

Psychosocial Risk Factors for Call Centre Employees

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Abstract

Two over-arching research questions are examined in this thesis. These questions concern call centre organisational features (dialogue scripting and performance monitoring), work design (e.g., autonomy, workload, role properties) and health outcomes (psychological strain and MSDs) which are examined using data from 1,141 employees taken from 36 call centres.

In the Study 1 the “lean service characteristics” of dialogue scripting and performance monitoring are examined in relation to the prediction of call handler job-related strain. Findings confirm that employees who experience greater dialogue scripting and more intensive performance monitoring show higher levels of strain. These relationships are fully mediated by work design. These findings demonstrate the importance of considering the impact of lean working practices on employee health.

In the Study 2, the work characteristics of autonomy and workload are examined in relation to the prediction of musculoskeletal disorders (upper back, lower body and arms). I find that the relationship of workload to upper body and lower back musculoskeletal disorders is largely accounted for by job-related strain. This mediating effect is less evident for arm disorders. Contrary to expectation, job autonomy has neither a direct nor a moderating effect on any musculoskeletal disorder.

In Study 3, a systematic literature review of intervention studies in call centres is presented. Sixteen papers are categorised into four intervention domains, namely, i) physical work environment ii) ergonomic iii) job design and iv) health. The majority of studies are ergonomic in nature and the physical work environment

is considered also. Study 3 implies that whilst work psychologists examining call centre working practices is a valid exercise it only forms part of a psychosocial risk story and that work psychologists need to work in a more interdisciplinary manner if we are to positively intervene in call centres.

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Publications and Conferences Arising

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Authored Books

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Conferences

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Sprigg, C.A. & Jackson, P.R. (2004). Psychosocial risk factors in call centres: Evaluating work design and well-being. In Book of Proceedings & Compendium of Abstracts of *The British Psychological Society (BPS) Annual Occupational Psychology Conference*, January, Stratford-upon-Avon, (pp. 120-124).

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Sprigg, C.A., Smith, P.R., & Jackson, P.R. (2003). Call centres as lean service environments: Impact on psychosocial risks. *APA/ NIOSH Work, Stress and Health: New Challenges in a Changing Workplace. The Fifth Interdisciplinary Conference on Occupational Stress and Health*. Toronto, March 20-22. (Abstracts published by APA on CD-Rom only).

Sprigg, C., Smith, P., Phelps, C., Beswick., & Travis, K. (2001). Health and safety in call centres: An occupational health psychology perspective. Proceedings of the *European Academy of Occupational Health Psychology Barcelona Congress*, October, Barcelona, (pp. 166-170).

CHAPTER 1

1.1. Introduction and Overview

“Working in a call centre is very much like a human robot. Work is very routine with no variation”. [Financial, Female, Under 20, 7 months -1 year in job, Call Handler]

“I have no control over my work, I make no decisions. I’m told what to say and when to say it, when I can move from my chair” ... [IT & Telecoms, Female, 40-49, 3-5 years in job, Call Handler]

“The most monitored and closely controlled working environment within the UK” [Utilities, Male, 50-59, 6-10 years in job, Call Handler]

“It feels very much like being a battery chicken with a headset” [Transport, Female, 30-39, 6-10yrs in job, Call Handler]

“I feel the job is highly stressful due to constant stream of calls and the fact that you cannot take a break or do another task for a little while, to get away from the phones and computer” [Retail, Male, 20-29, 3-6months in job, Call Centre Support]

In the UK in the past decade there has been a huge growth in the call centre sector. The sector has grown by almost 250% since 1995; and was forecast to grow to almost 650,000 agent positions by 2007, directly employing over 1 million people (Department of Trade and Industry, 2004). ContactBabel estimate that 958,925 people are employed in the UK's 5,040 call (or contact) centres, equating to 3% of the working population. While Key Note estimate that currently 862,070 people

work in front-line customer contact and they project that over 1 million people will be working in UK contact centres by 2012 (CCA, 2010).

In the late 1990s this was a new form of work that involved “*smiling*” at the customer down a telephone (Belt, Richardson, Webster, Tijdens, & van Klaveren, 1999) whilst retrieving and inputting information on a computer; this is the work of a call handler working in a call centre. As this form of work has grown so has the concern over the impact of this work on those that carry it out. This thesis is concerned with the human story of call centre working, and the relationship between this kind of work and psychological and physical well-being.

The central themes and variables of interest in this thesis are expressed eloquently by the quotations from call centre employees themselves at the start of this chapter. These quotations immediately draw our attention to two key aspects of call centre working: a) the psychological strain experienced by some who conduct this work, b) the uniquely pervasive nature of performance monitoring in this work context. Other quotations express the very nature of the “design” of this work, with its limited variety, highly repetitive nature and low or non-existent opportunities for personal control. Such highlighting of core work characteristics help us quickly to situate any applied psychological research in this context into the theoretical framework of work design and related theoretical frameworks (see “Theoretical Background”, where these theories are explained in detail). However, concurrently, this raises a further question about the applicability of such theories, originally developed and honed in manufacturing settings, to a modern service sector context.

The quotation “*I’m told what to say*” indicates another feature of this work that is worthy of investigation, that is, the practice of scripting. This same quotation

also hints at the very static and physically “tied down” nature of these jobs with “*I’m told, when I can move from my chair*”. This simple phrase provides further research impetus as one considers the musculoskeletal impact of working in this static, repetitive and relentless way.

1.2. Theoretical Background: An Overview of Classic Work Design

Theory and Studies

The dominant theoretical landscape to this thesis is taken from job characteristics theory (Hackman & Oldham, 1975; 1976) and extended models of work design that have suggested since, for example, Parker and Wall (1998). To understand the value of this theoretical framing we first have to travel back through time and see how the fundamental changes in the way that work was being conducted led to these theories.

Historical accounts of job design frequently take Henry Ford’s assembly line and F.W.Taylor’s ideas on “scientific management” as the starting point. However, the ideas that went on to shape job design research and practice have origins in the 18th century (Parker & Wall, 1998).

1.2.1. Early origins of job design

Ideas that underpin job design can be traced back in the UK to the Industrial Revolution from 1760 to circa mid-1830s. The Industrial Revolution changed the pattern of work in society. Production of goods was an increasingly important economic activity. With the invention of large-scale machinery people no longer worked alone in small community groups but started to work in factories. These developments led to greater consideration of how to organise and manage work.

Scholars began to consider how to organise work to maximise productivity, with one of the most fundamental principles being put forward being “the division of labour” proposed by Adam Smith’s in *The Wealth of Nations* (1776).

1.2.2. The division of labour: Adam Smith

The basic premise of Smith was that the making of a complex product should be broken down into a series of simpler tasks. Smith argued that efficiency was gained by dividing work in this way because, for example, it would lead to workers becoming more dextrous in their tasks, and avoid the time wastage that occurs as they changed from one type of work to another.

Smith’s ideas were reiterated by Charles Babbage, who noted that one of the additional advantages of the division of labour meant the need for less skilled and cheaper labour. As Parker and Wall (1998) state in summary

‘...in parallel with the technological advances of the Industrial Revolution, there emerged a social and economic philosophy of work organization that pointed toward breaking complex tasks down into a series of simpler tasks.This was the beginning of job simplification or deskilling’ (p.3).

At the start of the 20th century developments in the US associated with the work of Frederick Taylor and Henry Ford (discussed in the next section) made the earlier ideas of Smith and Babbage far more influential.

1.2.3. Frederick Taylor’s scientific management

Frederick Winslow Taylor (1856-1917) was an engineer who first joined the Midvale Steel Works as a labourer, then rose rapidly to be foreman, and later to be

Chief Engineer. Taylor “rediscovered Babbage”, writing a book in 1903 called “*Shop Management*”, which he followed up in 1911 with another called “*Principles of Scientific Management*” in which his ideas were further developed. In essence, Taylor proposed a method for determining the content of jobs, posing the question “How can jobs be designed so as to make work more efficient?” (p.3., Parker & Wall, 1998). Taylor examined alternative ways to carry out each aspect of work, as a means to determining the most effective methods. A job would then be reconstituted on the basis on the “best way”. Taylor was concerned with the vertical division of labour and the removal from employees of any discretion in *how* to carry tasks out (Parker & Wall, 1998). This approach to work was called “*Scientific Management*” or known more simply as just “*Taylorism*”.

Taylor’s ideas were controversial (Rose, 1975). There were labour troubles caused by attempting to apply his principles to in a government arsenal, and, a House of Representatives’ Special Committee was convened in 1911 to investigate his systems of management. Ironically the publicity during this time led to a wider adoption of the approach (Parker & Wall, 1998).

In Taylor’s lifetime there was much controversy over the inhumanity of his system of working, with it being said to “*reduce men to the level of efficiently functioning machines*” (p.136, Pugh, Hickson & Hinings, 1983).

1.2.4. Henry Ford’s assembly lines

Around the start of 20th century was another development pertinent to scene setting for this thesis: that of the introduction of the moving assembly line by Henry Ford. Ford was born in 1863 in Michigan. Like Taylor, Ford also became an

engineer and was promoted to a Chief Engineer at the Edison Illuminating Company in 1893. At the age of 40, with 11 investors he set up the Ford Motor Company. Ford developed the *“flow-line principle of assembly, in which, instead of having workers move between tasks, the flow of parts was achieved by conveyors, transporters, and other forms of machinery, and human assemblers could remain at their stations, with no need to move around the factory. As a result, the pace of work was controlled by the machinery, and ultimately management, rather than by employees themselves”* (p.4, Parker & Wall, 1998).

1.2.5. Widespread adoption of job simplification

Taylor’s and Ford’s thinking on management and production, despite some resistance, became the norm in the way that work was organised in American industry (Davis, Canter & Hoffman, 1955). With the single most important factors for job design being described as *“minimising time required to perform operation”*, followed by *“minimizing skill requirements”*, and *“minimizing learning and training times”*. Parker and Wall (1998) argue that *“the thinking behind job simplification is firmly embedded in organizational culture and is essentially the default option”* (p.5).

Twenty years later, these management methods were still being adopted under the guise of modern manufacturing practices, for example the application of “just-in-time” or JIT (whereby, for example, raw materials and the costs associated with them, are minimized by a “pull” system in the manufacturing process where each stage of a production process is carried out “just- in- time” to allow the next to be completed and just in time to meet the customer order’s requirement

(Schonberger, 1986)). These striking parallels between modern manufacturing and these “lean” forms of production in the call centres are drawn out in Study 1.

Some call centre organisations adopt this default option: with maximum times to take calls rigidly specified, and the use of scripting to minimise both skill requirements and training times. Taylor and Bain (1999) went as far as describing call centre work as “*an assembly line in the head*” as the title to one of their papers.

1.2.6. The psychological consequences of job simplification

Treating men as mere cogs in a machine had consequences, and whilst the managerial practice of job simplification was developed in the US, the research that started to examine the psychological consequences of it originated in the UK. The National Institute of Industrial Psychology (NIIP) established in 1921, with C.S. Meyers at the helm, examined such aspects as fatigue and boredom, questions that arose from the long working hours of civilians involved in the war effort. Results from these and other studies (Parker & Wall, 1998) over the next 30 years, confirmed the view that repetitive work was a dissatisfying experience.

In the US, research on mental health on those employed in car manufacturing led Kornhauser (1965) to conclude “*by far the most influential attribute [of jobs] is the opportunity work offers – or fails to offer – for the use of worker’s abilities and for associated feelings of interest, sense of accomplishment, personal growth and self-respect*” (p.363).

1.2.7. Social relations at work are important

Elton Mayo, an Australian psychologist, arrived in the US in 1924 (Griffin, Landy & Mayocchi, 2002) and started to study the emotions of workers, rather than

their efficiency. Central to Mayo's theorizing was the construct of *revery*. Mayo suggested that there was a mental state known as *revery obsession* resulting from the mind-numbing, repetitive and difficult work common in factories at that time. The psychologist was interested in the idea that work caused workers to act in pathological ways and proposed that as workers were using brawn rather than brains, their minds would wander and this would lead to paranoid thoughts. The result of this would be their unhappiness and the likelihood of unproductive and disruptive behaviours. As Landy and Conte (2004) suggest such a response to this kind of work would probably be considered normal rather than pathological in today's society.

Mayo was appointed at Harvard in 1926, whilst research was ongoing at the Hawthorne (Illinois) plant of the Western Electric Corporation. This research is a classic set of studies known together as the Hawthorne studies which I describe next.

1.2.8. The Hawthorne Studies

The Hawthorne Studies started as an attempt to improve productivity by altering levels of illumination, rest-breaks and work hours of employees (Roethlisberger & Dickson, 1939). The results of these experiments were far from straightforward; with production improving when conditions were worsened (lights dimmed) and vice versa. This led to the explanation that worker attitudes were impacting on productivity, and in the context of Hawthorne, the very fact that researchers were interested in them. This phenomenon became known as the "Hawthorne Effect"; the changed behaviour that results when researchers observe employees. These findings paved the way for a new movement called the "Human Relations Movement" where researchers were interested in understanding the complexities of motivation at work and the emotional world of employees. The

upsurge in studies that used job satisfaction as a dependent variable of choice followed (Landy & Conte, 2004). The underlying key concept of this work was that social relationships in the workplace are important (Morgeson, 2007).

Early research, such as that cited above, helped to establish the importance of job design for psychological well-being, and produced some recommendations for redesigning jobs.

1.2.9. Job characteristics theory

The Job Characteristics Model (JCM)

Hackman and Oldham (1975; 1976; 1980) identified five core job characteristics that relate to employee motivation and satisfaction. These five characteristics were: i) Skill variety, ii) Task identity, iii) Task significance, iv) Autonomy, and v) Feedback from the job. These characteristics were proposed to produce “critical psychological states” (e.g., experienced meaningfulness) and, in turn, these states were determinants of four outcomes – that is, work satisfaction, internal motivation, work performance, and absenteeism and turnover (Parker & Wall, 1998). The impact of the JCM has been acknowledged by several authors. For example, Parker and Wall (1998) conclude “*the job characteristics model has proved to be the most widely used theoretical approach to job design yet proposed*” (p.13).

Whilst, Evans, Kiggundu and House (1979, p.354) state “*The job characteristics model has rapidly become the dominant paradigm in organization psychology’s search for the alchemist’s stone*”. It comes as little surprise that the JCM has a dominant position in my work when considering the nature and

outcomes of call centre working. Both the skill variety and autonomy elements of the model are used in the studies of thesis. In Study 1, skill variety is more specifically conceptualised using the scales of both skill utilisation and task variety, and, autonomy is conceptualised, again, more precisely as both timing control and method control. In the Study 2, just the autonomy element is again used, but this time it is conceptualised as a key element of Karasek's (1979) Demand-Control Model of Strain, rather than as part of the JCM.

1.2.10. Socio-Technical Systems (STS) approach

Another job design theory that is worthy of inclusion is the "socio-technical systems approach" which came out of the Tavistock Institute of Human Relations in London during the 1950s (Parker & Wall, 1998). The gist of this approach is that there should be "joint optimization and parallel design" (p. 16, Parker & Wall, 1998) of the social technical subsystems in organisations. It was Cherns in 1976 and in 1987 who worked on clarifying what the main principals of the theory were, that is:

- Design processes should be compatible with desired outcomes
- Methods of working minimally specified
- Variances in work processes handled at source
- Those who need resources should have access to and authority over them
- Roles should be multi-functional and multi-skilled
- Redesign should be continuous, not a "once and for all" change

(Parker & Wall, 1998).

The focus of the socio-technical approach in comparison to the JCM was more on the proposition to work in a group or a team. Parker and Wall (1998) suggest, citing Pasmore (1988), that coming out of the socio-technical approach “*the key innovative proposal was for the development of autonomous work groups, which were considered to be the best way to optimize technical and social systems*” (p.17). I discuss what the STS approach might mean for call centre roles in the Discussion section of this thesis.

1.2.11. Does call centre work have to be both lean and mean?

Previous analyses for Sprigg, Smith and Jackson (2003) found that those call handlers with the poorer well-being amongst other things (see p. vii of Sprigg, Smith & Jackson, 2003) followed strict scripts and had their performance monitored either constantly (or rarely). In addition, call handling per se was made stressful for a call handler when they: i) had a high workload, ii) were unclear about their work role, iii) could not make full use of their skills, and iv) had conflicting role demands.

The conceptual framework presented in Figure 1 in my thesis and the supporting background literature to the framework suggests that the so-called ‘Lean Service System Characteristics’ of dialog scripting and performance monitoring have their deleterious effect on job strain through a negative alteration of basic job design dimensions (i.e., lessening autonomy etc). Again I discuss this further at the end of my thesis.

1.2.12. Job crafting and other extended models of job design

In 2001, Amy Wrzesniewski and Jane Dutton wrote a seminal paper titled “*Crafting a job: Revisioning employees as active crafters of their work*”. Job

crafting offers an alternative to job design perspectives; as the employee is placed in a role of the traditional manager and is seen as a competent and active architect of the job.

Wrzesniewski and Dutton proposed that "*employees craft their jobs by changing cognitive, task, and/or relational boundaries to shape interactions and relationships with others at work*" (p. 179). They argued that "*even in the most restricted and routine jobs, employees can exert some influence on what is the essence of the work*" (p.179). Call centre work can be viewed as one such environment where many jobs are both restricted and routine; however even here there will be opportunities and motivations to craft.

In a recent paper Clegg and Spencer (2007) present a new model of the process of job design and within it draw on the work of Wrzesniewski and Dutton (2001). Clegg and Spencer argue that the "*theory underlying mainstream job design thinking and practice has become rather set in its ways, if not to say moribund*" (p.321). Clegg and Spencer (2007) challenge the dominant ways of thinking about job design with the presentation of their model. They make five main claims about their new model of the process of job design, they:

- Extend the range of variables implicated in the job design process; with emphasis on the role of performance, competence, trust, knowledge and self-efficacy
- Argue for dynamic circularity ('loopiness') of the relationships between variables
- Include some consideration of the role of the various local actors in the job design process (e.g., job-holder, supervisor and peers)

- Identify some of the contingencies affecting the model about the scope and motivation for variation in role adjustment and performance
- Specify the causal order of events in the process and speculate on the nature of time lags in the model

Clegg and Spencer (2007) also suggest that there are jobs which have relatively fixed “givens” and again highlight that one such environment where there might be less scope for role adjustment is “*in carefully scripted and monitored call centres*” (p.329). Although, Clegg and Spencer (2007) go on to argue that there is more scope for role adjustments than is often perceived. Indeed, they highlight the assembly line as one of the most constrained of work systems (which many a call centre job has been likened too) and state that within this system there are choices over:

- Cycle times
- Work flow speeds
- Numbers and types of tasks that constitute a job
- Whether work is in fixed locations or move with a line
- Who undertakes quality control

I discuss job crafting in more detail in relation to the call centre context in the Discussion section of my thesis.

1.2.13. Extensions to the work characteristics approach

The content of job design is debated by leading academics in the field (Morgeson, 2007; Parker, 2007). An analysis of 259 job design studies by Morgeson (2007), following a review of 677 papers, found that the independent variables commonly examined were autonomy, skill variety, task significance,

interdependence, feedback from others, social support and work conditions (the latter is far less researched). Dependent variables examined in the 259 papers were routinely of job satisfaction, performance, turnover intentions, role ambiguity and stress.

1.2.14. “Going beyond the usual suspects” (Morgeson, 2007)

Morgeson (2007) calls for work design researchers to go beyond the usual suspects of work design research as the majority of the research has focussed on a narrow range of work characteristics and outcomes. This concurs with Parker and Wall’s (1998) much earlier call for the use of an extended and elaborated work design model. In their book, Parker and Wall (1998) argue that one of the biggest limitations in existing job design research and theory is its’ narrow focus. Traditional theories consider both a limited range of work characteristics and outcome variables. Job design has considered job satisfaction, performance, absence and turnover as outcomes. Yet, most researchers have concentrated on satisfaction and job strain and other “affective reaction variables” (Parker & Wall, 1998).

Morgeson (2007) suggests that the existing measures being used are narrow, incomplete and problematic. Furthermore, that a lack of comprehensive measurement has slowed down the development of work design research. One can only conclude that little has changed and improved in the intervening nine years of research in the area since Parker and Wall wrote their work design book.

Humphrey, Nahrgang, and Morgeson (2007) call for the inclusion of social and contextual characteristics in theoretical models and empirical studies. Study 1 presented in this thesis does this by measuring and considering the contextual

variables of scripting and performance monitoring in call centres and framing them as lean service characteristics. Whereas, Study 2 goes a step further by in addressing the limitations that Morgeson (2007) highlights, with the use of a novel dependent variable, of musculoskeletal disorders, whilst examining stress as a mediator. In the next section, I discuss the relationship between the work design theory and the work-related stress theory, as both provide the theoretical framework to my research.

1.2.15. Integration of work design and work stress research

The Job Demand-Control (JDC) Model of Strain (Karasek, 1979)

The demand-control model of strain as a theoretical perspective that is complementary to the dominant job characteristics approach (Parker & Wall, 1998). Karasek's model proposes that the health and behavioural consequences of work design can be predicted by the interaction of two key work dimensions: *decision latitude* (a combination of the amount of job autonomy and skill discretion) and *psychological demands* (that is, the workload requirements of the job).

A high-strain job results when there are high demands but low decision latitude. Some call centre jobs can be viewed in this way; where the call handler is working on, what is, essentially an assembly line of calls automatically fed through to them, and, they are scripted, monitored and expected to "wrap up" calls within a predetermined time period. These kinds of jobs are considered the most damaging to people's health, with the possibility of leading to longer-term stress-related illnesses such as coronary heart disease. With a *low strain job*, occurring where there is high decision-latitude and low demands.

The most contentious element of the model concerns the proposed interaction between demands and decision latitude. The buffer hypothesis of the model proposes that autonomy (job control) can moderate the negative effects of demands on well-being. Support for this moderating role of control (and social support) is inconsistent (Van Der Doef & Maes, 1999). This interaction is examined in both Study 1 and Study 2.

1.3. Outline of The Thesis

At the core of this thesis is a consideration of the psychological and self-reported physical health of call centre employees. Given the theoretical background just described this leads me to four fundamental research questions:

1. Do the call centre “context” or “lean service characteristics”, that is, scripting and performance monitoring predict call centre employee psychological well-being? Furthermore are these relationships mediated by work design characteristics? (Study 1)
2. Do the work design characteristics, of control and demands predict musculoskeletal disorders in call centre workers? Moreover, is psychological strain a viable mediating mechanism through which some MSD symptoms are manifested? (Study 2).

In Study 2 I examine musculoskeletal health. This variable is important as a variety of UK and US statistics reveal both the high prevalence of musculoskeletal health problems and the cost consequences of employees suffering from them. Whilst, the ergonomic and epidemiological literatures have more widely considered MSDs this is not the case for the work psychology and I/O literatures. Rarely, have MSDs been considered by work psychologists alongside work design and job strain

variables; this is surprising when we consider that both work design and job strain have been implicated as precursors to MSDs.

A further, broader question of my thesis is:

3. Do theories of job design and well-being translate to modern day forms of working, such a call centre working, in a way that is helpful for both the academic researcher and the management practitioner alike? (Studies 1 and 2).

Finally because of the extended time period over which this thesis has been conducted, my last (and fourth) question is:

4. What intervention studies have now been conducted and evaluated in call centres? How do these relate to my own research and recommendations? What are the theoretical and practical implications of these intervention studies?

In the next Chapter (Chapter 2) I outline the relevant research literature as background to my two empirical studies (Study 1 and Study 2).

Chapter 2

2.1. The Two Empirical Studies

This thesis comprises three distinct studies two of which are based on the same large data set of call centre employees (n = 1, 141). Study 1 investigates whether the lean system characteristics of scripting and performance monitoring are directly related to job-related strain and the extent to which this relationship can be accounted for by work design. Few researchers have actively framed call centres in this way, yet given the strong similarities between lean manufacturing processes and those utilised by managers in call centres this is a good way to conceptualise this unique working environment. This study uses an extensive range of work characteristic variables, allowing for both accuracy and specificity when examining the mediating framework hypothesised.

Study 2 examines self-reported physical health outcomes; namely musculoskeletal disorders (MSDs). Whilst this study again utilises the core job characteristics of autonomy and demands, the study goes further than both the majority of work design studies and call centre studies by thoroughly examining three different aspects of MSDs within the as outcome variables. Hence, acknowledging the calls by Parker and Wall (1998), and Morgeson (2007) to operate an extended work design framework, with a broader set of outcomes.

Both studies consider the utility of traditional theories of work design and the JCM in understanding more about the well-being of these employees working in the relatively contemporary context of the call centre.

Before looking in detail at both Study 1 and Study 2, some additional definitions and research background are provided for both studies. In the remainder of this Chapter, I will depict the unique organisational nature of call centres and some of the controversy that surrounds them, especially that concerning employee health.

Following this chapter then Study 1 and Study 2 will be dealt with separately. Each relevant chapter will have in a short introduction and hypotheses, methodology, results and study specific discussions sections. In Chapter 5 a broader, more detailed discussion of the findings from both studies relating to the primary research questions (as introduced in this Chapter 1) will be included. In a final chapter (Chapter 7) I will also summarise the implications of the studies for theory, future research and management practice.

2.2. What is a Call Centre?

A call centre is defined as a: “work environment in which the main business is mediated by a computer and telephone-based technologies that enable the efficient distribution of incoming calls (allocation of outgoing calls) to available staff, and permit the customer-employee interaction to occur simultaneously with the use of display screen equipment and the instant access to, and inputting of, information. It includes parts of companies dedicated to this activity, as well as whole companies that specialize in such services” (Holman, 2005, p. 111-112, based on Smith & Sprigg, 2001).

At the time of data collection for this thesis call centres were growing at a rate of 40% per year globally (Lewig & Dollard, 2003). They employed about 3% of the workforce in the US and 1.3 % in Europe, not including the UK (Datamonitor,

1998, 1999). In the UK, by the end of 2003 the call centre sector comprised 5,320 contact centre operations with almost 500,000 agent positions. The sector had grown by almost 250% since 1995; and was forecast to grow to almost 650,000 agent positions by 2007, directly employing over 1 million people (Department of Trade and Industry, 2004). The dramatic increase in the numbers employed results from advances in front-office automation (Batt & Moynihan, 2002) and innovations in telephone technologies such as the integration of automatic call distribution and other highly sophisticated telephone routing systems.

2.3. Call Centre Human Resource Practices and Outcomes for Employees

Call centres were controversial. They offered clear organizational benefits, for example, through centralization of functions leading to a reduction in costs (Holman, 2005). However, the benefits to employees were less clear, and practices such as repetitive and low discretion but highly pressurized work provoked substantial media interest both in the UK and elsewhere (e.g., Caulkin, 1999; 2004; Clement, 1999; Poulter, 2000; Puttick, 2001).

Obviously then the methods by which call centre employees are managed are the subject of a growing body of research (Deery & Kinnie, 2004). Work in call centres has been characterised as a newer phase of Tayloristic scientific management methods (Bain, Watson, Mulvey, Taylor & Gall, 2002; Houlihan, 2002) with management control elevated to new levels through the joint use of target setting and monitoring of both the quantitative and qualitative aspects of performance. For many in call centres work is a demanding and stressful experience (Holman, 2005) leading

to both burnout and quitting. The high labour turnover (approximately 50% in US call centres in 2000) of call centre staff has huge financial implications for these organisations (Bordoloi, 2004).

Empirical studies give credence to some of the negative views that have been expressed in the media. Baumgartner, Good and Udris (2002), for example, examined 242 call agents in 14 call centres in Switzerland and found high levels of turnover (annual rates of between 8 and 50%) and absence. The most often cited reason for call agents leaving in their sample was experienced monotony. Other studies, however, and especially those directly comparing call centre employees with those in other occupations, have been less negative. For example, in a study of 339 Swiss call centre employees Grebner, Semmer, Lo Faso, Gut, Kalin and Elfering (2003) compared call agents with a group comprising five occupations (cooks, sales assistants, nurses, bank clerks and electronics technicians) and they found similar levels of well-being and less intention to quit amongst call agents. A study by Holman (2002) in financial services call centres also found call centre work compared favorably with manufacturing and clerical work with regard to anxiety, depression and job satisfaction.

