PSYCHOSOCIAL ASPECTS OF WORK AND HEALTH IN THE NORTH SEA OIL AND GAS INDUSTRY
Parts III and IV

Part IV
The offshore environment in the mid-1990's: A survey of psychosocial factors

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Results, including detailed evaluation and, where relevant recommendations stemming from their research projects are published in the OTH series of reports.

Background information and data arising from these research projects are published in the OTI series of reports.

Please note that Parts I and II of the research are reported in OTH 96 523

Part I: A review of the literature
Part II: A five-year follow-up study (1990-1995) of offshore and onshore personnel
FOREWORD

The North Sea work environment has undergone extensive change in recent years, and the effects of organizational restructuring, cost reduction, and technological innovation will continue to impact on the oil and gas industry in the future. In these changing circumstances, the health, safety, and productivity of the North Sea workforce is an issue of concern not only to personnel working offshore, but also to onshore management teams and the industry as a whole.

In this context, there is a need for current information about work and health in the offshore environment. The present research, under the general title ‘Psychosocial aspects of work and health in the North Sea oil and gas industry’, seeks to contribute up-to-date findings in several areas of topical importance to the offshore oil and gas industry. The research was carried out by Oxford University with funding from the Health and Safety Executive, Offshore Safety Division; the main data collection took place during 1995-1996. The work is reported in four parts:

**Part I** reviews the available research literature relating to work and health (including psychosomatic complaints, mental health and stress, and health behaviours) among offshore personnel. General aspects of the psychosocial environment on North Sea installations and specific issues, such as offshore shift rotation, are considered; areas in which information is currently lacking are highlighted.

**Part II** reports a small-scale follow-up study which evaluated changes in mental health and job satisfaction in onshore and offshore personnel over the period 1990-95. A marked feature of the findings is the significant increase in perceived workload and anxiety in the occupational group concerned (production operators), both onshore and offshore, over a five-year period of re-structuring and down-manning.

**Part III** addresses the issue of offshore day/night shift rotation patterns. Repeated assessments of sleep, mood, and cognitive performance (e.g. reaction time, memory, reasoning) over the two-week offshore work cycle clearly demonstrated the adverse effects of a mid-cycle shift change as compared with a fixed-shift schedule in which either days or nights are worked for the entire two-week period.

**Part IV** presents the main findings of a survey of the perceived physical and psychosocial work environment, safety, health and job satisfaction among offshore personnel (N=1462) on 17 offshore installations. Overall, the offshore sample did not show elevated levels of stress symptoms relative to comparable onshore groups, but job types, shift patterns, and installation characteristics were significant predictors of safety, work, and health measures.

The research described would not have been possible without the high degree of cooperation received from the operating companies concerned, and the encouragement of the United Kingdom Offshore Operators Association. It is hoped that, in reflecting current offshore work conditions, the research findings will be of interest not only to the participating companies but also to the North Sea oil and gas industry more generally, and that the work will serve to promote greater awareness of the importance of human factors research at a time of rapid change in the industry as a whole.
This report describes findings from the analysis of survey data obtained from 1462 male offshore personnel employed on 11 production platforms and 6 drilling rigs operating in the UK sector of the North Sea. All the main occupational groups working offshore took part; the overall response rate was 83%. A wide range of psychosocial information was collected; the subjective data analysed included measures of exposure to physical environment stressors, perceived job characteristics, total working hours per offshore week, perceptions of safety measures and procedures, measures of psychological well-being, and minor health problems.

These measures were examined in relation to company groups, installations within groups, job types, and employer groups (i.e. operator personnel vs contractors); individual differences in age and in ‘negative affectivity’ were taken into account in these analyses. In addition, installation characteristics, such as size and age, were also examined as predictors of psychosocial variables.

The results demonstrated that companies, installations and job types were all significant predictor variables, although the precise pattern of results varied for different outcome measures. Personnel in the eight different job types differed on almost every measure; in particular, profiles of perceived job characteristics highlighted differences between jobs which were reflected in measures of job satisfaction, psychological well-being, and physical health.

Satisfaction with safety measures and procedures was generally high, as were the ratings of safety associated with specific work activities. Personnel directly involved in any particular activity rated it as more safe than those not involved; also, management personnel gave higher overall ratings than those in other job types. With few exceptions, almost everyone in the sample considered the installation on which they worked to be average or above-average in safety.

Analysis of the data relating to minor health problems revealed specific patterns whereby day/night shift rotation was associated with sleep disturbance and gastric problems, while job types differed in the incidence of musculo-skeletal problems and headaches. Heavy smokers also reported a relatively high incidence of health problems, independently of other factors. The overall levels of ‘stress’ symptoms in the present sample were significantly lower than those of comparable employees in manufacturing industry onshore, but anxiety levels were significantly higher than those observed in an offshore sample in 1990.

These and other aspects of the present study are discussed in relation to previous research into psychosocial aspects of the offshore environment, and in the light of more recent developments in North Sea work conditions. Methodological strengths and limitations of the present study are also considered.
6. ASSESSMENT OF SAFETY  
6.1 Satisfaction with safety procedures  
6.2 Perceived safety of specific work activities  
6.3 Safety relative to North Sea installations in general  
6.4 Summary  

7. PSYCHOLOGICAL WELL-BEING  
7.1 General work satisfaction  
7.2 Mental health  
7.3 Psychological well-being: The role of job characteristics  
7.4 Summary  

8. HEALTH PROBLEMS AND HEALTH BEHAVIOURS  
8.1 Initial analyses of health problems  
8.2 Categories of health problems  
8.3 Multivariate predictive models  
8.4 Smoking  
8.5 Body mass index  
8.6 Minor health problems: The role of the physical environment  
8.7 Summary  

9. CONCLUSIONS  
9.1 Sample characteristics and methodology  
9.2 Review of findings  
9.3 General health and safety issues  
9.4 Further research  

ACKNOWLEDGEMENTS  
REFERENCES
1. INTRODUCTION

Offshore oil and gas production, and the exploration and drilling operations that support it, play a significant role in the UK economy, and employ a substantial workforce. Although numbers fluctuate from year to year, over the past five years the North Sea workforce has averaged more than 30,000 personnel, with an estimated 29,500 employees in 1995 (Department of Trade and Industry, 1996). The nature of the offshore environment is such that the personnel concerned are exposed to work demands and constraints over and above those experienced in comparable jobs onshore.

The psychosocial stressors inherent in offshore employment include the remote and isolated location of many North Sea installations; adverse weather conditions and physical environment; confined work and living conditions; lack of privacy; the perceived hazards of offshore work and the helicopter travel that it necessitates; demanding shift patterns and, in some cases, monotonous or repetitive work; separation from family and local community; and possible family problems arising from intermittent absence from home.

In view of the demanding lifestyle of offshore employees, it is not surprising that the offshore work environment, and the combination of physical and psychosocial stressors that it imposes, has been the subject of considerable research interest over the past two decades. Although the study carried out by Hellesøy (1985) in the Norwegian Statfjord field is probably the most wide-ranging research into North Sea work conditions, other investigators from both medical and psychological backgrounds have also contributed to this field of research.

Most of these studies have focused on specific aspects of the offshore environment. For instance, Lauridsen et al. (1991) reported a large-scale survey of offshore shift patterns and their health implications; Gann et al. (1990) focused on anxiety and depression among onshore and offshore employees of a multi-national oil company; Horsley and MacKenzie (1996) surveyed lifestyle and health behaviours; and Iversen (1991) examined predictors of sickness absence among offshore personnel. Other studies have highlighted safety issues; for instance, Rundmo (1992) and Flin et al. (1995) assessed perceived risk among North Sea personnel, while Sutherland and Cooper (1991) investigated the role of personality factors in relation to self-reported accident involvement in an offshore sample.

An alternative research approach is to focus on particular occupational groups within the offshore workforce. Thus, Flin and Slaven (1992) examined the background and experience of offshore installation managers; Parkes (1992, 1993) compared onshore and offshore production personnel on a range of psychosocial factors; and Milcarek (1993) reported a longitudinal analysis of job tenure and turnover among offshore catering personnel.

These studies, and other literature relating to health and safety among offshore personnel, have recently been reviewed by Parkes (1996), and are therefore not discussed in detail here. Nonetheless, it is clear that a considerable amount of research has already been carried out into the work conditions and well-being of
offshore personnel, and it is therefore important to clarify, in the context of this previous work, the particular contribution that the present study seeks to make.

In part, the rationale for the present study lies in the nature and extent of changes that have taken place in the North Sea oil and gas industry in recent years. Few of the studies cited above are based on data collected sufficiently recently to reflect these changes. In particular, the Cullen report (Cullen, 1990) has led to significant improvements in offshore safety regimes during recent years, involving modifications to structures, procedures, and regulations, and a formal requirement for operating companies to produce detailed ‘safety cases’.

Other recent and significant changes in the North Sea work environment are also relevant. Thus, downward fluctuations in oil prices, and falling production levels in older oil and gas fields, have necessitated cost-reduction measures, including widespread down-manning (particularly on older platforms) and associated job insecurity. Correspondingly greater efficiency and flexibility, in terms of the amount and variety of work carried out, have been demanded of the remaining workforce; on some installations, also, the duration of offshore tours has been extended in a further attempt to reduce costs.

Moreover, installations built and commissioned over the past few years tend to be relatively small, and to operate with higher levels of automation and fewer personnel than those of earlier generations, a trend likely to continue in the development of new structures. Thus, the North Sea oil and gas industry has undergone a period of rapid change, and further innovation is likely in the remaining years of this decade.

In the light of these changes, studies based on data collected in the 1980's, even if published recently (e.g. Sutherland & Cooper, 1996), do not adequately reflect the current offshore work environment; indeed, research data collected only a few years ago is being rapidly out-dated by change. Furthermore, the studies cited above tend to address specific issues rather than seeking to provide a wide-ranging overview of psychosocial factors, health and safety among the North Sea workforce.

In addition, much of the available research into the offshore environment is based on survey data obtained from relatively small samples and/or with low response rates; in some cases, also, interpretation of the findings is limited by the use of overly simple statistical methods to address what are essentially complex multivariate problems in which many inter-related factors combine to predict outcomes.

Thus, in summary, the rationale for the present study lies in the need for up-to-date information about offshore work conditions, and their health and safety implications, based on a relatively large sample and covering a wide range of variables. The study reported here was designed to meet this need, and to address some of the methodological limitations of earlier work, albeit within the limitations of cross-sectional data collection. The central features of the work are summarised in the following sections.
1.1 PRESENT STUDY

1.1.1 Outline of aims

In planning the present study, and the analyses described in this report, the main aims were:

- To carry out a survey of offshore work conditions, including physical and psychosocial aspects of the work environment, job characteristics, safety procedures and measures, individual differences (particularly demographic factors), mental and physical health, and job satisfaction, within the framework of established models of occupational stress (e.g. House, 1981; Karasek & Theorell, 1990; Israel et al. 1992).

- To collect data on a range of offshore installations, both production platforms and drilling rigs, varying in size and age, and operated by a number of different companies.

- To obtain data from as large a sample as possible, including all the main occupational groups employed offshore, and both operating company personnel and contractors.

- To collect all data on site, rather than use postal survey methods. The main reason for this approach was to encourage a high response rate, but it also had the advantage of allowing the research team to gain first-hand experience of the offshore environment.

- To offer all participants individual feedback outlining how their personal profile of responses related to the overall findings.

- To set up the study in such a way that it would be potentially possible to follow up the cohort individually at a later stage, thus setting the stage for much-needed longitudinal research into work conditions and health among personnel in a rapidly changing offshore industry.

1.1.2 Participating companies, installations, and personnel

Operating companies. Seven companies operating offshore oil and gas production installations co-operated in the work, together with five drilling companies. Two large multi-national companies extensively involved in North Sea exploration and production, participated; three platforms operated by each of these companies took part in the study. In addition, data were collected on one installation of each of a
further five companies with more limited operations in the North Sea. Five drilling companies also participated, enabling data to be collected on six drilling rigs (including two operated by the same company).

**Installations.** The aim in setting up the study was to include as wide a range of installations as possible, in terms of characteristics such as type (production vs. drilling), age, and size. The 17 installations on which data were collected were located in the Northern or Central areas of the UK North Sea sector, and had been in operation for 2 - 22 years. Installation size, in terms of ’personnel on board’ (POB), also varied widely, although the production platforms (30-180 POB) tended to be larger than the drilling rigs (60-100 POB).

**Personnel.** As far as possible, all personnel on board the installations when the researchers visited were invited to take part; both operating company personnel and contractors were included, and all occupational groups.
2. RESEARCH METHOD

2.1 PRELIMINARY WORK

2.1.1 Interviews, and pilot questionnaire

Prior to the main data collection phase, 109 offshore employees (including personnel from all the major occupational groups) working on four North Sea installations were interviewed and empirical data collected using a pilot questionnaire. This initial phase of data collection provided background information which served to guide the range of material covered in the main questionnaire, the wording of specific items and inventories, and the scaling of quantitative responses. Individuals who took part in this preliminary work were not involved in the main study, although other personnel from two of the installations concerned were included.

The final questionnaire drew on material from previous work by the present author (Parkes, 1993); it also included modified versions of other relevant inventories (e.g. Rundmo, 1992), and items developed specifically for the present study.

2.2 MAIN SURVEY

2.2.1 Offshore data collection

All survey data were collected offshore, with the aim of maximising the response rate, and enhancing the reliability of the data. Visits to installations normally lasted 3-5 days, to allow time for completed questionnaires to be returned while the researcher was on board. In general, two visits were made to each installation timed to allow individuals from both back-to-back crews to participate, although inevitably some personnel were not on board during either visit, while others were there on both occasions.

During the main data collection phase, only one researcher carried out any particular offshore visit but, as far as possible, the two visits to the same installation were made by different members of the research team so as to avoid confounding installations with individual researchers. The survey data were collected over a 15-month period, ending in July 1996.

2.2.2 Procedure

On arrival offshore, the first stage of the work was to explain the nature and aims of the study to those on board, initially by briefing senior management personnel and subsequently by meeting informally with employee groups at the workplace, during breaks, or by means of a short presentation during regular safety meetings. These meetings provided opportunities for those concerned to ask questions about the work, and allowed the researcher to make arrangements for the distribution and return of the questionnaires.

Questionnaires and associated materials were given to as many as possible of those on board. On the largest installations, it was not always possible to contact everyone,
but on most of the installations concerned, the majority of personnel on board at the time of the visit were invited to participate. Participation was voluntary; however, it was rare for those contacted to decline to accept the survey materials, although particular problems were encountered on one installation.

Each set of survey material contained the following items, together with a large envelope in which to return the completed questionnaire:

- **Introductory letter.** This letter outlined the nature of the work, and the source of funding; in addition, it guaranteed the confidentiality of all individual data, and adherence to the provisions of the Data Protection Act. The letter also included the names of the researchers and the address at which they could be contacted.

- **Questionnaire, and brief instruction sheet**

- **Individual research number.** When the questionnaires were distributed, the particular research number on the set of materials given to a participant was recorded on a separate confidential list, together with the name of the individual to whom it had been given.

- **‘Feedback slip’.** This slip asked participants to indicate whether they would like individual feedback about their profile of responses in relation to the overall results; it included space for the research number, and the name and address to which the feedback should be sent, if requested. A small envelope was also provided so that this slip could be returned separately from the questionnaire. Those who did not want to receive feedback simply checked the ‘no’ response option and were not asked for other details.

The questionnaire took approximately 45 minutes to complete, although there were wide variations between individuals in the time required. Questionnaires were returned in the sealed envelopes, either directly to the researcher, or left with the sickbay medic for collection.

### 2.3 QUESTIONNAIRE CONTENT

The questionnaire developed from the preliminary work was used on all installations in the main survey, with occasional minor revisions of wording to accommodate specific features of particular installations. The main topics covered in the present report are outlined below:

- **Demographic information.** Age, marital status, place of residence, education, current job details (e.g. job title, employer, area of work), and total number of years of employment offshore.

- **Job characteristics.** Specific features of jobs (including workload, autonomy, variety, and clarity) were assessed by means of a set of 21 items. Further information requested included shift patterns, working hours, and overtime hours, if any.
• **Physical working environment.** A ten-item questionnaire assessed exposure to physical environment stressors, e.g. noise, vibration, poor air quality.

• **Safety issues.** Satisfaction with safety and emergency response measures was assessed using a modified version of the checklist from Rundmo (1992). In addition, the perceived safety of nine specific offshore operations and activities was assessed.

• **Work satisfaction.** Two aspects of work-related satisfaction were assessed. The ‘job satisfaction’ scale focused on satisfaction with the job itself, the content of the work carried out, and the skill, variety and responsibility involved. The ‘job prospects’ scale assessed more general aspects of work satisfaction, including job security, promotion opportunities, and future prospects.

• **Health.** Published scales were used for the assessment of minor physical/psychosomatic health problems (Vaernes et al. 1988) and for the assessment of mental health (Goldberg, 1978). Other health-related information recorded included smoking behaviour, and details of height and weight, from which the body mass index (BMI) was calculated.

• **Negative affectivity.** Several personality measures were included in the questionnaire, but only one plays a major role in the present report. Neuroticism, a measure of ‘negative affectivity’, and vulnerability to psychological distress, was assessed in the present study by the Eysenck Personality Questionnaire (Eysenck et al. 1985).

### 2.4 SAMPLE SIZE AND RESPONSE RATES

On the 11 production installations in the study, response rates ranged from 78.8% - 98.0% of questionnaires distributed, with a mean of 86.7 (± 6.3) %. In addition, on one platform, limited accommodation precluded a second visit, and 37 questionnaires were left for the back-to-back crew members to return by mail. In this group, the response rate was only 62.2%. Thus, having researchers on board to collect data, rather than relying on postal survey techniques, appears to have contributed significantly to the high response rates obtained.

