



The Royal Academy
of Engineering



Public Attitudes to and Perceptions of Engineering and Engineers 2007

A study commissioned by The Royal Academy of Engineering and
the Engineering and Technology Board





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of Engineering



Public Attitudes to and Perceptions of Engineering and Engineers 2007

Report

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Prepared for:

The Royal Academy of Engineering & the Engineering and Technology Board

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Executive Summary

The Royal Academy of Engineering and the Engineering and Technology Board jointly commissioned **BMRB Social Research** and **BMRB Stakeholder** to conduct research exploring public attitudes to and perceptions of engineering and engineers. The research aimed to provide a baseline measure of public knowledge and understanding of engineering which could be taken forward and used to inform action plans and to build engagement.

The research comprised two strands: a quantitative survey and a qualitative workshop. The quantitative survey was designed to provide a representative picture across the UK of public perceptions and views of engineering and engineers. The survey provided robust measures at the overall 'national' level as well as for age, gender and social grade. It provides a solid baseline measurement against which to track changes across subsequent years. The qualitative research aimed to build on the quantitative survey, providing greater depth of understanding and insight.

The quantitative survey was administered using Computer Assisted Telephone Interviewing (CATI) to a nationally representative sample of 1,000 adults aged 16+. A boost sample of young adults aged 16-19 years was also conducted. The qualitative research was deliberative in form and comprised one workshop event consisting of 48 participants. Participants were drawn to include a mix of demographic characteristics and age groups.

Awareness, knowledge and understanding of engineering and engineers

A limited initial awareness and understanding of engineering and engineers was identified in the findings from both the nationally representative quantitative survey and qualitative workshop. Initial awareness and understanding of engineers and engineering tended to be narrowly defined and primarily related to construction and manual professions.

The quantitative survey findings showed that people's top of mind associations with the word 'engineer' vary widely. The most frequently mentioned related to construction and mechanics - associations that put the profession into the role of building or fixing things rather than design, innovation or creativity. Participants with the highest awareness of engineering tended to perceive the profession as a more creative and cerebral profession compared to others.

However a broader understanding of engineering was identified in the qualitative workshop, with certain participants relating engineering to design and problem solving. This more sophisticated understanding was related to demographic characteristics, such as social grade and age, and as a result of exposure to engineering through friends, family or work. Younger people in particular were found to have a much more limited initial understanding of engineering in comparison to other groups.

Regardless of actual levels of awareness and knowledge, a lack of confidence in knowledge was noted in both the quantitative survey and the qualitative workshop. Respondents felt they had a low level of knowledge or questioned the accuracy of their knowledge. Engineering was seen as difficult to define and vague. The reason for this confusion was partly attributed to the misuse of the term engineering to describe other trades, include technicians or to describe repair work.

Participants who took part in the qualitative workshop, tended to attribute awareness and knowledge to contact with friends and family who worked in the profession or via contact with engineers through work, the media and education. The quantitative survey found that people tended to say they would go to the internet to find out more about the profession rather than using any other means.

Attitudes and views towards engineering

Even though awareness and knowledge was limited overall, findings from the nationally representative quantitative survey show that engineering as a profession was viewed positively, especially in comparison to other professions. On average engineering was perceived as making a good contribution to society and was said to be involved with several important issues affecting society today.

Between seven and eight out of ten respondents agreed that there are so many types of engineers that it makes engineering confusing for the average person to understand, but overall 'engineers fix things'.

In terms of the types of activities undertaken by engineers, nearly everybody in the quantitative survey thought that engineers were involved in construction, telecoms and the armed forces, but fewer thought they had any involvement in medicine.

In the qualitative workshop, attitudes towards engineering were more mixed: views were found to relate to the perceived benefits of engineering, either personally or for society more broadly. Positive attitudes towards engineering tended to relate to the belief that engineers were responsible for providing many of the things people relied upon in their everyday lives; whereas negative views linked to the belief that engineering was in some way responsible for some of the key problems in society, such as climate change.

Importantly, the experience of engaging in the workshop and specifically, increasing understanding was found to positively impact on levels of interest in engineering and ultimately on attitudes towards it.

Hooks and drivers to engagement with engineering

An attempt was made to model the quantitative survey data to arrive at an engineering engagement model and to see if certain attitudes and experiences could predict a propensity towards engagement. However, analysis of the data was unable to produce a strong model, as there was very little awareness of engineering among the sample. However, we can conclude from the quantitative survey that greater knowledge drives a more positive attitude to engineering.

Overall, engagement in the deliberative process was found to impact on participants' understanding of engineering. Engagement in the workshop was often said to have generated an interest in engineering and as a result a number of participants suggested they now wanted to delve deeper and gain a greater understanding.

A range of drivers of engagement were explored as part of the qualitative workshop. Overall, the impact of material to hook and engage participants can be seen as being determined by the following factors.

- ❑ The 'wow factor' - the greater the 'wow factor' the greater the interest and engagement. 'Wow factor' was linked to the uniqueness of the idea and the power of engineering to make a positive change;
- ❑ Simplicity of the idea - simple ideas were liked because they were considered resourceful and easy to understand;
- ❑ Social responsibility - engineering was viewed more positively where it was perceived as helping and benefiting those in need or society in some way;
- ❑ Potential for large scale change - the ability of engineering to bring about large scale change to the world in a positive way resulted in greater engagement and interest; and
- ❑ Relevance to own interests and concerns - the relevance of the example to the participant's own interests and concerns was also an important influencing factor.

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The importance of these 'drivers of engagement' differed across the sample according to individual preferences, but patterns did not relate to demographic characteristics.

The findings suggest that in order to engage more effectively with the public, overall awareness and knowledge of engineering needs to be increased.

I Introduction

This report presents the findings of research commissioned jointly by The Royal Academy of Engineering and the Engineering and Technology Board into public attitudes to, and perceptions of, engineering and engineers. The report draws together findings from a quantitative survey and a qualitative workshop which were conducted to explore people's understanding and attitudes in depth and to quantify some of the perceptions held about engineering which can be tracked over time.

I.1 Background

The Royal Academy of Engineering

As Britain's national academy for engineering, The Royal Academy of Engineering brings together the country's most eminent engineers from all disciplines to promote excellence in the science, art and practice of engineering. The strategic priorities are: to enhance the UK's engineering capabilities; to celebrate excellence and inspire the next generation; and to lead debate by guiding informed thinking and influencing public policy.

The Engineering and Technology Board

The Engineering and Technology Board is an independent organisation that promotes the essential contribution science, engineering and technology (SET) make to society. They work in partnership with business and industry, Government and the engineering profession to: improve the perception of SET in the UK; create and share evidence-based knowledge; inspire young people to choose careers in engineering; encourage engineers to continue their professional development; and support the wider community. Underpinning this activity is the need to ensure a supply of appropriately skilled individuals to meet the present and future SET skills needs of UK plc.

This research has been commissioned to provide a baseline measure of public knowledge and understanding of engineering which can inform action plans to build engagement including the provision of:

- ❑ Baseline data to measure and compare changes in public attitudes and perceptions, over time;
- ❑ A tool to indicate the impact of public engagement, communication and education activities; and
- ❑ Evidence to inform and guide public engagement, education and communications activities.

I.2 Research objectives

Overall the research aimed to:

- ❑ Determine public attitudes to engineering and engineers;
- ❑ Ascertain public perceptions of engineering and engineers;
- ❑ Explore, in depth, the reasons for public attitudes to, and perceptions of, engineering and engineers;
- ❑ Explore public perceptions on how engineering impacts and contributes to society, before and after exposure to the topic; and
- ❑ Explore public priorities in relation to the issues, topics and challenges that engineering should be focusing on.

I.3 Method

Two separate strands of research were commissioned: A quantitative survey and a qualitative workshop. Details of each are outlined overleaf.

1.3.1 The quantitative survey

The survey was administered using Computer Assisted Telephone Interviewing (CATI) among a nationally representative sample of 1,000 adults aged 16+. A copy of the survey questionnaire is provided in appendix 1.

In addition we interviewed a boost sample of young adults aged 16-19 years. These interviews were conducted during the same fieldwork period using CATI. Fieldwork was carried out between the 4th and 17th June 2007. Interviewers were fully briefed by the researchers as to the objectives of the survey as well as specific instructions on administering the questionnaire. The respondents were not told that the survey was about engineering specifically until Question 3 (see appendix 1) as doing so before this point would have influenced their answers to earlier questions.

Respondents were selected using Random Digit Dialling (RDD) and quotas were set to ensure the spread of people spoken to was nationally representative of age, gender and working status. Once all the data was collected it was weighted by age within gender, social grade within gender, working status within gender and region. Details of the weighting are included in appendix 2.

Profiles of these samples are set out below.

Table 1: Gender

	Main 1000			Boost 16-19 year olds	
	<i>Unweighted</i>	<i>Weighted</i>	<i>Weighted %</i>	<i>Unweighted</i>	<i>%</i>
Male	411	484	48%	105	51%
Female	589	516	52%	99	49%

Table 2: Age within main sample

	Main 1000			Main 1000			
	<i>Unweighted</i>	<i>Weighted</i>	<i>Weighted %</i>	<i>Unweighted</i>	<i>Weighted</i>	<i>Weighted %</i>	
16-19	49	74	7%	45-54	206	159	16%
20-24	52	70	7%	55-64	184	145	14%
25-34	146	163	16%	65-74	98	132	13%
35-44	216	190	19%	75+	49	67	7%

Table 3: Age within boost sample

	Boost 16-19 year olds	
	<i>Unweighted</i>	<i>%</i>
16	42	21%
17	71	35%
18	43	21%
19	48	24%

Table 4: Social Grade

	Main 1000			Boost 16-19 year olds	
	<i>Unweighted</i>	<i>Weighted</i>	<i>Weighted %</i>	<i>Unweighted</i>	<i>%</i>
A	85	81	8%	9	4%
B	181	173	17%	30	15%
C1	313	282	29%	63	31%
C2	179	208	21%	42	21%
D	115	112	11%	41	20%
E	117	137	14%	11	5%

Table 5: Region

	Main 1000			Boost 16-19 year olds	
	<i>Unweighted</i>	<i>Weighted</i>	<i>Weighted %</i>	<i>Unweighted</i>	<i>%</i>
London	110	124	12%	29	14%
South East	173	180	18%	30	15%
South West	99	85	9%	26	13%
East Anglia	67	38	4%	11	5%
Wales	65	50	5%	8	4%
East Midlands	47	71	7%	10	5%
West Midlands	67	89	9%	15	7%
North West	118	105	11%	31	15%
Yorkshire/ Humberside	97	84	8%	16	8%
North	29	50	5%	6	3%
Scotland	99	85	9%	17	8%
Northern Ireland	19	28	3%	-	-

Table 6: Ethnic Background

	Main 1000			Boost 16-19 year olds	
	<i>Unweighted</i>	<i>Weighted</i>	<i>Weighted %</i>	<i>Unweighted</i>	<i>%</i>
White	881	858	86%	155	76%
Black	23	33	3%	12	6%
Asian	47	54	5%	22	11%
Mixed	16	21	2%	11	5%
Any Other	21	20	2%	4	2%

Reporting Conventions

- ❑ The nationally representative sample includes the correct proportion of 16-19 year olds (74 people) in the total. In the tables within this report where breakdowns of 16-19 year olds have been split out separately we have used the total number of 16-19 year old interviewed: both main and boost samples (204 people).
- ❑ Where base sizes are low we have indicated this with a* next to the figure.
- ❑ Figures in brackets show the unweighted numbers of respondents answering the question.

A full set of tables from the quantitative survey are provided in the supplementary appendix.

1.3.2 The qualitative workshop

The qualitative element of the research was a workshop. This was deliberative in form and comprised one workshop event. A deliberative approach was adopted to help provide meaningful responses and also better understand how the public engage with the topic of engineering.

A total of 48 respondents participated in the qualitative workshop. During the course of the workshop participants were divided into five break-out groups (each containing 8 to 10 respondents) which were organised according to key demographic characteristics, including, social grade, age, gender and educational attainment. The demographic profile of each group is outlined in the table below. The workshop was held in May 2007 in West London.

Table 7 - Sample Profile

Group	Age	Social grade	Gender	Education	Ethnicity
Young Adults	15-18	n/a	Mixed (4M, 6F)	n/a	Mixed (5W, 5NW)
Young Adults	19-25	n/a	Mixed (3M, 5F)	FE+	Mixed (4W, 4NW)
Adults by Social Grade	26-39	C2DE	Mixed (7F, 3M)	n/a	Mixed (4W, 6NW)
Adults by Social Grade	40+	ABC1	Mixed (5M, 5F)	n/a	Mixed (6W, 4NW)
Women Only	30-45	n/a	Women (10F)	n/a	Mixed (7W, 3NW)

F = Female; M = Male

W = White; NW = Non White

Structure and design of the qualitative workshop

The workshop was designed to provide respondents with increasing levels of information, in manageable amounts, to enable them to think through issues relating to engineering in more depth. The workshop consisted of a number of sessions:

- ❑ **Introductory plenary session:** The workshop began with an introductory session welcoming attendees and outlining the structure of the day. This session was delivered in collaboration by the Academy and BMRB. Whilst waiting for the day to begin a short poll was taken with respondents to gauge perceptions of engineering. This poll included three questions from the quantitative survey and is in appendix 3. The poll was repeated at the end of the day as a measure of how perceptions had changed.
- ❑ **Initial perceptions:** The first group session of the workshop explored initial perceptions of engineering prior to the provision of any information on engineering. Spontaneous perceptions and misperceptions of engineering and engineers were explored using a range of qualitative enabling and projective techniques, including the use of mood boards, collages and pen portraits. Following the spontaneous discussion, a range of pictures relating to engineering were shown (as a prompt) and respondents were asked to consider how engineering or engineers might be involved in the scenario.
- ❑ **Presentation:** This first session was followed by a short presentation¹ which provided an introduction to engineering covering an overview of:
 - ❑ What engineering is and does;
 - ❑ The range of roles engineering has;
 - ❑ An explanation of the type of work engineers do; and
 - ❑ How engineering impacts on society using examples from the four key issues which the workshop later focused on (Climate change; Health and Well-Being; Telecommunications and Structural).

