Can Women Engineers be 'Real Engineers' and 'Real Women'?

Gender In/Authenticity in Engineering

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Introduction

A sociology student in one of my classes reported (unprompted) that men engineering students she knows describe the women on their course as either "ugly lesbians" or "pretty and only doing engineering in order to find a man". Threaded through the gross heterosexism of the engineering students' remarks is an equally worrying message about women engineers: women who are really into engineering are not 'real woman' and conversely 'real women' are not 'real engineers'. In what follows I will demonstrate how, in often subtle and taken-for-granted ways, this *gender in/authenticity* message gets reproduced again and again in engineering cultures, practices, and identities. I will argue that this is a crucial, but not widely understood, reason why the profession remains so resistant to gender change in most countries, in spite of concerted government- and industry-backed campaigns to recruit and retain more women engineers.

It is frequently claimed that women engineers have to "fit in to a masculine culture" (e.g. Carter and Kirkup, 1990), yet there is little systematic research on the subject, or any critical analysis of what is 'masculine' about the cultures in operating engineering. My evidence comes from a study, entitled 'Genders in/of Engineering' (Faulkner, 2006), which sought to bring a gender 'gaze' to an ethnographic investigation of engineering practices, cultures, and identities. The study combined interviews with observation through job shadowing in three companies: in software development (1 US workplace in 1998), in building design (2 UK workplaces in 2003), and in oilfield services (2 UK

workplaces in 2004). In total, 52 engineers (33 men, 19 women) were studied in these workplaces; a further 19 interviews were conducted with engineers from different disciplines and sectors. Analysis was based on repeated reading of extensive field notes, interview transcripts, and reports.

By using ethnographic methods, I hoped to document the more subtle gender in/exclusive dynamics which do not always register as such to participants. With notable exceptions (Hacker, 1989, 1990; Mellström, 1995; Tonso, 2007), ethnographic studies of engineers have not addressed gender; and most research into women in engineering has been based on interviews with women. By focusing on 'genders in/of engineering', I hoped to find out more about the men and masculinities of engineering in the belief that this is necessary if we are to understand the continuing poor representation of women in the profession. Gender in this framing is understood as multiple, fluid, and relational – not as fixed and time-less dualities of femininity/women vs. masculinity/men. I thus sought to investigate how genders are performed (see Butler, 1990) – how particular femininities and masculinities are actively constituted through social interactions and institutions – and, thus, how they may be changing and/or changed.

Two prior US studies informed my own. The first was a longitudinal, cross-sector study conducted by Judith McIlwee and Gregg Robinson (1992). They found that, although most women engineers occupied lower status positions than similarly educated men within ten years of graduating, they fared relatively better in some fields and organisations than in others. A key factor here was the existence of an 'engineering culture' which celebrates hands-on technical competence (even when the job does not require this) and rewards aggressive self-promotion. Thus, they conclude, "It is women's membership, not their competence, that is at question. They do not conform, or more accurately, do not *appear* to conform, to the culture of the workplace." (McIlwee and Robinson, 1992: 138) The second was an ethnographic study by Karen Tonso who, after 15 years work experience as an engineer, felt that "something about engineering seems to make it difficult for women to be thought of as full-fledged members" (2007: 2). She sought to investigate the process of 'becoming' an engineer by conducting extensive participant observation amongst college engineering students. As an insider/outsider, she was uniquely placed to observe various subtle ways in which the ability of the women students as engineers is often rendered invisible (see later).

Gaining relevant qualifications and technical expertise are necessary but not sufficient criteria for membership of an occupational community of prac-

tice; many other, informal mechanisms and criteria determine whether one is seen and felt to belong. In engineering, shared pleasure in technology (Kleif and Faulkner, 2003) is a common bond, as are shared approaches to thinking about problems and a shared humour about non-engineers' inability to see the world as 'we' do. Also crucial, in all occupations, are everyday aspects of what I am calling workplace culture, unrelated to the immediate demands of the job – such as how people interact with one another, topics of (non-work) conversation, what they find funny, and who socialises with whom. These things not only help oil the wheels of the organisation and get the job done, they also have a huge bearing on who is seen and felt to belong, and on who gets on. As numerous studies of workplace culture reveal, 'doing the job' frequently entails 'doing gender' (e.g. Acker, 1992; Collinson and Hearn, 1996; Halford et al., 1997).

