Variable and flexible constructions of gender within German engineering. First outcomes of a long-term discourse analysis.

Tanja Paulitz, Bianca Prietl
University of Graz, Department of Sociology, Universitätsstraße 15 (G3), 8010 Graz, Austria

In recent years gender relations in engineering have attracted more and more attention outside as well as inside the field. Within Feminist Technology Studies (FTS) three major strands of research have been prominent: firstly, a pragmatic approach that has primarily been motivated by gender equality issues, secondly, a structural approach that has studied men and women in the field of technology mainly at the level of social practices and thirdly, newer studies on workplace culture that have uncovered gendered identity constructions of engineers (see among others Faulkner 2000, 2007). At the symbolic level of knowledge, however, much less is known about the discursive construction of gender. Given that Wajcman (1991) among others has hinted at the importance of the symbolic association of technology with masculinity for the shaping of the field, a closer examination of the gendering processes within the professional knowledge of engineering, i.e. what engineers know about their profession and their field, seems a worthwhile endeavor for Gender Studies[1].

1. Studying engineering knowledge: a theoretical and methodological outline

By assuming that distinctions made in professional engineering knowledge are relevant for gender research, the dominant FTS research perspectives can be extended to grasp gendering processes at the level of knowledge. In other words, processes of social differentiation, like gender differentiation, also happen at the epistemic level of conceptualization with regards to epistemic distinctions made in the process of defining what engineering is and what it is not. Looking at the history of German engineering, it is the theory/practice difference that has been of major concern for the emergence of the modern understanding of technology. The questions of whether engineering is a fully rationalistic scientific endeavor, whether it is mainly an applied science or whether it is a practice-oriented science, have remained crucial for the self-conception of – at least German - engineering to date (see among others Heymann 2005). As a result, it can be assumed that different variations of „boundary-work“ (Gieryn 1999) between theory and practice within the field have taken place over time and have produced diverse, modern understandings of technology, its actors and its area of activity. However, much less attention has been paid to the constructions of gender that have emerged in the course of the history of German engineering with special regard to these very theory/practice distinctions.

For this undertaking, the Science and Technology Studies (STS) scholarship offers some important lines of reference. At least three respective aspects shall be roughly outlined (for an overview of the 'state of the art' see among others Paulitz 2006; Wajcman 2002; for a critical perspective on the premises of Feminist Technology Studies see also Grint & Woolgar 1995; Omrod 1995). Firstly, while there have been numerous studies on the social impacts of technological artifacts until now, little research has been done within STS on the area of *engineering* itself, which became a part of the scientific field in the late 19th century. Secondly, regarding the available Gender Studies scholarship on engineering, the recent trend has been to look at women's exclusion from this field at the level of *social practices.* However, little attention has been paid to the role of the gender category in the engineering domain's knowledge and to the possible variety of gender symbolism over a longer time period. Thirdly, the existence of a strictly *binary* gender system has been presupposed, leading to the promotion of a dominant, mostly unchallenged, hypothesis – also widely taken for granted within parts of Gender Studies - namely the assumption of technology as being socially masculine-coded and the non-technological (emotional, social, etc.) as being feminine-coded. Consequently, the construction of masculinity in engineering – and also partly elsewhere – has primarily been conceptualized as the result of a distinction from femininity as a mapping of the binary gender system, which has been prevalent at least from the 19th century civil society onwards. For the construction of gender symbolism in many societal areas and thus also for the processes of gendered images in the course of the design of new technologies, highly flexible and heterogeneous modes of gendering effects have been uncovered. However, in the case of the more traditional engineering disciplines, the dominant premise is still mostly an almost monolithic image of a 'male' domain.

