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TECHNICAL UNIVERSITIES BEYOND MARKETIZATION:
EDUCATING THE VIRTUOUS ENGINEER

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Introduction

In academia and in the public media, a discussion is raging about the aims, the style of management and the ideological background of the university. This debate has spread to several countries, notably countries in which neoliberal models of governance are enforced in systems of higher education¹. As a result, several student protests have been initiated, as for example the protests in Amsterdam during which university buildings were occupied. Generally, these protests are initiated at classical universities, while engineering students at technical universities don't seem too eager to go protesting. As an oft-mentioned illustration of the assumed disconnected attitude of engineering students, it is recalled that students of Caltech protested during the student protests of 1968 that revolved around military service and the Vietnam War; but for quite a different reason: the cancellation of the TV series Star Trek. The dealings of the engineering sciences are said to be a long way off from political and societal concerns and engineers seem to occasionally embrace this idea.

However, there are good reasons to believe that even the Star Trek protests of '68 arose out of an ideological context (Keyser 2015). Even more pressing reasons can be found for arguing that the current debate that

revolves around the 'marketization' of the universities and the consequences of this trend for academic education is relevant for technical universities. It would be foolish to think that students of engineering sciences cannot or should not be involved in such political matters that concern the way their education is organised. As a contribution to the debate, I will focus on the specific status of marketization in the engineering sciences at technical universities, taking the Dutch technical universities as illustrative examples. In the argument, I will aim at countering the marketization paradigm at technical universities by juxtaposing the 'tuned' engineer with the idea of *bildung* of the virtuous engineer.

The marketization of technical universities

What is meant by the marketization of the technical university? To answer this question, I firstly need to address the origins of the engineering sciences, which are very different from the origins of sciences at the classical universities. Initially, the education of engineers emerged from two background conditions in the 18th and 19th centuries: a development from 'the shop to the school' (Lintsen 1993: 12) and developments in state building (Lintsen 1993: 23). The education of engineers moved from professional training (apprenticeship) in artisan shops to formal education that laid down the requirements for being an engineer. Moreover, the first instances of formal education for engineers were directly organized by the state, which trained engineers to be specialized in building military fortifications. Hence, engineering sciences have developed out of a context of professionalization and state interest, which culminated in the so-called 'polytechnic schools' (Reynolds 1992: 462).

Nonetheless, the engineering sciences have been transformed and put on an equal footing with the natural sciences and humanities. In the Netherlands, the academic status of the engineering sciences was fully recognized in 1986 when the three institutes for the engineering sciences in Delft, Eindhoven and Enschede were officially titled 'technical *universities*', and therefore elevated from the level of polytechnic school to university. Still, the technical universities are tightly connected to the professional sector.

In the Netherlands, they are far ahead of the classical universities in terms of ‘market valorisation’, indicating their success in deploying commercial activities out of their research (Leeuwen & Marc 2013). While acknowledging the differences in background conditions between technical universities and classical universities, I want to assess what has been the alleged impact of neoliberal governance and ‘marketization’ for the technical universities.

Henceforth, I will discuss the general problematization of marketization in universities. I distinguish three distinct aspects of the process of marketization, most of which originated from the rise of neoliberal ideas of governance initiated in the 1980s: the emergence of the knowledge economy, the rise of new public management, and the transformation of curricula. The first aspect, the emergence of the knowledge economy, refers to an increased interaction between businesses and universities in knowledge *production* at the backdrop of ideas about ‘knowledge capitalism’ (Peters 2013: 13). Knowledge is increasingly seen as a commodity that can be subjected to market forces in order to be made profitable. As such, the idea of the knowledge economy has led to the idea of *economic* knowledge, both in terms of academic results and of global competition (Levidow 2002: 2-3). Academic results are expected to be quantifiable and capable of being subjected to performance indicators. Global competition between universities, fuelled by the increasing importance of university and scholar rankings, revolves around attracting the most competent and productive students and researchers.

