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# 'One of the Boys' or 'Never Just Right'? Women's In/Visibility in Engineering

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## Abstract

This chapter focuses on social, cultural and gendered aspects of engineering. These aspects are explored within a theoretical framework linking the performance at work with expectations on behaviour in accordance with appropriate display of femininity and masculinity. Theories about women's in/visibility paradox and in/authenticity, as developed by Wendy Faulkner, are used to explain women's performances, experiences and strategies in engineering. The chapter draws on the results from the European research project *PROMETEA – Empowering Women Engineers in Industrial and Academic Research*. The aims of that project were to map the career paths of women in engineering and to learn more about how women's careers could be improved.

## Introduction

This chapter treats engineering as a culture in order to explain gender differences concerning career possibilities within this professional field. The arguments presented are thus in accordance with a research tradition that draws on perspectives from the social studies of science and technology (STS) (Wajcman 2006, 773). This tradition frames science, engineering and technology (SET) as social phenomena that cannot be understood without situating them in the social context where they are produced. Moreover, technologies are not only social, they are also gendered. Science, engineering and technology produce and re-produce certain ideas about gender, and gender affects the production of science, engineering and technology (Kirkup & Keller 1992).

Feminist studies have illustrated how the cultural images of engineering are associated with images of masculinity. According to Wendy Faulkner, gender and engineering is co-produced (Faulkner 2007, 334). As stated by Judy Wajcman: 'gender relations can be thought of as materi-

alized in technology, and gendered identities and discourses as produced simultaneously with technologies' (Wajcman 2007, 293). This symbolic association between technologies and masculinities explains the under-representation of women in engineering and men's dominance in this field (Bagilhole & Goode 2001, 171; Faulkner 2001). The engineering culture enhances men's power not only over the machines and the material world but also over women (Bagilhole et al. 2010; Cockburn 1992; Keller 1992).

To be identified as an expert in engineering and thereby to have a successful career involves not only having the right engineering skills. It also involves the correct display of these skills (Kvande 1999). 'It is not simply a question of acquiring skills, because these skills are embedded in a culture of masculinity' (Wajcman 2010, 31). The chapter hence recognizes the importance of what Judy Wajcman describes in the following way: 'that social and technical skills are inseparable in contemporary work organizations' (Wajcman 2006, 777). Those who perform the 'proper' behaviour are rewarded and promoted, while those who do not conform risk being deemed as unfit for the work (Dryburgh 1999, 668).

Boel Berner describes these impression management techniques as 'situated practices of knowing' involving: 'performance as display in front of others' (Berner 2008, 320–321). The 'others' here is the professional group consisting mainly of colleagues and managers but also customers and other professional groups. Learning the right performance is an on-going practice in interaction with the social and material world (Berner 2008, 321). However, not everyone has the same opportunity and possibility to perform as competent experts in engineering. Doing engineering is a way of doing masculinity:

To be taken as an engineer is to look like an engineer, talk like an engineer, and act like an engineer. In most workplaces this means looking, talking, and acting male. (Robinson & McIlwee 1991, 406)

The aim of this chapter is to highlight: (i) the gendered character of work performance (as display in front of others) in engineering, (ii) the challenges women face when performing as engineers, (iii) the different strategies women use to manage these challenges.

The analysis draws on empirical material gathered within the framework of the European research project *PROMETEA – Empowering Women Engineers in Industrial and Academic Research*. The goals of this project were to describe and analyse gendered organisational cultures in engineering research settings, to understand how masculine cultures influence women's careers, and to learn more about the individual experiences and coping strategies of women.<sup>1</sup>

This chapter has five parts following this introduction. The next section introduces previous research on gender and technology and describes the masculine culture in engineering in more detail. The concepts 'in/authenticity' and 'in/visibility paradox' are delineated and the 'double-bind dilemma' is further explained in relation to theories about expectations on women to behave in accordance with appropriate femininity. Women's strategies to cope with double-bind dilemmas are also outlined. The chapter continues with a brief presentation of the methodology and material of the research project PROMETEA, describing the qualitative research approach, the empirical data, the case studies and the interviewees. Subsequently, the research results and the analysis are presented in two sections. The results in the first section show that a successful career in engineering is dependent on the right performance. The other section illustrates women's invisibility as engineers and their visibility as women. The article concludes with some summarising remarks.

