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The Engineers

1.1 Introduction: technological creativity

1.1.1 Engineering is essentially a creative profession

Ask almost any engineer why he or she chose to be an engineer and the reply may reveal something akin to an ideology that underpins their working lives: a high-minded aspiration to be useful to the community at large. They may not wear these ideals on their sleeves, but probe beneath the surface and you will find an altruistic streak. Engineers tend to have a strong sense of purpose, believing they have a contribution to make to society, and knowing that, through designing a myriad of things we use in everyday life (components, gadgets, software, all sorts of machines, buildings, bridges, and even the shoes we wear), their work affects nearly every aspect of human activity. So, engineers see themselves as being essentially creative, and working towards some kind of solution that has been asked for. This is a distinctive feature of their work: engineers have to be creative to order. The customer looms large on the horizon of any engineering workplace. Solutions need to be designed and produced for customers, the more ingenious the better.

It could be said then that engineers see their roles at work as being constructive and productive, which gives them a strong sense of raison d'être, and an altruistically motivated one at that. Like aspiring novelists, musicians and poets, who can see or hear the physical fruits of their compositions, engineers believe their contributions have some kind of measurable, physical 'presence' that contributes towards helping others in their endeavours. This book is based on a 6-year study of engineers working on products for the aerospace, defence, and automotive industries (Sales 2002). It pays particular attention to engineers working on design, although it is informed by those from other areas

within engineering. The study has an ethnographic basis, having been influenced by anthropological and sociolinguistic research methodology (Saville-Troike 1989). It involved working within an engineering community for extended periods, and examining the texts, both spoken and written, that the engineers produced in the course of their work. The aim of the study was to learn from the engineers themselves about the communication tasks they perform at work, the texts (and language) they produce, and their views about them. It is a 'grounded' study, inspired by the work of others who have used similar ethnographic methods, working from within a particular community, rather than looking on from the outside (Latour and Woolgar 1986, Berkenkotter and Huckin 1995). During the study, different sets of data were analysed:

1. *Written texts*, comprising engineering proposals, numerous reports, technical notes, log book entries, and other technical documents. Texts (and genres) of particular interest to design engineers are examined in later chapters.
2. *Spoken data*, comprising 25 recorded interviews. During these interviews and other conversations, engineers shared candid views about their work and use of language in various situations.
3. *Research journal entries* written over the course of the study. These are included throughout the book to describe the engineering workplace from a more personal perspective. The extracts tell stories, providing insights into the events surrounding the texts and the engineers who produce them.
4. *Email responses from 59 engineers* who participated in an email survey. A variety of engineers participated in the survey, which was voluntary and primarily devised to investigate the writing tasks they have to perform at work. Survey findings are discussed in this and later chapters.

The engineers who provided information for this book perform a myriad of complex tasks as part of their jobs, including, for example, designing solid-state silicon 'gyroscopes' for use in cars; choosing the best glue to use, including testing the stickability and reliability of various adhesives for use in the stratosphere (to glue a component to a metal casing on a rocket); and writing software code to program screen displays for pilots in aircraft. The engineers work on both hardware and software systems, with the majority being practical engineers, concerned with the design, production, and maintenance of a product. There is a smaller number, concerned with theoretical modelling and research, sometimes

referred to as 'boffins' and looked on with respect for their high-level knowledge of physics and mathematics. A few are primarily concerned with management and commercial aspects. Finally, a small fraction are women. Of those who took part in the email survey, with the exception of five, all are men.

1.2 Why they became engineers

As part of the email survey, engineers were asked why they chose to join the profession. Their explanations reveal that a pragmatic outlook and desire to be technologically creative was the main motivation, the vast majority having made a deliberate choice to become engineers. Of the 59 who took part in the survey, only 3 had either drifted into the job or chose it for financial reasons. A significant proportion of engineers had a strong sense of engineering vocation when young, making a choice of career at school. The majority (95 per cent) became engineers because they liked science and mathematics, had a keen interest in how things work, and wished to work in a job that was practical and involved problem solving (Sales 2002: 1–30). Nearly 30 per cent of all engineers described themselves as not having been particularly inclined towards the sciences, claiming to have more balanced inclinations: they are either neutral or positive in their attitudes towards English and Arts subjects, but have an overriding liking for, and, in some cases, a love of, science and mathematics:

> I very much enjoyed English in school and the science subjects too. I was pretty good at all my subjects but it was much more fun to play rugby and experiment with electronics after school rather than to try and read Shakespeare plays.
>
> I chose engineering mainly because I like problem-solving. I did not dislike Arts subjects, but found them to be not as challenging as scientific subjects.

One respondent explained he had been equally good at Arts and Science subjects at school, but had always wanted to join the Navy:

> It was a natural progression. I'd wanted to join the Navy when I was a boy. I'd always liked fiddling with machinery and the Navy let me do this.