Following the plenary presentation, respondents were divided back into their groups and reactions to the presentation and the impact of this on their initial perceptions and understanding were explored;

- ❑ **The key issues stage:** This stage of the workshop focused on the 'hooks and drivers' to engagement. Participants were exposed to a series of information stimuli relating to four key issues currently being advanced by engineering. The key issues and case studies were not provided to find out participants' views of the case studies specifically, but were designed to expose participants to some applications of engineering in relation to key issues and unpick how participants engage with this - what 'hooks' them in, and what 'drives' their understanding. Each key issue was represented by two case studies:
 - ❑ Structural - the Thames Flood Barrier and tsunami shelters;
 - ❑ Health and well being - prosthetic legs for sprinters and clean water in Ethiopia;
 - ❑ IT and Telecommunications - O2 Airwave digital radio system for the emergency services and the BlackBerry; and
 - ❑ Climate change- development of Bio fuel and the Beddington Zero Energy Development sustainable community.

¹ The presentation was given by Dr Mark Miodownik, Head of the Materials Research Group at Kings College London.

Further details of the stimulus materials are provided in appendix 5 and full copies of the materials are available in the supplementary appendix ².

- ❑ **Wrap up session:** This final session allowed respondents to reflect on how their understanding had developed during the course of the workshop.

Conduct of the qualitative workshop

The workshop was facilitated by experienced qualitative researchers using a topic guide and stimulus materials. These were both developed by BMRB, in close liaison with the Academy and the ETB (see appendix 4). Although the topic guide ensured systematic coverage of key points across the groups, they were used flexibly to allow the issues of relevance to participants to be covered.

All the group discussions were digitally recorded in stereo. The verbatim transcripts produced from the digital recordings were subject to a rigorous content analysis, which involved systematically sifting, summarising and sorting the verbatim material according to key issues and themes, within a thematic matrix. Further classificatory and interpretative analyses were then derived from the analytic charts and these formed the basis of the findings reported in subsequent chapters.

It is important to note, that qualitative research aims to map the range of emergent issues and explore the reasons underpinning these, focusing on questions such as 'how' and 'why', rather than 'how often' or 'how many'. Importantly, the purposive nature of the sample design means that qualitative research cannot provide any statistical data relating to the prevalence of these views or suggestions.

1.4 Report structure

This report draws together the findings from the quantitative and qualitative elements of the research, comparing and contrasting the results across three chapters.

- ❑ Chapter one considers awareness, knowledge and understanding of engineering;
- ❑ Chapter two explores initial perceptions and views of engineering; and finally
- ❑ Chapter three focuses on the key hooks and drivers underpinning the public's engagement with engineering.

² available on request.

2 Awareness and knowledge of engineering

This chapter of the report explores participants' awareness and knowledge of engineering and engineers. Specifically, it considers participants' understanding of engineering, including initial perceptions, understanding of the nature and type of work undertaken and the different types of engineering; levels of confidence in their knowledge and understanding; and sources of awareness and knowledge.

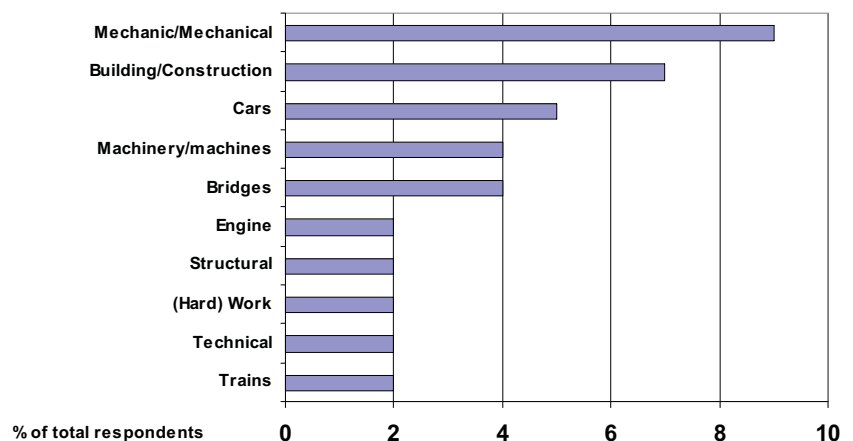
Overall, findings from the quantitative survey and the qualitative workshop suggested that participants had a limited awareness, knowledge and understanding of engineering and engineers. Engineering tended to be associated with construction and manual professions rather than professions relating to creativity or design. However, participants were often found to lack confidence in their knowledge and engineering was said to be difficult to define. Patterns in knowledge were found to relate to demographic characteristics, such as social class, education, gender and age. Younger people in particular were found to have a much more limited understanding of engineering in comparison to other groups. These findings are discussed in more detail in the following sections.

2.1 Knowledge and understanding of engineering

2.1.1 Initial knowledge and understanding of engineering

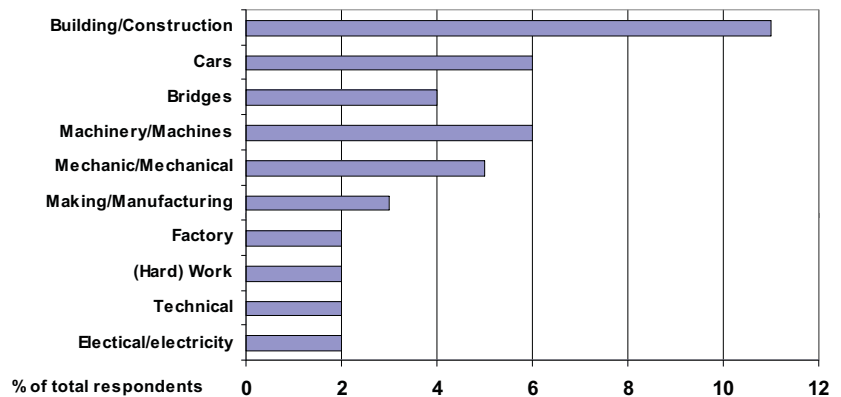
The quantitative survey findings showed that top of mind associations with the word 'engineer' varied widely, with few items mentioned by more than three per cent of respondents. The most frequently mentioned related to construction and mechanics - associations that put the profession into the role of fixing things rather than design or creativity. The only items mentioned by more than a few individuals were associations with family members in the profession such as a husband or father (18 mentions), that engineering was 'skilled' (17 mentions) and that it was 'professional' (14 mentions).

Figure 1: Top 10 associations with the word "Engineer"



Associations with the word 'engineering' were very similar and were even more closely related to manual work. Figure 2 overleaf shows the top ten associations.

Figure 2: Top 10 associations with the word “Engineering”



Findings from the qualitative workshop very much reflected those outlined in the quantitative survey, with engineers tending to be associated with fixing things rather than, for example, design or problem solving. Workshop participants mentioned a range of activities or objects to describe engineering, including the following: construction, manufacturing, mechanics, cars, aeroplanes, trains, bridges, roads, astronomy, machines, electronics and computers. Genetic engineering was also spontaneously highlighted, although participants were unable to explain why or how they considered this to be engineering, except that the word ‘engineering’ was in the title.

The understanding expressed by participants in the qualitative workshop regarding engineering and associated issues varied. Analysis suggested respondents who exhibited a more sophisticated understanding tended to be older; in the ABC I socio economic group; or they had come into contact with engineering through friends, family or work in the past. In a number of instances, respondents suggested that engineering was related to ‘everything’ man-made which aimed to improve life through invention, including mundane objects such as pens, cups and tables.

‘Most people probably associate engineering with construction rather than the design of that table or the seat that you’re sat on... Over time you realise that engineering is a wide field ... it’s not one element of our life; it’s a whole mixture of things.... It’s everything, it’s how our life evolves.’

‘Slowly over time you hear about it [engineering] and you realise engineering is just everything... Just everyday things, everything is engineered, you know, it’s just actually making something, isn’t it? It’s like a pen, the ink’s got come out but it’s made by somebody.’

(Group D: 40+, ABC I)

The younger participants (15-18 year olds) who took part in the qualitative workshop were found to have a much more limited understanding of engineering, with this group generally associating engineering with building, construction, mechanics and electronics. This was clearly illustrated in the picture exercise where this group chose pictures of buildings, technology and electrical products, such as digital set top boxes and washing machines, to describe engineering. Although to a lesser extent, respondents in the C2DE group also viewed engineering in this way and primarily defined engineering in terms of manual labour and fixing things. Notwithstanding this, there was some understanding of the link between engineering and design within the C2DE group.

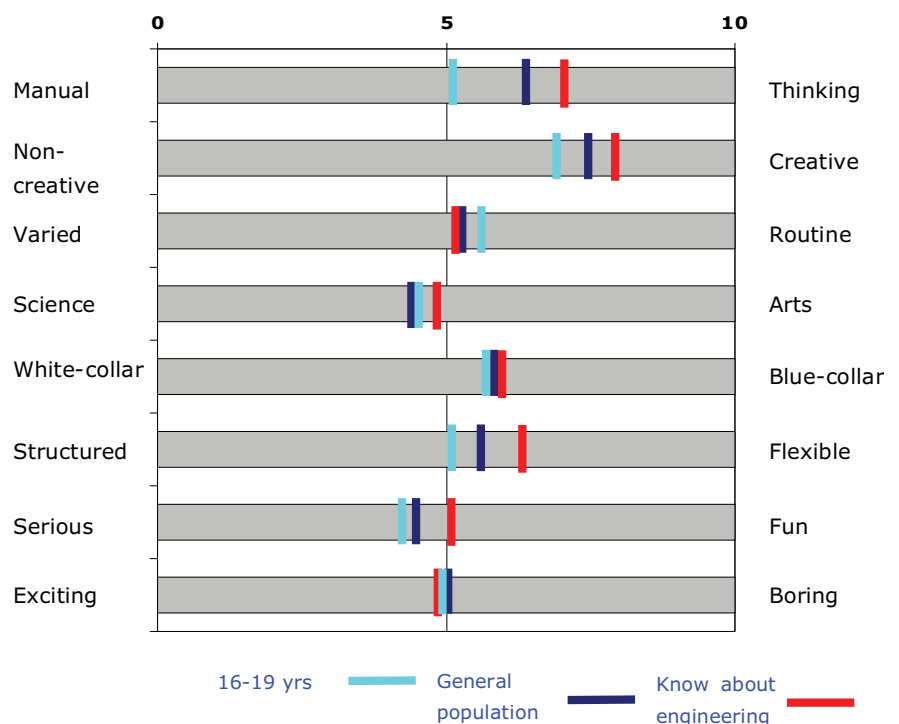
2.1.2 Understanding of the nature and type of work undertaken by engineers

As part of the quantitative survey, respondents were read a series of descriptors and asked to state which ones were most closely associated with engineering. Figure 3 shows the results of this exercise for the nationally representative sample and the 16-19 year olds.

Overall engineering was seen to be a 'creative' profession, more 'thinking' related than 'manual' and yet slightly more 'blue collar' than 'white collar'. Its image was more 'science' based than 'arts'. It was seen to be a 'serious' profession, and among the young particularly, more 'routine' than 'varied'. The youngest age groups were more inclined to see it as 'manual' work than the population as a whole and also less 'creative'.

This rather contradictory image of engineering coupled with the perceived lack of knowledge would lead us to conclude that many of the assumptions made are not based on fact or personal involvement with the profession but on mixed messages formed through the media or talking to other people. This very much links to the lack of confidence and confusion expressed by participants as part of the qualitative workshop as discussed in more detail in section 2.2.

