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Setting a New Course or Stepping Out of Line? Challenges to Previously Disconnected Theoretical Fields in a Danish Profession-Oriented Higher Education Context

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Introduction

At the time when I initiated my PhD project I was fortunate enough to have become simultaneously part of a research alliance working with engineering education. Its mission was to qualify engineering education institutions to reform in order to provide engineers more adequately trained for tackling societal challenges and fulfilling a responsible role in societal development. My colleagues in the alliance were high-ranking researchers mainly based in different engineering education institutions in Denmark. They had ambitions about influencing engineering education and engineering curriculum development in a positive and fruitful direction which contributed to a motivating ambience. However, as a newcomer to the field of engineering and engineering education, having originally graduated from the arts and humanities and later transplanted myself in the social sciences, I felt a frustrating lack of secure theoretical ground under my feet.

My interest in engineering education remains a social scientific interest; the work practices of engineers involve an appropriation of science and technology with massive potential implications for societal development and sustainability. In other words, engineering students hold an important key to the way in which society should confront a range

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of global, societal challenges in the future. The fostering and nurturing of professional responsibility and self-critical reflexivity among future engineers is an important task for engineering education systems worldwide. In my PhD I wanted to identify how young engineering students construe that future role and how notions of a professional engineering identity begin to emerge during their education.

This chapter will provide an account of my search for an adequate theoretical field in an interdisciplinary journey involving a great deal of balancing, a great deal of stumbling and a risk of involuntarily offending proponents of the theories that I deemed insufficient for my purpose. This process has been rewarding and has also resulted in much personal gain and growth along the way. However, from a career strategic perspective other routes would arguably have brought me further.

The traditional academic pursuit of the un-traditional

It is an acclaimed ideal of the academic community to pursue new and innovative results. At the same time, however, one must stand solidly on the shoulders of previous researchers. Science is considered a cumulative endeavour and theory does not float freely and undirected. According to Bhaskar (2008: 21 ff.), scientific endeavour is socially produced in a process that builds on previous knowledge. So as a researcher in the making, you are supposed to pay your respects to the founding fathers of your field and then add your own little personal twist, bringing about something new. I was told to search for and select the theoretical foundation I wished to adhere to. However, I found it difficult to decode exactly what was meant by that. Each and every research colleague I met had a different background, hence a different notion of an adequate theoretical framework.

I needed to find a way of balancing the dilemma of, on the one hand, bringing new ideas or angles into a theoretical field and, on the other hand, being satisfactorily grounded in the dogmatic, scientific establishment. This presented the challenging necessity of familiarising myself with a range of academic cultures, involving competing views on theory, theory adequacy and use; competing world views, even, in order to move on with my project. I found it imperative to try to map out for myself the landscape of theoretical fields that could potentially contribute to my research. With hindsight I see that this metaphor was somewhat naive. Such a mapping would have been a never-ending project in itself. Some important clusters or islands in an ocean of theories would have to do.

Coming to belong in the academic field through theoretical positioning

My field of research involved investigating how engineering students initiated their journey towards a professional formation. At the same time I found myself undergoing a parallel process of seeking legitimate membership of the academic field into which I intended to position myself and my emerging professional academic identity. Mere reproduction does not signal a glorious academic career, and given my cross-disciplinary research interest, this did not constitute any real risk for my journey to academia. However, to stray too far from the unwritten rules and traditions of a disciplinary field may not be conducive to one's inclusion in the academic professional community; neither does it contribute to your formation as an academic scientist.

Furthermore, it seems to me that the PhD journey is not just about acquiring the specific skills necessary for initiating a research career. It is also – as much learning theory (such as Lave & Wenger, 1991; Wenger, 1998) would put it – about coming to belong in academia. However frustrating it may be, this process lies not entirely in one's own hands. In order to undertake the journey from peripheral practitioner to legitimate member of the academic field, one must gain the acceptance and recognition of the already established members of that community. From the viewpoint of Bourdieu (1988, 1995a, 1995b) the academic community may be considered a field (possibly with various subfields) in which one takes a position by means of a certain habitus. This habitus consists of a taken for granted pattern of values, assumptions and preferences; a set of dispositions that legitimate and 'naturalise' field membership. The current Danish academic community is undoubtedly configured very differently from that described by Bourdieu in France. However, some of the mechanisms of negotiating status, excellence and disciplinary jurisdiction do seem to resemble recent thinking on academic identity formation processes. 'Competitors have both to distinguish themselves from their predecessors and rivals and to integrate the work of these groups into a construction that transcends it' (Henkel, 2000: 18).

