Eidos
ISSN: 1692-8857
ISSN: 2011-7477
Fundación Universidad del Norte

Mets, Ave

FEMALE MOUNTAIN, MASCULINE MINING: AN INTERPRETATION OF *ENTBERGEN*1,2

Eidos, no. 29, 2018, July-December, pp. 119-149
Fundación Universidad del Norte

DOI: https://doi.org/10.14482/eidos.29.7129

eidos
Fecha de recepción: octubre 18 de 2016
Fecha de aceptación: febrero 22 de 2018
DOI: http://dx.doi.org/10.14482/eidos.29.7129

Female Mountain, Masculine Mining: an Interpretation of *Entbergen*[1,2]

Ave Mets
University of Tartu (Tartu, Estonia)
avemets@ut.ee

Resumen

Unverborgenheit (desvelamiento) es la verdad en el pensamiento heideggeriano de inspiración griega, esto ocurre en el *Entbergen*, o desocultamiento. La tecnología es una forma de desocultar, y las verdades desocultadas por las tecnologías de base científica en la antigüedad y en la época contemporánea son esencialmente diferentes; la última estaría determinada por lo dispuesto, o *Gestell,* que sería la esencia de la ciencia y tecnología contemporáneas. En este texto presento una interpretación etimológico-ecológico-feminista de las esencias de la tecnología antigua y contemporánea como ontogénesis y sus desvelamientos. También se puede apreciar un punto crucial en la aproximación eco-feminista de Carolyn Merchant al cambio mental-espiritual debido al cambio tecnológico de las prácticas ligadas a la tierra, en especial la minería, durante la revolución comercial y el surgir de la ciencia contemporánea. Como la terminología de Heidegger sugiere fuertemente a las montañas como salvando lo todavía no oculto, y a las relaciones humanas con las montañas como encontrar lo oculto, el enfoque de Merchant sobre la naturaleza mujer, o Madre Tierra, y la ciencia masculina que penetra en sus oscuras parcelas en busca de secretos para ser explotados por la humanidad, y su conexión con las prácticas mineras, parece clarificar en ciertos aspectos las oscuras nociones heideggerianas de desvelamiento y verdad.

Palabras clave
Martin Heidegger, Carolyn Merchant, tecnología, ciencia, desvelamiento, ecofeminismo.

---

[1] Great thanks go to the three anonymous referees of the initial version of this paper for their very thorough and helpful reviews. I tried to benefit from those as much as possible.

This work has more or less directly profited from my exchange with: Ülo Matjus, Daniel Gruschke, Andreas Demant, Rein Vihalemm, Frank Suttner, Janar Mihkelsaar and Magdalena Ziętek. I also wish to thank Piret Kuusk, Rafaela Hillerbrand, Endla Lõhkivi, Joseph Rouse, Ena Mets, Tõnis Mets, Reet Mets, Winfried Lotz-Rambaldi, Ruth Jürjo, Riho Reiljan, José Cañete Correas. Additionally, I wish to acknowledge the support and assistance of the following institutions: Archimedes Foundation for their DoRa scholarship (July-November 2012) and Kristjan Jaak scholarship (December 2012-March 2013); the Centre for Entrepreneurship at the University of Tartu; the Human Technology Centre at RWTH Aachen; the Estonian Research Council grants n° IUT20-5 and n° 7946; Estonian Ministry of Education and Research grant SF0180110s08; University of Tartu grants PFLFI15915 and PHVFI16941; and European Regional Development Fund (Centre of Excellence in Estonian Studies).

I retain responsibility for all errors and misunderstandings.

[2] The paper is a complemented and amended version of the parts 2, 2.1, 2.2 and 2.3.1 of (Mets, 2013).

Abstract

Unverborgenheit (unconcealment) is truth in Heidegger's Greek-inspired view that happens in Entbergen, or bringing forth. Technology is a way of bringing forth and the truths brought forth in ancient and contemporary science-based technologies are essentially different, the latter being destined by enframing or Gestell that is the essence of contemporary science and technology. Here I give an etymological-ecological-feminist interpretation to the essences of ancient and contemporary technologies as ontogeneses and their unconcealments. A turning point is also identified, on the basis of Carolyn Merchant's eco-feminist account of the mental-spiritual change due to technical change of earth-bound practices, specifically mining, during the commercial revolution and the rise of contemporary science. As Heidegger's wording strongly hints to mountains as salvaging the not-yet-concealed, and human relation to mountains as finding the concealed, Merchant's account of the female nature, or Mother Earth, and male science as penetrating her dark plots for secrets to be exploited by humans, and its connection to mining practices, seems in some respects to clarify Heidegger's somewhat dark notions of unconcealment and truth.

Keywords
Martin Heidegger, Carolyn Merchant, technology, science, unconcealment, ecofeminism.

Female Mountain, Masculine Mining: an Interpretation of *Entbergen*

Introduction

Unverborgenheit (ἀλήθεια – *aletheia*), translated as unconcealment (Lovitt, Heidegger, 1977) is truth; technology is a way of bringing forth the truth, of bringing being[3] into unconcealment, of *Entbergen* (Heidegger, 1954/1959a), or a kind of cognition.[4] Heidegger argues that ancient and contemporary technologies are essentially different as to their comprised inherent unconcealments, which is my primary driving issue. Although contemporary technology applies contemporary science and is based upon it, its essence holds sway within science (pp. 29-30). Hence, this practical grounding of technology on science means more than

[3] Being —*das Sein*— is one of the essential terms in Heidegger.

[4] By 'cognition' I mean becoming aware and knowledgeable of something in an epistemological sense. I have analysed Heidegger's conception in such terms in Mets (2012, particularly pages 86-90).

merely applying theory: it rather refers to the general conditions for practices like contemporary science and technology to emerge in the first place. Thus, the linkage to science as ontology will be helpful in uncovering the essence of contemporary technological unconcealment in contrast to its ancient counterpart.

I will offer a specific historical-etymological-ecofeminist interpretation of an aspect of Heidegger's conception of technology as ontogenesis in his "Die Frage nach der Technik" (Heidegger, 1954/1959a; "The Question Concerning Technology", Heidegger, 1977).[5] I consider changes in the mental side of world cognition arising from human practical treatment of nature, which might underlie the rise of contemporary science. My primary aim is understanding contemporary techno-scientific world cognition and its related conception of nature, including its alleged essential difference from other world cognitions, for which Heidegger (1954/1959a) offers an interesting philosophical approach. More particularly, the mutual relation between the ontic (various technologies and devices) and the ontological (the way of construing the world) —for instance the technological world picture, or technology in an ontological or ontotheological sense (Thomson, 2005)— is in focus here. This is also a principle in the practice-based philosophy of science, which is informing my approach to the chosen topic: that cognition is informed in mutual influence of concrete experience (the ontic) and pre-theoretical attitude (the ontological).[6]

Matjus (1989) in his afterword to the Estonian translation of Heidegger's "Die Frage nach der Technik" (Heidegger, 1989) emphasises that each translation is an interpretation, an attempt

[5] Thanks to Prof. Ülo Matjus for many patient explications on Heidegger's philosophy. However, there remain substantial disagreements between us, as I keep to large extent to my own (mis)interpretations that were disapproved by him —as it is not specifically Heidegger's philosophy in my focus but my own comprehension of contemporary world view and its normativity, and how reading Heidegger has helped me understand and conceptualise these on a certain plane.