Many engineers have this interest in (or, in a many cases, a passion for) tinkering with machinery and making things. They tend to feel an affinity with things technological, a few suggesting that engineering is 'in the genes':

> I became an engineer because I was always curious about 'how things worked'. I did enjoy Maths more than English at school because I found English boring, therefore I didn't work as hard at English (and other Art subjects) as I did at Maths and the Sciences. I did not make a conscious decision to become an engineer because I didn't like English.
>
> I enjoyed science (especially physics at school) and saw engineering as a useful example of applied science.
>
> Very interested in science – I see engineering as one of the best ways to exploit this.

If the email responses so far strike you as having been written mainly by men, you would be correct. When the survey was conducted, out of a total workforce comprising around 350 engineers, only 10 of the engineers were women. These numbers reflect the lamentably small proportion of females in engineering, with about 5 per cent of professional British engineers being women, and 10 per cent in the United States of America. All 10 were contacted, since there were so few of them, and 5 of the 10 responded. One, reflecting a generally held view that women are better at language-related skills, suggested that female engineers were probably equally good at Arts and Science subjects, and, furthermore, were probably more proficient writers. However, small though the female sample is, this belief is certainly not substantiated by the findings of this survey, as evidenced by the following responses, all provided by female engineers:

> I did prefer maths, physics and art at school as opposed to subjects involving lots of writing, e.g. Biology, History and literature.
>
> Performed better in Maths and science subjects at school, and less well at writing and spelling.
>
> This may be more of a female trait – I enjoyed both maths/physics and English language/literature, but it was predominantly my love of science that swayed me. I also enjoyed practical subjects and wanted to escape from an office-based career.

Around 30 per cent of respondents had performed better in Science (and, in several cases, Mathematics) and less well in English at school. All the engineers in this category clearly believe themselves to be poor (or underperformers) in Arts subjects, and that a scientific inclination was a deciding factor in their choice of engineering as a career, as the following responses reveal:

> a) I became an engineer because it was the easiest way to express my creativity. b) I fit into the Maths stream c) I was not good at languages at school. The mechanics of both reading and writing never came naturally to me, consequently, it is much easier for me to do engineering type jobs which involve a lot less of this.
>
> I am a Maths stream person. I was good at Maths, Science and practical subjects at school. I always found spelling difficult and never performed well in English.

These comments lend some support to a kind of engineering lore that exists, perpetuated by the engineers themselves, about how badly engineers communicate. A variety of horror stories circulate in the engineering community about how their inadequate writing skills lose the industry millions of pounds each year. For example, it is believed that a significant proportion of the estimated annual wastage of £2 billion (of an annual defence budget of c.£20 billion in the United Kingdom) is attributable to the poor writing of specifications and requirements, and badly written contracts (Kincaid 1997: 54). When asked about the accuracy of these stories, a senior engineer responded with these words, expressing a view that is fairly typical:

> Oh yes, absolutely – they don't call it a problem – this is an issue, an issue [sharp intake of breath] and people say they're engineers, they're not going to write documentation unless you stand on their neck. And when they do write it, it's a moveable feast. It might be good, it depends on the person. I mean you get people – you've seen Rick's stuff – who say, 10 o'clock I went to the toilet . . . and he goes on writing, and records the last 15 years of his life on that project. I've known half a dozen people like that . . . (Author's interview data)

Clearly, such stories are a misrepresentation of the full picture, but they are told and retold all the same. The fact that nearly one-third of the engineer respondents believed they performed less well (or were low

achievers) in English would seem to lend credence to the view held by some lecturers in engineering that their undergraduates are deficient in English language (EL) skills, and, because of this, have chosen to follow a science and mathematics route as an avoidance strategy, in the mistaken belief that they would not have to write very much. The fact is, though, that they do have to write, they have to write a lot, and what they have to write is important.

1.3 Engineers have to write a lot

Let us now turn our attention to temporal matters. It is a little-known fact that writing is a time-consuming activity for many engineers. Nearly 50 years ago, Hicks commented on the sheer volume of paper and text that was produced in engineering offices:

> The output varies from a single-page maintenance instruction to a volume of five hundred or more pages covering an important scientific or engineering project. Operating maintenance and instruction manuals for some advanced missile systems run to several thousand pages, weigh 100 or more pounds, stand 5 feet high, and cost almost $1 million to prepare. (1961: 2)

When Hicks wrote this, much of the burden of writing was borne by technical authors working with pools of typists, professional draftsmen, illustrators, and printers. He claims that the 'normal duties for which the engineer or scientist is employed are not writing' (ibid.: 3), unlike the findings of this study which reveal that engineers can spend at least 50 per cent of their working time on writing. Now, in the modern engineering office, with working roles less clearly delineated, engineers play a much larger role in the writing process, sometimes taking responsibility for the production of a whole document, if not large sections of it.

Over the last two decades, engineers' work has changed dramatically, concomitant with developments in office technology. Their preoccupation with documentation, and the importance of writing about the product, continues unabated, not having changed much in this time. However, what has clearly changed is the way that engineers have taken on more responsibility for writing, having been given their own personal computers. The typing services that used to be provided by secretaries

and the 'typing pool' have disappeared for those who are not in senior management positions.