## Performing gender in engineering

Much research has considered the ways in which the (right) display of competence and expertise is pivotal for a successful career in engineering. Robinson and McIlwee conclude from their study of the culture of engineering that: 'What is important is not technical ability alone (...) but styles of self-presentation' (Robinson & McIlwee 1991, 417). According to Ruth Carter and Gill Kirkup, to be identified as an engineer it is important to present: 'an appropriate professional image and identity' (Carter & Kirkup 1990, 94).

Robinson and McIlwee also describe what this style of presentation requires: 'Engineering competence is a function of how well one presents an

image of an aggressive, competitive, technically oriented person' (Robinson & McIlwee 1991, 406). In a similar way Rosemary Wright describes the engineering culture as characterised by 'aggressive displays of technical self-confidence and hands-on ability' (Wright 1996, 86). Elin Kvande studied women in engineering organisations in Norway and found that these women experienced that 'it is not enough to be skilful and good in one's job if no one notices them. You have to make people notice you and stand out like the men do' (Kvande 1999, 315).

This specific kind of performance is a manifestation of the masculine culture within engineering. It is in line with what is understood as stereotypical, appropriately masculine behaviour. These traits include an ability to be self-interested, efficient, tough minded, assertive, taking charge and control (Britton 2000; Dryburgh 1999; Fondas 1997; Robinson & McIlwee 1991). What is understood as 'appropriate' behaviour for women is traditionally embedded in norms concerning feminine emotional competence involving empathy, caring, co-operation, helpfulness, listening, interpersonal sensitivity, attentiveness of others and responsiveness to their needs and a focus on work relationships and collaboration (Fondas 1997). Women thus 'do not fit the cultural mold' of engineering (Wright 1996, 91).

Being identified as technically competent and skilled is also contradictory to being identified as feminine and as a woman. Masculinities and masculine symbolism are embedded in technologies (Wajcman 1991, 2004). Rosalind Gill and Keith Grint describe the relationship: 'technical competence has come to constitute an integral part of masculine gender identity' (Gill & Grint 1995, 8). In the words of Judy Wajcman – women's reluctance to do engineering can be explained with 'the sex-stereotyped association of technology as an activity appropriate for men' (Wajcman 2010, 31). Robinson and McIlwee also conclude that: 'Men are not better engineers, but they are better at *appearing* to be better engineers in a *male-defined* way' (Robinson & McIlwee 1991, 417 italics in original).

Within the field of engineering women's credibility rests on their ability to 'navigate male-defined interaction rituals' and 'demonstrate an appropriate interest in technology' (Jorgenson 2002, 355). If women wish to have a successful career as engineers they are forced to accommodate

and, to the extent that this is possible, must take on 'the attributes of their successful male colleagues' (Britton 2000, 427). One typical adaptive strategy involves fitting in as much as possible, adhering to the rules of behaviour – looking, talking and acting male. Women thus need to develop similarities with male peers; to become 'one of the boys' (Dahmen 2010; Jorgenson 2002, 352; Kvande 1999). The problem with women adopting these strategies is that no long-term change of the culture is promoted. Nonetheless, for the individual woman these strategies can be extremely successful (Bagilhole et al. 2010, 271).

However, taking on masculine attributes is no straightforward solution for women. The display of aggressive and assertive self-confidence is a 'role with which most women are uncomfortable, even when they're capable of its performance' (Wright 1996, 87). Performing as an engineer also provokes disapproval from colleagues and managers if it entails women being perceived as too masculine and not appropriately feminine (Bagilhole & Goode 2001; Dryburgh 1999; Kvande 1999). This means that when women behave as an engineer this behaviour may not be perceived as positive or rewarded if this also means that they fail to fulfil expectations on gender-appropriate behaviour (Martin 2003). Women are thus never just right.

Not surprisingly Ruth Carter and Gill Kirkup observe that women in engineering have to face a range of dilemmas concerning personal presentation (Carter & Kirkup 1990, 94). Wendy Faulkner describes women's dilemma in engineering using the term 'gender in/authenticity' (Faulkner 2000). Faulkner explains:

For women engineers, tensions can flow from the very 'gender inauthenticity' of the woman engineer, which means that women engineers have a constant struggle to prove that they are not only 'real engineers' but also 'real women'. In this context, moving away from narrowly technical roles is a case of 'damned if you do, damned if you don't'. (Faulkner 2007, s. 350)

If women act in a manner consistent with appropriate femininity (e.g., by co-operating and showing empathy) they are considered less competent and less ambitious. When women perform as engineers (e.g., by displaying ambition and self-assertiveness) they are regarded as unfeminine

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and too aggressive (Jamieson 1995; Sabattini 2007). As a result, women in engineering encounter a double-bind dilemma. A double-bind dilemma presents a person with two incompatible, mutually exclusive, but also desirable alternatives (Trethewey 1999, 425). The double-bind dilemma for women is a 'no-win' situation for women in engineering since they also have to take into account the expectations about appropriate feminine behaviour, qualities and conduct (Bagilhole & Goode 2001; Jamieson 1995; Martin 2003; Sabattini 2007). Men do not experience the double-bind problem since the professional performance and expectations about appropriate masculine behaviour overlap in engineering.