My own fieldwork observations on engineering workplace cultures paint a mixed picture (see Faulkner, 2009a). Two workplaces provided extreme cases: in one UK oilfield engineering base, strong pressures to conform to a macho version of masculinity; and in the US software development department, a keen awareness of diversity politics. In general, the engineering workplace cultures I observed were respectful. Nonetheless, in all five workplaces I identified dynamics which tend to include some and marginalise others: most notably, the use of fraternal forms of greeting ('mate' or 'man') for which there is no feminine or gender neutral equivalent; a tendency to lean on topics of conversation stereotypically associated with men (e.g. football); and the existence of social networks of men whose masculinity is locally hegemonic and/or organisationally powerful. Such dynamics make it easier for (most) men than (most) women engineers to build and maintain working relationships and to progress their careers.

Underlying these dynamics is a phenomenon suggested also by Tonso's findings – a phenomenon I am calling the in/visibility paradox, whereby women engineers are simultaneously highly visible as women yet *in*visible as engineers. I believe this paradox is a key to understanding why women engineers struggle to belong in engineering workplace cultures. This chapter elaborates how the in/visibility paradox operates, and explores the related concept of gender in/authenticity. I initially coined the latter concept to capture *the apparent congruence or non-congruence of gender and engineering identities for men and women engineers respectively* – as in engineering is (felt and perceived to be) a gender inauthentic option for women (Faulkner, 2000a). It is a gender authentic option for men simply because the large majority of engineers are men; this is the statistical norm. Norms shape expectations; when people think 'engineer' most envisage a man. Women engineers are invisible, and surpris-

ing, as engineers for the same reason. They find themselves having to explain why they chose this career, where men who opt to be engineers are not remarkable, as men. With norms come normative pressures. Crucial amongst these, I believe, is the symbolic association of men/masculinities and technologies (Lohan and Faulkner, 2004), and the conventional gendering of the technical/social dualism evident in stereotypes like the asocial engineer. Even though actual people and practices are far more diverse than dualised stereotypes (Faulkner, 2000b), such symbols still perform work; they serve to normalise gender difference and inequalities. Accordingly, the term gender in/authenticity also serves to capture *the normative pressures of the way things are.*

INVISIBILITY AS ENGINEERS

Being seen to be professionally capable is naturally crucial to gaining membership in any occupational community of practice. That this is a particular struggle for women as engineers is evident at all stages of the career cycle. At university, men students are often surprised when the women start performing well academically. Even when faced with evidence to the contrary, there can remain lingering doubts about the women's ability (Dryburgh, 1999). Participating in student design teams, Tonso (2007) was able to observe subtle dynamics by which the contributions of very able women engineers were rendered invisible to faculty members. The men students involved were generally unaware of their part in this process, and the women were left wondering why they weren't getting good jobs.

Most women engineers have experienced being (quite literally) invisible as engineers – classically when they are mistaken for the secretary by outsiders. Arriving to do a presentation to a potential new client, building design engineer Karen knows she must immediately introduce herself and take a prominent role if she is to avoid this: "As a senior woman who is blond and girlie looking, there are people who don't take me seriously to start with. But once they realise I can do the job, it's over." It is a frequent lament of women in any occupation where they are in a minority that they have to work harder than the men to prove their ability. Yet none of the younger women engineers I interviewed voiced any concern that this might undermine their career. They tend to claim that any lack of credibility because of their gender is short-lived. Sadly, however, my findings indicate that doubts over women's engineering ability do not stop once they have passed the 'apprentice' stage. Even really

senior, older women engineers told me they have to (re)establish their credentials every time they encounter a new colleague, associate or client. So, having to demonstrate you can do the job constitutes an extra layer of practitioner identity work which women, and not men, have to do throughout their careers. A recent EU study, Prometea (Godfroy-Genin, 2010), found that this pressure is compounded by the (apparently widespread) perception that women engineers benefit from 'unfair' preferential treatment – that they 'got the job because they were a woman not because they were good enough'. This explicit questioning of the women's competence can be extremely undermining.