Figure 3: Where engineering falls on a bi polar scale of 1 to 10:



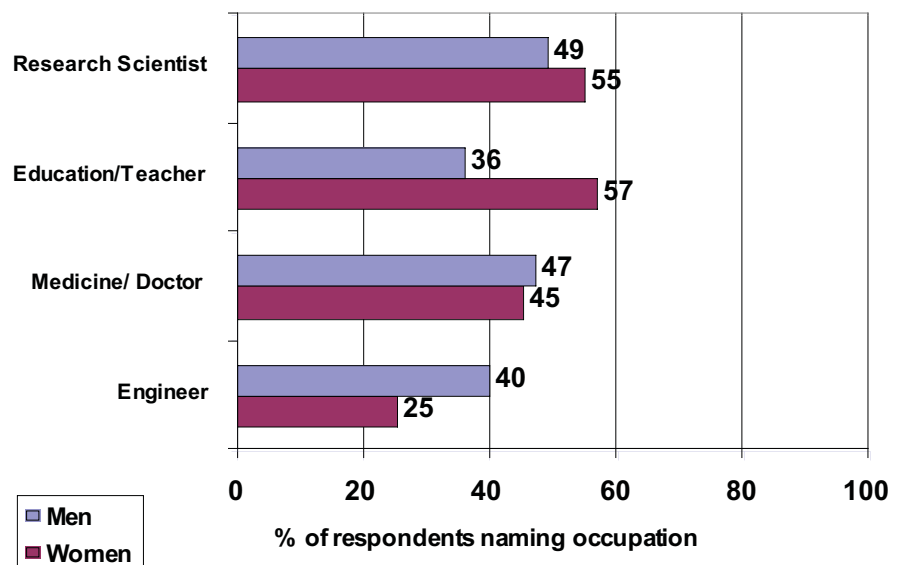
In the quantitative survey, among the group of people who claimed to have a good knowledge of engineering (scoring 7-10 on the scale of 1-10) the profession had a pronounced 'creative' and 'thinking' rather than 'manual' image. It was also seen to be decidedly 'flexible'. One finding which could appear to be contradictory was that it has a 'blue collar' image. In retrospect this term may have been interpreted differently by different respondents and could mean 'hands on' as well as a manual or industrial worker.

In some instances, participants in the qualitative workshop divided engineering and engineers into two camps: those who undertook manual work and fixed things such as computers; and those who engaged in non-manual, academic or 'thinking' type of work and designed things. Interestingly, it tended to be respondents with a more sophisticated understanding of engineering that made this distinction.

In the quantitative survey, a sample of respondents were read a statement describing an occupation and asked which of a number of occupations they thought it best described.³ The statement was: “It is an occupation where people are expected to come up with new ideas, face and overcome challenges and devise solutions to some of society’s most pressing needs”. The majority (52 per cent) thought it described scientists and only one third thought it described engineers. Among those people who felt they knew quite a lot about engineering (scoring 7-10 on a 1-10 scale) a higher than average proportion thought the statement described that profession (45 per cent), but they were still more inclined to say that the statement best described scientists.

The biggest differences in perceptions were found by gender and Figure 4 below show the occupations mentioned most frequently.

Figure 4: Which occupation is best described by this statement?

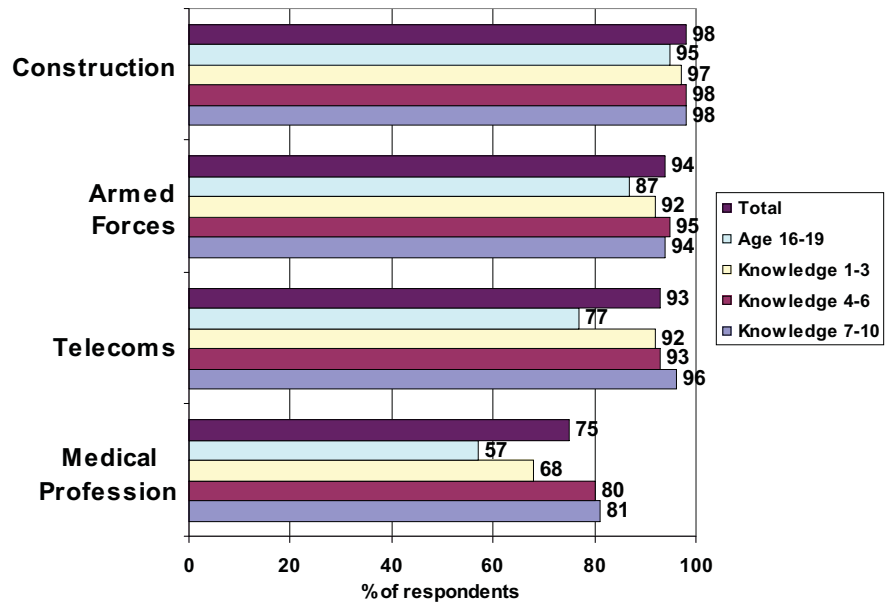


Findings from the qualitative workshop suggested that engineering was perceived as overlapping with other professions including: science, medicine, academia, mechanics, building and architecture. In some instances, participants confused engineering with other professions, particularly the younger group, for example surveying and engineering were confused on account of surveyors examining the structure of buildings and it was suggested that surgeons might also fall into this category as a result of using tools and equipment to fix people.

In terms of the types of activities undertaken by engineers, nearly everybody in the quantitative survey thought that engineers were involved in construction, telecoms and the armed forces, but fewer thought they had any involvement in medicine (Figure 5). This was particularly the case among the youngest age group who knew least about the profession.

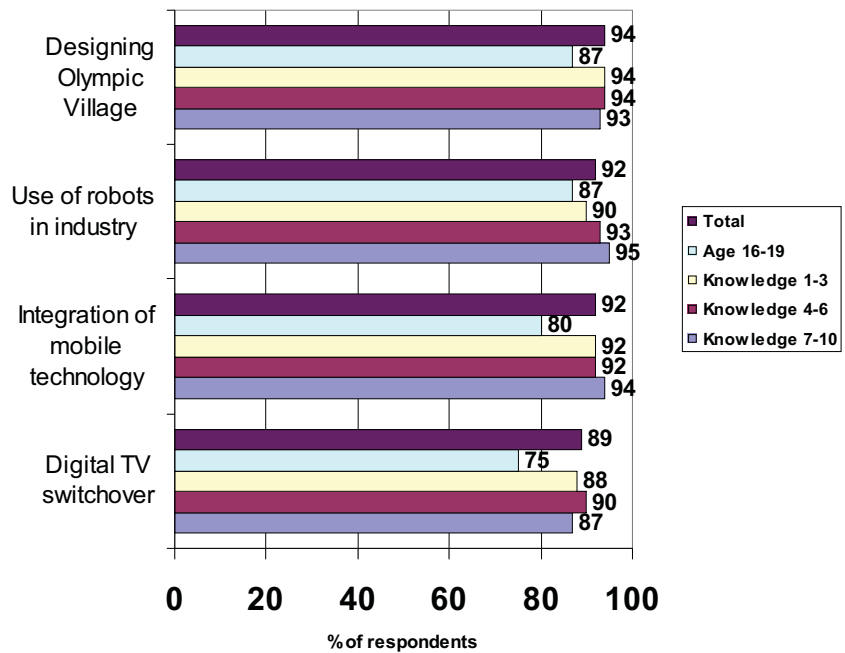
³ This question was only asked to the first 100 people interviewed in the survey and is therefore an indication of public feeling rather than a robust and representative answer to this question.

Figure 5: How involved are engineers in...



Most thought that engineers had been involved in all four of the projects described during the quantitative survey - designing the Olympic village, the use of robots in industry, the integration of mobile technology and the digital TV switchover - regardless of how much they claimed to know about the profession (see Figure 6).

Figure 6: How involved are engineers in...



As part of the qualitative workshop, respondents were shown a series of pictures and asked how they thought engineering or engineers would be involved in the process. Participants were able to link engineering or engineers to all the pictures shown. Examples of how the pictures were linked to engineering are outlined below:

- ❑ **A CCTV camera**
 - ❑ Engineers were perceived as building the posts the cameras sat on, making the casing and the mechanisms inside;
 - ❑ Enabling the cameras to receive electricity;
 - ❑ Calculating how many cameras would be required and the most suitable location for them to be situated.
- ❑ **An overweight person**
 - ❑ The invention and technology to design liposuction machines;
 - ❑ Design of the nutritional make up of new foods to help combat weight gain.
- ❑ **A starving child in the developing world**
 - ❑ Building pumps and irrigation systems to supply clean water;
 - ❑ Designing and making the metal cups and plates depicted in the picture.
- ❑ **Identity theft**
 - ❑ Inventing machines to copy cards and steal identities;
 - ❑ Developing technology to track stolen cards.
- ❑ **Rollercoaster**
 - ❑ Structural engineers ensuring the frame supports moving cars;
 - ❑ Choosing materials that do not rust and can bend to curves;
 - ❑ Analysis of weights and forces to make sure passengers do not fall out.
- ❑ **Combine harvester in a field**
 - ❑ Genetic engineering of crops for large scale production;
 - ❑ Designing machinery;
 - ❑ Designing pesticides in the field to kill bugs without harming the crop.

Overall the picture exercise showed that when engineering was considered in greater depth and probed in relation to specific situations, engineering was understood to have a much wider remit than that initially highlighted. Importantly, engineers were seen as being involved in both design and building and participants appeared to have a greater understanding than initially noted.

This suggests that respondents' initial awareness had developed quickly following the early group discussions about general knowledge and awareness of engineering and engineers. The time to think about what they understood about engineering and engineers, and hearing the views of others in the group, had developed and crystallised understanding and awareness.

2.1.3 Awareness and knowledge of different types of engineering

The qualitative workshop explored participants' awareness and knowledge of different types of engineering and asked respondents to consider the similarities and differences between them. A range of types of engineering were discussed including the following:

- ❑ **Civil engineering** tended to be associated with 'infrastructure'. Examples used included roads, railways, bridges, aeroplanes, the electricity grid and water pipeline system. Understanding was evident in the groups with a wider understanding of engineering including the 19-25 group, 40+ ABCI group, and the women only group. However, awareness was not universal within these groups with certain participants suggesting they had not heard of civil engineering and assumed it must be related to the civil service;
- ❑ **Mechanical engineering** was described as being related to the working of machinery or anything to do with a 'moving part', such as the building of trains, planes and cars;
- ❑ **Chemical engineering** was viewed as one of the more easily definable stands of engineering, especially by the younger group. The fluid in batteries, medicines, cosmetics, cleaning products, and chemical bombs were all highlighted as examples of chemical engineering.

'To do with batteries maybe... like there's fluids in batteries ... I suppose it could be like vaccines, medicines, that type of thing.'

'You could make cosmetic products. Maybe shampoo ... or be like people that clean and test water.'

(Group A: 15-18)

Respondents were not able to say how chemical engineers differed to scientists but felt certain that their roles overlapped; and

- ❑ **Electrical engineering** was also deemed relatively easy to understand and in part this understanding was said to be linked to the name 'electrical engineering.' Respondents said they understood intuitively what electrical engineering was because electrical products were part of their daily life. Electrical appliances such as washing machines and ovens were offered as examples of electrical engineering. The younger group also assumed that engineers who fixed broken washing machines and ovens would count as electrical engineers and they were likened to gas engineers sent out to homes to fix broken gas boilers.

2.1.4 Perception of engineers' working environments

In the qualitative workshop 'guided dreams'⁴ were used in order to gain insight into participants' understanding of engineers and the work they undertake. When respondents described the mental image they had of an engineer as part of the guided dream, they described both manual and non-manual occupations and this very much impacted on the type of demographic characteristics (such as gender or social grade) they perceived the engineer to have. Few qualifications were felt to be needed for engineering associated with manual work, which was also regarded as more 'working class'. In contrast, the non-manual engineering was regarded as relatively 'upper class' and requiring a degree level qualification.

Engineering tended to be seen as a male dominated profession - although this was not universal. Respondents generally struggled to explain reasons underpinning this perception, although it was generally linked to the association made between engineering and science which were seen as male dominated areas.

⁴ 'Guided dreams' are a qualitative technique used to explore perceptions. Respondents are asked to imagine and describe their perception. For this study guided dreams were used to explore perceptions of engineers and the environment they work in.

Notwithstanding this, there was a sense expressed by certain participants that this pattern was changing.

[Engineering is] 'male orientated.'

'I think I agree, I think it's very male dominated and that's the way they want to keep those industries.'

'No I think it's starting to go the other way though now. I think women are getting more into it now as they go through university more now than they would have done [in the past].'

'I think as time's going on and the world's changing women are getting involved in industries like that [engineering] which were probably male dominated, but I think you'll probably find now women want to be in situations where, you know, new things are happening and, big designs and things like that, so things are changing.'

'But ... I mean you've got heavy industry engineering like manufacturing and you've got the side where people are creating computers ... so women are perfectly capable of doing both, it's whether they choose to do so.'

'But it does tend to be more of a male dominated, even the computer engineering.'

(Group E: 35-45, women only group)

Based on these discussions, six pen portraits or types of engineers were identified and these included the: 'middle aged boffin'; the 'whiz'; the 'designer'; the 'mad scientist'; 'Mr fix-it' and 'high visibility vest man'. These descriptions pull together the ideas from across the groups. Each description shows perceptions of class, education, gender and type of work perceived. The pen portraits are outlined overleaf:

The designer

Male or female

Cool looking

Works with designs and creates things

Very clever

Big office with piles of paper and designs, perhaps works with tiny models on computers

The whiz

Male or female

Well travelled and experienced

Has at least one degree, possibly more

Studied maths, physics, chemistry

Extremely clever, bookworm

Likes to find out how things work

If female a 'tomboy' that does not take care of nails

Mr Fix-it

Grubby looking man

Works in homes or offices fixing things or a workshop

Possibly a mechanic

Did an apprenticeship or course to learn trade

The mad scientist

White coat

White, male, beard

Wears big glasses

Works long hours

Eccentric

Works in a noisy environment with metal and chain saws or perhaps a laboratory

The middle aged boffin

Shirt, tie and a clipboard.