The choice of theory appears to me to play an important role towards positioning oneself in academia. Such a choice seems to be a highly visible – and publishable – element of academic productivity. Furthermore it tends to become an important internalised element of an academic's professional identity in that the use of or adherence to a certain theory or method becomes part of who you are, as illustrated by notions such

as 'I am a Foucauldian'. Critical theoretical debate can also be construed as a way to mark your interrelation with and relative position within a particular paradigm as opposed to the theories you deselect.

If I were to realise my aspiration of an academic trajectory, it seemed inevitable that I had to adopt a theoretical stance. However, I am not sure I adhere to the viewpoint that theories are available for picking like apples on a tree. Theoretical foundation must also resonate with what is done, including the research question and design, and with why it is done. Therefore, I will next turn to the motivation for my research question.

Why engineering education deserves a particular interest from social science

This section explains why engineering education is a particularly important field of research; it also provides an overview of engineering and engineering education in Denmark, followed by a presentation of the ideal of a hybrid professional engineering identity.

Climate change, overpopulation, starvation, inequality, resource depletion . . . The list of societal challenges calling for coordinated, global measures is long. Technology optimists believe these problems can be solved by means of a 'smart fix'. Pessimist opponents claim that it is too late to solve any of them and that mankind is doomed. Instead of just awaiting which of the competing diagnoses of contemporary society will prove right, I am committed to the idea that as humans we must at least attempt to take charge of our collective future development. This is where the engineers enter the picture, since they often play the role of facilitators in societal development based on technologies of various kinds. These range from mechanical and construction technology to production, management, and communications technology, whereby securing an appropriate technological development is paramount (Hård & Jamison, 2005). By investigating the issue of societal challenges and sustainability in the nascent professional identity construal of future engineers enrolled in an engineering education in Denmark, I sought to consider the extent to which these students are aware of and interested in eventually taking on a professional responsibility for societal sustainment in the way that surrounding society expects them to do as future engineers.

Historically, the engineering profession is rooted in the military field. The first engineers were occupied with concrete problem-solving of strategic military importance. At a later point in time, engineers found

employment in non-military fields, hence the use of the term 'civil engineer' (Mitcham, 2009). These engineers were publicly employed to develop sanitation or infrastructure, for instance in the service of the state as a form of civil service (Wagner, 2006; Mitcham, 2009). Engineers and the state remain mutually dependent on one another, in the same way as other professions, with engineers contributing to the solution of a range of state problems. At the same time the state exercises a symbolic power over the engineering education system, which secures the legitimacy and exclusivity of the engineering profession (Harrits & Olesen, 2012).

Concurrently with the industrialisation of the Western world, a genuine professionalisation took place linking engineering identity closely to a technical paradigm coined by an optimistic confidence in the internal forces of progression and industrial development (Wisnioski, 2009). The twin desires of mastering and exploiting nature and its resources for civilisation's purposes were traditionally part of engineering identity per se, and technical development was considered a means to this purpose (Jamison, 1997; Wagner, 2006).

After the Second World War, it became increasingly clear that technological development brought about a range of risks to society. Not only had advanced technology been a direct means for atrocities, as was the case with military technology and technical developments for efficient extermination, technological development also began to show a backlash in terms of long-term exacerbation of natural and human living conditions. During the twentieth century environmental and social consequences of modern industry and its technological constituents received negative attention and concern and caused severe harm to the image of engineering. 'One of the main prejudices about engineers—and a serious obstacle for young people taking up the engineering profession—is that engineers pave the world with asphalt, create pollution, and generally wreck the environment' (Henriksen, 2006: 44).