Various forms of labelling can serve to undermine the visibility and credibility of women as engineers. By no means trivial is the near universal use in the UK workplaces I studied of the generic 'he' to refer to an engineer who is not known, and the widespread use of masculine terms – 'men', 'boys', 'guys' – to refer to groups of engineers. There is little awareness of the impact of gendered language, even amongst engineers who support getting more women into engineering. But when a company director says "We put our key men forward" in bidding for a big design contract, he is perpetuating a tradition which makes it 'normal', even 'natural', to choose men for such jobs. At best, such statements render women engineers invisible; at worst, they render the very category woman engineer a non-sequitur.

Tonso (2007) asked interviewees to list and explain any terms they use to identify different types of engineering students. This yielded 36 terms in three categories: 'nerds', who were like design engineers; 'academic achievers', who performed best at the more abstract core of the curriculum; and 'geeks', who also performed well academically but were identified by their wider campus activities. Strikingly, only four of these 36 terms refer to women, all of them in the 'geek' category, so not defined by engineering performance. Informants simply didn't *see* women as being 'nerds' or 'academic achievers', even though many of their women colleagues would fit in these categories. As with the generic 'he', Tonso warns that such constructions of practitioner identities are consequential: "One cannot belong as an engineer if there are no recognised ways to belong as such." (Tonso, 2007: 255)

Perhaps somewhat less obvious is the implicit gendering of dichotomised categories used to describe different kinds of engineering work – hard/soft, concrete/abstract, practice/theory, technical/social. Gender hierarchies are often constituted through these dualisms – both symbolically and organisationally – albeit in contradictory ways (Faulkner, 2000b). The technical/social distinction surfaced repeatedly in my research, perhaps because it maps so

readily onto culturally available presumptions about masculine instrumentalism and feminine expressiveness. For example, many men engineers cleave to a 'nuts and bolts' identity: although this technicist identity is at odds with the profoundly heterogeneous nature of engineering practice, it converges with (and performs) available masculinities with which they are comfortable. The gender messages operating through these various mechanisms render women's membership as 'real engineers' more fragile than men's (Faulkner, 2007).

A crucial consequence of their fragile membership as engineers is its impact on the professional self-esteem and confidence of many women engineers, at various points in their career. Several younger engineers told me they unexpectedly experienced a sudden loss of confidence on entering university. I found this a shocking discovery, given the self-confidence required even to opt for a non-gender-conventional career, but Tonso's work signals the kind of identity and educational dynamics that might contribute to this. Both the McIlwee and Robinson (1992) and the Prometea studies (Thaler, 2010) encountered women engineers who reported a loss of confidence on getting stuck in dead-end jobs mid-career. Like Tonso, I believe many women engineers internalise a sense of their fragile status as engineers; it is *felt* as well as perceived. One older woman engineer recounted how, when she and other women engineers meet, they often "confess to feeling a fraud" after a few drinks together. Another told me that she and other women engineers who have been in senior management roles for some years tend now to introduce themselves to new acquaintances or associates as 'a manager' rather than 'an engineer', where senior men colleagues in these roles continue to refer to themselves as engineers.

We see very clearly here the sense of women engineers lacking 'authenticity' as engineers; indeed the strength of the evidence on this is a key reason why I have been unwilling to abandon the concept of gender in/authenticity. Shaky self-esteem and confidence can be insidiously undermining, with very damaging consequences for the retention and career progression of women in engineering. Whilst most women engineers are aware of their gender visibility and of the need for them to work harder than the men to prove their engineering credentials, few appear to be aware of the more subtle dynamics within engineering workplaces by which their professional self-esteem is undermined. Feelings of lack of confidence or authenticity are rarely voiced in public (in front of men). They tend to be seen as a personal failing rather than something for which the wider community and organisation bear responsibility, which is one reason why networks for women in technical occupations can be such an empowering mechanism for their members (Lee, 2011).