5'7, white, about 40 years old, male

Wears glasses

Has wife and children

Works 9am-5pm

Clever and reads big books

Works in an office

The high visibility vest man

Dirty overalls/uniform

Orange gloves

High visibility vest

Male, 40+

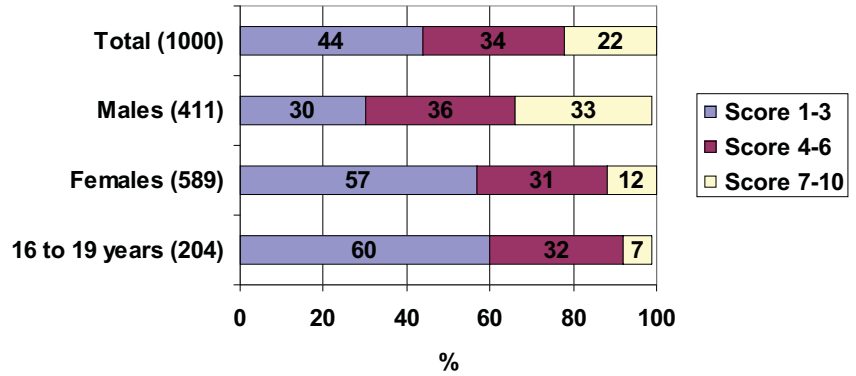
Works out doors or in a factory with machinery

Working class

2.2 Confidence in knowledge and understanding

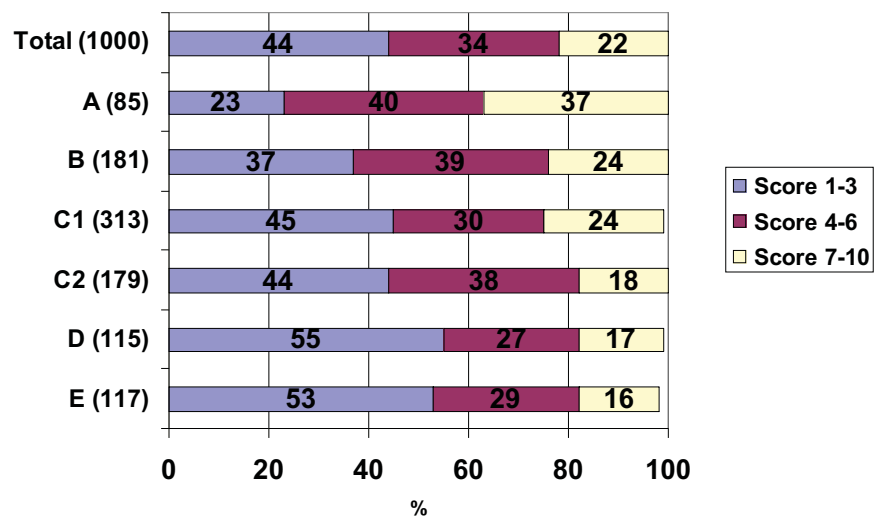
Findings from both the quantitative survey and the qualitative workshop suggest participants often lacked confidence in their understanding of engineering or felt they had low levels of knowledge. For example, when the nationally representative sample in the quantitative survey were asked on a scale of one to ten how much they knew about engineering (1 being 'very little' and 10 being 'a lot') the largest proportion of people scored 1-3 which translated as 'not very much' (Figure 7).

Figure 7: Amount known about engineering as a profession on a scale of 1 to 10 (Gender & Sample)



Respondents in the higher social grades tended to feel they knew more about the profession, as shown in Figure 8 below.

Figure 8: Amount known about engineering as a profession on a scale of 1 to 10 (Social Grade)



The same pattern emerged when respondents were asked how well informed they felt about the work of engineers, as shown in Figures 9 and 10.

Figure 9: Extent to which feel informed about the work of engineers (Gender & Sample)

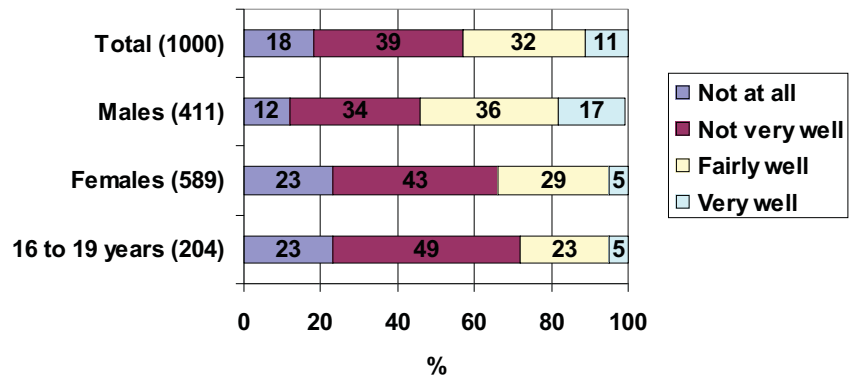
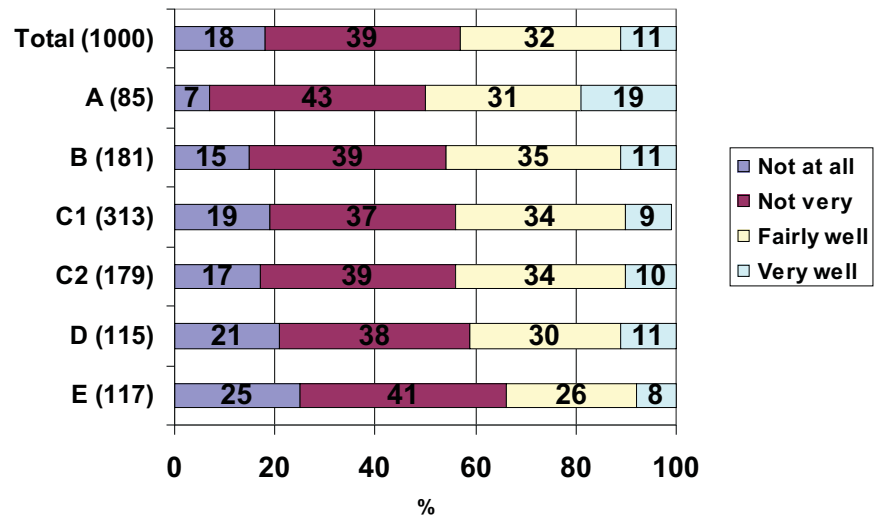


Figure 10: Extent to which feel informed about the work of engineers (Social Grade)



Participants who engaged in the qualitative workshop were often found to lack confidence in their knowledge of engineering and as a consequence questioned the accuracy of their understanding, especially when it conflicted with the understanding of others in their group. When discussing doubts regarding the accuracy of their knowledge, participants concluded that engineering was a broad and vague term that was difficult to define and pin down.

In part this lack of clarity was thought to be a result of people misusing the term, primarily to make a job or task sound better. For example, it was felt the term 'engineer' was sometimes used in job titles or to describe types of work that did not fall under the umbrella of engineering in order to raise their profile.

'It's slightly vague when you say engineering ... It's like one of those corporate like buzzwords, like you kind of say 'engineering' but it could mean anything ... kind of avoids the question, makes something sound better than it is. ... They're trying to make like people feel like the job that they're doing is really worthwhile. For example you could hear something like, what is it, personal assistant ... and you think wow I'd love to be a PA. But then before, it was like a helper and they do that with this [engineering] too... like you used to be like a dustman and now you're a street engineer.'

(Group B: 19-25)

2.3 Sources of awareness and knowledge

Participants who took part in the qualitative workshop were found to gather information regarding engineering from a range of different sources. These included:

- ❑ **Word of mouth** - word of mouth was identified as a key source of knowledge, for example, friends and family who worked in jobs relating to engineering or had studied engineering at university were highlighted as a key source of knowledge. In particular, the 40+ ABC1 group and 19-25 group were able to identify examples of friends and family who had studied engineering for a higher degree and had discussed their degree with the respondent. This knowledge had informed their understanding of engineering and goes some way to explaining their greater level of knowledge regarding the work performed by engineers;
- ❑ **Life experience** - linked to word of mouth, knowledge about engineering was also said to have been developed with age. The 40+ group for example, felt their understanding of engineering had come as a result of experience and explained how they had come into contact with engineering and engineers through friends, work and the media.

'When you're younger, all you're hearing is engineering and steelworks, engineering and the coal mine, but as you get older you [hear more about it] and think, well it's not only that, it's everything.'

(Group D: 40+, ABC1)

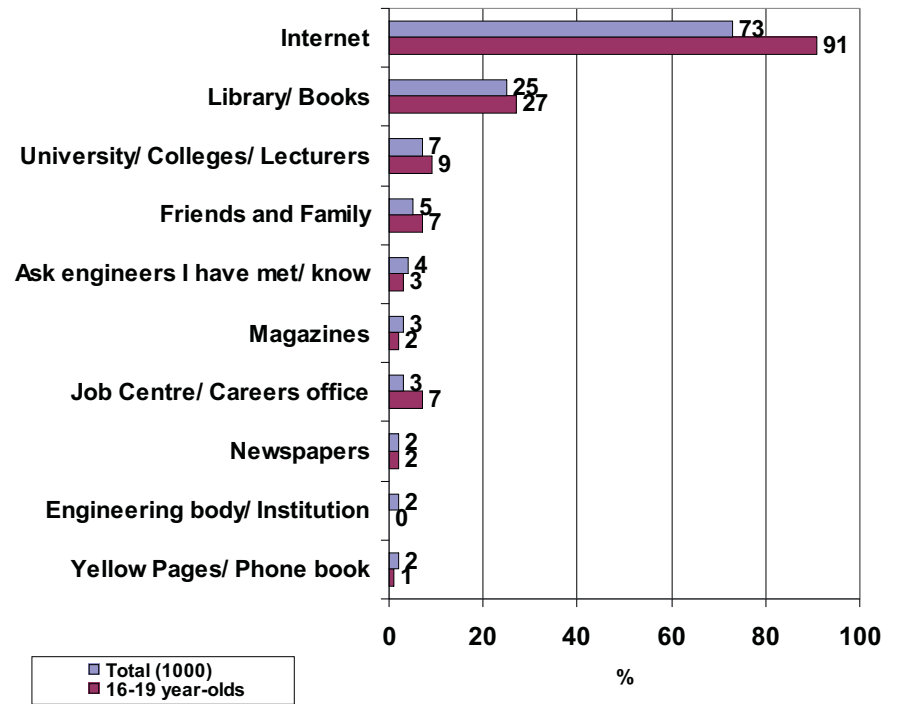
- ❑ **Via school** - the younger group (15-18 years old) felt their understanding, although limited, had been gained at school. Examples of when this had been discussed included science lessons (where they had heard about genetic engineering) and religious education where the ethics of cloning had been debated. Because the term 'genetic engineering' included the word 'engineering' respondents said they thought this was engineering. Engineering had also been heard of in relation to careers but only in relation to joining the army, who had advertised at school career fairs. More exceptionally, courses had been undertaken related to building construction where the word 'engineering' was reportedly used a lot; and
- ❑ **Contact with engineers** - contact with individuals thought to be engineers, had worked to inform respondents' perceptions of engineering in some instances. For example, IT engineers, photocopier engineers and sound engineers. Likewise the term 'engineering works' used on the train and tube networks meant respondents said they associated engineering with manual work in this environment.

Interestingly, **the media** was not identified as a key source of knowledge, although this does not of course mean that this did not impact and influence awareness/perceptions of engineering and engineer. Although respondents recalled television adverts which referred to engineers (for example by Honda), it was felt that engineering was not depicted widely in the media. Respondents recalled famous engineers such as Brunel and historical innovations in engineering such as the steam train, but were unable to name any modern day famous engineers who had invented anything considered to be of similar importance.

In the quantitative survey, respondents were asked where they would go to look for information about engineering and the work of engineers. As shown in Figure 11 overleaf, the most frequently mentioned source was the internet, given by 73 per cent. About a quarter of the sample would search for information in books, and this tendency was stronger among older people. Only graduates were inclined

to cite their place of education as a sizeable source of information (16 per cent). Among 16-19 year olds still studying however, only 9 per cent claimed they would search for information at their university or college.

Figure 11: Top 10 places would search for information about engineers



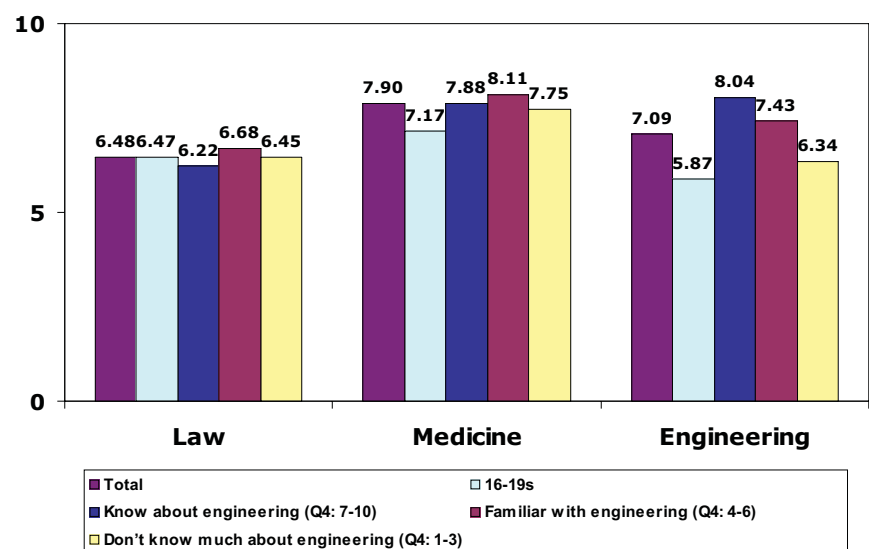
3 Attitudes and views of engineering and engineers

This chapter considers views and perceptions of engineering and engineers. It explores attitudes towards the profession, reasons underpinning these views and perceptions of how engineering can benefit the individual and society.