The formation of ethical codices pertaining to engineering proliferated, emphasising the ethical obligation of going beyond the serving of state interests; an engineer should serve general society and mankind. Today, serving a greater societal good is to a large extent considered part of the engineer's professional identity (Ambler, 2009; Mitcham, 2009; Wisnioski, 2009).

The ideal notion of an engineer's professional role is intricately linked to the role attributed to technology in society. In addition to technology's two-edged nature of supporting, but sometimes also potentially harming, human activity, technology also influences human thinking

and communication (Baillie, 2006). Furthermore, technology can be construed as a social and political phenomenon, which means that technology professionals play social and political roles as part of their everyday work (Kleinman, 2005).

The high potential influence of engineering professionals on society's development emphasises the role of the engineering education system in the provision of engineering graduates who are fully ready to take on this large professional responsibility. As the starting point of my investigation I decided to be explicit about the emphasis I put on societal challenges and professional responsibility in the desired professional identity formation of engineering students. I borrowed the term 'hybrid imagination' from Jamison (Hård & Jamison, 2005; Jamison, 2012, 2013) to describe the ideal engineering identity.

Hybridity intertextually relates to various things. First, it is used in ethnography to refer to the dynamic mixing and development of cultures initially conceived of as distinct and separate in postcolonial contexts. Within biology, the term means cross-breeding, which is a mixing of previously incommensurable species. Finally, Jamison utilises the term in opposition to the Greek notion of hubris that describes an overconfident, blinding arrogance that has been connoted to much technological development driven by the urge to transcend nature's limitations. As a corrective to such an over-optimistic, unreflected hubris, hybris seeks to encompass self-reflection, contextual and cultural concern with the scientific-technological skills and understanding resulting in a more holistic and change-oriented professional engineering identity.

Cross-disciplinarity plays an important role in this vision of professional engineering, influenced as it is by the understanding of the new conditions and implications of knowledge production (Gibbons et al., 1994; Nowotny et al., 2001). Not only is technology seen to permeate ever wider areas of our everyday lives, it also penetrates the boundaries of more and more previously separate disciplines of knowledge production. The so-called life sciences are an example of an entirely new disciplinary field that has developed as a hybrid, mixing engineering with medicine, biology, psychology and sometimes even ethics. Such a mixing of disciplinary fields is now seen to be a defining characteristic of knowledge production in contemporary society. However, the technological ubiquity and the aspirations related to the role of technology towards societal challenges and sustainability make cross-disciplinarity particularly pertinent for engineers. Engineers are technological experts with a huge potential power to influence society (Ambler, 2009), so

engineering practice cannot be considered engineers' own business entirely. It matters to us all how they practise their profession, how they approach, define and solve problems. For the world to understand and take a part in how technology affects societal development, the role of the engineer is vital as a field of investigation.

Methodology and meta-theory

Conducting empirical research involves a reflected use of methods. The fact that I dealt with a distinction between what engineering 'is' – or is considered to be – and what it 'should' be, made normativity play an important role in my research design. Whereas the first aspect is descriptive, the latter implies a whole lot of exploring and explaining, which called forth a mixed methods approach.

A clear normative element was an underlying presupposition. Early on in my project, I realised that I could not uphold any possible ideal of approaching an objective position; the viewpoint that some directions for the professional identity formation of engineering students are more desired than others contributed to occasioning my PhD project. I decided to take a normative starting point and articulate my ideal notion of a responsible, professional engineering identity based on Jamison's 'hybrid imagination' (Hård & Jamison, 2005; Jamison, 2012, 2013). The traditional methodological divide between a quantitative and a qualitative camp focusing on exact measures of recurring regularities and on in-depth understanding of individual phenomena and meaning-making processes, respectively, had to be transcended. This necessitated a specific attention to clarity and coherence in the way of collecting, analysing and interpreting data. Thoroughness in my efforts to understand and explain the empirical findings and their wider implications was also pivotal (Henkel, 2000; Schwandt, 2000; Schrøder et al., 2003; Bhaskar, 2008; Creswell & Plano Clark, 2011). Furthermore, my methodological position posits a world view in which the two types of data about the field of research make sense together.