On the six drilling rigs, response rates tended to be lower than those on platforms, ranging from 67.2 - 83.1%, with an average of 76.7 (± 6.0) %. Overall, the level of response was encouraging in view of the size of the sample, the wide range of occupational groups included, and the length of the questionnaire.
2.5 DATA CODING AND PROCESSING

The questionnaire data were coded according to a pre-determined schedule: nominal categories (e.g. job type) were given discrete numerical codes for identification; ordinal and interval level measures were entered quantitatively. Individual participants were identified by research numbers, and installations and company groups were also coded into numerical form. The pre-coded data were entered into the SPSS-PC program. Prior to analysis, the data set was examined to check that each variable was in the expected range; occasional missing data and out-of-range values were identified, and corrected if necessary, and any recoding required for analysis purposes was carried out.

2.5.1 Coding of categorical variables

Company groups. Participating companies were divided into four groups for the purposes of analysis and reporting. Companies A and B, large multi-national oil and gas production and exploration companies, each of which had three platforms involved in the study, were treated as separate groups. The installations operated by the five additional companies were treated as a further group, Group C. The six drilling rigs, operated by five different companies, formed the fourth group, Group D.

Installations. Installations within company groups were identified by randomly-assigned numbers; thus, for instance, A1, A2, and A3 represent the three platforms in Group A, and installations in Groups B, C, and D were coded similarly. Size of installation was coded in terms of POB level: small (30-75 POB), medium (76-140 POB), and large (145-200 POB). Age of installation was coded in three categories: <5 years, 5-15 years, and >15 years.

Employer. The distinction between operating company employees and contractor personnel was represented in the ‘employer’ coding. On production platforms, ‘operating company personnel’ (i.e. those directly employed by the operating company) were distinguished from those employed by contractors, services companies and drilling companies, the latter being designated ‘contractors’. On drilling rigs, personnel employed by the company operating the rig were designated ‘drilling operator personnel’. Drilling rigs also had a small number of ‘operator company’ personnel (e.g. the company representative), and some ‘contractors’ employed by service and contracting companies. Thus, the basis of this classification was the distinction between those employed by the company operating the installation (either production or drilling), and those with other employers.

Job type. The questionnaire asked respondents to indicate their job title and also the main area of work in which they were involved from a list of eight categories (maintenance, production, construction/deck operations, technical/mechanical, drilling, management, catering/flotel, and administration). In addition, an ‘other’ category was included for those whose jobs did not fit into any of the areas listed. Subsequent examination of job titles indicated that the small number of ‘other’ personnel could most appropriately be combined with the ‘administration’ group.
**Job level.** Job level was designated by four ordered codes, derived from job titles. The levels/codes used were: senior management (1); supervisor (2); lead technician (3); and technician/operator (4). The most senior level, coded (1), included only the Offshore Installation Managers (OIM), and a few senior colleagues (usually two or three of those on board). An additional job level code, designated ‘not applicable’ (N/A) in this report, was included for individuals (mostly specialist and technical personnel) who did not fit clearly into the hierarchical structure. Whereas job types were coded according to the nature and area of the work carried out, job levels 1 - 4 were determined solely by seniority.

**Additional duties.** The survey questionnaire asked respondents to indicate whether they undertook any specific offshore duties additional to their main jobs. The additional duties specified were helideck crew, emergency response team, fire team, musterman/cox, nominated first-aider, and safety representative, and ‘other’.

### 2.6 DATA ANALYSIS

In reporting findings from the large data set available, it was necessary to focus on a limited number of analyses from the vast range of possibilities. The work reported here is primarily concerned with assessing the extent to which objective factors such as type of installation (i.e. production vs. drilling rigs), job types, and shift patterns, predict subjective outcomes, such as perceived job characteristics, safety perceptions, and health measures, rather than examining relations between subjective measures.

The factors chosen as the basis for the initial analyses were job type and company group, with control for age and negative response biases (see below). Within this framework, differences between production installations and drilling rigs, and between installations within company groups, were also examined where appropriate. In further analyses, extended models that included other independent predictor variables, such as the age and size of the installation, were also tested. In addition, specific points of interest were followed up in relation to particular outcomes. Several more technical aspects of the analysis are outlined below.

**Multivariate analyses.** As the predictor variables of interest were not independent of each other (see Section 3.2), it was necessary to use multivariate methods of analysis which allow the effects of more than one variable to be evaluated simultaneously. Although univariate methods are also reported where appropriate, multivariate analyses provide more clearly interpretable results.

**Main effects, interactions, and curvilinear effects.** Two predictor variables may either act separately (each showing an overall effect in relation to the outcome, independently of the other), or they may combine interactively, in which case the effect of one variable depends on the level of the other. For instance, company group and job type may both relate independently to, say, perceived workload; alternatively, the two factors may interact, the effect of job type varying across company groups and, conversely, the effect of company groups varying across job types.
Both overall main effects, and interaction effects were tested in the present work, although when multiple predictors were used simultaneously, the nature of the data set was such that analyses were necessarily restricted to overall main effects. In most cases, continuous quantitative variables (e.g. neuroticism) were linear in effect (i.e. the outcome variable was directly related to the predictor) but, in a few instances, curvilinear trends were also observed.

**Data distributions.** Some measures described in this report had markedly ‘skewed’ distributions, that is, most scores were bunched together within a small range, but there was a tail of extreme scores at one end. For distributions of this nature (e.g. reported working hours per week, health problems scores), the overall mean is not a useful measure as it tends to be distorted by the extreme values. In these cases, the percentages of the sample falling within certain ranges of scores are reported, and statistical analyses appropriate to this format are used. **Significance levels.** The sample size in the present study was such that very high levels of significance were obtained in many of the analyses. The convention adopted in this report is that probability levels less than .001 (i.e. the probability of the observed result being obtained by chance is less than 1 in 1000) are reported as p<.001, irrespective of the actual level of significance achieved which was often much higher (i.e. a smaller probability value reflecting a more highly significant result). Probability levels which were statistically significant (p<.05), but which did not reach the p<.001 level are quoted precisely.

**Control for response biases.** A general tendency to perceive both self and environment in a negative light is reflected in a wide range of self-reported information, including job perceptions and health measures. In analysing survey data, individual differences in this tendency, labelled ‘negative affectivity’, must be taken into account for two reasons. First, negative affectivity acts to inflate observed correlations between stressors and outcomes (e.g. Brief et al. 1988). Second, between-group differences in negative affectivity may distort comparisons across groups; for instance, differences between job types in, say, perceived workload, may be partially attributable to differences in the overall levels of negative affectivity in different job groups. The measure used to control for this form of response bias was neuroticism (Eysenck et al. 1985); it was routinely included as a covariate in all multivariate analyses.

**Control for age effects.** A second covariate, age, was also routinely included in the analysis models, both as a predictor variable of interest in its own right, and to take into account possible confounding due to age differences between sub-groups within the overall sample.
3. DESCRIPTION OF THE SAMPLE

A total of 1647 offshore personnel (1598 men and 49 women), employed on 17 North Sea installations (see Section 1.1.2), returned completed questionnaires. The data set that forms the basis of the analysis presented here differs in two ways from this original sample. First, as company groups, installations, and jobs were main factors in the analysis model, it was important not to confuse the results by including personnel for whom these factors were of little significance. Accordingly, those with less than two months’ experience of the job and/or the installation were excluded from the sample prior to analysis. This screening reduced the original sample by 136 personnel (8.3%) to 1511. As compared with the sample analysed, the group removed were more likely to be younger, to have less offshore experience, to be working on drilling rigs, and to be employed by ‘services’ companies.

Secondly, data from female participants were not included in the analyses reported here. Women formed a very small proportion of the survey respondents (n = 49, 3% of the original sample), corresponding to their low representation in the offshore workforce. Furthermore, the majority of women were in one job category (catering). For these two reasons, including women in the analysis sample would have complicated the interpretation of the statistical findings. The data analysis presented in this report is therefore restricted to the remaining sample of 1462 male personnel.

3.1 DEMOGRAPHIC AND BACKGROUND CHARACTERISTICS

Broad demographic categories, and other background factors that characterise the sample, are shown in Table 3.1. Considering, first, the demographic information, the table presents a breakdown of age, educational level, marital status, and years of offshore employment. The overall average age was 38.8 years (± 8.9 years) with a range of 19-63 years. As shown in Table 3.1, the 30-49 years age range accounted for more than 70% of the sample. The majority (58%) of personnel in the sample had been employed offshore for ten years or longer.

As also shown in Table 3.1, 75% of those taking part were married or living with a partner, and 50% had children under 18 years living at home. Other background information in Table 3.1 shows that the most frequently reported reason for having chosen to work offshore was financial advantage, although lack of opportunities onshore was the main factor for nearly 20% of the sample. In spite of increasing concern about job security, the great majority of the sample reported that they expected to be, or probably would be, in the same job in a year’s time.

3.2 SAMPLE COMPOSITION

Table 3.2 sets out the proportions of the overall sample falling in sub-groups defined by the company (or company group) operating the installation, job type, employer, and job level. These data are shown for the sample as a whole, and separately for personnel on production platforms and drilling rigs.
**Table 3.1**  
Demographic and background characteristics

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<td><strong>Educational level</strong></td>
<td>No formal qualifications</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>GCSE/O- or A-level or equivalent</td>
<td>23.1</td>
</tr>
<tr>
<td></td>
<td>Technical qualifications</td>
<td>53.5</td>
</tr>
<tr>
<td></td>
<td>Degree level qualifications</td>
<td>6.6</td>
</tr>
<tr>
<td><strong>Reason for taking offshore employment</strong></td>
<td>Financial advantage</td>
<td>41.6</td>
</tr>
<tr>
<td></td>
<td>Lack of opportunities onshore</td>
<td>19.8</td>
</tr>
<tr>
<td></td>
<td>Better career prospects</td>
<td>6.9</td>
</tr>
<tr>
<td></td>
<td>Other reason</td>
<td>9.7</td>
</tr>
<tr>
<td></td>
<td>Combination of above reasons</td>
<td>22.0</td>
</tr>
<tr>
<td><strong>Expectation of being in same job in a year’s time</strong></td>
<td>No</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td>Probably not</td>
<td>7.3</td>
</tr>
<tr>
<td></td>
<td>Probably yes</td>
<td>35.7</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>50.6</td>
</tr>
</tbody>
</table>
Table 3.2
Sample composition

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>Total sample</th>
<th>Production installations</th>
<th>Drilling rigs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td><strong>Operating companies</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company A</td>
<td>377</td>
<td>25.8</td>
<td>377</td>
</tr>
<tr>
<td>Company B</td>
<td>316</td>
<td>21.6</td>
<td>316</td>
</tr>
<tr>
<td>Company Group C</td>
<td>363</td>
<td>24.8</td>
<td>363</td>
</tr>
<tr>
<td>Company Group D</td>
<td>406</td>
<td>27.8</td>
<td>----</td>
</tr>
<tr>
<td><strong>Employer</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating company</td>
<td>402</td>
<td>27.5</td>
<td>385</td>
</tr>
<tr>
<td>Contractor/services</td>
<td>753</td>
<td>51.5</td>
<td>671</td>
</tr>
<tr>
<td>Drilling operator</td>
<td>307</td>
<td>21.0</td>
<td>----</td>
</tr>
<tr>
<td><strong>Job type</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td>382</td>
<td>26.1</td>
<td>310</td>
</tr>
<tr>
<td>Technical</td>
<td>109</td>
<td>7.5</td>
<td>61</td>
</tr>
<tr>
<td>Catering</td>
<td>112</td>
<td>7.7</td>
<td>74</td>
</tr>
<tr>
<td>Production</td>
<td>223</td>
<td>15.3</td>
<td>223</td>
</tr>
<tr>
<td>Management</td>
<td>164</td>
<td>11.2</td>
<td>115</td>
</tr>
<tr>
<td>Admin/other</td>
<td>101</td>
<td>6.9</td>
<td>63</td>
</tr>
<tr>
<td>Construction</td>
<td>126</td>
<td>8.6</td>
<td>119</td>
</tr>
<tr>
<td>Drilling</td>
<td>245</td>
<td>16.8</td>
<td>91</td>
</tr>
<tr>
<td><strong>Job level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior management</td>
<td>97</td>
<td>6.6</td>
<td>68</td>
</tr>
<tr>
<td>Supervisor</td>
<td>209</td>
<td>14.3</td>
<td>159</td>
</tr>
<tr>
<td>Lead technician</td>
<td>104</td>
<td>7.1</td>
<td>66</td>
</tr>
<tr>
<td>Technician/operator</td>
<td>886</td>
<td>60.6</td>
<td>661</td>
</tr>
<tr>
<td>Not applicable</td>
<td>166</td>
<td>11.4</td>
<td>102</td>
</tr>
<tr>
<td><strong>Shift pattern</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day work</td>
<td>692</td>
<td>47.6</td>
<td>532</td>
</tr>
<tr>
<td>Day/night shiftwork</td>
<td>662</td>
<td>45.5</td>
<td>469</td>
</tr>
<tr>
<td>Other</td>
<td>100</td>
<td>6.9</td>
<td>48</td>
</tr>
<tr>
<td>Missing data</td>
<td>8</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td><strong>Hours / week &gt; 84 hrs.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>900</td>
<td>62.4</td>
<td>609</td>
</tr>
<tr>
<td>1 - 9 hours</td>
<td>147</td>
<td>10.2</td>
<td>114</td>
</tr>
<tr>
<td>10 - 16 hours</td>
<td>197</td>
<td>13.7</td>
<td>164</td>
</tr>
<tr>
<td>&gt; 16 hours</td>
<td>199</td>
<td>13.8</td>
<td>160</td>
</tr>
<tr>
<td>Missing data</td>
<td>19</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>1462</td>
<td>100</td>
<td>1056</td>
</tr>
</tbody>
</table>
Consistent with the different work activities on production platforms and drilling rigs, the two types of installations differed significantly in the proportions of personnel in different job groups ($\chi^2 = 304.0$, df=7, p<.001). However, there were also significant differences between rigs and platforms in the other factors shown in Table 3.2.

For instance, work patterns on platforms and rigs were significantly different ($\chi^2 = 37.3$, df=2, p<.001); just over half the personnel on platforms only worked day shifts, whereas the corresponding proportion on drilling rigs was less than 40%. This difference was also apparent in the reported working hours, as jobs that are covered by day/night shiftwork rarely involve work hours in excess of the standard 12-hour shift. In contrast, day-work jobs often necessitate ‘overtime’ hours.

Thus, the higher proportion of rig personnel working day/night rotating shifts was reflected in the smaller proportion reporting that they regularly worked more hours than the normal 12-hour shift ($\chi^2 = 30.1$, df=3, p<.001). Overall, 41.8% of platform personnel reported working in excess of a normal 12-hour shift, as compared with 26.5% of those working on drilling rigs. However, among those who worked only day shifts, approximately half of each group reporting that they regularly worked longer than a 12-hour shift.

There were also significant differences between rigs and platforms in employment patterns. Among personnel on drilling rigs, approximately 75% were directly employed by the drilling company; in contrast, little more than one third of production platform personnel were employees of the operating company. Two examples of differences associated with the employment patterns merit particular attention.

**Job types.** As shown in Figures 3.1 and 3.2, job types differed significantly in the relative proportions of personnel employed by operating companies and contractors ($\chi^2 = 674.1$, df=14, p<.001), but the pattern was different for platforms and drilling rigs. Thus, for instance, on production platforms, the proportion of contractors among maintenance personnel was much higher than among production personnel, while catering personnel were almost entirely contractors. In contrast, on drilling rigs, the majority of maintenance personnel were employed by the drilling operator company, together with nearly half of the catering staff.

**Age.** There were significant differences in the age profiles of groups classified on the basis of employer ($\chi^2 = 128.5$, df=16, p<.001). This pattern is illustrated in Figure 3.3, in which the sizes of shaded areas represent the relative numbers of personnel in each group, while the profiles show the age distribution of each group. A conspicuous feature of the diagram is the relatively small proportion of operating company personnel in the 30-34 years and 35-39 years age groups, and the high overall frequency of personnel in the 40-49 years age group. It can also be seen from Figure 3.3 that the proportion of personnel aged 55+ years is very small; indeed, virtually no personnel employed by production operator companies were in this age band.
Figure 3.1
Sample characteristics: Job type by employer (production platforms)

Figure 3.2
Sample characteristics: Job type by employer (drilling rigs)
There were also significant differences in age associated with other factors shown in Table 3.2. For instance, the mean age of personnel differed significantly across company groups, $F(3,1458)=3.23, p<.01$; on average, personnel working on installations in Group C were older (40.3 years) than those on installations in other company groups (38.4 years). Age also varied significantly across job types, $F(7,1454)=17.9, p<.001$, management and administration personnel being older, and drill crews younger, than other groups.

As a check on the representativeness of the present sample, the age distribution of those working on production platforms was compared with that of the entire offshore workforce of a major operating company; this comparison was carried out for operating company personnel and contractor personnel separately. In each case, there was a high level of correspondence between the present sample and the comparison data, thus providing independent confirmation that the present data set adequately represented the population concerned in terms of age distribution.

### 3.3 PERSONALITY

Although personality variables are not considered in detail in this report, two dimensions assessed in the present study are relevant to the description of sample characteristics in that they throw light on the general adaptability and emotional stability of offshore personnel. The overall mean score on the extraversion-introversion scale was 8.1 ($\pm 3.4$), and the mean score on the neuroticism scale was 3.8 ($\pm 2.9$).
Relative to normative data (Eysenck et al. 1985), the extraversion scores were significantly high and the neuroticism scores significantly low. This combination of low neuroticism and high extraversion (reflecting a tendency to be sociable, active, emotionally resilient, and adaptable) is associated with better-than-average mental health, and good coping skills.

Thus, the present data suggest that selection processes involved in seeking, obtaining, and remaining in, offshore employment give rise to a workforce that, on average, shows personality characteristics likely to promote favourable adaptation to the offshore environment. However, it should be noted that on both scales the full range of scores (0-12 in each case) was observed, indicating considerable individual variation around the overall mean values.