3.1 Attitudes towards engineering

Even though the quantitative survey found that public awareness of engineering was low, overall, people did have a generally positive feeling towards the profession. When compared with the medical profession and law, engineering did rather well among the general population, but the 16-19 year olds were much less positive. It is true to say however that the more people knew about the profession the more positive they felt towards it and 16-19 year olds were among the least knowledgeable. The question asked was: *Thinking about everything you know about these professions and whatever you may have heard about them from other people or the media, on a scale of 1 to 10, where 1 is the least positive and 10 is the most positive, how positive do you feel towards each?* The results are shown in Figure 12 below.

Figure 12: Level of positive feeling towards each profession (mean score)



Using the quantitative survey data we proposed to make an engagement index based on how positive people felt towards the profession and profile those most engaged. When we looked at the spread of the data we arrived at three thresholds of positive feeling.

- ❑ Those who were most positive (scored 9-10 on the level of positive feeling scale) 26 per cent of the sample;
- ❑ Those who had some positive feeling (scored 5-8 on the level of positive feeling scale) 50 per cent of the sample;
- ❑ Those who had little/no positive feeling (scored 1-5 on the level of positive feeling scale) 24 per cent of the sample.

The most positive group were older on average (often retired) and more 'upmarket' than the average population - in fact they were very similar to the group who had a high awareness of the profession.

Respondents in the quantitative survey were read a series of statements about engineers and engineering and asked the extent to which they agreed with each

statement. The results of this exercise are shown in Table 8 overleaf. Overall people tended to take the view that engineers are well respected and make a good contribution to society, making people's lives easier. Over eight out of ten respondents agreed with these statements and this did not vary widely across the sub groups within the sample apart from one notable exception - people who claimed to know most about engineering were less likely to say that it is a well respected profession. This group were most likely to say that engineers should get into the media more.

Between seven and eight out of ten respondents agreed that there are so many types of engineers that it makes engineering confusing for the average person to understand, but overall 'engineers fix things'.

There was strong disagreement from all types of respondent that engineering is mainly concerned with underdeveloped countries and that engineering is a profession for men. 59 per cent thought that hardly anyone knows what engineers do and interestingly enough this view was also held by those who know a lot about engineering (scoring 7-10 on the 1-10 scale).

Table 8: Attitudes to engineering

Agreement with statements	Total %	Age 16-19 %	Knowledge 1-3 %	Knowledge 4-6 %	Knowledge 7-10 %
Engineering makes a good contribution to society	94	88	91	95	99
Engineers make our lives easier	87	83	83	89	93
Engineering is essential for all human development	84	68	81	84	89
It is important for people to understand what engineers contribute to daily life	82	74	78	84	86
Engineering is a well-respected profession	82	83	85	84	74
So many types of engineer it is confusing for the average person to understand	80	70	84	76	75
Engineers fix things	78	79	79	72	82
More time should be given to the achievements of engineers in the media	72	56	67	71	81
Engineers should get themselves in the public eye more	71	65	69	69	76
Hardly anyone knows what engineers do	59	53	66	48	61
Engineers should listen more to what ordinary people think	55	47	56	54	55
Engineers are very similar to scientists	51	42	47	53	57
On the whole, men make better engineers than women	24	24	24	22	25
Engineering is a profession for men	20	20	22	16	21
Engineers are mainly concerned with underdeveloped countries	11	13	11	8	14

3.1.1 Reasons underpinning attitudes

Reasons underpinning perceptions of engineering were discussed as part of the workshop event. Views were found to be related to the perceived benefits of engineering, either personally or for society more broadly.

Positive attitudes towards engineering tended to relate to the belief that engineers were responsible for providing many of the things people used or relied upon in their everyday lives, such as transport, electricity and buildings and therefore, engineering was seen as something that improved the quality of people's life experiences. Views were found to be positively related to understanding, with perceptions of engineering becoming more positive the more participants understood the scope of engineering and the impact it had on their lives.

However, participants did also express some negative viewpoints, primarily because engineering was seen as being responsible in part for some of society's key problems, as a result of its contribution to technical advances. For example, the contribution cars and planes were perceived to have made on climate change and the development of nuclear and chemical bombs. This view was universally raised in the groups during the initial session. Furthermore, engineering was also perceived to be part of a type of commercialism that acted in the interests of money and progress rather than the good of people.

'There's a lot of money involved in those industries and everything to do with it, so much money that you can't even imagine.'

'That's right, it's so commercial.'

'Yes, sometimes I think it's just money being wasted.'

'But they're not doing it for the good of the people.'

'It is going in a harmful direction.'

'It's progress for its own sake and it's divorced a little bit from society, I suppose that's the thing, engineers, I tend to think of them as not really having that social awareness necessarily.'

'[It's] like they run on their own little track and develop, develop, develop, and that's all that's important.'

In line with this, a number of the young people attributed their negative perceptions to a lack of interest, which they felt stemmed from a lack of understanding in the subject. In instances where the young person had an interest in a particular area relating to engineering, such as motorbikes, they tended to be much more positive.

In the quantitative survey, on a scale of 1-10 respondents were asked how much contribution engineering and engineers had made towards the resolution of a number of world issues where 1 meant little or no involvement and 10 meant a lot of involvement. The results are shown in Table 9 overleaf.

The total sample felt that engineering had most involvement with the disposal of nuclear waste followed by sanitation and water quality and had the least involvement with fertility treatment and the loss of plant or animal species.

Among the 16-19 year olds, issues were placed in a broadly similar order but overall this group felt that engineers had less involvement across the board.

The group who claimed to know most about engineering also placed issues in a broadly similar order to the total sample, but they were much more inclined to think that engineers had involvement in river pollution and much less inclined to think that engineers were involved in developing HIV vaccines.

Table 9: Contribution of engineers to resolving issues (Mean score)

	Total %	Age 16-19 %	Knowledge 1-3 %	Knowledge 4-6 %	Knowledge 7-10 %
Disposal of nuclear waste	7.05	5.28	6.63	7.45	7.27
Poor sewage and sanitation	6.88	**	6.60*	6.99*	**
Poor drinking water quality	6.79	5.20	6.34	7.03	7.30
Preventing global warming/ climate change	6.49	4.99	6.20	6.64	6.82
Poor air quality/ air pollution	6.36	5.28	5.90	6.58	6.92
Pollution of rivers/ lakes or oceans	6.35	5.88	6.11	6.34	7.06
Developing new medical treatments for illnesses	5.85	4.76	5.52	6.09	6.10
Alleviating poverty in developing countries	5.80	4.79	5.61	5.90	6.02
Developing a vaccine for HIV	5.08	4.13	4.63	5.73	4.93
Alleviating poverty in my country	5.07	4.38	4.81	5.50	4.87
Loss of plant or animal species	4.76	4.18	4.48	4.96	5.00
Fertility treatment	4.76	4.38	4.55	5.12	4.56

** base too small for analysis * caution small base

Importantly, in the qualitative workshop, views regarding engineers' contribution to the world shifted as respondents were provided with stimulus material and had time to consider issues in more depth. This is discussed in more detail in the following chapter.

4 Hooks and drivers to engagement with engineering

This chapter considers the key hooks and drivers to engagement with engineering. An attempt was made to model the quantitative survey data to arrive at an engineering engagement model and to see if certain attitudes and experiences could predict a propensity towards engagement. In the event the model did not work well because there was very little awareness of engineering among the sample but overall we can conclude that greater knowledge drives a more positive attitude to engineering. The qualitative workshop also explored in depth the key hooks and drivers to engagement in engineering as part of the deliberative process and therefore it is this data which is explored in this chapter.

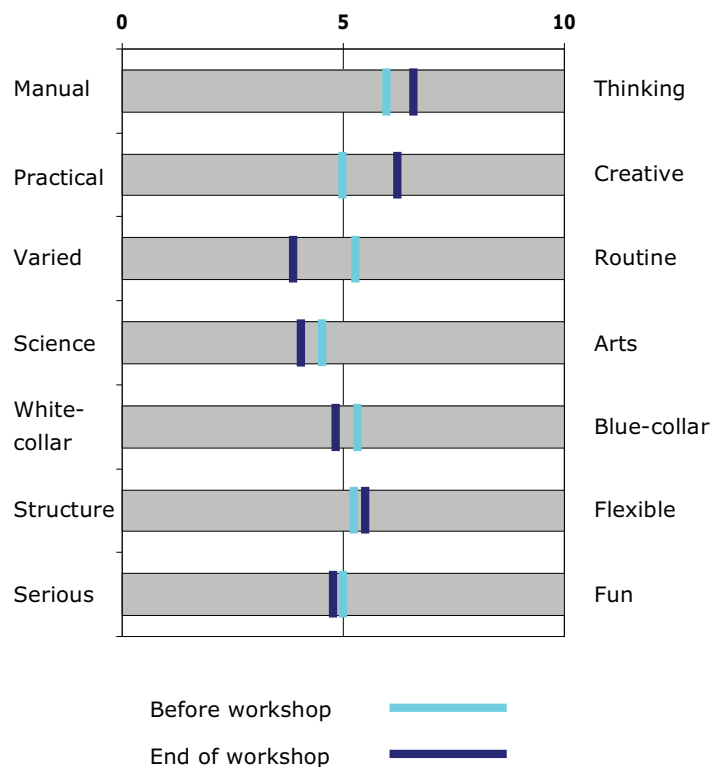
4.1 Overall engagement

A poll was conducted at the start and end of the workshop using a small number of questions from the nationwide survey. The aim of the poll was to gauge any changes in perceptions of engineering as a result of the deliberative workshop.

The poll found that perceptions of engineering changed positively during the workshop. As shown in the chart below, by the end of the workshop respondents perceived engineering as more 'thinking', 'creative' and 'varied'. Other changes suggested that participants engaged with engineering in a way that resulted in seeing the profession as more 'white-collar' than 'blue-collar' and 'flexible' rather than 'structured'.

It is important to note that, due to the poll only being conducted with the participants at the workshop, the findings should not be seen as statistically robust. Data from the poll is outlined in the Figure 13 below:

Figure 13: Where engineering falls on a bi polar scale of 1 to 10



4.1.1 Impact of the deliberative process

Overall, engagement in the workshop did impact on participants understanding of engineering. Certainly when explored, participants overwhelmingly felt their understanding and views of engineering had shifted as a result. For the most part, participants suggested that on reflection they had not understood the scope and breadth of engineering at the outset and even in cases where previous knowledge was identified, the process was thought to have helped clarify understanding and reduce areas of confusion.

Engagement in the workshop was often said to have generated an interest in engineering and as a result a number of participants suggested they now wanted to delve deeper and gain a greater understanding, for example, regarding different types of engineering and the work currently being undertaken. Furthermore, it was felt the workshop and the information gathered had changed the way they would look at the world.

'I think mine [views of engineering] have changed now because instead of just seeing cars and bikes and all that stuff as engineering, I'll be like everything in this street and look at other things as well.'

'When I leave here I will think about it [engineering] and I probably will go home and bore my kids stiff about what I did today.'

(Group C: 26-39, C2DE)

Previously it was suggested that engineering had been primarily perceived as rather 'boring' and 'geeky', but through engagement the profession was seen as much more exciting. Key to this excitement was the impact engineering could and did have on both private and public spheres and importantly, the ability of engineering to help people and benefit society as a whole.

For the future, respondents felt it was important that engineering focused on work which bettered the world in a socially responsible way, for example, combatting global warming, education, health and wellbeing in developing countries. Conversely, technology focusing on developing weapons and games in some cases was felt to be a misuse of engineering.

Interestingly, participants felt confident that if other members of the public were provided with information regarding engineering, then they too would engage with engineering. Television adverts and programmes were felt to be the most effective way of informing people, although communicating information via the education system was also deemed to be of paramount importance. Especially, given the impact this was felt to have on choosing career options.

4.1.2 Impact of the presentation

Following the presentation that provided an overview of engineering respondents described feeling more engaged with engineering. They said this was because they felt they had a better understanding of engineering which worked to increase their interest. Furthermore, the examples used in the presentation reportedly made the participants feel amazed at the achievements of engineering.

The presentation showed a timeline through history of changes that occurred as a result of engineering. It finished with a photograph of a modern day street scene which was used to highlight how engineering had designed everything in the picture. Respondents generally reflected on how they had not considered the role of engineering in this way before and felt amazed by how engineering had contributed to their lives which they had previously taken for granted. It was clear that even seemingly mundane things such as toilets, light bulbs and fresh water captivated the respondents and made them engage with engineering in a positive way.

'Yes it makes you more aware, you can think about it like obviously ages ago, like hundreds of years, nothing would be the same as it is today, but it just makes you more aware of how much things have changed.'

