

Towards implementation of feminism in engineering: The relation to nature and Keller about self-organization

Maria K. Udén

This is a working paper by Assistant professor Maria K Udén, PhD, for the Gender and Technology unit at Luleå University of Technology, Luleå, Sweden.

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Nature, feminism, engineering

When in the late 19th and early 20th century the creation of a scientifically informed and systematically trained engineering corps first became a topic of interest across the world, the male designation of the profession was standard. (Canel 2000) In Sweden, where the author of this article is from, women were in practice able to enter the polytechnics from the mid 1920's. This was several decades after the country's first institution of this type, the Royal Institute of Technology, was opened in Stockholm. (Berner 1982) It has since been debated if, how and in what settings of engineering women can actually fit. This is a common situation. For instance, in an article presenting the distribution of women students in Turkish engineering education Zengin-Arslan (2002) commented that environmental, chemical and food departments have a distribution of women/men around 50/50, while the overall mean for engineering studies is 26 per cent women and 74 per cent men. She related the figures to attitudes:

The logic of industrialisation is based on the idea of overcoming the limits of, struggling with and controlling nature. Therefore, the image that people have of environmental engineering is that it is a field related to Nature and responsible for taking care of it while departments such as mechanical, petroleum and civil engineering are involved in struggle against Nature. Thus, it can be argued that environmental engineering is related to woman who is identified with Nature at a symbolic level and is convenient for women. However, mechanical and civil engineering /.../ are linked to masculinity and conceived of as convenient for men. (Zengin-Arslan, 2002: 403)

If, as in the words of Zengin-Arslan (2002), the logic of industrialisation is based on the idea of overcoming the limits of, struggling with and controlling nature, does this entail that this must be the logic of engineering? The issue is the stance from which to take action. The nature concept is controversial but, it has significance. In Judith Butler's philosophy the function of resistance to the concept of the 'natural' is clearly stated. At heart, feminists cannot but identify the concept nature as an instrument of oppression. This comes from the experience of nature as: "... an 'idea' generated and sustained for the purposes of social control" (Butler, 1999: 159). Looking beyond the apparent boundaries of the possible, of the 'natural', is a necessary strategy. At the core of that from which we have to break free is a violent regime that desires to: "... keep the order of binary gender natural or necessary, to make of it a structure, either natural or cultural, or both, that no human can oppose, and still remain human." (Butler, 2004: 35) Still, Butler points to how in feminism nature is

concurrently seen as: "... a resistant materiality, a medium, surface or an object..." (Butler, 1999: 159) Adequate ideas are needed, about the character of the dealings engineering have with nature, or so to speak, of the contract by which they take place.

The word 'nature' as such is imprecise and seldom used in engineering practice. Nevertheless, feminist scientists and engineers necessarily include in their intentions, to be dealing with some aspects of the conditions that are commonly referred to as 'nature'. This situation is indicated by the difference between how respectively engineer Birgitta Rydhagen (2002) and sociologist Wendy Faulkner (2001), both in the early 2000's, characterized heterogeneous engineering. While Faulkner highlighted holism and the social Rydhagen basically embraced the same values but also expanded the content, by stating that "knowledge of how natural resources behave is necessary to succeed". (Rydhagen, 2002: 225) See also (Rydhagen, 2010).

Self-organizing systems and power-law distributions

To approach engineering methodologies, with the aim of informing them, the collected works of respectively Karen Barad and Evelyn Fox Keller can be combined. (Udén, 2009) In this context however, I would like to discuss one particular article only, which in relation to the topic of this article is both concrete and directly applicable: Evelyn Fox Keller's (2005) "Ecosystems, Organisms and Machines". Keller arrives here at a definition of human doings within ecosystems, via an exploration of how the term self-organization has evolved in first the life sciences, then cybernetics and physics. Thinking particularly of *self*-organization arrived in early biology with the understanding of organisms as bounded bodies that are not designed by some external force but, capable of self-regulation and self-generation. The delineation marked by the word 'self' was directed against the inanimate machines, that is: against what is designed by humans. As science now regards the universe as a non-equilibrium self-organizing system, the question occurs, as Keller remarks, if biology is reduced to physics or physics is revived by the infusion of life.