[6] See also Mets (2012) for an interpretation of Heidegger's "Die Frage nach der Technik" in this framework.

to bring to one's own language what is said in another language. In Heidegger's case, it is particularly apprehensible how difficult translating can be: by making use of specificities of the German language, he has created a conceptualisation, to which one cannot similarly find an equivalent, in neither English nor Estonian, that would preserve both the whole idea as well as the different images that unfold on the way to it. In my interpretation, leaning on the German version is essential while I endeavour to outline some possible associations that do not come forth in translations. For this I gather together Carolyn Merchant's account of the beginnings of contemporary natural resources management, industry and science in eco-feminist terms (Merchant, 1983; see also Merchant, 1980) and Martin Heidegger's original German version of "The Question Concerning Technology". Therefore, I have restricted my discussion to those aspects of Heidegger that appear to coincide with Merchant's recount.

Merchant tells the story of the changing world picture that enabled the rise of the contemporary commercial exploitation of natural resources —primarily those located in the bosom of the earth and obtained through mining— and how that change relates to contemporary science. The corresponding world pictures that mining practices were embedded in before and after the commercial revolution were organismic and scientific-technological, respectively. My interpretation offers another (albeit closely related) view to technical practices and understandings than Heidegger's, including an opposition of earlier and later understandings. Therefore, I draw a parallel between Heidegger's and Merchant's accounts that I consider illuminating about the changes.

In the first part I explicate the notions in Heidegger's "Die Frage nach der Technik" that I perceived as indicating earth and mining, as if they were icons of concealment and unconcealment. Those notions thus create the connection to Merchant's account in the following parts. In the second part I consider the practical aspect of mining activities as the focus of comparison of earlier and contemporary technical thinking and as an example of technological practices,

wherein the unconcealment involved in older and contemporary mining practices will be explicated mainly with Merchant's help. In the third part I look at the theoretical understanding of nature, related to the outlined practical and world picture changes.

By utilising Merchant, I propose a feminist expansion of some of Heidegger's conceptions that he himself has not approached from a gendered perspective. As I am neither a Heideggerian nor a specialised feminist philosopher, my analysis of both will be that of a philosopher of science. Diverse feminist interpretations and criticisms have been made of Heidegger's work (Holland & Huntington 2001), including the masculinity of 'Dasein' (*e.g.* Chanter, 2001; Bigwood, 2001; Glazebrook, 2001) and an ecofeminist interpretation (Glazebrook, 2001), that most closely pertain to my focus: *Dasein* as the locus of unconcealment, and ecofeminism as Merchant's field which I use to frame my analysis. My analysis differs from them in its emphasis on the character of scientific knowledge and its masculinist roots.

Basic notions: world, unconcealment, berg

Cognition —world cognition and human self-cognition— is to a considerable extent constituted through human (material) relations to their immediate surroundings, including nature and the earth. Thus, to come closer to understanding one aspect of Heidegger's distinction between ancient and contemporary technologies as cognitions of world and human —and thereby the fundamental world view related conditions of contemporary science— I will trace the evolvement of this relation in some historical moments of material practices, particularly mining as an intimately earth-bound practice[7] and as an almost iconic illustration to Heidegger's understanding of truth as *Unverborgenheit*.[8] Also, scientists of the

[7] Heidegger's own example of agriculture (*e.g.* in 1954/1959a) is of course equally earth-bound, but it could be a topic of another paper.

[8] Literally 'being out of mountain/salvage'.

age draw parallels between the truth-aimed scientific inquiry and mining: William Gilbert imagines scientific experiment as "penetrat[ing] the inner parts of the earth", whereas he regards Earth as "our common mother" (Henry, 2001, p. 115; quoting Gilbert's *De Magnete*); Robert Boyle likens experimental learning to "dig[ging] in the quarries for materials towards so useful a structure, as a solid body of natural philosophy" (Agassi, 1956 Part II, pp. 99 and 181, quoting Boyle's *Proemial Essay*).

In a sense, 'world' (*Welt, wer-alds*) is itself to be understood as unconcealment, as what has come to light, open to human cognition and comprehension: it is something *for* man and *through* him, his (life)time and being together with other humans, times and places filled with people that offer maintenance and stand and thereby security (for one's existence being secured), in contrast to wilderness (*Wildnis*) that is perceived as dangerous (Grimm & Grimm, 1966, referring to the possible Christian origin of the word 'world'). Wilderness, or desert, is dangerous because it is unknown, it is concealed from man and his comprehension and insubordinate to his administration.[9] Being and truth are the same (Heidegger, 1999, pp. 135–136). Being is limiting the brought-to-the-fore or the brought-to-standstill[10] that happens in coming out of concealment (*Verborgenheit*), in quarrel that weighs up the counters (Heidegger, 1999, p. 151; 1966, p. 87). Mining could on this ground be seen as an activity that opens up the earth as dark, opaque and concealed, bringing it into the light and thus making it a part of the world, of human cognition. Man broadens the world,

[9] Also in Balt languages the word 'world' *–pasaulis* (lt) and *pasaule* (lv), literally 'under-sun' – refers to something lighted, open to cognition. The Slavic *'mir'* to people, peace, concord, order, light (Vasmer/Trubachev, 1964-1973, p. 626). The Latin *mundus* to order, clarity, purity, sunlight (www.etimo.it). The Estonian *maailm*, literally 'earth-heaven', refers to the being-together of the dark and opaque earth and the light and transparent heaven (sky, atmosphere) (http://heli.er.ee/helid/970321.mp3, in Estonian; Metsmägi, Sendrik & Soosaar, 2012, p. 91). This understanding of earth correlates with Heidegger's as expressed in (Dreyfus, 1993, p. 300).

[10] 'Ergrenzung des zum Stand Gebrachten'.

his understanding, by pushing the limits of world ever further into wilderness, bringing ever more of the wilderness forth into light and to standstill, subsuming it thus under his understanding, dominion and administration.

In order to better understand the words related to the stem 'berg' (*e.g.* 'bergen', 'verbergen', 'entbergen', 'Gebirge'), let us look into their history. 'Berg' and 'bergen' stem from the hypothetical Indo-Germanic parent language and can be related to each other, whereas Grimm and Grimm (1966) claim 'berg' to stem from 'bergen'. 'Bergen' means etymologically 'keep, maintain, preserve' (*e.g.* grain, foodstuff) (Kluge, 1989) and 'bring into a firm place (*e.g.* into a tower), bring to a mountain, to rescue, to salvage' (Grimm & Grimm, 1966; Auberle, 2001; Paul, 1992); 'berg' means 'high, rising higher of the plane, raised', and also 'sublime, exalted'. Mountains were seen as firm, secure places, as rescue, from which 'Burg' with the same meaning stems, also 'rescue for the truth from appearing'[11] (Grimm & Grimm, 1966, pp. 1503, 1505). This originates from warfare, from hiding troops behind mountains to conceal one's military might from the enemy, to face him unexpectedly, to bring him into stand(still) (Auberle 2001). Here one can notice associations that appear between these two meanings —'mountain' and 'maintain'— as relevant in the current context. I consider three of them in the following.