'Yes, I was thinking of the most simplest things are taken for granted that play such a crucial part in everyday life. ... Just like, taking light bulbs for granted but then when they were first invented they were the most needed thing. Just how it's moved on, all of a sudden everything is taken for granted. It's just amazing.'

(Group A: 15-18)

However, exciting 'high-tech' innovations also mentioned in the presentation, such as satellites, the internet and 'Google Earth,' also captivated the respondents and engaged their interest in engineering.

Perceptions of engineering clearly moved on as a result of the presentation.

Following the presentation respondents said they understood engineering to be about creativity and problem solving, with the purpose of improving the world.

Reflecting on their views at the start of the workshop they felt they had only understood engineering in a narrow sense and now had a broader understanding.

However, increased understanding brought about a level of confusion regarding the remit of engineering and what did not fall within engineering, given the breadth of its influence. Importantly, participants suggested it would be useful to have an official definition to clarify understanding.

4.2 Drivers of engagement

Overall, the impact of the stimulus material to hook and engage participants can be seen as being determined by the following factors:

- ❑ The 'wow factor';
- ❑ Simplicity;
- ❑ Social responsibility;
- ❑ Potential for large scale change; and
- ❑ Relevance to own interests and concerns.

The importance of these 'drivers of engagement' differed across the sample according to individual preferences, but patterns did not relate to demographic characteristics. It is important to note that the stimulus materials were designed to expose participants to some applications of engineering in relation to key issues and unpick how participants engage with this. They were not designed to explore participants' views of the case studies themselves.

The key drivers are discussed in the following sections.

4.2.1 The 'wow factor'

One of the drivers of engagement noted was what respondents referred to as the 'wow factor.' By this they meant the extent to which they found an example of engineering to be amazing. Although they found it hard to describe why they felt amazement in relation to some examples of engineering and not others, this factor impacted on how interesting an example seemed to them.

For an example of engineering to have the wow factor, it did not need to be an especially complex idea, but needed to be easy to understand and be new or unusual in some way. For example, the BlackBerry and its 'Push Technology' (used as one example of Telecommunications engineering) was not felt to be amazing. Instead, this technology was seen as just like computers and mobile phones and therefore a familiar technology. Although respondents understood from the stimulus material that the BlackBerry was different to a mobile phone or a computer, it was not considered unusual or exciting.

On the other hand, the special prosthetic leg for sprinting initiated much interest and amazement. Although some respondents had seen this design of prosthetic

leg before, they had not considered how carefully it was designed or that it meant disabled athletes could run not just fast, but very fast. The key driver to amazement here was that the disabled athlete featured in the stimulus material could run as fast as able-bodied athletes. However, respondents also felt that this particular example showed the power of engineering to 'play god' and this did create an element of concern:

'It's amazing.'

'It's quite, it's a bit daunting as well, kind of the way that technology moves so quickly, no pun intended.'

'Making us god like in a way, it's terrible to say that, but giving this person limbs that he hasn't got.'

'That's similar to changing your baby's genes and stuff.'

(Group B: 19-25)

The Thames Flood Barrier also generated much amazement as a result of the ability of humankind to overcome nature. Although respondents were very familiar with the Thames Flood Barrier they had not generally considered it in relation to engineering or indeed in terms of the impact it had on their lives or the lives of others, for instance, preventing London from flooding regularly. In this sense, they felt feats of engineering such as this, were often taken for granted.

4.2.2 Simplicity

The simplicity of the idea and design of the engineering was found to affect participants' reactions. In line with this, the simplest ideas outlined in the stimulus material often received the most positive reaction. Ideas identified as simple and yet affective were felt to be engaging both because they were easy to understand and interesting.

For example, the tsunami shelters were felt to be a simple idea which had an enormous affect. The resourcefulness of the idea by using materials which people (in the aftermath of a tsunami) could easily find or have sent to them meant that the idea was regarded as *'simple and brilliant'*. However, some respondents were less impressed with the simplicity of the shelters and misunderstood that they were for temporary relief in disasters. As a result they thought it belittling to give people huts to live in and thought that the idea was so simple anyone could have thought of it.

The Beddington Zero Energy Development (a carbon neutral community) was also considered exciting. The stimulus material explained how the buildings were designed to save and generate energy. Although some of the terminologies used in the explanation were not familiar to respondents, they felt that simplicity of how the design created energy savings was stimulating.

Complex ideas were seen as harder to relate to. Respondents felt a lack of interest in the BlackBerry because they said the innovation in Push Technology was difficult to engage with without understanding electronics. Likewise the O2 Airwave system, although found interesting for other reasons (discussed later), tended to be seen as too complex to understand how it worked and therefore less easy to engage with.

4.2.3 Social responsibility

The 'social responsibility' of engineering was very important to respondents across the groups and was discussed in relation to nearly all the different stimulus materials. Respondents evaluated whether they thought the engineering was helping people in any way or whether it served the interests of a sub group of people at the expense of others.

For example, the stimulus about getting clean water into Ethiopia was felt to be a very positive example of engineering because it was helping people in a 'life and death' situation. This was seen as an example of engineering doing something very good and meeting a problem which they worried about.

'I think this is engineering for mankind as opposed to what we've been talking about, building of structures.'

(Group D: 40+, ABC1)

Likewise the special prosthetic leg for disabled athletes was also regarded as hugely interesting because it enabled disabled athletes to compete against able bodied athletes thus addressing social inequalities.

Social responsibility was also relevant in relation to the stimulus about climate change. Engineers were viewed as partly responsible for climate change and therefore respondents felt that it was important they played a role in providing solutions. The Beddington Zero Energy Development project was viewed as exciting and positive because it was an example of engineers trying to find solutions to make the world a cleaner and more efficient place.

On the other hand, the bio fuels example was met with more scepticism. Although respondents understood that the engineers featured were trying to develop alternatives to petrol and diesel, they felt that it was contradictory testing fuels in the context of using cars for sports rather than necessity.

'But she's doing it in an outlet using cars for sport. So it's not even out of a necessity to drive. It's contradictory.'

(Group C: 26-39, C2DE)

Furthermore, respondents were rather sceptical regarding the development of the fuels and argued that it was probably being conducted in the interest of Shell and Formula One rather than the planet. The Shell emblem on the engineer's jumpsuit generated many negative reactions about the role large oil companies played in climate change and it was felt they could not develop alternative fuels impartially as the interests of the company would undoubtedly take precedence.

'I mean they've got the technology there, they've had it for the last 30 years. ... [I read] they designed a car in Peru that ran just on water but because the government and all the big Shell companies and stuff won't want it coming out because they'll lose too much money on petrol.'

(Group C: 26-39, C2DE)

The high cost of some innovations in engineering also resulted in negative reactions. For example the 2.9 billion pounds spent on the Q2 Airwave system was considered to be a great deal of money which could have been spent differently to benefit more people. Although the system itself was viewed positively as it addressed a serious need for the emergency services, the cost involved made respondents question whether the money had been spent wisely.

The stimulus material on the tsunami shelters explained that they were designed by engineers working on shelters for the moon. Respondents reacted strongly to this because they felt that engineering should devote resources to helping people such as those in developing countries. Although they felt it was good that the shelters idea had been applied to disaster situations, they were surprised and concerned that this was not the main focus of the engineers' work.

4.2.4 Potential for large scale change

The potential for engineering to make major changes to the world was picked up in relation to some of the stimulus materials.

The Beddington Zero Energy Development was felt to be very important because of the potential for new homes to be built in this way and therefore contribute towards preventing further climate change. Likewise, the potential for more engineering work to be devoted to developing countries in order to overcome problems like the provision of clean water or emergency housing after disasters was also considered important, as it was felt this had the potential to change the course of development in the world.

4.2.5 Relevance to own interests and concern

Participants tended not to engage with examples of engineering - either positively or negatively, in cases where they did not feel it was relevant to them, their concerns or their interests. This was especially the case for the younger participants. For example, a number of the young people, primarily the girls, found the bio fuels example 'boring' as they were not interested in Formula One.

'I suppose for, like, boys it's more interesting because it's talking about Formula One cars. I don't find it that interesting.'

(Group A: 15-18)

Similarly, discussions relating to the BlackBerry were often found not to interest the older participants, as they regarded it to be technology they would not personally use or benefit from. However, others said they were interested as they thought it demonstrated a shift in the working patterns of society, especially the expectation of young people to work out of office hours.

The bio fuels stimulus material featured a young female engineer. Although respondents had viewed engineering as a generally male profession, they did not feel this made them more interested in engineering or about the bio fuels featured. Instead they felt that the engineer featured was patronised by the information because it highlighted that she had to attend media events and meet drivers in addition to her engineering work.

'There is something I've just noticed about the way they say about hosting press and media events, I mean, this is trying to push the role of female engineers in the industry, why say about that. What's the point of saying 'oh yes, it's a girls' job, but they still do girl things.' I don't think that's a very positive way to present it.'

'It's patronising isn't it.'

'Yes, she also gets to meet the drivers.'

'It's a pat on the head isn't it, like a little girl.'

(Group E: 30-45, women only)

5 Conclusions

This final chapter of the report outlines the key conclusions in relation to the main aims of the research as uncovered by both the quantitative and qualitative research.

5.1 Summary of key findings

5.1.1 Quantitative survey

- ❑ A limited initial awareness and understanding of engineering and engineers was identified;
- ❑ Overall awareness and knowledge was found to relate to demographic characteristics, such as social class, education, gender and age. Younger people in particular were found to have a much more limited understanding of engineering in comparison to other groups. Understanding was also linked to exposure to engineering via friends, family or work;
- ❑ Top of mind' associations with the term 'engineer' showed the profession to be more closely associated with fixing things rather than creativity, practical solutions or design. Participants with the highest awareness of engineering tended to perceive the profession as a more creative and cerebral profession compared to others;
- ❑ Between seven and eight out of ten respondents agreed that there are so many types of engineers that it makes engineering confusing for the 'average' person to understand;
- ❑ In terms of the types of activities undertaken by engineers, nearly everybody in the quantitative survey thought that engineers were involved in construction, telecoms and the armed forces, but fewer thought they had any involvement in medicine;
- ❑ The quantitative survey suggest people would go to the internet to find out more about the profession rather than any other means; and
- ❑ Despite limited awareness and knowledge, findings from the quantitative survey suggest that engineering as a profession was viewed positively, especially in comparison to other professions. On average engineering was perceived as making a good contribution to society and was said to be involved with several important issues affecting society today.

5.1.2 Qualitative workshop

- ❑ A limited initial awareness and understanding of engineering and engineers was identified;
- ❑ Overall awareness and knowledge was found to relate to demographic characteristics, such as social class, education, gender and age. Younger people in particular were found to have a much more limited understanding of engineering in comparison to other groups. Understanding also linked to exposure to engineering via friends, family or work;
- ❑ Engineering was perceived as overlapping with other professions including: science, medicine, academia, mechanics, building and architecture;
- ❑ Findings from the qualitative workshop suggest engineering was regarded as a male orientated profession, notably by women, as it was linked to science which was seen as a male dominated area;
- ❑ Regardless of actual levels of awareness and knowledge, a lack confidence in knowledge was noted;

- ❑ Attitudes towards engineering expressed as part of the qualitative study were mixed and tended to relate to the perceived impact of engineering on society - whether that be a positive or negative contribution. Positive attitudes towards engineering tended to relate to the belief that engineering was responsible for providing many of the things people relied upon in their everyday lives; whereas negative views linked to the belief that engineering was in some way responsible for key problems in society, such as climate change;
- ❑ The experience of the workshop suggests that providing people with information about engineering improves and clarifies understanding of the scope and breadth of engineering and importantly, generates interest in the profession;
- ❑ A range of drivers of engagement identified in the qualitative research were highlighted and these related to:
 - ❑ The 'wow factor' - the greater the 'wow factor' the greater the interest and engagement. 'Wow factor' was linked to the uniqueness of the idea and the power of engineering to make a positive change;
 - ❑ Simplicity of the idea - simple ideas were liked because they were considered resourceful and easy to understand;
 - ❑ Social responsibility - engineering was viewed more positively where it was perceived as helping and benefiting those in need or society in some way;
 - ❑ Potential for large scale change - the ability of engineering to bring about large scale change to the world in a positive way resulted in greater engagement and interest; and
 - ❑ Relevance to own interests and concerns - the relevance of the example to the participant's own interests and concerns was also an important influencing factor.
- ❑ The findings suggest that in order to engage more effectively with the public, overall awareness and knowledge of engineering needs to be increased.

5.2 Implications of the research

Overall the findings suggest there was both a lack of awareness and understanding about engineering and engineers as well as a degree of confusion and uncertainty. Although there was some understanding of the breadth and depth of the profession, this was clustered within groups of individuals namely those with higher levels of education, those in the ABCI socio economic groups and older age groups. This means that while all groups should be targeted for raising awareness and understanding of engineering and engineers, young people and groups with lower levels of education could be considered to be the primary target.

Understanding about engineering and the work of engineers was limited to construction and fixing things. The diversity of engineering - innovation, problem solving, creativity, practical solutions - needs to be communicated to raise awareness of the real nature of engineering and to broaden public understanding and perceptions of engineering and engineers.