There is much more detail to the picture, but roughly speaking, the quan-qual dualism has been upheld by the interpretivists, who favour in-depth investigation, and the empiricists, whose intention is to 'prove' the laws and systems of society in the picture of natural science. This epistemological dualism is based on an ontological dispute; the two end positions in the continuum from empiricism to interpretivism simply disagree both on how to understand human interaction and on how to procure valid knowledge about the human societies. Whereas

empiricists insist that the ideal researcher is an objective observer making exact documentation in search of regularities, the interpretivists claim that no such thing is possible; the researcher affects his object and excludes himself from the potential knowledge in taking an alternative perspective by selecting one, and researcher and researched co-construct knowledge.

To provide a corrective to both interpretivism and empiricism I choose as the philosophical tenet of my study's scientific foundation a combination of critical realism (Archer, 1995; Danermark et al., 2002; Bhaskar, 2008) and discursive realism (Schrøder et al., 2003). The ontological assumption was that a social reality exists independently of our knowledge of it (Schwandt, 2000; Danermark et al., 2002; Schrøder et al., 2003; Bhaskar, 2008). However, reality and its social phenomena are not unequivocal, tangible entities that can be measured by the researcher directly. According to a critical realist position, the nature of social science studies involves an epistemological constructivism. The discursive emphasis of my meta-theoretical standpoint takes the consequence of this epistemological relativism and realises that the object of science is discursively constructed: '[…] our only access to knowledge about […] reality goes through language and other sign systems' (Schrøder et al., 2003: 45). Regardless of our methods of approaching the world, I believe that we can only understand and theorise about it through the use of language and other symbolic sign systems. Therefore, the field of social research consists of discourses – here widely understood as social practice involving use of language or symbolic signs. This is the epistemological basis of the project. In addition, I construed the critical term as a normative obligation in line with the world views of action research or critical theory (Fairclough, 2003; Schrøder et al., 2003). Being critical did not to me involve any particular political stance or message. Rather, I considered my normative approach to engineering's societal obligation a critical position.

My data collection took place by means of surveys with closed-ended as well as open-ended questions. I analysed the data by means of quantitative as well as qualitative techniques. The quantitative measures allowed for findings of the 'how many first year engineering students agree to viewpoint this or that' and 'what other quantifiable characteristics do they have in common', whereas the qualitative methods of analysis identified some internal dilemmas and oppositions in the engineering student discourse. For instance an expressed technological fascination was found to coexist with some guilt among the engineering students because of the conception that technological

development bears the blame for a range of societal ills that endanger sustainability.

Methodologically, my study of engineering students' understandings and preconceptions of their future professional identity and societal role is marked by its interdisciplinary nature, with few established theoretical or methodical paradigms, reflecting the hybrid nature of the challenges at stake (Jamison, 1997; Jamison, 2001; Williams, 2003).

Most researchers agree that any research project involving empirical data collection should base its methodical steps and techniques on theoretically informed understanding of these methods, their workings, implications and underlying assumptions, in short on methodology. However, I find that use of theory requires similar considerations. In my case, particularly, the scanning of competing theoretical frameworks against which to approach and understand my research question forms some kind of method in itself, which merits epistemological and ontological argumentation. As Layder states, theory can be considered a pattern of '[…] concepts, propositions, and "world-views" ' (1993: 15). I believe such assumed world views need to be laid out in the open in order to inform the readers and qualify their assessment of the research. The next sections give an overview of the fields I crossed in my search for a theoretical foundation for my PhD project.

Education for sustainable development

Societal challenges and sustainability (here construed as an umbrella term that includes economic, social and environmental aspects, along with the engineering-specific challenges related to the role of technology in society) are key points in my research and in my motivation to study engineering education. When a PhD course on sustainability was offered by one of the researchers in the collaboration I was affiliated with, it became an invitation for me to start my theoretical journey by investigating the field of education for sustainable development.

The field seemed to have a large focus on desired learning outcomes (Haase, 2014b), which was fruitful to me in order to develop my notion of an ideal professional engineering identity. It was also insightful to my project to gain from this field a nuanced understanding of the concept of sustainability, the definitional debate about it and the cultural differences in what is meant by it. For instance I learned that the American use of the term sustainability corresponded mainly to environmental sustainability, which in other contexts is considered to encompass only a fraction of the meaning of the term.