Several analysts have encountered a reluctance amongst (some) women engineers to see gender as relevant in their careers and workplaces, or to engage in collective feminist action. There seems to be a pervasive 'discourse of gender neutrality' – that everyone is being treated equally – amongst women and men scientists and engineers (Eisenhart and Finkel, 1993). In interviews with 15 women engineers (between the ages of 29 and 45) in the US, Jane Jorgenson found that "participants do not frame difficult episodes in their professional lives in terms of gender inequality" (2002: 350) and largely adopted a non- or anti-feminist position. Tellingly, Lisa Lee (2011)'s interviews with members of women's technology networks in Europe reveal a sensitivity that being 'feminist' implies a threat to the unity of the profession. Faced with challenges from feminists, the women students Dryburgh (1999) studied defended the 'play hard' culture of their men peers, even though they themselves rarely participated; and frequently dismissed any sexist behavior by men engineers as exceptional, even when presented with evidence to the contrary. She sees commitment to group solidarity as a key element in the socialisation of engineering students and concludes that learning to convey solidarity, like learning to convey one's competence, "requires extra effort [for the women] beyond what is asked of men in a similar position" (Dryburgh, 1999: 681).

We see again in these tensions the non-congruence of practitioner and gender identities for women engineers. It seems that, by refuting or playing down the significance of gender, women engineers are better able to strengthen or protect their fragile membership as engineers, while playing up gender and heightening their visibility as 'women' can be seen (and felt) to threaten their membership in the community of practice. Jorgenson suggests that women engineers' choice to distance themselves from feminist analyses and forms of intervention should be read as discursive positioning: it performs important identity work "consistent with assimilation strategies widely observed amongst female scientists and engineers to disqualify their femininity by muting their visibility as women" (2002: 169–70).

Visibility as Women

Whilst the invisibility of women engineers as engineers means they have to do extra layers of practitioner identity work, their visibility as women often means – paradoxically – that they also have to do extra layers of gender identity work. The point here is that women engineers tend to get pigeon-holed by

their colleagues into certain stereotypically feminine identities – most commonly as (hetero)sexually available or as mother – identities which have nothing to do with the job and which can be extremely problematic.

Of the labels used by Tonso's students to identify women engineers, only one (sorority woman) was respectable; the remainder characterised women engineers in terms of whether they were pretty and, by implication, sexually available to men (Betty, sorority chick/girl), or ugly and undesirable to men (engineering school woman). As in the remarks with which I opened this chapter, 'real woman' is defined in heteronormative terms: she is heterosexual and attractive to men. Being sexually visible brings the risk of predation. Most women engineers, unlike their men colleagues, have experienced unwanted flirting and/or sexual harassment from men colleagues or associates at some point. Young women are often ill-equipped to deal with this effectively. One oilfield engineer was sexually harassed by a client early in her career; with the benefit of hindsight, she says, "I should have reported him, but I didn't have the confidence, or the support." Some men are aware of these issues. Martin (also an oilfield engineer) told me, "I don't see my women colleagues as women", by which I later realised he meant he doesn't see them as sexual. Since he doesn't approve of sex between colleagues, Martin's intention here is supportive – as are the crewmen's who tell me they often 'protect' women on their team from sexual advances by other companies' crewmen offshore. But the equation drawn between 'woman' and '(hetero)sexually available' is striking.

Being visible as a mother can occur in two ways. One is a tendency to view *all* women as potential mothers – as when small firms refuse to employ a young woman in case she becomes pregnant, or when a lack of family-friendly provision is identified as *the* major reason for the loss of women engineers. The other occurs when having children is deemed to be the sole responsibility of the women. Thus, such family-friendly measures as exist in engineering workplaces are frequently viewed as 'for women', with scant awareness that more men engineers than women engineers are parents (in both absolute and relative terms). Little wonder that, in the absence of adequate support from either employers or partners, opting to have children is often a watershed in the careers of women engineers, the point when they get overtaken by their men peers. Those who stay frequently report that their visibility as mothers reduces further their visibility as engineers, where men with children continue to be taken seriously as engineers and are not defined by being parents (Lee et al., 2010).

There is evidence that becoming a mother shifts both the kinds of femininities women engineers perform at work and the career strategies they pursue.