Firstly, as will be seen in Merchant's explications about understanding Earth as the nourishing mother, the Earth maintains her fruits (*e.g.* metals and ores), keeps them firmly ripening and ripened in her womb, in mountains. As the first mining activities took place in mountains (Kluge, 1989, p. 75, entry word 'Bergbau', or 'mining'), they came to be cognised as the womb of the Earth. Secondly, crops and other reserves were gathered into heaps resembling mountains according to their shape, those were also called 'berg' (Grimm & Grimm, 1966), and conceal and keep

[11] 'hinter dem berge halten'.

that what is in and behind them. And thirdly, keeping the truth in concealment behind the mountain harmonises with Heidegger's understanding of truth as *aletheia*, and facing the enemy to bring him to standstill from behind a mountain with his understanding of being as quarrel, as mutual bringing into limits with the brought-to-the-fore, bringing to standstill and to appearance.[12]

Let me bring evidence of the import of 'bergen' in Heidegger's text: what are the relevant words, and why they matter. Concisely, the substantial words related to 'berg' —'salvage, mountain', and 'bergbau'— mining, in Heidegger's text, are the following:

- *bergen* – to save, salvage or (literally) to bring (on)to a mountain
- *verbergen* – to hide, or to keep in or behind mountain
- *entbergen* (this one is contrived) – to open, to bring out of concealment, or bring out of or from behind a mountain
- *Verborgenheit* – concealment or being in or behind a mountain
- *Unverborgenheit* – unconcealment or being open, in light, outcropped
- *zutage fördern* – to quarry, literally to bring into daylight
- *herausfördern* – to extract or haul something out
- *verbauen* – to work a mine without loss, or obstruct (also through mining)
- *Gebirg* – the gathering of the salvaged, concealed, literally a mountain range
- *Gestell* – base frame, rack, support

[12] This conception of truth as quarrel probably has its roots in Ancient Greek conception of the ground (*ἀρχή – archê*) of being as lying in the mutual countering and balancing between love and strife (Kelsen, 1939/1940, p. 90). Also Heidegger, 1980; Brogan, 2005, p. 50

There will be other expressions that harmonise with the eco-feminist account that I will identify in the following paragraphs.

I especially emphasise Heidegger's expressions in relation to mountains and mining for two reasons. Firstly, there is a remarkably important role in relation to their content for words whose stem —*berg*— would be translated as 'mountain' and to words relating to mining. Sometimes in ways in which their meanings are usually not understood anymore, even though they could be understood as such some centuries ago. There are other ways to express the same meanings in German. This is why I suggest that his choice is not "random". Secondly, the historical link between science and technology that Heidegger refers to, as it seems to me and as I will show on the basis of Merchant's eco-feminist account of technical development, is influenced by the relation of humans to nature, or man to earth, evolvement of this relation and its reflection in the mental-spiritual and activity-related world. Furthermore, Seubold (1986, pp. 35–36) finds the essence of technology to be inherently related to the relation between man and earth: as technology mediates man and earth, helping man to make the earth usable and to process her for himself, then more technical methods engender a farther-from-earth disposition in man. One can also say: technology is the mutual limiting of man and nature (*φύσις*[13]), where they claim and individuate themselves by trying each other out: man on his part by rearranging nature into technical artefacts, nature on her part by dictating how she can be rearranged and by disobeying the prescribed aims of man's rearrangements. Hence, I try to identify a break point that introduced such a substantial difference between the modern and ancient technologies that Heidegger focuses on.

[13] The Greek *φύσις* (*fysis*) has a slightly different connotation —it is what comes forth out of itself, has its ground in itself, in contrast to artefacts that have their ground (effectuator) outside of them.

The main characteristics of modern technology that discerns it from the ancient one is said to be *Gestell*[14] (enframing) which is the essence of science and the ontological (not ontic[15]) structure of the contemporary world (Seubold, 1986, p. 111), challenging man to regard the world, including nature, as a *Bestand*[16] (a standing-reserve). This challenging is due to the following three important aspects of 'Bestand' that the enframing enforces as essential traits of the techno-scientific world picture. Firstly, as 'standing', it means something stable, brought to stand(still) and thus secured in its state. This indicates order, cognitive transparency and manageability. Secondly, as 'reserve' or 'inventory', it is something that can be expressed in quantitative terms, something measurable and calculable. Thirdly, it 'stands' at human disposal and discretion.[17] This kind of thinking was not that prevalent in earlier technologies as I will indicate in the following paragraphs. I will interpret *Gestell* in the framework of mining as an activity-related mechanism in service of extraction, resulting from the commercial-capitalist disposition to see earth as *Bestand*, and engendering and perpetuating the techno-scientific disposition to see nature as a mere stock of supplies also in theoretical and mental senses (in theory and in worldview or spirit), rendering any ideas of sanctity or emotional worth of the earth and landscapes obsolete.

[14] Gestell: base frame, frame, framework, mount, rack, shelf, stage, stand, support.

[15] Meaning that it is not the inherent structure of the world itself but what human takes to be its structure.

[16] Bestand: inventory, population, stock, asset, book of business, constancy, continuance, crop, stability, supplies. Words which are underlined have the most relevant meanings to the context.

[17] Glazebrook's interpretation of *Gestell* also hints at this aspect: "a way of revealing things that sets them up as a standing reserve of *resources available for human disposal*" (Glazebrook, 2000, p. 113; my italics).

The relation of (technical) cognition to mining: an eco-philosophical analysis

Heidegger describes technology (*τέχνη - techne*) as bringing the truth forth out of concealment[18] (Heidegger 1954/1959a, p. 19). Together with *episteme*, it is a way of cognition (*Erkennen*): capturing something; "cognition gives explanation [or opening, or making available, or outcrop] (*Aufschluss*) (p. 21)." Technology brings being forth through a work (*das Werk*) —it is skill to set being into a work, thereby bringing it to stand(still) (Heidegger, 1999, p. 204; 1966, p. 122), or open it for understanding, cognition and disposition. Man and truth (or being) mutually limit and set boundaries to each other. Being, for Greeks, was *φύσις* —what underlies its own change (Glazebrook, 2000, p. 99), hence takes active part in unconcealing the truth and the mutual bounding. Taking into account Heidegger's understanding 1) of thinking as a way of disclosing different views before "getting there" and gathers[19] the views together, and 2) of what is traditionally called *causa efficiens*[20] that sets them into the fore in imagination, to bring them into sight in reality as a complete (technical) thing, I see here the following association. This *causa efficiens*, for example the silversmith, is on a way of technical thinking which discloses different views to him of the artefact he intends to bring forth. This way can also already be that of smithing, where the initially imagined thing changes, due to contingent factors, or because of the way the material, form, or other discloses (*entbirgt*) itself: the thing can appear once this way, once another way (Heidegger, 1954/1959a, p. 21). Particularly, the material worked with (the *causa materialis*) as the "cause" of the artefact that originates in

[18] *Entbergen*, 'aus Verborgenheit her in die Unverborgenheit vor'.