A large focus of the field of education for sustainable development was aimed at identifying institutional directions and desired development of the education system, which seemed rather distant from the students' pursuit of a legitimate role in the professional community from a bottom-up perspective. Furthermore, the vast majority of literature within this field did not have an engineering-specific approach (Haase, 2014b).

Engineering educational research – Engineering's own theoretical base

To substantiate and position my research I needed to acquaint myself with the theoretical field that most directly focuses on educating engineers, namely engineering education research. This is a rather new and immature field where much debate has revolved around whether and how to include in the curriculum subjects which give engineering students an understanding of the wider societal implications and contexts of engineering practice. The tendency in the field has moved toward an acceptance of the necessity of such contextual understanding as an integrated part of the engineering curriculum. Now, the discussion within engineering education research focuses more on the delineation of specific subjects and competencies that should be included (a question about disciplinary priorities and boundary definitions) and how this can most fruitfully be realised (questions about didactics, pedagogical strategies and learning theory) (Haase, 2014b). Learning theory – particularly the branch of it focusing on learning as something that takes place in communities of practice (Lave & Wenger, 1991; Wenger, 1998; Reid et al., 2008) – seems to resonate well with Danish engineering education institutions' focus on engineering as a practising profession. Therefore with regards to the PhD, I encountered an expectation that learning theory would be fundamental to the project, and I probably disappointed those who had hoped to find in my work the ammunition in support of an argument that could prove a specific approach to learning the most adequate method to teach engineering students these engineering-contextual perspectives. However, this was not the primary focus of my study, and my time frame did not allow for any solid conclusions about causal effects of didactical or pedagogical frameworks spanning an entire engineering education of up to five years.

Finally, factions within the field of engineering education are concerned with the consequences for the engineering identity of widening the engineering field (Haase, 2014b). The tendency here is to depict

engineering as a collection of occupations that are increasingly dissipated. It is feared that the engineering profession will degrade or dissolve into paraprofessional fields or communities without a common ground or value-base (Williams, 2003). Whilst this argument has resonance with my focus, I also felt it lacked a theoretical foundation for understanding the concept of professional identity and the professional identity formation processes.

High enough for inclusion in the higher education field?

The minor role of professional education (including engineering education) and professional identity formation in higher education literature (Trede et al., 2012) took me by surprise. Many occupations are subject to debate regarding the legitimation of their professional status (Abbott, 1988), as signposted by the term 'semi-professions', used for instance to assign an inferior status to social work as an 'incomplete' profession (Etzioni, 1969).

In the Danish context professional further education formally holds the status of higher education. Engineering education, to be more explicit, has been organised in a two-tier system within the higher education system in many nations, including Denmark. Danish engineering education is provided as either an academic master level education, corresponding to five years of full-time studies at a university, or as a vocational education offered both by universities and university colleges, lasting three and a half years including an internship of approximately six months and leading to a professional bachelor's degree.

Historically, engineers from the vocationally oriented system formed the majority of the Danish engineering workforce, of which a large part is now approaching retirement age. A higher share of newly educated engineers consists of academically rounded engineers, implying a demographic shift in the total engineering workforce, with the proportions of students enrolling in academic and vocational engineering programmes being almost equal in recent years.

Both types of educational systems have come under pressure. Universities increasingly need to focus on employability and the needs of the market, whereas an academisation has taken place within the university colleges and engineering colleges, in some cases resulting in mergers with universities. With the last education policy reform the two systems, previously under the jurisdiction of two different ministries, were subsumed within the same ministry, and their systems for quality assurance, employment and education accreditation have been aligned

(Christensen and Ernø-Kjølhede, 2011; FIVU, 2013). However, it seems that engineering education has only to a marginal extent been included in the theoretical landscape of the higher education community. The fact that engineering is traditionally a high status occupation makes this seeming neglect from higher education academia additionally peculiar.