The second aspect of the process of marketization of universities is the rise of ‘new public management’. This type of management indicates an application of business management models on government or semi-government institutions. For the academic world, this involves a shift of the justification of the function of a university, moving from a ‘culture of open intellectual enquiry and debate’ to one with ‘an institutional stress on performativity’ (strategic planning, performance indicators, academic audits) (Olssen & Peters 2005: 313). As a consequence, a class of academic managers became part of the university organization, consisting of people responsible for the management, measurement and audit of academic output.

The third aspect of the marketization process entails a transformation of academic education, both structurally and content-wise. Structurally, education became organized in such a way that its outcomes can be better monetized, measured and audited. Although separate segments of a university’s organization remain responsible for the organization and financing of the curricula, the norms for their performance are strictly regulated by means of output-related criteria. Content-wise, individuals are increasingly assessed on their ‘skills’, which implies that curricula are deemed valuable only insofar as they deliver measurable skills that are explicitly separated from knowledge and understanding (Curren 2003: 564). Skills relate to pragmatic goals that are context-dependent as juxtaposed to the universality that is implied in the knowledge and understanding aimed at by universities. The impacts that these structural and content-wise changes have are best captured by the concept of ‘tuning’, with the aim of ‘producing graduates with relevant skills and dispositions to meet the demands of industry’ (Chan 2014: 15).

Opposing the ‘tuned’ engineer

Now that I have identified the three main aspects of the marketization of universities in general, I will assess to what extent these aspects can be called *problematic* for technical universities. First of all, strong traces of the above-mentioned aspects of marketization can be observed in the strategic plans of the three Dutch technical universities. Amongst the principal long-term objectives we find: the attraction of leading academic talents, creating business locations (TU Delft 2010), strengthening disciplinary excellence, securing fixed investment goals (TU/e 2011), taking societal and economic impacts as criteria for performance-indication and promoting valorisation activities (Universiteit Twente 2014). Hence, I tentatively argue that the marketization trends influencing the management of universities in general impact the management of technical universities as well; perhaps even more vividly.

As I discussed before, technical universities share a history and a societal embeddedness that differ from those of classical universities. The academ-

ic tradition on which classical universities are grounded, which can be traced to the scholastic age, revolves around a universalist idea of knowledge; as knowledge for truth's sake (Brody 2009: 8). Moreover, the classical concept of the university as it developed during the enlightenment was based according to Humboldt on the 'unity of research and teaching', without any necessary connection to the realm of praxis (Scharmer & Kaufer 2000). Though these original values of classical universities have certainly been put under pressure, they nonetheless are part of their history and position in society. Technical universities, on the contrary, are originally grounded in the interests of states and professions. As such, one could argue that a focus on interaction with businesses and state interests is more closely related to the idea of a technical university. Perhaps for this reason, technical universities in the Netherlands have generally spearheaded initiatives focused on valorisation of their knowledge: with as a striking example the focus of the University of Twente on creating an 'entrepreneurial university' as early as in 1987 (Kan 2011), when the first contours of neoliberal university management appeared.

Still, we need to critically assess the impact of marketization trends at technical universities. For the aspect of the emergence of the knowledge economy and economic knowledge, this seems to be a question of finding a right balance. Technical universities are originally involved in the application of the knowledge they produce, both in terms of human capital and academic output. However, a danger persists in excessively vesting economic interest in universities through a principle that Max Weber coined *technical reason* (Peters 2013: 12). Technical reason refers to the emergence of a paradigm in thinking as a result of the economization of knowledge. Because knowledge is increasingly translated into practice, applied to the human life world, a form of what Morozov designates as *solutionism* (Morozov 2013) arises. This translates into an ideology of seeing technological knowledge and its application as a form of domination over both nature and men (Hamilton 1991: 135). A dominance of such a way of thinking at universities can abstract from the human aspect of technologies: from the societal embeddedness of applications of technical knowledge. The second aspect of marketization of universities, the application of new management practices, strongly relates to the first. A cer-

tain set of managerial criteria that map the impact of the work of technical universities can be very beneficial, but an excessive use of such criteria can lead to what scholars of the Frankfurt School designated as the danger of *administrative reason* (Peters 2013: 12): an over-monitoring of processes leading to the loss of academic freedom and the imposition of substantial bureaucratic burdens.