These days writing plays an important role in engineers' work, to the extent that it can be extremely time-consuming. However, until the email survey was conducted, there was a lack of information about actual amounts of time spent on writing. Part of the survey involved discovering the extent of the writing done by engineers, who were asked to provide estimates in percentage terms. They were also asked questions about the types of writing tasks being performed and documents produced (these being the focus of later chapters). The main reason for asking these questions was to pinpoint those texts and documents that engineers find time-consuming and to gauge whether or not an investigation into written communication was justified. In the event, results showed that writing takes up a significant amount of an engineer's time and that certain documents are problematic.

The results are impressive or stark, depending on your viewpoint: slightly more than half of the engineer respondents, 50.1 per cent to be precise, spend between 30–60 per cent, and a further 15 per cent of the engineers spend more than 60 per cent of their time on writing at work. Figure 1.1 provides an overview of amounts of time spent on writing,

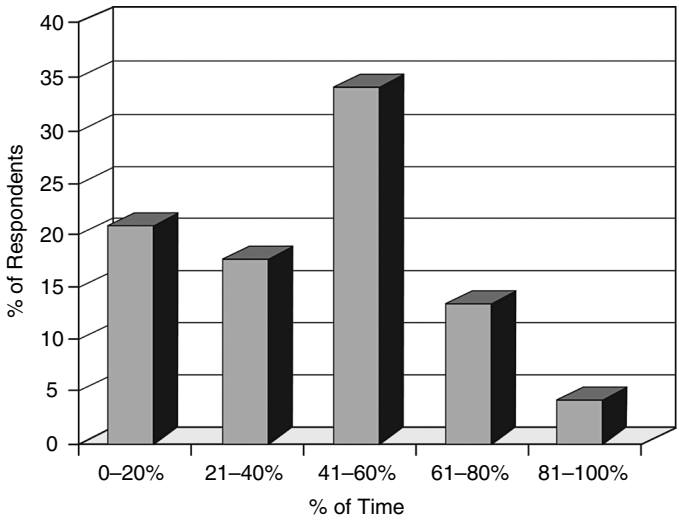

Figure 1.1 Time engineers spend on writing

providing a breakdown in 20 per cent time-bands of the figures for every respondent to the questionnaire.

The picture emerging here contradicts the stereotypical image of engineers engrossed in tinkering with machines and making things. However, it coincides with findings of another study carried out on scientists at the Salk Institute. The study, which concerned biologists rather than engineers, showed the major output of the scientists' work to be documentation rather than scientific experiments, and writing scientific papers to be central to their working lives (Latour and Woolgar 1986). The figures lend support to an idea that develops in Chapter 4 about the importance attributed to certain documentation, and the emerging realisation that text is, in fact, a substitute for the product, in that the product is negotiated and shaped through the documentation.

1.4 The customer

The customer looms large in engineers' work and holds a position of power and control over them. Rarely is the customer talked about except in impersonal terms, in much the same way as one might talk about 'the government', and, in fact, government departments in different countries may indeed be the customer. The customer, usually referred to in the singular and as a proper noun (and therefore capitalised in writing), is usually the company or person who commissions (or buys) goods or services designed and produced by the engineers. The customer is rarely referred to by pronouns, such as 'he', 'they', or 'it', except when the engineers are talking about, and know, a person who represents the customer. Put simply, in engineers' minds, the customer is the paymaster, or is a group entity comprising emissaries of the paymaster. Engineers are ever mindful of the customer's wants (and needs) and strive to cater for them as satisfactorily as possible, for, in the end, their livelihoods depend on the customer being satisfied. This probably accounts for exhortations by managers from time to time that they should be less preoccupied with the product and become more customer-focused. However, engineers' informal talk in day-to-day discussions reveals otherwise: in their working inclinations, they are essentially product-centric, that is, they are naturally pre-disposed to thinking about the product. In the day-to-day tasks that they perform, the messages they compose, and their unguarded discussions, engineers are engrossed in the minutiae of the design of their product, how it can be assembled or compiled, and tested before delivering to the customer. This is perfectly understandable, and it is far from the case

that the customer is ill-served or lost sight of, although it has led to some prevarication over terminology later, where choices had to be made between using product-centred or customer-centred terminology: 'product' versus 'solution', 'product-support' versus 'customer-support', and 'selling-point' versus 'benefit', are some examples.

1.5 Types of engineer

Research journal entry: 'Good God No, I'm mechanical'

. . . I then ask Nick if he's talking about log books. He says he doesn't write logbooks. He can keep a record on his computer, and that's all he needs. He writes RESs instead, which, he says (straight faced but tongue-in-cheek) are what engineers call 'rough engineers' sketches'. The electronics boys, as he refers to them, keep logbooks because they have to keep track of so many (said with special emphasis and knowing look) changes. When I said: 'So you're not an electronics boy then?' he said: 'Good God, no! Give me something I can hit and knock about. I'm mechanical'. I now think of him as Good-God-No-Nick, because he says it so often and with that special rise-fall intonation. A lot about his reaction, I think, relates to the fact that he is a different type of engineer, ie 'hardware' as distinct from 'software'. Very different beasts. Engineers do tend to separate themselves into the different engineering disciplines, and see themselves as belonging to distinct groups.