One way of conceptualizing and framing these specific call centre HR practices of dialogue scripting and performance monitoring is to consider them exemplars of *lean* system characteristics adopted within this new lean service environment. In the next sections, I explain the reasoning behind drawing this parallel to lean production settings.

2.4. Call Centres as Lean Service Systems (Study 1)

This conceptualization of call centres as lean service systems is proposed, by building on earlier research that has focused on lean production environments (e.g., Jackson & Martin, 1996; Jackson & Mullarkey, 2000). Jackson and Martin (1996) described lean production systems in terms of three characteristics: workflow integration, team interdependence, and process simplification. The practice of call centre work is essentially an individual one involving interactions between call handlers and customers, such that team interdependence is not typical of call centre work. However, there are similarities between call centre work and that within lean production systems (Womack, Jones & Roos, 1990) on the other two lean characteristics which support the proposition that call centres are essentially lean service systems.

Process simplification involves the removal of uncertainties by simplifying and standardizing production processes, and this leads to tasks which are narrowly defined and highly standardized (Batt & Moynihan, 2002), with typically very short cycle times (often one minute or less in auto-assembly). The way in which process simplification can be achieved within call centres is through *dialogue scripting*, and this is the first distinctive characteristic of call centres as lean service systems and is examined next.

I used the term “contextual variables” for the lean service system characteristics of performance monitoring and scripting. Another term for such aspects, and possibly a more appropriate term, is to describe them as *antecedents* (Parker, Wall & Cordery, 2001) and in particular, antecedents of an *internal organizational* nature. In 1984, Clegg criticised work design theory because it had

failed to take into account those factors that influence and constrain work design choices.

Parker et al. (2001) argue that antecedents of an *internal* organizational nature are such things as: i) style of management, ii) technology, iii) nature of the tasks, iii) information systems, iv) human resource practices, v) strategy, vi) history, and, vii) culture. Scripting can be viewed as a style of management or a human resource practice (and to some extent is also a piece of electronic technology on a computer screen controlling exactly what is said). Performance monitoring again is a style of management and human resource practice, and in its electronic form is most certainly a piece of technology. As far back as 1999, John Cordery was arguing that intensive performance monitoring can act to constrain employee autonomy.

There are important practical contributions of expanding work design theory to include such *contextual* antecedents. As Parker et al. (2001) state “*taking account of contextual antecedents also enables us to better predict the types of designs that will be found in various settings and to understand how wider changes taking place in modern organizations might impinge on work design*” (p. 419).

Furthermore, if such antecedents are considered then work design can be thought of as a link between organisational initiatives and practices and outcomes such as well-being and performance. Thus, the effects of an organizational practice will depend to some degree on how that practice impinges on the work design (Parker et al., 2001). Yet, a particular initiative rarely determines work design in totality. The effect of an antecedent on, for example, autonomy might be mitigated or enhanced by making different work design choices. So you could have these lean practices (i.e., tight scripting, coupled with intensive monitoring) but managers could

work to enhance other work design aspects – for example, autonomy and social support – to limit the impact of these antecedents on well-being.

2.4.1. Dialogue scripting

In many cases call handlers are required to follow a scripted dialogue, often displayed on a computer screen, when interacting with customers (Deery, Iverson & Walsh, 2002). This can take the form of a greeting message that has to be repeated verbatim before the interaction with each customer can begin, as well as an array of alternative scripts to be followed depending on the responses of the customer. Call handlers may even be told to display specific emotions, for example be friendly (Zapf, Isic, Bechtoldt & Blau, 2003). The benefit to employers of dialogue scripting is that it reduces initial training times so that staff can be placed ‘live’ onto the phones with the minimum of knowledge. Scripts also ensure the call handler adheres to a precise form of words which may be required for legal reasons (Zapf *et al.*, 2003).

Workflow integration involves the removal of waste (in the form both of in-progress inventory and of idle time between tasks) and of barriers to the free flow of work, leading to high levels of pacing within the production process with workers left with little rest-break between tasks (Delbridge & Turnbull, 1992). Workflow integration is also typically high in call centres. The work of a call handler is essentially machine-paced through automatic routing of incoming calls or dialling of outgoing calls. Furthermore, cycle times in call centres are short: Smith and Sprigg (2001) found that call handlers were typically required to complete calls in less than two minutes and 15 seconds. Moreover, call handlers are expected either to maximize the number of calls they take on a shift or to reach a pre-determined call

target. This is supported by computerized systems which are often used to monitor call duration and time lags between calls (Taylor & Bain, 1999), and call handlers may be encouraged to achieve “wrap-up” of calls quickly.

2.4.2. Performance monitoring

The presence of electronic *performance monitoring* is a second distinctive feature of call centres as lean service systems that I examine. Essentially, there are two types of performance monitoring in call centres: traditional and electronic (Carayon, 1993; Holman, 2005; Stanton, 2000). The traditional form is exemplified by observation, work sampling and customer surveys, and in a call centre typically involves a supervisor listening in on calls (Smith & Sprigg, 2001). The electronic form involves the computerized collection, storage, analysis and reporting of information about employees’ activities on a continuous basis. Such monitoring allows for the collection of minute-by-minute statistics on duration of calls and activities between calls, and is used to monitor performance against targets.

Individual call centres may vary in the extent to which they utilize the two lean system characteristics of dialogue scripting and performance monitoring, and thereby in how lean they are. It is proposed that the *leaner* the call centre the *meaner* it will be. This “*meanness*” is brought about by the way in which the lean system characteristics are expressed through the work design. Evidence for this proposition is given next.

Lean Systems and Work Design

There are a number of studies in the literature showing how technological systems can impact upon work design characteristics. From a study on postal

workers. Amick and Celentano (1991) found that machine-paced rather than self-paced technology produced higher levels of job demands and lower levels of autonomy and co-worker support. In effect, that study demonstrated that the impact of technology on worker stress was indirect and mediated through changes in work design characteristics (Carayon, 1993). The Turner and Karasek (1984) model of how computer technology influences worker performance and worker health also demonstrated that technology can both directly and indirectly affect worker strain. Carayon-Sainfort (1992) tested part of the model and showed that technological characteristics influenced worker stress indirectly through the work design characteristics: demands, control and social support. Drawing upon this work, specific predictions can be derived about the impact of the two lean system characteristics on work design within call centres. The focus is particularly on autonomy, work demands and role characteristics since these have been shown to be important in previous studies of lean production systems (e.g. Jackson & Martin, 1996; see also Parker *et al.*, 1998).

Process simplification through dialogue scripting With respect to worker autonomy, dialogue scripting imposes a standardized form of interaction with the customer, leading to an expectation of reduced method control (i.e., employee autonomy over *how* tasks are performed) and less varied tasks, while the management of work flow by computer would be expected to lead to reduced timing control (i.e., employee autonomy over *when* tasks are performed). Pre-scripted dialogues displayed on the computer screen obviously rely on a degree of predictability in customer requirements, and reduced ability to respond to unscripted circumstances would make role demands less clear and increase role conflict. When routing decisions

during a call are made by the computer, there is obviously less need for detailed worker knowledge and reduced skill utilisation is expected to be seen. Finally, automation of the call management process is likely to lead to increased workload pressure.

Workflow integration through performance monitoring The strict monitoring by computer of the duration of calls and of time lags between calls is an integral element in supporting the flow of work within a lean system. The continual emphasis on minimising call duration and time between calls places the work process under the control of the computer rather than the call handler, and reduced timing and method control are expected to be seen here. Employees within call centres often report that there is a strong emphasis on performance targets, and when the level of such targets is unrelated to customer needs; increased conflict between the demands of meeting performance targets and satisfying customers are expected, together with reduced role clarity as call handlers are unsure about what is required of them. The constant emphasis on timing targets implied by performance monitoring would be expected to increase workload pressure and reduce opportunity for workers to use their skills. Overall then, these predictions are consistent with Schleifer's (1990) conclusion that "there appears to be a theoretical basis and some empirical evidence which supports the premise that electronic monitoring techniques can alter basic job dimensions" (p. 6).

2.5. Employee Well-Being in "Lean" Settings

Just like call centres themselves, the practice of lean production is controversial and views are mixed about its benefits. Some (Wood, 2004) argue that it will require increased discretion for employees and thus lead to enriched forms of

work. Others (e.g., Delbridge, 2004; Delbridge & Turnbull, 1992; Turnbull, 1988) depict lean production as a form of deskilling and work intensification which damages employee well-being. Studies of employee well-being in lean production environments show mixed results. Jackson and Martin (1996) studied the introduction of just-in-time working within a production line and found reduced job satisfaction but no change in psychological strain. Jackson and Mullarkey (2000) compared batch production methods with lean production teams in garment manufacture and found no difference on indicators of well-being: employees in both forms of work organisation were found to have low levels of well-being. The main conclusion of these studies is that the impact of leanness on employee well-being depends on the specific lean practices deployed, such that general conclusions cannot be drawn. In extending this work to call centres therefore, it is important to examine the consequences of differences in the implementation of lean practices rather than simply to assume that all call centres are lean.

Dialogue scripting represents an extreme form of process standardization reducing the call handler's ability to respond to unpredicted idiosyncratic circumstances (Deery *et al.*, 2002). Thus, it is expected that such scripting will have negative consequences for call handler well-being. However, the only empirical data to support this expectation comes from a study of Australian call handlers by Deery *et al.* (2002). They measured dialogue scripting by means of a single item '*I don't like speaking in a scripted way to customers*', and found that call centre employees who disliked speaking in a scripted manner were also more likely to report suffering emotional exhaustion. However, the evaluative nature of the wording of the

scripting item makes the finding somewhat tautological, and a stronger test of this relationship is desirable.

In many call centres, performance monitoring is of an overt and pervasive nature (Holman, 2005) and it is expected to have a negative impact on well-being (Holman & Wood, 2002). Carayon (1993) proposed a conceptual model within which performance monitoring is considered as a technological work stressor, and there is empirical evidence of links to increased stress (Aiello & Shao, 1993; Smith, Carayon, Sanders, Lim & LeGrande, 1992). A study in the telecommunications industry (Smith et al., 1992) showed that monitored employees reported higher levels of work pressure than did employees whose performance was not monitored. Carayon (1993) also found higher employee stress where monitoring is highly intensive, frequent, continuous and irregular.

2.6. Employee Psychological Well-Being and Work Design

Characteristics

Work design characteristics within have all been shown in previous research to influence job-related strain (Parker & Wall, 1998; Wall, Corbett, Martin, Clegg & Jackson 1990; Warr, 1999). Autonomy has a well-established association with lower worker strain (e.g., Wall, Jackson, Mullarkey & Parker, 1996); while job demands are associated with higher strain. Task variety is also associated with well-being (Warr, 1999; Xie & Johns, 1995). Skill utilization has also been shown to promote employee well-being (Campion & McClelland, 1993). Finally, Abramis (1994) and Jackson and Schuler (1985) have shown that high role conflict and low role clarity have been consistently identified as stressful and dissatisfying aspects of work.

2.7. The Mediating Role of Work Design

In Study 1, it is proposed that work design characteristics mediate the link between the two lean system characteristics and job-related strain. Mediation effects have been found in a number of studies of the relationship between technology and job satisfaction (e.g., Jackson and Mullarkey, 2000; Rousseau, 1978). A longitudinal quasi-experimental field study by Parker (2003) used this same work design mediational framework. In the Parker study, the negative effects of lean production were partly attributable to declines in perceived work characteristics (job autonomy, skill utilization and participation in decision-making). These findings are consistent with Landsbergis, Cahill and Schnall's (1999) suggestion that lean production can be damaging to employees. Although the organization in the Parker (2003) study was only in the early stages of a lean production initiative, negative human consequences still emerged with groups reporting poorer quality work designs and a decline in organizational commitment.

The mediational framework employed in Study 1 draws primarily on job characteristics theory (Hackman & Oldham, 1975; 1976; 1980). The job characteristics theory provides a guiding framework for understanding the impact of the so-called lean service system characteristics (scripting and monitoring) as we expect that these practices will systematically impact on the work characteristics.

This mediating role of work characteristics has been suggested and demonstrated by a number of earlier studies (Jackson & Martin, 1996; Parker, Griffin, Sprigg & Wall, 2002; Parker, Wall & Cordery, 2001). The studies that have examined explicitly the mediating role of work characteristics in relation to *lean* production processes are those of Jackson and Mullarkey (2000) and Parker (2003).

This latter paper by Parker groups multiple work characteristics together in a mediational framework which was the inspiration behind the framework used in Study 1. Indeed, Study 1 was seen as an improvement on the Parker (2003) framework as it included seven job characteristics in contrast to Parker's four.

The mediational framework in Study 1 includes the following seven key job characteristics: timing control, method control, workload, role conflict, role clarity, task variety and skill utilisation. All these job characteristics are known to influence job-related strain – the single outcome variable in the Study 1 framework - and these relationships are written about in section 2.6.

There is a strong logical rationale to it, if not a theoretical one from the JCM, as these job characteristics do co-occur in real working life and their impact is felt simultaneously by employees. They do not operate in isolation within the workplace.

2.8. An Expanded Work Design Framework: The Case for Examining Musculoskeletal Disorders (Study 2)

In 1998, Parker and Wall called for researchers to examine a broader number of aspects within the work design framework. Responding to this call I chose to include measures of musculoskeletal symptoms alongside the work design in the bespoke call centre questionnaire I compiled (whilst working at HSL). This was a deliberate attempt to test a slightly broader work design conceptual framework, and look beyond the more commonly tested psychological outcome variables.

Musculoskeletal disorders (MSDs) are a neglected outcome variable for the majority of work psychologists, yet are a burden on individuals and organisations alike. Many different body parts can be affected, resulting in pain in the upper body

(i.e. neck, shoulders and upper back), lower back, and arms (i.e. elbows, wrists and hands) (Coover & Thompson, 2003). MSDs affect the quality and duration of employees' working lives, as evident from the fact that in the US they are reported to be the third most frequent reason for disability and early retirement (Brenner & Ahern, 2000). There are also substantial economic implications for employers and society more generally. The US Department of Labor reported costs from MSDs of more than \$50 billion a year (Coover & Thompson, 2003). An equivalent figure for the UK is £5.7 billion, with MSDs accounting for some 11.6 million lost working days a year (Health & Safety Executive, 2005). More recently, in Hanson, Burton, Kendall, Lancaster and Pilkington (2006) state that "On average, each affected person took an estimated 20.5 days off work in that 12 month period. This equates to annual loss of 0.50 days due to MSDs per worker in the UK" (p. vii).

A common belief is that MSDs are caused by physical demands, especially those involving biomechanical load from a combination of repetition, force and posture, such as that found in factory, construction or nursing work (Ariens, van Mechelen, Bongers, Bouter, & van der Wal, 2001; Devereux, Rydstedt, Kelly, Weston, & Buckle, 2004). However, there is also evidence that such disorders are common amongst office employees. A UK study of 2,000 office employees, for example, found that almost two-thirds suffered from pain in their neck, upper limbs or back (Chartered Society of Physiotherapists, 2005). The underlying assumption is that office work, where unremitting demands tie people to their workstations whilst requiring frequent repetition of arm and hand movements for keyboard entry leads to MSDs (Punnett & Bergqvist, 1997).

As I have already outlined the methods by which call centre employees are managed are the subject of a growing body of research (Deery & Kinnie, 2004). Much of work psychology research on well-being in call centres to date examines the relationship of job demands (e.g., workload, call volume, concentration demands) and job resources (e.g., autonomy, social support, skill utilisation) with such outcomes as anxiety, depression and emotional exhaustion (Grebner et al., 2003; Witt, Andrews & Carlson, 2004; Zapf, Vogt, Seifert, Mertini, & Isic, 1999).

Little research, however, has looked beyond these psychological constructs (Ferreira & Saldiva, 2002; Halford & Cohen, 2003) to include MSDs. Yet it is important to do so in order to determine the extent to which MSDs result simply from the physical demands of the work itself (e.g., the repetition of using telephones and computers) or through the effects of such demands on psychological well-being (e.g., holding oneself tense because of strain). Either the foregoing biomedical or psychologically mediated forms of causation would predict absenteeism (Bakker, Demerouti & Schaufeli, 2003), but the differing aetiologies and mechanisms imply different strategies for dealing with the problem (Devereux et al., 2004). They thus warrant more detailed consideration.

The Biomechanical Explanation

The biomechanical explanation of MSDs focuses on how work characteristics, of which the most prominent is workload, affect physical posture and movement. Unremitting workload is deemed to have its effect by restricting some movements and requiring repetition of others. High workload can 'tie' employees to their workstation, because as soon as one call is finished the next is waiting. Under the most demanding conditions individuals will sit for long periods entering or

retrieving information for callers, without rest breaks. This can result in changes in trunk kinematics, the forces and muscle activity that increase loads and stresses on the musculoskeletal system (Ariens, et al., 2001; Devereux, et al., 2004). This will be a particular problem for the upper body and lower back which, under conditions of high workload, are likely to be held in one position for extended periods of time. The specific implication of high workload for the arms and hands is rather different, as the biomechanical requirements of keyboard entry mean that the greatest risk comes from repetitive over-use rather than immobility (Crawford, Laiou, Spurgeon, McMillan & Ieromnimon, 2005). The basic prediction, however, is the same - the higher the workload, the greater the likelihood of MSDs. Workload is expected to have direct effects on MSDs of the upper body, lower back and of the arms.

A second consideration is the degree of autonomy that employees are afforded in how and when they complete their tasks. For many call centre staff this can be severely limited, with screen-based scripts constraining their responses (Sprigg & Jackson, 2006), and with automatic call distribution (ACD) giving them little option of scheduling their own work (Bain, et al., 2002). Where employees have autonomy it can be used to counteract the effects of the relentless pace of work, for example by allowing them to reschedule tasks in response to bodily discomfort, or to take a break when required. If call handlers have such autonomy it allows them to manage the pace of work better, and to select the nature of the call they are taking from different options available (e.g., bill checking, complaint, other query). As is the case for psychological strain in call centres (Holman & Wall, 2002), we would also predict a beneficial effect of autonomy on MSDs.

There is some empirical evidence supporting these positions, which comes from the medical rather than the work psychology literature. High workload frequently has been associated with high levels of upper body MSDs (e.g. Ariens et al., 2001; Hales, Sauter, Peterson, Fine, Putz-Anderson, Schleifer, Ochs & Bernard, 1994; Hoekstra, Hurrell, Swanson & Tepper, 1996) as it has with lower back MSDs (Heliövaara, Makela, Knekt, Impivaara, & Aromaa, 1991), and repetitive strain injury (Bakker et al., 2003). Similarly, lack of autonomy has been found to be related to increased MSDs of all types (Ariens et al., 2001; Parkes, Carnell & Farmer, 2005; Torp, Riise & Moen, 2001). As Bernard et al. (1997) concluded: “While the etiologic mechanisms are poorly understood ..(and) the findings of the studies reviewed are not entirely consistent, they suggest that perceptions of intensified workload, monotonous work, limited job control .. are associated with various work-related musculoskeletal disorders” (p. 71).

2.9. The Mediating Role of Psychological Strain

The above literature might reasonably be interpreted as showing direct effects of workload on MSDs but research suggests (Devereux et al., 2004; Malchaire, Cock & Vergracht, 2001) that restricting one’s explanation to biomechanical factors alone is inappropriate. The alternative, which goes some way towards identifying a mechanism, is an explanation in which workload operates through psychological strain to produce MSDs. There are two reasons for giving this perspective some credibility. The first is that the job factors identified as associated with MSDs, namely workload (or work demands) and autonomy (or control), are also strongly implicated as determinants of work-related strain. These are at the core of leading theoretical propositions such as Karasek’s (1979) Demands-Control Model as well

as being prominent in many empirical studies (Warr, 1999). Furthermore, our propositions can be theoretically framed within the Job Demands-Resources (JD-R) model used to examine absenteeism and turnover intentions in call centre employees (Bakker, et al., 2003). According to the JD-R model, jobs with high workload demands may exhaust employees' mental and physical resources, leading to health problems.

The second reason to consider psychological strain is evidence that those employees suffering from greater work-related strain report more MSDs (Ahlberg-Hulten, Theorell & Siagala, 1995; Heliovaara et al., 1991; Shannon, Woodward, Cunningham, McIntosh, Lendrum, Brown & Rosenbloom, 2001; Vasseljen, Holte & Westgaard, 2001).

There are three further arguments for a psychological mechanism underlying MSDs which come from the work design and job strain literatures. The first simply formalises an assumption implicit in the previous discussion. Given workload relates to strain, which in turn relates to MSDs, it is that strain mediates the relationship of workload and autonomy with musculoskeletal disorders. There is a strong rationale for such a proposition. For workload the argument is that the greater the demand the more strain it imposes upon employees, and it is this psychological state (rather than immobility) that affects the musculature (Theorell, Harms-Ringdahl, Ahlberg-Hulten, & Westin, 1991) and leads to MSDs. Here, psychological strain has a physical consequence that manifests itself in physical symptoms; for example as a result of anxious people holding themselves tense. For autonomy the implication is the reverse: the more autonomy an individual has, the less their strain and hence the fewer are their MSD symptoms.

Though this mediation hypothesis often has been proposed (Bongers, Kremer & ter Laak, 2002; Carayon, Smith, & Haims, 1999; Devereux et al. 2004; Lundberg, 2002), rarely has it been directly tested. In one of the few studies where it was examined, affective distress, especially anxiety, largely mediated the relationship between work characteristics (also known as psychosocial factors) and MSDs among oil industry employees (Parkes et al., 2005).

The second implication is that such mediation will apply to MSDs of the upper body (neck, shoulders and upper back) and of the lower back, but not to the arms and hands. Explanations of the effect of strain in terms of holding the body tense apply mainly to the torso rather than to the limbs (Lundberg, 1996), which is consistent with the empirical findings to date. Evidence shows associations of strain with MSDs of the upper body (Shannon et al., 2001; Vasseljen et al., 2001) and lower back (e.g. Ahlberg-Hulten et al., 1995; Davis & Heaney, 2000; Heliovaara et al., 1991), but none with the arms and hands. Psychosocial factors are more important for the neck/shoulder region than the hand/wrist area (Hales et al., 1994).

A third implication comes from the Demand-Control model of strain (Karasek, 1979). This model posits that the health consequences of work design can be predicted by the interaction of two key work dimensions: decision latitude (autonomy) and psychological demands (workload). A high-strain (unhealthy) job is expected when there is low autonomy and high workload. The interaction implies that as long as autonomy is increased, demands can be increased without detrimental effects on health (Parker & Wall, 1998). It is expected that the effect of workload on strain and MSDs will be moderated by autonomy. More specifically, the prediction

is that the lower the level of autonomy, the stronger the relationship of workload with strain and MSDs.

2.10. Summary of Chapter 2

In this Chapter I have justified the framing of call centres as lean service environments, and the practices of scripting and performance monitoring as exemplars of lean service characteristics. I have proposed that work design characteristics will mediate the relationship between these lean service characteristics and the psychological well-being outcomes. In addition, I have outlined the importance of considering MSDs as a health outcome variable within work design studies, and especially the need to examine this in call centres. Moreover, I have set up the proposition that psychological strain may be an explanatory mechanism in the case of some MSDs symptoms.

With these background details in place, I proceed to report, after a brief Introduction, the Hypotheses, Methods, Results and discuss the key findings of Study 1 (concerned with lean service characteristics, psychological well-being outcomes and the mediating role of work design). I do the same for Study 2 (concerned with work design, musculoskeletal disorders and the mediating role of psychological strain). The findings and implications of both studies are discussed in greater detail in the following chapter (Chapter 5).

Chapter 3

3.1. Chapter Overview

In this Chapter I describe the specific hypotheses that were developed for Study 1. My first study was concerned with the relationships between the call centre lean service characteristics, of dialogue scripting and performance monitoring, and psychological well-being. Furthermore, the study examined whether job design characteristics played a mediating role in this relationship. Before I present the specific hypothesis, the methodology and the results, I recap on the conceptual rationale for this Study.

3.2. Conceptual Framework for Study 1

The theoretical background to this study is given in the sections proceeding chapter. Extensive previous research has established job characteristics impact on well-being, and, there is also some research on the impact of lean production techniques on employee well-being. Other research has also established that technological systems, such as performance monitoring do fundamentally alter core work design characteristics. However, no previous research has specifically examined the impact of dialogue scripting and performance monitoring on the job design of call centre employees, and, in turn, examined the influence of both factors on psychological well-being, in the form of job-related strain.

3.3. Summary of Hypotheses Linking Lean Service Characteristics, Work Design Characteristics and Job-Related Strain

The material presented as research background and theoretical underpinning in the previous chapters led to the formation of the following four research hypotheses. The conceptual framework is presented in Figure 1 as a way of guiding the reader through both the underlying assumptions of the research and also the initial analysis. Thus, the following hypotheses should be read in conjunction with the figure on the next page.

Hypothesis 1. Greater utilization of dialogue scripting and higher levels of performance monitoring are associated with higher job-related strain (path *A* in Figure 1)

Hypothesis 2. There is an association between lean service characteristics and work design characteristics. Dialogue scripting is associated with lower autonomy (timing and method control), lower task variety and skill utilization, higher workload, lower role clarity and higher role conflict. Performance monitoring is associated with lower autonomy (timing and method control), lower skill variety, higher workload, lower role clarity and higher role conflict (path *B* in Figure 1).

Hypothesis 3. There is an association between work design characteristics and job-related strain (path *C* in Figure 1).

Hypothesis 4. Work design characteristics mediate the relationship between lean service characteristics and job-related strain (path *A* is small relative to the joint path *B / C*).

In summary, this study investigated whether the lean system characteristics of scripting and performance monitoring are directly related to job-related strain and the extent to which this relationship can be accounted for by work design.

3.4. Methodology and Study Contexts

Participants, Procedure and Sample Characteristics

Participants were front-line call handlers (n = 823) drawn from 36 call centres operated by 19 organizations in the UK. The sample included call centres from nine business sectors, namely telecommunications and IT, financial services, retail, utilities, hotels and leisure, public/ voluntary sector, transport and travel, emergency services and outsourcing. The distribution of respondents by industry sector is shown in Table 1. The largest sector included in the study was telecommunications & IT, followed by financial services and utilities. The study also included much smaller groups working in sectors (such as the emergency services) which are rarely the subject of study in call centre research.