<table>
<thead>
<tr>
<th>SUMMARY</th>
</tr>
</thead>
</table>

### 3.4 DESCRIPTION OF SAMPLE

- The survey data analysed were obtained from 1462 male personnel on 17 offshore installations (11 production platforms and 6 drilling rigs).

- The sample covered the operating company personnel (27.5%), contractors (51.5%) and drilling operator personnel (21.0%). All job types and job levels were represented.

- The age range was 19-63 years, with 70% in the 30-49 years age group. The distribution of ages in the sample closely matched that of the entire offshore workforce of a major operating company.

- Nearly half the total sample reported 10-20 years of offshore work.

- In the sample as a whole, scores on personality measures indicated relatively high extraversion and low neuroticism, characteristics typically associated with adaptability, emotional resilience, and above-average mental health.
4. PHYSICAL ENVIRONMENT

4.1 MEASURES

Ten items were used to assess the physical work environment; participants were asked to indicate to what extent their work exposed them to various physical stressors, such as noise, cold, and heavy physical workload. Responses were scored on a five-point (0 - 4) scale, ranging from ‘not at all’ to ‘to a high extent’. Factor analysis identified two factors in this item set, from which two scales were constructed.

The ‘general environmental stressors’ scale included six items concerned with poor workplace design, noise, vibration, cold, poor ventilation, and exposure to chemical hazards. The ‘specific environmental stressors’ scale had three items (heavy physical workload, working at heights, and working over the side). The remaining item (exposure to production or well fluids) was not clearly located on either factor, and was disregarded. Mean item scores for each scale were calculated.

4.2 PREDICTORS OF PHYSICAL ENVIRONMENT MEASURES

The extent to which company groups and job types, and the interaction between these factors predicted scores on the physical environment measures was evaluated for each of the scales separately, with age and neuroticism as covariates (see Section 2.6 for details of the analysis model). The results are summarised in Table 4.1.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Main effects</th>
<th>Covariates</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Company groups</td>
<td>Job type</td>
<td>Age</td>
</tr>
<tr>
<td>General stressors</td>
<td>F=9.71</td>
<td>F=39.82</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>df=3,1446</td>
<td>df=7,1446</td>
<td>p&lt;.001</td>
</tr>
<tr>
<td>Specific stressors</td>
<td>F=2.99</td>
<td>F=67.70</td>
<td>F=6.66</td>
</tr>
<tr>
<td></td>
<td>df=3,1443</td>
<td>df=7,1443</td>
<td>df=1,1443</td>
</tr>
<tr>
<td></td>
<td>p=.03</td>
<td>p&lt;.001</td>
<td>p&lt;.01</td>
</tr>
</tbody>
</table>

General stressors: F(32,1426) = 12.15, p<.001; R = .451, R² = .203
Specific stressors: F(32,1423) = 18.13, p<.001; R = .518, R² = .268

Note: The signs in brackets indicate the directions of the covariate effects
### 4.2.1 Company groups

Company groups differed significantly on the measure of *general physical environment stressors*. Within the overall analysis, Companies A and B (the two single-company groups) differed significantly, A reporting higher exposure levels than B; Company Group C was significantly more favourable than either of the single company groups. Overall, on the general environmental stressors measure, Group D (drilling rigs) did not differ significantly from the combined mean for the production installations (Groups A, B, and C). These results were further examined by analysing each group separately to evaluate the significance of differences between installations in the group.

After job type, age, and neuroticism had been taken into account, no significant differences were found between the three platforms of Company B, while those in Company A showed only a marginal difference (p<.10). However, differences between platforms in Group C (which were operated by five different companies) were highly significant, F(4,362)=11.33, p<.001, two installations (C2 and C5) showing particularly favourable levels. There were also differences between the drilling rigs in Group D, but these were smaller than those in Group C, F(5,404)=2.92, p<.02.

Figure 4.1 shows mean scores for each company group, and for each installation within company groups (the data shown are scores adjusted for job type, age and neuroticism).

![Figure 4.1](image)

**Figure 4.1**

*Exposure to general physical environment stressors by company group and installation*
These results should be seen in the context of the overall range of possible scores (0-4); all mean scores were in the lower or middle part of the range, none showing levels higher than 2.5. Thus, on the installations concerned, overall perceived exposure to adverse physical conditions did not appear to be unduly high.

Differences between company groups in levels of specific physical environment stressors were much less marked than those for the general stressors scale, and there were no overall differences between production platforms and drilling rigs. However, for this measure, the pattern of scores across company groups varied across job types.

### 4.2.2 Job types

As shown by the results in Table 4.1, personnel in different job groups reported significantly different levels of exposure to general and specific environmental stressors. Scores on each of these measures (adjusted for company group differences, age and neuroticism) are shown in Figure 4.2.

On the general physical environment scale, job types could be divided into two groups, roughly corresponding to the groups that spent most of their time in the accommodation and office areas (catering, management and administration) and those in other jobs whose work was mainly in the production, drilling and deck areas and who therefore experienced higher levels of environmental stressors.
Scores on the specific stressor scale showed a profile across job types significantly different from that for the general scale, $F(7, 1444) = 20.37, p<.001$; the drilling and construction/deck crews were exposed to these specific stressors (heavy physical work, working at heights and/or over the side) to a greater degree than other groups. Consequently, it was these groups that reported the least favourable overall scores when the two scales were considered together.

### 4.2.3 Further analysis of physical environment measures

The factors considered above, job type and company group, were major predictors of physical environment ratings but other factors were also potentially relevant. Several further factors were examined in an extended analysis. The additional predictor variables used were platform size and age, job level, operating company vs. contractor personnel, and work responsibilities additional to the individual’s main job (e.g. fire team, helideck crew).

The significance of these variables was examined over and above the effects of company group, job type, age and neuroticism. Production platforms and drilling rigs were considered separately, as the form of the analysis did not allow possible differences in the effects of the predictor variables in the two environments to be examined.

**Production platforms.** The results for production platforms are summarised in Table 4.2 and illustrated in Figure 4.3. Both platform age and, to a lesser extent, platform size predicted ratings of general environmental stressors. Older platforms were rated significantly less favourably than new ones on this measure. For platform size, the pattern of results was non-linear with personnel on platforms in the mid-range of size (POB 76-140) tending to rate exposure to environmental stressors as more severe than those on larger or smaller platforms.

Job level was inversely associated with reported exposure to both general and specific physical environment stressors; personnel in the more senior job grades reporting significantly less exposure to adverse conditions than those at lower job levels. Environmental stressors were also rated differently by operating company personnel and contractors; the greater reported exposure of contractors to specific stressors was particularly marked, in spite of the fact that differences associated with job types and companies had already been taken into account.

Of the additional work responsibilities examined, membership of the fire team was associated with higher reported exposure to general environmental stressors, while helideck crew members reported higher levels of specific stressors, largely attributable to the ‘heavy physical work’ component of that scale.

**Drilling rigs.** The data from personnel in drilling rigs was examined using the same extended model. In this case, the overall model was non-significant, and no further analyses were carried out.
### Table 4.2
**Extended analysis of physical environment scores:**
**Production platforms**

<table>
<thead>
<tr>
<th>Predictor variables</th>
<th>df</th>
<th>General stressors</th>
<th>Specific stressors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>F</td>
<td>p</td>
</tr>
<tr>
<td>Platform size (POB level)</td>
<td>2</td>
<td>3.48</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Platform age</td>
<td>2</td>
<td>8.30</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Job level</td>
<td>4</td>
<td>9.88</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Operating company vs. contractor personnel</td>
<td>1</td>
<td>3.72</td>
<td>[.06]</td>
</tr>
<tr>
<td>Additional responsibilities:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helideck crew</td>
<td>1</td>
<td>2.64</td>
<td>ns</td>
</tr>
<tr>
<td>Fire team</td>
<td>1</td>
<td>10.62</td>
<td>.001</td>
</tr>
<tr>
<td>Emergency response team</td>
<td>1</td>
<td>&lt;1</td>
<td>ns</td>
</tr>
<tr>
<td>Other role</td>
<td>1</td>
<td>1.01</td>
<td>ns</td>
</tr>
</tbody>
</table>

Overall model (general stressors): F(24,1028) = 18.62, p < .001; R² = .30
Overall model (specific stressors): F(24,1026) = 19.50, p < .001; R² = .31

*Company group, job type, age, and neuroticism were also included in the model. All factors were corrected for the effects of these variables, and for all other factors shown.*

---

**Figure 4.3**

*Relations between perceived exposure to adverse physical environment and (a) job level, and (b) platform age.*
4.3 PHYSICAL ENVIRONMENT

- Both general (e.g. noise, poor air quality), and specific (e.g. working at heights) aspects of exposure to adverse physical environment were assessed,

- In the sample as a whole, the scores did not suggest an unduly adverse physical environment, although there were significant differences between sub-groups in the sample.

- Job types were significant predictors of perceived exposure to physical stressors. Highest overall exposure was reported by drilling and construction personnel, while those with catering or office-based jobs reported lowest exposure. Exposure ratings were inversely related to job levels.

- Overall differences in both general and specific physical stressor ratings between the four company groups were significant, and were not accounted for by other factors in the analyses.

- The age of production installations significantly predicted exposure to the physical environment, over and above the effects of other factors. Older platforms were rated least favourably. However, this pattern of results was not found for drilling rigs.
5. JOB CHARACTERISTICS

5.1 MEASURES

The job characteristics scale consisted of 24 statements describing particular features of jobs. Participants were asked to indicate to what extent they agreed with the statements as applied to their jobs; each item had a five-point response scale, ranging from 0 (do not agree at all) to 4 (agree strongly). Using standard factor-analytic methods, four sub-scales were derived from the data set, and scores on each sub-scale were calculated for each participant. Details of the sub-scales and content areas are shown in Table 5.1. Four items which did not clearly belong on any of the sub-scales were discarded.

Table 5.1
Job characteristics measures

<table>
<thead>
<tr>
<th>Scale</th>
<th>Content area</th>
<th>Mean item score ± s.d.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Workload</strong></td>
<td>Time pressures, quantity of work, difficult to get work done in time, have to work very hard</td>
<td>2.25 ± 0.89</td>
</tr>
<tr>
<td>5 items</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Task variety and skill</strong></td>
<td>Varied activities, opportunities to learn new skills, interesting work. Repetitive tasks (reverse-scored)</td>
<td>2.24 ± .74</td>
</tr>
<tr>
<td>6 items</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Autonomy</strong></td>
<td>Can decide own workspace, work in own way, work independently, take short breaks</td>
<td>2.71 ± .89</td>
</tr>
<tr>
<td>4 items</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Clarity</strong></td>
<td>Given clear instructions, details of tasks are planned by others, know what to expect from others</td>
<td>2.62 ± .59</td>
</tr>
<tr>
<td>5 items</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.1.1 Initial multivariate analysis

A multivariate analysis of variance (MANOVA) was carried out to determine whether company group, job type, age, and neuroticism were significant predictors of the overall set of job characteristics variables. The results showed that each main factor, and the interaction between company group and job type, was highly significant (p<.001 in each case), thus justifying the use of this model in separate analyses of the four job characteristics, as reported in the following sections.
5.2 WORKLOAD

5.2.1 Company groups and job types

The main results of the analysis of workload scores in relation to company groups and job types are shown in Table 5.2. Each of these factors showed highly significant main effects. There was also a significant interaction between company group and job type indicating that patterns of workload across the eight job types varied across companies.

Table 5.2
Analysis of workload in relation to company groups and job types

<table>
<thead>
<tr>
<th>Measure</th>
<th>Company groups</th>
<th>Job type</th>
<th>Age</th>
<th>Neuroticism</th>
<th>Company x job type</th>
</tr>
</thead>
</table>

Overall model: F(32,1427) = 7.01, p<.001; R = .330, R² = .109

Note. The signs in brackets indicate the direction of the covariate effects

Company groups. Further analyses were carried out in which differences between installations in each company group were the main factor of interest; job type, age and neuroticism were included as control variables in these analyses. The results showed no significant differences in workload levels between installations in either of the single operating company groups (Group A and B). However, the five installations in Group C, did show significant, although not large, workload differences (p<.04). Differences between the drilling rigs in Group D were only marginally significant (p<.10).

Thus, except in Group C, overall workload levels were similar on installations within groups, but varied significantly across groups. These results are illustrated in Figure 5.1. The mean workload scores in Groups A and B were higher than those in Group C, and higher than the average for the Group D drilling rigs. Tests of specific contrasts indicated that workload scores were significantly higher in Group B than in Group A (p<.05), that the average score for these two groups was significantly higher than that for Group C (p=.001), and that personnel working on production platforms (Groups A, B and C) reported higher scores overall than those on rigs (Group D) (p<.001).
Figure 5.1
Workload levels by company group and installation

Figure 5.2
Mean workload scores on platforms and rigs in relation to job types
**Job types.** Further analyses of the interaction between company group and job type showed that it was largely attributable to the difference between platforms and rigs in the pattern of scores across job types, as shown in Figure 5.2. On platforms, two job groups, management and catering, stood out as having particularly high scores relative to other job groups, while the construction and maintenance groups tended to report lower workload levels. However, the pattern was different for drilling rigs, on which admin/other job type showed relatively low scores, while the construction group had relatively high scores.

**Covariates.** Both age and neuroticism were significant factors in the analysis of workload; higher age, and higher neuroticism, predicted higher workload ratings.

### 5.2.2 Further analysis of workload

Additional analyses were carried out to determine the extent to which the variation in workload was predicted by platform size and age, job level, operating company vs. contractor personnel, number of years of offshore work, and offshore responsibilities additional to an individual’s main job. The significance of these factors was evaluated over and above company group, job type, age and neuroticism, using the extended analysis model in which the independent contribution of each factor was evaluated, taking into account all other factors in the model. As previously, these analyses were carried out separately for platforms (Groups A, B, and C) and rigs (Group D).

**Production platforms: Groups A, B, and C.** The results of the analysis are summarised in Table 5.3. Job level was the most highly significant predictor in this model, although platform size (POB level) and three of the four additional responsibilities (fire team, emergency response team, and one or more of several other roles) also contributed to the variation in perceived workload. Platform age was not a significant factor, nor was operating company vs. contractor personnel.

Examination of the data showed that higher job level, smaller platforms, and additional work responsibilities were all associated with higher perceived workload. These results are illustrated in Figure 5.3. Whilst more detailed examination of the pathways underlying these significant effects is outside the scope of this report, some further points relevant to the interpretation of these data are noted in the following paragraphs.

- **Operator company vs. contractor personnel.** When differences in perceived workload between operating company and contractor personnel were examined separately, contractors were found to report significantly lower workload, $F(1,1053)= 10.56, p < .001$. However, the analysis in Table 5.3 shows no significant difference between these groups. This result suggests that apparent operator personnel vs. contractor differences in perceived workload were actually due to related factors included in the multivariate analysis (particularly the relative proportions of operator and contractor personnel at the most senior job level) rather than to operator/contractor differences per se.
Table 5.3
Multiple predictors of workload: Production platforms

<table>
<thead>
<tr>
<th>Predictor variables*</th>
<th>df</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform size</td>
<td>2</td>
<td>3.89</td>
<td>p&lt;.03</td>
</tr>
<tr>
<td>Platform age</td>
<td>2</td>
<td>1.12</td>
<td>ns</td>
</tr>
<tr>
<td>Job level</td>
<td>4</td>
<td>16.82</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Operating company vs. contractor personnel</td>
<td>1</td>
<td>&lt;1</td>
<td>ns</td>
</tr>
<tr>
<td>Years of offshore work</td>
<td>1</td>
<td>3.79</td>
<td>[p&lt;.06]</td>
</tr>
</tbody>
</table>

* Company group, job type, age, and neuroticism were also included in the model.
All factors were corrected for the effects of these variables, and for all factors shown.

- **Years of offshore work.** The results indicated that those who had worked more years offshore tended to report higher levels of workload than those with shorter offshore experience, either because they experienced the same level of work as more demanding than their younger counterparts, or because their experience actually led them to do more. Thus, the relationship between perceived workload and age, noted in Section 5.2.1, may be partially due to duration of offshore experience.
Figure 5.3
Additional predictors of perceived workload

- ‘Life expectancy’ of installations. Platform age (i.e. the number of years since oil was first produced) was not significant in the analysis of perceived workload; however, future ‘life expectancy’ (i.e. the number of years of anticipated production, as estimated by the management personnel of the installation concerned) did contribute significantly, F(2,1028)=4.62, p<.01, when included in the model shown in Table 5.2. Personnel on platforms with a ‘life expectancy’ of six years or less reported lower workload than those on platforms that anticipated longer future production (see Figure 5.3).

Drilling rigs: Group D. An analysis similar to that reported above was carried out on the data for personnel on the six drilling rigs in Group D. The only factor found to be significant over and above job type, age and neuroticism, was installation age (p<.05). Personnel on the newest rigs (< 5 years) reported the highest workload levels.
5.2.3 Reported number of work hours per week

In addition to the scale measuring perceived workload, a separate item in the survey questionnaire asked participants to indicate how many hours they normally worked each week when offshore; a significant proportion (38.4% overall) reported that they worked overtime hours in addition to the normal 84-hour week. This information was not included as a predictor variable in the analysis of perceived workload, as long work hours are more appropriately regarded as an outcome of high perceived workload rather than as an antecedent factor. However, the correlation between perceived workload and reported work hours was positive and highly significant ($r=.27$, $p<.001$), consistent with the view higher perceived workload is associated with longer work hours.

Which groups report overtime hours? Logistic regression analysis was used to examine the extent to which company group, job type, job level, employer, and daywork vs. day/night shiftwork jointly predicted whether or not overtime hours were reported. Each of these factors was found to make an independent and highly significant contribution to the regression model ($p<.001$ in each case).

Overtime hours were most likely to be reported by personnel in Company B, by personnel at the most senior job level, by those in management roles, by those employed by production operating companies, and by those doing day shifts as opposed to day/night shiftwork. Conversely, those least likely to report overtime hours were personnel in Company A, catering personnel, and those at the lower job levels. In addition, the proportion of day/night shift workers reporting overtime hours was relatively small as, in normal circumstances, back-to-back crews take over at the end of a 12-hour shifts, an arrangement that does not usually apply to those who only work day shifts. Age was non-significant in this analysis, and neuroticism, although significant, did not play a major role.