From a study of women and men engineers in six organisations in Norway in the late 1980s, Elin Kvande (1999) identified four 'ideal type' femininities, split on two axes: (i) sameness or difference to men and (ii) proactive or not with respect to their careers. Younger women and women who opted to not have children tended to adopt a 'sameness strategy' whereby they sought to fit in and/or compete with the men on the men's terms. Like women in the studies reported earlier, they believed gender is not relevant at work, and tended to distance themselves from other women. By contrast, women with children pursued a 'difference strategy' because "By being pregnant, the women erase the idea of gender neutrality at the workplace." (Kvande, 1999: 307) They were unwilling to conform to the organisational norms and values, so either withdrew from the competition and prioritised family life or attempted to combine family and career by competing on their own terms.

The same/different choice of available femininities revealed here stands in some contrast to the fairly wide range of masculinities, some of them quite marginal, accommodated in the engineering workplaces I studied (Faulkner, 2009a). Kvande attributes this polarity to a 'dilemma of difference' whereby women have to position their gender identities in relation to the hegemonic masculinity/ies (see Connell, 1987) operating in the profession. This dilemma of difference is fundamentally linked to the non-congruence of gender and engineering identities for women engineers captured by the gender in/authenticity concept. If to be a 'real engineer' is to be a man, *and if 'men' and 'women' are necessarily different*, then women engineers have to play down their identity as 'real women' if they are to belong in engineering. Whilst women engineers are highly visible as women, they must also learn to, in some sense, become *in*visible as women. This is what Jorgenson (2002) means by "disqualifying their femininity", a perhaps superficial example being Kvande's finding that women engineers who "wear frills" or use make-up would not be taken seriously.

Jorgenson (2002) has challenged the tendency of the women in engineering literature to cast women as victims or (less commonly) resisters, arguing for a more nuanced and situated analysis; my own research supports this move. Certainly, my fieldwork identified pressures to become 'one of the lads' if they are to fit in to a workplace culture largely defined by and comfortable to men, where in some settings fitting in can mean sitting on the margins of conversations about football and families, going along with sexual humour or swearing, and so forth (Faulkner, 2009a). But my evidence also reveals a more complex and changing picture than is suggested by the 'disqualifying of femininity' conclusion of much earlier research. When I asked women engineers what

they felt about going into an occupation dominated by men, the first response of many was that they enjoy the company of men and have many men friends. Some relish the challenge this presents. Oilfield engineer Kathleen "liked being a novelty" and feels very proud that she "was good at the job and got noticed for it". Others are pragmatic, claiming that being visible as a *woman* engineer can work to their advantage: once their engineering credentials *are* established, colleagues and contacts remember them *because* they 'stand out in the crowd'. Yet others claim to be neutral on the subject. Kristin was initially the only woman in her oilfield base where now women are in the majority; "It doesn't bother me either way", she says.

Dress is one of the ways in which gender identities are, rather literally, performed; and it is an area in which women generally have more discretion than men. In all four UK engineering workplaces, where almost all the women engineers are in their 20s or 30s and not mothers, a higher proportion dress 'up' for work in conventionally 'feminine' ways – including high heeled shoes, 'pretty' tops, even dresses. This indicates a shift from the 'no frills and make up' norm reported by Kvande. I sense that many of these women enjoy the perceived dissonance between a 'girlie' gender identity and their identity as engineers. This surfaced humorously on the occasion of oilfield engineer Laurie's birthday, when she wore a dress and a cream shawl to work (which shocked me, I must confess). She tells her colleague, Kristin, "I was getting my nails and hair done on Saturday", to which Kristin quips "And you an engineer!" and Laurie responds "Only from Monday to Friday!"

I suggest there is something more complicated going on here than a simple sameness/difference choice. Rather, I found a double paradox with respect to women's gender in/visibility in that, alongside the pressure to become 'one of the lads', there are also pressures not to 'lose their femininity'. Women engineers are expected to 'blend in' but, at the same time, *not* to behave like men in certain areas. The dividing lines are often only obvious when crossed. Women engineers offshore are judged badly if they aren't willing to 'have a go' at physically demanding jobs like turning valves, but they are expected to demure to men over heavier lifting work. Similarly, when building design engineer Alison cracked a sexual joke, the consternation of her men colleagues made it clear she had broken tacit norms about appropriate behavior for women: it is OK to laugh at sexual jokes but not to make them.