[19] *legein*, *lesen*

[20] Ground, in Greek *αρχή*, arché – that which gathers the other three "causes" (better: occasionings, Greek *aitia* - debts): *causa materialis – ὑλη*, *causa formalis – μορφή* or *εἶδος*, *causa finalis – τέλος*, together in thinking.

nature opens its secrets, bringing its specific idiosyncrasies out of concealment as the smith works with the matter. The silversmith must be attentive and adapt to the situation, for example by changing the form or the matter of the final product.

Contemporary technology also brings forth, but not from behind a mountain, rather from within a mountain: it extracts and unearths (*herausfördern, zutage fördern*). It does not seek different views, it does not adapt to nature, but forces a mountain to open itself (*erschliessen*), it exposes nature (*herausstellen*). It thus does not let nature guide it, but rather guides itself through nature and secures this guiding with an enframing, such as a rack (*Gestell*) in mine shafts and other necessary constructions (material enframing), which enables the optimal and secure unearthing and processing of the contents of a mountain. In another sense, it does let nature guide its conception as composition or reserve of natural resources. The mountain thus becomes for man a strike which is opened (*aufschliessen*) and an important parameter of which is now the supply of its stock (*Bestand*), as it must be worthwhile to set the enframing. At the same time, by dump-hills (*Berg*) and by mining constructions (*verbauen*), this enframing closes up or obstructs previous production, which ran on the ways of gathering. As this kind of production is not practiced anymore, this way of unconcealment disappears.

Based on several sources, Carolyn Merchant (1983) describes an antiquated understanding of the Earth as a nurturing mother, from whom everything on her has been born, both animate and inanimate, and that what is in her are the fruits of her womb and entrails, ripening in her. The Earth was imagined as a human-like organism, which has a circulation system (streams, seas) and several functions characteristic to organisms (breathing, perspiration, metabolism). Mining "natural resources" (minerals, ores) was imagined as cutting open the womb or entrails of mother Earth. The Earth bestows on her surface what she wants to allow man to use, and keeps in herself what she does not want to allow man

to use.[21] Such an understanding entails a moral attitude as well: the Earth as a mother, as the bearer, nurturer and keeper of life is sacred, she must be honoured; mining metals and minerals out of her is in violation of her sacredness (that she avenges, for example in the form of earthquakes), hence an inadmissible activity.

Such an attitude still endured during the Renaissance, but the growing interests of the mining industry in the conditions of commercial revolution in the 16th century facilitated a new conception of the Earth and of nature. Hence Merchant describes, based on Adams, Agricola and others, the conflict of old and new conceptions. The new conceptions aimed at suggesting that the Earth is not a benevolent nurturing mother, but a wicked stepmother who conceals from man resources useful for him, and that the damage resulting from mining (like environmental pollution and destruction) enables these to be exploited advantageously (one can, for example, cultivate fields in areas where forests have been cut down for metal smelting, and construction materials lost in the form of wood can be indemnified by the income from mining). Moreover, the moral decline that the new conception brought with it spoke in favour of the old view: metals evoked greed and lust, drive brutality and violence, polluting the human soul like mining pollutes the Earth's womb. At the same time, mining activity was regarded as changing the Earth: instead of being a nurturing mother, she indiscriminately bore monsters into life and passively received their violence (pp. 424-425; Merchant refers to Spenser, 1758). By strengthening of new values (the growth of human well-being with exploitation of natural resources) contrariness toward technical study and exploration of the Earth decreased.

[21] This material consideration and treatment parallels mental consideration, held for example by Socrates (who can be regarded as a shaman, see De Crescenzo, 2007, Part 2: Ch. 1) that one should rather involve in ethics as human affairs than in physics, because the Gods hide from humans what they do not want them to know (Pelseneer, 1949, p. 40).

Although Merchant recognises that the mining of resources had been, from time to time, carried through with weaker moral sanctions already earlier, the dominant attitude was, however, honouring the Earth as an organism. Consequently, the activity of mining and processing of metals was regarded with greater attentiveness: they were bound with special rites of purity, special power was assigned to smith-work and -tools. I think, as an example about similar attitudes, mining practices of Celts could be looked at.[22] They honoured the sites where they extracted rocks or ores from inside the Earth as sacred, bound them with spirits or gods of the Earth and donated to them for their gifts.[23] This could be compared to Heidegger's 'way of thinking': the attention that was focused on opening the Earth's womb for human well-being and on exploiting her riches to create things is a way of thinking wherein senses must be pure and, in veneration, notice that which is concealed (in the mountain), the bringing forth of it, and things from it.[24]

In contrast to this view, as Merchant recounts, the commercial turn brought along a disposition according to which Earth must be profitable in the form of richness, glory, technical or military success. A conceptual change took place: Earth and what was born from her were not an animate organism anymore, they became understood in terms of expenses and incomes. In my

[22] The example told by Frank Suttner on an excursion concerning sacred sites of Aachen in spring 2012.

[23] I interpret this as exemplifying Heidegger's (1954/1959c) conception of *Ding*, '*thing*', as a gathering site for the Fourfold (*Geviert*): Earth and Sky, Mortals and Divinities. The Earth, or places, particularly the mining sites were for Celts such kinds of 'things', gathering sites including the Divine, not plain reserves of resources. Furthermore, this thankfulness towards those sites may evince of "personification" of the Earth. She may have her own *telos* (end), but nonetheless she is so generous as to donate to humans from the fruits of her womb.

[24] Things were dealt with concernfully, see Glazebrook (2000, p. 109) who includes "the context of equipmentality and ['things'] involvement" into the constitutions of things in concernful dealings, contrasting it to the theoretical attitude, where "such involvement does not belong to beings."

Heidegger-inspired reading of Merchant, they were to be measured and calculated, that is to say that Earth and Earth's womb and bowels had turned into stock, a standing-reserve, which was to be profited from and the supply of which was to be monitored.[25] In accordance with this, mining, setting of landscape and nature or rebuilding it (or even obstructing it) became admissible in such a way that profitable resources could be extracted. This at once ended the previous ways of dealing, as they cannot be commercially evaluated.

As I see Heidegger's point, technology as relation to earth and cognition of the world thus indeed has changed as to what and how it reveals: previous technology focused on concrete 'thingness' and the interlocking of things with the overall entirety of nature and society. The rituals related to mining and smithing are an indication of this relatedness. Things gathered in them the steps by which they were created. Each step, in its own way, brought the thing into being, or rather, the taker of those steps gathered them into a thing. By exploring what is, that which unconceals itself disposes this exploring mind and thereby shapes it. This, in turn, shapes the way the explorer's mind creates the path of exploration and thus the world in terms of how and what will be unconcealed. This is how I understand Heidegger's expressions:

> That which primordially unfolds the mountains into mountain ranges and pervades them in their folded contiguity is the gathering that we call *Ge*birg [mountain chain].
>
> That original gathering from which unfold the ways in which we have feelings of one kind or another we name *Ge*müt [disposition]. (Heidegger, 1977, p. 19)

[25] Glazebrook (2000, p. 113) expresses a similar understanding of the meaning of technological *Gestell*: nature is set upon "to unlock and expose its energy for stockpiling."