Wendy Faulkner also describes the in/visibility paradox for women in engineering. The paradox entails that women in engineering are simultaneously invisible as engineers but visible as women (Faulkner 2009). This means that women have to put in a greater effort to be taken seriously as engineers: 'Being invisible as engineers means they have to work harder to (re)establish their engineering credentials (e.g. to prove they are not the secretary)' (Lee, Alemany & Faulkner 2010, 414). Being visible as a woman also increases the risk of experiencing sexual harassment (Lee, Alemany & Faulkner 2010, 414).

## The PROMETEA project

The researchers working in the PROMETEA project gathered empirical material in thirteen different countries – Austria, Chile, Finland, France, Germany, Greece, Lithuania, Russia, Serbia, Slovakia, Spain, Sweden and the UK. The use of common research tools allowed cross-comparison between countries, research settings and disciplines. Focus group interviews, one with women and one with men, were performed in two work places in each country. In these focus groups the participants discussed their personal careers and, more generally, the different career paths in that particular work organisation. Furthermore, semi-structured separate interviews with women engineers were carried out. In addition to the case studies, women researchers with experiences of positive career changes were interviewed. The aim of these interviews was to gain an understanding

of factors that influence women's career changes in engineering and technology research settings. The qualitative data also included interviews with so called 'top women', i.e. women in top positions in engineering.

The informants answered questions such as: How do you personally define career? What has been especially supportive for your career? Has there been anything that has hindered you in your career? Would your career be different if you were a man / woman? What does it take to get to the top in engineering and technological research? What were the reasons for your latest professional change?

The informants worked in the academic and industrial sectors, in engineering and technological disciplines such as materials science, energy, telecom and ICT, electronics and bio-engineering. Most of them had a doctoral degree. All interviews were recorded and then transcribed. The researchers working in the PROMETEA project in each country translated the interviews and focus group discussions into English. This made it possible to share the empirical material with the researchers in the other countries. A total of over 270 researchers (women and men) participated in interviews or focus groups in thirteen countries. In Sweden 22 persons were interviewed. The analysis in this chapter primarily draws on this Swedish material although the same results can be found in the empirical material from the other countries (cf. Dahmen 2010; Wächter 2010).

## Performing as an engineer

The data collected in the PROMETEA project reveal the importance of the social, cultural and gendered aspects of performing engineering. The in-depth interviews as well as the focus group interviews with women and men working in engineering sought to explore factors hindering or supporting careers. The analysis of the interviews illustrates how the masculine culture prescribes a certain performance in order to fit in and be identified as a successful or promising engineer. Even more than actual skills and competence, a certain performance was described as contributing to a successful career. Engineering involves a lot of communication, meetings and agreements and calls for a certain performance (Sagebiel, Dhamen &

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Hoeborn 2007, 22). This performance reflects a masculine organisational culture and was described as having a negative impact on women's careers in engineering. As a consequence, women engineers change their career paths and: 'leave because they get fed up' (Wächter, Thaler & Hofstätter 2007, 9).

In order to be successful as an engineer you need to be visible and self-assertive, elbow yourself up, stepping on others and surviving being stepped on, the interviewed engineers explained. One of the Swedish 'top women' emphasised the importance of having self-confidence and working very hard in order to have a successful career in engineering. Gender differences concerning career possibilities were not acknowledged in the discussion in a focus group with men in France. However, the importance of appearances was emphasised: 'It's the ability to sell yourself!'. Another French engineer explained that even if the technical competence was vital it was also important to: 'know how to be noticed'. In one of the French focus groups with women the need to be 'visible' to obtain a raise or a promotion was also stressed. Although not acknowledged by all engineers in the study, some women described how challenging it was to perform in a credible way as self-confident engineers. One of the women in the Finnish focus group put it like this:

Credibility is by the way one challenge. To be credible, to create an impression that you are credible. Not only that you create the illusion but really that I know and do master issues and I am equally competent than anybody else, or some man.