[Author's comments: (1) 'RES' actually stands for Registered Engineering Sketch. (2) The significance of 'changes' is discussed in Chapter 5.]

1.5.1 Snap-shot of an engineering work-force

Engineers themselves provide the most realistic impression of their jobs. When asked to describe their work, they refer either to the type of work they are doing, to the official title of their positions in the company, or to their qualified status, as exemplified by the following responses:

'Software', 'Graduate Electronics Hons Engineer',
'As for my discipline, I'm a mechanical engineer'.

'Quality Assurance with electronics background'
'Support. Control engineering originally'
'I am employed as a Systems Engineer but I am qualified as a Chartered Electrical Engineer'
'Technical Director (ex-Systems Engineering)'
'By formal training an electronics engineer. By career, a systems engineer.'

Some engineers refer to the fact that their work involves different areas:

'I am a hardware engineer – although I get to have a go at systems, software, mechanical – whatever needs doing!'
'Labelled as Systems Engineer . . . reality is sitting on the fence between AR [Applied Research] and Business.'

By far the largest group in the survey comprises electronics engineers (25 per cent), four of whom describe themselves as being concerned with design, systems design, or design and testing. The second- and third-largest groups are software and systems engineers (20 and 18.3 per cent, respectively), whose work is inter-dependent. In very simple terms, systems engineers deal with design and drawing up requirements, and the software engineers with implementing those requirements (see Chapter 5). Systems engineers also write requirements for 'hardware' engineers to implement, for example electrical, electronic, and mechanical engineers. Mechanical engineers make up a smaller proportion of the respondents (8.3 per cent), with others (less than 5 per cent each) working in: production, support, mechanical design, manufacturing process, test equipment design, optical, control systems, and metallurgical and materials engineering.

For the purposes of this book, we can simplify the complex picture of the various types by narrowing them down to five major categories, described here by a support engineer in 'lay-speak':

Mechanical – 'designs the casing'
Hardware/Electronic – 'designs the circuits and innards'
Software – 'designs the software that makes it work'
Systems – 'integrates all the above, and makes sure the whole thing works'
Support – 'looks after the system, providing help and maintenance when it is being used.'

In the above list, it is possible to see two broad categories of engineer, which for the sake of simplicity and practicality are referred to as design and support engineers, that is, the first four categories and final category, respectively. Both design and support engineers contributed ideas to this study, bringing a different perspective and different views, although many more design engineers have been consulted than support engineers. This is because design engineers are the focus of this book. The role of support engineers is pivotal in post-design phases, when they become the mainstay and primary source of reference for the customer once the product starts to be used.

It would be more accurate, in fact, to place the systems engineer at the top of the list, since he develops the functional concept of the product, the detail of which is developed by the other engineering disciplines. However, this simplistic portrayal will suffice for the purposes of this book, which will examine particular communication tasks that engineers have to perform at work. These tasks, which most interest and preoccupy them, will emerge in later chapters.

Design engineers and support engineers

Figure 1.2 shows the symbiotic relationship that exists between three particular types of engineer: design, production, and support engineers. It depicts their roles to provide, at a glance, an understanding of how much time and effort they expend during the design and production of the product. It is compatible with various, more complex, diagrammatic representations of the product life-cycle, and maps onto the diagrams in Chapter 3, in particular Figure 3.4. Design engineers receive the most attention in this book, and it can be seen that they are primarily involved in the early stages of the product life-cycle, their work tapering off as the product develops and as support engineers assume more responsibility.

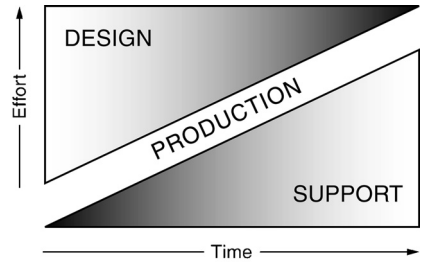

Figure 1.2 Work expended by different engineer categories

(The work of production engineers, however, is beyond the scope of this book, since they are concerned with the manufacture of the product, designing and testing the method and equipment used.)

Figure 1.2 is a fair representation from an engineering perspective, rather than from a financial, marketing and sales, production, or supplies/resourcing perspective, although these would throw up something very similar.

Design engineers have a tendency to be highly specialised and focused on arcane features of design. Of course, not all design engineers are narrowly focused like this, but as a general rule, this observation holds true. The very nature of their work, and their work practices, and procedures encourage design engineers in this tendency. Their high status is understandable, for it is the design engineers who are fundamental to winning new business for an engineering company. In any bidding war, where companies compete for business by submitting proposals to the customer, it is design engineers who must devise the most attractive design (or solution) with which to win the bid. Proposal writing is a central activity in many engineering companies, and it demands creativity from the engineers who concentrate on the design to the exclusion of anything else. (Engineering proposals are examined in later chapters.)