Confusion around engineering was in part seen as stemming from the wide and often misleading use of the term 'engineering'. The interchangeable use of the term in everyday language, such as 'engineering works' (for repair and maintenance work), or to mean a fitter or technician such as a 'telephone

engineer' or 'heating engineer', means the public feel confused and lack confidence in their understanding. This suggests that a unified description of engineering needs to be communicated.

The social responsibility of engineering is an important issue underpinning attitudes towards the profession. The ability of engineering both to provide solutions to social problems and to contribute to social problems through advancement both engaged and animated the respondents during the qualitative workshop.

Overall, engagement in the deliberative workshop was found to impact on participants understanding of engineering. Engagement in the workshop was often said to have generated an interest in engineering and as a result a number of participants suggested they now wanted to delve deeper and gain a greater understanding.

The qualitative exercise showed that information designed to raise awareness of engineering and engineers needs to be interesting, easy to understand and socially or individually relevant, for example, participants responded well to examples of engineering which related to improving the world and people's lives. Examples of engineering tailored to different types of people and their interests were effective in capturing curiosity. The qualitative exercise also showed that participants enjoyed learning about how engineering is contemporary and relevant to both everyday needs and the excitement of shaping the future - with amazing technology developments. This indicates that communication about engineering needs to be presented in context and framed within the issues it contributes to (eg climate change; poverty reduction and medicine) rather than formal disciplines (civil or electrical engineering). Commercial applications of engineering were not as well received, primarily as they were seen as benefiting industry and they often evoked negative feelings.

Appendix I - Quantitative survey questionnaire Public Perceptions of Engineering - Final

31st May 2007

Good morning, afternoon, evening. My name is... from Kantar Operations, on behalf of BMRB, an independent market research organisation. Today I would like to talk to you about various occupations and people's attitudes towards them. I will tell you who our survey sponsor is after the first few questions.

The interview will take around 15 minutes, and, if now is not convenient for you, we could arrange a time for me to call back at a time that would be more convenient.

IF NECESSARY: We will tell you the name of BMRB's client at the end of the interview. I would like to assure you that all the information we collect will be kept in the strictest confidence, and used for research purposes only. It will not be possible to identify any individual or address in the results.

Firstly I need to ask a couple of questions to determine whether you qualify for the survey, and also to help us classify the results.

QSI First of all, could you please tell me your age?

IF REFUSE: It is important that we know your age, so that we can group the results of the survey and also so we know we have spoken to people of a range of ages.

16-24

25-34

35-44

45-54

55-59

60-64

65-74

75+

REFUSED - THANK AND CLOSE

QS2 INTERVIEWER CODE GENDER

MALE

FEMALE

QS3 Could you please tell me which of these best describes your current working status?

Working full time (30+ hrs)

Working part-time (9-29 hrs)

Retired

Student

Other non working

REFUSED - THANK AND CLOSE

QUOTAS TAKEN FROM Q51, Q52 and Q53

Q1 I am going to read out three professions. Thinking about everything you know about those professions and whatever you may have heard about them from other people or the media, on a scale of 1 to 10 where 1 is the least positive and 10 is the most positive, how positive do you feel towards each?

Medicine

Law

Engineering

Q2 a) What is the first word which comes to mind when I say engineer?

b) What is the first word which comes to mind when I say engineering?

Our survey today is about Engineering and Engineers, and how they are perceived by the public. We hope to find out how much people know about the profession, and their attitudes towards it.

Q3 I am going to read out some descriptions of engineering as a profession and I would like you to tell me where engineering fits on this scale of 1 to 10? READ OUT 1ST DESCRIPTION.

PROMPT: Where does engineering work fit on this scale?

if manual is 1 and thinking is 10

if non-creative is 1 and creative is 10

if varied is 1 and routine is 10

if science related is 1 and arts related is 10

if white collar is 1 and blue collar is 10

if structured is 1 and flexible is 10

if serious is 1 and fun is 10

If exciting is 1 and boring is 10

Q4 How much would you say you know about engineering as a profession, on a scale of 1 to 10 where 1 is nothing at all and 10 is have a very detailed knowledge of?

Q5 How well informed do you feel, if at all, about the work of engineers? SINGLE CODE ONLY

Very well informed

Fairly well informed

Not very well informed

Not at all informed

Don't know

Not stated

Q6 Now I am going to read out some statements that people have made about engineering and engineers and I would like you to tell me the extent to which you agree or disagree with them. As I read each statement please say whether you 'strongly agree', 'agree', 'neither agree nor disagree,' 'disagree' or 'strongly disagree' with each one

Engineers make our lives easier

Engineers should listen more to what ordinary people think

It is important for people to understand what engineers contribute to daily life

Engineering is essential for all human development

Hardly anyone knows what engineers do

Engineers are mainly concerned with underdeveloped countries

Engineering is a well respected profession

Engineers are very similar to scientists

Engineers should get themselves in the public eye more

There are so many types of engineer that it makes engineering confusing for the average person to understand

On the whole men make better engineers than women

Engineering is a profession for men

Engineers fix things

Engineering makes a good contribution to society

Q7 If you wanted to find out more information about engineering and the work of engineers, where might you search for information? DO NOT READ OUT.

CODE LATER

Ask Engineers I have met/I know

Friends and family

Work colleagues

Internet/Worldwide web

Magazines

Newspapers

Library/books

TV or Radio programmes

Universities/colleges/lecturers

Schools/teachers

Other (WRITE IN)

Don't know

IF INTERNET AT Q7

Q8a Which particular websites would you try?

IF MAGAZINES AT Q7

Q8b Which magazines would you look in?

IF NEWSPAPERS AT Q7

Q8c Which newspapers would you look in?

Q9 Now I'd like to ask you about the way that engineers portray themselves to the general public. To what extent do you agree that more time should be given to the achievement of engineers in the media?

- Strongly Agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly Disagree

Q10 How involved do you think engineers are in the following areas of work?

- Armed forces
- Medical profession
- Construction industry
- Telecoms industry

Would you say...?

- Very involved
- Fairly involved
- Not very involved
- Not at all involved
- Don't know

Q11 And more specifically, how involved do you think engineers are in the following areas:

- The digital TV switchover
- The use of robots in industry
- Designing London's Olympic Village for 2012
- The integration of mobile technology

Would you say...?

- Very involved
- Fairly involved
- Not very involved
- Not at all involved
- Don't know

Q12 I am going to read out a list of global issues that are facing communities across the world and which you may have heard something about.

On a scale of 1-10, where 1 is little or no contribution and 10 is a substantial contribution how much do you think engineers contribute to resolving each of these issues?

Poor drinking water quality

Poor air quality/air pollution

Preventing global warming/ climate change

Loss of plant or animal species

Alleviating poverty in developing countries

Disposal of nuclear waste

Developing new medical treatments for illnesses

My final questions are for classification purposes only:

SOCIAL GRADE AB, C1, C2, D, E

**TERMINAL
EDUCATION AGE** Up to 14yrs old
15, 16, 17, 18, 19, 20
21-23
24+
Still studying

REGION London
South East
South West
E. Anglia
Wales
East Midlands
West Midlands
N. West
Yorkshire/Humberside
North
Scotland

Number of children in the household? SINGLE CODE ONLY

None

1

2

3

4 or more

Don't know /Refused -

**How would you describe your ethnic background?
SINGLE CODE ONLY**

White
Black
Asian
Mixed
Any other
Refused

**Finally which, if any, of the following applies to you?
MULTICODE OK**

I am an engineer
I've been a member of an engineering organisation in the last 5 years
Currently subscribe to an engineering magazine
Have (ever) worked as an engineer in the past
Have an engineering degree
I have engineers among my friends and relatives
I meet engineers frequently (i.e. at least once a month)
I meet scientists or engineers infrequently (less than once a month)
I work with engineers
I have looked up engineering information on the internet
I have never met an engineer
I am a scientist
Have studied science to A level
Have studied science to GCSE/O Level
Member of a science organisation
None of these
Don't know

Thank you very much for taking part in our survey. Our survey today was carried out for the Royal Academy of Engineering in collaboration with the Engineering Technology Board.

THANKS AND CLOSE

Appendix 2 - Quantitative survey weighting procedures

The data were weighted to ensure that demographic profiles matched those for all adults in Great Britain aged 16 or over. A raking weighting technique was used in which target profiles were set for eight separate demographic variables. The computer system then allocated a weight to each individual such that the overall composition of the sample was balanced in terms of the targets set.

Target Weights Applied:

Sex 1:	%
Men	48.37
Women without children	32.43
Women with children	19.20

Sex 2:

Men working full time	26.25
Men not working full time	22.11
Women working at all	24.24
Women not working at all	27.40

Age within Sex

	Men	Women
	%	%
16 - 24	7.28	7.09
25 - 34	8.11	8.17
34 - 44	9.43	9.58
45 - 54	7.91	8.04
55 - 64	7.13	7.35
65+	8.51	11.40

Social Grade within Sex

	Men	Women
	%	%
AB	12.93	12.48
C1	13.26	15.63
C2	11.23	9.61
DE	10.95	13.91

Standard Region

	%
Scotland	8.76
North West	10.81
North	5.20
Yorks/Humber	8.60
East Midlands	7.36
East Anglia	3.89
South East	19.57
Greater London	12.79
South West	8.78
Wales	5.11
West Midlands	9.13

ISBA Region

	%
North East Scotland	2.08
Central Scotland	6.24
Border	1.02
North East	4.84
Yorkshire	9.67
North West	11.92
Wales and West	8.21
Midlands	15.85
East of England	7.34
London	20.36
South	9.36
South West	3.11

(Source of profile data: BMRB Target Group Index, 2005 and NRS, 2005)

Appendix 3 - Qualitative workshop poll



Research Event: Engineering

Thank you for agreeing to take part in our research event on engineering. To start off, we would like to get an idea of your current views and opinions of engineering overall.

Please answer the following questions using the pens provided.

Q1 How much would you say you know about engineering as a profession?

Please tick the answer which best corresponds to your opinion.

- A great deal
- A little
- Not very much
- Nothing at all

Q2 How well informed do you feel, if at all, about the work of engineers and their role in society?

Please tick the answer which best corresponds to your opinion.

- Very well informed
- Fairly well informed
- Not very well informed
- Not at all informed

Q3 Here are some words that might be used to describe engineering as a profession.

Please circle the number where you feel engineering falls on this scale of 1 to 10.

Example: Happy	1	2	3	4	5	6	7	8	9	10	Sad
Manual	1	2	3	4	5	6	7	8	9	10	Thinking
Practical	1	2	3	4	5	6	7	8	9	10	Creative
Varied	1	2	3	4	5	6	7	8	9	10	Routine
Science related	1	2	3	4	5	6	7	8	9	10	Arts related
White collar	1	2	3	4	5	6	7	8	9	10	Blue collar
Structured	1	2	3	4	5	6	7	8	9	10	Flexible
Serious	1	2	3	4	5	6	7	8	9	10	Fun

Thank you. Now please hand this paper back to one of the researchers.

Appendix 4 - Topic Guide - Qualitative Workshop



45106198 TG final
MAY 2007
GROUP DISCUSSION

PUBLIC PERCEPTIONS OF ENGINEERING **Topic Guide**

The workshop aims to explore:

- The public's awareness and understanding of engineering and engineers, looking in detail at both perceptions and misperceptions of the profession;***
- Reasons underpinning awareness and understanding, considering the key drivers of perceptions and misperceptions; and***
- Key hooks and drivers to engagement in engineering, considering how the public engage with engineering and reasons for this.***

SESSION I - INTRODUCTORY PLENARY (TOTAL 15 MINUTES)

10.15am

- Name badges and registration
- Coffee reception
- Poll

10.45am

Initial intro - Lucy Joyce

10 MINUTES

- Welcome to all participants, thank them for attending
- Introduce BMRB - independent research company
- Research carried out on behalf of the RAEng/ETB
 - Introduce RAEng
 - Introduce research team
 - Introduce any other attendees
- Housekeeping
 - Fire exits/security
 - Toilets
 - Incentive payments will be distributed at end of the day
 - Agenda for the day
- Will be divided into groups by letter on name label

Introduction to the research

5 MINUTES

- Who are the RAEng/ETB
- Why are they conducting research

10.55-11.00am

Move into groups

5 MINUTES

There are 5 breakout groups:

GROUP

A - Young Adults (15-18)

B - Young Adults (19-25)

C - Adults by Social Grade (26-39; C2DE)

D - Adults by Social Grade (40+; ABC1)

E - Women Only (30-45)

SESSION 2 - BREAK OUT GROUP INTRODUCTIONS (TOTAL 10 MINUTES)

11.00am

Background and introductions

10 MINUTES

- Affix name labels if have not already
- **Introduce self / observer**
- Remind people about the objectives of the research for this session. To explore:
 - *The public's awareness and understanding of engineering and engineers, looking in detail at both perceptions and misperceptions of the profession;*
 - *Reasons underpinning awareness and understanding, considering the key drivers of perceptions and misperceptions; and*
 - *Key hooks and drivers to engagement in engineering, considering how the public engage with engineering and reasons for this.*
- **Explain about the discussion and agree ground rules**
 - Emphasise like it to be a discussion; we really want to hear from everyone; whether or not you agree with the views of others
 - No right/wrong answers
 - Not expecting to be experts
 - Some people may be more familiar than others with subject
 - Agree any other ground rules
- **Group introductions:** Ask each participant
 - First name
 - Household composition
 - Current activity
 - Hobbies

SESSION 3 - PERCEPTIONS OF ENGINEERING (TOTAL 50 MINUTES)

11.10am

Spontaneous perceptions of engineering

10 MINUTES

Note to researchers: You may wish to use the mood board exercise as a visual stimulant for this discussion. Ask participants to spend 10 minutes in pairs/ trios selecting pictures which they associate with engineering from the magazines/newspapers provided. Then spend a further 10 minutes asking each pair to explain their choices. Use the guide for this section to prompt their explanations and broaden the discussion afterwards. You can do this exercise at any point in the first session.