A German woman engineer explained what she had been lacking in order to have a successful career: 'I should have known about presentation and self advertisement'. One of the four top women interviewed in Germany explained what was needed to reach the top in engineering: 'Women need to learn talk big, men can do that better and therefore they get the better jobs even if they cannot do better' (Sagebiel, Dahmen & Hoeborn 2007, 37).

The women agreed having 'sharp elbows' was a masculine characteristic. Promoting yourself was a behaviour described as something women were not taught and something they were not comfortable with. According to one Swedish woman, as an engineer: 'You really have to



promote yourself and that is not something that you learn as a girl'. Another Swedish woman depicted the problems for women to perform as engineers in the following way: 'You have to be very competitive, not co-operate but be protective to your own research. You need to be thick-skinned. And that is perhaps difficult [for women]'. A French woman engineer explained the gender differences: 'Men do not hesitate, women exercise self-restraint, and we are less audacious. A man would sell himself more, and we would try not to shine, to search for glory'. This opinion was shared by another woman researcher, also from France: 'If we have to present a result, we want to be 800 per cent sure. Men advance results when they're 10 per cent sure, and people buy it. We self censor'. A Finnish woman described how she performed in front of her male colleagues:

Sometimes I focus on how I present things. I try not to be too insecure or 'twist' too much with the matter, just say it directly that this is the way it is. With women you tend to use a lot of conditionals like 'maybe' or 'it could be like this'. But with men you just have to forget about the conditionals and say that this is the way it is and this is how it should be done. And then they start to argue but you don't have to get frightened about that.

According to one of the Swedish women, in order to have a successful career, a woman needs support to be able to learn how to become aggressive and develop the capacity to grab an opportunity. She therefore suggested courses for women on how to become more aggressive.

Paradoxically, compared to men, women can face extra tough demands to perform appropriately as an engineer. Also drawing on the results from PROMETEA, Christine Wächter, Anita Thaler and Birgit Hofstätter describe how women 'have to show an extra portion of ambition, motivation, enthusiasm, self-assertion, willingness to prove one's abilities, being resolute and systematic, having and communicating a clear goal and being demanding' (Wächter, Thaler & Hofstätter 2007, 34).

A conclusion from the British case studies could be interpreted as an example of a manifestation of the double-bind dilemma. Women were stereotypically seen as either not career oriented or when they did get ahead they were depicted as too aggressive. This is also reflected in the women's answers to career questions. Almost unanimously the women

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answered that they were not career oriented but just wanted to do what they considered as fun: 'I would not define myself as a careerist' (French woman); 'I have never thought about a career. I want to do something that is fun' (Austrian woman); 'What is important is that you do something you like and feel is important' (Swedish woman).

## Visible as a woman

Previous research has described it as a challenge for women to gain acceptance and respect in engineering (Kvande 1999, 314). The women interviewed in the PROMETEA project also talked about the hard work needed, harder for women than for men. One of the Swedish focus groups with male engineers also recognised the tougher resistance faced by young women, and their struggles to become respected and accepted as competent researchers (cf. Wächter 2010). However, the women could not only rely on performance. Sometimes having a body identified as female was enough not to be identified as an engineer. The women's stories are hence in line with the in/visibility paradox described by Wendy Faulkner (2007). Women engineers are highly visible as women but not visible as engineers. Although the visibility was commented on as something positive by some of the interviewed women the wrong kind of visibility creates problems when women become visible as sexual objects in a heteronormative context (Dahmen 2010, 217–218).

Informal socialising with colleagues was a common feature described in all countries as important in order to be invited into networks. This kind of socialising also demanded a special kind of performance with masculine undertones. In particular informal socialising and social activities involved drinking and football. A male researcher in Germany explained: 'If you want to be successful in raising funds or getting project partners, you have to get drunk once with your future cooperation partner'. A woman researcher, also in Germany, described that her male colleagues: 'meet in the evening for a beer'. However, for women this kind of important informal socialising was not a straightforward performance, as another woman researcher in Germany explained: 'As a woman you

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cannot go out with your colleagues, everyone would be talking about you having an affair with your colleague'. One German 'top woman' had experienced it as difficult to access important networks and explained it as a 'gender question' because: 'Men meet for a drink'. A French woman explained: 'I do not have leisure activities with colleagues out of the workplace'. A British woman described how intimidating it was for her, being almost the only woman among male colleagues, to join them in the bar after work:

All the men are standing with their beers talking up there somewhere because they're all tall. We know we need to get in there and need to speak to them, but I felt like a little girl because I'm small in comparison. You have to think 'go on', 'let's do it'. (...) It was an effort but you make yourself do it.