I argue that the third aspect of the marketization of universities, the transformation of engineering education, is the most problematic aspect at technical universities. The focus on 'tuning' of the 'skills' of an engineer implies an application of the principles of technical and administrative reason on the *person* that is educated in the engineering sciences. That is, universities increasingly treat their students as an output-variable that needs to be adjusted, 'tuned', to the needs of administrative criteria and the paradigm of the knowledge economy. This leads to several problematic tendencies. First of all, a sole focus on skills empties curricula of their substance: it makes them fully dependent on pragmatic end-points that are themselves not part of the knowledge and understanding of the engineering sciences (Curren 2003: 565). Secondly, the 'tuning' of engineers directly impacts the societal, educational and personal expectations that are connected to the curricula. Engineers are expected to excel in their discipline *in a way* that makes them meet the demands of domain-specific professions. For example, a good mechanical engineer is deemed a good engineer inasmuch as his skills make him fit for serving the needs of the industry demanding mechanical engineers. This has moved the focus of educating a 'whole' engineer, expressing a holistic idea of an engineer who actively needs to embed his knowledge in society (Ruprecht 1999), to an engineer who is economized and made into a fragment of a designated process in the knowledge economy. Put bluntly, an engineer is not expected to oversee the impacts of his work in a broader societal setting, but rather to comply with administrative and technical rules by correctly ticking the boxes of the ethical requirements he is confronted with. Furthermore, neglecting the holistic idea of what it means to be an engineer in an educational setting causes failure in living up to the explicit goal of marketization at universities: namely, to *produce*, as the specific jargon frames it, proper engineers. Next to fragmented skills of *problem solving*, the skills required to *identify* challenges and societal contexts from which these

problems arise are just as important.

Taken together, I argue that the marketization at technical universities has led to a focus on the ‘tuned’ engineer, which has led to the failure of considering the holistic idea of an engineer as someone who not only solves problems but also identifies and justifies them out of a sense of societal embeddedness. In order to address this challenge, we need to try to answer the question: what *does* it mean to be a good engineer? In order to do so, I will invoke the idea of ‘Bildung’, framed in opposition to the marketization of engineers.

‘Bildung’ of the virtuous engineer

I argue that in order to counter the problematic tendencies of marketization at technical universities, ideas of what it means to be a good, or rather ‘virtuous’ engineer need to be brought to the table. As such, it is not the skills of a person (end-points that fit within the marketization paradigm) but the person herself – her character – that ought to be the aim of education at technical universities. The idea of a cultivation of ‘character’ is not to be confused with cultivating a psychological disposition of an individual, but refers instead to cultivating a character as in a narrative, as someone endowed with ethical qualities operating in a *cultural* setting². A vested idea that is grounded on the cultivation of the individual is captured by the originally German idea of ‘bildung’. Bildung strongly connotes with the German word *bauen* (to construct) (Voskuhl 2014) and as such can be interpreted as the construction of the self, the cultivation of a person. At the same time, it originates from the word *bild* (image), denoting the designing of a holistic image of the self (Schneider 2012: 303). I argue that since especially engineers are involved with the art of *construction and design*, the construction and design of our artificial world, the idea of bildung is a relevant starting-point for reflection.