Figure 1 Conceptual framework for call centres as lean service environments

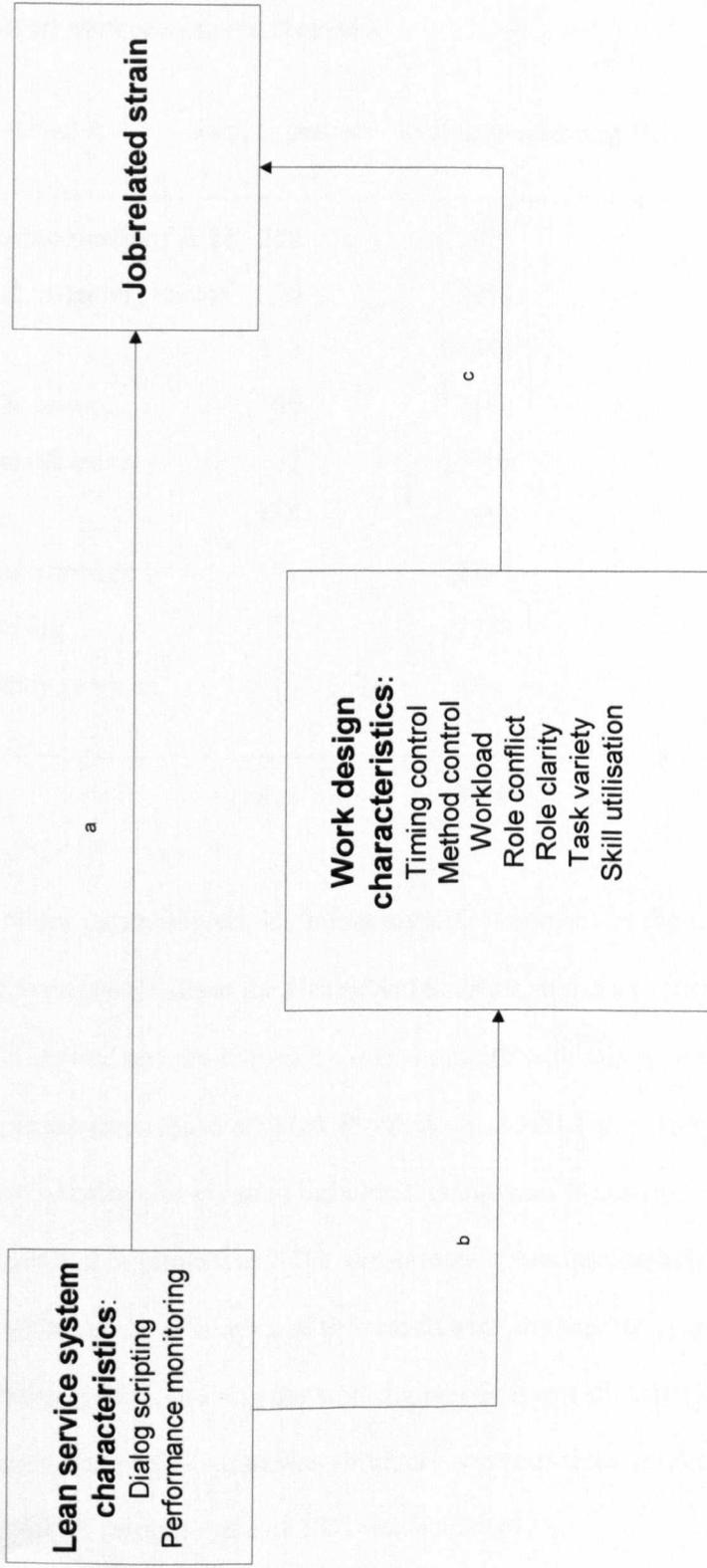


Table 1: Distribution of sample by business sector, and incidence of each lean service characteristic

Business sector	Sample percent	Dialogue scripting	Performance monitoring
Telecommunications & IT	202	28%	47%
Public & voluntary sector	70	29%	56%
Retail	113	43%	56%
Hotels & leisure	69	31%	32%
Transport & travel	57	57%	50%
Utilities	116	25%	62%
Financial services	171	47%	41%
Outsourcing	12	25%	42%
Emergency services	13	0%	25%
Overall	823	35%	48%

Work psychologists, including myself, employed by the UK Health and Safety Executive (HSE) at the Health and Safety Laboratory (HSL) collected all the data. I compiled and developed the questionnaire with minor consultation with Phoebe Smith (then Head of Work Psychology at HSL) and other colleagues in HSE. The questionnaire was given to individual employees by survey champions within call centres and organizations. The questionnaire was accompanied by a covering letter explaining the affiliation of the researchers and that the research was part of a large HSE project examining the working practices in call centres. It was emphasized that participation was voluntary and responses would be kept confidential. A response rate of 38% was achieved

Measures

Lean System Characteristics The study included measures of two lean service system characteristics. *Dialogue scripting* was measured by asking respondents whether or not they followed a set script. *Performance monitoring*, was measured by a single item adapted from Carayon (1994): 'My performance is monitored by recording the duration of calls and time lags between calls'. Responses were recorded on a five-point scale from *rarely or never* to (1) *constantly* (5). A dummy variable was created by combining the first four scale points to indicate whether or not performance was *constantly* monitored.

Work design characteristics. Autonomy (control) was measured using the two scales developed by Jackson, Wall, Martin and Davids (1993), with the wording amended slightly to make items more specific to call handlers. Thus, *timing control* was measured by five items ($\alpha = 0.73$) assessing the extent to which call handlers had influence over the initiation, pacing and completion of calls. An example item is 'To what extent do you decide on the order in which you answer calls?' *Method control* was measured by four items ($\alpha = 0.77$) assessing the extent to which call handlers have influence over how they carry out work tasks (for example, 'To what extent can you control how many calls you answer?'). Responses to both scales were recorded on a five point scale from (1) *not at all* to (5) *a great deal*.

Workload was measured using the seven-item measure ($\alpha = 0.78$) devised by Mullarkey, Jackson and Parker (1995). Example items are 'To what extent do you find your work piles up faster than you can complete it?' and 'To what extent do you feel under pressure at work?' Responses were recorded on a 5-point scale from (1) *rarely or never* to (5) *constantly*.

Role conflict was measured by a six-item scale ($\alpha = 0.89$) based on Rizzo, House and Lirtzman (1970). Items recorded the extent to which call handlers' role demands were either consistent or inconsistent. An example item is 'I have to do things that I believe should be done in a different way'. *Role clarity* was measured with a seven-item scale ($\alpha = 0.88$) based on Rizzo *et al.* (1970) and Sawyer (1992). This scale measured the extent to which work goals, work processes and performance requirements are clearly specified. An example item is 'How clear are you about the goals and objectives for your team?' Responses for both sets of items were recorded on a 5-point response scale from (1) *rarely or never* to (5) *constantly*.

Skill utilization was assessed using a four-item measure ($\alpha = 0.82$) adapted from Clegg and Wall (1990), reflecting the extent to which call handlers were able to use and develop their skills. An example item is 'To what extent do you make full use of your skills?' Responses were recorded on a 5-point scale from (1) *not at all* to (5) *a great deal*.

Task variety was measured using two items ($\alpha = 0.83$) adapted from Jackson and Martin (1996), reflecting the extent to which call handlers were involved in a range of different tasks. Items are 'To what extent do you carry out the same tasks over and over again?', and 'To what extent is your work repetitive?'. Responses were recorded on a 5-point scale from (1) *not at all* to (5) *a great deal*.

Job-related strain This was assessed by combining the job-related anxiety and job-related depression scales developed by Warr (1990). For job-related anxiety, respondents rated the extent to which their job made them feel 'tense', 'calm', 'relaxed', 'worried', 'uneasy' and 'contented'. For job-related depression, respondents

rated the extent to which their job made them feel: 'miserable', 'depressed', 'optimistic', 'enthusiastic', 'gloomy' and 'cheerful'. Responses were recorded on a 5-point scale from (1) *never* to (5) *all the time*, and positively worded items were reverse-scored. Internal reliability (α) was 0.91.

Qualitative data was obtained from open-ended questions throughout the questionnaire, when participants were invited to make comments on any aspect of their experience as a call centre employee.

Sample Characteristics for Study 1

Nearly three quarters (74%) of the sample were female, and almost all (94%) described themselves as white. The majority (64%) were aged between 20 and 39 years, with only 7% under 20 and 10% aged 50 years or over. Only 25% were members of a trade union. There was a wide distribution of job tenure within the sample: 32% had worked in the call centre for less than one year, 24% for between one and two years, 28% for between three and five years, and 16% for six years or more.

Virtually all call handlers (97%) had formal educational qualifications. For 39% these were up to GCSE level, a further 44% had 'A' level or equivalent qualifications, and 14% were university graduates. Analysis of contracted working hours showed that most call handlers (70%) were employed full-time, and 21% were contracted to work for 25 hours or less a week. Over 40% of the sample worked rotating rather than fixed shifts, and the most common pattern was to work weekdays as well as weekends. Very few people worked only evenings (5%) or only weekends (2%).

3.5. Results

All the data were analyzed in collaboration with and under the supervision of Professor Paul Jackson (Manchester Business School, University of Manchester) apart from the LISREL analysis.

3.5.1. Descriptive statistics

Table 2 shows the means, standard deviations, and correlations among the study variables. The two lean system characteristics were moderately positively correlated, such that call handlers who followed a set script were also more likely to work in environments where their performance was constantly monitored. Relationships among the work design characteristics were somewhat higher. In general, work demands were lower where control was higher. Both lean system characteristics were significantly correlated with job-related strain: the *leaner* the work environment, the higher was employee strain, confirming hypothesis 1. The work design characteristics were also correlated both with the lean system characteristics and with job-related strain: a lean system was associated with lower control and higher work demands, and higher strain was associated with lower control and higher work demands.

Table 2: Means, standard deviations and correlations among study variables (n = 823)

	1	2	3	4	5	6	7	8	9	10
1. Dialogue scripting	-									
2. Performance monitoring	.05	-								
3. Timing control	-.13	-.12	-							
4. Method control	-.17	-.12	.66	-						
5. Workload	.21	.27	-.20	-.28	-					
6. Role conflict	.14	.22	-.18	-.23	.56	-				
7. Role clarity	-.06	-.10	.12	.15	-.27	-.41	-			
8. Task variety	-.17	-.13	.20	.23	-.21	-.17	.06	-		
9. Skill utilisation	-.04	-.06	.28	.32	-.06	-.27	.32	.28	-	
10. Job-related strain	.15	.20	-.31	-.36	-.50	.52	.34	-.25	-.37	-
Mean	.35	.48	1.92	2.10	2.54	2.19	5.13	1.50	2.50	2.90
Standard deviation	.48	.50	.86	.96	.85	.92	.85	.77	1.00	.74

Note: correlations greater than +/- 0.10 are significant at $p < .01$.

Table 3. Lean Service Characteristics Predicting Job Strain (Path A of Figure 1)

<i>Predictors</i>	<i>Beta</i>	<i>R-Square</i>
Step 1		.01
<i>Sector</i>	.04	
<i>Age</i>	.02	
<i>Gender</i>	.06	
Step 2		.13
<i>Sector</i>	-.01	
<i>Age</i>	-.02	
<i>Gender</i>	.07	
<i>Scripting</i>	.12**	
<i>Performance Monitoring</i>	.33**	

* $p < .05$; ** $p < .01$.

Work design as a function of lean system characteristics

Hypothesis 2 (path B of the study framework) was tested using multivariate and univariate analysis of variance for each lean system characteristic separately. Given the large sample size, the .01 level of significance was employed throughout, in order to avoid interpreting trivial effects. Summary results are shown in Table 4. Taking

performance monitoring first of all, the multivariate test was highly significant (Wilks' lambda = .95, $F = 10.49$, $df = 7, 819$, $p < .01$), and all seven univariate tests were also significant with mean differences in the predicted direction. Call handlers whose performance was constantly monitored reported lower control over work methods and timing, as well as lower task variety and skill utilization. They also reported higher workload, higher role conflict and lower role clarity. Results for dialogue scripting are similar: the multivariate test was highly significant (Wilks' lambda = .94, $F = 8.58$, $df = 7, 819$, $p < .01$), and five of the seven univariate tests were significant. Following a set script was associated with lower control over work methods and timing, lower task variety, higher workload and higher role conflict. Overall then, the data lend strong support to hypothesis 2 relating to path *B* in our study framework.

Table 4: Mean scores for each work design characteristic as a function of each lean service characteristic separately, and results of analysis of variance

	Performance monitoring			Dialogue scripting		
	no	yes	F ratio	no	yes	F ratio
Timing control	1.98	1.78	10.24*	1.99	1.78	12.04*
Method control	2.17	1.94	10.59*	2.22	1.89	22.85*
Workload	2.36	2.82	60.38*	2.42	2.77	34.12*
Role conflict	2.02	2.44	40.67*	2.11	2.36	15.22*
Role clarity	5.21	5.03	8.72*	5.17	5.07	2.55
Task variety	1.54	1.38	9.60*	1.59	1.32	24.03*
Skill utilisation	2.57	2.39	6.00*	2.53	2.44	1.38
Multivariate test			10.49*			8.58*

* $p < .01$

3.5.2. Hierarchical regression analysis

Table 5 shows results from hierarchical regression analysis. Business sector, age and gender were included as covariates in all analyses reported below. At the first step, hypothesis 1 was tested more rigorously by entering the two lean service indicators (dialogue scripting and performance monitoring) together to assess their independent impact on job-related strain. Both indicators were significant predictors (for dialogue

scripting, $\beta = 0.12$, $p < .01$ and for performance monitoring, $\beta = 0.33$, $p < .01$). Call handlers who followed a dialogue script and whose performance was constantly monitored reported higher levels of job-related strain, consistent with hypothesis 1.

Table 5. Lean Service System Characteristics Predicting Job Strain with Work Design Characteristics as Mediators

<i>Predictors</i>	<i>Beta</i>	<i>R-Square</i>
Step 1		.01
<i>Sector</i>	.04	
<i>Age</i>	.03	
<i>Gender</i>	.06	
Step 2		.13*
<i>Sector</i>	-.00	
<i>Age</i>	-.02	
<i>Gender</i>	.06	
<i>Scripting</i>	.12**	
<i>Performance Monitoring</i>	.33**	
Step 3		.41*
<i>Sector</i>	-.01	
<i>Age</i>	-.09*	
<i>Gender</i>	.03	
<i>Scripting</i>	.06	
<i>Performance Monitoring</i>	.04	

<i>Timing Control</i>	-0.05
<i>Method Control</i>	-.31**
<i>Role Conflict</i>	.27**
<i>Role Clarity</i>	-.07
<i>Task Variety</i>	-.06
<i>Skill Utilization</i>	-.13**

* p <.05; ** p <.01.

The qualitative data complement these findings, by illustrating call handler perceptions of monitoring and its relationship to their well-being. One call handler from the study working described the call centre working environment as “*the most monitored and closely controlled*” in the UK. Another wrote that “*the constant minute by minute monitoring throughout my working day is very oppressive and demoralizing*”. Similarly, another call handler wrote “*I think call centres in general can be very stressful work due to constant monitoring of advisors to be productive at all times – there are very few jobs where people are expected to be accountable for each minute of the day*”.

At the second step of the regression analysis, hypothesis 3 was tested by adding the work design variables (assessing path C of Figure 1). Note, first, that there was a substantial increase in the variance accounted for when the work design variables were added (from $R^2 = 0.13$ to $R^2 = 0.41$). Examination of the regression weights for the added variables shows the extent to which each adds independently to the prediction of

job-related strain. Three out of the seven work design predictor were statistically significant in the predicted direction, and hypothesis 3 is thus partly confirmed.

The strongest predictor was workload ($\beta = 0.27, p < .01$), showing that heavier workload was associated with higher job-related strain, independently of other work design characteristics. Again, qualitative data substantiate this finding. Call handlers commented, for example, *"lots of pressure to take certain amount of calls"* ... *"There is constant pressure to churn out the calls, quantity rather than quality even though we are told otherwise by management"* *"The one thing I notice is that I feel very stressed when the calls come through one after the other with no pauses"* ... *"it is a very mentally exhausting job due to the degree of concentration required"*.

Role conflict was also significant, with higher strain associated with higher role conflict ($\beta = 0.27, p < .01$). Again call handler's comments illustrate some of the inherent conflicts of call centre working : *"Too much emphasis on quantity but quality expected to be of a high standard"* ... *"Managers say that quality is important, yet we have to keep to strict call per hour target"* ... *"Too much emphasis is put on answering calls i.e. quality and quantity goes out the window it – it is very stat driven. Customers still want to be treated as individuals so you feel torn at times"*... *"You are constantly aware as customers are talking that your call handling time is monitored and feel by wanting/wishing this person to finish that you not listening as you should and giving quality service as you would prefer to give"*.

Skill utilization acted as a protective device: call handlers reported lower job-related strain if they had greater opportunity to use their skills ($\beta = -0.13, p < .01$). Again

this is reinforced by views expressed by call handlers: *“I feel that tasks should be more wide ranging involving time off phones as well” ... “I find it very monotonous and the job has no variation” ... “People in this call centre are on line all of their time, with no variation of work” ... “Working in a call centre is very much like a human robot. Work is very routine with no variation”*.

Although all the work design variables were significantly correlated with job-related strain, the regression analysis shows that the two measures of control are weak and non-significant predictors, as are role clarity and task variety. Examination of the sample means in Table 2 shows that control and task variety are generally low within this sample, while role clarity is very high indicating that job tasks for call handlers are very clearly defined. It seems likely that the non-significant findings result from restriction of range.

Hypothesis 4 concerns the mediating role of work design, and support for this element of the study framework requires that several criteria be met. First, the model requires that lean system characteristics should be significant predictors of job-related strain (path *A*) and of work design characteristics (path *B*); and both of these have been established by the analyses reported above testing hypotheses 1 and 2. Second, work design characteristics should be significant predictors of job-related strain (path *C*), as required by hypothesis 3. Finally, the mediational model requires that the link between lean system characteristics and job-related strain can be accounted for by work design. This is shown by non-significant direct paths from lean system characteristics to strain when work design characteristics are included as predictors (Baron & Kenny, 1986).

The mediational hypothesis was tested in two ways: by examining the change in the beta weights for the lean system variables when the work design variables were added, and by partitioning total effects into their direct and indirect components. A strong mediating effect would be shown by significant regression weights at step one (path A) together with non-significant regression weights for the same variables at step two, and by large indirect effects but low direct effects. The figures in Table 5 indicate strong support for the mediational model, since the regression weights for the lean system characteristics, though substantial when considered alone (at step 1), are small and not statistically significant at step 2 when the work design variables are also included in the equation. Thus the beta weight for dialogue scripting goes down from 0.12 ($p < .01$) to 0.06 ($p = ns$); while that for performance monitoring goes down from 0.33 ($p < .01$) to 0.04 ($p = ns$).

3.5.3. Additional analyses

[Note: These additional analyses were asked for by the Reviewers and Editor of the Journal of Occupational Health Psychology and were conducted by Professor Paul Jackson.]

Findings related to the mediational hypothesis were assessed more formally using LISREL. First, the mediational model was compared with a direct effects model which excludes the paths between the two lean service variables and job-related strain. The difference in the fit of these two models is the strongest test of the mediational model, and this was found to be negligible (change in $\chi^2 = 0.82$, $df = 2$, $p = ns$). More detail is given by the decomposition of direct and indirect effects for the model shown in

Figure 1. Table 5 shows the breakdown of total effects into direct and indirect effects for the two lean service variables. Direct effects include all direct paths between lean service characteristics and job-related strain (path *A*). Indirect effects are the sum of all other paths between the two sets of variables involving work design characteristics (paths *B* & *C*). Total effects for both dialogue scripting and performance monitoring were highly significant (reflecting the correlations shown in Table 1, and confirming hypothesis 1); while direct effects were small and non-significant and indirect effects were large and highly significant. Thus, we find strong confirmation for hypothesis 4.

Table 6: Decomposition of total effects for each lean system characteristic

	Dialogue scripting			Performance monitoring		
	total effect	direct effect	indirect effect	total effect	direct effect	indirect effect
Job-related strain	.21*	.00	.21*	.29*	.04	.26*

* $p < .01$

3.6. Summary of Findings for Study 1

Table 7 summarizes the study findings with respect to each hypothesis. Overall, the findings show strong relationships between lean system characteristics and job-related strain reported by call handlers which are mediated by work design. Call handlers who worked in leaner environments reported that: they had less control over

both the timing and methods aspects of their work; their workload was higher; they were subject to more conflicting demands from different aspects of their role; they were less clear about what their role requires of them; they performed less varied tasks; and they had less opportunity to exercise their skills. Three of these work design characteristics were significant influences on job-related strain, and variations in work design almost entirely accounted for the link between lean system characteristics and job-related strain.

Table 7: Summary of findings with respect to each study hypothesis.

Hypothesis 1: *lean system characteristics and job-related strain*

Dialogue scripting and performance monitoring both significant predictors of job-related strain

Hypothesis 2: *lean system characteristics and work design*

Dialogue scripting – lower timing and method control, lower task variety, higher role conflict

Performance monitoring – lower timing and method control, lower task variety and skill utilization, higher role conflict and lower role clarity, higher workload

Hypothesis 3: *work design and job-related strain*

Significant predictors of job-related strain: workload, role conflict, skill utilization

Hypothesis 4: *work design as mediator of the impact of leanness on job-related strain*

Direct effects small and non-significant

Indirect effects large and significant

Discussion of Study 1

Study 1 is discussed fully in Chapter 5 of this thesis.

Chapter 4

4.1. Overview of Study 2

Study 2 concerns the work design characteristics, of control and demands and the prediction of musculoskeletal disorders in call centre workers. Moreover, this research examines whether psychological strain a viable mediating mechanism through which some MSD symptoms are manifested. In essence this builds on and compliments Study 1 as again it is concerned with the aspects of elaborating our work design models but this time by looking at a novel outcome variable.

The demands of the modern office are thought to contribute to the development of musculoskeletal disorders. For upper body and lower back disorders these effects are hypothesized to be mediated by psychological strain. A study of 936 employees from 22 call centres supports this hypothesis. Using logistic regression and SEM it was found that the relationship of workload to upper body and lower back musculoskeletal disorders is largely accounted for by job-related strain. This mediating effect is less evident for arm disorders (although does exist). Contrary to expectation, job autonomy has neither a direct nor a moderating effect on any musculoskeletal disorder.

4.2 Study 2 Hypotheses

Based on the findings of previous research presented in the earlier Chapters the hypotheses for Study 2 are as follows:

Hypothesis 1: Workload will be positively related and autonomy will be negatively related to MSDs of the upper body, lower back and arms and hands

Hypothesis 2: Psychological strain will mediate the relationships of workload and autonomy with MSDs of the upper body and lower back, but not those with MSDs of the arms and hands.

Hypothesis 3: Autonomy will moderate the relationship of workload with strain and MSDs, such that the lower the levels of autonomy, the stronger the relationship of workload with strain and MSDs.

4.3. Method

Participants, Procedure and Sample Characteristics

The data were collected by work psychologists (including the author) employed by the UK Health and Safety Executive (HSE) at the Health and Safety Laboratory (HSL). A questionnaire (compiled by the author) was given to employees of 34 call centres. The questionnaire was accompanied by a cover letter explaining the affiliation of the researchers, and that the study was part of a larger HSE project, examining working practices in call centres. Participation was voluntary and responses anonymous. The questionnaire was completed by 1,140 participants (response rate of 38%). The final working sample for Study 2 was 936 employees from 22 call centres. Data were removed from 12 call centres with few respondents (< 15 employees) and list-wise deleted across the variables used in the analyses to ensure comparability between various analytic stages.

Table 8: Sample size and percentages suffering from each type of MSD symptom by business sector

Business sector	Sample (N)	Upper Body	Lower Back	Arms
Telecommunications & IT	200	46%	33%	17%
Financial services	193	38%	27%	15%
Retail	150	43%	37%	19%
Utilities	138	45%	33%	16%
Hotels & leisure	82	59%	41%	15%
Public & voluntary sector	81	53%	28%	25%
Transport & travel	58	48%	48%	24%
Emergency services	19	53%	37%	21%
Outsourcing	15	27%	47%	27%
Total	936	45%	34%	18%

As shown in Table 8 the sample included call centres from nine sectors, namely telecommunications and IT, financial services, retail, utilities, hotels and leisure, public and voluntary sector, transport and travel, emergency services and outsourcing. Seventy-four per cent of the respondents were female, 40% were under 30 years old, and 38% had less than a year's service. Eighty-one per cent were front-line call handlers, and the remainder of the sample comprised other roles including supervisors and team leaders, all of whom also answered calls. This working sample was almost identical in its demographic characteristics to the excluded cases.

4.3.1. Questionnaire measures

All measures, based on existing scales, are described in Appendix 1. In brief, *Workload* was measured using a five-item scale with an internal consistency reliability (Cronbach's α) of 0.84 and *Job autonomy* by a four-item scale with an internal consistency reliability of 0.79. Job-related strain was measured using a pair of three-item well-being scales for job-related *anxiety* and job-related *depression* whose internal consistency reliabilities were 0.81 and 0.87 respectively. The hypothesized four factor measurement model was tested using Confirmatory Factor Analysis (CFA), and provided a satisfactory fit (CFI = 0.922, RMSEA = 0.075 and SRMR = 0.055). Estimated correlations between factors were of small to medium size ($0.1 < |r| < 0.35$), with the exception of that between anxiety and depression ($r = 0.65$), which are known to be related. Neither alternative item-factor configurations (notably with the anxiety and depression items loading onto a single factor), nor additional parameter constraints, produced a better fitting model.

The convergent and discriminant validity of these four factors were examined using the 'average variance extracted' (AVE) method of Fornell and Larcker (1981). The AVE scores of workload, autonomy, anxiety and depression were 0.53, 0.50, 0.61 and 0.71 respectively, satisfying the criterion ($AVE > 0.50$) for convergent validity. Likewise, the variance shared between any pair of factors (0.42 for anxiety and depression, less than 0.15 otherwise) measured by the respective squared correlation, was less than the AVE score for any factor. This satisfies Fornell and Larcker's (1981) criterion for discriminant validity.

Musculoskeletal disorders were measured using the HSE version of the Nordic Musculoskeletal Questionnaire (Dickinson, Campion, Foster, Newman, O'Rourke & Thomas, 1992), shown in Appendix 1. Omitting the lower limbs, where few if any problems were reported, the remaining variables were grouped into three meaningful areas as used in the research literatures. These were *upper body*, comprising neck, shoulders, upper back; *lower back*, consisting of just the lower back; and finally *arms*, comprising elbows, wrists and hands. For each of three areas, respondents scored 1 if they had suffered any work-related musculoskeletal trouble in any part of that area, and 0 if not.

4.3.2. Prevalence of MSDs

Forty-five percent of the sample reported discomfort in the upper body (neck, shoulders and upper back), 34% reported low back discomfort and 18% reported problems with arms (elbows, wrists and hands) (see Table 8). These figures are all higher than those reported by Parkes et al. (2005) on male oil industry employees

(n=321), supporting the contention that MSDs are prevalent in call centre work, though in common with that study neck and shoulder problems were the most frequent.

4.3.3. Analyses

The following variables: call centre, gender, role (i.e. front-line call handler or supervisor/team leader), age and job tenure were controlled for in all our analyses. In response to pilot work on the questionnaire the last two variables were measured categorically (age: <20, 20-29,30-39,40-49, 50+; tenure: < 1 month, 3-6 months, 7-12 months, 1-3 years, 4-6 years, 7+ years). Age, gender and job status are known risk factors for musculoskeletal disorders (Pincus, Burton, Vogel & Field, 2002) with the others having an effect in the present sample.

4.4. Results

Zero-order relationships

Table 9 shows the correlations, means and standard deviations of the predictor, mediator and dependent variables. Consistent with hypothesis 1 it is evident that workload is positively correlated with all three types of MSD. Workload is also related to job-related anxiety and depression, which in turn are positively correlated with the MSD variables, thus presenting a pattern consistent with the mediation central to hypothesis 2. In contrast autonomy does not show the expected strong negative correlations with MSDs. These zero-order relationships are not definitive as they take no account of potentially confounding factors, which are controlled for in the following analyses.

Table 9: Intercorrelations, means and standard deviations among study variables (N = 936)

	Mean	SD	1	2	3	4	5	6
1. Workload	2.93	1.03						
2. Autonomy	2.21	1.03	-0.25					
3. Job-related Anxiety	2.34	0.85	0.57	-0.20				
4. Job-related Depression	2.22	0.94	0.44	-0.25	0.73			
5. MSDs Upper Body	0.45	0.50	0.16	-0.06	0.21	0.19		
6. MSDs Lower Back	0.34	0.47	0.14	-0.06	0.17	0.19	0.30	
7. MSDs Arms	0.18	0.38	0.22	-0.08	0.16	0.19	0.30	0.11

N=936 Correlations of $|r| > 0.084$ were significant at the $p < 0.01$ level, correlations of $|r| > 0.107$ were significant at the $p < 0.001$ level.

4.4.1 Work characteristics and MSDs

Hypothesis 1 predicted that the work characteristics will be related to MSDs in the upper body, the lower back and the arms. This was tested using a series of logistic regressions (as the dependent variables are dichotomous), examining the relationships of the two work characteristics together with each of the three MSD outcomes in turn. In each case the combined effect of the work characteristics statistically significantly improved the fit of the model, thus supporting the hypothesis (see Table 10). However, examining the unique effects of each job characteristic indicates that for all three types

of MSD this model improvement comes largely from the effect of workload, with autonomy contributing little.

Hence, hypothesis 1 is supported in the case of workload but not with regard to autonomy. The implication of this workload effect is that an increase of one unit in workload will result in a 44% increase in the odds of suffering upper body MSDs, a similar increase in the estimated odds of lower back MSDs, and a 64% increase in the estimated odds of being stricken by arm MSDs. These percentages are calculated using the $\exp(B)$ (i.e., the exponential of the B coefficient of the respective predictor) given in column 9 of Table 10, which is the factor by which the odds (i.e., $p/(1-p)$, where p is the probability of suffering the respective MSD) change when the respective predictor increases by one unit. For instance, multiplying by a factor of 1.64 is equivalent to a 64% increase.

