

# Engineering Women: The ‘Gendering’ of Professional Identities\*

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*This paper presents some of the findings of a research project conducted in the year 2000 in the UK, investigating the under-representation of women in the engineering profession. Many of the conclusions revolve around the imagery and cultural stereotyping that affects the educational decisions made by girls and young women, and suggests that professions and curricular areas are ‘gendered’ in a way that tacitly limits their career choices. Suggestions are made for initiatives that might combat this problem, suggesting in particular that images of female engineers should be prioritised in the context of industry public relations.*

## INTRODUCTION

‘When women undertake male work, such as engineering, they upset a widely accepted sense of order and meaning.’ [1]

WHY IS IT that in the popular imagination, and often in reality, ‘the engineer’ is always a man? What makes our conceptions of engineering as a profession so incompatible with the figure of the woman engineer, or to be more abstract, with our conceptions of femininity? This paper presents the results of a UK study designed to formulate some answers to these questions. During the course of the research, *image* emerged as a prominent issue in terms of female under-representation in the engineering profession.

This discussion deconstructs the way in which sexual imagery interacts with notions of work to inform the definition of careers that are considered acceptable for men and women—a process that has been termed the ‘gendering’ of professional identities [1]. The conclusions deal with the gendering of engineering as it relates to the predominance of men in the field and their high visibility in its outward presentation, without reference to factors that may be inherent in the discipline and its practices. The justification for this approach comes from my interviews with a group of women in the industry, who felt that the status of the female engineer as a cultural anomaly was strongly connected to the public image of the profession, rather than to any intrinsically ‘male’ characteristics of the subject itself. My analysis is also informed by the postmodernist reluctance to view any cultural product as a natural phenomenon, and posits that instead of defining engineering practices and institutions as essentially male, an investigation of the field’s masculine exterior may be more pertinent in terms of the under-representation of female practitioners. I will

contend that in addition to socio-cultural analyses of prejudice and discrimination, stripping away the masculine packaging of engineering may yield significant gains in the representation of women in the industry.

## METHODOLOGY

Recent feminist methodologies have criticised the objectification of research subjects in mainstream social science. In contrast, a feminist approach uses the research exercise to create a space in which thoughts and experiences are *shared* in a supportive environment, placing researcher and researched on the same critical plane [2]. My own interview-based study was focused on the attainment of an intersubjective understanding, making some limited claims to ‘truth’ by virtue of its dialogic nature. In other words, a variety of views and experiences distinct from my own were taken into account.

Fifteen female engineers from a variety of backgrounds were interviewed, all of whom were training or working in the UK. Due to the fact that fifteen interviews are not sufficient material on which to base generalisable claims, the sample was used instead to offer insights that may be valid only in the context of this study, in a particular time period, or a specific geographical area. This does not, however, negate their importance.

## FEMALE ENGINEERS IN THE UNITED KINGDOM

The United Kingdom is a developed and democratic country. Yet despite liberal doctrines of equal opportunity, the number of women employed in the engineering industry is minuscule. Table 1 highlights the ‘gendering’ of the sciences at

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Table 1. Enrolment for science subjects at undergraduate level (UK, 1997). Source: *UCAS Annual Report*.

	Biological sciences (%)	Physical sciences (%)	Mathematical sciences (%)	Engineering and technology (%)	Combined sciences (%)
Male	36	65	77	86	58
Female	64	35	23	14	42

Table 2. Employment figures for scientific and engineering domains (UK, 1998). Source: LFS Spring 1999.

	Biological scientists and biochemists (%)	Other natural scientists (%)	Engineers (%)	Other occupations (%)
Male	59	76	95	54
Female	41	24	5	46

degree level—the greatest discrepancy between male and female representation is in the field of engineering and technology—and Table 2 shows that women make up just 5% of the community of professional engineers.

#### *Theoretical context*

Feminist theories of science and technology have explicated the difficulties that women encounter in these fields with reference to abstract insights regarding the nature of science and of sexual difference. The ‘feminist standpoint’ suggests that scientific values and practices are inherently male-identified and as a result the main obstacle for the female scientist. Other theorists have derived contrasting interpretations that focus on the image and appearance of science rather than its innate masculinity. This relates to the uncertainty surrounding any bid to define sexual characteristics as ‘natural’, and the difficulty of installing these attributes at the centre of an epistemology. It is also connected to the paucity of evidence that might be used to support the claim that scientific practices are intrinsically male and thus the primary means of women’s exclusion.