Parallels can be drawn with the building industry where the acknowledged 'king pin', a term sometimes used by members of the building team, is the architect. The architect is responsible for the overall design concept and converting it into a building or other structure. He has the responsibility for creating a blueprint of the design which others then use to construct the building. Behind the architect functions a team of consultants of various types – engineers, quantity surveyors, and building contractors – but it is the architect who has the kudos and the highest prestige within any building project. A similar situation exists within the engineering environment: the design engineers are the 'king pins', enjoying high status in the project. Much of the creative activity of the project team, including text creation, centres on catering to their needs and supporting them in devising the best solution. In the process, others' needs may be under-resourced or neglected, which is a situation support engineers commonly perceive themselves to be in.

If it were not for the involvement of the support engineers in the early stages of design (and in proposal writing), it could be argued that the design engineer would be less mindful of issues concerned with the use of the product. Several stories, which are possibly apocryphal, circulate about design blunders. One, which is gleefully cited by support engineers to show how the problems would have been averted had they been

consulted, concerns an anti-tank weapon which was designed to be used in forests in cold regions. When it had been built and was being tested in the field, the user found he could not operate it with gloves on; nor could he see the controls in the dark. Although all engineers tell stories of this type, support engineers are particularly good at telling them. It helps to compensate for their perception that they are undervalued and have lower status in the engineering workplace, and also their belief that they are consulted less than they should be in matters of design. The investigation into design and proposal documentation described in Chapter 9, which includes the cinderella domain of product support, would seem to confirm this impression.

Aspiring engineer writers and frustrated technical authors

In-company technical authors can play a pivotal role in preparing and writing formal company documents, for, to extend and borrow Swales' coining (1996: 194), they are 'textographers' with expertise in working with text. They co-ordinate the (sometimes numerous) contributors, collating the various (far from homogenous) textual contributions they receive, and compile documents that are professionally presented and read coherently (Austin 1990). As mentioned earlier, with the introduction of modern working practices, secretaries have almost disappeared and, instead, engineers have their own computers, providing word-processing facilities and other software. With new, more independent, methods of team working, a combined focus on both product and customer, having to respond to customer queries themselves (rather than a secretary doing it), and the need to do their own typing/word-processing, it is hardly surprising that the engineers should produce their own drafts of text, or take the initiative in producing documentation. Rather than produce a sketch outline for the technical author to interpret and flesh-out, as they used to do, it is now more convenient for them to commit their thoughts to the screen and compose their own drafts. All this has had an impact on technical authors, who are used to taking responsibility for document production. They find they are called on less frequently to draft documents from scratch, which is what they prefer to do, and where they see their expertise lies. Instead, they now deal more often with cosmetic aspects of writing: formatting text, integrating graphics, 'tidying-up' sentences, and generally checking grammar and spelling, and editing what engineers have written. Some see this as a retrograde step and feel, as the editor of the 'Communicator' (a journal for technical authors) puts it, 'dismay at the potential effect on the role of technical author' (Newell 2005). Being presented with texts

that engineers have written themselves more often these days, authors believe, limits their professional practice and restricts opportunities to use higher-level writing skills. It also, in their view, erodes their status in the eyes of some of their colleagues who fail to understand the true role of the technical author.

Technical authors have expressed the opinion that design engineers cannot write as well as they design, and that by writing their own technical descriptions and other kinds of writing, they are using time that would be better spent on work they have been trained, and paid, to do. The authors feel that much of the time and effort they spend on rewriting and editing engineers' compositions is a poor use of their time, and ultimately affects the quality of the finished document. They are sometimes exasperated with the texts they are given to work with, finding them illogically structured, often grammatically incorrect, and stylistically inelegant. By the very nature of their jobs, technical authors offer engineers a documentation and writing service, and, unfortunately for them, usually find themselves having to be reactive rather than proactive, too often responding to requests, rather than being involved at the outset of document production.

A tension clearly exists over authorship and ownership of text, with the engineers who are concerned with design also concerned about any text that is produced about their design for other people to read. They are proprietary about any text relating to their product intended for an external audience. In this book it is suggested that text performs the role of substitute for the product in design documentation (see Chapters 3 and 7), where the text is treated as being the product for certain intents and purposes until the actual product is produced. It is therefore understandable that engineers should feel responsible for, and have a 'mother–hen' attitude towards, any text that describes their product.

1.6 Creativity versus restriction

Engineers attribute different values to different texts, holding particular documents in esteem and disregarding, or even disparaging, others. Figure 1.3 represents the views of an engineer, who values any documents relating to the engineering development of a product, but who dismisses as bland and restrictive most others.

His is a design-focused view of text, showing his interest in the creative aspects of product development. Not all engineers would agree with his description of 'official' documents as being bland, however, although they would accept they are restrictive. They tread a fine line between