Table 10: Work characteristics predicting musculoskeletal disorders (MSDs)

DV - MSDs	Model	-2LL	Δ -2LL (Δ df)	Pseudo R^2	Δ Pseudo R^2	B	Wald	Exp (B)
Upper Body	(Just controls)	1206	83 (32) **	0.114	---	---	---	---
	Controls + all IVs	1179	27 (2) **	0.148	0.034	---	---	---
	Workload	---	---	---	---	0.363	21.797 **	1.438
	Autonomy	---	---	---	---	-0.093	1.439	0.912
Lower Back	(Just controls)	1149	51 (32)	0.074	---	---	---	---
	Controls + all IVs	1122	27 (2) **	0.111	0.037	---	---	---
	Workload	---	---	---	---	0.361	20.112 **	1.435
	Autonomy	---	---	---	---	-0.127	2.469	0.881
Arms	(Just controls)	816	61 (32) **	0.104	---	---	---	---
	Controls + all IVs	784	32 (2) **	0.156	0.052	---	---	---
	Workload	---	---	---	---	0.496	25.085 **	1.643
	Autonomy	---	---	---	---	-0.150	2.108	0.860

N = 936, * $p < .01$, ** $p < .001$, one-tailed test

4.4.2 Strain as a mediator

Hypothesis 2 predicts that psychological strain will mediate the relationship of workload and autonomy with MSDs in the upper body and lower back, but not in the arms. Following Baron and Kenny (1986), the above findings demonstrate that a prerequisite for such mediation exists for workload, as the independent and dependent variables are related, but that this is not so for autonomy. In progressing with the tests for mediation, however, autonomy is included to ensure that the analyses remain directly comparable by including the same set of variables, and to examine the effect of workload whilst controlling for autonomy. The second requirement in testing for mediation is to demonstrate that the work characteristics are related to the hypothesized mediators, namely job-related anxiety and job-related depression. The relevant findings from standard multiple regressions are shown in Table 11. The results meet the requirement as workload and autonomy together account for a substantial amount of variance in both job-related anxiety (28.5%) and in job-related depression (21.9%), with these effects being statistically significant at $p < .001$. Workload and autonomy both have unique effects on job-related depression, with workload also having a unique effect on job-related anxiety.

Table 11: Work characteristics predicting psychological strain

DV - Strain	Model	R ²	Δ R ²	B	Beta
Job-Related Anxiety	(Just controls)	8.6%	8.6% **	---	---
	Controls + all IVs	37.0%	28.5% **	---	---
	Workload	---	---	.0475 **	0.580
	Autonomy	---	---	-0.054	-0.066
Job-Related Depression	(Just controls)	7.9%	7.9% **	---	---
	Controls + all IVs	29.8%	21.9% **	---	---
	Workload	---	---	0.425 **	0.465
	Autonomy	---	---	-0.152 **	-0.165

N = 936, * $p < .01$, ** $p < .001$, one-tailed test

The third requirement is that the mediators must be related to the MSDs. The results from the logistic regression analyses testing the relationship of both measures of psychological strain with each of the three MSD areas are shown in Table 12. Considering first the combined effects of the two mediators (column 4) it is evident that they relate to all three types of MSD (at $p < .001$), though more strongly to the upper body and lower back disorders than to those of the arms. With regard to unique effects, only one mediator is a statistically significant predictor of each dependent variable; for upper body this is anxiety, for lower back and arms it is depression. A one unit increase in either anxiety or depression produces an increase in the estimated odds of experiencing the various MSDs of up to 46% (final column in Table 12).

Table 12: Relationships between the strain mediators and the musculoskeletal disorders

DV- MSDs	Model	-2LL	Δ -2LL (Δ df)	Pseudo R^2	Δ Pseudo R^2	B	Wald	Exp (B)
Upper Body	(Just controls)	1206	83 (32) **	0.114	---	---	---	---
	Controls + all mdtrs	1162	44 (2) **	0.169	0.055	---	---	---
	Anxiety	---	---	---	---	0.379	8.696 *	1.461
Lower Back	Depression	---	---	---	---	0.215	3.599	1.240
	(Just controls)	1149	51 (32)	0.074	---	---	---	---
	Controls + all mdtrs	1113	36 (2) **	0.123	0.049	---	---	---
Arms	Anxiety	---	---	---	---	0.272	4.334	1.313
	Depression	---	---	---	---	0.266	5.280	1.305
	(Just controls)	816	61 (32) **	0.104	---	---	---	---
	Controls + all mdtrs	792	24 (2) **	0.143	0.039	---	---	---
	Anxiety	---	---	---	---	0.140	0.747	1.150
	Depression	---	---	---	---	0.379	6.535 *	1.461

N = 936, * $p < .01$, ** $p < .001$, one-tailed test

Having met the above requirements, the final test of mediation is to examine the effects of our independent variables on the dependent variables having controlled for the hypothesized mediator variables. The relevant findings are presented in Table 13. Column 4 shows that the inclusion of job-related anxiety and job-related depression in the regression equation removes the previously established significant effects (Table 10) of workload and autonomy together on upper body and on lower back MSDs. Specifically the respective improvements in the fit of the model from entering workload and autonomy, indicated by the change in $-2 \times \log\text{-likelihood}$ ($\Delta -2LL$), are substantially reduced: from 27 to 3 for upper body; and from 27 to 6 for lower back. This is not so for arm MSDs, however, where the original effect, though reduced remains statistically significant ($\Delta -2LL = 14$ on 2 df, $p < .001$).

Table 13: Work characteristics predicting musculoskeletal disorders after mediation [N = 936, *p < .01, **p < .001, one-tailed test]

DV – MSDs	Model	-2LL	Δ -2LL (Δ df)	Pseudo R ²	Δ Pseudo R ²	B	Wald	Exp (B)
Upper Body	(Just controls)	1206	83 (32) **	0.114	---	---	---	---
	Controls + Mediators	1162	44 (2) **	0.169	0.055	---	---	---
	Controls + mdtrs + all IVs	1159	3 (2)	0.173	0.004	---	---	---
Lower Back	Workload	---	---	---	---	0.153	2.770	1.165
	Autonomy	---	---	---	---	-0.049	0.385	0.952
	(Just controls)	1149	51 (32)	0.074	---	---	---	---
Arms	Controls + Mediators	1113	36 (2) **	0.123	0.049	---	---	---
	Controls + mdtrs + all IVs	1107	6 (2)	0.130	0.007	---	---	---
	Workload	---	---	---	---	0.187	3.884	1.251
Arms	Autonomy	---	---	---	---	-0.085	1.058	0.918
	(Just controls)	816	61 (32) **	0.104	---	---	---	---
	Controls + Mediators	792	24 (2) **	0.143	0.039	---	---	---
Arms	Controls + mdtrs + all IVs	778	14 (2) **	0.166	0.023	---	---	---
	Workload	---	---	---	---	0.403	12.009 **	1.497
	Autonomy	---	---	---	---	-0.112	1.124	0.894

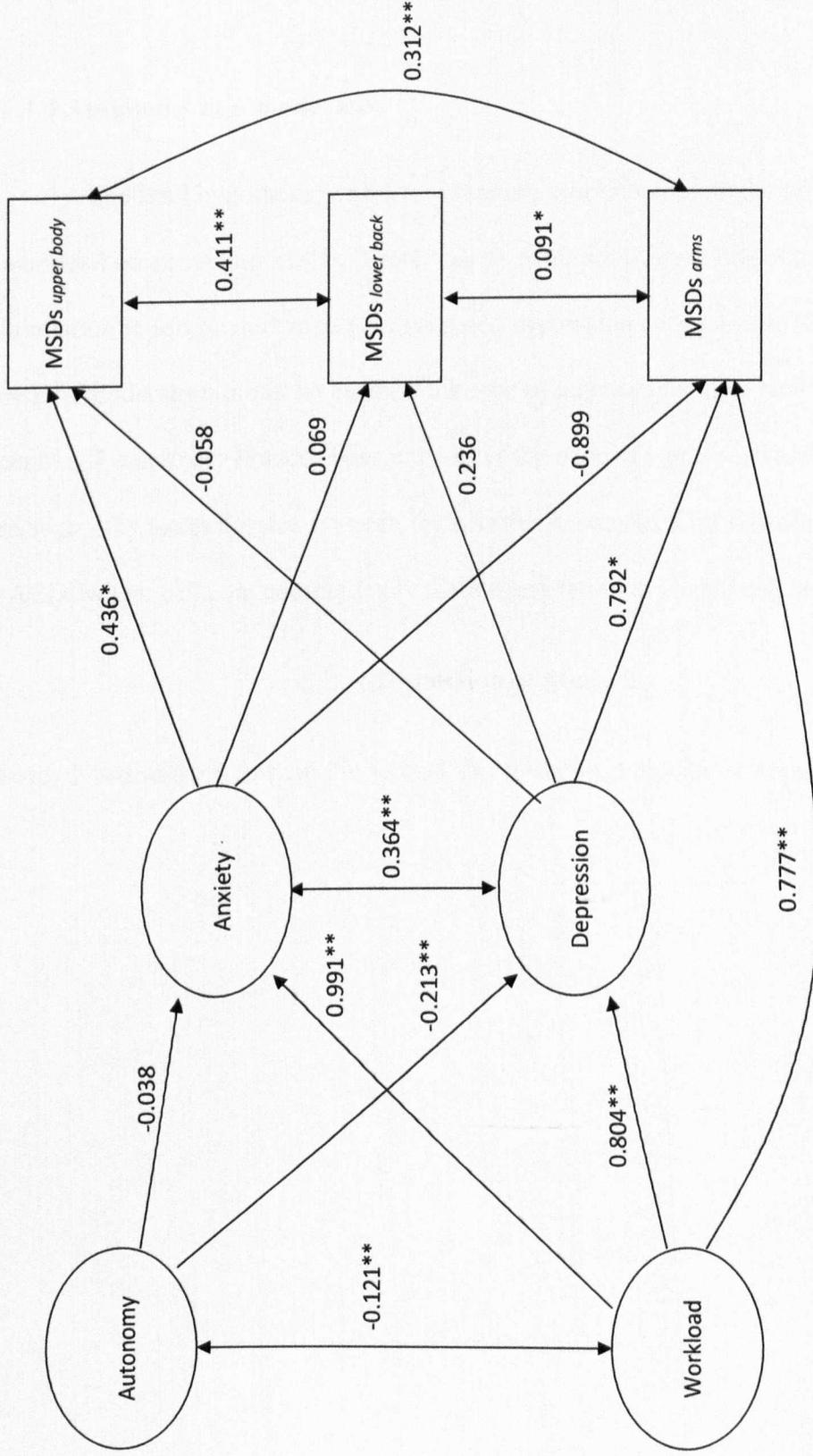
As for the previous analyses, of course, this interpretation applies almost exclusively to workload since autonomy has no unique effect on MSDs to explain. This is reinforced by comparing the findings in column 8 of Table 10 with those of the same column in Table 7. The observed unique effects of workload on upper body and lower back MSDs that are present when the effects of job-related anxiety and depression are not controlled for (Table 10) are no longer evident when these mediators are included. In contrast the significant effect of workload on MSDs of the arms remains. Hypothesis 2 is therefore partially confirmed, since strain fully mediates the relationship between workload and MSDs of the upper body and lower back; though contrary to the hypothesis, strain partially mediates the relationship between workload and MSDs of the arms rather than having no linking role at all.

4.4.3 SEM supplementary analyses

As an alternative and complementary set of analyses, a series of structural equation models were run, extending the measurement model described earlier to test the hypothesised direct relationships and mediation. The analyses were performed using *Mplus* V3, which enabled the fitting of structural equation models with multiple observed dichotomous outcomes, using weighted least squares estimation with a variance-adjusted chi-squared statistic. The starting point was a constrained model representing full mediation, that is one without any direct paths from the work factors to the dichotomous outcomes representing the presence and absence of MSD symptoms, which provided a satisfactory fit to the data (Chi-sq = 99, CFI = 0.929, RMSEA = 0.041). Paths were sequentially introduced from both work factors to each outcome in

turn. The model which provided the most significant improvement over the full mediation model was that with a single direct path from workload to MSD symptoms in the arms (Chi-sq = 94, CFI = 0.933, RMSEA = 0.040). The latent variable regression parameters within this model showed strong positive relationships between workload and both anxiety and depression, between anxiety and upper body MSDs, between depression and arm MSDs, and between workload and arm MSDs. This illustrates a similar pattern of effects found in the analyses of the observed data above; job-related strain mediates the effects of workload on the MSDs of the upper body, but this is not the case for such effects on the arms, where mediation is only partial and the unique effect of workload remains significant. Compared to the analyses of the observed data, evidence for the mediation of the effect of workload on lower back MSDs is less convincing; whilst no significant unique effect exists, the positive effect of depression on lower back MSDs falls below the $p < 0.01$ level of significance. The best fitting model with estimated parameter values is illustrated in Figure 2.

Figure 2: Best-fitting Structural Equation Model for prediction of MSDs from work factors, mediated by psychological strain



Model Chi-square = 94, df = 40, CFI = 0.933, RMSEA = 0.040. Parameters shown are correlations/unstandardised coefficients. Item-factor paths, control variables and their paths to outcomes, and item variances are omitted for parsimony. N = 936, * p<.01. ** p<.001, one-tail test.

4.4.4 Autonomy as a moderator

The final hypothesis was that autonomy would moderate the effects of workload on strain and MSDs. There was no evidence of such interaction effects in relation to job-related anxiety, job-related depression or any of the MSDs. This lack of moderation might be because the type of autonomy people have in call centres is extremely limited. Discretion over the pace of work is severely restricted by technological systems, such as the Automatic Call Distribution (ACD) where calls are automatically dialled and fed to available call handlers.

Discussion of Study 2

Study 2 is discussed fully in the second half of the next chapter (Chapter 5).

Chapter 5

DISCUSSION OF THE TWO EMPIRICAL STUDIES

5.1. Chapter Overview

In this chapter the key findings from both empirical studies (Studies 1 & 2) are discussed. Each study is considered separately to begin with and then conclusions are drawn from considering the two empirical studies together. Furthermore, for each study the theoretical and practical implications are discussed. The limitations and strengths of the research are also considered.

5.2. Discussion of Study 1

5.2.1. Lean system characteristics: Dialogue scripting and performance monitoring

Study 1 investigated the relationship of two lean system characteristics, dialogue scripting and performance monitoring with call handler job-related strain. Call handlers who were subjected to higher levels of dialogue scripting and performance monitoring reported higher job-related strain. These findings are consistent with the conclusions of Deery *et al.* (2002) who reported negative effects of scripted customer service interactions, although Study 1 provides much stronger evidence for the link between the two by improved item wording. The findings on performance monitoring are also consistent with earlier research showing that monitored employees experienced greater stress and less job

satisfaction than those whose performance was not monitored (Aiello & Kolb, 1995; Irving, Higgins & Safeyeni, 1986; Smith *et al.*, 1992). Such findings justify the premise that these system characteristics are best described as lean and that call centres which are *leaner* are also *meaner*.

5.2.2. Lean service characteristics, work design and job-related strain

Both dialogue scripting and performance monitoring are associated with significantly poorer forms of work design, and three of the seven work design variables (workload, role conflict, and skill utilization) are in turn found to be significant stressors.

The relationship between lean system characteristics and job-related strain was almost entirely accounted for by the indirect effects through work design characteristics. This complete mediation is consistent with the findings of Jackson and Mullarkey's (2000) study of lean production teams in garment manufacture, but differs from Parker (2003) who found only partial mediation. However, the Parker study used a limited range of work design characteristics (autonomy, skill utilization, participation and role overload), in contrast with the seven characteristics of the Study 1. Therefore the residual direct effect of lean system characteristics in the Parker study reflects model misspecification through omitted variables rather than a true direct effect of lean system characteristics on worker strain. Future research should be designed with care to include all those variables which theory predicts are relevant.

5.2.3 Key differences from other Lean Production (LP) studies

These findings show an important difference from the findings of a previous study of lean production teams in garment manufacture (Jackson & Mullarkey, 2000). In that study, there was no net impact on lean system characteristics on job-related strain, despite large and significant links between lean production and work design, and between work design and job-related strain. Detailed analysis of the individual effects showed that lean production had both negative *and* positive effects on work design, which cancelled each other out when aggregated. By contrast, Study 1 found that effects of lean system characteristics on work design were uniformly negative. When the two studies are considered together, an important feature of the model framework emerges. The relationships among organisational system characteristics, work design and individual job-related strain are not deterministic. The underlying characteristics of organisational systems (i.e., how lean they are) can be expressed through work design in a variety of ways, and these differences in work design expression will lead to different impacts on job-related strain. Thus, some lean systems can be benign in their impact on employees, while others can be much more damaging. The difference lies in how the proximal work environment is designed, and therein lies both the opportunity and the responsibility of managers. The evidence of Study 1 of over thirty call centres is that not all call centres are lean and mean (as the variability in the data demonstrates), but that those call centres that are lean are also mean. The challenge this poses is how to design the call centre in order to alter the relationship between *leanness* and *meanness*.

5.2.4. The limited importance of job control

The most unexpected outcome of the analysis was the limited importance of control within the mediational model. Jackson and Martin (1996) showed that implementing key elements of lean production led to a reduction in timing control; and there is widespread evidence that lack of control leads to psychological strain. The explanation for this puzzling finding is restriction of range within the sample: no-one in the sample reported high levels of control over either work methods or work timing. The means obtained in this study are substantially lower than those recorded elsewhere (e.g. Sprigg, Smith & Jackson, 2003). In other words, it is not that control is unimportant to well-being, but that in this case there was insufficient variation to see the effect. This is consistent with the qualitative data that emphasize the salience of control within call centres. Call handlers commented: *"I feel very limited and restricted in how I am allowed to work"...* *"I have no control over my work, I make no decisions. I'm told what to say and when to say it, when I can move from my chair"...* *"I feel as though work is a black hole I disappear into each day"*.

5.2.5. Study design implications

Study design is an important factor in influencing the findings, and therefore great care needs to be taken in drawing inferences. The sample for Study 1 was drawn from a large number of organizations, but all those studied here were call handlers. By contrast, the two studies which found a significant association between lean system characteristics and worker control were both comparative studies. Jackson and Martin (1996) employed a pre-test post-test design and found a reduction in timing control when Just-in-Time (JIT) was

implemented. Jackson and Mullarkey (2000) found much lower timing and method control for individuals working in lean production teams compared with those working on large-batch production lines. Future research would benefit from such comparative designs: either comparing call centre working with other occupations (i.e., Grebner *et al.*, 2003; Sprigg *et al.*, 2003), or preferably through planned change studies with longitudinal designs.

5.2.6. Call centre work design characteristics and job-related strain

Workload demand is the strongest predictor of job-related strain, with heavier workload associated with higher strain independently of other work design characteristics. This is to be expected, since call handling has been portrayed as the ultimate in demanding tasks (Holman, 2005). Task demands are exacerbated by the constant monitoring of performance against predefined and rigid targets. Role conflict was the next strongest predictor, with higher strain associated with higher role conflict. This reflects the asymmetrical pressures (Deery *et al.*, 2002) of call centre work, that is, the contradiction between management expectations of good customer service (which may require a long call to resolve a particular query) and high utilization (short call and the minimization of time between calls) which is common in call centres. Call centre managers still place great emphasis on call quantity despite the espoused importance of call quality (Frenkel, Tam, Korczynski, & Shire, 1998; Knights & McCabe, 1998). Even in those call centres driven by quality rather than quantity, work is still considered demanding, repetitive and stressful (Taylor & Bain, 1999; Wallace, Eagleson, & Waldersee, 2000). Indeed, Irving, Higgins and Safayeni (1986) found that electronically monitored workers indicated that

quantity was over-emphasized at the expense of quality. Skill utilization is also a mediator of job-related strain, and call handlers report higher strain if they have limited opportunity to use their skills. The practical implication of this is that managers must find innovative ways to use and develop the skills that employees possess.

5.2.7. Implications for management practice in call centres

The practical message from this Study 1 is clear: the practices of dialogue scripting and performance monitoring should be minimized in the interests of employee health. Managers and team leaders alike must make clear the requirements of the call handler role. The inherent conflicts in attempting to maximize the quantity of calls taken (or made) and delivering a quality response to a customer in a predetermined time allocation, irrespective of the complexity of the query, is obvious. Although the UK call centre sector has been acknowledging these tensions for some time, these consequences of lean system characteristics in call centre practices are still in evidence. Given the relationship of these working practices to well-being, managers must minimize these psychosocial risks to employees.

The centrality of good management practice is again illustrated by the qualitative data. For example, call handlers commented: *“No longer treated as human beings, robots is the nearest description of how we are treated”*. . . *“What matters most to them is lost calls, robotic is a mild way of describing our jobs”*... *“Very few employers have any concept of the psychological and physiological pressures of working in such a highly controlled environment with all consideration given to production”* ... *“Stress and upset isn’t caused by the job*

itself, in my experience, it's caused by lack of management help re work issues...as a company the answers always seem to be resolved with the answer 'for the needs of the business' forgetting the needs of the employee".

There are examples in the literature of successful empowered call centres (e.g. Hutchinson, Purcell & Kinnie, 2000); and call centre managers are encouraged to experiment with innovative and empowered forms of work organizations. Indeed, call handlers and customers alike often want to increase the duration and the quality of the calls (Knights & McCabe, 1998; Korczynski, Shire, Frenkel & Tam, 2000). This is exemplified by one participant's comment that "*Frustrated customers are being cut short because you're monitored on duration of time that you are talking, we need more time to sort out customer's problems with their bills*". The argument for improving work design within call centres is one of a virtuous circle of self-reinforcing improvements. If call handler attrition rates can be reduced through providing a less impoverished form of work, then the need for dialogue scripting and pervasive performance monitoring will be reduced, and this will lead to better forms of work design and improved employee health. With the successful retention of experienced and skilled staff, performance monitoring and dialogue scripting will become increasingly unnecessary.

5.2.8. Other avenues of research in call centres

The focus of Study 1 is on work design factors as a means of furthering understanding the link between lean system characteristics and the job-related strain of call centre employees. A growing body of literature is revealing the salience of additional work features, especially those concerned with emotion-

regulation, emotional labor and emotional dissonance (Deery *et al.*, 2002; Holman 2005; Holman, Chissick & Totterdell, 2002; Lewig & Dollard, 2003; Totterdell & Holman, 2003; Zapf *et al.*, 2003) which are all highly relevant to the social exchanges of customer service work.

5.2.9. Verbal aggression to call handlers

Examining the impact of customer verbal abuse and aggression within call centre work is also a potentially fruitful line of inquiry (Deery *et al.*, 2002; Grandey, Dickter & Sin, 2004; Sprigg, Armitage & Hollis, 2007). More specifically, aggression directed towards call handlers from customers is under-researched (see Leidner, 1996), and we need to understand much more about why call handlers are considered to be “readily available targets” (Deery *et al.*, 2002) for abuse. What are the employee health implications of so-called ‘phone-rage’ on a repeated basis? Future research must continue to address these emotional aspects of work; and more specifically, relationships between such emergent variables and work design characteristics. For example, Grandey *et al.* (2004) found that job control helped to explain who it was that found customer aggression particularly stressful.

5.2.10 Musculoskeletal disorders (MSDs) in call centres

Future research might also examine the incidence of work-related musculoskeletal disorders in call centres (Bakker, Demerouti, & Schaufeli, 2003; Halford & Cohen, 2003; Sprigg, Stride, Wall, Holman & Smith, 2007). There is little rigorous research of such disorders in this context even though call handlers may be at particular risk. With performance monitoring, use of display screen

equipment and headsets, call handlers are quite literally ‘tied to their desks’ and are thus vulnerable to a variety of physical disorders as well as those whose origin is more psychological.

5.2.11. Recommendations for other future research on call centres

There is a need for greater research design rigour when evaluating call centres, and it would be valuable to incorporate behavioral measures such as performance and turnover. It would not be surprising to find that the performance benefits which employers seek from this form of work specialization are offset by the negative consequences of harmful work designs. Furthermore, turnover within call centres is often reported to be very high, and recruitment and retention costs could potentially be greatly reduced by more ‘worker-friendly’ forms of work design. However, such research would require a different form of study from Study 1.

Performance measures vary greatly from one company to another, and this makes comparative studies very difficult to achieve. Assessment of turnover leads to some of the same difficulties, but has additional problems too. Sound inference requires longitudinal data in a design where individuals’ scores can be tracked over time and linked to company data. The access agreements made with the collaborating call centres in Study 1 precluded a longitudinal element as it involved a guarantee of anonymity for all participants. This then remains an area of potentially great importance, both conceptually and practically.

5.3. Summary of Study

In Study 1, I demonstrated that consistent with the model framework (Figure 1), call handlers who were subjected to higher levels of dialogue scripting and performance monitoring reported higher job-related strain. Call handlers who worked in leaner (and *meaner* call centre) environments reported that: they had less control over both the timing and methods aspects of their work; their workload was higher; they were subject to more conflicting demands from different aspects of their role; they were less clear about what their role requires of them; they performed less varied tasks; and they had less opportunity to exercise their skills. Three of these work design characteristics (workload, role conflict and skill utilization) were significant influences on job-related strain, and variations in work design almost entirely accounted for the link between lean system characteristics and job-related strain. This suggests the importance of understanding how technological (context) characteristics impact the basic design of jobs.

In conclusion, the evidence of the Study 1 with data from over thirty call centres is that not all call centres are *lean* and *mean* (as the variability in the data demonstrates), but that those call centres that are lean are also mean. The challenge this study poses is how to design the call centre in order to alter the relationship between leanness and meanness.

5.4. Concluding Comments for Study 1

Given the findings of this study and the projected growth of the service sector in Europe, the US and Asia, these research suggestions are worthy of

consideration. With large numbers of employees now engaged in this particular form of work, then maintaining physical and mental well-being must be of paramount importance to employers and Governments alike. At the time this research was starting to be written up for journal publication this form of work was actively being promoted in the UK (Department of Trade and Industry, 2004).

5.5. Discussion of Study 2

5.5.1. Expected and unexpected findings from Study 2

There are three key findings from Study 2. First, call centre employees who experience heavier workload are more likely to report musculoskeletal disorders (MSDs) in the upper body, the lower back and the arms. Second, psychological strain mediates the relationship of workload with upper body and lower back MSDs, and partially mediates the relationship with MSDs of the arms. Thus, whereas strain appears to be a mechanism between workload and upper body and lower back MSDs, the relationship of workload with MSDs of the arms needs to be explained by both the direct effect of biomechanical factors and the partial mediating effects of strain. Study 2 is believed to be the first direct evidence of strain as a mediator of MSDs in a sample of call centre employees. Third, autonomy (job control) does not moderate the effects of workload on strain and on MSDs.

Two findings were not as expected. First, the predicted associations of autonomy with MSDs were not obtained. This is surprising given previous research (Ariens et al., 2001; Torp et al., 2001), but might be explained by the

particular kind of job control that call centre employees actually have; that is one that prevents them from behaviour that might mitigate MSDs. This might also explain the lack of the interaction of autonomy with workload in predicting strain and MSDs, though such moderation has not always been found in previous research (Van der Doef & Maes, 1990).

The second unexpected finding was that strain did partially mediate the effect of workload on MSDs of the arms. Strain was not expected to lead to arm discomfort in the same way that it does to discomfort in the upper body and lower back. However, this finding does not conflict directly with previous evidence in that investigators in general have neglected to examine the role of psychological strain in the MSDs of the arms (Devereux, et al., 2004). Thus, it may well be that strain plays at least a part in MSDs of the arms. At present, the explanation for this remains unclear. But it can be speculated that strain may have a general effect in sensitising people to musculoskeletal pain (Westgaard, 1999) this being evident for MSDs of the arms as well as for MSDs of the upper body and lower back. It is possible to arrive at the suggestion that for the upper body and lower back, both holding oneself tense as a result of strain and the sensitising effect of that affective state leads to MSDs; whereas for the arms it is the repetitive requirements of the work (hence the direct effect) together with the general sensitising effect (the partial mediation) that results in MSDs. This deserves closer attention in future research, albeit that strain appears to be a less important factor in the explanation of MSDs of the arms than in the other two types of MSDs.