‘I don’t think women do the hard design of engineering any differently, because you can’t. It’s all so prescriptive—there are standards and codes of practice. The softer issues can be different, like dealing with clients, but the fundamental laws of physics are the same.’ [3]

My own approach centres around the social construction of gender, drawing on some of the arguments put forward in recent years. Post-modernist theories of science permit that the identity of the scientist may act as a conceptual sieve through which ideas and facts are filtered [4, 5]. However, this identity cannot determine the nature of science in a world where the subject is temporal and contextual—if sexual categories themselves are destabilised, the implication that the predominance of male engineers can alter the constitution of the discipline is weakened. These contentions highlight the status of gender and

science as cultural productions, and their conceptual dependence upon one another. As Cynthia Cockburn has argued, a close relationship to science and technology is essential to modern masculinity [6]. This study suggests that if men are prominent among engineering practitioners, the field may become masculine in orientation simply because many people perceive it to be so, a self-perpetuating process that relies on continual configurations of engineering and engineers in accordance with prevailing social and sexual stereotypes. The theoretical context for my research proposes that breaking down these established images may be a necessary component of any drive to encourage more young women to enter the engineering profession.

### RESEARCH FINDINGS: IMAGES OF WOMEN AND ENGINEERS

All fifteen women interviewed for this study cited the image of engineering and engineers as a major determinant of female under-representation in the profession. There appears to be a complex interaction between the masculine image of engineering and the very traditional notions of gender that often inform career choices.

‘People do still say that engineering is a man’s job. I had an acquaintance of my brother’s tell me I was taking a man’s job away from him, when I was about 18 and I’d decided to do engineering at university.’ [3]

It can be argued that the aspirations of young women are limited by the stereotypes to which they are exposed—and that this is a contributing factor to a cultural climate that fosters disapproval and mistrust of the female engineer.

#### *‘Dirty hands’*

‘The image of engineering is that it’s a bit mucky. It is practical, but it’s not like you’re doing the digging. You’re not mucking out the machines or anything—it’s a clean job. As a graduate, it’s more about using your brain.’ [7]

The metaphor of 'dirty hands' was alluded to during the course of the interviews with a frequency that places it at the centre of generally held conceptions of the profession. The public image of the engineer, to a certain extent synonymous with that of the labourer, was stressed by many of the interviewees as being inconceivable in terms of femininity.

These perceptions have been shown by other researchers to be significant even in the earliest stages. 'By the time they come to school, children already have preset ideas which you may need to break down. When I praised one girl for her LEGO building and suggested she might want to be an engineer when she grew up, she said, 'Oh no—engineers get their hands dirty.' This was in the mid 1990's and she was five.' [8]

Inextricably linked to the concerns regarding 'dirty hands' was a widespread belief that engineering lacked credibility as a profession, especially for women.

'These days every Tom, Dick and Harry is an engineer—the term has been taken up by a lot of trades. And there's nothing wrong with those trades—but it downgrades the profession when everyone is calling himself an engineer.' [9]

It was also implied that practical trades are often seen as particularly inappropriate for a woman—although manual labour is generally regarded as a respectable masculine activity, it is thought to be a form of employment that strips women of their feminine qualities.

#### *Old boys' network*

Many of the interviewees complained about the predominance of the old boys' network within the industry, stating that among its harmful consequences, it places women at a great disadvantage purely because of their sexual identity. A number of women expressed the feeling that they could not 'fit in'.

'There's a big social side to engineering, when you get to winning jobs and things. It's the clubs, or the football match, or the golf match, or the cricket match—and I hate all that side of things. Trying to do something which is not your natural social behaviour can be deeply unattractive.' [10]

While it was allowed that this masculine culture does not overtly exclude women, many of the interview subjects asserted that it is nevertheless tacitly discriminatory, and contributes to a public image of the engineering field that is unattractive to young women who are considering making it their profession.

#### *The image of femininity*

In tandem with the image of the field itself, negative images of femininity were highlighted by many of the research subjects. A number spoke of the notions of femininity that predominate within the profession, pointing out that female engineers and women in general tend to be seen in terms of

their sexuality or their reproductive function. It seems that many women who have fought gender stereotyping in order to enter the industry often come up against similar outdated notions within it. One of the interview subjects spoke at length about a manager who found it very difficult to interact with her as a female consultant due to the fact that he had no paradigm via which to understand the role:

'He didn't seem to know whether to treat me like the other consultants, which meant treating me like a bloke, or to treat me like a woman, which would have meant treating me like a secretary. He didn't seem to be able to put me in my own category.' [11]

It appears that many of the activities which compose an engineering job are incongruous in terms of the often regressive images of femininity that abound within the engineering field and within society at large. This can lead to a mistaken conviction that women are incapable of performing the necessary tasks:

'I met one client who kept telling me that I couldn't possibly want to get involved in the site activities because I was a woman. He wasn't nasty about it—he just found it unbelievable, really.' [12]

Many extremely retrograde stereotypes of femininity affect office politics to a notable extent:

'Gender is an issue for middle management people. I think that they're under the impression you're going to burst into tears if they say something you don't want to hear.' [13]

As well as the notion of the woman in thrall to her emotions, the ancient figure of the sexually voracious woman looms large.