> Was die Berge ursprünglich zu Bergzügen entfaltet und sie in ihrem gefalteten Beisammen durchzieht, ist das Versammelnde, das wir Gebirg nennen.
>
> Wir nennen jenes ursprünglich Versammelnde, daraus sich die Weisen entfalten, nach denen uns so und so zumute ist, das Gemüt. (Heidegger, 1954/1959a, p. 27)

I perceive here certain allusions: wandering the length and breadth (*durchziehen*) of mountains, the mountain range opens itself to the wanderer, displays its details (*entfaltet*) and sets the disposition of the wanderer. Although the wanderer has a predetermined destination, he lets himself be guided by the mountains on mountain paths, where a new world opens itself behind each mountain and affects the wanderer's further journey. To translate this story of a mountain into the language of *techne*, we should imagine a thinker or a craftsman concernfully pondering upon the matter that he is working with —the matter, coming out of the dark, concealing earth,[26] that is yet to be cognised— attentively groping for its being to unconceal itself, bringing the end result forth as the matter's idiosyncrasies allow.

In contrast, in my Merchant-inspired reading of Heidegger, mining does not let itself be guided by mountains to find the truth hiding on the other side. On the contrary, it guides itself through the mountain, securing its way with supports and frames or the opening with outright outcropping, whereby the earth opens itself up and comes to be handled as a reserve of resources in measurable veins and seams. So the relation of cognition is no longer the relation between a human being as the ground and a thing's coming into being in the mutual hearing of man and nature, but rather something like the relation between a storekeeper on one side, and a stand of stock on the other: Earth is seen not as a being with her own moral, but in the technological enframing as

[26] See also Heidegger (1980).

a composite of mere resources for exploitation with the help of technical enframings. The same applies to technologies other than mining, using other natural resources than those in the bosom of the earth: contemporary technology abstracts from things, both raw materials and their finished products, and generalises objects into abstract relations between reserve parts which are detached from their original context and which have no end of their own. Matter is for it a mere material, expected to be always isomorphic, to secure certainty in results of predetermined homogeneous shaping. The product is a mere exhaustible and replaceable result, the need for constant replacing keeps the industry alive.[27]

Contemporary science and technology as ways of studying nature: an eco-feminist approach

The preconditions, described in the previous section, for relations between cognition of nature on one hand, and applying technology on the other hand, arising from social practices, guide the way to examining relations between technology and scientific theory. One of the conditions for the rise of such practices like contemporary science and technology is a change in attitude towards nature and the Earth as treated in the previous section: where she comes to be regarded as something that can be divided into reserve parts and arranged as an order (*bestellen*). In this section I consider more closely the acting of science and technology as bringers forth of nature in the form of division into parts, corresponding to the enframing. Inspired by Merchant's ideas, I will specify the relationship between man and nature, as it appears in the practices of science and technology. Whereas, in the previous

[27] Feenberg (1999) criticises Heidegger's conception of and negative attitude to technology for its generalising essentialism and determinism, ignoring positive roles of technology in life-world and social influence on its development. However, for the considerable relevance and importance of this criticism it must be addressed more thoroughly in a separate paper.

section, the guiding idea was the Earth as the mother whose child is man, here nature appears as a female and man is imaged as a male who tries to seduce her.

Heidegger discerns ways in which that what, as I express it, a mountain conceals from view is brought into unconcealment, or how cognition of it is built up. He regards previous technology as an activity which helps nature to appear such as she would not appear by herself, gathering her capacities into an aimed thing. Contemporary technology is regarded as challenging nature, ordering (*Bestellung*) her for predefined functions to appear in a given enframing. The 'ordering' directly grasps three essential aspects for this context, parallel to *Bestand*. Firstly, that something is arranged in an orderly manner like on a list of goods with their quantities and prices. Secondly, that it is requested from the provider. Thirdly, it assumes *Bestand* or a kind of stock to order from. While in mining, the earth is ordered in such a way that natural resources are quarried and delivered as a stock, in technology, nature is ordered in such a way that she appears as a composition of (standing) reserves of forces. According to Heidegger, nature herself requires such an ordering from man by constantly concealing herself from him:

> Thus when man, investigating, observing, ensnares nature as an area of his own conceiving, he has already been claimed by a way of revealing that challenges him to approach nature as an object of research, until even the object disappears into the objectlessness of standing-reserve. (Heidegger, 1977, p. 19)

> Wenn also der Mensch forschend, betrachtend der Natur als einem Bezirk seines Vorstellens nachstellt, dann ist er bereits von einer Weise der Entbergung beansprucht, die ihn herausfordert, der Natur als einen Gegenstand der Forschung anzugehen, bis auch der Gegenstand in das Gegenstandlose des Bestandes verschwindet. (Heidegger, 1954/1959a, p. 26)

Let us consider this ordering in technology and science, and how the way of revealing challenges man to be ordered. As to

the first aforementioned aspect, I understand this citation as follows: man is after (*nachstellt*) nature as his study area and lays into her (*angeht*) as into an adversary and regulates her. As such, technology rules nature, harnessing and enframing her. Moreover, nature as an adversary is reduced to a composition of controllable and measurable forces that in practical matters easily obeys human management. The objectlessness I interpret in two senses pertaining to contemporary technology. Firstly, in engineering practice it is not individual objects that are essential as triggers of causal reactions through the powers they possess, but instead as representatives of forces that in themselves are not objects but undelimited theoretically construed entities. Secondly, in engineering theory, there are no objects but only mathematically defined forces and other quantities, and their relations (the so-called laws of physics) that play a role.

Similar attacking and tracing enframing is applied in science (Heidegger, 1954/1959a, p. 29): physics sets nature in an experiment in order to study if and how she answers to such a setting. In an experiment, physics gathers forces into a reliable stock, it regulates them appropriately. Forces must be calculable. As in contemporary technology concrete objectness is not essential, let alone thingness —a thing with its occasioning relations in the entirety of being— that is even abolished. Neither concrete occasioning relations nor material singularity are essential in physics. Rather, causality fades out into a provoked appearing of supplies (of forces), deploying one after another or simultaneously (p. 30). By this, (techno-)science, particularly experimentation as the activity of bringing nature into the (mathematical) form of the scientific enframing, enacts violence to nature, making beings observable as what they are (Glazebrook, 1998).

As Trish Glazebrook (2000) says, modern science deprives nature of its own end (*telos*), to superimpose human-determined ends upon her, that will be achieved through technical treatment

of nature.[28] Things in themselves —'as what they are'— are, therefore, inherently nothings in this scientific world picture, according to Heidegger. This is stated as one way how things, including human, can be inherently meaningless, to be optimised and exploited as mere resources (Thomson, 2005, p. 72). But, this way of being, I surmise, is specific to the unconcealment involved in the contemporary science and technology, to the *Gestell*.

