design. All this is done by including stakeholders from SOI target markets in a dialog that should be led by discourse ethical principles in order to openly reflect on cultural traditions that might help to anticipate a system's value consequences not grasped by the Western-ethical canon. Taken together, four questions are asked for value elicitation:

1. What are the positive and negative life consequences one envisions from the SOI's use for direct and indirect stakeholders? (Utilitarianism)
2. What are the negative implications of the SOI for the long-term character and/or personality of users—that is, which virtues 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)
4. Which forms of human conduct should be fostered by the SOI or prohibited, against the background of the religious, spiritual or common traditions of a target market?

Once values are thus elicited, they are prioritized and it is it is taken into account how important they are for life, human well-being and health. One possibility is that they may negatively impact life, human well-being and health, or are recognized in international human rights agreements and target market legislation. In this case they must be traceably respected in the SOI's design with the help of risk assessment methodology. Risk assessment methodology systematically anticipates likely value threats, followed by the identification of appropriate controls to address them (similar to standards in security (NIST, 2013) and privacy (EU Commission, 2011). The other possibility is that prioritized values do not impact meaningfully on human lives, but are nevertheless important in terms of strengthening the corporate value proposition. In this case they are set as the engineering goals pursued by any development method a company might have, including iterative or agile forms of work on prototypes. Value qualities are effectively becoming the goal function of these design efforts.

No matter what approach is taken, all value handling is captured in a Value Register and accompanied by some form of risk-thinking. That is, the engineering team keeps in mind that they should not risk forgoing a positive value proposition they actually agreed to prioritize or to undermine a value they found important. Finally, Value-based Engineering recognizes that value work never ends, as systems progress and evolve over time. Once a SOI is deployed into the real life of stakeholders the values unfolding in reality are monitored and narratives are collected on what the true system impact is. Iteratively and over time, the SOI is then continuously improved to ensure it is and stays a good member of society.

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