Engineering as a failed profession? Visiting a sociology of the professions

Next, I turned to a sociology of the professions for fruitful theory for my project. I found this theoretical field to be very heterogeneous. The question of how to define a profession has become a classical nexus of the field along with the defence and attack on the definitional project itself. Some theorists are proponents of focusing on professionalisation processes rather than passing a professional/non-professional verdict over the status of a specific occupation (Haase, 2014a). However, any 'professionalisation project' (Larson, 2013 [1977]) must involve the search for and articulation of notions of professional attributes expressed as ideals of that profession. Alternatively, the professionalisation process may be described as a development of functionally differentiated, specialised fields of labour contributing to societal sustainment. However, processes of de-professionalisation occur coextensively with and in counter-movement to professionalisation. De-professionalisation refers to the redeployment of the professionalisation process and is a general denomination for a range of tendencies that challenge professionals and their role in society. Currently, external as well as internal pressure is put on the professions, constituting loss of power, prestige and work control to others (Leicht & Fennell, 2001; Scanlon, 2011; Schinkel & Noordegraaf, 2011: 89–90). This includes increased routinisation of tasks that – sometimes by means of technological devices – become less demanding and cease to involve professional competencies (Abbott, 1988) to the point of proletarianisation.

Furthermore, economic and managerial changes during the last decades have also eroded professional autonomy (Leicht & Fennell, 2001). Evetts (2011) finds that engineers have difficulty sustaining occupational control of their work and their discretionary decision-making powers. Additionally, the large-scale societal challenges of sustainability, internationalisation and globalisation (Williams, 2003; Baillie, 2006; Petroski, 2008; Sheppard et al., 2009; Wisnioski, 2009; Evetts, 2011; Jamison, 2012) complicate professional engineering work and contribute to its de-professionalisation.

Consideration of the characteristics outlined by the proponents of definitional criteria for professional status gives an indication of the direction of professionalisation processes and makes possible an assessment of the state of the professional project of engineering. In spite of its oft-mentioned status among the 'full' professions, engineering seems not to merit comparison with medicine or law when it comes to fulfilling the criteria most often listed as professional traits (Haase, 2014a). This causes Brante (2011: 8, 1988: 125) to refer to engineering as a 'failed profession'. Engineering in Denmark is not characterised as an archetypal profession when measured by the most common profession attributes (Haase, 2014a).

First and foremost, engineering may have a close relation to both scientific knowledge and to the knowledge form referred to as tacit knowledge, particularly emphasised for its importance in discretionary, professional judgement, but engineering knowledge is not particularly homogeneous, since the field is divided into a multitude of branches each with its own specialised field of knowledge.

Secondly, considering the societal impact of technology, engineers have not accordingly been successful in their professionalisation project. They have neither succeeded in safeguarding their jurisdiction and exclusivity nor been granted particularly enviable power and privilege in the market and bureaucratic contexts. Danish engineers do not have any formal licensing, and their professional association is weak compared to other forces of the labour market. Engineers stand out from most professions when judged by their occupational orientation and are considered more subordinate to market forces than other professions. The role of economic profit is therefore less marginalised in their professional practice, yet their capability to control their professional market is limited because of the subordination to industrial development, considerations of accounting and business profit. Hence, economic profit becomes an important motive for engineers (Larson, 2013 [1977]: 29).

Dealing with risks is inherent to professional practice, which continually threatens the engineering image. Latent risks are present in engineering decision-making and include for instance the risk of miscalculations causing a bridge to collapse, the risk of misjudging the consequences of an intervention, the risk of discovering adverse effects of a seemingly harmless chemical used in industrial production, the risk of contributing to local recession and unemployment of certain groups (Layton, 1986; Beck, 1997; Bertilsson, 1999). Hence, professional dilemmas between the diverse orientations within which the engineers may feel imbricated seem increasingly relevant.

The image of engineering is therefore contradictory: on the one hand, the profession is acknowledged for its importance and influence in society; on the other hand, a negative, prejudicial conception of the engineer still prevails. Working conditions, work practices and work place context are all changing. Routinisation and transcendence of boundaries both challenge professions and contribute to a destabilisation of the professional identities. Elite status and exclusivity are no longer a matter of course for professionals (Scanlon, 2011). Professional jurisdiction must be resettled, which involves a threat to professional legitimacy. The process of de-professionalisation implies uncertainty about the future direction(s) of the engineering profession and the conception of an engineering identity.