In negotiating and performing gender identities which are comfortable for them but also admissible within the workplace culture, women engineers occupy a rather ambivalent space. Leila is a case in point: "[Engineering] Being

male-dominated doesn't bother me. I always had more men friends than women. Many women are too girly. I think I have managed to stay very feminine; men comment on it. Some [women engineers] have lost it a bit because […] it starts early." References to women engineers who have 'lost it' were common in the oilfield engineering company. This underlines the thread running through the literature, that simply by being a woman in a man's job, women engineers jeopardise their status as women. But notice the delicate juggling act: Leila is 'very feminine' but not 'too girly'. Similarly, Léa told me she tries to find "a medium place between 'girls with nails' and 'feminist'". So what we see here is a tension between two gender messages: one which says, 'To be a woman engineer is to be somewhat less conventionally feminine, or more masculine, than most women' (several of the women software developers I interviewed made comments like this about themselves); the other which says, 'To be a "real woman" – or in my terms, to preserve one's gender authenticity – one must conform to stereotypes of femininity.' That the required stereotypes remain heteronormative is evident in Leila's reference to men as the judging audience for 'staying feminine', and in the concerns of men offshore to 'protect' their women co-workers from undue sexual predation and hard labour.

Conclusion

Gender in/authenticity and the in/visibility paradox create issues for women engineers which men engineers, by virtue of being men, rarely have to experience. Through numerous subtle and not so subtle dynamics, women engineers are perceived, and can feel themselves, to be not quite 'real engineers' *or* 'real women'. Men engineers belong more 'naturally' both professionally and in terms of gender, whilst women have to do additional identity work on both fronts if they are to secure their membership in, and so stay and progress in, engineering. The cumulative impact of these in/visibility dynamics on individual women engineers can be insidious and undermining, throughout their careers – a 'dripping tap' effect. Studies and policy recommendations on the retention and progression of women in engineering (e.g. European Commission, 2006) typically foreground structural factors, like the lack of flexible work practices and the norm of long working hours. Significant though these issues are, however, my research demonstrates how subtle, 'taken-for-granted' gender dynamics in workplace cultures also have a huge bearing – and so also need to be tackled.

For some, the language of gender in/authenticity implies a worrying essentialist judgement – about 'real' women, etc. The point for me is that it signals *real membership*, of engineering and genders. The deeper I reflected on my evidence, the more I realised that it is precisely the shocking quality of the term that gives the concept salience: it signals how consequential it is to be an 'exception to the norm' – and conversely, how much easier life is for those who conform to the norm. It would be wrong, however, to view genders in/of engineering as monolithic and unchanging. My evidence on the in/visibility of women engineers is mixed, as it is on other gender dynamics in/of engineering workplace cultures. This complexity allows us to consider the second aspect of the gender in/authenticity concept – namely, the normative pressures of the way things are – and to pose the question, how might gender change happen/be happening in engineering?

In this connection, I have found it useful to resurrect the dual meaning of norm: as statistical norm and as sociologically normative pressures. It seems to me that both are operating in engineering workplace cultures. Thus, comparison of the different workplaces I studied (Faulkner, 2009a), reveals that engineering workplace cultures are more comfortable for (most) men than (most) women to the degree that (i) men outnumber women and that (ii) narrow and locally hegemonic gender norms are operating. In general, the largest cultural group will tend to set the tone in any workplace, leaving any minority groups to adapt and 'fit in'. This is what Vivian Lagesen (2007) calls the 'strength of numbers' phenomenon. The greater the relative numbers of men to women, the greater the normative pressures and the more tenuously women belong. At the same time, women's membership and career progression in engineering are stronger where organisations work to nurture more inclusive workplace cultures. So the impact of relative numbers can be obviated to some extent, through instruments like strong team management and diversity training.