5.5.2 Implications for management practice in call centres

Managers are advised to consider taking a dual-approach to tackling MSDs in call centres, one that acknowledges their complex biomechanical and psychological aetiology. This may go towards reducing call centre sickness absence and turnover issues. A primary prevention strategy is managing call centre workload so that it does not become too demanding. In the case of arm MSDs, where workload appears to have a direct effect, risks can be minimised by ergonomic good practice, with call handlers given adequate rest-breaks away from workstations and telephones. MSD symptoms have been found to be reduced by introducing ten minutes per hour rest-breaks for those using the telephone over eight hours per day (Crawford *et al.*, 2005). Employees should be trained to set up and adjust their workstations (*i.e.*, adjust screens, chairs, desk heights) effectively, and be given time to do this. Employers should encourage early symptom reporting.

Yet, the full mediating role of psychological strain in the case of upper body and lower back MSDs suggests that ergonomic good practice will not provide a complete solution. In call centres it is not always feasible to manage workload effectively. Employees are at the mercy of unpredictable fluctuations in demand, which means they will inevitably experience high workload. Even the nature of the calls can be stressful, with verbal abuse an issue (Grandey *et al.*, 2004). Thus there always will be a role for secondary prevention by helping employees to develop effective coping strategies for dealing with the psychological strain.

5.5.3. Study limitations and strengths

Study 2 is cross-sectional and self-report; the same respondents were asked to rate both the predictor and criterion variables concurrently, using the same questionnaire. This gives rise to the danger of common method and other forms of bias as identified by Podsakoff, MacKenzie, Lee and Podsakoff (2003) (e.g., consistency motif, leniency or acquiescence biases), and also to the possibility of reverse causality. So the current findings could arise, for example, because respondents with a more negative outlook describe the same degree of workload, strain and MSDs as worse than those who are more optimistic (Burke, Brief & George, 1993). It is equally possible that those who experience more strain are more sensitive to their workload and to bodily discomfort (Bernard 1997; Burton, 1997; Davis & Heaney, 2000; Devereux et al., 2004). To counteract such bias, objective or independent measures of MSDs could be used, such as those available from medical history forms (Griener & Krause, 2006). Yet the solution may not be that straightforward as evidence suggests that questionnaires are more sensitive indicators of MSD problems than pre-existing data sources (Silverstein, Stetson, Keyserling, & Fine, 1997). There are also substantial practical difficulties in obtaining medical data on a large multi-site sample such as in Study 2, and this is a challenge for future research.

This study has a number of strengths. One is that it is based on a large sample of employees from a work context of growing global significance (Batt, 2002), the call centre. The second is the focus on MSDs. These are relatively neglected as dependent variables within the occupational psychology literature, despite featuring within the National Institute of Occupational Safety and

Health's (NIOSH) top eight occupational diseases and injuries. The third strength lies in measurement and analysis of work characteristics, strain and MSDs within the same study. The majority of the occupational psychology literature relevant to this study focuses only on work characteristics and strain but ignores MSDs. In contrast, the literature on work characteristics and MSDs is predominantly found within the medical, ergonomic and epidemiological fields, where strain is neglected. Where both work characteristics and strain are considered their measurement is typically not as sophisticated as it would be in occupational psychology studies (Hoogendoorn, van Poppel, Bongers, Koes, & Bouter, 2000).

5.5.4 Implications for research and theory

Longitudinal and quasi-experimental intervention studies are required to strengthen the basis for causal inference regarding MSDs. Such studies would benefit by being framed within broad conceptual frameworks of stress where other enduring health outcomes, such as cardiovascular disease, are considered (Israel, Baker, Goldenhar, Heaney & Schurman, 1996).

Theoretically, this study implies the need to consider a broader range of outcome variables in work design research (Parker & Wall, 1998). Research on MSDs in the medical arena could be better informed by including the psychosocial variables studied in applied (and occupational) psychology (Martocchio, Harrison & Berkson, 2000). Furthermore, occupational psychology research should also take more account of work in medical and epidemiological fields.

In the next chapter (Chapter 6) interventions, work design and otherwise, which have already been implemented in call centres are examined. In addition, the conclusions drawn from evaluations of these interventions are presented. The interventions which appear the most fruitful are discussed.

Chapter 6

Call Centre Intervention Effectiveness:

A Systematic Literature Review

6.1. Chapter Overview

This chapter is a systematic review of the literature to determine the effectiveness of interventions which have been designed to improve the health, well-being and performance of call centre employees. Also, in this chapter the practical implications of the limited available literature are described.

The rationale behind concluding the thesis in this way is that since my initial empirical call centre studies were conducted the literature has moved on. This is a good opportunity to evaluate the intervention research that has been conducted to date and which interventions appear successful.

In addition, the research recommendations that were made in my own earlier papers are reviewed and examined against the interventions carried out since my papers were published. For example, Study 1 concluded that more rigorous research designs are needed in call centres and called for longitudinal projects in our own field of work psychology. In Study 2 again there was a call for longitudinal and quasi-experimental research specifically about MSDs (in call centres).

6.2 Introduction

Despite substantial criticism of the call centre as a work context it appears that there is little research which has examined the effectiveness of *interventions* designed to improve life for those that work in them. The research that has been conducted is from disparate disciplines, e.g., management, building/ built environment, ergonomics, and work psychology. Given it is well over a decade since this form of work organisation started to proliferate in the UK and beyond (e.g., India) there is great value in systematically reviewing the research output on intervention effectiveness in call centres. Furthermore, it is timely to examine the quality of this research and understand its' conclusions

I am unaware of any previous systematic review of the call centre intervention literature. Thus, the aim of this review is to bring together in one place the research findings on interventions in the call centre context from disparate, but related, scientific disciplines. More specifically this review chapter examines in some detail the form these interventions have taken and how effective they have been in improving the health, well-being and performance of call centre employees. This effectiveness is dependent on the quality of the research design, the amount of data collected and the appropriateness of any analyses conducted.

Why is it important to do this review now?

The sector has grown by almost 250% since 1995; and was forecast to grow to almost 650,000 agent positions by 2007, directly employing over 1

million people (Department of Trade and Industry, 2004). [The thesis data collection took place in the autumn of 2000].

ContactBabel states that 958,925 people are employed in the UK's 5,040 contact centres, equating to 3% of the working population. Currently 862,070 people (Key Note) are estimated work in front-line customer contact, with a projection that over 1 million people will be working in UK contact centres by 2012 (CCA, 2009). This is a still significant number of the UK workforce; despite the reduction in media interest in these work environments since my research was initially conducted.

6.3. Method

6.3.1. Databases used in the review

The following databases were searched for this systematic review: MEDLINE (from 1951 to July 2010); Web of Knowledge: Social Sciences Citation Index (SSCI), Arts & Humanities, Science Citation Index (SCI-Expanded) (From 1900 to July 2010); PsycINFO (from 1967 to July 2010). Table 13 shows the initial number of hits from all the different permutations of the search terms.

6.3.2. Search terms used

Searches were conducted on “call centre/s” and “call centre/s”. In addition the terms “customer service centre/s/centre/s” and “customer contact centre/s/centre/s” were used to reflect the other terms frequently used to refer to call centres. In addition to these terms the following searches were used:

“Random*”, “Trial”, “Control*”, “Experimental”, “Intervention”, “Intervention study/ studies”, “Quasi-experiment*” and “work redesign”.

6.3.3. Exclusion and inclusion criteria

Papers not written in English or conference proceedings were excluded. Papers were also excluded because they were not about call centres but were initial “hits”. For example many papers from MEDLINE were initial “hits” because of the process of being “on-call” in the medical profession or, for example, the word “trial” yielded papers about clinical trials. Papers were excluded if they were not concerned with **interventions** designed to improve the health, psychological well-being or productivity/ performance effectiveness of employees working within call centres.

Furthermore, the research had to be conducted in a “real” call centre – that is a functioning call centre in the field – and not in a laboratory setting with, for example, students. Thus, simulations with students were excluded too. Papers were excluded if they concerned “out-of-hours” medical services that were conducted over the phone; this meant that many of the papers from MEDLINE were indeed excluded as many papers have been written in recent times about the practice of “tele-medicine”. These latter papers were simply not relevant to the review.

6.3.4. Inclusion

Papers included were concerned with interventions to improve the health, well-being and physical comfort of a call centre employee. For example, a paper was concerned with the outcomes of an intervention to decrease musculoskeletal

discomfort, or an intervention to decrease vocal symptoms in call handlers. Papers were included that were about interventions to improve productivity by, for example, improving physical and ergonomic properties of a call centre employees work context. Papers were also included if they were follow-on papers reporting the longer-term effects on an intervention after a longer period of time (i.e reported on 21 months after an intervention rather than at a 6 month point when a previous paper had been written).

6.3.5. Search process

Each search term was used individually and then other relevant search terms were added to this “stem”. For example “call centre” yielded initially 343 “hits” on MEDLINE. I then looked through all of these 343 to search for what looked to be relevant papers from the title and the abstract (I only used the abstract if the title was ambiguous in some way). In Table 13 is a worked example of my search for papers in the each database. This illustrates the large number of papers that I had to sift through to get the appropriate “hits” for the review.

Table 14: Number of papers per search term for each database searched

<i>Search/Term</i> <i>Database Used</i>	<i>MEDLINE</i> (1950 – 1 st Week July 2010) Initial number of Five Star Hits	<i>Web of Knowledge: Social Sciences Citation Index (SSCI), Arts & Humanities, Science Citation Index (SCI-Expanded)</i> (From 1900 to July 2010)	<i>PsycINFO</i> (from 1967 to July 2010). Initial number of Five Star Hits
<i>Call Centre</i>	343	638	144
<i>Call Centres</i>	193	425	86
<i>Call Center</i>	1,005	1,882	488
<i>Call Centers</i>	562	1,007	241
<i>Customer Service Centre</i>	2	240	16
<i>Customer Service Centres</i>	0	88	12
<i>Customer Service Center</i>	41	240	33
<i>Customer Service Centers</i>	17	203	19
<i>Customer Contact Centre</i>	1	11	2

Customer Contact Centres	0	7	0
Customer Contact Center	1	38	1
Customer Contact Centers	1	52	3
Call Centre + Random*	10	12	1
Call Centre + Trial	343	51	144
Call Centre + Control*	343	105	144
Call Centre + Experimental	4	15	2
Call Centre + Intervention/ Intervention Study/Studies	37/ 4/ 0	45/	10/ 1 /0
Call Centre + Quasi- Experiment*	0	1	0

Call Centre + Work Redesign	343	0	144
Call Centre + Job Design	8	6	19

Note: That for each permutation of call centre/s; call centre/s; customer service centre/s etc then a search was conducted for each of these with the other keywords, e.g., call centre + random*; call centres + random*; customer service centre + random*.

6.4. General Results

The systematic review identified **16** published papers which report on intervention studies and the effectiveness of them in minimising the health and well-being risks to call centre employees. This small number of studies and the variety of measures precluded meta-analysis being undertaken.

As in previous systematic reviews (e.g., Wassell, 2009) the papers are organised under four areas, to reflect the research domain from which the interventions had been informed. The four areas are: i) Physical work environment interventions, ii) Work design and organisational interventions, iii) Ergonomic interventions and, iv) Health interventions. In the following sections are presented, in some detail, the methodologies and findings of each of the 16 papers selected by the methods already outlined.

6.4.1. Physical work environment interventions in call centres

Niemala, Hannula, Rautio, Reijula and Railio (2002) conducted two studies to examine the impact of air temperature on productivity in call centres. In one call centre the productivity between two zones with a temperature

difference was simply compared; in the other study in the second call centre the intervention used was the installation of extra cooling units to lower summer temperatures. Thus, it is this second study that is of relevance to the present systematic review and will be discussed in more detail here.

The call centre where the intervention took place employed 15 females. The productivity of these employees and carbon dioxide concentrations were measured before and after the intervention. The productivity measure used was the number of telephone calls divided by active work time. In addition, an indoor climate questionnaire which asked about sensations of indoor air factors, symptoms related to both indoor air and the psychosocial environment.

Niemala et al. (2002) found that the mean air temperature in the intervention call centre was 25.1 degrees centigrade before the intervention and 22.6 degrees centigrade after it. Where productivity was compared before and after the intervention, then productivity was 7% higher after the intervention (a statistically significant difference). No other explanation was evident apart from the air cooling for this increase in productivity. [In terms of additional information the carbon dioxide levels were slightly higher after the intervention and the room was perceived (via questionnaire) as stuffy and dry prior to the air cooling intervention.]

Niemala et al. (2002) conclude that when the findings of the intervention study and their other observational study (not reported here) are taken together: “The labour productivity in the call centre work decreased 5-7%, when the air temperature exceeded 25 degrees centigrade” (p.764). These findings concur

with other studies of office environments; there is a strong association between indoor air temperature and labour productivity.

The Niemala et al. (2002) study was a rational and solid attempt to gain evidence of the linkage between indoor air environment and productivity; a topic where scientific data is relatively sparse. There is a great strength in the field-setting of two call centres rather than being a laboratory simulation study. The over-riding strategy of the research was to analyse labour productivity differences and compare the thermal conditions in two call centres. The study has a relatively strong research design in that other relevant environmental factors were measured and a questionnaire was used to capture the psycho-social and organisational atmosphere of the call centres. These elements of the study are not reported on in any detail in the paper which is perhaps surprising given the attempts to measure them. Only associations rather than causal pathways can be deduced from the study, so in that sense it is limited.

Despite some of the limitations of the Niemala et al. (2002) study it is obvious that those who operate call centres need to be aware of these associations and take steps against the deleterious effects which temperatures – either too high or too low can have in relation to productivity.

In another study that falls under the physical work environment category, Federspiel, Fisk, Price, Liu, Faulkner, Dibartolomeo, Sullivan and Lahiff (2004) investigated the relationship between ventilation rates and individual work performance in a call centre. These researchers “randomized” the position of outdoor air control dampers and measured: a) ventilation rate, b) differential (indoor minus outdoor) carbon dioxide concentration, c) supply air velocity, d)

temperature, e) humidity, f) occupant density, g) degree of under-staffing, h) shift length, i) time of day and time required to complete two different work tasks (talking with clients and post-talk wrap-up to process information).

Federspiel et al's paper (2004) is a complex and at times a slightly impenetrable description of their detailed analyses about the aspects listed above. This impenetrability is partly because these researchers are from departments of built environment, indoor environment, electrical engineering, and biostatistics, rather than from within my own discipline of work psychology. However, the findings are important to consider as a part of this review and there are clear practical implications for call centres from their work.

In short, like the Niemala et al. (2002) study the work of Federspiel et al. is valuable because unlike previous studies that have examined the impact of indoor air quality on performance, this is an attempt to examine the impact on "real" work performance in a field setting as opposed to a simulation.

Federspiel and colleagues (2004) conducted their study in a call centre in northern California operated by a health maintenance organisation. This call centre was heated, cooled and ventilated by four variable air volume (VAV) air handling units (AHUs) that modulated the flow of cool or warm air to maintain indoor air temperatures in a desired range. Federspiel et al. (2004) used performance data from registered nurses who worked in the call centre and states that there was a maximum of a 119 of them in the building during the study period. The use of performance data in this way is an obvious strength of the study.

The nurses performed two discrete tasks; one is talking to the client on the phone (talk task) and the other is the data entry (wrap-up) after the nurse has finished talking. During the latter task the nurses are free to work at their own pace. Federspiel et al. (2004) hypothesised that the environmental stressors would have a greater impact on the wrap-up task rather than the talk task because the nurses could work at their own pace during wrap-up and are not constrained by the interaction with the client. Unfortunately, Federspiel et al. (2004) do not elucidate further on the logic behind this particular hypothesis which can be considered a weakness of the paper. The researchers went on to analyse performance data from two types of reports. These were: 1) the average talk time and average wrap-up time of each call-handler averaged over a shift, 2) the average handle time (talk time plus wrap-up time) averaged for all call handlers in 30 minute (non-overlapping) intervals. Agents signing in and out of the automated call distribution (ACD) gave the researchers further information on the length of each call handler's shift. Additional information was collated via the ACD system about the levels of staffing in the call centre. Call handlers worked in areas called "neighbourhoods" and Federspiel et al. (2004) used these to associate temperature, humidity, outdoor airflow rate and carbon dioxide with individual call handlers.

Federspiel et al. (2004) intervened by changing the position of the dampers that regulate the amount of outdoor air entering each AHU. The interventions ran for approximately three months and the call handlers were not aware of these changes. The "blind" research design element to the study has to be commended.

The expected dose-response relationship between ventilation and the work performance of the nurse call handlers was not found. However, Federspiel et al. (2004) did find that at the level of individual performance analysis showed that performance at low and high rates of ventilation were statistically the same. Performance at intermediate rates was 2% worse and that increased talk time (decreased work speed) was also statistically significant. Group performance analysis showed the same pattern with performance worst at intermediate levels of ventilation.

Evidence for the link between ventilation and performance was only found in the talk task and not in the wrap-up element; Federspiel et al. (2004) explain this with the possibility of some “unidentified confounding factor”. Both the initial hypothesis concerning this and the subsequent findings are poorly explained by the researchers which is a weakness of this study.

In addition, Federspiel et al. (2004) found that the nurse call handlers were 16% slower at wrap-up when the temperature was higher than 25.4 degrees. The researchers also discovered that in the “neighbourhood” where some of these higher temperatures occurred was where the day-time and night-time call handlers “were fighting over the temperature setpoint” (p.49); with night-time workers wanting a higher temperature than those in the day. Federspiel et al. (2004) describe how the night-time call handlers would raise the temperature setpoint very high and the day-time handlers would then not lower it until two to three days later, thus causing the higher temperatures which correlated with slower task performance. This seems to be a very important and practical

finding from the study. Anecdotally, this resonates with comments made to me during the early stages of my own call centre research with HSE.

Finally, Federspiel et al. (2004) found that when the call centre was understaffed call handlers performed wrap-up slower; the logic being that when the call centre is under-staffed call handlers get little chance for rest between calls and make up for this quick work pace by working slower in wrap-up. In conclusion, Federspiel et al. (2004) recommend the following for those operating call centres: i) that high temperatures should be avoided and, ii) call handlers should be restricted in the amount and duration they can change temperature setpoints.

Despite some of the limitations highlighted above I still see the research as important with a solid practical value emerging from it concerning the changing of temperature by employees themselves.

A further study that can be categorised as physical work environment intervention is that of Wargocki, Wyon and Fanger (2004) who conducted a field study in a Danish telephone company call centre who provided national directory enquiries. Again an obvious strength of the research is a field setting. Here twenty-six call centre operators participated who worked in shifts of 7 hours and 20 minutes; they took 10-15 minute breaks every hour. A weakness of the study is the relatively small sample size of just 26 call centre operators.

The two (reversible) interventions that were applied were: i) new versus used filter (the latter is a filter that has been in place 6 months which is the normal service life of the filter in this call centre), ii) Constant outdoor air supply

rate 8% versus 80% of total supply air flow, nominally 2.5 and 25 l/s/person with an average of 14 operators working at the same time in the call centre when periods with high call volume expected.

The experimental design was a repeated measures 2 x 2 design. This allowed for all combinations of the two interventions new/used filter, low/high outdoor air supply rate to occur in each of 4-week periods, with each combination being maintained for one week at a time. All changes to conditions were “blind” to the call centre operators. The underlying research design is a strong one.

The experimental period was from the end of January to the start of April 2001. Temperature and relative humidity of the supply, return, outdoor and room air and the measured carbon dioxide levels, both outdoors and in the supply and return air, were all recorded continuously using small battery-powered data loggers. Operators were able to open windows so event-recorders on the windows were used to monitor this compensatory behaviour. On the same day each week operators completed questionnaires with scales on perceived air quality, environmental perceptions, Sick Building Syndrome (SBS) symptom intensity, and self-estimated productivity. Thermal comfort and perception of air movement were also assessed. Operator performance was measured also; the average talk-time in each 30-minute period was calculated by dividing the total-time (in the 30 minute period) by the number of calls answered. The amount of detailed and relevant information collected by the researchers is again an obvious strength of the study.

Wargocki et al. (2004) found that outdoor air supply rate and filter condition are important determinants of office work performance, perceptions of indoor environment and the intensity of SBS symptoms.

As expected with a *new* filter and a higher outdoor air supply rate employee performance was better, nose irritation was reduced, aching eyes were lessened and employees felt better in general. Such a positive effect of increased ventilation on employee performance is in line with previous research (Milton, Glencross & Walters, 2000; Wargocki, Wyon, Sundell, Clausen, & Fanger, 2000a). With the positive effects of increased outdoor air supply on SBS symptoms again in line with previous field studies (Sundell, Lindvall & Stenberg, 1994; Seppanen, Fisk & Mendell, 1999; Wargocki, Sundell, Bischoff, Brundrett, Fanger, Gyntelberg, Hanssen, Harrison, Pickering, Seppanen & Wouters, 2002a). The research maps well onto to earlier work which is made clear by the authors. This serves to strengthen their findings and my overall perception of the rigour of their study (with continued caveat that I am not an expert in the field of air quality).

Employee performance was worse with a *used* air filter. However, contrary to expectations operators also felt worse with more outdoor air; which seems counter-intuitive. Wargocki et al. (2004) explain this by suggesting that the increased outdoor air supply rate can lead to an increased concentration of some indoor air pollutants. Such an increase in pollutants is compatible with the increase in SBS symptoms and decrease in performance. Again these findings concur with previous studies that have shown that *used* ventilation filters are a source of pollution (Clausen, Alm & Fanger, 2002). As Wargocki et al. (2004)

explain the negative effects of dust-laden filter is probably why some field studies have not shown the expected improved perceptions of air quality or reductions in SBS symptoms when ventilations rates have been increased. The explanations of their results are logical and carefully considered in the context of their own research domain. This leads me to evaluate their study as a piece of good quality research that is working hard to move knowledge forward in this very specific work environment domain.

Wargocki et al. (2004) found that at the higher outdoor air supply rate performance was better and the acceptability of the indoor air quality was higher with a new filter. There is also a positive effect of changing the filter at a high outdoor air supply rate; whereas replacing a used filter with a new one did not significantly affect performance at the lower air supply rate. This replacement filter also increased irritation of nose and eyes which was unexpected; however, as expected there was a perception of greater air freshness and reduced feelings of fatigue. The unexpected nose and eye irritation is well explained by Wargocki et al. (2004) as being caused by uncontrolled changes in infiltration.

Wargocki et al. (2004) believe that their study provides field validation of previous laboratory experiments (Wargocki et al., 2000b). Wargocki et al. (2004) state “the size of the effect of the air quality on performance in this study (5-10%) is similar to that observed in laboratory simulation experiments” (p.15). Furthermore, their research provides confirmation that filter *status* affects perceived air quality and intensity of SBS symptoms and that pollution source strength of a *used* supply air filter increases as the proportion of outdoor air in the air flow is increased.

Wargocki et al. (2004) conclude that increasing the outdoor air supply rate with a *new* filter in place improved operator performance, reducing talk-time by 6%; whereas with a *used* filter in place, increasing the outdoor air supply rate reduced performance, increasing talk-time by 8%. The replacement of an old filter with a new one also improved operator performance at a *high* outdoor air supply rate, reducing talk-time by approximately 10%. There was no such significant effect at a low outdoor air supply rate.

There are clear practical implications of Wargocki et al's (2004) research. Firstly, that air supply filters should be changed frequently because if not they degrade air quality with negative consequences for health, comfort and the performance of office work more broadly. Secondly, that increasing outdoor air supply rates may only be useful when *new* filters are in place. Thirdly, filter condition, i.e whether they are new or used, should always be recorded in research studies on this type on building occupants so that the conclusions made are the most valid and valuable they can be. This is a well-designed and rigorous study which makes a number of important contributions to the quest to understand what might be best in terms of comfort and health for those working in call centres.

A further study which can be categorised as a physical work environment intervention intervention is that of Tham (2004) who carried out a field intervention concerned with the effect of both temperature and outdoor air supply in a call centre. Tham (2004) changed the ventilation rate between two levels (4.5 l/s/ person vs. 12 l/s/ person) and indoor air between two levels (22.5 degrees vs. 24.5 degrees) in a billing inquiry services call centre, which one

presumes was in Singapore (where Tham is based) although this is not explicitly stated in the paper.

The intervention was blind; although the occupants were aware that some monitoring of the indoor air quality was taking place. The blind nature of the intervention is an obvious strength of the research design; as is the field setting.

The 2 x 2 field experiment was conducted over a nine-week period from the 21st of July to 21st of September 2003. The study uses data from a selected group of 56 customer service officers who agreed to complete regular weekly surveys about their perceptions of the indoor environment and report any SBS symptoms. The operators all worked in billing inquiries and Tham (2004) considered this to be both a complex and time-consuming task dealing with customers. All the operators were female with a mean age of 28 years (range 25-36 years). Thus, the sample size is relatively small and there are no males in the group.

During the study period continuous measurements of environmental parameters were conducted; this included chemical gaseous pollutants, biological and physical parameters (i.e thermal comfort and ventilation measurements). The questionnaire used for the study had 39 scales and utilised visual analogue scales. Operators were asked about their perception of thermal comfort, acceptability of indoor air quality, odour levels, irritation effects, warmth, stuffiness, and dryness. In addition, operators were questioned about eye, thermal-related, and neuro-behavioural (i.e headaches and difficulty concentrating) symptoms. This range of measures is appears comprehensive and can be considered a further strength of the study; although 39 “scales” seems excessive and one wonders

whether Tham is referring to items here rather than scales as we know them.

Tham (2004) then uses “talk-time” as a performance measure (i.e time spent on the phone talking to the customer); this was collected using a dedicated computer program.

Tham (2004) describes how insufficient dehumidification capacity at higher temperature couple with high outdoor air led to a significantly higher relative humidity than in other settings. It is explained this problem is difficult to overcome as the means to control relative humidity is not found in air conditioning systems in tropical settings. However, on the more positive side it appears that within a comfortable temperature range this relative humidity has minimal impact on employees.

From interaction analyses it was found that temperature and outdoor supply rates have significant interactive effects on some subjective responses as well as self-assessed productivity. Perceived thermal comfort, acceptability of air quality, perceived air warmth, perceived air stuffiness, intensity of cold hands and cold feet, and difficulty in concentrating were all affected by the combination of temperature and outdoor air supply rates. So when employees’ perceptions of SBS symptoms are evaluated – then the combined and interactive effects of temperature and outdoor air supply rates need to be considered (Tham, 2004).

Employee “talk-time” was also influenced by the interaction of temperature setting and outdoor air supply rate. An increased outdoor air supply rate (from 5 l/s/p to 10 l/s/p) at 24.5 degrees centigrade saw a reduction in mean talk time (210 to 187 seconds). Conversely, a decrease in temperature from 24.5

to 22.5 degrees centigrade at an air supply rate of 10 l/s/p increased talk-time from 187 to 216 seconds. Employee perceptions and reported intensity of SBS symptoms offered no explanation for these talk-time changes. Collection of this employee perception data alongside the “harder” measures again can be viewed as a particular strength of this study.

A principal components analysis shed some light on the talk-time changes. Tham (2004) explains how a component that comprised intensity of dryness symptoms, aching eyes and nose-related symptoms was significantly associated with talk-time performance. When outdoor air supply rates were increased this cluster of symptoms also increased. Another symptom cluster which was neuro-behavioural symptoms and two nose-related symptoms (i.e., blocked nose and flu-like symptoms) explains the effect on talk-time of reducing temperature at a higher ventilation rate. Therefore a reduced temperature at a higher outdoor air supply rate elevated the neuro-behavioural symptoms, which in turn, affected cognitive performance.

A significant improvement in performance of 35% was found when the outdoor air supply was increased 5 l/s/p to 10 l/s/ at the higher temperature of 24.5 degrees centigrade. Tham (2004) states that this is indicative of “the effectiveness of increasing outdoor air supply rates is higher at the lower range of fresh air provision” (p.124).