'It's assumed that if a woman is getting on, it must be because the director wants to get her into bed or has got her into bed.' [12]

At the other end of the spectrum is the view of every woman as a potential wife and mother:

'At the interview for my engineering course I was asked, at the age of 18, whether I intended to have a family. And the boys just couldn't handle seeing a girl on the engineering course—they could relate to us as girlfriends but nothing else.' [10]

#### *Masculine imagery and careers advice*

All fifteen research subjects cited issues of image as being particularly pertinent with reference to female under-representation in the industry. These gendered characterisations of engineering are already well instituted by the culmination of the educational process, as became apparent during a short survey of careers literature for undergraduates. In a total of six booklets on engineering, women constituted only 28% of the 161 contributors, and the need to encourage more female representation in the field was highlighted in only three of the articles that were produced. In the advertisements scattered throughout the pages the imagery used primarily featured men—when women were portrayed it was usually in the

context of the office rather than on-site. One particular advert consisted of a picture of a small boy, above the caption, ‘Some say civil engineering is just a job—we say it’s a calling’, implying that an interest in the subject is a natural masculine trait. Another advertisement was notable for its blatant misogyny. The cartoon image depicted a woman in a version of a doctor’s attire that was obviously designed to titillate—her extremely short dress displaying very prominent breasts, adjacent to the caption ‘let the doctor take away the pain’. This representation was repeated a number of times [14].

## CURRENT SOLUTIONS

The 1993 UK government White Paper *Realising Our Potential* highlighted the importance of Science, Engineering and Technology (SET) for the country’s economic growth [15]. As a result of human resource needs and commitments to equality of opportunity, an increasing number of initiatives have been put in place to improve the representation of women in the field. Some of these are detailed below.

- *Education*: in 1997 a GASAT (Gender and Science and Technology) Association report found that role-modelling, ‘hands on’ interaction with science in the classroom, single sex groupings for science classes and training in gender issues for teachers were being used with a certain amount of success in school situations [16]. There are also 10 national, private scholarship programmes being offered to encourage more young women to pursue further study in engineering fields. Each scheme offers from 1–20 scholarships, and payments range from £200–£6500 [16].
- *‘Family friendly’ policies*: BMW, BP Amoco, Esso, Ford and Shell are among the companies who are offering flexible working hours and ‘family friendly’ packages to their employees. These include career breaks of up to five years for employees who have child care, domestic or welfare requirements [16].
- *Government actions*: in 1994, a ‘Promoting SET for Women’ Unit was created as part of the Department of Trade and Industry. Engineering is a strong government priority: recent budget reports confirm that the Engineering and Physical Sciences Research Council is in receipt of more government funding than any other similar body [16].
- *Associations*: the Women’s Engineering Society was founded in 1919 to inform young women in the United Kingdom about opportunities open to them in engineering fields. There are other bodies in existence that perform a similar function, such as AWiSE (Association for Women In Science and Engineering) and WiTEC (Women in Science, Engineering and

Technology). These are a source of educational initiatives and scholarships, and provide information and assistance during career breaks, enabling women to ‘catch up’ before returning to work [17].

These initiatives have all met with certain levels of success. However, the image-related problems that have been highlighted by this paper still persist. A number of suggestions for tackling these were formulated during the course of my research; which could be used in conjunction with current measures in order to address image-related issues.

### Information

‘At GCSE and A-level there are not enough girls who are shown the option of engineering, because the teachers just assume that the girls aren’t interested.’ [18]

Many of the women I interviewed highlighted a need for better, and earlier, information for young women making educational and career choices. Most of the interview subjects pointed out that young people choose their curriculum in a situation where information is scarce, despite the fact that these decisions have an explicit impact upon their future. More information for girls and young women may dislodge some of the negative images of engineering that have already been discussed in this chapter, reassuring them that despite gender archetypes, engineering may be a subject that they would find interesting.

‘I don’t think girls would find it boring if they knew what it was about.’ [19]

The solutions suggested during the course of the interviews included work shadowing and other links with industry in order to show young girls the day-to-day activities that are undertaken by engineers. Some such initiatives are being instigated at the present time—many of these are short courses run by groups such as the WISE (Women Into Science and Engineering) campaign that take place either residentially or on mobile vehicles [20].

### Role models

Role modelling was also posited as a good strategy. All fifteen interviewees stated that they had been influenced in their career decisions by a scientific family environment, or an outside inspiration. It was emphasised that young women are often aware of the fact that engineering is an unusual choice, and welcome the reassurance of those who have tackled the difficulties.