Applying the above stated flexibility thesis to the areas of traditional engineering, the engineering domain can be addressed in a slightly different way by empirically taking a closer look 'inside' engineering with respect to the epistemic level of knowledge and its symbolism. Furthermore, more light is shed on the internal rationalities and power games of the social field itself in the sense of Bourdieu. More specifically, the theory/practice boundary, as one of the central characteristic distinctions within German engineering, is illuminated from a sociology of scientific knowledge (SSK) perspective by focusing on the claims for 'epistemic authority' (Gieryn 1999). Relying on a meanwhile prominent thesis, developed in Feminist Constructivist Technology Studies, a mutual co-construction of gender and technology is assumed (Wajcman 1991). Extending the analytical perspective by assuming historically flexible ways of a mutual co-construction of gender and engineering, the epistemic level of engineering itself, i.e. what engineers know about their profession and their domain, is analyzed from a gender perspective. Following this, contingent forms of gendering

the engineering profession and domain, dependent on context and time, are a major point of departure.

Drawing on these theoretical considerations, the endeavor is to study the development of social construction*s* of gender that accompany the distinctions between theory and practice in the course of the historical German engineering knowledge.

The empirical investigation consists primarily of a qualitative, longitudinal study of the professional discourse of German engineers as displayed in engineering journals. The main source of data is *The Journal of the Association of German Engineers* (from here on *The Journal*), published since 1857. *The Journal* provides a rich source for (controversial) debates among engineers, e.g. about how to understand the profession, the role of technology in culture and the engineering education. The broader context of these debates at the beginning is the professionalization of engineering as it became part of the scientific field and thereafter the positioning of engineering as an academic profession. As analyzing strategies Grounded Theory and Discourse Analysis were employed. This broad palette of contributions provides the basis for the following initial results.

2. Results: Flexibility and variability of gender constructions in engineering

These first results of the long-term analysis of debates within the professional engineering knowledge as reflected in *The Journal* show two major features with regard to gendering processes. From 1850 to date, discursive gender constructions display *flexible* and *variable* modes of construction as will be outlined below.

2.1. Engineering masculinities from 1850 to 1930

Generally, it can be stated that in the professional discourse of German engineers during the time span from 1850 to 1930, the gender difference was hardly addressed at all. Engineers did not refer to the binary gender category or to women in the course of their central debates about the constitution of the profession. Instead two dominant constructions of masculinity evolved in the course of the professionalization of engineering as an academic profession in this period (see also Zachmann 2004): Firstly, the – pretended neutral – “scientist of machinery” emerged from around 1850 onwards as a result of a first wave of strong ‘scientification’ of mechanical engineering. Secondly, another model of the engineering profession, the "man of action", was developed from the 1880s onwards in the context of a new understanding of engineering as a more practice-oriented science. These masculinities were predominantly formed in the negotiation between class status and ethnicity. Both engineering masculinities were discursively constituted by separation from or alignment with

other social groups of men respectively other, culturally available, constructions of masculinity. Thus, women did not emerge as an important contrasting group.
However, in the rare occasions engineers did talk about women, they treated the male/female dichotomy as a marker for the external border of the technical sphere. Femininity as opposed to technology thus held the discursive function of regulating the boundary between what is technological and what is not (for further details see Paulitz 2009, 2010). Drawing on these results, the question is whether the marginality of the binary gender category holds true in the long run. Systematically tracing the discursive construction and functions of the binary gender category in the engineering debates throughout the 20th century until the present produces a well-distinct answer.

2.2. Systematically tracing the gender category in a long-term perspective

Already the overall numerical picture of the data basis indicates that the gender issue has remained marginal in German engineers' professional discourse until the present. Overall, even though marginal, the binary gender difference shows a historically flexible function and variable construction modes in the "professional project" of German engineers. Treating the gendered spheres of production and reproduction as an undisputed given, engineers employed rather exclusionary strategies until the 1920s, whenever explicitly handling the topic of women. According to the bourgeois gender system, these exclusionary strategies were based on the unquestioned assumptions of the different nature of 'sex'. The discursive function of the gender difference changed with the advent of WWII. To balance the need for women in the industrial workforce and the maintenance of men's privileged position, demarcation strategies were employed, geared at drawing and controlling boundaries between men's professional leadership and technological expertise on the one hand, and women's support in routine work as technological novices on the other. The demarcation was based on arguments of physical and cognitive differences. From this time onward, a shift from basically physical and cognitive criteria to behavioral ones can be observed for marking the gender difference. Thus, demarcation strategies are again employed, but nowadays to draw boundaries at the level of leadership in organizations.
Accordingly, as these journeys into *The Journal*'s debates on the gender dichotomy indicate, this very dichotomy plays only a marginal role, when engineers discuss their professional field. Throughout the whole time-span from 1850 to 2009, the construction of the binary gender category as well as the construction of engineering masculinities both display instable, flexible and variable modes.