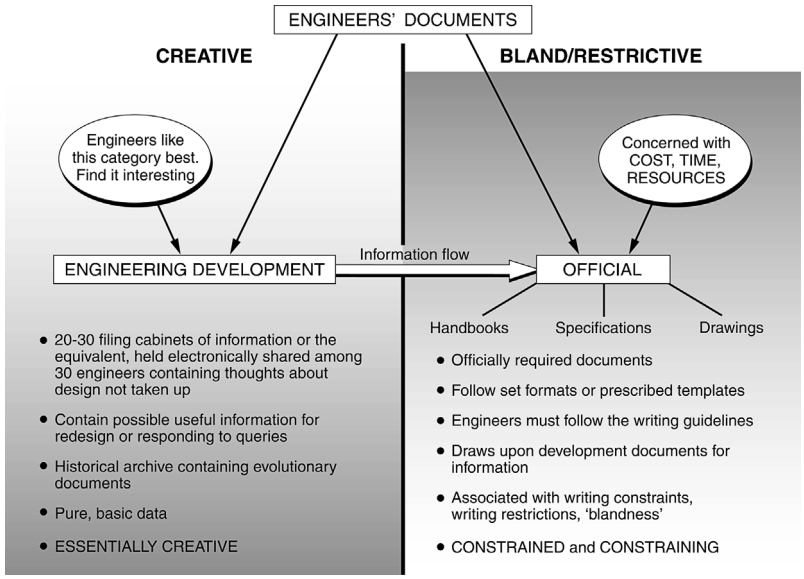

Figure 1.3 Engineer's view of documentation he has to produce

being creative and being controlled by regulations and procedures that are part and parcel of any modern 'high-tech' workplace. Subsequent chapters explore how engineers deal with this tension, exploring the issues that arise, their communication tasks, and the texts they produce when working on key documents at work.

Engineers are solution-oriented

When asked about their writing activities at work in the survey, a few engineers listed, among other things, writing poetry and post-it messages. Post-it messages may appear to have some relevance to work, but composing poetry has less obvious work connotations. However, one of the engineers explained why he liked to write poetry:

> Sometimes it helps to spend a few moments on something creative, which has got nothing to do with the problem you are working on – helps clear the mind.

It would be misleading to perpetuate stereotypes and myths that circulate in non-scientific circles. Arts students and lecturers, for example,

have been known to refer disparagingly to engineers and engineering students as 'inarticulate nerds', or some such uncomplimentary epithet. By the same token, engineers are vexed at times by the scientific ignorance of those from non-scientific backgrounds, and view disparagingly their want of self-discipline, for, and let there be no doubt about it, one of the distinguishing features of engineers is their self-discipline and circumspect behaviour. Their minds and bodies they regard, not unlike the things they design and make, to be sorts of machines that can be controlled, modified, and maintained. They regard thinking processes as controllable, and capable of being managed to obtain optimal performance. Thus, composing poetry or music for a short while at work will aid concentration: all the better to achieve work goals.

It would therefore be true to say that by training, and possibly by inclination, engineers are solution-oriented, in that they strive to produce the item the customer has ordered. In a sense, they are not unlike tailors, especially in the case of 'bespoke' products, like, for example, a navigational tool for a car or a ship. Having agreed on the details of the tool, engineers engage with the task of designing and making it, despite the many obstacles that they usually encounter. In pursuing their goals, some may be considered almost obsessive, because of their preoccupation with the minutiae of design. Such rather contentious observations have been made by those outside engineering. Engineers have explained that their absorption is understandable, since solving mathematical problems or difficulties with software coding can monopolise their thoughts, even in non-work social and domestic situations, making them appear distant or socially gauche. Putting such considerations of behavioural traits aside, however, it is an irrefutable fact that engineers are goal-oriented, perpetually solving problems in the search for solutions. 'Solution' is the word so often on their lips.

Sensitivity to language: 'solution' versus 'problem'

Design engineers, and their managers, do not use the word 'problem' very much in their writing and everyday work talk, some acknowledging that they consciously avoid using it. These are engineers in direct communication with the customer, who needs to be persuaded and reassured about the effectiveness of the product they have designed. They explain that 'problem' has negative connotations that sit uneasily with the sort of mindset and positive attitude needed to perform the task. So focused are these engineers on working towards a solution, that 'problem' tends to be used only when the obstacle seems

insurmountable. However, in other engineering domains, for example, materials, manufacturing, and production, engineers use the word more frequently, simply because they interact with colleagues, and not the customer, in problem-solving tasks. It is clear the different audience and context calls for a different linguistic register.

'Solution' ≈ 'product'

By contrast, the positively coloured 'solution' is more popular with engineers, especially with those who are in direct contact with the customer. They use 'solution' in speech and writing to refer not only to the answer to a problem, but also to the product itself. In the case of proposal writing, for example, or talking about proposals, engineers prefer 'solution' to 'product' for referring to what they are trying to sell to the customer, because it portrays the speaker as having a customer-oriented approach, that is, as one engineer put it: 'By using "solution", we show the customer we are focused on coming up with the best solution to his needs'. Again, as with 'problem', it is clear that context of use and audience determines stylistic choice of words. It is possible to see the attraction of 'solution' as a cover-all term, useful for engineers to convey to the customer that they have the answer to his problems, and that they are working in the customer's best interests. 'Product' conveys the sense of tangible objects, whereas 'solution' is more abstract and intangible, with much wider (non-engineering) applicability. In discussions about the complexities of engineering design, it is sometimes more appropriate to use 'solution' when a generic sense is intended, or where the speaker is referring to the whole answer to a customer's requirement (or need), which may include different aspects, for example, a maintenance plan, or training for users. However, tellingly, 'product' is the term engineers use amongst themselves in meetings and informal discussion at work, although they tend to use 'solution' more often in dealings with the customer.