Instead of pursuing an assessment of whether or not engineering fulfils the criteria for being a profession or not, I find it more useful given my research objective to identify the ideal conceptions of an engineering 'professionalism', understood as a set of occupational values related to legitimate engineering practice and acceptance in its professional field. I adopted the theoretical notion of professionalism drawn mainly from Freidson's (2001) identification of a distinct professional rationale, the third logic, coextensive with neither a bureaucratic nor a market-oriented logic. He uses the term 'free market' as a non-existent ideal type, opposed to the somewhat more blurred ideal type of a bureaucracy controlled by managers aiming at policy implementation as opposed to economic gain. Ideally, the professions' role as mediators between market and bureaucracies involves fiduciary responsibilities. Professionals are expected to follow a seemingly self-sacrificing logic in the service of others; an almost altruistic motive.

This logic ideally should supersede the role of economic profit as a motivator of professions (Parsons, 1939; Freidson, 2001; Larson, 2013 [1977]), and can be considered an ideology of professionalism underlying professional decision-making and practice. In practice, however, a range of motives might be expected to coexist among professionals, causing increased complexity and ambiguity (Bertilsson, 1999). In the way I have used Freidson's concept, I have focused on the normative dimension or – as Evetts terms it – professionalism as 'occupational value' (2010).

To me this positive, normative ideal of the professions as a community with a particular role in sustaining societal development runs parallel with Jamison's engineering-specific ideals that I have articulated above. This focus on the moral obligation and responsibility of the professionals can be traced back to Parsons (1939, 1952), who focused on the

function of the professions and considered them a societal good contributing to continuous development, social order and cohesion. More critical approaches emphasise that professions actively influence the shaping of culture, structure, institutions and discourses as well as the execution of power in ways that are not always transparent or accessible for laymen (Abbott, 1988; Laursen, 2004; Larson, 2013 [1977]). Without discounting the potentially negative role of professionals in society I decided to focus on the positive descriptions that I construe as an ideal conception of how engineering professionals 'should' be because I intended to identify the aspired professional identity of coming engineers. Moreover, these normative ideals are largely formulated in awareness of the risks of a negatively enacted professional practice. The research question of my project could thus be reformulated as an investigation of the existence, nature and extent of nascent professional values among engineering students in Denmark.

A journey (hopefully) finds its direction – My theoretical contribution

As outlined above, the absence of pre-existing theory that would encompass the multifaceted issues of my research question made me traverse various fields for possibly fruitful territory concerning the expected societal role and professional identity construal of future engineers. I gained insights into many theoretical perspectives and hope to have contributed a little myself. I have an aspiration that my work will contribute to theory development henceforth, in an area where it was previously lacking. The marriage I arranged between Jamison's engineering-specific hybrid imagination and Freidson's third logic appears to be a happy one. By applying this and other sociological perspectives in the analyses I made of my empirical data I was able to identify a range of identity conflicts in the engineering students' construal of their professional identity. There were conflicting values in relation to business/commercial interests, on the one hand, and the intention to do societal good, on the other. There was a conflict between the emphasis of engineering work as an individual, rationality-driven way of thinking and doing and the highly prioritised collective approach to engineering. And finally, I found an affective identity conflict in the engineering students' appraisal of specialised knowledge development, whereby the highly specialised engineer was connoted as a boring, lonely 'nerd' whom students dissociated themselves from (Haase, 2014a).

Based on the survey answers made by engineering students within their first year of studies, my findings suggest that engineering education research may have overrated the risk of a fragmented engineering identity. Despite the fear of a vanishing common value-base of professional identity within a widening engineering field, formulated within engineering education research, I do find common value-orientations reappearing among students from across the 100+ different engineering disciplines that are taught in Denmark.