The mood board should be used in the group with 15-18 year olds.

- Explore participants understanding of term 'engineering'
 - What comes to mind when they hear the word
 - Explore reasons for this
- Explore what is understood by the occupation 'engineering' - explore spontaneous views
- Explore what type of profession/ industry engineering is
 - Draw analogies between engineering and other occupations/ professions; what other occupations/ professions are similar to engineering
 - Explore reasons for these views; why seen as similar
- Explore link to:
 - Science
 - Technology
 - Manual work
 - Professions
 - Academia
 - Other
- What type of person do they associate with engineering; reasons for this
 - How would they describe an 'engineer'
 - Reasons for these views

Exercise: guided dream - **probe:** what does an engineer look like; who would be an engineer; what age would they be; what gender would they be; what characteristics do they have; how would they talk; what would they wear

- What kind of environments do they imagine engineers work in - explore spontaneously and probe:
 - Manual work on sites
 - Office based
 - Laboratory
 - Other
- Explore reasons for view

Exercise: guided dream - imagine a room full of things relating to engineering - probe: what do you see; what does it smell like; what are people doing; why are they doing what they do

- Explore types of qualifications an engineer would need - what subjects would need to study at school/ college
 - Explore level of education would need
 - Explore reasons for views

Warmed up discussion of engineering

20 MINUTES

- Explore the type/s of work engineers engage in - ask participants to provide examples of engineering projects; explore things in London/ Ealing can think of that engineers would have been involved in
 - Explore types of issue engineers/ engineering deals with
 - How would engineers be involved
- Explore purpose of engineering
- Who can/do engineers influence; reasons for views

Picture exercise - STIMULUS MATERIAL A

- Explore reactions to a series of pictures in stimulus A (include as many as possible in the time); ask participants to consider how they would expect engineers to be involved in the scenario; what would they be doing; how would they be involved
- Explore reasons for these views
- Spontaneously explore types of engineering and engineers; what different kinds/types of engineers are there
 - What do they know about different types
 - How do they know this
 - What kind of work do different types do; how varies
- Spontaneously explore awareness and knowledge of different types of engineering:

Probe:

- Mechanical engineering
- Civil engineering
- Chemical engineering
- Electrical engineering
- Explore what know about different types - provide examples; how know this

Probe:

- Outline main focus; what they do
- Who uses it
- Why is it needed
- What problems they solve
- Explore whether all types associated with engineering; whether seen as part of engineering
- Explore whether identify any similarities/ differences between types of engineering
- Explore whether more familiar with certain types compared to others and reasons for this
- If not associated, what did they think it related to

Key drivers - factors underpinning perceptions

15 MINUTES

- Recap on reasons throughout discussion and explore reasons in detail
- Explore key drivers of perceptions; how gained knowledge on engineering

Probe:

- Media (news/adverts/drama or fictional presentation of engineers)
- Education (school/university/training)
- Work (contact with engineers through job)
- Social (family/friends in industry)
- Public information (e.g. engineering works on the train/tube)
- Other
- Explore whether can recall when first knew about engineering; what underpinned this
- Explore whether ever had contact with an engineer; explore details of this
 - who this was; under what circumstances
- Briefly explore **attitude** towards engineering
 - Positive/negative feelings about it
 - What they find interesting/boring about it; reasons
 - Whether they believe engineering is useful - how it is of use; who it is of use to

Session 3 wrap up

5 MINUTES

- Get respondents to sum up what they knew before session and know now about engineering; whether feel more informed; what informed them
- Are they confused about any issues; whether any areas where feel need more information; anything would want to know more about
- Explore any questions have at this stage

Lunch and move into plenary

12.00pm

- Half an hour for lunch
- Sandwiches and drinks in Take 6

Meet back in main room we were in this morning at 12.30pm

SESSION 3 - FIRING UP STAGE (TOTAL 40 MINUTES)

12.30pm

- **In plenary** - 10 MINUTE presentation on 'A brief overview of engineering'
- This includes
 - An overview of the different types of engineering
 - The range of roles engineering has (from problem solvers to technicians)
 - An overview of the work of engineers
 - Issues that engineering influences and focuses on

12.40pm

Move into break out groups

5 MINUTES

12.45pm

Reactions to 'A brief overview of Engineering'

30 MINUTES

- Ask participants to each write down 5 key points they took from the presentation - can discuss in pairs/ trios
- Explore reactions to the presentation overall
- Ask each participant/ pairs to feedback key points; reasons for picking these points
- Probe on:
 - What learnt from presentation
 - Anything unexpected/ surprising; reasons for this
 - Explore how fitted with their previous perception of engineering; how differed
 - Any specific element of presentation changed their views
- Explore whether previously associated/ identified issues raised (during presentation) with engineering/ engineers
 - Whether presentation moved perception of engineering; how moved
- What did they previously associate issues with; what type of profession - probe: science; technology; building; other
- Explore current perception of engineering/ engineers
 - What now see as main purpose of engineering; what do engineers aim to do
 - Who would be an engineer; what qualifications would they need
 - What types of issues are dealt with by engineering; what issues engineers might engage with

Prompt:

- Climate change
 - Poverty
 - Travel congestion
 - Planning a travel network for the Olympics
 - Preventing bank crime
 - Obesity
 - Anti-ageing
 - Environmental disaster planning
 - Identity cards
 - Other
- Explore how issues are dealt with (using prompts); how might engineers engage with this issue; what could they do
- How would engineering be involved
 - How can engineering influences these
-
- Explore attitudes towards engineering; what like/ dislike about engineering
 - Explore whether any aspects of it appear interesting; anything found engaging in presentation; anything would want to know more about
 - Explore whether attitude has changed since began workshop

SESSION 4 - HOOKS AND DRIVERS (TOTAL 100 MINUTES)

Note to researcher: This section is designed to expose participants to some applications of engineering in relation to key issues and unpick how participants engage with this - what 'hooks' them in, what 'drives' their understanding. Each piece of stimulus material relates to an issue already touched upon during the workshop and provides a broad overview of the issues and then focuses on specific topics within this - providing examples of engineering in action. 3 to 5 minutes of stimulus will be shown for each issue. 4 issues are covered overall. After each issue - reactions to this will be explored. Key questions and probed are outlined below.

Give respondents the overview of the issue first (**stimulus B, C, D and E**) followed by a case study. You have two case studies to cover if you have time but we only expect you to cover one. Please ensure you use at least one case study from the developing world (stimulus B.2 or C.2).

Aim to spend 20-25 minutes on each key issue.

1.15pm Following provision of stimulus on each issue explore the following questions:

- Explore **immediate reactions** to stimulus material
- Ask participants to note 5 key issues/ points and note on flip chart - immediate thoughts that come to them, consider:
 - Why raised these issues; why came to mind; why these points stood out
 - Consider 'buzz' words that sum up stimulus
- Compare immediate thoughts of participants and explore whether other also noticed points raised
- Explore what **learnt** from stimulus
- Anything unexpected/ surprising; reasons for this
- Explore how fitted with their previous perception of engineering; how differed
- Any specific element of presentation changed their views
- Explore whether previously associated/ identified issues raised (during stimulus) with engineering/ engineers
 - Whether presentation moved perception of engineering; how moved
- What did they previously associate issues with; what type of profession - probe: science; technology; building; other
- Explore anything found **interesting** about stimulus material; anything exciting
- Explore anything did not find interesting/ anything boring
- Explore impact of stimulus
- Explore anything would like to have more information on; know more about

Probe:

- How it works
- The job of the person who works on it
- How it will help the issue
- How/ who it will affect
- Impact of engineering
- What difficulties experienced in the development of the solution
- Others
- Explore who they think would be interested in these issues - probe: peers; young/ old people; men/ women; other
 - Explore reasons for this
- Explore who thinks this type of engineering will help; how will these innovations help
- Who should know about this; who needs to be aware - explore reasons

Probe:

- This country/across the world
- Government
- The public
- Schools
- Other
- Explore how people can be made aware
- Explore any other examples of issues or problems engineering could help with - reasons for this
- Consider questions stimulus material has generated; reasons

IF YOU HAVE TIME - spend up to 20 minutes on the following exercise:

Following all four issue based discussions split into groups of three or four.

Exercise: advert for engineering - Ask each group to imagine they are writing a newspaper article or advert on what the public should know about engineering and note down key points for the article.

They need to think about the following:

- 5 points they think are important for people to know about engineering
- How it should be explained to them
- What the public will find interesting
- Good examples of engineering in action

- Ask each group to feedback/ deliver their advert to the group, explore:
 - Why they have decided on these 5 points; what did they exclude and why
 - What is important when explaining engineering to people
 - What makes them think
 - Reasons for choices of examples

2.50pm

TEA AND COFFEE BREAK

10 MINUTES

SESSION 5 - REFLECTION STAGE (TOTAL 30 MINUTES)

3.00pm

Reflections

30 MINUTES

- Reflecting back on the day, explore overall attitudes towards engineering; what like/ dislike about engineering
- Explore whether attitude has changed since began workshop (reflect back on initial perceptions)
- How do they feel their views have changed; reasons for this
- What are the main things they feel they have learnt; reasons for this
- What has been most exciting for them to learn about; reasons
- Given what they now know, who should engineering be trying to influence; reasons
- What should engineering focus on for the future; what's important that engineers address
- How should they raise their profile among the public; how can they best promote themselves; reasons
- Conduct Poll

Thank and close

Distribute incentives

Collect signatures

FINISH 3.30PM

Appendix 5 - Qualitative workshop stimulus materials

This appendix summarises material designed for use in session 4 of the qualitative workshop and references other resources used.

1 Structural

An overview of structural engineering was provided to participants before they were handed the case studies. The overview outlined the role of infrastructure in daily life and some of the challenges of living it deals with such as water supply and transport planning.

CASE STUDY: the Thames Flood Barrier

This case study was taken from the 'Little Book of Civilisation' published by the Institution of Civil Engineers (2005, p.10-11). The case study outlined why the Thames Flood Barrier was designed and built and some key features of the design.

CASE STUDY: Tsunami shelters

This case study outlined how the shelters were buildings developed for future communities on the Moon, adapted to create affordable emergency housing for survivors of disasters. It also explained how the shelters were built and the cost. This case study was taken from the 'Little Book of Civilisation' published by the Institution of Civil Engineers (2005, p.9).

2 Health and well being

The overview of health and wellbeing outlined the role of engineering in this area. It explained that much of modern medicine is driven by medical technology developed by engineers and provided examples including pacemakers and scanners as well as treatments such as radiotherapy and large-scale production techniques for vaccine manufacturing. The overview also reflected the role of engineering in relation to health and wellbeing in the developing world and provided examples.

CASE STUDY: Prosthetic legs for sprinters

This case study featured Oscar Pistorius, the amputee from South Africa who runs in the Paralympics on using prosthetic legs. The case study stated his record achievements as well as principles of the design which facilitates the function of the prostheses.

CASE STUDY: Clean water in Ethiopia

The case study stated how few people have access to clean water in Ethiopia and how engineers have tackled this issue. This case study was taken from the 'Little Book of Civilisation' published by the Institution of Civil Engineers (2005, p.5).

3 IT and Telecommunications

This overview outlined how the means of communication have evolved from signal fires to radio, and to modern day digital communication technology and mobile phones. Highlighting some major innovations, the overview drew attention to the role IT and telecommunications plays in everyday life and society.

CASE STUDY: The O2 Airwave digital radio system for the emergency services

A short information sheet on the O2 Airwave system was provided. This explained that the system is a secure digital radio network dedicated for the exclusive use of the UK's emergency and public safety services. The key benefits of the system were outlined including security, emergency buttons, interoperability greater call clarity, and radio and telephony in one.

Information on the O2 Airwave system was taken from the website www.scenta.co.uk which provides information on science and engineering careers and issues.

CASE STUDY: The BlackBerry

The stimulus material explained what a BlackBerry is and what it can be used for. The information also explained how it differed from a mobile phone in the technology it used, outlining why 'push technology' was an important innovation in communications and why the BlackBerry has become popular with businesses.

4 Climate change

This overview outlined the issue of climate change and presented how engineers will play a major role in providing solutions. Examples were given of how engineers were developing ways to reduce pollution and to increase renewable sources of energy like wind and solar power.

CASE STUDY: development of Bio fuel

This case study was taken from the 'Shape the Future' booklet published during National Science and Engineering week (2007, p.14-15). The case study featured a young, female engineer working as a project manager for Shell's Formula One team with Ferrari. The case study explained her role in developing Bio fuels and testing them under Formula One conditions.

CASE STUDY: the Beddington Zero Energy Development sustainable community.

This case study provided details of the Beddington Zero Energy Development in Wallington, South London. The materials defined what is meant by a 'zero energy development' and summarised the key features of the community and how the buildings were designed to make them energy efficient.

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