It is concluded that doubling the outdoor air supply rate (5 l/s/p to 10 l/s/p) at a higher temperature caused a significant reduction of talk time, whilst a temperature lowered by 2 degrees centigrade (from 24.5 to 22.5) increased talk time (a performance improvement as productivity is measured in terms of time

spent talking to customers on the phones). These findings concur with an earlier study by Tham (2003).

In terms of the practical implications of this research, Tham (2004) suggests that for those employers with employees in the tropics (at least) then performance may be improved by an increase in outdoor air supply from 5 l/s/p to 10 l/s/p if a temperature is maintained at a higher level of thermal comfort – approximately 24.5 degrees centigrade. With a low ventilation rate (5 l/s/p) a decrease in the temperature from 24.5 to 22.5 (the latter temperature being the common set-point in tropical office buildings) also led to an improvement in talk time. Overall, Tham (2004) concludes that talk time was improved more markedly (more than four times better) when the outdoor air supply rate was at the lower range of supply rate (5- 10 l /s/p) as opposed to the higher rate (9.8 – 22.7 l/ s/ p).

6.4.2. Summary and conclusions from physical work environment intervention studies

The studies presented above are overall good quality research studies and taken together these papers provide some important practical insights:

- i) A decrease in call centre performance when the temperature increases beyond 25 degrees centigrade and that as a consequence these higher temperatures should be avoided (Federspiel et al., 2004; Niemala et al., 2002). Furthermore that call centre employees should be restricted in how much they can alter temperature set points (especially groups on different shifts – i.e night vs. day).

- ii) Air filters should be replaced frequently and increasing outdoor air supply may only be useful when new filters are in place (Wargoeki et al., 2004). Moreover, filter condition should be always recorded in research studies so that valid conclusions can be made.
- iii) There is an interaction effect on performance of outdoor air supply rate X temperature. For tropical call centres at least, performance may be improved by an increase in outdoor air supply from 5 l/s/p to 10 l/s/p if a temperature is maintained at a higher level of thermal comfort – approximately 24.5 degrees centigrade (Tham, 2004).

6.4.3. Work design and organizational interventions in call centres

In this section, papers are examined that can be categorised as work design or organizational intervention papers from within my own discipline of work psychology. Whilst there are many cross-sectional papers examining work design aspects in call centres (including my own Sprigg & Jackson, 2006 and Sprigg *et al.*, 2007; presented as part of this PhD thesis), when it comes to papers reporting longitudinal intervention studies in call centres using work design variables there are very few.

The first to be examined is that of Bond, Flaxman and Bunce (2008). Using a quasi-experimental design these researchers implemented a Participative Action Research (PAR) intervention in two financial service customer service centres in the UK (West Yorkshire and Merseyside). Eighty-four employees completed both the Time 1 (pre-test) and Time 2 (post-test) questionnaires in the Merseyside call centre and 97 in the West Yorkshire one did the same. Both the field-setting and the sample size are strengths of this

study. The West Yorkshire call centre was randomly designated as the intervention site; with Merseyside acting as a control.

The aims of the intervention were to reduce stress and absence rates and to improve motivation within the call centres and to also examine *psychological flexibility* (i.e., an ability to focus on the present moment and persist with or change one's behaviour in pursuit of goals and values) as a moderator.

Using findings from a Time 1 survey the intervention was targeted to: i) improve the control and influence a team had over daily and weekly work plans. ii) allow more discretion over selection, timing and ordering of work tasks. Fifteen teams in the intervention site implemented systems to allow members to participate in work planning. Arising from this change was a daily work cycle which gave the employees the opportunity to select when to complete a piece of work and when to take lunch and rest breaks.

The PAR intervention improved employee mental health and reduced absence; it did not affect motivation. The beneficial effects of the PAR were enhanced for those with higher psychological flexibility at the outset of the research; that is, those who had higher flexibility, perceived greater control post-intervention, and in turn this led them to be absent less and have better mental health (Bond et al., 2008). Contamination between the two employee groups was limited by a distance of 60 miles and the manager of the control group reported a lack of awareness of the interventions at the other site. The distance of 60 miles between the groups is a further strength in the research design of the study.

In this call centre context increasing job control was effective in improving mental health and absence rates; especially so for employees with higher levels of *psychological flexibility*. The practical implication from the research is that it may be beneficial to improve psychological flexibility before increasing job control; which they suggest might be done by means of an ACT intervention (see Bond & Hayes, 2002).

Bond et al., (2008) conclude that their study is consistent with earlier research evidence demonstrating that flexibility, both independently and interacting with job control, predicts mental health and productivity outcomes (e.g., Bond & Bunce, 2000; 2003; Bond & Flaxman, 2006; Donaldson-Fielder & Bond, 2004). Therefore, psychological flexibility is a worthy candidate for inclusion in occupational health and performance models.

The Bond et al., (2008) study has overall a strong research design with the utilisation of a quasi-experimental design and in more operational terms the use of a pretest-posttest control group design. Bond et al., (2008) are critical of themselves in not using an “inert” intervention in the control group and also state that it was possible “that the effects of the PAR intervention were caused by a Hawthorne effect” (p.653). However, Bond et al., (2008) go on to strongly argue that such a Hawthorne effect is unlikely to have occurred in their study because of Time 2 observation occurred 5-7 months after the work organisation intervention. Such an effect is unlikely to have been maintained over that time period.

In conclusion the Bond et al., (2008) is a very important study in the terms of the current systematic review. It is a call centre intervention study

conducted in a rigorous quasi-experimental manner in a field-setting in the UK. The only other recent study to do attempt to do anything of a similar magnitude in intervention terms in the UK is that of Holman, Axtell, Sprigg, Totterdell and Wall (2010) but this was excluded from this systematic review because the data from the call centre operations of the organisation in the study was insufficient to separated out and examined in a way similar to Bond et al., (2008).

Another study which can be categorised as a work design intervention in call centre interventions is that of Workman and Bommer (2004) who like Bond et al., (2008) present a pretest-posttest field experiment (with a control group) which examines 149 support specialists in a computer technology call centre. Workman and Bommer (2004) initiated three interventions to improve job attitudes (i.e organizational commitment and job satisfaction), these were: i) alignment of organisational structures (the so-called AJD intervention), ii) increasing employee involvement in work processes (high involvement) (the HIWP intervention), and iii) the implementation of autonomous work teams.

In short, Workman and Bommer (2004) found that those who received the AJD intervention reported increased job satisfaction (compared to control), but there was no significant effect on organizational commitment. Those subjected to the HIWP condition reported significantly improved job satisfaction and commitment compared to the control group. Furthermore, employee preferences for group work moderated the HIWP's effect on job satisfaction; such that when employees preferred group work they were more positive about the high-involvement intervention than those who did not share this preference.

The autonomous work team intervention did nothing to improve either job satisfaction or commitment relative to control group. Employee preferences for group work moderated the autonomous team intervention's effect on job satisfaction; the intervention had a greater impact on the job satisfaction of those employees with a preference for group work - than those with no such preference. There was no support for such an interaction effect for organizational commitment.

Additionally, Workman and Bommer (2004) conducted post hoc analyses to examine whether employees in the experimental conditions (taken together) reported higher job satisfaction and organisational commitment than the control group. Whilst specific interventions (e.g., HIWP) had specific results, the mere act of engaging in an intervention itself did *not* result in changes to job satisfaction or organisational commitment.

The attitudinal outcomes of job satisfaction and organisational commitment investigated in this study are important because of their relationship to turnover (Workman & Bommer, 2004). This study suggests that the turnover associated with low job satisfaction and low commitment is at least partly preventable through the use of the interventions described. This study is a highly significant and rigorous one with the examination of three interventions concurrently in the same context.

In summary, Workman and Bommer (2004) found that the AJD intervention had a significant positive impact on job satisfaction; there was no support for it enhancing organisational commitment. Yet, in this same context, HIWP was shown to improve both job satisfaction and organisational

commitment. Workman and Bommer (2004) believe that improvements to job satisfaction and organisational commitment may have resulted from a “combination of structural alignment and an exchange of essential ideas and effort” (p.332).

Although not an original hypothesis of their study, Workman and Bommer (2004) tested whether one intervention was more potent than the others. By examining the effect size differences between the AJD and the HIWP interventions for job satisfaction and organizational commitment evidence was found to suggest that the HIWP was the most effective for improving both satisfaction and commitment. Additionally, greater satisfaction and commitment may be garnered by organisations implementing HIWP with employees who have initial preferences for group work. However, Workman and Bommer (2004) conclude that employees will benefit from HIWP even if they have no group-work preference; indeed they go as far as to say that the HIWP intervention had “a little something for everyone” (p.333).

As for the AWT intervention; without taking the group preferences into account, there is no evidence for improvements in satisfaction or commitment. Team members who preferred group-working had significantly better job satisfaction than those that did not.

Several limitations of their study are discussed by them and also as is the norm recommendations made for future research. The researchers believe that the different results for the interventions are at least partially explained by managers being involved to varying degrees in the interventions. Such

managerial involvement was at its' highest in the HIWP, followed by the AJD and lastly the AWT (Workman & Bommer, 2004).

One of the most obvious limitations is whether the findings of the study can be generalised beyond the specific type of call centre – that is, a computer technology-based one (Workman & Bommer, 2004). The researchers suggest that future studies need to focus on interventions that are designed to influence job performance. They also warn that there may have been some cross-group contamination (some employees discussing their intervention with those in other intervention conditions) within their study and they advise researchers to build in controls for this. Finally, Workman and Bommer (2004) argue that future research should examine in more detail the impact of different types of interventions on different types of employees; that is, there will be a multitude of moderators beyond the preference for group work measured here which will impact on the success of such interventions.

This study makes a substantial contribution to our knowledge of which interventions are likely to yield positive attitudinal benefits to employees which may as consequence stop them from wanting to leave; in call centres this potential limiting of turnover will be beneficial to many. The study is strong in terms of research design and it is especially valuable to consider multiple interventions concurrently. The sample size is reasonably good with 149 participants.

There is another journal paper by Workman in 2003 which is more specifically targeted at Human Resource Development (HRD) professionals. This paper reports on a study in a technology call centre which “concurrently

investigated the effects of job satisfaction from structural-alignment, high-involvement, autonomous team interventions compared to a control group” (p. 215). This sounds remarkably similar to the Workman and Bommer (2004) paper albeit this earlier 2003 paper is just focussing on job satisfaction.

Workman (2003) found that low job satisfaction produced workers who wanted to leave the technology call centre; hence the requirement to intervene in some way to improve job satisfaction. Thus, job satisfaction was found to improve with the “Alignment Job Design” (AJD) and the “High-Involvement Work Process” (HIWP) interventions but not the “Autonomous Work Team” (AWT) one. Again, a post-hoc analysis shows the HIWP intervention having the greatest impact on job satisfaction.

Workman (2003) explains that further analysis revealed that employees with low preferences for individual work had higher job satisfaction in the AWT intervention group than did the high preference for individual work employees. Follow-up interviews also revealed issues about skill levels in the AWT group which may have impacted on reported satisfaction; with junior employees feeling they were inadequately skilled for solving difficult problems.

Workman (2003) concludes that from these findings HRD professionals may infer that in the case of autonomous teams then: i) pre-requisite skills may need developing before call centre employees might work in a way that does not impact on their job satisfaction, ii) more emphasis might be needed on team building and team-working. The only additional value I can see of this paper is in making these strong practical recommendations to HRD professionals.

The study by Halliden and Monks in 2005 can be also categorised as a work and organisational intervention in a call centre. They conducted “action research” in a recently privatised telecommunications customer contact centre in Ireland.

In this study a pre-interventions climate survey (Human Resource Index) was administered to 68 employees (88.9 % response rate). Interventions included: i) a new performance management system, ii) a new communications system, iii) focus on training and development, iv) an accreditation programme, v) a recruitment campaign, vi) changes to physical working arrangements, and vii) social committees. The survey was re-administrated six months later. Results of the interventions indicate both an improvement in employee perceptions of their work situation and performance, and turnover decreased. Whilst these authors acknowledge the difficulty in determining cause and effect relationships from their data they state that it is possible “to identify factors that appeared to have an impact on the changes that occurred” (Halliden & Monks, 2005; p.379). For example, the management commitment to the change interventions through an involvement process is seen as one such key factor. However, Halliden and Monks then go on to state “Although positive changes in performance were reported following the changes, it is not possible to identify whether or not the changes in performance resulted directly from the employee-centred initiatives, whether they occurred simply as a result of the changes themselves” (p.380). Halliden and Monks (2005) conclude that the attempts the organisation made to involve a variety of stakeholders in the change process was in itself a positive outcome.

The Halliden and Monks (2005) is an interesting study in that it takes a different “action-research” strategy to intervene in a call centre. The study is far less rigorous in research design terms than the others reviewed in this section but still makes a contribution to an otherwise scant literature. It is important to include it within the overall systematic review even if it is far less methodologically robust in design than either Bond et al., (2008) or Workman and Bommer (2004).

6.4.4. Summary and conclusions from work design and organizational interventions in call centres

Taken together these papers provide further insights into interventions that might improve the lives of those working in call centres. For example,

- i) Bond et al., (2008) conclude that increasing job control in their study call centre was effective in improving mental health and absence rates; especially so for employees with higher levels of *psychological flexibility*. Moreover, because their findings concerning psychological flexibility are in tune with previous research, they suggest that flexibility is a worthy candidate for inclusion in occupational health and performance models.
- ii) Attitudinal outcomes of job satisfaction and organisational commitment investigated in the Workman and Bommer (2004) study are important because of their relationship to turnover. High involvement work processes (HIWP) were found to be the most effective for improving both satisfaction and commitment in their computer technology call centre study. In addition,

greater satisfaction and commitment might be garnered by organisations implementing HIWP with employees who have *initial preferences* for group work.

- iii) The Halliden and Monks (2005) study is a less rigorous study than those others in this section, but this is acknowledged by the authors themselves. However, they do suggest the management commitment to the change interventions through an involvement process is seen as key factor in positive outcomes of interventions. Indeed, Halliden and Monks (2005) conclude that the attempts the organisation made to involve a variety of stakeholders in the change process was in itself a positive outcome.

6.4.5. Ergonomic interventions in call centres

The third category of call centre interventions which can be created is one where studies are rooted in the discipline of ergonomics. The first of these is a study by Lindgaard and Caple (2001) who report on a participatory design (PD) approach to changing a keyboard intensively used by call centre operators; more specifically these were Directory Assistance (DA) employees in a major telecommunications company in Australia. Participative or cooperative design involves end users in the design of a system or a tool they will eventually be using. As well as ergonomic and physiological considerations, Lindgaard and Caple (2001) suggest that operator satisfaction is an important issue in keyboard redesign. As a result of a change to a standard keyboard from a customised

keyboard there was a requirement for two functional keys to be sacrificed. In addition, there were options to move keys from their existing position.

The DA operator job involves alternating between talking and listening to customers and retrieving information from database searches. The operators rely on special function keys for shortcuts in advanced database searches. The challenge is that frequently used keys are close to natural resting position for the hands on the keyboard. With those keys needing stretching of fingers or excessive wrist-twisting allocation should be to less used functions.

The Lindgaard and Caple (2001) study employed three main methodological approaches, these were: i) PD principles to involve employees in the design process and ensure end-user ownership, ii) observation of employees using the keyboard, iii) objective measures of key usage and keyboard ergonomics.

To work on the design of the new keyboard five focus groups were held. These groups included 46 employees representing 59 call centres. Each focus group was between four to five hours in duration. The focus groups were an opportunity to discuss the planned system changes which included the keyboard replacement and also explain the keyboard redesign process. More specifically, participants were asked to indicate the frequency of use of particular keys and they were shown a printed keyboard template with the some keys left blank and others labelled. The template from the first focus group where design decisions had been agreed upon was then the starting point for the second focus group. After the final focus group a poster was produced showing the resulting

prototype keyboard and this was placed in all call centres so that any call centre employee could comment either directly on the poster or by email.

A survey was conducted to collect both demographic information and feedback about the operators concerns and preferences about the availability and placement of keys. The questionnaire was distributed to 3,100 call centre employees. In addition 100 operators were observed in an unobtrusive manner to examine the techniques they adopted and the layout of the equipment on the desk when processing a sample of ten calls. Video recordings were also made of 12 operators in a Melbourne call centre; with 50-100 calls processed by each operator during the observed time. The camera was behind the operator so that the entire keyboard could be seen for accurate logging of which keys were used. These recordings were then analysed using “The Observer” software enabling event logging and basic statistics to be performed. Finally, keystroke data was also extracted and the ergonomic measures of force and reflectance. The strength of this study has to be the degree of care taken by the researchers to collect relevant data by a number of different means.

Lindgaard and Caple (2001) found that 28 of the 35 function keys placed by the first focus group were not changed subsequently. Small changes were made by the second and third focus groups (four and three keys respectively); with no changes made by the final two groups. The data from the software and the focus groups matched well in terms of frequency of key use, thus, Lindgaard and Caple (2001) conclude that the operators’ perceptions of usage was reasonably accurate. Three ergonomists checked the final design outcome for any potentially harmful aspects of key placement. Again, this checking by the

ergonomists at the end of study adds to a feeling of general rigour and care taken throughout this research.

A 58% response rate (1800 responses) was achieved for the survey questionnaire. This is a very good sample size and again reflects the overall rigour of the work by Lindgaard and Caple (2001). Only five different function keys featured were seen as most frequently used across the 1800 responses. Both the video-recording and the software logging confirmed this to be the case. Therefore all of the data sources confirmed these five keys as the most frequently used. Seven keys were seen as least frequently used and two of these were removed in the redesign. Other issues about the work environment, for example, the glare from windows, ceiling lights were commented on within the survey. Many of the aspects raised were due to be dealt with anyway but the survey was a catalyst for these schedules of improvement to be communicated earlier. Lindgaard and Caple (2001) see the high response rate as evidence of the concern employees had about the work environment and the desire to be actively involved the design of the new keyboard.

The redesign process within the focus groups was seen to be successful by Lindgaard and Caple (2001); however as 80% of the design was established by the first focus group and the rest by the third then the number of focus group used here could clearly have been reduced to save resources. This study suggests that involving users in a participatory design process, even when there are several thousand end users, is a realistic avenue to pursue. For future research it is useful to note that the subjective estimates of key usage were very close to the observed ones.

As Lindgaard and Caple (2001) emphasise the absolute test of the success of any new design is how little it interferes with the smooth running of the business of that organisation when it is implemented. So the researchers examined the impact on business by looking at two aspects: performance monitoring and absenteeism. Data collected from one of the pilot call centres revealed that overall performance dropped by 14% when the keyboard was first introduced but performance was back to normal 10 days later. Operators were keen on the new keyboard and were even reluctant to take scheduled breaks because they wanted to practice on the new keyboard.

Other call centres did not follow the pattern of the pilot in terms of “recovery” from the new keyboard implementation as it took 20 days for the first “real” call centre to return to normal performance levels. In an attempt to remedy such issues in subsequent call centres expectations that performance would return to normal by 10 days were communicated to all employees. It took on average 9 days for normal performance to return (with the fastest performance return at 3 days and the slowest exceeding 25 days).

Lindgaard and Caple (2001) suggest that a PD project such as this should include “several months of closely monitored post-installation performance of systems and people” (p.79). Another lesson learned from this work is that predictions should be made about: i) effects of the introduction of new equipment, ii) the length of “run-in” time. Such predictions can be included in business and project plans and be cross-referenced against what actually happens to performance after new equipment is introduced (Lindgaard & Caple, 2001).

For the other performance indicator, absenteeism, there were no changes in the patterns. Neither were there any reports of discomfort associated with the new keyboard. Overall there was no suggestion of serious disruption or stress amongst staff. Lindgaard and Caple (2001) conclude “In this project, clear and timely communication and involvement of staff certainly provided clear anticipation’s of changes to come. We think that the ready acceptance by staff and the proactive reporting of concerns and suggestions to the project management was influenced by the way the design process was managed” (p.79).

The Lindgaard and Caple (2001) project was strong in design and execution, with a good sample size and response rate. The study clearly shows the value of a participatory approach to ergonomic workplace changes even with very large groups of employees. The only obvious weakness and one that Lindgaard and Caple (2001) comment on themselves is that they may have conducted more focus groups than were necessarily required; however, this would have been impossible to judge at the outset of the project.

The second study in this ergonomic category is that of Smith and Bayehi (2003) whose research was based on the guiding principle that computer workstation improvements can increase worker health and performance. Smith and Bayehi’s study was concerned with whether improving ergonomic characteristics of computer workstations could improve productivity in a catalogue retail call centre.

These researchers used three levels of ergonomic intervention, each of which added incrementally on to the previous one. The first level intervention was ergonomics training for all computer users accompanied by workstation

ergonomics analysis leading to specific customised adjustments to better fit each worker (Group C). The second level of intervention added in specific workstation accessories to improve worker fit if the need had been indicated (Group B). Finally, the third level intervention was all that was required for inclusion in Group B plus an improved chair (Group A). Smith and Bayehi (2003) hypothesised the greatest productivity improvement will be shown by Group A, followed by Group B and then Group C; with all intervention groups showing more improvement than the control group.

Using 72 volunteer participants and 370 control participants, Smith and Bayehi (2003) concluded that improved ergonomics of various types (e.g., training, workstation ergonomics analysis, customized adjustments to workstation set up) led to 'modestly higher output from pre- to post-intervention, and a benefit greater than a control group not receiving ergonomics improvements' (p.16). The sample size mismatch between the intervention group and the control group looks odd and there is no obvious explanation for this within the paper. More specifically, the findings (no parametric statistical tests were undertaken) indicated an average improvement in total units processed correctly per hour for the combined ergonomics intervention group of approximately 5% in comparison with a decrease of 3% in the control group post-intervention. The lack of statistical tests undertaken is a weakness of the study.

It is good that Smith and Bayehi (2003) do caution their readers about the over- interpretation of their findings because no parametric statistical evaluation was carried out. Additionally, half of the participants in the ergonomics

intervention groups showed a decrease in performance. Despite this the way productivity (i.e., productivity trends for each individual and then aggregated up to group outputs) was measured in the study gives them some confidence that their study gives a more accurate picture of productivity improvement at both individual and group levels than earlier studies.

The most surprising element of Smith and Bayehi's study is that the predictions about which ergonomic interventions would produce the greatest performance impact were not validated. The group with most ergonomic improvement interventions (Group A) did not yield the greatest productivity improvement. Indeed, quite the contrary occurred as Group C with the least intervention showed the largest average productivity output increase (9.43%); this was more than 2.5 times greater than the productivity increase in Group A. [Group B showed the lowest increase]. Smith and Bayehi (2003) pose the question as to whether this means that simple ergonomics interventions have more benefit than more elaborate ones. They do not have a clear answer on this question; partly because of the lack of statistical analysis. However, they emphasise that "the average percentage of output improvement increased for all of the ergonomics conditions while it decreased for control subjects" (p.15). They conclude "that improved ergonomics of various types led to modestly higher output from pre- to post-intervention, and a benefit greater than a control group not receiving ergonomics improvements" (p.16; Smith & Bayehi, 2003).

It terms of practical recommendations from their research Smith and Bayehi (2003) suggest that it is reasonable to expect that improved work station design will increase productivity given the assumptions (based on previous

research and not their own) that interventions will reduce physical loads and increase personal comfort. Furthermore, they caution that individual differences must be considered when making improvements; which they base on an earlier paper by Bayeh and Smith (1999).

Overall, the conclusions of Smith and Bayehi (2003) research are unclear despite an initial strong research design and the concerted effort to measure productivity in detail. Their unexpected findings are not well-explained and this is compounded by the lack of statistical analysis. At best the research *appears* to show that half of the participants in the ergonomic interventions did benefit; but the benefit is in terms of productivity, rather than in health, comfort and well-being explicitly. [Although one can make the obvious assumption, as Smith and Bayehi (2003) seem to do, that the latter led to the former productivity gain].

Given the vague way the paper is written in places it is difficult to delineate what can be taken from this research in practical terms; however one has to admire the initial research design. Furthermore, this was in research terms a fairly early call centre research paper and this intervention study would have been undertaken in the field at a time when most researchers were conducting much more simplistic and descriptive studies in call centres. For the latter aspect Smith and Bayehi (2003) deserve some credit.

Another study to be categorised as an ergonomic intervention is that of Cook and Burgess-Limerick (2004) who conducted a randomised controlled study of the provision of forearm support in a newspaper call centre. The specific aim of the study was to examine whether adjusting a conventional work station to allow forearm support during computer use (of an intensive nature) decreased

reports of musculoskeletal discomfort in neck/shoulder and wrist/hand. The study was conducted over a six-week period and with the control group receiving the intervention after six weeks (because this was open-plan office). Both groups were then monitored for a further six weeks. There were initially 30 participants in the intervention group and 29 in the control group. The study has a good initial research design and a nice balance in the sample size of participants in the control and intervention groups.

The intervention consisted of the following features: i) workstation adjustments to enable forearm (but no elbow) support, keyboard re-positioning (so that top row of keys level with fingertips when forearms supported), and mouse re-positioning (so at least half forearm supported), ii) Keyboard, desk and chair heights recorded, iii) Participants monitored for first few hours to make sure working posture was good (i.e., no trunk flexion, shoulder elevation, or increased wrist extension) iv) Participants given prompt sheet about maintenance of forearm position, v) weekly compliance visits. For the control group there were simply desk, chair and monitor height adjustments where needed. Questionnaires were given at weeks 1, 6 and 12; these concerned work patterns, hours at computer, mouse use at home and work, break frequency and duration. Musculoskeletal symptoms were measured with the Nordic questionnaire and in addition a *goniometer* was used to measure shoulder flexion. There is methodological rigour in the type and amount of data collected for the study.

Cook and Burgess-Limerick (2004) found that once participants were set up with the forearm support the reported discomfort reduced within 6 weeks in

both of the groups. When pre- and post-intervention of forearm support were compared, a significant decrease in the frequency of neck, back, forearm and wrist discomfort was found. Significant reductions in reported wrist and forearm discomfort were reported at 12 weeks. The study is limited by virtue of the shortness of the intervention period; the authors state that a randomised control longer than six weeks is needed.

Cook and Burgess-Limerick (2004) conclude that “the study confirms that use of forearm support has a number of advantages over a traditional floating posture and should be considered as an alternate posture for keyboard users” (p.341). This study is well-designed with a reasonable sample size. The study makes an important contribution to the very limited literature because it is an intervention in a call centre field setting that has been carried out and written up in a clear and rigorous manner. It makes a practical contribution because it provides call centre managers with a steer for tackling forearm discomfort (and the productivity consequences of it) within this group of employees.

A further study to be categorised as an ergonomic intervention is that of Chi and Lin (2009) who conducted an experiment to evaluate the effectiveness of screen filters for relieving visual fatigue in a small (N= 22) group of disabled call centre employees. [Those with visual disabilities were removed from the analysis]. There was no control group (although originally intended) as all agents were given the filter because they felt that the filter could reduce visual fatigue caused by glare and reflection. The small sample size and the lack of control group are obvious initial weaknesses of the research design.

Chi and Lin (2009) used the following to evaluate the effectiveness of the screen filter for the call centre employees: a subjective rating scale of visual fatigue, CFF, accommodation power, and visual acuity. Measurements were taken without the screen filter (as a baseline), and with filter use of 2.5 months, 5 months and 12 months. The subjective rating scale for visual fatigue had seven items; eye pain; hard to focus; headache; eyes feeling tired; eyes are dry, irritated, or burning; double vision on screen; and flicker vision. All measurements were taken in the morning and in the afternoon – that is, before and after the 8 hour work shift. The number of different measurements and frequency of them serve to strengthen ones view of the research.

The research had a 2-factor design with repeated measures, with the screen filter and time of measurement as fixed factors and employees treated as random factors. ANOVA was used to examine whether the screen filter use or measurement time significantly impacted on any of the dependent measures.

Visual acuity was found to be improved significantly after using the screen filter. It was also found that by adding a screen filter reduced the luminance contrast and significantly decreased CFF after 2.5 and 5 months; however the CFF then returned to the level without the filter after 12 months use. This might be because of user adaptation. Double vision was significantly improved after using the filter for 2.5 months, but again this improvement disappeared after 5 or 12 months (Chi & Lin, 2009).