(Engineering) education for sustainability and hybrid imagination as an engineering-specific ideal professionalism emphasises the democratic, participatory, self-critical, reflexive, experience-based processes involved in learning. This involves an ideal understanding of the learning process that breaks with traditional transfer thinking. Higher education institutions cannot transmit certain curricula or knowledge 'packages' into the heads of their students. A hypodermic needle metaphor for transferral must, from this point of view, be rejected. Engineering pedagogy requires a much more student-oriented engagement with internal self-development processes, as they occur in specific contexts and collective interrelations. When learning, as a consequence of the participatory metaphor, is depicted as a matter of 'becoming', the focus on 'content' elides, as indicated in Barnett (2009) and Sfard (1998). A decentralisation of learning opens up the question of how to maintain control of the learning process, to which proponents of participatory learning would claim that control over learning was never in the hands of the educational institutions. However, it matters how engineering education systems address their task of providing engineers capable of administering their potential professional power. The institutionalisation of teaching for educative purposes does involve intentions about what learners' desired outcome should be. The mere listing of what we hope our future engineers are able to accomplish is an exercise of exclusion, whereby some skills are deemed desirable, others discarded. The fact that society needs engineers of a certain kind involves a contingent, normative aspect, and this complex interrelation of participatory ideals and ideal intentions would benefit from a more explicit handling both theoretically and in the practice of engineering educators.

Therefore I argue that engineering education systems need to balance their inherent intentionality with the demand for a design of the social infrastructure that facilitates student participation in order to fulfil their societal role of providing qualified engineers who are both technical experts and empowered scientific citizens.

Over and above the de-professionalisation metaphor, we might consider engineering as an and-both hyphenated profession, retaining its classic ideals and ordinary dilemmas of balancing competing profession-internal and -external demands with a technology-specific depth or even additional disciplinary approach. However, the professional role and its dilemmas are largely avoided among engineering students in my study. I have pointed to the necessity of facing such dilemmas and internalising them in an engineering professionalism, as both Freidson (2001) and Jamison (Hård & Jamison, 2005; Jamison, 2013) would suggest.

In my PhD I have taken the first steps towards discursively constructing ways of addressing professional values and responsible engineering identities in the service of society in a manner that embraces and confronts normative positions in the engineering education field.

An ongoing pursuit to take root in academia as a theoretical connector

On completion of my PhD thesis I have received a great deal of interest from people involved in engineering education and from people engaged in sustainable development. This has been really rewarding. For instance I have been asked to present my findings and call for debate among engineering students as well as engineering education faculty. In this way I have contributed to the ongoing processes of developing the engineering education system. However, none of the potential influence my research may accomplish in a practical or system perspective seems to register in the academic field. From a narrow perspective of how to gain a position in this field, my success is measured by the extent to which my claim of a new course of connectivity gains recognition and legitimisation.

Rather than adding cumulatively to one strand of theory, I have selected particular theoretical threads at the expense of others. No 'founding fathers' of the field can authenticate these decisions, because there is no foundation laid out below me. Instead, I have had to justify why I chose not to use the pre-existing frame of reference common to each theoretical framework and institutional culture (thus bolstering the theories that their respective representatives had introduced to me). This means that I have had to develop more independence and self-reflexivity about my theoretical stance than I would have had to otherwise. But it also appears that by retaining a distance from the field of engineering education that I have been studying I excluded

myself from a position in this field. Moreover, by studying it in the first place I have alienated myself somewhat from the social sciences. My meta-theoretical ambition to transcend dualistic disputes between quantitative and qualitative methodologies seems to provoke similar ambiguous reactions. Although I have received good feedback on my general research design, I have also encountered proponents of quantitative/qualitative methods who on finding their favourite approach deemphasised in my project, imply that I have debased myself by adhering to anything other than the 'right' approach.

The specialised knowledge I lay claim to has an immanent interdisciplinary nature where each theoretical field is used to reframe and contextualise the next. The various theories I draw on provide new perspectives and layers in the total picture. However, I persistently come up against the prejudice that interdisciplinarity has precluded profound expertise in any one theory.

As a peripheral practitioner in the academic field, it appears I have made myself vulnerable. Where do I fit in? Where do I go to look for legitimisation of my theoretical position in academia? How do I establish and uphold a legitimate position of my own? Have I stepped out of line too much to belong?

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