However, turning to the second question, *Gestell* is not a human doing[29], something that he makes up and imposes upon nature. Rather, man is challenged by nature into *Gestell*, he already finds himself inexorably forced into it. I see it as the dominating technical-social-mental situation that determines one's ways of acting, thinking and perception (also Dreyfus, 1993, p. 295). As others have expressed: it is the clearing that creates man (*Dasein*), and the *Bestand* that uses man, not the other way around (pp. 296, 306). So, *Gestell* and *Bestand* as the truth of contemporary techno-science, both about nature as well as about human, need *Dasein* as the locus of *Entbergen*, in order to be something rather than nothing, even if this being is as mere resources (p. 307); also Holland and Huntington (2001, p. 25). I take this to mean, on the one hand, that if man wants to survive in society, he must fit in and participate in its functionalities, in driving the mechanisms of survival rooted in the society and its environs —the technological functions use man to drive them. On the other hand, the inexorability of contemporary technology stems onticly from its ubiquity and ontologically from the dominating world picture: the world and nature are defined in technical terms, expressed as impossibility of understanding them unless one can model or measure or manipulate them.[30] Thence, one has an ever-scanter possibility to

[28] John Lunstroth (2009) says: in 11th-19th centuries, nature was claimed to have no moral, no essence.

[29] Thanks to Prof. Matjus for the explanations.

[30] *e.g.* Bacon, Kepler and others, referred to in Hand, 2004, p. 4–5; Feynman,

come to nature without human theoretical-technical mediation.[31] So, *Gestell* as the prevailing ontology uses man to drive it forth.

Nonetheless, just like in mining, so also in technology and scientific experiment, not everything that occurs depends solely on man:

> Since man drives technology forward, he takes part in ordering as a way of revealing. But the unconcealment itself, within which ordering unfolds, is never a human handiwork, any more than is the realm through which man is already passing every time he as a subject relates to an object. (Heidegger, 1977 p. 18)

> Indem der Mensch die Technik betreibt, nimmt er am Bestellen als einer Weise des Entbergens teil. Allein die Unverborgenheit selbst, innerhalb deren sich das Bestellen entfaltet, ist niemals ein menschliches Gemächte, so wenig wie der Bereich, den der Mensch jederzeit schon durchgeht, wenn er als Subjekt sich auf ein Objekt bezieht. (Heidegger, 1954/1959a, p. 26)

Here one can surmise an allusion to the stance that man is the measure of all things: man takes himself to refer to nature ("he as a subject relates to an object"). That is, man measures everything on the basis of himself, in his enframing, and he acquires the illusion as if nature indeed had the shape endowed by this enframing. Nevertheless, Heidegger points out that exactly this stance, which stems from the delusion that nature has entirely the form of the enframing (a non-corporeal composition of abstract forces), is the greatest danger to human nature. Man comes to be cognised in the same terms —as plain resources. In light of the above discussion, the totalising urge of this ontology threatens to render everything to nothings and conceal all other truths. Moreover, the claim that nature challenges man to approach her —and thereby woman, and

1965, p. 58; Heidegger, 1954/1959b, p. 58, quoting Max Planck.

[31] Also Heisenberg, 1958, and Feenberg, 1999, p. 223.

human being in general— in an objectifying and finally nullifying manner, is like a license for immoral conduct.

Here, I think, Heidegger's vocabulary allows us to once again see associations with Merchant's treatment of attitudes towards nature and science in the dawn of contemporary science. When it was for man already morally admissible to invade into mother Earth in order to get at the metals and minerals concealed in her, then the human power over nature had been instituted. Merchant refers mainly to Bacon as the advocate and expander of the new moral attitude from technical to scientific activities (Merchant, 1983): man was the ruler of nature, until he fell into the original sin —of which woman was first guilty— and was cast out of the Garden of Eden, thus losing his dominion over nature. Science's task is to re-establish this dominion, and this is only possible by invading into her womb, mining into her and shaping her as though on an anvil. Nature is imaged as a woman and re-establishing power over her as (violently) seducing her, penetrating her dark plots and caves, to uncover her secrets. Contemporary science was intended to get to know nature, then to exploit this knowledge in harnessing her to serve man in "conquer[ing] and subdu[ing]" her, even raping and torturing her as though she was under inquisition. In scientific experiment, with the help of mechanical arts, human knowledge must help him harness his dominion over nature, dissect her and shape the nature through man's hand.[32] Merchant calls this approach sexual imagination.

Merchant's interpretation can be disagreed with, for example, Alan Soble (2003) claims that Bacon's allegories have been misinterpreted. However, the allegories of gender and sexuality did arguably have an important impact on society at those times in deprecating femininity and boosting masculinity into ground

[32] Also Heisenberg likens scientific-technical research and the brought-forth thereby to cutting open a human body (for example in a surgical operation): both can incite estranging (Heisenberg, 1955, p. 14).

principles of science and technology (Scharff & Dusek, 2003, p. 414). In this light, Heidegger's treatment of being after (*nachstellen*) and organising nature and laying into her (*angehen*) suggest to me a rather good fit with the masculine understanding of science that traces nature as a female being and tries to conquer her. I perceive that both the practical handling of nature and of the Earth (mining, producing), as well as theoretical examination, is forcing her to open herself through a stand or enframing (mechanical arts), to disclose her secrets. That which is disclosed appears to sciences in an abstracted form, as a reserve that can be subdued to human counting, accounting and will. In other words, to calculate, model and exploit in order to reveal new secrets by further shaping nature.

In both Heidegger's and Merchant's treatments I find two further aspects to be important. Firstly, man has been forced or challenged by nature to examine her provocatively, compellingly. This can be gathered in Merchant's presentation of the story of the Garden of Eden: female-nature lured male-human into a state where he does not dominate nature anymore, but is rather dominated by her; in Heidegger's words: man is in unconcealment for nature, out of salvage. Secondly, that which appears in the course of scientific(-experimental) examination is only partly within human power. This aspect follows from the requirement that, in order to dominate nature, one must know her secrets, because only by knowing nature, by harnessing her own laws, is it possible to dominate her. Even if man rules nature technically and, in Bacon's account only then, nature discloses herself and only herself, not something created by man, not human power (*Gemächte*).

In such a feministic context I am also tempted to ask about the abovementioned word: *Gemächte*. Did Heidegger purposefully use this word? In Estonian translation the word 'power' is used in its place, which could also be 'Macht' in German. In English translation the word is 'handiwork', which in German would be 'Handwerk' or 'Geschöpf'. That Heidegger has willingly chosen a word related to (primarily male) reproductive potency to express

human capacities, is also suspected by Johannes Fritsche, who analyses the use of gender notions 'Geschlecht' and 'Gemächte' in Heidegger's works (Fritsche, 1999, pp. 188-194). Merchant's discussion allows us to surmise that the image of sexual dominion and potency has indeed, more or less consciously, shaped the essence of contemporary science and technology, which raises the question of whether or not Heidegger can be interpreted as having also perceived of the nature of technology and its aimed effect in a similar way. This would be in accordance with his attitude towards contemporary technology, while he explicitly and acutely expresses what implicitly resides in techno-scientific worldview —the male dominance and suppression of female— and thereby denies the legitimacy of this worldview.