Bildung plays a prominent role in the ideas about education of the German philosopher and statesman Wilhelm von Humboldt who had a strong influence on the formation of the German education system. He

framed bildung as the ability to be able to understand one’s own fragmented field of action, one’s own narrow worldview shaped by a discipline (mathematics, physics, philosophy) in the context of a ‘higher perspective’, a general humanist overview and understanding (Humboldt 1986: 1). This amplifies the need for *reflection* upon one’s own standpoint in order to be able to *transcend* it and to see one’s work in a broader historical, cultural and societal setting. Originally, bildung referred to the autonomous construction of the self, but in the course of the 18th century it gained the meaning of forming *another* person’s self (through education) (Schneider 2012: 304). Schneider explains that the educational process of bildung as a moral development occurs in the course of a person’s life. From the impulsive self of one’s childhood, a person constructs herself according to stages in which she organises her thinking, devotes her thoughts to the goals of a community, identifies these goals with an ideology and finally distances herself from this ideology (Schneider 2012: 306). In the context of our earlier discussion, this could entail a formative process in which engineers identify the goals of their thinking with a *solutionist* ideology, enabling them to reflect upon this ideology by distancing themselves from it.

Unfortunately, bildung is a widely diverse concept with manifold meanings attached to it (Horlacher 2004: 424). In order to make better sense of the concept of bildung, I interpret it in line with the recently revived tradition of virtue ethics (a tradition that has largely been based on Aristotelian ethics). Virtue ethics diverges from the ethical systems that originate from the enlightenment, utilitarian and deontological ethics, by grounding ethics in the moral agent rather than in the application of certain universal principles (Silva 2011: 142). Virtue ethics revolves around the *reliability* of a moral agent: the reliability of an agent to act according to certain conditions of a virtue in a given situation. In other words, virtue ethics deals with *how* to act instead of *what* to do. One of the strong criticisms of virtue ethics is aimed at its communitarian character: the liberal critique of the idea that the meaning of virtues is constituted by society. The concept of bildung, as a free and autonomous process of reflection that belongs to the individual serves to overcome this critique (Silva 2011: 154). According to the idea of bildung in a context of virtue ethics, education should be aimed at promoting individual self-reflection in the context of a

historical, cultural and societal understanding. In order for an engineer to distance herself from the ideology that grounds the goals of her work, her education should enable reflection upon these goals *and* embed this reflection in the context of the idea of *how* she can be a virtuous engineer. For example, when a computer scientist is working on a specific problem in her discipline, say cyber security, she will first be confronted with the historical and normative grounding of this problem (why is it a problem, due to which circumstances, in order to attain which goal, and why?). Consequently, she will contextualize this holistic view (this 'bildung') in accordance with what it means for her to be a virtuous computer scientist. For instance, she can develop an idea of herself as an engineer who works on the development of cyber security while respecting the privacy of the users of the technology and contributing to a friendly and just interaction between people in cyberspace. Through the process of *bildung*, she can juxtapose her idea of a virtuous engineer with the goals set out in her specific field of study. Though this educational outlook can be fruitful for both classical and technical universities, it is particularly relevant for technical universities because engineering students focus on very specific, designated problems and because they regularly work with actual applications of their work that can have direct historical, ethical and political consequences.

How does the education of a virtuous engineer differ from the education of a tuned engineer? This difference can be established by considering the differences with the goals of the 'skills' that are central to the tuned engineer. Current management strategies of technical universities mention 'packages of skills' that make engineers 'suitable for employment' (TU Delft 2010), offering 'management', 'entrepreneurial', 'team-work' and 'communication' skills (TU/e 2011). These skills all relate to certain endpoints that arguably can be very beneficial for the ways engineers operate, but barely relate to any aspect of *bildung*. None of these skills involves an aspect of reflection, of relating to one's discipline from a more general perspective. Rather, they refer to proper functioning within a fragmented domain (even, paradoxically, skills like 'team-work' that focus on working with *peers* rather than *reflecting* on this work). Conversely, the virtuous engineer engages with a model of education that is embedded in a culture of reflection. This does not imply the reflection that is often required in