A Hawthorne effect was suggested to be in operation during part of the study and the researchers conclude that the only practical approach to relieve visual fatigue in call centre employees is to limit the amount of time they have to

search for information on screen or interact with the VDT. This might be achieved by collecting together frequently asked questions into one database; so reducing on screen information search times and switching screens. Again, this is a valuable study but it is weakened by both the small sample size and lack of control group. Although, the repeated measures design and the variety of data collected are strengths.

A study by Rempel, Krause, Goldberg, Benner, Hudes and Urbiel Goldner (2006) examined whether two simple workstation interventions – a forearm support board or a trackball – would reduce incidence of upper body musculoskeletal disorders (MSDs) and severity of pain. A further aim was the examination of the effects of the intervention on productivity and costs.

This study was rigorous in design employing a “randomised intervention trial with four treatment arms” (p.300) over a period of one year. Participants in the study were from two customer service centre sites of a large healthcare company; the operators were either nurses or healthcare specialists. The criteria for participation in the study was that they used computers for more than 20 hours a week to perform their customer service work and they were not involved in any ongoing compensation claim involving neck, shoulders or upper extremities.

Participants completed a baseline questionnaire and then on a weekly basis completed a one page questionnaire on pain severity. Participants were randomised (using a computer-generated permuted-block sequence) to receive one of four interventions. The four different interventions were as follows: i) ergonomics training, ii) trackball and ergonomics training, iii) forearm support

and ergonomics training, and iv) forearm support, trackball and ergonomics training. [Specific dimensions of the armboard and the trackball mouse can be found in the original paper on page 301]. The ergonomics training was of a standard nature as it included advice on: i) maintaining an erect posture when sitting, ii) adjusting chair heights and arm supports so that thighs and arms are parallel to floor, iii) adjusting keyboard and mouse to minimise reach, iv) adjusting monitor so that monitor is 15 degrees below visual horizon, and v) a reminder to take all scheduled rest breaks.

The baseline questionnaire collected demographic information and other covariates i.e., medical history, hobbies, exercise and psychosocial stressors. The questionnaire was completed for 52 weeks at the end of each week. Questions assessed work schedule, medication use for pain, and any acute injury events. With three body regions: i) neck/shoulders, ii) right elbow/forearm/wrist/hand and, iii) left elbow/forearm/wrist/hand all assessed for the worst pain during previous seven days on a 1-10 scale (0= no pain; 1 = unbearable pain).

Further rigour is introduced to the study by having a physician (blind to which intervention) examine particular participants. These were employees who recorded on their weekly survey a pain intensity of more than 5, or had used medication for two days or more for upper extremity or neck pain (and had *not* experienced an acute traumatic event e.g., a fall). Additionally, one month after the intervention had started an unannounced visit was made to make sure the intervention assigned to them was being used. Productivity was measured using employer productivity tracking already in place.

One hundred and eighty-two participants were randomly assigned to one of the four intervention groups. This is a good initial sample size; a further study strength. Using general linear models and confidence intervals (at 95%) Rempel et al., (2006) found that the arm-board reduced the risk of neck/shoulder disorder by approximately half. The arm-board also reduced the rate of left upper extremity disorders but the effect was only marginally significant. The trackball intervention led to a significant reduction of left upper extremity disorders but no effect on the right. Interaction effects between the arm-board and trackball were not significant.

Linear regression was used to examine the effects of the interventions on pain scores. Again, the interaction terms for arm-board and trackball were not significant. So as before analytical models were simplified to evaluate just arm-board or trackball effects. For the arm-board interventions a significant decline in neck/shoulder pain and right upper extremity pain was found. The trackball intervention was also associated with reduced pain in these regions but this was not statistically significant.

Participants in the intervention groups reported decreased pain in comparison to the control group. When participants were asked an open-ended question about what had improved their discomfort in their upper body in the past four weeks the top four factors were reported to be interventions, medications, stretching and rest. No productivity differences were found between intervention groups on either company-tracked or self-reported measures.

This randomised controlled trial found that a relatively simple workstation change can reduce upper body pain in customer service workers who

interact with computers. The support prevented neck/shoulder disorders when compared with the ergonomics training alone. This matched what the participants themselves thought about the arm-board intervention.

The trackball intervention yielded a more inconsistent pattern of results; as it only reduced pain and musculoskeletal disorders in the left upper extremity. The latter finding was unexpected because 98% of participants used the mouse and trackball in the right hand. Rempel et al. (2006) find the trackball results difficult to explain, although they suggest that it allowed participants to do more mouse work with the right hand and thus, perform less keyboard work with the left hand (leading to less pain in the left upper extremity). Conversely, some participants reported more pain with the trackball and nine others reported difficulty in using it.

Rempel et al. (2006) themselves see one of the main strengths of their research being in the 20 plus confounding factors that were examined and then, if significant, were then controlled for in subsequent analyses. Their study took into account and measured psychosocial job factors that are known to potentially confound the relationships between physical work environment and MSDs (Rempel et al., 2006). They suggest that when managing upper body pain and associated disorders the factors that should be taken into account include:

- The severity of the disorder
- Tasks at home and work that aggravate symptoms
- Hours of computer use per week
- Work/break patterns
- Work station set up

- Co-morbid conditions.

It may take several weeks for a wide forearm support to show benefits for users. With the findings for the trackball being less consistent Rempel et al. (2006) believe that it should be trialled and that if hand pain stays the same or increases then something different should be used (e.g., a touch-pad). Employers should consider offering forearm supports to computer users in customer service roles to reduce MSD risks and employers should continue to provide the appropriate ergonomics training, workstations, chairs and lighting (Rempel et al., 2006). This was a very strong study with strong practical recommendations; one of the best, if not the best one, in this category of call centre interventions.

The final study in this systematic review category is that of Cook, Downes and Bowman (2008). This is a follow-up of the study conducted by Cook and Burgess-Limerick (2004). The aim of this study is to examine the longer-term effects of fore-arm support at 21 months following the intervention. The rationale for the study was partly because straight-edged desks are far more common than concave desks and a need for research into these conventional desks as a means of forearm support.

The study was conducted within the newspaper call centre used in Cook and Burgess-Limerick (2004). For this follow-up study there were 35 (59%) of the original sample who were able to participate. The sample comprised 33 females and 2 males and the average age was 43. Productivity statistics revealed that 75% of employee time was spent using the keyboard. The same questionnaire was used as before with the second part of the questionnaire based on the Nordic Questionnaire. In addition, questions were asked about the comfort of and use of

the forearm support posture. Chi-squared tests were used to look at the differences in proportions of symptoms between pre-intervention and follow-up (21 months) and post-intervention (at 12 weeks). Furthermore, t-tests were used to examine differences between work-station dimensions at the different data collection stages.

Cook et al. (2008) found interesting differences between the participants at the pre-intervention and follow-up stages but these were *not* statistically significant. For example, more participants used a computer at home (60% compared to 51.4% at pre-intervention) and more participants found their job stressful (56% at follow-up compared to 38% at pre-intervention).

For the forearm support posture again there was little variation from post-intervention to follow-up. At follow-up there was a significant difference between the pre-intervention mean distance of the keyboard from the desk edge (although this had lessened from the post-intervention distance).

Musculoskeletal discomfort was examined in relation to the difference in reported symptoms for the previous 12 months and the previous 7 days. In terms of the former reports of neck discomfort decreased significantly between pre-intervention and follow-up. Also there were decreases found for back and forearm discomfort but these were not statistically significant. A non-significant *increase* in shoulder discomfort was found. For the previous 7 days measure at the 21 month follow-up the symptom prevalence for one or more body region had increased to 57% (63% at pre-intervention and 38% at post-intervention). However, again this was not statistically significant.

In sum, the only significant decrease between the pre-intervention and the follow-up stage was in neck discomfort. Therefore, although there had been some significant decreases in discomfort for most body regions following the initial intervention, these changes were not sustained at 21 months. There are a number of inconsistencies in the findings; for example, although neck discomfort had decreased, more participants reported a decrease in activity due to neck discomfort.

Overall, this group of employees accepted the practice of forearm support as evidenced by the 80% continuing to use at least part of the time. Given that this means adopting a different working posture this is a significant amount of staff. Cook et al. (2008) suggest that the rounded (concave) desks are to be recommended if the forearm support posture is adopted.

The reduction of discomfort was much less marked at the 21 month follow-up than immediately post intervention (Cook et al, 2008). Several suggestions are made as to why these findings occurred: i) an experimental effect, i.e., the expectation that a different posture may be better ii) no further input or education provided after the intervention and before the follow-up. Cook et al. (2008) conclude that as more participants at follow-up reported their job was stressful than at the pre-intervention stage then future studies must be more thorough in their examination of organisational and psychosocial factors.

The study shows at a 21 month follow-up that a forearm support procedure in a call centre has had a positive effect on the reducing neck discomfort; this aligns with previous research. However, Cook et al. (2008) conclude that because of an *increase* in shoulder discomfort then a concave desk may be better than a

conventional straight-edged desk when the forearm support working posture is adopted.

6.4.6. Summary and conclusions from the ergonomics interventions research

- i) Involving call centre users in a participatory design process, even when there are several thousand end users, is a realistic avenue to pursue (Lindgaard & Caple, 2001). However, the lesson learned from this research on keyboard changes is that predictions should be made about: i) effects of the introduction of new equipment, ii) the length of “run-in” time. The way the design process is managed is critical too.
- ii) Smith and Bayehi (2003) suggest that it is reasonable to expect that improved work station design will increase productivity given the assumptions that interventions will reduce physical loads and increase personal comfort. Although there are many limitations with this study and the authors urge caution in the interpretation of their findings.
- iii) Use of forearm support has a number of advantages over a traditional floating posture and should be considered as an alternate posture for keyboard users in call centres. Cook and Burgess-Limerick’s (2004) study makes a useful contribution and provides managers with a practical steer in tackling such discomfort (and the productivity consequences of it).
- iv) Visual acuity for call centre employees was found to be significantly improved after using the screen filter (Chi & Lin, 2009). Probably, the only practical approach to relieve visual fatigue in call centre

employees is to limit the amount of time they have to search for information on the screen or interact with the VDT.

- v) Rempel et al., (2006) found that an arm-board reduced the risk of neck/shoulder disorder by approximately half. The arm-board also reduced the rate of left upper extremity disorders but the effect was only marginally significant. The trackball intervention led to a significant reduction of left upper extremity disorders but no effect on the right.
- vi) A 21 month follow-up found that a forearm support procedure in a call centre had a positive effect on the reducing neck discomfort (Cook et al., 2008); this aligned with previous research.

6.4.7. Health interventions in call centres

My final categorisation of research is that of “health interventions” which comprise those studies that have attempted to directly improve the physical and psychological health of call centre employees. The first of these is that of Kennedy and Pretorius (2008) who conducted two studies in two South African call centres to assess the impact of a heart-rate variability (HRV) biofeedback device on performance and stress-related complaints.

In Study 1 twenty participants were given the device for 45 days and compared to 318 call agents at a different site of the same organisation. The primary outcome measure for the study was a “call score rating” (a third party who calls back customers to ask about the call experience and service). The intervention group significantly improved their call scores in comparison to the

controls; those adhering most closely to the intervention study protocol having the highest scores of all.

In Study 2 there was no control group but a pre-intervention assessment and a post-intervention measurement. One of the baseline questionnaires assessed the stress-related symptoms (i.e. gastro-intestinal problems, burnout, depression) whilst the other environmental stressors (i.e. supportive work environment). There was a significant decrease in personal but not environmental stressors over the study period. The largest reduction effects were found for burnout, fatigue, GI problems, and headaches. Days absent were reduced from 10 in the month prior to 7 in the intervention period.

Kennedy and Pretorius (2008) conclude that both studies suggest the biofeedback device may be a novel and effective stress intervention strategy for call centre employees. In performance terms the device improves the interaction with customers and the device effects not *what* they do but how they do it (Kennedy & Pretorius, 2008). The research is limited by the small samples, having volunteer participants, and the limited time periods of the study; these are acknowledged by the researchers. A greatest strength of the research lies in the attempt to measure the effectiveness of relaxation tool that can be used in the call centre context.

The final paper in my systematic review overall and in this health interventions category is that of Lehto, Rantala, Vilkinen, Alku and Backstrom (2003) who conducted a study to examine the effects of a two day vocal training course for call centre customer service advisors in Finland. They describe how people who use their voice professionally, such as call centre employees, are at

risk of occupational voice disorders. Lehto et al., (2003) emphasise some of additional risk factors for voice professionals such as background noise, poor room acoustics and poor quality of air which are all aspects of the call centre context.

This study was initiated by a large Finnish telecommunications company noting that call centre employees had more sick leave than other groups of employees in the same organisation. The aims of the Lehto et al. (2003) study were to examine: i) the frequency with which the employees experienced vocal symptoms ii) how a short vocal training course might affect subjective vocal symptoms, iii) the relationship between the change in voice symptoms and the subjective effect of the vocal training, and iv) views on the vocal training in general.

Forty-eight (38 female, 10 male) call centre customer service advisors who used the telephone extensively participated in the study. These employees were given vocal training by a speech-language therapist for two days. The first day was six hours in duration and divided into two parts. The first part was made up of lectures on the theory of voice production, resonance and articulation, whereas the second part was concerned with vocal activities (e.g., using the voice more economically, warming up and cooling down the voice). All of the second day was devoted to practising the newly learned vocal exercises. After these two days the participants then took part in a further one-day speech communication seminar (this included discussion on the special demands of telephone communication, principles of speech technique etc).

The participants completed a questionnaire on self-reported vocal symptoms (e.g., my voice gets tired easily, my throat is dry and/or itchy). Three weeks after the voice training participants completed a second questionnaire describing the effects of training on symptoms reported in the first questionnaire. In addition, they were asked about their opinions of the training itself.

Lehto et al. (2003) found that the most common symptom (once a month/quite often) females reported was a feeling of mucus in the throat with a related need to clear the throat. Other symptoms experienced sometimes (or a few times a year) were hoarseness, vocal fatigue, dry throat, worsening of voice quality during a day and feeling of a lump in the throat. Males too suffered this symptom of needing to clear the throat as the most common one. For males this was followed by vocal fatigue and the dry throat sensation. There was no significant difference between males and females on symptom scores (where symptoms were pooled together to create a score).

Lehto and colleagues examined the reported changes after the training. Following the training females reported less vocal fatigue, a feeling of less mucus and related need to throat clear and less worsening of the voice. Sixty-three percent of females reported voice training had improved their vocal habits, with none reporting a negative impact of the training. The mucus problem also decreased in males, as did the voice-worsening issue. Sixty percent of males reported improved vocal habits due to the training. All participants experienced the training positively; with males showing less interest in taking an advanced training course.

Voice problems are complex and can include self-reported reductions in social, emotional and professional well-being. The Lehto et al. (2003) study makes an important contribution, because, as they state “to the best of our knowledge, the present study is the first to investigate the effects of a *short* course arranged for healthy *professional speakers*, who are ‘ordinary’ employees in the sense that they are not singers or actors. Moreover, the emphasis in the current study was on the effects of preventative voice care” (p.169).

The research is carefully executed and the paper well-written, which bolsters my opinion of the value of their unique study (the obvious caveat being I am not an expert in the field of speech therapy). One design weakness of the research is the lack of control group. This weakness is not ignored by Lehto et al. (2003) who state “we chose not to have a control group, because the purpose was to investigate the effects of vocal training in a given group of subjects” and then they raise the issue that the presence/absence of a control group is subject of intensive debate. Lehto et al. (2003) go so far as to cite research which suggests that studies with control groups have shown those receiving speech therapy always gain the best results. This reads like a deflection of the thorny issue of why there is no control group in their study.

Lehto et al. (2003) conclude that even a short vocal training course might be positive for those working in “vocally loading” occupations.

6.4.8. Summary and conclusions from the health interventions research

- i) A biofeedback device may be a novel and effective stress intervention strategy for call centre employees (Kennedy & Pretorius, 2008).
- ii) A short vocal training course could be positive for those working in “vocally loading” occupations such as working in a call centre (Lehto et al., 2003)

6.5. Summary and Conclusions for Chapter 6

In this penultimate chapter of my thesis I have located, described and evaluated 16 intervention studies in call centres. The studies are diverse; ranging from studies concerning indoor air quality to short vocal training courses. This chapter forms a further unique contribution of my PhD thesis as these studies have not been systematically collated previously in this way.

Six studies can be classified as ‘ergonomic’ in nature (i.e., Chi & Lin, 2009; Cook & Burgess-Limerick, 2004; Cook *et al.*, 2008; Lindgaard & Caple, 2001; Rempel et al. 2006; Smith & Bayehi, 2003). This is followed by four that are categorised as ‘work design and organisational’ in nature (i.e., Bond *et al.*, 2008; Halliden & Monks, 2005; Workman, 2003; Workman & Bommer, 2004). A further four are considered to be examples of ‘physical work environment’ studies (i.e., Federspiel, et al. 2004; Niemala et al. 2002; Tham, 2004; Wargocki, Wyon & Fanger, 2004). Finally, just two can be categorised as health interventions in call centres (i.e., Lehto et al. 2003; Kennedy & Pretorius, 2008).

6.5.1. Relationship of these studies to my own research

How do these studies map onto my own recommendations for future studies in Study 1 and Study 2? Looking at the studies in this way helps to establish what research gaps still exist and potential new approaches we might take in designing intervention studies in call centres.

I suggested that more rigorous research designs were needed in call centres and called for longitudinal projects in our own field of work psychology. The research of Bond, Flaxman and Bunce (2008) and Workman and Bommer (2004) partly answer this call; although neither of the studies specifically examine job performance and turnover of call centre employees which was something I called for. In Study 2 I called for longitudinal and quasi-experimental research specifically about MSDs (in call centres); none of the intervention studies isolated in this review address this call. In addition, a broader range of outcome variables in job design research was called for, which again has not been addressed by the intervention studies suitable for inclusion in this review.

In the next and final chapter (Chapter 7) I discuss the contribution of my research to work design theory. Also, I suggest how conceptual frameworks of stress at work need to consider a broader range of variables if they are to be accurate and holistic portrayals of a work environment which impacts on worker health.

Table 15: Summary Table of Systematic Review Papers

Reference/ Study/ <i>Physical Work Environment Intervention Studies (1-4)</i>	Sample Context	Sample N / Response Rate	Research Design /	Method of Data Collection	Questionnaire Measures/ Study Dimensions	Analysis used	Outcomes/Results/ Conclusions
1) Niemala, R., Hannula, M., Rautio, S., Reijula, K, and Railio, J. (2002). The effect of air temperature on labour productivity in call centres – A case study. <i>Energy & Buildings</i> . 34, 759-764.	Two call centres	15 + 18 employees	Comparison & an intervention Observational & Interventional approach	Productivity measured by number of calls divided by active work time Cooling units installed	Questionnaire perceived environment and psychosocial Looking at thermal conditions Mean air temps etc	Particle concentrations	Northern zone of Call Centre 1 productivity increased about 5% after decrease in room temperature. Authors believe the decrease in temperature is explanation for productivity gain Call centre 2 had a post-intervention productivity gain of 7% - again no other explanation apart from cooling Productivity decreases when temperature exceeds 25 degrees
2) Federspiel, CC., Fisk, W.J., Price, P.N., Liu, G., Faulkner, D., Dibartolomeo, D.L., Sullivan, D.P. & Lahiff, M. (2004). Worker performance and ventilation in a call centre: Analyses of work performance data for	Call centre		Randomization & Intervention Intervention was to change the position of the dampers		Used a ventilation metric which was the difference between the carbon dioxide in the return air and the outside	Multivariate regression & linear regression	Found no dose-response relationship between ventilation and work performance. Some evidence that ventilation rates less than 100% outdoor air were associated with lower work performance but no conclusive results

registered nurses. <i>Indoor Air</i> , 14, 41-50.					air The difference is a proxy for occupant generated pollution..		Call centre agents worked slower at high temperature (>25.4) Agents worked slower when call centre understaffed and when they work longer shifts
3) Wargocki, P., Wyon, D.P. & Fanger, P.O. (2004). The performance and subjective responses of call centre operators with new and used supply air rates, <i>Indoor Air</i> , 14, 8, 7-16.	A call centre providing telephone directory service	N = 26	that regulate the amount of air entering each air handling unit (AHU) . DVs = Talk time or wrap-up time?	2x2 replicated field intervention experiment	Talk time recorded	Environmental perceptions & sick building syndrome	Replacing used filter with a clean filter reduced talk-time by about 10% at the high ventilation rate. Increasing the outdoor air supply rate reduced talk-time by 6% with anew filter in place but increased talk-time by 8% with a used filter in place. Interventions had significant effects on some SBS symptoms and environmental perceptions. Results indicate that increasing outdoor air supply rate and replacing.
4) Tham, K.W. (2004) Effects of temperature and outdoor air supply rate on the performance of call centre operators. <i>Indoor Air</i> , 14, 119-25.	56 customer service operators			2 x 2 balanced experimental plan for 9 consecutive weeks Blind	Measurement of indoor environmental parameters	Thermal comfort, acceptability of indoor air, irritation effects etc. Talk time performance	Results of interaction analysis revealed that temperature & outdoor air supply rate have significant interactive effects on some subjective responses as well as self-assessed productivity.

Reference/ Study/ <i>Work Design & Organizational Intervention Studies 5-8</i>	Sample Context	Sample N / Response Rate	intervention	Questionnaire	measurement	tests	Outcomes/Results/ Conclusions
5) Bond, F.W., Flaxman, P.E., & Bunce, D. (2008). The influence of psychological flexibility on the work redesign: Mediated moderation of a work reorganization intervention. <i>Journal of Applied Psychology, 93, 645-654.</i>	Call centre 2 customer service centres of large financial services organisation in UK	110 at T1 Merseyside (84 at T2) 134 at T1 West Yorkshire (97 at T1) Response rates / matched sample = good	Two time points 14 months apart Participative action research (PAR) too Has control groups	Questionnaire	Job control Acceptance & action GHQ Intrinsic job motivation Absence	Means Correlations ANOVAs ANCOVAs Chi-Square Hierarchical regression to test for mediated moderation	The PAR intervention – as compared to control group – improved employee mental and reduced the number of days & occasions absent . PAR had no effect on motivation. Beneficial effects enhanced for people who had levels of psychological flexibility at start Moderated intervention effects were mediated by JOB CONTROL. People with higher flexibility perceived that they had greater control that led these people to experience greater improvements in absence & health
6) Workman, M., & Bommer, W. (2004). Redesigning computer call centre work: A longitudinal field experiment. <i>Journal of Organizational Behavior, 25, 317-337. Psys/INFO</i>	Call centre employees	N= 149	Longitudinal field experiment Randomly assigned pretest-posttest	Questionnaire	Job satisfaction Organisational Commitment Group work preference Intervention 1: aligning		Found that high-involvement work processes produced the most potent effects on job satisfaction and organizational commitment, as well as on performance (i.e., improved customer satisfaction scores, increased closed problems, reduced problems escalated and fewer repeat calls). Group work preference moderated the results between group-oriented interventions and

<p>employee job satisfaction.</p>				<p>7) Workman, M. (2003). Results from organizational development interventions in a technology call centre. <i>Human Resource Development Quarterly</i>, 14, 215-230.</p>
<p>Low satisfaction produced workers with intentions to leave</p> <p>Job satisfaction improved in both alignment job design (AJD) and high-involvement work process (HIWP) interventions but not in autonomous work teams (AW/Ts)</p> <p>Greatest increase in satisfaction with HIWP</p>	<p>Descriptives</p> <p>ANOVA</p>	<p>Thinking style inventory</p> <p>Job satisfaction data</p>	<p>Effects on job satisfaction of structural-alignment, high-involvement, autonomous team interventions compared to a control group</p>	
<p>Results on interventions within call centre indicate improvements in employee perceptions of their work situation as measured by the dimensions of the survey instrument.</p>	<p>HRI scores compared to a norm</p> <p>CSC score</p>	<p>1) Human Resource Index</p> <p>2) Balanced scorecard? Measures of overall performance</p>	<p>Survey</p>	<p>8) Halliden, B., & Monks, K. (2005). Employee-centred management in a call centre. <i>Personnel Review</i>, 34, 370-383.</p>
<p>and control group to compare 3 interventions</p>	<p>151 support specialists</p>	<p>Technology support call centre</p> <p>1 call centre</p>	<p>Has control group and has interventions</p>	<p>Action research</p> <p>Measures in June 2000 & January 2001</p> <p>No control</p>
	<p>68 employed</p> <p>Had 88.9% response rate</p>	<p>Customer contact centre</p>		

Reference/ Study/ <i>Ergonomic Intervention Studies 9-14</i>	Sample Context	Sample N / Response Rate	Research Design /	Method of Data Collection	Questionnaire Measures/ Study Dimensions	Analysis used	Outcomes/Results/ Conclusions
9) Linggaard, G., & Caple, D. (2001) . A case study in iterative keyboard design using participatory design techniques. <i>Applied Ergonomics</i> , 32, 71-80.	Call centres in Melbourne	3000 operators 1800 completed surveys	Case study	Survey, Focus Group, Physical observation, Keystroke data & Video recordings	11 questions	Examined keyboard locations, arm-resting, had positioning for frequently/in frequently used keys, keyboard leg-raising, reflection. Video recordings Keyboard force measured	Realistic option to involve many users in participatory design process User perception of relative frequency of key usage was reasonably accurate Operators liked new keyboard Performance in some call centres took longer to resume to normal than expected Clear and timely communication provided clear anticipation of changes Design process managed well; concerns and suggestions reported to project managers
10) Smith, M.J. & Bayehi, A.D. Do ergonomics	Two departme	81	3 levels of ergonomics	Productivity	Separate SPSS file of weekly	Complete data for 72	Changes observed showed a small overall improvement in the mean output values for each

<p>improvements increase computer workers' productivity?: An intervention study in a call centre. <i>Ergonomics</i>, 46, 3-18.</p>	<p>nts in a mid-west USA catalogue retail organization</p>	<p>volunteers 26 workers in Group A 21 workers in Group B 25 workers in Group C</p>	<p>interventions Group C: ergonomics training & workstation ergonomics analysis Group B: All that Group C had plus specific workstation accessories analysis indicated need for Group A: Had all of Group B interventions plus an improved chair</p>	<p>tracked EPM data examined Baseline productivity data collected for a 4 month period from July to October Post-intervention a single score of the change in units of output per worker Descriptions of workstations and physical work environment</p>	<p>productivity results created for each participant in each area/department N= 81 study participants 414 = controls</p>	<p>ergonomics improvement t participants & 370 controls Change in productivity equation used No parametric statistics used on the data</p>	<p>ergonomics improvement group & small mean decrease for controls. Caution needed because of no statistics and one half of the ergonomics groups showed decrease in performance. The group with the least amount of intervention (Group C) showed the highest input productivity increase. Does this mean simple ergonomics improvements have greater benefit than more elaborate ones?</p>
<p>11) Cook, C. & Burgess-Limerick, R. (2004). The effect of forearm support on musculoskeletal discomfort during call centre work. <i>Applied Ergonomics</i>, 35,</p>	<p>Call centre computer users</p>	<p>N= 59</p>	<p>Randomised controlled study 12 weeks</p>	<p>Questionnaire at 1, 6, 12 weeks</p>	<p>Discomfort, Workstation set up, Working posture & comfort</p>		<p>At 6 weeks the group using the forearm supported generated significantly fewer reports of discomfort in the neck & back, although the difference between groups was not statistically significant. Findings indicate that for a majority of users, forearm support may be preferable to</p>