How many overtime hours? The analysis of work hours was extended to examine the overtime hours worked by different groups. Table 5.4 shows the proportions of personnel reporting a standard 84-hour week, or one of three levels of longer work hours (85-93 hours, 94-100 hours, and >100 hours), the data being shown separately for company groups, job types, job levels, employers, and in relation to shift pattern.

Chi-square tests showed that the proportions in each overtime category were significantly different across each of these factors ($p<.001$ in each case). Particularly marked was the high proportion (60.8%) of those at the most senior job level who reported working more than 100 hours per week, the maximum reported being 126 hours. Also notable was the fact that almost 15% of the entire sample reported working in excess of 100 hours per week. In interpreting the information in Table 5.4, it should be noted that these data are observed values which do not take account of inter-relationships between factors. For example, the relatively high proportion of those in the drilling job type who work a standard 84-hour week is partly attributable to the fact that the majority of personnel in this group work day/night rotating shifts.
Table 5.4
Reported working hours per offshore week

<table>
<thead>
<tr>
<th></th>
<th>Percentage of sample reporting work hours per week in each of four ranges:</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>84</td>
<td>85 - 93</td>
<td>94 - 100</td>
<td>100 +</td>
</tr>
<tr>
<td></td>
<td></td>
<td>hours</td>
<td>hours</td>
<td>hours</td>
<td>hours</td>
</tr>
<tr>
<td><strong>Company Group</strong></td>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>A</td>
<td></td>
<td>73.8</td>
<td>8.0</td>
<td>7.5</td>
<td>10.7</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>43.8</td>
<td>13.4</td>
<td>24.6</td>
<td>18.2</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>54.4</td>
<td>11.7</td>
<td>16.4</td>
<td>17.5</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>73.5</td>
<td>8.3</td>
<td>8.3</td>
<td>9.8</td>
</tr>
<tr>
<td><strong>Job type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
<td>68.2</td>
<td>9.7</td>
<td>12.4</td>
<td>9.7</td>
</tr>
<tr>
<td>Technical</td>
<td></td>
<td>72.0</td>
<td>10.3</td>
<td>11.2</td>
<td>6.5</td>
</tr>
<tr>
<td>Catering</td>
<td></td>
<td>75.7</td>
<td>10.8</td>
<td>9.9</td>
<td>3.6</td>
</tr>
<tr>
<td>Production</td>
<td></td>
<td>65.3</td>
<td>18.9</td>
<td>11.7</td>
<td>4.1</td>
</tr>
<tr>
<td>Management</td>
<td></td>
<td>18.4</td>
<td>8.9</td>
<td>25.9</td>
<td>46.8</td>
</tr>
<tr>
<td>Admin/other</td>
<td></td>
<td>49.0</td>
<td>16.0</td>
<td>21.0</td>
<td>14.0</td>
</tr>
<tr>
<td>Construction/deck</td>
<td></td>
<td>49.6</td>
<td>2.4</td>
<td>19.5</td>
<td>28.5</td>
</tr>
<tr>
<td>Drilling</td>
<td></td>
<td>81.0</td>
<td>5.0</td>
<td>6.2</td>
<td>7.9</td>
</tr>
<tr>
<td><strong>Job level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior manager</td>
<td></td>
<td>9.4</td>
<td>4.2</td>
<td>26.0</td>
<td>60.4</td>
</tr>
<tr>
<td>Supervisor</td>
<td></td>
<td>34.5</td>
<td>16.0</td>
<td>21.0</td>
<td>28.5</td>
</tr>
<tr>
<td>Lead technician</td>
<td></td>
<td>70.9</td>
<td>8.7</td>
<td>15.5</td>
<td>4.9</td>
</tr>
<tr>
<td>Technician</td>
<td></td>
<td>77.1</td>
<td>8.6</td>
<td>8.7</td>
<td>5.6</td>
</tr>
<tr>
<td>Not applicable</td>
<td></td>
<td>42.9</td>
<td>16.0</td>
<td>22.7</td>
<td>18.4</td>
</tr>
<tr>
<td><strong>Employer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production operator</td>
<td></td>
<td>48.0</td>
<td>16.1</td>
<td>16.1</td>
<td>19.8</td>
</tr>
<tr>
<td>Contractor</td>
<td></td>
<td>63.2</td>
<td>7.8</td>
<td>15.7</td>
<td>13.2</td>
</tr>
<tr>
<td>Drilling operator</td>
<td></td>
<td>79.0</td>
<td>8.2</td>
<td>5.6</td>
<td>7.2</td>
</tr>
<tr>
<td><strong>Shift pattern</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day shifts</td>
<td></td>
<td>46.4</td>
<td>10.6</td>
<td>20.6</td>
<td>22.4</td>
</tr>
<tr>
<td>Day/night shifts</td>
<td></td>
<td>76.2</td>
<td>10.7</td>
<td>7.4</td>
<td>5.6</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>80.6</td>
<td>3.2</td>
<td>7.5</td>
<td>8.6</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>62.4</td>
<td>10.2</td>
<td>13.7</td>
<td>13.8</td>
</tr>
<tr>
<td>N = 1443</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. The percentages shown in each category are the observed values; they are not adjusted for inter-relationships between the factors.*
5.3 AUTONOMY

Analysis of the other three job characteristics measures (autonomy, task variety and skill, and clarity) followed a pattern similar to that used in the analysis of workload. For the measure of autonomy (which assessed the extent to which the job allowed an individual to work independently, and to carry out tasks in his own way), the results of the initial analysis are summarised in Table 5.5. In this analysis, the main factors were company groups and job types; individual differences in age and neuroticism were treated as covariates.

Table 5.5
Analysis of autonomy in relation to company groups and job types

<table>
<thead>
<tr>
<th>Measure</th>
<th>Main effects</th>
<th>Covariates</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Company groups</td>
<td>Job type</td>
<td>Age</td>
</tr>
<tr>
<td>Autonomy</td>
<td>F=9.64</td>
<td>F=13.45</td>
<td>F=26.95</td>
</tr>
</tbody>
</table>
|          | df=3,1447     | df=7,1447  | df=1,1447 | df=1,1447 | p=.001 [+]
|          | p<.001        | p<.001     | p<.001 | p=.001 | [-] |

Overall model: F(32,1427) = 7.32, p<.001; R=.359, R² = .129

The direction of the covariate effects are shown by the signs in the brackets

5.3.1 Company groups

Figure 5.5 shows the mean autonomy scores in each company group, together with the means for the installations in each group. Considering, first, the overall means for the company groups, contrast tests showed that autonomy scores were significantly higher in Company A than in Company B (t=2.12, df=1456, p<.05); in addition, the mean for Company Group C was significantly higher than the combined mean for Companies A and B (t=6.32, df=1456, p<.001). However, there was no significant difference overall between production platforms (Groups A, B and C) and drilling rigs (Group D).

Tests of differences between individual installations in each group showed that differences in mean scores within Group B were non-significant, while those within Group D were only marginally significant (p=.06). Within Group C, differences between installations only just reached conventional significance levels F(4,362)=2.50, p<.05, but the effects were more marked between platforms within Company A, F(2,375)=4.56, p=.011, A3 having the lowest scores on this measure.
5.3.2 Job types

Overall differences in mean autonomy scores between job types were found to be highly significant (see Table 5.4). The mean scores, corrected for the other factors in the analysis, are shown in Figure 5.6. Two job types, production and drilling, both of which involve teamwork and coordination between individuals, stand out as having relatively low scores on the autonomy scale. Although management personnel tend to show the highest scores, differences between the remaining job types were not significant.

5.3.3 Covariate effects

Both age and neuroticism were highly significant covariates in the analysis of autonomy. Age was positively related, and neuroticism was negatively related, to greater perceived autonomy. These effects were independent of the overall effects of company and job type differences.

5.3.4 Autonomy: Further analyses

The set of additional predictor variables examined in relation to workload (see Section 5.2.2) was also used in the further analyses of autonomy. As previously, these analyses were carried out on the data for production platforms and drilling rigs separately, and company group, job type, age and neuroticism were included in all models.
Production platforms (Groups A, B, and C). For production platforms, only two additional factors were found to be significant, job level, $F(4,1028)=6.08, p<.001$, and platform age, $F(2,1052)=10.40, p<.001$. The results for job level and platform age are illustrated in Figure 5.7.

As shown in Figure 5.7(a), the lowest level of autonomy was reported by technicians and others in basic job grades. The highest level of autonomy was reported by personnel in the group whose job level could not be identified from the questionnaire data; this result is consistent with other evidence that suggested that this group consisted predominantly of specialist engineers and others whose work was relatively independent of that of most personnel on the platform. Personnel in other job level groups did not differ in perceived autonomy scores.

The results for platform age, Figure 5.7(b), showed that personnel reported significantly higher levels of autonomy on platforms in the 15+ years group as compared with the newer platforms, possibly as a result of reduced levels of supervision associated with down-manning on older platforms.

Drilling rigs (Group D). The same analysis carried out for the data relating to drilling rigs produced results comparable to those described above for production platforms. Thus, the job level factor was significant and the pattern of results very similar to that found among platform personnel. Age of the installation was also a significant factor on drilling rigs; in this case, personnel on rigs in operation for less than 5 years reported the lowest levels of autonomy.
5.4 TASK SKILL / VARIETY

The results of the analysis of scores on the skill/variety job characteristics dimensions are shown in Table 5.6. Company group, job type, and both covariates were highly significant predictor variables, but the interaction between company group and job type was non-significant.

Table 5.6
Analysis of scores on task variety/skill scale in relation to company groups and job types

<table>
<thead>
<tr>
<th>Measure</th>
<th>Main effects</th>
<th>Covariates</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variety/skill</td>
<td>F=4.87</td>
<td>F=16.89</td>
<td>F=44.88</td>
</tr>
<tr>
<td></td>
<td>df=3,1447</td>
<td>df=1,1447</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>p=.002</td>
<td>p&lt;.001</td>
<td>[+]</td>
</tr>
</tbody>
</table>

Overall model: F(32,1429) = 9.66, p<.001

The direction of the covariate effects are shown by the signs in the brackets
5.4.1 Company groups

Overall mean scores for each of the four company groups are shown in Figure 5.8 for the measure of task skill/variety; individual scores for each installation are also shown. Contrast tests showed that Company A had significantly higher scores than Company B (t=3.29, df=1456, p<.001), that Company Group C had a higher mean score than the combined average of Companies A and B (t=3.05, df=1456, p<.002), but that there was no overall significant difference between production platforms (Groups A, B, and C) and drilling rigs (Group D). Only in Group C were there significant differences between installations, F=6.67, df=4,362, p<.001; one installation (C5) had a particularly high mean score on this measure. This score was significantly higher than those of other installations in this group.

![Figure 5.8](image)

**Figure 5.8**
Mean skill/variety scores in relation to company groups and installations

5.4.2 Job types

Mean scores on the task skill/variety scale are shown in Figure 5.9 for each job type. Multiple comparison tests indicated that management personnel had higher scores than all other groups on this measure, while catering personnel reported lower scores than all other groups. Production personnel also had markedly low scores.

5.4.3 Covariate effects

Higher age and lower neuroticism were both significantly related to higher scores on the skill/variety measure. Thus, irrespective of particular job type or company, older personnel and those low in neuroticism reported more opportunity to work in an independently than their younger or more neurotic counterparts.
Figure 5.9
Mean skill/variety scores in relation to job type

Figure 5.10
Mean skill/variety scores on platforms and rigs in relation to job level
5.4.4 Skill/variety: Further analyses

The extended analysis model that included additional predictor variables was used to examine the extent to which other factors, over and above company group, job type, age and neuroticism predicted skill/variety scores.

Production platforms (Groups A, B, C). In this analysis, only one factor, job level, was found to be significant. As shown in Figure 5.10, higher job levels were associated with greater perceived skill/variety, $F(4,1028)=16.2, p<.001$, while scores for the job level ‘not applicable’ category were generally comparable with the supervisor job level.

Drilling rigs. The results of the analysis of skill/variety in the data from drilling rigs were similar to those above; job level was found to be the only significant predictor, $F(4,384)=2.98, p<.02$, although the effects (also shown in Figure 5.10) were less marked than those for platforms.

5.5 JOB CLARITY

Scores on the job clarity scale (which refers to the extent to which tasks are clearly structured and defined) were analysed in relation to company group, job types and the two covariates. As shown in Table 5.7, the overall effect of company group was not significant, but there was a significant interaction between company group and job type, indicating that the effect of job type was dependent on company group and vice versa.

| Table 5.7 |
| Analysis of job clarity in relation to company groups and job types |
| Measure | Main effects | Covariates | Interaction |
| Clarity | Company groups | Job type | Age | Neuroticism | Company x job type |
| ns | F=8.82, df=7,1447, p<.001 | F=21.14, df=1,1447, p<.001 | F=1.96, df=20,1427, p<.01 |
| Overall model: $F(32,1427) = 3.98, p<.001$; $R = .238, R^2 = .057$ |

The direction of the covariate effect is shown by the signs in the brackets
5.5.1 Job type
Multiple comparison tests identified two job groups on the basis of the job clarity scores: catering, construction and drilling were significantly higher in clarity than technical, management, production and administration/other jobs, the latter having a particularly low score. The interaction between company group and job type was found to be largely due to the different patterns of scores on platforms and drilling rigs. Figure 5.11 illustrates these results; two jobs, catering and construction were perceived to be higher in clarity by platform personnel as compared with those on drilling rigs, whereas the opposite was true of those in management and technical jobs.

![Figure 5.11](image)

**Figure 5.11**
Mean job clarity on platforms and drilling rigs in relation to job types

5.5.2 Covariate effects
Neuroticism was significantly related to job clarity scores, higher neuroticism being associated with lower ratings of clarity, but age was not a significant factor in this analysis.

5.5.3 Job clarity: Further analyses
Two factors were found to be significant in the extended analysis of job clarity scores. On production platforms, job level, F(4,1029)=4.29, p=.002, was inversely related to job clarity in a linear manner across the four identified job levels, higher job level being associated with lower clarity, i.e. with less clearly structured and defined work. In the remaining job level category, which did not fit into the hierarchical structure, scores were comparable to those in the higher two job levels.
The other significant predictor in this analysis was a variable representing whether or not an individual had one of several additional responsibilities (such as safety representative, or first aider); those who had such responsibilities perceived job clarity to be lower than those who did not have these additional roles.

5.6 JOB CHARACTERISTICS: OVERALL PROFILES

To summarise the main information presented in this section, overall profiles were plotted which allowed direct comparison of job characteristics across company groups (Figure 5.12), and across job types (Figure 5.13). In these diagrams, the data plotted are raw mean scores rather than adjusted means controlled for other predictors, but nonetheless they provide an overall representation of the nature and extent of variation in job characteristics across the main factors of interest.

In Figures 5.12 and 5.13, it is clear that the four job characteristics (workload, skill/variety, autonomy, and clarity) do not vary consistently in overall level; rather, the patterns represent significant interactions between job characteristics and groups, whether company groups or job types (p<.001 in each case). Thus, Company B reports high workload and low skill/variety scores relative to other company groups, while Group C shows particularly high levels of autonomy. Only job clarity shows an even profile across groups.

The pattern across job types also highlights important differences in the job characteristics profiles. For instance, catering personnel report levels of job skill/variety sharply lower than those of other job groups, but also relatively high level of autonomy and clarity. In contrast, management personnel have high levels of workload, skill/variety, and autonomy but low job clarity. The construction and drill crews both report high levels of clarity, but only the construction personnel are also high in autonomy.
Figure 5.12
Job characteristics profiles across company groups

Figure 5.13
Job characteristics profiles across job types
5.7 JOB CHARACTERISTICS

- Four job characteristics were measured: workload, autonomy, skill/variety, and clarity. Company groups and job types, either independently or in interaction, were significant predictors of each of these measures.

- The pattern of scores across company groups and across job types was different for each measure.

- Perceived workload on production platforms was higher than on drilling rigs, but there were no overall significant differences between platforms and rigs on other job characteristics measures.

- Hierarchical job level was linearly related to each of the job characteristics measures, higher job level predicted higher workload, autonomy, and skill/variety, and lower clarity. Additional responsibilities, e.g. fire team, were associated with higher perceived workload.

- Reported work hours per offshore week were significantly related to perceived workload.

- Overall, 38.4% of the sample reported work hours longer than standard 12-hour shifts. Among those at the most senior job level, 60.8% reported working >100 hours per week while offshore.
6. ASSESSMENT OF SAFETY

6.1 SATISFACTION WITH SAFETY PROCEDURES

6.1.1 Assessment

The extent to which offshore personnel were satisfied with safety measures and procedures on the installation was assessed using an 18-item scale. The safety features listed were of a general nature and potentially relevant to all offshore personnel (e.g. escape routes on the installation, communication of safety information). Participants rated each item on a five-point scale ranging from -2 (very dissatisfied) to +2 (very satisfied), with a neutral point of zero. The items were found to form a single global measure of general safety satisfaction; there was no evidence of separate subscales within the item set. For analysis, scores were re-coded to a 1-5 range, and summed to give a total score for the whole scale, for which the range of possible values was 18-90.

6.1.2 Company groups and job types

Scores on the general safety measure were analysed in relation to company groups and job types; the results are summarised in Table 6.1. Both factors showed highly significant main effects, but there was no interaction between them; thus, the pattern of scores across job types was similar for the four company groups. The two covariates included in the analyses were also highly significant; higher age and lower neuroticism predicted higher ratings of satisfaction with safety.