Conclusion. The world of contemporary technology

The switch from the metaphor of Earth as a nurturing mother to the one of Earth as a whore submissive to human lust, greed and discretion, harmonises with how Glazebrook (2000) recounts Heidegger to construe the change in the conception of nature under the metaphysics of contemporary science and technology, hinted to above. In the Aristotelian conception, both artefacts as well as natural things were assigned all four occasionings: the ground, the matter, the form and the end. Hence nature was seen as having her own end independently of human. However, science abolished the end of nature, the teleological conception of nature was replaced by a theoretical one that was defined through mathematical homogeneous dimensions like space and time, in which nature becomes a set of numbers through measurement, experimentation and calculation (Heidegger, 1954/1959a, b; Glazebrook, 1998; Heisenberg, 1958). This is violence and an assault to nature (Glazebrook, 1998) because man is not listening to her anymore, but predefining and pre-setting her according to his discretion and with a claim to a mathematical-numerical truth about her. Instead of concernfully hearing and dealing with

nature man now keeps her under his scrutiny and observation. In accordance with the ideas recounted by Merchant, I would express it thus: nature has become a public woman bereft of rights to her own being, privacy and will. Her secrets are to be spied out for the whole of mankind to gaze and use to his avail. A technological view of the world, and of Earth, reduces them to resources (also Bunge, 2003), to be calculated in terms of cost and profit, gained in mass stocks and submitted to human will and agency. This is another assault, just like reducing a woman —a human being— to mere resource of sexual satisfaction to be gained at a bargain flat-rate.[33] This reduction answers the *Gestell*-ontology and *Bestand*-ontics of techno-science.

Entbergen, as opening the Earth changes the world. Man wants security in satisfying his needs and wants, and Earth pays for man's salvage. Man believes to be secure when he has made earth into the world, and the world into a system that he can manage and rearrange. This belief disagrees with what Heidegger takes onticly to be the case: that it is not in man's power to determine how the world unconceals itself. He stresses the epistemic insecurity due to ontic opacity and darkness of earth even more strongly, contrasting earth to material as a technological notion (Heidegger, 1980). The truth remains concealed because man often does not see anything other than what comes forth in *Gestell*. It also disagrees with man's own being: where he imagines dominion over nature as a virtue of his techno-scientific enframing, which he believes to reveal the truth about nature. He himself is stuck in this enframing, taking on its shape: he sees himself as a calculable, disposable resource. As science has "disenchanted" nature, it has "disenchanted" human as well, having allegedly quarried out their wilderness and

[33] Such an attitude is implicitly evidenced and explicitly expressed in the documentary film "Sex: Made in Germany" by Tina Soliman and Sonia Kennebeck (2013), DokuKinoDE, at 23:56 and 42:30.

demonstrated their conceptualisability, thus calculating away all concerns and taboos pertaining to them.

To recap the point made about mountains, mining and *Entbergen*: mountains and mining stand as icons of the unknown and making available for cognition. That is to say, they are an icon of *Entbergen*, bringing forth out of concealment. The parallels between mining and scientific research can be drawn as follows:

	Mining	Scientific Research
The Bestand, concealed and to be brought forth	Natural resources in the bosom of the Earth	Laws of nature
The manner of unconcealment, of realising the Entbergen	Digging into the mountain and bringing out its contents	Setting up and running an experimental observation
The Gestell, securing the Entbergen	Racks and stands, or baggers and outcrops nowadays	Theoretical-mathematical plan of the experiment and the apparatus for its realisation
The aim of Entbergen	Making available for exploitation	Refining and manipulating
Method of administration	Counting stocks	Measurement and calculation

This is an analytic representation in Heideggerian terms of the iconic role of mining, stated by scholars of early science, as quoted above. Both mining and (experimental) science apply particular technological devices, but more importantly, they presuppose (particularly contemporary mining) and perpetuate the technological world picture according to which their subject matter, the Earth and nature respectively, are there for man to outcrop, measure, model and exploit. In an organismic world picture where Earth is seen as the mother of everything on it, mining is the most intimate kind of violation of her by technology. Surpassing the aversion toward this violation constitutes the most straightforward sign of the normalisation of a technological stance that regards the reality

as 'the sum total of resources' (Bunge, 2003, p. 175). Taking Earth as a metaphor for matter in general, what counts for contemporary mining practices in contrast to the ancient ones will, upon other necessary translations, count for other contemporary technologies in contrast to ancient ones.

There are problems related to the world pictures addressed here that could not be raised. One is the whole topic of femininity and masculinity, their social images and relations. When female is linked to passivity and motherhood, male to proactivity and hunting, are we not oppressively attributing characteristics to them, reducing them to mere resources, and thereby doing violence to them? In a similar vein, the silversmith reduces silver to a mere material. A village commune reduces forest to building material, town inhabitants reduce a river to a source of fish. Hence the earlier world view was not more ecological. For an ecological world view to emerge, nature must claim man in a more manifold mode: namely, so that the complexities of an enframing of her "standing-reserves" comes forth more sharply, perhaps irretrievably.

Another question is how to solve the problem of totalising technological world picture that renders everything to mere resources? Heidegger (1954/1959a) thinks that art is the answer. Perhaps Borgmann (2005) is more convincing. He takes 'the thing' (*das Ding*) to be the answer. It is another kind of *Entbergen* than *Gestell*, inducing the concernful dealings that Glazebrook mentions, whereas art uses the earth as resources of material to be shaped. I also would side with her analysis of the deep-ecology-approach (Glazebrook, 2001). I consider both these fields of problems worth to be more thoroughly addressed in separate papers.

References

Agassi, J. (1956). *The Function of interpretations in physics.* Thesis, University of London

Auberle, A. (2001). *Herkunftswörterbuch*. Mannheim: Dudenverlag.

Bigwood, C. (2001). Sappho: The She-Greek Heidegger Forgot. In N. Holland & P. Huntington (Eds.) (pp. 165-195).

Borgmann, A. (2005). Technology. In Hubert L. Dreyfus & Mark A. Wrathall (Eds.), *A Companion to Heidegger* (pp. 420-432). Blackwell Publishing.

Brogan, W.A. (2005). *Heidegger and Aristotle. The Twofoldness of Being*. Albany: State University of New York Press.

Bunge, M. (2003). Philosophical inputs and outputs of technology. In R.C. Scharff & V. Dusek (Eds.) (pp. 172-181).

Chanter, T. (2001). The Problematic Normative Assumptions of Heidegger's Ontology. In N. Holland & P. Huntington (Eds.) (pp. 73-108).

De Crescenzo, L. (2007) *Geschichte der griechischen Philosophie* (audiobook). Zürich: Diogenes

Dreyfus, H. L. (1993). Heidegger on the connection between nihilism, art, technology, and politics. In Charles B. Guignon (Ed.), *The Cambridge Companion to Heidegger* (pp. 289-316). Cambridge: Cambridge University Pres.

Feenberg, A. (1999). *Questioning Technology*. London and New York: Routledge.