‘There was a female lecturer in the acoustics department who had qualified as an engineer in the 1930s, and I think she had a very positive influence on the female students in the department, as a role model. To qualify as an engineer in the 1930s and to make a career for yourself was pretty amazing.’ [9]

*Positive action advertising*

This suggestion is linked to both the strategies discussed above: a combination of information and role modelling within the context of government campaigning careers literature and industry public relations. This involves the development of advertising that prioritises female imagery, designed to explode some of the most conservative stereotypes attached to engineers and women. At the beginning of the 21<sup>st</sup> century, the influence of our various media cannot be doubted, and it is possible to argue that a premeditated shift in imagery could help to modulate our perceptions. Advertising should not reflect the temporary reality that women are under-represented in the engineering profession, but should be focused on the desired goal of equity in gender ratios.

*Exemplars*

A handful of companies have indicated their intention to make female images paramount in a bid to change the image of engineering as exclusively masculine [21]. There is little evidence at present of this measure being put into practice: an exception is the Ford Motor Company, whose 'woman-orientated' advertising is particularly notable. The company have purchased adverts in careers journals that display case studies of female engineers—in a short statement, Ford assert that these images will be instrumental in increasing female representation within the company [22].

The *Go for it!* poster campaign by the Promoting SET for Women Unit at the Department of Trade and Industry is a government-led exemplar. Due to

the fact that very young girls may not be directly influenced by images disseminated through the media, this measure is particularly well targeted. The DTI's promotional strategy is aimed specifically at schoolgirls, featuring a series of bright young role models with the explicit intention of changing the image of engineering and engineers [23].

**CONCLUSIONS**

This paper subscribes to the feminist insight that there is a need to look beyond the language of formal equality in order to tackle the female minority in engineering fields, and that equal pay, maternity benefits and other organisational and structural measures will not have maximum impact without social and cultural change. However, I have posited that in addition to issues of prejudice and discrimination, the masculine *image* of engineering needs to be addressed: and tied to what I have called the 'gendering' of this professional identity are conceptions of women and femininity that are incongruous with it. I wish to conclude by reiterating that the *perception* of engineering as 'male-identified' is a major factor contributing to the female minority. The 'gendering' of professional identities is a circular process—masculine images of engineering and engineers both proceed from and bring about the under-representation of women in the field. Governments, employers, teachers and parents need to combine their resources and foster a commitment to make a decisive break in the chain.

**REFERENCES**

1. Julia Evetts, *Gender and Career in Science and Engineering*, Taylor & Francis Ltd, London (1996).
2. Dorothy Smith, Women's perspective as a radical critique of sociology, in Sandra Harding, ed., *Feminism and Methodology: Social Science Issues*, Indiana University Press, Bloomington (1987).
3. Research interview with 'Janet' (2000).
4. Ruth Hubbard, The emperor doesn't wear any clothes: the impact of feminism on biology, in Dale Spender, ed., *Men's Studies Modified: The Impact of Feminism on the Academic Disciplines*, Pergamon Press, New York (1981).
5. Luce Irigaray, Is the subject of science sexed? in (Nancy Tuana, ed.) *Feminism and Science*, Indiana University Press, Indiana (1989).
6. Cynthia Cockburn, *Brothers: Male Dominance and Technological Change*, Pluto Press, London (1991).
7. Research interview with 'Patricia' (2000).
8. Marie-Noëlle Barton, and Christine Brown, *Engineering Equals: A booklet for parents*, WISE (Women into Science and Engineering) Campaign, sponsored by Marconi (2000).
9. Research interview with 'Paula' (2000).
10. Research interview with 'Hannah' (2000).
11. Research interview with 'Lucy' (2000).
12. Research interview with 'Christine' (2000).
13. Research interview with 'Gemma' (2000).
14. GTI, *GTI 2000 Civil and Structural Engineering; GTI 2000 Construction and Building Services; GTI 2000 Engineering*, GTI, Oxford (1999).
15. Office of Science and Technology, *Realising Our Potential: A Strategy for Science, Engineering and Technology*, HMSO (Cm 2250), London (1993).
16. WISE (Women Into Science and Engineering) Campaign, *Directory of Initiatives 2000*, WISE Campaign (sponsored by Marconi), London (2000).
17. Women's Engineering Society, Women's Engineering Society Homepage UK (2000). <http://www.cant.ac.uk/misc/wes/weshome.html>
18. Research interview with 'Liz' (2000).

19. Research interview with 'Maria' (2000).
20. Department of Trade & Industry, *Making the Most: Women in Science, Engineering & Technology*, HMSO, London (2000).
21. Department of Trade & Industry, *Promoting SET for Women Unit* (promotional materials) HMSO, London (2000).
22. CSU, *Prospects Focus on Engineering*, CSU Ltd, Manchester (1999).
23. Department of Trade and Industry with GASAT (Gender and Science and Technology Association), *Breaking the Mould: An Assessment of Successful Strategies for Attracting Girls into Science, Engineering and Technology*, HMSO, London (1997).

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