Table 6.1
Analysis of safety ratings in relation to company groups and job types

<table>
<thead>
<tr>
<th>Measure</th>
<th>Main effects</th>
<th>Covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Company groups</td>
<td>Job type</td>
</tr>
<tr>
<td>Satisfaction with safety</td>
<td>F= 9.32</td>
<td>F=8.21</td>
</tr>
<tr>
<td>measures</td>
<td>df=3,1446</td>
<td>df=7,1446</td>
</tr>
<tr>
<td></td>
<td>p&lt;.001</td>
<td>p&lt;.001</td>
</tr>
</tbody>
</table>

F(32,1424) = 5.72, p<.001; R = .317, R² = .100

Notes. The directions of covariate effects are shown by the signs in brackets. The company x job type interaction was non-significant.
**Company groups.** Tests of specific contrasts showed that mean scores on the safety rating scale were significantly different in Groups A and B (t=4.45, df=1453, p<.001), Group B having the higher mean score. Comparison of the combined mean for Groups A and B (both single operating companies) with Group C showed a significant difference, t=2.60, df=1453, p<.01, but this result was attributable to the relatively low Group A value. Groups B and C had closely comparable overall scores. Overall, production installations were not significantly different from drilling rigs in general safety scores.

The effects of company differences were further examined in analyses carried out within each company group separately. The results showed only marginally significant differences (p<.10) in safety ratings between platforms in Group B. However, within each of the other groups, differences between individual installations were highly significant; for Group A, F(2,350)=17.22, p<.001; for Group C, F(4,324)=5.17, p<.001; and for Group D (drilling rigs), F(5,363)= 3.10, p<.01. Thus, with the exception of Company B, safety ratings varied significantly across installations within company groups, as well as across the four company groups. These results are illustrated in Figure 6.1.

![Figure 6.1](image.png)

**Figure 6.1**

*General safety ratings in relation to company group and installation*

**Job types.** Overall differences in general safety ratings across job types were highly significant (see Table 6.1). The data (adjusted for company, age and neuroticism effects) are illustrated in Figure 6.2. Using Tukey’s multiple comparison test (with .05 significance level) two discrete subsets of job types were identified. Personnel whose work was primarily based in the accommodation and office areas
(management/supervisory, administration, and catering job types) formed one group; these personnel had relatively high scores indicating general satisfaction with safety measures. The second group included production, maintenance, technical, and construction job categories; in this group the level of satisfaction with general safety was significantly lower.

6.1.2 Further analyses of general safety ratings

Additional analyses were carried out to determine the extent to which a number of other factors, not considered above, also contributed to variation in general safety ratings. Included in this model were platform size and age, job level, operating company vs. contractor personnel, and responsibilities (e.g. fire team, emergency response team, helideck crew) additional to an individual’s main job.

These factors were evaluated as potential predictors over and above the factors examined in the main analysis. The analysis evaluated the unique contribution of each factor, taking into account all the other factors, including company group, job type, age and neuroticism. As previously, the analyses were carried out separately for platforms (Groups A, B, and C) and rigs (Group D) as it could not be assumed that the same pattern of findings would apply to fixed production installations and drilling rigs.
Production platforms: Groups A, B, and C. The results of the analysis are summarised in Table 6.2. Both platform age and platform size were highly significant predictors of the safety ratings. As shown in Figure 6.3, the newest and the largest platforms had the highest safety ratings. In addition, members of the helideck crew rated safety higher than those who did not have these responsibilities; this result appeared to be due to their higher ratings on particular items relevant to helideck duties.

<table>
<thead>
<tr>
<th>Predictor variables</th>
<th>df</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform size</td>
<td>2</td>
<td>6.21</td>
<td>p&lt;.002</td>
</tr>
<tr>
<td>Platform age</td>
<td>2</td>
<td>7.86</td>
<td>p&lt;.001</td>
</tr>
<tr>
<td>Job level</td>
<td>4</td>
<td>1.19</td>
<td>ns</td>
</tr>
<tr>
<td>Operating company vs. contractor personnel</td>
<td>1</td>
<td>1.51</td>
<td>ns</td>
</tr>
</tbody>
</table>

Additional work roles:
- Helideck crew     1   4.39  p<.05
- Fire team         1   1.43  ns
- Emergency response team 1  1.30  ns
- Other role (e.g. first-aider, safety rep) 1  <1  ns

Overall model: F(24,1026) = 8.19, p < .001
Multiple correlation, R = .40, R² = .16

Company group, job type, age, and neuroticism were also included in the model. All factors were corrected for the effects of these variables, and for all other factors shown.

Drilling rigs: Group D. An analysis similar to that reported above was carried out on the data for the six drilling rigs in Group D. None of the factors examined was found to be significant over and above the effects of job type, age and neuroticism.
6.2 PERCEIVED SAFETY OF SPECIFIC WORK ACTIVITIES

In addition to the general safety assessment, participants were asked to assess the safety of each of a set of specific work activities (e.g. drilling, production, construction, and deck operations). All participants were asked to respond to all items, as applied to their particular installation, using the response format -2 (very unsafe) to +2 (very safe). This scale was recoded to 1-5 for analysis purposes. A ‘not applicable’ category was included for some activities, e.g. drilling, which did not apply on all installations. Participants were also asked to indicate whether their jobs involved them directly in the activities listed.

In analysing these data, an overall score representing the average of the eight item scores was derived, but scores for each item were also examined separately in relation to whether or not the individual was directly involved in the work activity concerned. A separate item concerned with helicopter travel to/from the installation was also included in the questionnaire; it was not added into the overall scale score, but analysed as a single item. The main findings derived from analyses of these data are summarised in the following sections.

6.2.1 Analysis of total scores

The analysis of total scores on the specific safety scale followed the same pattern as described above for the general safety scale.

- Total scores were examined in relation to company groups, job types, age and neuroticism. Scores were not significantly different across company groups, nor were there significant differences between production platforms and drilling rigs. However, there were significant differences between personnel in different jobs, F(7, 1204)=3.72, p<.001. Multiple comparisons, using Tukey’s test, showed that management/supervisory personnel had more favourable safety perceptions than personnel in all other jobs except administration and catering. Age and
neuroticism also predicted overall scores (p<.001 in each case), higher age and lower neuroticism being associated with higher perceived safety ratings.

- Further analyses of the total scores demonstrated that, on production platforms but not on drilling rigs, age and size of platform were also significantly related to the total score on the safety scale. Perceived safety was lower for older platforms, the effect being particularly marked for platforms which had been in operation for more than 15 years. The relationship between size and perceived safety was non-linear, the lowest scores being those for medium-sized platforms (POB, 76-140).

### 6.2.2 Analysis of individual safety items

Individual item scores on the specific safety scale were analysed to determine whether personnel who were directly involved in any particular work activity responded differently from those who were not directly involved. Two further factors examined in these analyses were ‘management’ vs. ‘others’ (i.e. all non-management job types), and production platforms vs. drilling rigs. However, initial analyses showed that, for all items except those relating to the perceived safety of drilling and deck operations, the comparison between platforms and drilling rigs was non-significant, both as a main factor and in interaction with other factors. This factor was therefore dropped from the analysis of items other than drilling and deck activities. Two covariates, age and neuroticism, were included in the analyses for control purposes.

It was necessary to carry out these analyses separately for each work activity item as membership of the groups representing ‘involved’ or ‘not involved’ in the activity concerned was different for each item. Both this factor, and the factor representing ‘management’ vs. ‘other’ personnel were found to be significant in each analysis, but there was no evidence of interactions between the two factors. The results for the factor representing personnel involved in the particular activity vs. those not directly involved, together with the numbers of personnel in each group for each analysis, are summarised in Table 6.3. The profile of results for this factor is shown in Figure 6.4, and that for management vs. ‘other’ personnel in Figures 6.5.

**Perceived safety of specific work activities.** Several points of interest are apparent from the data in Table 6.3 and Figure 6.4.

- Mean scores (on a 1-5 scale) on all items are relatively high irrespective of whether the individuals worked in the area concerned. Thus, the data do not suggest that there are intense concerns about the safety of specific offshore work activities in the sample as a whole.

- The final item, helicopter travel to and from the installation, of which everyone had direct experience, also shows a relatively high overall mean score; again, therefore, the data do not indicate that offshore personnel as a group are seriously uneasy about the safety of helicopter flights, although high levels of concern among a few individuals would not be apparent in the data presented.
Table 6.3
Perceived safety of specific work activities as reported by personnel working in the areas concerned or in other areas

<table>
<thead>
<tr>
<th>Type of work activity/operation</th>
<th>Mean safety ratings</th>
<th>Significance of difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine production process**</td>
<td>4.26 (n=298)</td>
<td>F(1,1013)=27.2 p&lt;.001</td>
</tr>
<tr>
<td>Other production operations**</td>
<td>4.12 (n=274)</td>
<td>F(1,1007)=13.8 p&lt;.001</td>
</tr>
<tr>
<td>Maintenance</td>
<td>4.00 (n=471)</td>
<td>F(1,1312)=26.3 p&lt;.001</td>
</tr>
<tr>
<td>Deck/crane/scaffolding ¹</td>
<td>4.31 (n=235)</td>
<td>F(1,1389)=44.3 p&lt;.001</td>
</tr>
<tr>
<td>Drilling ¹</td>
<td>3.99 (n=307)</td>
<td>F(1,1164)=31.1 p&lt;.001</td>
</tr>
<tr>
<td>Construction</td>
<td>3.98 (n=158)</td>
<td>F(1,1000)=12.3 p&lt;.001</td>
</tr>
<tr>
<td>Work with radio-active (RA) materials</td>
<td>4.13 (n=78)</td>
<td>ns</td>
</tr>
<tr>
<td>Catering/flotel</td>
<td>4.52 (n=119)</td>
<td>F(1,1409)=54.1 p&lt;.001</td>
</tr>
<tr>
<td>Helicopter travel to and from installation</td>
<td>Overall mean 3.99 (n=1435)</td>
<td></td>
</tr>
</tbody>
</table>

Age, neuroticism, and the factor representing management vs. other personnel were included in all analyses as control variables.

** Data from production platforms only

¹ Significant interaction with platforms vs. drilling rigs

- Personnel whose jobs directly involved them in a particular work activity had consistently higher scores than those not involved in that activity. Thus, direct experience of particular operations was associated with greater perceived safety relative to that reported by personnel without direct experience. This difference was significant for every type of activity except ‘work involving radio-active materials’ (which was only relevant to a small proportion of personnel). Neuroticism was a significant covariate in each of the analyses (high neuroticism being associated with low safety ratings), again demonstrating the major role played by this personality characteristic in determining how individuals perceive their environment.
Figure 6.4
Perceived safety of different work activities: Personnel working in the area compared with those not directly involved

Figure 6.5
Perceived safety of different work activities: Management and non-management personnel compared
Management personnel. The analyses of individual safety items also took into account overall differences between personnel in management roles (who have responsibilities which go beyond the specific areas of work considered here) and those in other types of jobs. The results showed that management gave significantly higher safety ratings than other personnel to almost all the specific activities listed; only for construction and helicopter were differences between management and other personnel non-significant (see Figure 6.5). In general, the ratings made by the management personnel were comparable to those of the operating group with direct experience of the tasks involved.

Production platforms compared with drilling rigs. The factor representing type of installation (i.e. the comparison between production platforms and drilling rigs) was also examined in these analyses (except for the items relating to production processes which did not apply on drilling rigs), but it played a significant role for only two items, drilling and construction. For both these items, there was a significant interaction (p<.001 in each case) between type of installation (platforms vs. rigs) and the factor representing whether or not the individual was directly involved in the activity. These significant interactions indicate that, as shown in Figure 6.6, different patterns of results apply to drilling rigs and production platforms.

The main point of interest in Figure 6.6 is that personnel on production platforms perceive the safety of drilling operations to be relatively low; this is especially true of those not working in the drilling areas. In contrast, platform personnel, especially those directly involved, give relatively high safety ratings to deck operations as compared with their counterparts on drilling rigs.
6.3 SAFETY RELATIVE TO NORTH SEA INSTALLATIONS IN GENERAL

A single item sought to discover how the offshore personnel in the present sample viewed the overall safety of their installations relative to North Sea oil and gas installations in general. The response scale ranged from -3 (much less safe) to +3 (very much safer) with zero as the neutral point. The most marked feature of the distribution of responses was that only a very small percentage (6.1%) of personnel in the present sample judged the installation on which they worked to be below-average relative to the North Sea as a whole. In contrast, 60% of respondents considered their installation to be above-average in safety.

This form of distribution with the great majority of responses towards the top end of the scale applied across all four company groups; relative to the magnitude of this effect, differences between companies were relatively small although they were significant (chi-square = 10.5, df=3, p<.02, Kruskal-Wallis non-parametric test). Distributions of responses for each company group are shown in Figure 6.7. One platform accounted for most of the low ratings in Company A, while two platforms largely accounted for the relatively high proportion of maximum ratings recorded by personnel from Company Group C.

![Figure 6.7](image)

**Figure 6.7**
Overall safety perceptions relative to North Sea installations in general
6.4 ASSESSMENT OF SAFETY

- Scores on the scales assessing offshore safety reflected general satisfaction with safety measures and procedures, although there was significant variation across company groups, installations, and job types.

- Personnel whose jobs were based primarily in the accommodation and office areas were more satisfied with safety measures and procedures than those who worked outside these areas.

- Platform age and size were both significant factors, newer and/or larger platforms being rated more favourably.

- The safety of any particular work activity was consistently rated more highly by those who were directly involved in that activity than by other personnel.

- Management personnel tended to perceive the safety of all the work activities assessed more favourably than other job groups.

- Almost all personnel considered the installation on which they worked to be average or above-average in safety compared with other installations in the North Sea.
7. PSYCHOLOGICAL WELL-BEING

7.1 GENERAL WORK SATISFACTION

Two facets of overall satisfaction with the work situation were assessed; the ‘job satisfaction’ scale (7 items) focused on satisfaction with the job itself and the content of work tasks (including responsibility, interest, use of abilities, control over work tasks), while the ‘job prospects’ scale (9 items) assessed satisfaction with broader aspects of employment, including job security, manning levels, opportunities for promotion, and future career prospects. Each item had a five-point response scale, ranging from -2 (‘very dissatisfied’) to +2 (‘very satisfied’), with zero as the neutral point. For analyses purposes, responses were recoded to a 1-5 scale, and mean item scores were calculated for each measure. The overall mean item score for the job satisfaction scale was 3.55 ± 0.77, as compared with 2.76 ± 0.83 for the scale assessing job prospects.

7.1.1 Job satisfaction

The results of the initial analysis of job satisfaction scores (using company and job types as factors, and age and neuroticism as covariates) are shown in Table 7.1. Both the factors and the covariates were highly significant predictors, but there was no significant interaction between company and job types (i.e. the pattern of scores across company groups was the same for all job types, and vice versa).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Main effects</th>
<th>Covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Company groups</td>
<td>Job type</td>
</tr>
<tr>
<td>Job content</td>
<td>F=4.32</td>
<td>F=15.92</td>
</tr>
<tr>
<td></td>
<td>df=3,1441</td>
<td>df=7,1441</td>
</tr>
<tr>
<td></td>
<td>p&lt;.005</td>
<td>p&lt;.001</td>
</tr>
</tbody>
</table>

F(12,1441) = 21.05, p<.001 \( R^2 = .149 \)

Notes. The interaction between company group and job type was non-significant. The direction of the covariate effects are shown by the signs in the brackets.
Company groups. Figure 7.1 shows the mean job satisfaction score in each company group, and for each installation within the groups. Company A and Company B differed in overall satisfaction levels (t=3.15, df =1450, p<.01), Company A having a higher average level. However, the overall average for Companies A and B was significantly lower than the average value for Company Group C (t=3.08, df=1450, p<.01). No significant difference was found between the means for production platforms (Groups A, B, and C) and for drilling rigs (Group D).

Within the separate company groups, no significant differences were found between the Company A platforms, or between Company B platforms, or between the drilling rigs in Group D. However, there was a significant differences within Group C, F(4,323)=3.41, p<.01, this result being largely due to the high level of job satisfaction on the C5 platform.

![Figure 7.1](image)

Job satisfaction in relation to company groups and installations

Job types. Mean job satisfaction scores for the eight job types (adjusted for other variables in the model) are shown in Figure 7.2. Multiple comparison tests revealed that management personnel reported significantly high levels of job satisfaction, and those in production and catering jobs reported significantly low levels. However, differences across the remaining six job types were generally non-significant.

Covariates. Both neuroticism and age were highly significant covariates in the analysis of job satisfaction. Neuroticism was negatively related to satisfaction
scores, while age showed a positive relationship, older personnel reporting higher levels of satisfaction.

7.1.2 Job satisfaction: Further analyses

An analysis using an extended set of predictor variables showed that, on both production platforms and drilling rigs, job level was the only significant predictor of job satisfaction over and above those already considered. The relationship between job level and job satisfaction was highly significant, \( F(4,1431)=10.15, p<.001 \). Over the four hierarchically-ordered job levels, the trend was approximately linear. Highest job satisfaction was reported by those at the most senior job level, satisfaction decreasing at lower job levels. The ‘N/A’ group whose job level did not fall within the hierarchical structure, showed job satisfaction scores similar to those of the second job level category, supervisory personnel.
7.1.3 Job prospects

Analysis of scores on the scale that assessed satisfaction with job prospects took the same form as that used for the job satisfaction scale. As shown in Table 7.2, all the main factors in the analysis were significant, as was the interaction between the two main factors, company groups and job types. The significance of this interaction indicates that the pattern of scores across job types differs across companies.