Feynman, R.P. (1965). *The Character of Physical Law*. London: British Broadcasting Corporation.

Fritsche, J. (1999). *Historical destiny and national socialism in Heidegger's* Being and Time. University of California Press. Available at: http://publishing.cdlib.org/ucpressebooks/view?docId=ft5k4006n2;brand=eschol

Gilbert, W. (1600). *De magnete, magnetisque corporibus, et de magno magnete tellure; Physiologia nova, plurimis & argumentis, & experimentis demonstrata*. London (English edition: *De magnete*, tr. P. Fleury Mottelay, New York, 1958).

Glazebrook, T. (1998). Heidegger on the experiment. *Philosophy Today: A Quarterly Survey of Trends and Research in Philosophy Directed to the Interests of Scholars and Teachers within the Christian Tradition, 42* (3), 250–261. Doi: 10.5840/philtoday199842326

Glazebrook, T. (2000). From *φύσις* to nature, *τέχνη* to technology: Heidegger on Aristotle, Galileo, and Newton. *The Southern Journal of Philosophy, 38* (1), 95–118. Available at: https://www.pdcnet.org/southernjphil/content/southernjphil_2000_0038_0001_0095_0118

Glazebrook, T. (2001). Heidegger and Ecofeminism. In N. Holland & P. Huntington, *Feminist Interpretations of Martin Heidegger* (Eds.) (pp. 221-251). University Park, PA: The Pennsylvania State University Press.

Grimm, J., & Grimm, W. (1966). *Deutsches Wörterbuch* (various issuers, lastly Leipzig).

Hand, D.J. (2004). *Measurement Theory and Practice. The World Through Quantification*. Oxford University Press.

Heidegger, M. (1954/1959a). Die Frage nach der Technik. In *Vortäge und Aufsätze* (pp. 13–44). Verlag Günther Neske Pfullingen.

Heidegger, M. (1954/1959b). Wissenschaft und Besinnung. In *Vortäge und Aufsätze* (pp. 45–70). Verlag Günther Neske Pfullingen.

Heidegger, M. (1954/1959c). Das Ding. In *Vortäge und Aufsätze* (pp. 163–185). Verlag Günther Neske Pfullingen.

Heidegger, M. (1966). *Einführung in die Metaphysik*. Max Niemeyer Verlag Tübingen.

Heidegger, M. (1977). *The question concerning technology and other essays* (Translated and with an Introduction by William Lovitt). New York and London: Harper & Row (also in R.C. Scharff & V. Dusek (Eds.) (2003, pp. 252–264), slightly edited).

Heidegger, M. (1980). Der Ursprung des Kunstwerkes. In *Holzwege* (6. Auflage, pp. 1-72). Frankfurt am Main: Vittorio Klostermann.

Heidegger, M. (1989). Küsimus tehnika järele (The question concerning technology) (in Estonian, translated by Ülo Matjus). *Akadeemia, 6,* 1195–1222.

Heidegger, M. (1999). *Sissejuhatus metafüüsikasse* (*Introduction into metaphysics*) (in Estonian).Translated by Ü. Matjus. Tartu: Ilmamaa.

Heisenberg, W. (1955). *Das Naturbild der heutigen Physik*. Hamburg: Rowohlts deutsche Enzyklopädie.

Heisenberg, W. (1958). The representation of nature in contemporary physics. *Daedalus, 87* (3), 95-108. Available at: https://www.jstor.org/stable/20026454?seq=2#page_scan_tab_contents

Henry, J. (2001). Animism and empiricism: Copernican physics and the origins of William Gilbert's experimental method. *Journal of the History of Ideas, 62* (1), 99–119. Doi: 10.2307/3654177

Holland, N. J. & Huntington, P. (Eds.) (2001). *Feminist Interpretations of Heidegger*. University Park, Pennsylvania: Pennsylvania University Press.

Kelsen, H. (1939/1940). Die Entstehung des Kausalgesetzes aus dem Vergeltungsprinzip. *Journal of Unified Science* (*Erkenntnis*), *8,* 69–130. Available at: https://www.jstor.org/stable/20010421?seq=1#page_scan_tab_contents

Kluge, F./Seebold, E. (1989). *Etymologisches Wörterbuch der deutschen Sprache*. Berlin, New York: Walter de Gruyter.

Lunstroth, J. (2009). Aping Political Science. *The American Journal of Bioethics, 9* (5), 15-17.

Matjus, Ü. (1989). Tehnika järele küsimise järel: Martin Heideggeri tõlkimisest (After questioning technology: on translating Heidegger) (in Estonian). *Akadeemia, 6,* 1222–1227.

Merchant, C. (1980). *The Death of Nature. Women, Ecology, and the Scientific Revolution*. New York: HarperCollins.

Merchant, C. (1983). Mining the Earth's womb. In J. Rothschild (Ed.) *Machina ex dea: Feminist perspectives on technology* (pp. 99–117). Oxford: Pergamon Press (abridged in R.C. Scharff & V. Dusek (Eds.) (2003, pp. 417–429).

Mets, Ave (2012). Some limitations of universal international law from a philosophical point of view. *Law, Innovation and Technology*, *4* (1), 85-106. Doi:org/10.5235/175799612800650635

Mets, Ave (2013). *Normativity of Sciencitific Laws.* Dissertation, University of Tartu. Available: http://dspace.ut.ee/handle/10062/31611

Metsmägi, I., Sedrik, M. & Soosaar, S.-E. (2012). Eesti etümoloogiasõnaraamat (Estonian etymological dictionary) (in Estonian). Tallinn: Eesti Keele Sihtasutus.

Paul, H. (1992). *Deutsches Wörterbuch*. Tübingen: Max Niemeyer Verlag.

Pelseneer, J. (1949). *L'évolution de la notion de phénomène physique des Primitifs à Bohr et Louis de Broglie; Leçons sur l'histoire de la pensée scientifique, professées à l'Université libre de Bruxelles* (*The evolution of the concept of physical phenomenon from the primitives to Bohr and Louis de Broglie; Lectures on the history of scientific thought held at the Université libre de Bruxelles*) (in French). Bruxelle, Liège: Desoer.

Scharff, R.C., & Dusek, V. (Eds.) (2003). *Philosophy of technology: The technological condition: An anthology*. Oxford: Blackwell Publishing.

Seubold, G. (1986). *Heideggers Analyse der neuzeitlichen Technik* (*Heidegger's analysis of contemporary technology*) (in German). Freiburg/München: Verlag Karl Alber.

Soble, A.G. (2003). In defence of Bacon. In R.C. Scharff, & V. Dusek (Eds.) (2003, pp. 451–466).

Spenser, E. (1758). *The faerie queene,* vol. 1 (edited by John Upton). London, 1590–1595.

Thomson, Ian D. (2005). *Heidegger on Ontotheology. Technology and the Politics of Education*. Cambridge: Cambridge University Press.

Vasmer, M./Trubachev, O.N. (1964-1973). *Этимологический словарь русского языка* (*Etymological dictionary of the Russian language*) (in Russian). Moskva: Progress. Available: http://etymolog.ruslang.ru/