Subjectivity versus objectivity

Those teaching in the Arts see as their role the fostering of a person's ability to express personal opinions and to give vent to self- and emotional expression through some kind of 'creative' outlet like music, painting, or literary composition. It could be said that such artistic expression requires egoism to a greater or lesser degree, depending on the artistic work, in which centrality of the 'self' is a natural starting point. The results of these expressions may be manifest as individual or

group efforts, as in the case of a painting, poem, or a novel, say, or an orchestral performance or dramatisation of a play script. In the sciences and applied sciences, such self-expression is generally anathema. Engineers baulk at the slightest hint of 'subjectivity' in their language use at work, and can be strident in their criticism of it. As a body, they resist strongly (and, some in the Arts and Humanities believe, stubbornly) any hint of personal opinion, consciously avoiding any use of the personal pronouns 'I', 'you', 'he', 'she', and 'we', for, as one engineer put it: 'the pronouns get in the way of objective thought'. They prefer to use passive rather than active verb constructions; for example, they prefer '"Gyroscope" is used generically . . .' to 'We use "gyroscope" generically . . .'. Kirkman, however, advocates a flexible approach, advising engineers to use a more personal style with certain documents, like reports or papers (1992: 73), but such advice tends to fall on deaf ears so far as design engineers are concerned. Van Nostrand similarly observes that in corporate documents in the American defense sector, and in corporate documents generally, the first-person singular personal pronoun ('I') is noticeably absent and 'the texts share a deep formal resemblance' (1997: 137). Dobrin refers to this stylistic convention in his discussion of objective writing, commenting that he finds 'the whole stipulation of formal objectivity puzzling', because the use of particular so-called impersonal, objective language 'doesn't confer objectivity, though it can be a shield' (1989: 35).

Engineers hold particularly firm views about the need to write clearly and objectively. Essentially, this demands that the writer should quell any egoistic tendency in writing, or at least should mask any such tendency. As the engineer cited earlier explained:

> Engineers are not impressed by anything that isn't a fact. It's difficult to be totally objective if you're using active verbs and personal pronouns. In our writing we go for the suppression of self, not the expression of self.

This is easier said than done, however, as there are times when engineers are caught between two stools. These are times when they need to reconcile their aim to be clear and objective with the obvious need to be persuasive. For example, when writing engineering proposals, they find themselves in the curious (and uncomfortable) situation of having to be persuasive without being too obvious about it. The rather slippery notion of persuasion and the stylistic and cultural conflicts facing engineers when working on proposals are discussed in later chapters.

1.7 Communication skills: engineers' aspirations

In one-to-one interviews, engineers have discussed stylistic aspects, expressing a yearning to be more articulate and elegant in their use of language. A few describe how they notice others' language performance, particularly in meetings (Sales 2002: 2–7). They mention by name articulate colleagues whose writing they admire, or whom they have noticed hold the floor in meetings. They say they wish they could hold people's attention in a similar way, regretting their lack of eloquence or conciseness. As one interviewee put it:

> I think what I'm maybe not so good at doing as I ought to be is saying things concisely, saying things in fewer rather than many words and I often find when I'm talking to people I can sense sometimes . . . a . . . you're saying too much, you're going too far, and yet I can see other people that can command attention by saying fewer words because what they say is straight to the point. I think that would be a nice thing to work on, to be able to say things concisely and accurately. Get your meaning across in fewer words.

Rather larger numbers of engineers say they find writing stressful, not being confident in their writing abilities, and being concerned about grammar and vocabulary. Some are self-critical, denigrating their spoken and written expression by describing themselves as lacking in conciseness, being mediocre, and not having the 'right' words. In the case of writing, apart from mentioning the problems they have with grammar, spelling, punctuation, and the like, they also worry about having mental blocks and spending too much time composing relatively short pieces of text. Professional writers would claim that this is all a natural part of the writing process. Other engineers talk about resorting to copying from other documents as a strategy to help them complete a writing task, one referring to it as plagiarising and describing it as an exercise in damage limitation. Associating such copying with plagiarising and feeling a sense of guilt are needless and unnecessary, however, for this is a common practice throughout the commercial sector when drafting documents, especially certain commercial letters and reports (Marshall 1986: 136).

A few others, who work on commercial and administrative aspects, talk about the 'drabness' of their writing, finding it difficult to write in a friendly or positive way without being 'smarmy', and difficulties in composing a rejection letter without making the reader feel slighted, and

without appearing rude or indifferent. One engineer laments his over-formal style when writing letters and memos. His problem, he believes, is appearing to his audience as a distant and unfriendly stranger, even when he is, in fact, writing to people he knows well and with whom he has been communicating over several years. He says he does not know how to be friendly in a letter. Judging by his writing, it appears that he is indeed in the habit of expressing himself formally, as the following extract from a memo shows:

> RE: *MAJOR BID PERFORMANCE WORKSHOP*
>
> As discussed at the end of our workshop, please find attached transcriptions of our charts, and my draft memo to TCB/DMD/IDHS/PC which encapsulates the way ahead.
>
> Please provide me with any comments on the attached by COB 6 June; in particular any disagreements or further suggestions.
>
> [COB – close of business]