Table 7.2
Job prospects scores in relation to company groups and job types

<table>
<thead>
<tr>
<th>Measure with job prospects</th>
<th>Main effects</th>
<th>Covariates</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company groups</td>
<td>Company</td>
<td>Job type</td>
<td>Age</td>
</tr>
<tr>
<td></td>
<td>groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>F=17.40</td>
<td>F=10.39</td>
<td>F=3.96</td>
</tr>
<tr>
<td></td>
<td>df=3,1439</td>
<td>df=7,1439</td>
<td>df=1,1439</td>
</tr>
<tr>
<td></td>
<td>p&lt;.001</td>
<td>p&lt;.001</td>
<td>p=.05</td>
</tr>
<tr>
<td></td>
<td>[~]</td>
<td>[~]</td>
<td></td>
</tr>
</tbody>
</table>

Overall model: $F(32, 1419) = 21.06, p<.001, \quad R^2 = .146$

**Note.** The directions of the covariate effects are shown by the signs in the brackets

**Company groups.** Figure 7.3 shows the mean job prospects score in each company group, and for each installation within the groups. There was no significant difference between Company A and Company B in overall scores on this measure, but Company Group C had significantly higher overall scores than Companies A and B combined, $t=2.52, df=1448, p<.02$. However, the most marked difference in the job prospects scores was that between platforms and drilling rigs, the latter showing significantly higher overall scores, $t=9.41, df=1448, p<.001$.

Analyses carried out within company groups showed that there were significant differences between installations in each group; these differences were least marked in Company B, and most marked in the more heterogeneous groups, Group C and Group D. As was also evident in the analysis of job satisfaction, scores on the job prospects scale were particularly favourable on the C5 installation.
Figure 7.3
Satisfaction with job prospects in relation to company groups and installations

**Job types.** As shown in Table 7.2, the interaction between company group and job type was highly significant, indicating that the pattern of scores across job groups differed across companies. This pattern is illustrated in Figure 7.4. Overall differences between jobs are reflected in the relative position of the lines, while the mean scores for the different companies in each job group are indicated by the symbols.

The interaction effect is consistent with the fact that, although Company B has the lowest (or nearly the lowest) scores for most job categories, in two job groups, catering and technical, the scores for Company B tend to be higher than for job other groups. Similarly, Company Group D has high scores in most, but not all, job groups; for instance, there is a relatively low mean score among catering personnel on the Group D drilling rigs.

**Covariates.** Both covariates (neuroticism and age) were significant in the analysis of the job prospects scores.

- **Neuroticism** was negatively related to satisfaction with job prospects; thus, individuals higher in neuroticism perceived their job security and career prospects more negatively than those low in neuroticism.
Age, tested as a linear term, was not a strong predictor of scores on the job prospects scale, only just reaching the .05 significance level. However, further analyses revealed that the data were better fitted by a regression model which included a curvilinear age term. In this analysis, a weak linear term ($t=-1.96$, $p = .05$), and a highly significant quadratic term ($t=4.28$, $p<.001$), were found to predict satisfaction with job prospects over and above job type, company group, and neuroticism.

The curvilinear relationship between age and job satisfaction is shown diagrammatically in Figure 7.5. The method used in this analysis was such that the exact level of the curve, but not its shape, is determined by the arbitrarily chosen ‘reference’ groups in the analysis, in this case Company Group C, and maintenance job type.

As shown in this figure, both younger and older personnel reported greater satisfaction with job prospects than did those in the middle range of age. The lowest level of satisfaction with job prospects was reported by those in the age range 39 - 44 years.
7.1.4 Job prospects: Further analyses

A further analysis of job prospects scores was carried out to examine the significance of several additional predictor variables (job level, employer, platform age, platform size), over and above company group, job type, age and neuroticism. These analyses were carried out using the data from production platforms. The main significant findings are summarised below, and shown in Figure 7.6.

**Job level.** Higher job level was associated with higher scores on the satisfaction with job prospects measure, $F(4,1026)=6.92$, $p<.001$. The pattern of results is shown in Figure 7.6(a).

**Employer.** Operating company personnel reported significantly lower scores on the job prospects measure than contractor personnel, $F(1,1026)=4.30$, $p<.05$. (Figure 7.6b)

**Platform size and age.** Both platform size, $F(2,2026)=7.63$, $p<.001$, and age, $F(2,2026)=14.96$, $p<.001$, were highly significant predictors of reported satisfaction with job prospects (Figure 7.6c and Figure 7.6d)
Overall level of mental health was assessed by the 12-item General Health Questionnaire (GHQ), which asks respondents to what extent they have experienced each of 12 symptoms of psychological distress over the previous six-week period. Responses were scored using the 0-0-1-1 format (Goldberg, 1978); in this method of scoring, the first two points of the four-point response scale (‘not at all’, and ‘no more than usual’) score zero, while the last two points (which represent responses of worse than usual or much worse than usual, the exact form of wording depending on the item) score one. A total score is calculated by summing the scores on individual items.

The overall proportion of personnel with ‘high’ GHQ scores was 14.6% (N = 1460), taking the recommended 2/3 cutting point (Banks et al. 1980) as the basis for identifying high scorers (i.e. those whose scores indicate possible clinical or near-
clinical levels of distress). This proportion can be compared with other data, collected by the medical department of a large North Sea operating company over approximately the same time period as in the present study. In these data (obtained from N=334 offshore personnel), the proportion of high GHQ scores was 14.1% (Forbes, personal communication, 1996). Thus, although differing in data collection method, the two studies agree closely in this overall index of mental health in the offshore population.

Comparisons with data from onshore samples are also of interest. Consistent with the above-average health status of the offshore population, and their generally favourable personality characteristics (see Section 3.3), the proportion of ‘high’ GHQ scores in the present sample was lower than published data for cross-sections of the male population employed onshore. For instance, in a recent survey carried out in several UK manufacturing companies (Wall et al. 1995), the overall proportion of ‘high’ GHQ scores (based on the 2/3 cutting point for the 12-item GHQ, as in the present study) among male participants (N=651) was 25.0% (Wall, personal communication, 1996). This level is significantly different from, and higher than, the overall rate of 14.6% in the present sample ($\chi^2 = 84.94$, df=1, p<.001).

Similarly, in a large sample of civil servants, the proportions of male employees with ‘high’ GHQ scores (based on a 5/6 cutting point for the 30-item GHQ), varied between 21.6% and 24.8% in different job grades (Stansfield & Marmot, 1992). However, in the present study, there were no significant differences in the proportions of personnel with ‘high’ GHQ scores across company groups, job types, job levels, or groups distinguished on the basis of employer (i.e. operating company, contractors, or drilling operator personnel).

### 7.2.2 Anxiety

Overall GHQ scores are a relatively insensitive measure in that they combine a number of different symptom types; furthermore, if items are dichotomously coded (as above, in the identification of ‘high’ overall scores), they produce markedly skewed distributions with many scores clustered at the low end of the scale and a long tail of high scores.

For the purpose of examining predictive factors in the present study, therefore, attention was focused primarily on the 7-item GHQ anxiety measure; for these analyses, items were scored on a 0-1-2-3 scale, differentiating between each of the four points of the original response format (Goldberg & Hillier, 1979). Using this method of scoring, the mean total score on the anxiety scale was $4.13 \pm 3.65$. The results of the initial analysis in which company group, job types, age and neuroticism were used as predictors are shown in Table 7.3.

Neuroticism was by far the strongest predictor of anxiety, highlighting the central role played by this personality trait in mental health. Two other factors, age and job type, were also significant, although they accounted for much less of the variance in anxiety than neuroticism. As a linear term, age was positively and significantly related to anxiety, but further analysis revealed a weak (p<.10) curvilinear trend
whereby individuals towards the upper end of the age range tended to show lower anxiety than would be predicted solely by the positive linear trend.

**Table 7.3**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Company groups</th>
<th>Job type</th>
<th>Age</th>
<th>Neuroticism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>ns</td>
<td>F=2.27</td>
<td>F=5.86</td>
<td>F=620.32</td>
</tr>
<tr>
<td></td>
<td>df=7,1447</td>
<td>df=1,1447</td>
<td>df=1,1447</td>
<td>df=1,1447</td>
</tr>
<tr>
<td></td>
<td>p&lt;.03</td>
<td>p&lt;.02</td>
<td>p&lt;.001</td>
<td>p&lt;.001</td>
</tr>
</tbody>
</table>

Overall model: $F(12,1447) = 55.34$, $p<.001$, $R^2 = .315$

**Notes.** The company group x job type interaction was non-significant. The direction of the covariate effects are shown by the signs in the brackets.

**Company groups and installations.** Although there were no overall differences in anxiety levels across company groups, there were significant differences between installations in two of the groups. First, levels of anxiety differed significantly among the three installations in Company Group A, $F(2, 365) = 4.30$, $p<.02$, one installation (A2) showing a particularly high level compared with the other two platforms in this group. Second, the drilling rigs in Group D differed significantly in mean anxiety levels, $F(5, 391) = 3.30$, $p<.01$, two installations (D4 and D6) showing high levels relative to the other drilling rigs in this group.

**Job type.** In the present context, the significant relationship between job type and anxiety was the main focus of interest. Mean anxiety scores for job groups are shown in Figure 7.7. Four job types (catering, production, management and drilling) had relatively high scores in comparison with other personnel, but multiple comparison tests primarily distinguished catering personnel as being significantly different from the two groups with lowest anxiety, maintenance and technical personnel.

**Further analyses.** Extending the analysis to the larger set of predictor variables, including employer, job level, platform size and age, and additional responsibilities, yielded only one finding above a chance level; members of the emergency response team reported significantly higher levels of anxiety, $F(1,1439) = 5.28$, $p<.025$, than those who did not have this responsibility.
Comparison with previous data. It is also relevant to compare the anxiety levels reported here with those obtained in previous work using the same GHQ scale. Thus, the mean anxiety score for production personnel in the present study (4.58 ± 3.77) was significantly higher ($t=3.13$, $df=305$, $p<.01$) than the corresponding mean score (3.42 ± 3.42) in data collected from offshore production personnel in 1990 (Parkes, 1993). This study also showed that personality factors and, more importantly, personality factors acting in combination with environmental characteristics, were the major determinants of mental health outcomes. There was some evidence of similar patterns in the present data, but such analyses were outside the scope of the present report.

7.2.3 Social dysfunction

The GHQ ‘social dysfunction’ subscale assesses the extent to which individuals feel demoralised, unable to make decisions, and dissatisfied with life in general. As for the anxiety subscale, the social dysfunction measure had 7 items, with responses scored on a four-point (0-1-2-3) scale; the overall mean total score was 6.98 ± 1.80.

The scores were analysed in relation to company groups and job types, with neuroticism and age as covariates. Neither company groups, nor job types, were significant factors in this analysis, although neuroticism and age were both positive and significant predictors.

However, within two of the company groups, there were significant differences between installations. In Company Group A, installation A2 had a high mean score (7.70) on the social dysfunction scale (indicating low morale) relative to other
platforms in this group. In Company Group B, B1 had the least favourable score (7.32), B3 was intermediate (6.97), and B2 had the most favourable score (6.43). There were no significant differences in mean social dysfunction scores between installations within Groups C and D.

7.3 PSYCHOLOGICAL WELL-BEING: THE ROLE OF JOB CHARACTERISTICS

In the analyses presented so far in this report, perceived job characteristics (workload, autonomy, skill/variety, and clarity) and measures of psychological health have been examined separately in relation to company groups and job types. However, from a theoretical perspective, objective work factors (such as job type) are seen as influencing health-related outcomes through the intermediate processes of perception and appraisal (e.g. Israel et al. 1992; Lazarus, 1991). Thus, theoretical models propose a sequence by which objective characteristics influence individual perceptions of the work situation, and these perceptions in turn influence well-being.

Some preliminary analyses were carried out to determine to what extent the present data reflected this theoretical model. Thus, these analyses examined the role of job characteristics as intermediate variables or ‘mediators’ of relations between objective factors (job type and company group) and measures of psychological well-being (job satisfaction and anxiety). The analyses involved testing a sequence of predictive models which evaluated relations between job type and measures of psychological well-being, with and without including measures of perceived job characteristics. The findings were consistent with the view that job perceptions act as intermediate variables in the sequence by which objective work factors impact on health.

In particular, it was found that differences in job satisfaction between different job types were primarily attributable to differences in two job characteristics variables, task skill/variety and clarity. Jobs which were perceived as affording higher levels of one or other, or both, of these characteristics were associated with higher levels of job satisfaction. However, it was also clear that this process did not entirely account for the relationship between job type and job satisfaction, and that other factors were also involved. Relations between job type and anxiety were found to be primarily mediated by workload. As described in Section 5.2, certain jobs (e.g. management, catering and drilling) were perceived as high in workload, and high workload in turn predicted high anxiety. Low job clarity also played a significant role in relations between job type and anxiety, but the skill/variety measure was not a significant factor in these results. Further exploration of these pathways, although important in understanding the processes by which psychological well-being is influenced by work conditions, was outside the scope of the present work.
7.4 PSYCHOLOGICAL WELL-BEING

Job satisfaction

- Job satisfaction differed significantly across job types, but there was no overall difference between production platforms and drilling rigs.
- Management personnel reported significantly higher, and production and catering personnel significantly lower, job satisfaction than other groups.
- Job level and age were directly related to job satisfaction.

Satisfaction with job prospects

- Company group and job type jointly predicted job prospects (i.e. job security, promotion opportunities, future career prospects).
- Age showed a curvilinear relationship to satisfaction with job prospects; both younger and older personnel had more favourable scores than those in the middle age range.
- Several other variables, including platform age and size, and job level, also predicted job prospects scores.

Mental health

- The proportion of high scorers on a standard measure of ‘stress’ symptoms was 14.6%, in close agreement with other recent offshore data. This proportion did not vary across company groups or job types.
- Anxiety differed significantly across job types; catering, production, management and drilling personnel tended to have high scores relative to other groups.
- Job characteristics were found to play a significant role in the link between objective predictors (e.g. job types and company groups) and measures of psychological well-being.
8. HEALTH PROBLEMS AND HEALTH BEHAVIOURS

8.1 INITIAL ANALYSES OF HEALTH PROBLEMS

8.1.1 Assessment

Minor health problems were assessed by an eight-item checklist, used previously with process-control workers in the Norwegian chemical industry (Vaernes et al. 1988). For each of the health problems listed, participants reported whether or not they had experienced it during offshore work periods over the previous six weeks, and if so, to rate its severity. Responses were coded 0-3, with zero representing negative responses, and 1-3 representing mild, moderate, or severe positive responses. Thus, the maximum score was 24 (although only five individuals had scores of 17 or more).

8.1.2 Distributions of overall scores

Table 8.1 shows the percentage of responses falling into each category for each item. The distribution of responses was highly skewed, with a majority of zero scores on each item, and the highest level of severity being endorsed by less than 3% of the sample on each item (except for sleep problems, 5.2%). However, only 23.5% of the sample had zero scores on all the health items listed.

| Table 8.1 |
|---|---|---|---|
| **Minor health problems: Percentage of responses in each category** | **No reported problem** | **Severity** | **% of sample** |
| | 0 | Mild 1 | Moderate 2 | Severe 3 |
| **Sleep disturbance** | 54.6 | 20.1 | 20.1 | 5.2 |
| **Headache** | 62.0 | 20.0 | 15.5 | 2.5 |
| **Musculo-skeletal** | | | | |
| Neck pain | 77.1 | 11.6 | 9.7 | 1.5 |
| Shoulder pain | 82.6 | 7.6 | 7.9 | 1.9 |
| Back pain | 69.9 | 16.3 | 11.1 | 2.7 |
| **Gastric problems** | | | | |
| Indigestion | 78.5 | 12.4 | 7.6 | 1.4 |
| Heartburn | 81.4 | 10.5 | 6.5 | 1.6 |
| Stomach | 88.1 | 7.3 | 3.8 | 0.9 |
| **Total scores** | 0 | 1 - 2 | 3 - 5 | 6+ |
| **% of sample** | 23.5 | 30.9 | 25.1 | 20.4 |

*Sample size: 1452 - 1458*
8.1.3 Distributions of total scores across job types

Variation in the reported incidence and severity of minor health problems across company groups and job types was evaluated using the Kruskal-Wallis one-way non-parametric analysis. There were no significant differences across company groups, but personnel in different types of jobs differed significantly in total scores on the health problems scale, $\chi^2 = 29.8$, df=7, $p<.001$. The results indicated that drillers reported the highest scores, followed by production and construction personnel, while technical personnel tended to have the lowest overall scores.

![Figure 8.1](image)

**Overall severity of health problems in relation to job type**

These results are illustrated in Figure 8.1 which shows profiles across job groups for total scores falling in four ranges shown in Table 8.1. Consistent with the statistical analysis, the drilling job type had the smallest percentage personnel with zero scores, and the largest percentage with scores in the highest band (total scores of 6 or more). Conversely, the technical, catering, and administration groups had the highest percentages of personnel with scores in the lowest two bands (2 and less).

8.2 CATEGORIES OF HEALTH PROBLEMS

Examination of the raw data revealed that the three items concerned with musculoskeletal problems (neck, shoulder and back pain) could be combined in a single measure, and similarly the three items concerned with gastric problems (indigestion, heartburn, and stomach problems) could also be combined. For these two composite measures, observed scores for the three items were summed to give an overall score, transformed to a range of 0-3. The remaining two items, sleep problems and headaches, were treated as separate measures, also with a 0-3 range of scores. Further analyses were carried out using these composite scores; in analysing these
data, it was necessary to use methods appropriate to the highly skewed distributions of the measures.

An initial analysis was carried out to examine scores for the four separate health problems categories (sleep, musculo-skeletal, gastric problems, and headaches) in relation to job type. As shown in Table 8.2, significant results were found for each category, except gastric problems. These results are illustrated in Figure 8.2.

Table 8.2
Health problems categories: Significance of job types

<table>
<thead>
<tr>
<th>Category of health problem</th>
<th>Sleep disturbance</th>
<th>Gastric</th>
<th>Musculo-skeletal</th>
<th>Headaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>df = 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$p &lt; .001$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ns</td>
<td></td>
<td>$28.8$</td>
<td></td>
<td>$17.2$</td>
</tr>
<tr>
<td>df = 7</td>
<td></td>
<td>$p &lt; .001$</td>
<td></td>
<td>$p &lt; .02$</td>
</tr>
<tr>
<td>$p &lt; .001$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Tests were carried out using the Kruskal-Wallis non-parametric analysis.
In Figure 8.2, the relative sizes of the shaded areas reflect the overall incidence of each category of problem (in terms of the proportions of personnel with non-zero scores), while the profiles show the variation across job types. The two job types showing the highest levels of health problems are production and drilling, and in each case, sleep problems make a major contribution. For the drilling group, musculo-skeletal problems are also relatively high.