Rosabeth Moss Kanter's pioneering study of women entering the sales force of a large US corporation (1977) identified three common experiences: they felt highly visible as women and under pressures to perform better than the men; they felt isolated from the men's informal and professional networks; and they felt trapped in gender-stereotyped roles. These findings have been echoed in numerous subsequent studies (e.g. Padavic, 1991). Of particular note here, in/visibility dynamics and pressures to perform gender difference are almost invariably experienced by women in occupations dominated by men. Kanter attributed this to the numerical gender imbalance of an occupation, but in a persuasive critique, Janice Yoder (1991) demonstrates that gender

hierarchies, segregation, and various forms of sexism are also critical. This concurs with my conclusion that relative numbers *and* normative pressures in the wider gender order both work to reproduce stability.

Critical amongst these normative pressures is the tendency to see women as necessarily different from men, which so readily constrained the gender performances I observed. Judith Butler (1990) argues that this ideology of gender difference is a crucial symbolic aspect of heteronormativity, that most people have an investment in policing boundaries around what is admissible for women and men (e.g., by 'protecting' women from heavy work or swearing). She further argues that the performance of difference occurs through 'stylised repetition of speech acts' (e.g. the generic 'he'). It is common to find that actual people and practices are diverse, while people's accounts of them tend to dualise. For example, one frequently hears that women engineers have better 'people skills' than men engineers, but I found no empirical support for this in any of the workplaces I observed (Faulkner, 2000b). The repetition of such presumptions serves to reproduce the man engineer as the norm and the woman engineer as the invisible non-sequitur.

The upshot of this analysis is that we need to tackle both the wider gender order and the numerical gender imbalance if we want to achieve gender equality in engineering. Put another way, we need to normalise the woman engineer – both in the statistical sense, that the numbers of women become closer to those of men, and in the normative sense, that engineering becomes as 'gender authentic' an option for women as for men. This means that, as well as recruiting more women into engineering, its workplace cultures have to be made much more welcoming, comfortable, and supportive places for women in order to avoid losing or under-utilizing their talent.

The Prometea study found that, whilst most large engineering organisations across Europe now have policies which seek to improve the retention and progression of women engineers – addressing family-related issues, work-life balance, and career development – the uptake and the impact of such policies is generally limited or uneven (Lee et al., 2010). Moreover, few do anything to address gender dynamics in the workplace culture. There is a crying need for sustained 'culture change' to 'win hearts and minds' behind equality and diversity programmes at all levels of organisations (see Liff and Cameron, 1997). Such culture change requires time and commitment. A central element has to be raising awareness of in/visibility and other gender dynamics in the workplace. This is especially challenging, not only because of hostility to feminism and perceptions of 'unfair treatment', but also because many exclusion-

ary practices and cultures are so taken-for-granted they appear 'normal'. They persist because that they are not *seen* as exclusionary, even by members who care deeply about gender equality and who actively support women engineers (Tonso, 2007; see also Frehill, 1997).

This very taken-for-granted-ness is a key reason why gender inclusive efforts to date have had only limited impact. There may be promise, however, in my finding that in/visibility dynamics are far less prominent in women's individual interactions with close men co-workers than in group situations and encounters with outsiders (also observed by Padavic, 1991). With careful work on diversity awareness, such men could become agents of gender change – challenging the tendency of other men associates to ignore, undermine or stereotype their close women colleagues – so taking the pressure from them to do all the fighting or demure (Yoder et al., 1998 provides a compelling example of how this can be achieved).

I believe the other reason why gender inclusive efforts have had only limited impact to date is that so many cleave to the ideology of gender difference which underpins perceptions of gender in/authenticity. Crucially, following the argument developed here, we need to challenge stereotyped dualisms about both gender and engineering. In the words of physicist Evelyn Fox Keller (1992), we need to learn to 'count past two' – to create space for more plural versions of masculinities and femininities, and to foreground heterogeneous rather than dualised understandings of engineering (Faulkner, 2007). There remains considerable resistance to 'counting past two' amongst women into engineering practitioners as well as engineers. Many liberal feminists appeal explicitly to the conventional gendering of the technical/social dualism, in their attempts to attract more women (Lagesen, 2007). The ideology of gender difference is so pervasive (and comfortable), it can feel like 'tilting at windmills' to suggest this approach is counterproductive. But efforts to improve the representation of women in engineering will continue to flounder unless we succeed in getting this message across.

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