The momentum arrives where she isolates the anthropocentric meaning which in the conceptualization of self-organization, is systematically given to the word *self*. For the purpose she discusses an analogy made by Levin (1999), between ecosystems and the order (or lack of order) at his desk. "My office is indeed a self-organized system, with me at the center. It has more the element of design than do ecological systems, yet it still reflects a huge dose of chance and historical influence." (Levin, 1999, in Keller, 2005: 1072) Would it not be more accurate if Levin declared his desk a *myself*-organized system? Keller asks. "Why is it", she continues, "that, in every conception of self-organization, the self that is the source of organization is, in contrast to the human self (or "myself"), without intentionality or agency?"

To bring the engineer into the system, to put Levin in his office with his agency and intentionality intact, would be to *confound the entire tradition that takes human agency or intentionality as a priori unnatural*, and accordingly pits natural against artificial design. (Keller, 2005: 1073, my italics)

Keller's proposition is a redirection of the focus from intentionality (as a construct of vague relevance), to agency. She points to that agency is an attribute we share with many if not all other organisms. This implies to think of ourselves in the same terms as we think of other organisms that shape their environment by their activities and that build entities that serve as

extensions of themselves: beaver dams, bird nests, tunnels built by earthworms and that serve as their accessory kidneys, the bubble gills built by aquatic beetles, the horn-shaped burrows of crickets that amplify song, or homeostatic termite mounds. (Keller, 2005: 1073) We can think of the machines we create as simultaneously extensions of ourselves and effects of human agency on our environment.

The full picture of what Keller actually says about humans and machines emerges only after one more step of scrutiny. In the first instance, the post humanist position Keller suggests can be interpreted as that what an engineer does is comparable to what a beaver does, when either of them builds a dam. In explicit terms, this is what Keller writes. Nevertheless, power law distribution, which Keller notes as the bridge between understanding organisms and ecologies as self-organized, is a matter of what happens on *system* level. This is not highlighted by Keller, even though the material is laid out in her article. But, it means that in the assessment of an engineering accomplishment, the system in which it has taken place is the unit of analysis, not the singular accomplishment, not the singular human (engineer, technologist) – or the singular bird, beaver or termite, for that matter. This is a theoretical strength as engineering is a means through which our society, not singular individuals, deals with our living conditions. Notably, a theory that relates to nature and ecology does not for that reason imply harmony – or success, for that matter. Ecosystems are not in permanent equilibrium. Volatility can thus be described and accounted for.

Concluding the elaborations

This working paper neither builds on claims that new technology would be the solution to what is unsettled in the human existence, nor that feminism would bring ready-made solutions to any set of technological shortcomings, challenges or dilemmas. It is nevertheless devoted to the particular question of the future for feminist contributions to the advancement of engineering that is, to the development of technology design, production, maintenance and management. A framework for the understanding of technology and engineering in this context, should meet two criteria. First, the goal is reaching an understanding that override insupportable features and practices – not by pretending they are not there but, by placing them in the position of varieties rather than frames. Second, the unease, the tensions and inconsistencies in the feminist views on engineering should preferably be overcome.

In *Ecosystems, Organisms and Machines* Keller (2005) makes the point that power law distributions can be deployed to capture conditions and transitions in ecological systems that encompass animals which are socially highly complex as well as species less so. Engineering would thus be possible to regard as one expression of human self-organization. Or, in other words: if we think of engineering as one among the practices through which human societies deal with their actualities, in an every-day sense it is to think of it as another expression of what happens in nature, all around us, all the time. From this platform it is possible to override ideas that engineering, and certain engineering branches in particular are and will remain being about “overcoming the limits of nature” or “struggling against” nature, and it has the range to counter misogynist imaginary (which in this frame becomes a variety only). This is a good starting point for a feminist take on engineering. Yet, it is a starting point only. The human-as-organism-and-machine-as-natural-extension theory says *that* people produce and arrange the extensions of themselves, which we can for instance call machines and constructions. It can probably be useful for understanding *how* this is done that is, via the system level that it addresses (which in essence relates to mass and energy balances and

transitions, and which humans handle via intricate social arrangements). It does not however say how people *should* do it.

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