8.3 MULTIVARIATE PREDICTIVE MODELS

The analyses reported above provide information about the nature and severity of health problems in relation to job types. The statistical methods used did not allow more than a single predictor variable to be examined in the same analysis, although a number of other work-related factors are also likely to have implications for minor health problems.

Furthermore, individual differences in neuroticism are also known to predict responses to the health scale used (Parkes, 1993). Therefore, it was necessary to extend the analyses reported above by evaluating several predictor variables simultaneously; for this purpose, multivariate methods were required. In view of the skewed distribution of the data (see Section 2.6), dichotomous health scores were created, and logistic regression methods of analysis were used.

For the overall scale score, the sample was divided into two approximately equal groups, the dichotomy distinguishing between those with scores of 2 or less (54.4%), and those with scores of 3 or more (45.6%) (see Table 8.1). For the separate categories of health problems (sleep, gastric, musculo-skeletal and headache), the cut-point distinguished between those with zero scores and those with scores of 1 or more, using the scoring method described in Section 8.2.

The predictor variables examined initially in these analyses were company group (and also platform vs. drilling rig differences), employer (operating company vs. contractor vs. drilling operator), job type, job level, and shift pattern. Two individual difference variables, age and neuroticism, were also included.

Company groups, platforms vs. rigs, employer, and job levels were not found to be significant predictors of health outcomes. These variables were therefore dropped from the analysis model, which was restricted to job level, shift patterns, age and neuroticism. The results of the analyses are summarised in Table 8.3.

Different patterns of findings are apparent for the overall total measure, and the four separate categories of health problem. Whilst both job type and shift pattern were significant in the overall analysis, for the separate problem categories, either shift pattern or job type was significant but not both of these factors. Only neuroticism was a significant predictor of all the health outcome measures. Several further points of interest are noted in the following paragraphs.
Table 8.3
Multivariate analyses of health measures: Significance of predictor variables

<table>
<thead>
<tr>
<th>Measure</th>
<th>Categorical variables</th>
<th>Covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Job type</td>
<td>Shift pattern</td>
</tr>
<tr>
<td>OVERALL TOTAL</td>
<td>p&lt;.02</td>
<td>p&lt;.02</td>
</tr>
<tr>
<td>Sleep</td>
<td>ns</td>
<td>p&lt;.001</td>
</tr>
<tr>
<td>Gastric</td>
<td>ns</td>
<td>p&lt;.01</td>
</tr>
<tr>
<td>Musculo-</td>
<td>p&lt;.001</td>
<td>ns</td>
</tr>
<tr>
<td>skeletal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Headache</td>
<td>p&lt;.02</td>
<td>ns</td>
</tr>
</tbody>
</table>

Scores on each of the health measures were dichotomised. For the overall measure, the cut-point was 2/3, using the overall totals shown in Table 8.1; for each of the separate category scores (calculated as described in Section 8.2), the cut-point was 0/1. All predictor variables were entered simultaneously. The tests of significance were based on Wald’s statistic. For job type, df=7; for each of the other variables, df=1.

- **Shift pattern.** Consistent with the literature that identifies disruption of circadian rhythms as a causal factor in sleep disorders and gastrointestinal problems, shift pattern was a significant predictor of both sleep disturbance and gastric problems. Thus, among those exposed to day/night shift rotation, reported incidence of these problems was higher than that among personnel not working rotating shifts (the great majority of whom worked days shifts only, although a small proportion, mainly catering personnel, worked nights only). The relative risk values associated with day/night shift rotation were 1.41 for sleep problems, and 1.18 for gastric problems.

These results are reflected in the actual proportions of personnel reporting sleep problems. Among those working day/night rotating shifts, 55.5% reported sleep problems as compared with 36.9% of those not working rotating shifts. Similarly, for gastric problems, the corresponding values were 35.1% (day/night rotating shifts) as compared with 27.8% (fixed shift pattern).
• **Job type.** The findings relating to job type shown in Table 8.3 are similar to those reported in Section 8.2, with the exception of the results for sleep disturbance. In the logistic regression, job type did not predict sleep disturbance whereas the non-parametric analysis had shown a significant effect. This apparent discrepancy was attributable to the inclusion of shift pattern as a factor in the logistic regression; when the shift pattern factor was omitted, job type was highly significant predictor of sleep problems in the logistic regression analysis (p<.001), with production and drilling personnel showing particularly high rates.

Taken together, these findings imply that the apparent difference between job groups in the reported incidence of sleep problems was actually due to differences in the shift work patterns worked in different jobs. Thus, the observed job type effect was very largely attributable to the fact that production and drilling personnel are much more likely than other job groups to work day/night rotating shifts, and it is the shift pattern rather than the job type per se that accounts for the observed effects on reported sleep problems.

• **Neuroticism.** Each of the health measures examined was significantly predicted by neuroticism. In each case, the relationship was positive, high neuroticism scores being associated with a greater likelihood of higher scores on the health problems measures.

• **Age.** Age was found to be significant only in relation to the incidence of headaches. Higher age was a favourable factor in that older employees reported fewer headaches than their younger counterparts. Further analyses identified a relatively high incidence of headaches among those under 30 years of age and a low incidence among those over 55 years.

Further analyses were carried out to examine possible curvilinear effects of age; in these analyses, the quadratic age x age term was entered into the logistic regression in a final step. This term did not reach the .05 significance level in any of the analyses. However, in the analysis of overall health problems, it did reach the marginal .10 significance level; the trend was such that the youngest and oldest age groups were less likely to be in the group reporting higher incidence of minor health problems (3+) than those in the middle age range.

• **Interactions.** There was no evidence of significant interactions between the four predictor variables examined; thus, each variable contributed independently to the predictive model. In particular, there was no evidence to suggest that the effects of particular job types or shift patterns on health measures differed for individuals of different ages.

8.4 **SMOKING**

The analysis reported above focused on work factors as predictors of minor health problems, the two individual difference variables (age and neuroticism) being included primarily for control purposes. However, individual differences in smoking
behaviour are known to influence health, and it was of interest to determine the extent to which the potentially adverse health effects of smoking were apparent in the present data. For the purpose of these analyses, smoking behaviour was coded into three categories, *non-smoker*, ‘*moderate*’ smoker, and ‘*heavy*’ smoker, as shown in Table 8.4. Taking the two latter categories together, the overall proportion of smokers in the present sample was 36.3%, which compares with previously reported values of 31% (Gann, 1989) and 37.2% (Horsley & Mackenzie, 1996) among offshore samples, and with 34% in the Scottish male population as a whole (Scottish Home and Health Department, 1991).

**Table 8.4**
Proportions of non-smokers, moderate, and heavy smokers

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount smoked</th>
<th>N</th>
<th>% of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-smoker</td>
<td>-----</td>
<td>928</td>
<td>63.7%</td>
</tr>
<tr>
<td>Moderate smoker</td>
<td>&lt; 20 cigarettes per day</td>
<td>208</td>
<td>14.3%</td>
</tr>
<tr>
<td>Heavy smoker</td>
<td>20+ cigarettes per day</td>
<td>320</td>
<td>22.0%</td>
</tr>
</tbody>
</table>

*Total N = 1456 (missing data, n = 6)*

**8.4.1 Smoking: Company groups and job types**
Prior to examining relations between smoking behaviour and health problems, the data were examined to determine whether the proportions of smokers varied by company groups and/or job type. Both factors were found to be significant; the data are shown in Tables 8.5 and 8.6

**Table 8.5**
Smoking behaviour across company groups

<table>
<thead>
<tr>
<th></th>
<th>Company A n = 375</th>
<th>Company B n = 314</th>
<th>Company Group C n = 363</th>
<th>Company Group D n = 404</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-smokers</td>
<td>67.2 %</td>
<td>71.6 %</td>
<td>62.6 %</td>
<td>55.4 %</td>
</tr>
<tr>
<td>Moderate smokers</td>
<td>13.1 %</td>
<td>13.1 %</td>
<td>12.9 %</td>
<td>17.6 %</td>
</tr>
<tr>
<td>Heavy smokers</td>
<td>19.7 %</td>
<td>15.3 %</td>
<td>24.5 %</td>
<td>27.0 %</td>
</tr>
</tbody>
</table>

*Significance test: \( \chi^2 = 25.39, \ df = 6, \ p < .001 \)
Table 8.6
Smoking behaviour across job types

<table>
<thead>
<tr>
<th>JOB TYPE</th>
<th>Non-smoker</th>
<th>Moderate smoker</th>
<th>Heavy smoker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>66.4%</td>
<td>13.7%</td>
<td>19.9%</td>
</tr>
<tr>
<td>Technical</td>
<td>62.4%</td>
<td>17.4%</td>
<td>20.2%</td>
</tr>
<tr>
<td>Catering</td>
<td>51.4%</td>
<td>14.4%</td>
<td>34.2%</td>
</tr>
<tr>
<td>Production</td>
<td>73.3%</td>
<td>8.6%</td>
<td>18.1%</td>
</tr>
<tr>
<td>Management</td>
<td>73.6%</td>
<td>14.1%</td>
<td>12.3%</td>
</tr>
<tr>
<td>Admin/other</td>
<td>69.0%</td>
<td>13.0%</td>
<td>18.0%</td>
</tr>
<tr>
<td>Construction</td>
<td>55.5%</td>
<td>17.5%</td>
<td>27.0%</td>
</tr>
<tr>
<td>Drilling</td>
<td>52.6%</td>
<td>18.0%</td>
<td>29.4%</td>
</tr>
</tbody>
</table>

Significance test: \( \chi^2 = 49.71, \ df = 14, \ p < .001 \)

8.4.1 Smoking in relation to health problems

The initial analyses examined the overall association between reported health problems and the three categories of smoking behaviour. As in the previous analyses, the total health problems scale was divided into low and high scores on the basis of a 2/3 cutpoint (see Table 8.1), while a 0/1 cutpoint was used for the separate health problem scales. Table 8.7 summarises the percentages scoring above the cutpoints for the non-smokers, and for the moderate and heavy smoker groups, together with the significance of the associations between smoking and reported total health problems, gastric problems and musculo-skeletal problems. No data are shown for headaches or for sleep problems as neither of these variables showed significant associations with smoking.

For both the total score and the two specific problem scales, smoking behaviour was significantly related to health impairment, heavy smokers showing the highest proportions of those reporting health problems. Moderate smokers did not differ significantly from non-smokers on these measures, although they tended to be less likely to report gastric problems than non-smokers (\( p < .10 \)).
Table 8.7
Health problems: Incidence among smokers and non-smokers

<table>
<thead>
<tr>
<th>Smoking behaviour</th>
<th>Minor health problems</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% with score of ≥3 on total scale</td>
<td>% reporting one or more gastric problem</td>
</tr>
<tr>
<td>Non-smoker</td>
<td>43.8%</td>
<td>30.0%</td>
</tr>
<tr>
<td>Moderate smoker &lt;20 per day</td>
<td>42.4%</td>
<td>24.2%</td>
</tr>
<tr>
<td>Heavy smoker ≥20 per day</td>
<td>52.4%</td>
<td>38.5%</td>
</tr>
</tbody>
</table>

Significance tests
\[ \chi^2 = 7.86 \]  
\[ \text{df} = 2 \]  
\[ p = .02 \]  
\[ \chi^2 = 13.25 \]  
\[ \text{df} = 2 \]  
\[ p = .001 \]  
\[ \chi^2 = 7.21 \]  
\[ \text{df} = 2 \]  
\[ p < .03 \]

8.4.2 Smoking and health problems: logistic regression analysis

Whilst the analyses described above suggest that smoking has significant implications for reported health complaints, they do not take into account other factors already shown to predict scores on the health problems scale. To address this issue, the logistic regression analysis described above was extended to include smoking behaviour (again grouped into non-smokers, moderate and heavy smokers) as a further predictor over and above the factors (job type, shift rotation, neuroticism, and age) already in the model. In this analysis, two dichotomous scores were used to characterise health status; one was based on the 2/3 cutpoint for total scores, while a second dichotomy was based on the more stringent 5/6 cutpoint.

The results of these analyses, shown in Table 8.8, confirm that heavy smokers are significantly more likely to report health impairment, as reflected in high overall scores and, particularly, in gastric problems. Furthermore, smoking showed additive effects in the logistic model, independent of those of age, neuroticism, job type, shift rotation. Also consistent with the results described above, there was no evidence from the logistic analysis that moderate levels of smoking had significant adverse implications for health as assessed by the measures used here. Indeed, in relation to gastric complaints, the results showed that moderate smokers were less likely to report gastric problems than non-smokers.
Table 8.8
Significance of smoking behaviour in logistic regression model predicting minor health problems

<table>
<thead>
<tr>
<th>Cutpoint</th>
<th>Minor health problems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total score</td>
</tr>
<tr>
<td>2/3</td>
<td></td>
</tr>
<tr>
<td>5/6</td>
<td></td>
</tr>
<tr>
<td>0/1</td>
<td></td>
</tr>
<tr>
<td>0/1</td>
<td></td>
</tr>
<tr>
<td>Non-smoker vs. moderate smoker vs. heavy smoker</td>
<td>[p&lt;.08]</td>
</tr>
<tr>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>p&lt;.05</td>
<td></td>
</tr>
<tr>
<td>df=2</td>
<td></td>
</tr>
<tr>
<td>df=2</td>
<td></td>
</tr>
</tbody>
</table>

The table shows the significance levels of the variables representing smoking behaviour in the logistic regression, over and above those of job type, shift rotation, age, and neuroticism. The significance of these other variables in the model showed little or no change from those in Table 8.3 when smoking was included.

8.5 BODY MASS INDEX

Recent research suggests that self-estimates of height and weight are accurate enough to be used in place of formal measurements for research purposes (Imrhan et al. 1996). The present survey questionnaire included items asking for details of weight and height, and this information was used to calculate the body mass index (BMI), weight in kg / (height in ms)². The overall mean BMI value was 25.64 ± 2.83 kg/m², which agrees very closely with the value of 25.65 kg/m² reported for a comparable offshore sample by Gann (1989).

BMI levels did not differ across company groups, but job types and age were both significant predictors. Age was positively related to BMI, older personnel having higher BMI levels than their younger counterparts, F(1,1438) = 62.09, p<.001. This result is consistent with published findings from general population samples (e.g. Grinker et al. 1995). Job type was also a highly significant predictor of BMI levels, F(7,1438)=3.63, p=.001. Multiple comparison tests indicated that catering and
drilling personnel had significantly lower BMI values than management personnel, with other job types in a middle range.

8.5.1 Body mass index as a predictor of health problems

When tested as an additional factor in the logistic regression model used to predict health problems, BMI was found to be significant only in relation to gastric problems (p<.02). Those with higher BMI values were more likely to report gastric complaints. The effects of BMI were independent of those of other significant factors in the analysis; the significance of shift pattern and neuroticism as predictors (see Section 8.3) remained almost unchanged.

8.6 MINOR HEALTH PROBLEMS: THE ROLE OF THE PHYSICAL ENVIRONMENT

A further analysis was carried out to determine to what extent the physical environment of offshore work played a mediating role in the link between job types and minor health problems. An extension of the logistic regression analysis suggested that the significance of job type as a predictor of total health problems scores, and of scores on the measure of headaches, was reduced when the ratings of exposure to the physical environment were included in the predictive model. These results suggest that adverse physical environment characteristics may indeed play a significant role in the incidence of some minor health problems among offshore personnel.
8.7 HEALTH PROBLEMS AND HEALTH BEHAVIOURS

- Four types of minor health problems were assessed: headaches, sleep disturbance, musculo-skeletal, and gastric problems. An overall score was also calculated.

- There were no significant differences in the incidence of health problems across company groups.

- Multivariate analyses showed that job type and shift pattern (day/night rotation vs. day work) were both significant factors predicting health problems.

- Day/night shift rotation was associated with gastric problems and sleep disturbance, while job type (especially drilling) was linked to musculo-skeletal and headache problems. Total scores were predicted by both factors.

- Overall, 63.7% of the sample were non-smokers, 14.3% were moderate smokers, and 22.0% were heavy smokers. Personnel working on drilling rigs, and those in catering jobs, had high rates of smoking relative to other groups.

- Adverse implications of heavy smoking (but not moderate smoking) were apparent in some health measures. Body mass index (mean value, 25.6 kg/m^2) was linked to incidence of gastric problems. Both these effects were independent of other factors.
9. CONCLUSIONS

The purpose of this concluding section is to bring together information about particular topics addressed in the report, highlighting points of general interest, and noting relevant health and safety issues; it is not intended to consider details of the analyses presented, nor to discuss the findings in an academic manner. First, however, to set the findings in context, it is important to note the sample characteristics, and the methodological strengths and limitations of the study as a whole.

9.1 SAMPLE CHARACTERISTICS AND METHODOLOGY

From a positive viewpoint, the data set on which the present work is based is large relative to other studies of psychosocial factors carried out in the UK sector of the North Sea, and the response rate was high in comparison to most survey work. The work also had the advantage that, thanks to the excellent co-operation received from the production and drilling companies involved, it was possible for all the main occupational groups working offshore to be included, and for the data to be collected in the offshore work environment rather than by postal survey.

Furthermore, the study reflects current conditions in the North Sea (data collection continued until July 1996), and a wide range of measures was used. The analyses reported here do not cover all the information obtained, but were intended to focus on objective factors, such as job types and installation characteristics, in relation to subjective psychosocial data. The statistical methods allowed the independent effects of predictor variables to be identified, and incorporated control for individual differences in ‘negative affectivity’, a major source of response bias in self-report data of this kind.