3. Outlook

On the basis of these hitherto existing findings, it can now be stated that the discursive construction of the German engineer is, firstly, clearly not a monolithic conception and secondly, not primarily the result of demarcation with respect to the binary gender category. Consequently, masculinity in modern German engineering seems neither to follow a singular unitary pattern, nor to be the result of one monolithic binary mechanism of construction, i.e. the standardized result of a demarcation from femininity. The gendering of the engineer can thus be considered a heterogeneous and highly disputed epistemic formation, emerging in the context of boundary work along the theory/practice difference in the course of the professionalization of the domain.

In order to further broaden the research perspective on social constructions of gender within German engineering, the next empirical steps will comprise a longitudinal study of the professional engineering discourse's reflection in general knowledge as displayed in general encyclopedias. Additionally, a cross-sectional interview-study is designed for investigating different, selected sub-domains of today's engineering. In this vein and by employing this future research strategy, directed at understanding the flexible gendering mechanisms, the overall aim is to contribute to the de-construction of stereotypical gendered images of technology, arguing on the basis of the very fundamentals of engineering itself.

Notes

1. This paper is based on, firstly, a currently running research project titled "Gendering of Boundary Work in Engineering", conducted at the University of Graz under the direction of Tanja Paulitz and, secondly, a former project of Tanja Paulitz, entitled "Technical construction and gender in the information society". Both projects have been funded by the Austrian National Science Fund.

Selected sources

Faulkner, Wendy (2001), The Technology Question in Feminism: A View from Feminist Technology Studies, *Women's Studies International Forum* 24: 79-95.

Faulkner, Wendy (2007), Nuts and Bolts and People. Gender-Troubled Engineering Identities, *Social Studies of Science* 37: 331-356.

Gieryn, Thomas (1999), *Cultural Boundaries of Science. Credibility on the Line*, Chicago, London: University of Chicago Press .

Grint, Keith, Woolgar, Steve (1995), On Some Failures of Nerve in Constructivist and Feminist Analyses of Technology, in Grint, Keith and R. Gill (Eds.), *The Gender-Technology Relation*, London: Taylor&Francis, 48-75.

Heymann, Matthias (2005), *„Kunst“ und Wissenschaft in der Technik des 20. Jahrhunderts. Zur Geschichte der Konstruktionswissenschaft*. Zürich: Chronos.

Omrod, Susan (1995), Feminist Sociology and Methodology: Leaky Black Boxes in Gender/Technology Relations, in Grint, Keith and R. Gill (Eds.), *The Gender-Technology Relation*, London: Taylor&Francis, 31-47.

Paulitz, Tanja (2006), Geschlechterforschung und Technikwissenschaften. Konstruktionen von Wissen in Fachkulturen des Ingenieurbereichs‘, *Zeitschrift für Frauenforschung und Geschlechterstudien 24*: 23-42.

Paulitz, Tanja (2009), *Gender in Engineering Desing. Continuities and Transformations in Theories and Textbooks in Engineering* (report), Graz: www.ifz.tugraz.at/index.php/article/articleview/1566/1/153/

Paulitz, Tanja (2010), Vom Maschinenwissenschaftler zum ‚Mann der Tat‘. Zur Soziologie technikwissenschaftlichen Wissens, 1850-1930, Manuskriptform. Karl-Franzens Universität Graz.

Wajcman, Judy (1991), *Feminism Confronts Technology*. University Park, PA: Pennsylvania State University Press.

Wajcman, Judy (2002), ‘Gender in der Technologieforschung‘, in Pasero, Ursula and Anja Gottburgsen (Eds.), *Wie natürlich ist Geschlecht?,* Opladen: Westdeutscher Verlag, 270-289.

Zachmann, Karin (2004), *Mobilisierung der Frauen. Technik, Geschlecht und Kalter Krieg in der DDR*. Frankfurt/Main, New York: VERLAG.