The piece exudes formality through: clauses beginning with 'as discussed', 'please find attached'; the use of (lengthy) initials and acronyms, 'TCB/DMD/IDHS/PC' and 'COB'; a depersonalised style conveyed through omission of any reference, by name or use of pronouns like 'you', to those being written to; words like 'discussed' (instead of the prepositional verb 'talked about') and 'provide . . . with' (instead of the more colloquial 'let . . . have' or 'give'); and the use of punctuation (semi-colon) and complex sentence structures usually associated with formal writing. As it stands and considering that close colleagues were the target audience, it certainly comes across as formal. After examining his writing together, the engineer and I agreed he had developed the formal style during years of writing engineering documents, when his work involved more engineering and less administration. As we shall see, engineers and, more particularly, design engineers are most concerned about expressing technical description in writing.

Another engineer finds writing so difficult that he likes to ask others to do it for him. However, as mentioned earlier, changes in work practices over recent years have thwarted this tactic: a gradual reduction of secretarial assistance has led to the depletion of such writing support and seen the devolution of writing responsibilities to groups of engineers that are, in effect, writing teams. As a consequence, engineers themselves are now responsible for much of the written output in engineering companies.

There is ample anecdotal evidence of muttering in engineering circles about how badly engineers write. It is engineers themselves who are doing this muttering, and it is they who are critical about the writing produced by colleagues and peers. Anyone hearing such opinions would gain a general impression of negativity so far as engineers' writing is concerned, and certainly it seems to be quite accepted amongst engineers and in society at large that this is a fact. However, this blanket judgement is worthy of closer scrutiny, if only because, unquestionably, there exists great dissatisfaction (without exaggeration) about documentation across the industry, with complaints about how expensive, time-consuming, and costly it is when mistakes are made. But can engineers' inadequate writing skills really be blamed for this malaise? As this chapter has shown, only a quarter of engineers seem to have difficulties with writing, and so it is more likely that the answer will be found through examining communication tasks, and working and writing practices in the workplace. This is one of the main purposes of this book, and as later chapters reveal, the story is a complex one. It is possible that, by denigrating the writing done by others of their profession, engineers are perpetuating a possible myth.

1.8 Final comment on the discourse community and aims of this book

It would seem not much has changed since C.P. Snow's 'Two Cultures'. There still exists today, as there did when Snow gave his seminal lecture in 1959 on the cultural divide (some would say, chasm) between the Arts and the Sciences, a broad misunderstanding between the two camps (Snow 1964). Some see this in stronger terms, as amounting to a two-way antipathy between those working in the Arts/Humanities and those in the Sciences. As an applied linguist, I have had a foot in both camps over a decade or more, and through this book wish to achieve two main goals. First, to describe to aspiring engineers (and the customers who judge what they say and write) the complexities of the communication tasks they will have to perform as working engineers. Secondly, I would like to bring a better understanding of engineers and their texts to other applied linguists who are interested in analysing texts in the engineering domain.

Overall, a striking inference to be drawn from engineers' responses to the survey is that they see themselves as belonging to a distinct group in society, with cognate qualifications, similar interests and ideals, and common goals. They may be regarded as forming a distinctive

working community. Swales (1996: 20) refers to different terms we could use to refer to such a group, discussing variants of 'discourse community' (which he refers to as a troubled concept) like, for example, 'rhetorical community', 'disciplinary community', and the more recent 'community of practice'. He states that such communities are essentially occupational or recreational groups that are 'somewhat different' from the sociolinguistic 'speech communities' which have their basis in geographical location or delineation (ibid.), and that 'In effect, in discourse communities, communalities reside in what people do rather than in who they are.' In spite of his apparent ambivalence towards the term, Swales' description of a discourse community is clear and useful:

> Discourse communities are sociorhetorical networks that form in order to work towards sets of common goals. One of the characteristics that established members of these discourse communities possess is familiarity with the particular genres that are used in the communicative furtherance of those sets of goals. In consequence, genres are the properties of discourse communities; that is to say, genres belong to discourse communities, not to individuals, other kinds of grouping or to wider speech communities. (Swales 1990: 9)

It is important in a study of professional communication like this, be it from an applied linguistic or engineering perspective, to work within a recognisable discourse community or community of practice. At the heart of any study like this must be the oral and written tracts of language that are produced, manifest as texts or textual genres. It is these texts and the stories that surround them that form the basis of this book. Engineers are the main players in the stories, and their views have enabled an ethnographic approach to be taken to this study of their communication tasks at work.

They have revealed aspects of their work that merit particular attention, and have brought to my attention certain texts (spoken and written), documents, and other verbal outputs considered important in their discourse community. In the following chapters I examine those texts and documents that preoccupy engineers most, and tell their side of the story. There has been a long tradition within applied linguistics, particularly English for Specific Purposes, of research concentrating on a cluster of genres and text-types, namely, reports, academic journal articles, business correspondence, and academic assignments. Engineers have little interest in any of these. Therefore, this book also pays them scant heed.

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