To be able to join informal socialising with male engineers the women needed strategies, one of the Swedish women explained:

I really try to go to bed very early and don't linger in the bar talking because I don't want to give them the wrong idea by being happy and perky and party all the time but also to be serious at the same time.

In the Finnish context the sauna evenings were mentioned as problematic for women. In the Finnish culture it is often said that important decisions are made in the sauna (Husu & Koskinen 2007). As the Finnish sauna practice is single-sex in a professional context this was viewed as a practice that excluded women from important informal socialising, a woman researcher explained:

It's not nice to be the only woman in the group or in the team, when there's some evening gathering with sauna activity. You will be alone in the sauna and the guys are going afterwards. You don't know what they discuss there.

References to a masculine work ideal that centred around an interest in sports recurred in the interviews. In one of the British case studies the staff played football every lunch hour. Previous research has also outlined how men exclude women from networks and informal communication

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systems by: 'talking endlessly about sports', as women often are unfamiliar with sporting metaphors (Rutherford 2001, 378). References to sports appeared in connection with women's expressions of dissatisfaction with masculine behaviour that they did not feel they could identify with or adjust to. The women in one of the Swedish focus groups were asked if it was important for a successful career to network with men at work. One of the women answered: 'You can't network with men here! If you do, you have to play football with them and I am not interested in that'. In addition, another Swedish woman described how a male colleague's interest in football manifested itself in a professional research setting. She seemed unable to share his enthusiasm over the game and instead depicted it as ridiculous:

My previous supervisor used to tell me about how he had met other researchers at conferences and talked football with them. He seemed kind of proud about it. I think it's rather silly. Why should they talk about that? Don't they have more important things to do?

In more formal work settings women's visibility involved general images of gendered work tasks, such as women as secretaries. A woman researcher in Germany was labelled as secretary by her male colleagues and had difficulties being recognised as a competent engineer. She explained the performance that was needed: 'Women have to exert themselves more for bearing up'. One of the interviewed Swedish women described being stuck with a lot of non-qualifying administrative work tasks just because she was a woman. Another Swedish woman engineer illustrated how men turned to women for the execution of administrative tasks but also how women resisted this:

My manager asked me to keep the minutes at the meeting and I objected because I did that at our last meeting. He then turned to another woman who actually said; 'I took a class in gender perspective, so now you have to turn to a man'. She actually said that. And then he asked a man.

This is an example of how women resist being associated with these types of work tasks in a stereotyped, gendered way.

Women also found that their visibility as women meant that their competence as engineers could be questioned. A Swedish woman described how she had been called into question as a competent engineer by her male colleagues: 'It's a problem when people think that because you are a woman and underrepresented someone has helped you to get where you are today'. Women are not expected to be successful as engineers and even if they perform as engineers they can be distrusted as not competent.

## Concluding remarks

This chapter has highlighted women's in/visibility paradox in engineering and how difficult it is for women to combine 'gender authentic' performance with performing as an engineer. According to the engineers interviewed in the PROMETEA project, women's career progression and advancement in engineering depended on their ability to perform competitive, self-confident and ambitious. These accounts reflect performance in accordance with masculine traits and qualities characteristic of men and typical of men's lives and experiences (Fondas 1997, 260; Kvande 1999, 315; Robinson & McIlwee 1991; Wajcman, 1991, 141; Wright 1996, 85–87).

The accounts given in this chapter are also in agreement with the notion of women having to learn, although with great difficulty, how to accommodate their performance (Britton 2000, 427). The interviewed top women seemed to have adjusted exceptionally well to the demands on performing as an engineer. There is little evidence of women criticising the need to display a certain type of engineering performance in the data. In comparison, previous research has identified this as a common strategy for women engineers (Kvande 1999). The lack of data illustrating women's challenging strategy might be explained by the fact that women engineers 'leave if they are not adaptable to the cultures' or maintain 'unimportant positions' (Bagilhole et al. 2010, 271). The results from the PROMETEA project are thus in line with previous research underlining that men have been able to stipulate the 'rules of the game' (Bagilhole & Goode 2001, 166; Faulkner 2001, 81; Robinson & McIlwee 1991, 411).

Nevertheless, this chapter has highlighted that some women resisted the kind of informal socialising that demanded certain behaviour. They did not strive to become 'one of the boys' in this informal context. The women in the study, for example, expressed their discontent with their male colleagues' interest in sports. This draws attention to an often overlooked matter: that professional performance also has a more informal character. However, not adjusting to this informal performance in interaction with male engineers excludes women from important informal networks.

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