However, these potentially favourable features of the present work do not overcome the inherent limitations of all survey work in which information is collected by self-report, and in which data from individual participants are obtained on one occasion only (‘cross-sectional’ data). Data of this kind only provide a snapshot of conditions at one point in time. This limitation is relevant here for two main reasons. First, the North Sea work environment is currently undergoing significant changes; the present data provide no means of tracking these changes, nor of directly evaluating their implications for work conditions and morale among offshore employees.

Second, it is important to emphasise that cross-sectional survey data only allow associations between variables to be identified, and not causal effects. Thus, for instance, differences between sub-groups in the overall sample (e.g. personnel in different jobs, or on different installations) may be due to the causal effects of work conditions, or to the selection and ‘survival’ of certain types of individuals in particular work settings. Although, either conceptually or empirically, some directions of causation can be identified as being more plausible than others, and although survey data can highlight areas in which particular problems exist, it is not possible to demonstrate unambiguously that a particular factor is a cause of some observed outcome.
Two other important issues also arise in interpreting the findings of the present study. First, whilst the sample can be regarded as representative of the installations on which the data were collected, in order for the findings to be more widely applicable, it is necessary to consider the extent to which the sample represents the offshore population more generally. Overall, the present study covered approximately 5% of the workforce in the UK sector of the North Sea, based on the estimate of 29,500 for the total population employed offshore in 1995 (Department of Trade and Industry, 1996).

The information available tends to support the view that the present sample is representative of the demographic characteristics of the wider North Sea population. Thus, for both operator company personnel and contractors, the age distribution of the sample closely reflects that derived from a large database of offshore personnel (Forbes, 1996, personal communication). Also, the 3% of women in the present sample corresponds to their overall proportion of the offshore workforce. Furthermore, the installations on which the data were collected were operated by a variety of different companies, and ranged widely in size and age, both factors which lend support to the view that the sample can be regarded as broadly representative.

Nonetheless, the installations that took part were not randomly chosen from all those in the North Sea; some operating companies were not approached, and others declined to participate. Thus, although it is difficult to evaluate the extent of any bias in the sample, it is possible that companies and installations not involved in the work were different (and perhaps less favourable) in terms of the psychosocial work environment, from those that did participate.

Second, it was not possible to include an onshore comparison group in the present work, although plans for such a study were put forward. Thus, the extent to which the present findings are specific to the offshore work environment and extent to which they would also apply to comparable work settings onshore cannot be determined. Although funding for an onshore study may yet be forthcoming, it would clearly have been desirable for data to have been collected onshore over the same time period as the offshore data collection. Whilst none of the limitations noted invalidate the findings of the present study, it is important to take these issues into account in considering the findings.

9.2 REVIEW OF FINDINGS

In the following sections, general aspects of the findings are considered, with particular reference to points of interest which cut across the separate sections in which the data analyses were reported.

9.2.1 Production platforms compared with drilling rigs

In general, production platforms and drilling rigs did not differ significantly on most of the measures examined in the present study; however, two important differences should be noted. First, perceived workload on production platforms was higher than that on drilling rigs, and reported working hours also reflected the higher demands experienced by those working on platforms. This finding most probably reflects the
fact that extensive down-manning has been experienced on many production installations (particularly older ones) in recent years as production levels have decreased; consequently perceived demands have increased on these installations. Consistent with this view, a recent small-scale follow-up study demonstrated a significant increase in perceived workload among offshore production operators over the five-years period, 1990-95. This work is described in Part II of this series of reports (Parkes & Razavi, 1996). In contrast, drilling rigs have been less affected by these trends.

Second, although platforms and rigs did not differ significantly in job satisfaction, there was a highly significant difference in 'job prospects' (a measure of job security and future prospects in the industry). Personnel on drilling rigs, especially management personnel, were markedly more confident about their future job prospects than those on production platforms. This greater confidence was also observed among drill crews working on production platforms, as compared with other job groups on these installations, with the exception of those working on Company B installations who took a relatively pessimistic view of their job prospects.

9.2.2 Company groups and ‘corporate culture’

Differences between company groups were observed for many of the measures used in the present study. In part, these differences may be attributable to the particular platforms that were involved in the work (which could not be randomly selected by the researchers). However, certain aspects of the findings merit comment. Whereas Groups A and B consisted of groups of platforms operated by two large companies, Groups C and D were made up of diverse groups of installations operated by several smaller North Sea operating companies (Group C) or by drilling operators (Group D).

Thus, to the extent that a ‘corporate culture’ exists in large companies, it would be expected that installations within Groups A and B (even if differing in other factors such as age and size) would tend to show greater similarity in mean scores than those in Groups C and D. In general, the evidence supported the idea of a pervasive ‘corporate culture’, especially in Company B. Thus, in the ratings of exposure to the physical environment, in perceived workload and other job characteristics and (in Group B only) in safety perceptions, differences between installations within the large company groups, A and B, were non-significant. In contrast, differences between installations within Group C, and to a lesser extent, Group D, were highly significant.

9.2.3 Employer groups

In view of the concerns of many contractor personnel about an ‘us’ and ‘them’ culture between those employed by the operating company and those employed by contractors, it was of interest to find that in terms of the measures used in the present study, there were relatively few significant differences between the two groups.
Furthermore, some apparent differences (e.g. in perceived workload) were actually attributable to other factors, particularly differences between operator personnel and contractors in the relative proportions at different job levels. However, the measure that assessed future job prospects did distinguish significantly between the two groups. Whilst the difference in mean scores was relatively small, this measure actually favoured contractors who were more optimistic (or perhaps less pessimistic) than personnel employed by production operating companies.

The general lack of findings distinguishing the operating company personnel and contractors appears to reflect changes in the structure of offshore employment over recent years. Thus, the transfer of a significant proportion of those who were previously operator personnel to contracting companies, and the tendency to impose work conditions on operating company personnel that are less favourable than those they enjoyed previously, has had the effect of eroding differences between the groups. In addition, some companies and installations have made deliberate attempts to reduce distinctions between the two groups in order to promote effective teamwork.

9.2.4 Job types

Differences between groups in different types of jobs were a major source of variation in almost all the measures made in the present study. However, in terms of perceived job characteristics, the level of any one variable for a particular job group is of less interest than the profile reflecting the overall pattern of job characteristics. Thus, for instance, management, production, and catering personnel all tended to report higher levels of workload than other job groups, but only the management personnel also reported high levels of task skill/variety and autonomy. In contrast, production personnel had particularly low scores on both these measures, while those in the catering group perceived their jobs as low in skill/variety but relatively high in clarity and structure.

An influential current theory of work stress (Karasek, 1979; Karasek & Theorell, 1990) is relevant in this context. The ‘demand/discretion model’ is based on the idea that high workload is not detrimental to health provided the job also allows high levels of ‘decision latitude’; the concept of decision latitude refers to opportunities to develop new skills, to carry out a variety of tasks, and to be involved in decision making, in short, to characteristics similar to those assessed by the skill/variety scale in the present study.

In the demand/discretion theory, jobs of this kind are characterised as ‘active’ jobs and are associated with favourable outcomes in terms of health and job satisfaction. In general terms, this is the pattern observed in the present study for the management job type. However, there was also a relatively high level of anxiety among management personnel, a result that would not be predicted by the demand/discretion theory. Nonetheless, it is consistent with the data reported by Gann et al. (1990), who found that anxiety among those in the most senior offshore job grade was significantly higher than among their onshore counterparts, although there were no significant onshore/offshore differences among those in lower job grades. Relatively
high anxiety among senior offshore management personnel may be attributable to their responsibility not only for ensuring the safety and efficiency of offshore operations and the well-being of personnel, but also for meeting the demands of onshore management for increased productivity and reduced costs.

Jobs which are high in workload but low in discretion (‘high strain’ jobs in Karasek’s model) are associated with low satisfaction, and health impairment. The catering and production groups both share some of the characteristics of high strain jobs, and tend to have relatively low job satisfaction and high anxiety. Among production personnel there is also a generally high level of health complaints, partially attributable to the demands of day/night rotating shiftwork. Further analyses demonstrated that job types differed in the incidence of two specific health problems, musculoskeletal disorders and headaches, but not in sleep problems and gastric disorders. Both musculoskeletal problems and headaches tended to be most frequently reported by management personnel and by those involved in drilling and construction work.

9.2.5 Job level

Hierarchical job level showed a strongly linear relationship to perceived job characteristics (except job clarity), and to job satisfaction and future job prospects; in all these respects, those in the most senior job level had the most favourable profiles. However, these personnel also reported very long work hours; 60.4% of the group reported working hours in excess of 100 hours per offshore week.

Whilst the seniority of these personnel gives them a degree of freedom to arrange their own work patterns and take appropriate breaks, when such long hours are worked continuously for two, or in some cases, three consecutive weeks, there must be some question of cumulative fatigue impairing performance (see, for instance, Krueger, 1989). This is particularly true of the Offshore Installation Managers (OIM’s); the long working hours recorded in the present study for the most senior offshore personnel are consistent with data reported in a survey of OIM’s (Flin & Slaven, 1992).

9.2.6 Shift work vs. day work

The impact of day/night shift rotation as compared with day work was apparent in the data relating to minor health problems. In particular, both sleep disturbance and gastric problems (but not other types of health problems) were more likely to be reported by day/night shift workers, even when other potentially relevant factors such as job type had been taken into account. This specific pattern of health impairment associated with day/night shift work is consistent with findings in the wider literature on shift work and its consequences (e.g. Vener et al. 1989; Waterhouse et al. 1992). The present findings also add to those reported by Parkes (1994), and to those of the offshore shiftwork study described in Part III of this series of reports (Parkes et al. 1996).
9.2.7 Individual differences

Individual differences, although not a major focus of the present study, were none the less relevant in relation to psychosocial factors measured.

- **Age**: was a significant and positive predictor of perceived workload, and of the measures of autonomy and task skill/variety; it also predicted satisfaction with safety and job satisfaction. The positive correlation between age and job satisfaction has been widely reported; some possible interpretations of this association are considered by White and Spector (1987). In the present study, it would be unwise to interpret this finding as implying that greater age causes individuals to become more satisfied with their work situation (although this may of course contribute to the effect observed). More likely, the present correlational findings indicate that those who are less satisfied tend to leave offshore work at an earlier age than those who are more satisfied. Thus, the older age groups contain a disproportionate number of those who adapt favourably to offshore work.

The findings relating age to the job prospects measure took a curvilinear, rather than a linear, form; personnel at both younger and older age levels were more optimistic about job prospects than those in the middle ranges of age. Younger personnel have potentially better opportunities for promotion or moving to other jobs, and older ones can plan on earlier retirement than most onshore employees. On the basis of the present data, the groups in the middle range of age (particularly those between 35 and 45 years) experience the lowest optimism about future job prospects. Whilst this result represents an overall trend, and does not of course apply to all individuals in this age group, it was nonetheless a statistically highly significant result which is a potential cause of concern to the industry as a whole.

- **Personality**. The present data suggest that offshore personnel tend, through a process of self-selection, employer selection, and ‘survival’ in the job, to have personality characteristics that predispose them to adapt favourably to the demands of the offshore environment. Thus, as compared with population norms (Eysenck *et al*. 1987), the present sample was high in extraversion and low in neuroticism. This combination of personality traits reflects a tendency to be sociable, active, emotionally stable, resilient, and adaptable, and is associated with above-average mental health.

- **‘Negative affectivity’**. Although in the sample as a whole, as noted above, mean neuroticism scores were significantly lower than in the general population, this personality trait played an important role as a measure of ‘negative affectivity’. Almost all the self-report measures in the study were predicted by neuroticism, high scores being strongly linked to adverse perceptions of the work environment, and poor psychological and physical health. This finding is consistent with the more general research literature (Watson & Clark, 1984).
Any organization will inevitably include some individuals who are high in neuroticism, and prone to the emotional vulnerability that it entails, even if the overall mean level is relatively low. Thus, from the point of view of the present work, the relationships of neuroticism to job perceptions and health variables were not of great importance per se.

However, the present findings do serve to highlight the pervasive effects of negative affectivity in self-reported survey data, and the importance of correcting for these effects in analysing relations between psychosocial factors and health. It should also be noted that the between-group comparisons reported in the present study take account of the role played by negative affectivity; in particular, personnel in different job types differed significantly in mean levels of negative affectivity (catering personnel having the highest scores), and these differences were statistically controlled in the adjusted mean values reported for the measures of job perceptions and health outcomes.

9.3 GENERAL HEALTH AND SAFETY ISSUES

9.3.1 Safety

Analysis of the ratings of satisfaction with safety measures and emergency response procedures revealed that the data were strongly weighted towards the favourable end of the scale. Thus, the proportion of scores falling at or below the neutral point (i.e. neither satisfied nor dissatisfied) was less than 5%, and the great majority of mean scores were in the satisfied or very satisfied categories. However, several factors, including company groups, job types and the age of the installation were significant predictors of these safety ratings.

There was also a marked tendency for individuals to perceive the work in which they were directly involved as more safe than it was perceived by those not involved. Whether this reflects a more reliable estimate based on the greater knowledge and understanding of the processes involved on the part of those directly involved, or whether it represents a form of ‘defensive coping’ cannot be determined from the present data, but the issue is a potentially interesting one.

A further item in the section on safety asked participants to rate the safety of the installation on which they worked relative to installations in the North Sea as a whole. In response to this item, almost all personnel gave ratings of ‘average’ or ‘above average’ in safety relative to North Sea installations as a whole; only a very small proportion fell into the ‘below average’ categories.

The apparent satisfaction of personnel with the safety regimes of the offshore installations on which they work may reflect the positive changes that have resulted from the Cullen report. However, it is important to note that subjective perceptions of safety, although important indicators of confidence among offshore personnel, do not necessarily directly reflect the actual accident record of the installation concerned. Indeed, potentially valuable information could be obtained by relating the present
data to formal accident and incident records of the installations concerned, taking into account the variation across installations and jobs in physical environment, workload, and other job characteristics.

9.3.2 Health

**Minor physical health problems.** Physical health problems were assessed in the present study by a checklist devised by Vaernes et al. (1988). As compared with the data for onshore process control operators reported by these authors, the present sample were less likely to report minor health complaints. This result was found not only for the present sample as a whole, but also specifically for production personnel, the occupational group most closely corresponding to that in the study by Vaernes et al. Whilst this is a potentially encouraging finding, such comparisons must be treated with caution; it is significant also that medical screening for offshore employment is more stringent than for comparable jobs onshore.

**Mental health.** Medical screening, together with emotional stability and adaptability characteristic of personnel in the present study (see Section 9.2.7), is also relevant to findings relating to the overall levels of mental health in the sample. Taken together, above-average physical health and favourable personality characteristics would be expected to lead to an offshore population with an incidence of mental health problems below the average of the general population.

Consistent with this view, the present sample had an overall rate of ‘high’ scores on the GHQ-12 measure (an extensively validated index of psychological distress) of 14.6%, a rate significantly lower than that found among males employed in comparable jobs onshore, which is typically in the range 20-25% (see Section 7.2.1). It is possible that ‘macho’ attitudes among some offshore personnel may have made the present sample less likely to acknowledge psychological distress than male employees onshore; however, the rigorous medical screening and the personality profiles of those who work offshore, are more likely explanations for the differences observed between the present sample and the onshore comparison data.

Changes in mental health over time are also important, and the anxiety levels observed in the present study were higher than those observed among offshore personnel in 1990 (Parkes & Razavi, 1996). Two issues are raised by these findings. First, there may be a need to monitor anxiety levels in the offshore environment at a time when changing employment conditions, and increased job demands (e.g. ‘multi-skilling’) are being widely introduced. Second, as suggested by earlier work (Parkes, 1992, 1993), anxiety may be a specific psychological response to the demands of the North Sea environment, and its complex pattern of determinants among offshore personnel merits further study.

**Smoking.** The present study also demonstrated the relevance of smoking to health problems in the offshore workforce. The link between smoking and health impairment is of course widely recognised, and the relatively high rates of smoking among drill crews and catering personnel are a cause for concern.
However, a more positive finding relating to smoking behaviour also merits comment. Thus, smoking rates varied significantly across the four company groups, the lowest rate being observed in Company B in which an extensive health promotion programme for offshore personnel had been in operation for several years. Although causal inferences cannot be drawn from the present data, studies of onshore work sites have shown that such programmes are potentially effective in reducing smoking rates (e.g. Goetzel et al. 1994; Jeffery et al. 1993).

9.4 FURTHER RESEARCH

The data set obtained in the present study potentially provides many opportunities for additional analyses which could throw further light on the underlying mechanisms by which psychosocial factors in the offshore environment impact on the health and safety of the personnel concerned. Combining the present data with formal safety records and/or medical information would also be valuable. Two more detailed topics linked to the present work are outlined below.

9.4.1 Longitudinal studies

A potentially important role of the present data lies in its value as a source of baseline data against which to monitor changes in psychosocial factors, safety and health offshore. There has been very little longitudinal research carried out in the UK sector of the North Sea; two relatively small-scale studies appear to be the only examples of such work (Parkes, 1996; Sutherland & Cooper, 1991). Both to allow causal effects to be examined, and for practical reasons in a rapidly-changing environment, it would be particularly valuable to follow up the personnel who took part in the present study.

In addition to its more general interest, such a study would make a valuable contribution to understanding the effects of age on the mental and physical health of personnel exposed to the demands of offshore work; without longitudinal data, the effects of ageing in a work situation which the great majority of personnel leave for a variety of different reasons (some of them health-related) before reaching normal retirement age cannot be investigated. Hence, although there is considerable concern about ageing in the North Sea population as a whole, there is currently little reliable information.

9.4.2 Women and offshore work

Although women currently form only a very small proportion of the UK offshore workforce, and the majority of them are employed by catering/flotel contractors, this is not true of the Norwegian offshore industry. It seems likely that the numbers of women in the UK sector, particularly those in technical jobs, will increase in the next decade. It is important therefore that safety, health and family issues of particular concern to women are not neglected. To date no study specifically concerned with women in the UK offshore workforce has been carried out; the small proportion of data from women in the present sample is not sufficient for detailed analysis purposes, but it could usefully serve as a nucleus of further work.
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