study programs in the sense of 'reflecting on one's work', but rather in the sense of reflecting on one's discipline from a holistic perspective. Next to training in problem solving, engineers ought to be trained in the identification of problems (why is this engineering problem a *problem* at all from a societal perspective?). The 'whole' engineer should not just be expected to be excellently 'tuned' towards her future position (this includes team-building and communication skills) but rather to be capable of critically situating her position in society as a whole. This is also a point where an interaction between the engineering sciences, natural sciences and the humanities can occur (Ben-Haim 2000), for each has a stake in the 'bildung' of the virtuous scientist – be it an engineer or a philosopher. Such an interaction does not entail engineers having to engage in a form of *liberal arts* education, but rather that moments of reflection are built into the fabric of the educational program. For example, an engineering student in the discipline of mechanical engineering would be challenged to reflect upon her work by being confronted with the historical development of her discipline and the ethical and political consequences of the technologies she develops. Already, courses of ethics are included in educational programs of technical universities in the Netherlands. However, these courses are still separated from the field-specific courses in the discipline. A more suitable educational design would be one in which the ethical, historical and political aspects of technologies are integral parts of the domain-specific courses. In line with this idea, students could be expected to include these reflections in their work (e.g. as part of their bachelor or master theses).

Conclusion & Discussion

In this paper, I argue that marketization trends affecting universities in general are strongly present in the management and education of technical universities. Partly, this is due to the historical background of the technical university as such, but marketization can nonetheless negatively affect the purpose of technical universities, which I argue should be to educate virtuous engineers. Marketization trends tend to promote technical and administrative reason and culminate in the idea of an engineer

that is ‘tuned’ to her future position. As an alternative to the tuned engineer, I discuss the idea of ‘bildung’ of the virtuous engineer, whose education includes a strong reflexive component. This component, I argue, should enable engineers to distance themselves from their disciplines and reflect on their discipline-specific goals by juxtaposing them with their perception of what it means to be a virtuous engineer (how one envisions one’s role as engineer in society). Instead of exclusively focusing on sets of skills that are preferred due to societal and business constraints, universities should also encourage students to reflect on their discipline as a whole; not only from a technical, but also from a historical, ethical and political perspective.

However, a merely educational reform at technical universities would be insufficient to achieve this change, for the marketization pressures are present in the research and management structures as well. The purpose of a reform of these structures would be, in line with the bildung principle of educating the virtuous engineer, to enable the university as an *institution* to engage in critical reflection with regard to its own goals and to contextualise this reflection in terms of what it means to be, so-to-say, a virtuous technical university. I argue that this can be done according to three main reforms. First, the management of universities should be de-fragmentised. Currently, the technical universities especially have faculties and departments that enjoy strict financial and managerial autonomy. Such a separation supports the ‘tuning’ of goals for departments to be most competitive in a societal setting conditioned by marketization trends (to gain the most funding, to ‘tune’ research according to the need of businesses) and to pursue their goals separately. Breaking down the barriers between departments enables more solidarity within the university’s organisation, results in a softening of marketization goals, and makes it easier for researchers from different fields to be embedded in disciplines foreign to their own (e.g. a historian or ethicist working in a computer science department). Secondly, technical universities should adapt more democratic structures to allow for critical self-reflection. When the entire organisation is involved in setting the goals of the university, the opportunities for reflection are enhanced and managerial decisions can be adjusted to the agreed-upon perception of a virtuous technical university. Thirdly, at the societal level, limits to the involvement of business and government in-

terests in setting the goals of technical universities should be deliberated and implemented. In line with our earlier discussion, I argue that we need to balance the gains from marketization against the over-excessive presence of processes of technical and administrative reason that obstruct the possibility for free reflection implied in the idea of bildung.

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¹ Student protests have notably occurred in Chili, Canada, the US, the UK, and the Netherlands (Roos, 2015)

² This idea of ‘character’ is borrowed from Ricoeur’s discussion of characters in a narrative setting (Ricoeur, 1983 p.59).