<p>337-42.</p> <p>12) Chi, C-F, & Lin, Y-H. (2009). Effects of using a screen filter on call centre workers' visual fatigue measurement. <i>Perceptual and Motor Skills</i>, 108, 229-238.</p>	<p>Call centre</p>	<p>22 disabled workers</p> <p>11 men</p> <p>11 women</p>	<p>duration</p> <p>Two-factor design with repeated measures</p> <p>Evaluated the effectiveness of screen filters in relieving visual fatigue</p> <p>Before & after lunch break (on 8 hour shift)</p>	<p>Critical Flicker Frequency Test and vision test used to measure CFF and visual acuity</p> <p>VDT near-point tester to measure accommodative power</p>	<p>Group 1:30 allocated to forearm support using the desk surface</p> <p>Group2: control At 6 weeks control group was set up with forearm support -both groups monitored for another 6 weeks</p>	<p>ANOVA</p>	<p>the "floating" posture implicit in current guidelines for computer workstation set up.</p>	<p>Visual acuity was significantly improved after use of screen filter</p> <p>The CFF reading showed that visual fatigue was more pronounced after the installation of the filter. Improvement in subjective ratings of double vision was found after 2.5 months screen filter use, but disappeared by 5 months.</p> <p>A Hawthorne effect may account for short-term and inconsistent findings</p>
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<p>13) Rempel, D.M., Krause, N., Goldberg, R., Benner, D., Hudes, M & Goldner, G.U. (2006). A randomised controlled trial evaluating the effects of two workstation interventions on upper body pain and incident musculoskeletal disorders among computer operators <i>Occupational & Environmental Medicine</i>, 63, 300-306.</p>	<p>Call centre operators in healthcare company</p>	<p>182</p>	<p>Four different conditions: Without screen filter, with 2.5 months use, 5 months use, and 12 months use</p>	<p>VDT filter</p>	<p>Physical examination by blinded physician</p>		<p>Post-intervention, 63 participants were diagnosed with one or more incident of MSD. Hazard rate ratios showed a protective effect of armboard for neck/shoulder disorders (HR =0.49, 95% CI 0.24 to 0.97) after adjusting for baseline pain levels and demographic and psychosocial factors. Armboard also significantly reduced neck/shoulder pain (p=0.01) and right upper extremity pain (p=0.002) in comparison to control grps Providing a large forearm support combined with ergonomic training is an effective way to prevent upper body musculoskeletal disorders and reduce upper body pain associated with computer work in call centre employees.</p>
<p>14) Cook, C., Downes, L., & Bowman, J. (2008). Long-term effects of forearm support: computer</p>	<p>Call Centre</p>	<p>33 females</p>	<p>To determine longer-term effect of forearm</p>	<p>Self-report questionnaires</p>	<p>Hazard rate ratios Significance tests</p>		<p>The only significant decrease in discomfort over 21 months was the neck. Results of the follow-up study indicate that a forearm support has a positive effect on the reduction of neck</p>

users working at conventional desks. <i>Work, 30, 107-112.</i>		support on musculoskeletal discomfort	Work station assessments				discomfort. An increase in shoulder discomfort indicates that a concave desk may be preferable to the conventional desk if the forearm supported posture is adopted.
Reference/ Study/ Health Intervention Studies 15 & 16	Sample Context	Sample N / Response Rate	Research Design /	Method of Data Collection	Questionnaire Measures/ Study Dimensions	Analysis used	Outcomes/Results/ Conclusions
15) Kennedy, J., & Pretorius, M. (2008). Integrating a portable biofeedback device into call centre environments to reduce employee stress: Results from two pilot studies. <i>Journal of Workplace Behavioral Health, 23, 295-307.</i>	Two studies in 2 call centres. One call centre of a health maintenance organization in Cape Town, South Africa The other call centre	Study 1 n=20 (12 female, 8 male) Study 2 n=19 with 16 completing post-intervention questionnaire	Study 1: 20 participants given "StressEraser" biofeedback device for 45 days & compared to 318 controls. Study 2: 19 given pre-intervention baseline questionnaires & another at end of study	Study 1: Call score ratings by a third party that calls back customers) Study 2: Questionnaires Stress-related symptoms, gastro-intestinal problems, burnout, depression etc Environmental stressors	Univariate ANOVA T-tests Comparison of baseline scores against post-treatment Correlations	Study 1: Participants showed significantly improved call scores in comparison to controls Study 2: Decrease in personal stressors Preliminary results from both studies suggest device may be effective intervention strategy for call centre employees to combat intense pressure in that environment.	

	specialise d in employee assistant & beh. risk managem ent	A call centre Customer service advisors	38 female 10 male	Questionnaire Followed by training followed by Questionnaire No control group	Questionnaire	Eleven symptoms on a questionnaire Questionnaire about effects of training on the symptoms What they thought of training	ANOVA Correlations	More than 50% of females and males reported diminished sensation of mucus and consequent need to clear the throat as well as worsening of their voice. Over 60% thought that the voice training had improved their vocal habits and nobody reported the course to have exercised a negative influence on voice. Females also reported vocal fatigue had diminished.
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Chapter 7

OVERALL DISCUSSION and CONCLUSIONS

7.1. Chapter Overview

This thesis has examined psychosocial health risks for call centre employees. In this final chapter the findings of the two primary empirical studies are discussed, as is the systematic literature review on call centre interventions. Practical and theoretical contributions of each study are also considered and recommendations made concerning a future research agenda. Furthermore, the reality and the rhetoric of expanded work design models are explored and questioned.

7.2. Summary of Main Findings From Study 1

Study 1 demonstrated that consistent with the model framework (Figure 1), call handlers who were subjected to higher levels of dialogue scripting and performance monitoring reported higher job-related strain. Call handlers who worked in leaner (and thus, *meaner* call centre) environments reported that: they had less control over both the timing and methods aspects of their work; their workload was higher; they were subject to more conflicting demands from different aspects of their role; they were less clear about what their role requires of them; they performed less varied tasks; and they had less opportunity to exercise their skills. Three of these work design characteristics (workload, role conflict and skill utilization) were significant influences on job-related strain, and variations in work design almost entirely accounted for the link between lean system characteristics and job-related strain. This is clear evidence of the importance of understanding how technological

characteristics and manager's operational decisions impact on the basic design of jobs.

It is evident from Study 1 is that not all call centres are *lean* and *mean* (as the variability in the data demonstrates), but that those call centres that are lean are also mean. The challenge posed by this study is how to design the call centre in order to alter the relationship between leanness and meanness.

7.3. Theoretical and Practical Contributions of Study 1

Study 1 makes an important contribution to the broader academic literature on work design because it takes into account the organizational context (Morgeson, Dierdorff, & Hmurovic, 2010) that call centre jobs are embedded within; a context where the managerial choices of scripting and pervasive electronic performance monitoring have been exercised. Indeed, as Morgeson, et al. (2010) state "*the sizeable body of work design literature has largely ignored influences stemming from occupational factors*" (p.353). The contribution of Study 1 cannot be overstated as there has been so little research conducted that systematically explores both context and work design that any research done represents a *significant* contribution (Morgeson, et al., 2010).

Furthermore, Study 1 shows the strong link between work design and the job-related mental strain outcomes of anxiety and depression within this group of call centre employees. From this we see that jobs and employees do not operate within a vacuum; but are prey to managerial choices which impact on the fundamental design of the jobs they do. In this case, such choices have impacted on the job-related strain of call centre employees.

The practical message from this research is strong; the practices of dialogue scripting and performance monitoring should be minimized in the interests of employee health. Managers and team leaders alike must ensure absolute clarity in the requirements of the call handler role. The inherent conflicts in attempting to maximize the quantity of calls taken (or made) and delivering a quality response to a customer in a predetermined time allocation, irrespective of the complexity of the query, is obvious. Managers must seek innovative ways to minimize these psychosocial risks to employees.

7.4. Summary of Main Findings from Study 2

There are three key findings from Study 2. First, call centre employees who experience heavier workloads are more likely to report musculoskeletal disorders (MSDs) in the upper body, the lower back and the arms. Second, psychological strain mediates the relationship of workload with upper body and lower back MSDs, and partially mediates the relationship with MSDs of the arms. Thus, whereas strain appears to be a mechanism between workload and upper body and lower back MSDs, the relationship of workload with MSDs of the arms needs to be explained by both the direct effect of biomechanical factors and the partial mediating effects of strain. This study is believed to be the first direct evidence of strain as a mediator of MSDs in a sample of call centre employees. Third, autonomy does not moderate the effects of workload on strain and on MSDs.

7.5. Theoretical and Practical Contributions of Study 2

This study makes a strong theoretical contribution because it goes beyond the *usual suspects* in terms of outcome variables used in job design research. In practical

terms, managers are advised to consider taking a dual-approach to tackling MSDs in call centres, one that acknowledges their complex biomechanical and psychological aetiology. This may go towards reducing call centre sickness absence and turnover issues. A primary prevention strategy is managing call centre workload so that it does not become too demanding. In the case of arm MSDs, where workload appears to have a direct effect, risks can be minimised by ergonomic good practice, with call handlers given adequate rest-breaks away from workstations and telephones. MSD symptoms have been found to be reduced by introducing ten minutes per hour rest-breaks for those using the telephone over eight hours per day (Crawford et al., 2005). Employees must be trained to set up and adjust their workstations (i.e., adjust screens, chairs, desk heights) effectively, and be given time to do this. Employers should encourage early symptom reporting

In sum, the major contribution of the two empirical studies to the job design literature is in the enlargement of the standard job design model to i) consideration of occupational context in Study 1 and ii) the examinations of an important and novel outcome variable in Study 2.

7.6. Summary of Main Findings from Study 3 and Practical Implications

The systematic review presented in Chapter 6 forms a further unique contribution of my PhD thesis as these studies have not been systematically collated, described and evaluated previously. After searching through a considerable number of papers (see Table 13) just 16 papers were judged to be examples of call centre intervention studies.

The review identified that the majority of intervention studies came from the subject domain of ergonomics; with six studies being classified in this way. Following on from this four studies were categorised as work design and organisational in nature. With a further four considered as examples of physical work environment studies and finally just two can be categorised as health interventions in call centres.

The quality of the research in the review varies enormously; with some studies employing strong initial research designs and exhibiting appropriate analysis of the results gained through careful measurement practices. Many of the studies are relatively exploratory in nature and as such more replication and follow-up work is now needed.

Without doubt this attempt to identify those research studies which have evaluated a workplace intervention to improve the health, well-being and performance of call centre employees had limitations. There are a large amount of papers that have been written on call centres in the last decade. Indeed, this is so much the case that in order to make this review task a practical and useful one then very strict inclusion parameters were devised. It is inevitable that there are some relevant studies which may have been missed; but great care has been taken in undertaking this review to keep these to an absolute minimum.

Despite the possibility that some studies may have been missed the study makes an important contribution because it has identified the types of interventions that have been evaluated and the discipline domains, i.e., ergonomics, built environment etc. they have emerged from.

Conclusions about which interventions should be adopted universally by call centres are difficult to make and such a blanket, 'one-size fits all' approach is probably ill-advised. However, the sixteen studies do present call centre managers and operators with a list of interventions they can consider as potential solutions to the psychosocial risks and health issues for call centre employees.

In summary, this list of potential interventions for common call centre problems based on the available interventions research reads as follows:

- As call centre performance decreases when the temperature increases beyond 25 degrees centigrade these higher temperatures should be avoided (Federspiel et al., 2004; Niemala et al., 2002). Furthermore that call centre employees should be restricted in how much they can alter temperature set points (especially groups on different shifts – i.e night vs. day).
- Air filters should be replaced frequently and increasing outdoor air supply may only be useful when new filters are in place (Wargoeki et al., 2004).
- There is an interaction effect on performance of outdoor air supply rate X temperature. For tropical call centres at least, performance may be improved by an increase in outdoor air supply from 5 l/s/p to 10 l/s/p if a temperature is maintained at a higher level of thermal comfort – approximately 24.5 degrees centigrade (Tham, 2004).
- Increasing job control in a call centre might be an effective in improving mental health and absence rates; especially so for employees with higher levels of *psychological flexibility* (Bond et al., 2008).
- High involvement work processes (HIWP) might prove effective for improving both satisfaction and commitment in call centres. In addition,

greater satisfaction and commitment might be garnered by organisations implementing HIWP with employees who have *initial preferences* for group work (Workman & Bommer, 2004).

- Management commitment to the change interventions in call centres through an involvement process is seen as key factor in positive outcomes of interventions (Halliden & Monks, 2005).
- Involving call centre users in a participatory design process, even when there are several thousand end users, is a realistic avenue to pursue (Lindgaard & Caple, 2001). However, the lesson learned from this research on keyboard changes is that predictions should be made about: i) effects of the introduction of new equipment, ii) the length of “run-in” time. The way the design process is managed is critical too.
- Smith and Bayehi (2003) suggest that it is reasonable to expect that improved work station design will increase productivity given the assumptions that interventions will reduce physical loads and increase personal comfort.
- Use of forearm support has a number of advantages over a traditional floating posture and should be considered as an alternate posture for keyboard users in call centres (Cook & Burgess-Limerick, 2004).
- Visual acuity for call centre employees was found to be significantly improved after using the screen filter (Chi & Lin, 2009). Probably, the only practical approach to relieve visual fatigue in call centre employees is to limit the amount of time they have to search for information on the screen or interact with the VDT.
- Rempel et al., (2006) found that an arm-board reduced the risk of neck/shoulder disorder by approximately half. The arm-board also reduced

the rate of left upper extremity disorders but the effect was only marginally significant. The trackball intervention led to a significant reduction of left upper extremity disorders but no effect on the right.

- A 21 month follow-up found that a forearm support procedure in a call centre had a positive effect on the reducing neck discomfort (Cook et al., 2008); this too aligned with previous research.
- A biofeedback device may be a novel and effective stress intervention strategy for call centre employees (Kennedy & Pretorius, 2008).
- A short vocal training course could be positive for those working in “vocally loading” occupations such as working in a call centre (Lehto et al., 2003).

7.7. Theoretical Implications of Study 3

The systematic review was useful in drawing together studies that have been already conducted and evaluated in call centres. If one considers these studies as exemplifying intervention priorities and employee needs then something interesting materialises. In short, the majority are ergonomic in nature and the physical work environment is considered also. The pattern and nature of these intervention studies must reflect organisational priorities, demands and employee needs. This has to be the case as the counter claim to this is that organisations allow researchers to study what they want at whim; this is both unpalatable and unlikely to be true. Thus, the theoretical implications of the review, have to be that i) work psychologists examining call centres working practices is a valid exercise but only forms part of a psychosocial risk story, and that ii) we, as work psychologists, need to work in a far more interdisciplinary manner if we are to positively intervene in call centres (and other modern day complex work contexts). The latter is not a new idea and not an

original idea of mine; more I am making a call to reconsider, for example, the seminal work of Campion and Thayer (1985). This will be discussed in more detail later in this chapter.

7.8. Further Discussion Relating to Studies 1 and 2

7.8.1. The reality and the rhetoric of the new and elaborated design models

In the last decade there has been a reduction of interest in job design research; this stemmed from a belief that many practical and theoretical questions had been answered already (see Ambrose & Kulik, 1999). A recent special issue of the *Journal of Organizational Behavior* (Volume 31, 2010) sought to explode this myth by publishing papers from leading job design scholars from across the globe.

Some of these papers are useful in that they can apply to our future examinations and understandings of the call centre context; but one striking aspect is the dearth of enthusiasm of these scholars for the macro- and micro-context of the worker, that is, both the broader organizational context and the local physical working environment (i.e., the comfort of a desk chair, the orientation of a desk, the view from a window (if indeed they have one), the amount of light gained, the heat levels and the spatial proximity of colleagues). One explanation for the lack of interest in “environment” might be that modern work is not as “static” as it once was, many employees have the freedom to work when they want and where they want, for example, this might be at home, in a café, on public transport, or in different offices or spaces within the same organisation. However, many employees do not share such environmental freedom and are restricted to a permanent, *in situ*, mode of working.

Despite continued calls to include these “context” aspects in our job and work design research the majority still ignore this aspect of the call: either because it is considered too difficult to measure or just seen as somehow peripheral to our interests of the employee work experience. Is it because these micro- contextual and ergonomic aspects are considered somehow “old fashioned” (i.e., taking us back in time to Hawthorne and the manipulation of light levels) and deeply unfashionable research?

In the next section, I consider what a revitalised research agenda may look like based on my own research findings and where I see research gaps still exist.

7.9. Revitalising a Previous Research Agenda

7.9.1. Organizational context and technical systems

Fred Morgeson is one of the few work psychology researchers who writes about the value of considering both organizational “context” and physical work environment in job design research. Morgeson et al. (2010) discuss how *technical* systems within the organizational context act as *constraining* or *enabling* forces; the performance monitoring and the scripting measured in Study 1 are clear examples of such constraint from technical aspects of the call centre organizational context.

Given Study 1’s findings on the importance of the broader organisational context, it is vital that future job design research in new work contexts, such as call centres, strive to capture contextual aspects in data-gathering. Only then can we see how the elements of context, be them technological or otherwise, impact on work characteristics and how these work characteristics (as in Study 1) mediate the relationships between context and outcomes. I agree with Morgeson et al. (2010)

who set up this aspect as one of the four broad priorities for future job design research.

7.9.2. Physical work context characteristics: Continuing to be ignored?

Even though work context characteristics (Humphrey et al., (2007) describe these as physical demands, work conditions and ergonomics) continue to be included in expanded and elaborated models of job and work design (Parker & Wall, 1998) the amount of research measuring these aspects remains severely limited. This is evidenced by the limited available research that could be used in the meta-analytical paper by Humphrey et al. (2007). Indeed, these types of work context characteristics are almost ignored in work psychology and management (Morgeson & Campion, 2003).

Humphrey et al. (2007) only had sufficient data to meta-analyse the relationship between physical demands and job satisfaction; finding that such demands were negatively related to satisfaction. In the same meta-analyses two work context characteristics were found to account for an additional 4% of variance in job satisfaction beyond the 51% of the variance explained by the motivational and social characteristics. As Humphrey et al. (2007) note this is not a large amount of variance when compared with the other characteristics in the meta-analysis but it does show that attitudinal outcomes are influenced by work context conditions and as such we should not ignore them.

Furthermore, it is likely that in more “static” jobs – like working in a call centre – the impact of these context characteristics is exacerbated. Indeed, when working on a subset of my call centre data (n=254; Telecommunications call centre

employees) an additional 7% of variance in job satisfaction was explained by environmental characteristics (e.g., satisfaction with air quality, light and noise levels, cleanliness of workspace, quality of desks, chairs, space and personal storage) (Sprigg & Armitage, 2007). Additional qualitative written comments provided by these participants showed much evidence of the salience of these features in the everyday jobs of call centre workers.

The time has come to include these aspects in our research; so at least when researchers next try to draw meta-analytic conclusions the data is in place to use. Of late, there may even have been a potential *over*-emphasis on the social, relational and proactive aspects of work (see Grant & Parker, 2009) which has contributed to these physical work context variables being pushed ever further into the research background.

7.9.3. The need for novel health outcomes in future work design research

Undoubtedly, part of the reason Study 2 was accepted for publication in the *Journal of Applied Psychology* was because of the use of a relatively novel outcome variable that of musculoskeletal disorders (MSDs). Whilst MSDs might be relatively neglected in the I/O and work psychology literatures they do feature in NIOSH's top eight occupational diseases and injuries. More research must give consideration to psychological and physical health outcomes which go beyond the usual stress and job satisfaction outcomes. Again, this is not a new idea, as Barbara Israel and colleagues (2006) presented an overarching conceptual model of stress, safety and health incorporating multiple factors from diverse disciplines over a decade ago.

7.9.4. Why are we not using an interdisciplinary model of job design?

Over 20 years ago Campion and Thayer (1985) (this was incidentally a SIOP award-winning study) urged us to utilise a more interdisciplinary model of job design; here too we seem to have made little progress. Two of the four parts of the Campion and Thayer (1985) model were the so-called *biological* and the *perceptual-motor* approaches which are particularly useful for framing future research in call centres.

The biological aspects of the Multi-method Job Design Questionnaire (MJJDQ) developed by Campion and Thayer (1985) include aspects such as seating (adequacy/postural support), noise (freedom from excessive noise), work breaks (adequate time for work breaks given job demands) and climate (is it comfortable in terms of temperature and humidity). The perceptual-motor aspects include lighting (adequate and free from glare), workplace layout, displays (easy to read and use), and information-processing requirements.

By framing call centre work in this more holistic way there is much more chance that variables which impact on stress and satisfaction for these employees are accurately captured.

7.9.5. Electronic sweatshops?

Not all call centres are 'electronic sweatshops' and it is wrong to label them as such: I agree with Holman (2003) here. The statistical variability in my own data from call centres (albeit sometimes limited especially in the case of autonomy) reveals that there is some good managerial practice and some not so good managerial practice within the sample. There are elements of the role of being a call handler

which will be difficult to change, that is, the role is about repeated handling of phone calls and interaction with computers. However, there will be undoubtedly elements of these jobs that can be *redesigned* to make them less stressful and more satisfying; and there is a unique challenge here in delineating what these changes might look like.

7.9.6. Socio-technical systems intervention in call centres

The option of working in a more team-based form is one that is open for adoption in call centres. Indeed, it is an organisational intervention that could help to ameliorate the potential impact of call handlers relatively impoverished work designs. During my original research for HSE many call centres already operated with so-called team structures, however it was evident that these were not teams working in any interdependent fashion. Rather the term here was applied as a label to a group of employees working completely independently for the majority of their time; indeed being seated together was often the only feature to define them as a team.

There is some evidence for performance-related benefits from team and group-based structures in call centres. Batt (1999) conducted research in the customer service context and found that groups with more self-regulation, coaching support, level of education, training and better work group relations had higher scores on a measure of service quality. Furthermore work group self-regulation, coaching support and level of education were positively related to sales volume.

But is there research evidence of employee benefits from team or group working in call centres? My systematic review (Study 3) would suggest that the answer to this question is a tentative “yes”. For example, Workman and Bommer (2004) found that high-involvement work processes led to greater job satisfaction and organizational commitment and this was especially the case when it was implemented with those who had an initial preference for group work.

Changing to an authentic team-working (as opposed to calling a group of employees a team because of seated spatial proximity) may increase the levels of autonomy for call handlers. However, even then the relationship between team-working, autonomy, and individual-level well-being is not necessarily a straightforward one. For example, Sprigg, Jackson and Parker (2000) found that when team working was introduced in a manufacturing context where genuine interdependence (the degree to which team members need others to get their job done) was low, the well-being benefits were *hijacked* by only some employees within the teams and it was only these people who then derived the benefits to well-being of enhanced autonomy.

I wrote (along with my co-authors Phoebe Smith and Paul Jackson) in 2003 that “*if call centres are adopting teamworking....as possible antidotes to alleviate the effects of poor work design (Houlihan, 2001), then we need evidence that redesigning call centre in this way is having the intended performance and well-being consequences*” (p.55). As I write this now in 2011, there is still very limited solid research evidence of the positive impact of socio-technical interventions in call centres.

7.9.7. Does call centre work have to be both lean and mean?

Lean work, in this case signified by the use of strict scripting and constant monitoring, does not necessarily have to be *mean* because efforts can be made to maintain, or enhance the job design mediators. In practice these work design improvements could be to i) improve levels of autonomy for call handlers, ii) give opportunities for the management of their own work demands iii) allow call handlers to use all their skills and, iv) give call handlers more variety in their work (Sprigg, Smith & Jackson, 2003). So in short, the answer to the question posed as a title to this sub-section is 'No'.

7.9.8. Job crafting in call centres

The added complication with the call centre context is that as Wrzesniewski and Dutton (2001) suggest where employees are closely monitored by managers (e.g., customer service agent) then job crafting is likely to be high visibility and potentially less welcomed. In an environment that is '*explicitly defined and controlled*' (p.184, Wrzesniewski & Dutton, 2001) employees may see less opportunity to craft. In turn, this suggests that employees in such environments may need managerial encouragement to become active *job crafters* and in a sense the work of Holman, Axtell, Sprigg, Totterdell and Wall (2010) does this with employee participation in a job redesign intervention (part of which was carried out in call centre operations).

Wrzesniewski and Dutton (2001) explain how changing the way one *frames* the purpose of your work in turn changes the meaning of your work and how one defines oneself in relation to that work. They give the example of an internet service

provider who changes the framing so that it is no longer about sales and profit and becomes more about making sure people are not left out of the computer age. They suggest that the identity change that results here is from “*dealmaker to champion of the masses*” (p.180).

It is assumed that employees alter the task and relational boundaries of their jobs to create work with which they are more satisfied (Wrzesniewski & Dutton, 2001). Even in low-autonomy jobs (of which many call centre jobs are clear examples of) Wrzesniewski and Dutton (2001) believe that employees ‘can create new domains for mastery and shape facets of job tasks to take control over some aspect of the work’ (p182-183). An example in this in a call centre might be that an employee seeks to shorten an opening salutation, or greeting message in a script and may seek to make the script more manageable for his/ or herself and others; given that this might be said hundreds of times a day.

There is the risk that crafting might cause so problems (i.e an assembly line worker deciding to change their tasks) but the flip-side is that employee job crafting might just boost quality and productivity too (Wrzesniewski & Dutton, 2001).

7.10. Working in a Call Centre Today

Given the data was collected in 2000 for the empirical studies in this thesis it is appropriate to consider what working life is like in call centres today. Despite the Chancellor of the Exchequer George Osborne’s recent comment about finding public sector call centres and phone-lines that nobody calls (see Kirkup, 2010) there is little doubt that the call centre sector remains an important source of employment in the UK (and beyond our shores). Indeed, this importance as employment in the UK at

the time was exemplified, be it anecdotally, in the following way: that when the research report for HSE (Sprigg, Smith & Jackson, 2003) was published the original press release written by myself and others was changed so much by the senior government officials at the last minute (all discussions relating to these changes via phone) to make the findings less of a bad news story that I hardly recognised my own research.

So how is working in a call centre now any different from how it was a decade ago? Purely anecdotal comments from both my undergraduate and postgraduate students who work in call centres today suggest very little has changed in terms of either work design or managerial practice. The frequency of the call centre being derided by the UK media as the new “dark satanic mills” has naturally fallen away as this new form of work became more familiar; but does this necessarily mean it has all got a lot better for those that continue to work in them?

A search of those papers and reports that cite my original empirical studies reveals evidence that things have not improved dramatically. For example, a recent paper by Lin, Chen, Hong and Lin (2010) from a study in a Taiwan banking call centre found that “the perceived job stress in the call center profoundly affected worker health” (p.349). In addition, Boyte’s (2009) study of job design and wellness in New Zealand contact centres pessimistically concludes that “Despite over 10 years of academic research regarding the Contact Centre industry and recommendations on improvements, it is concluded that very little change has permeated through to Contact Centre practices” (p.66). As neither of these recent studies were conducted in the UK one could conclude more optimistically that the lot of employees here has improved whilst greater call centre *teething* problems are still

to be found overseas. Indeed, only this week (w/c 27/09/10) have I been contacted by an Indian scholar examining substance abuse in call centre employees in Delhi.

All this suggests that our work as researchers and applied psychologists is far from over if we want to continue improve life for people who work in call centres across the globe.

7.11. Final Conclusions

My final conclusions of my thesis are:

i) We should be using more interdisciplinary job design models in our research. The technological and structural context of work (Study 1) has to be understood and incorporated into our future research proposals.

ii) My research has shown that self-reported health outcomes do clearly relate to work design (Study 2) in complex ways and the relationship of other health outcomes (self-reported and objective) to our daily work needs much further investigation.

iii) The interventions (Study 3) which have been conducted in call centres to some extent reflect employee comfort, psychological well-being and health priorities on which further work is needed.

Each study points to the value of a more interdisciplinary work design model; as only by using such a holistic model can we fully examine psychosocial and other workplace risks to health and well-being.

Work design researchers planning studies today are advised to i) make genuine efforts to consider the work context thoroughly, ii) include novel health

outcomes and iii) work in a truly interdisciplinary fashion with health psychologists, ergonomists, engineers and even architects when workplaces, such as call centres, are first designed.

Whilst the current emphasis in the job design literature on the proactive and relational aspects of work (Grant & Parker, 2009) and job crafting (Wrzesniewski & Dutton, 2001) is interesting it may be that in some workplaces, such as call centres, these ideas are difficult to realistically apply. In these types of workplaces (in addition to considering the psychological risks from workload demands) our time could be spent instead on making employees as physically and environmentally comfortable as possible and reducing risks to their physical health (from MSDs, from voice loss etc). Little doubt remains in my mind that these latter factors are ones we cannot just keep ignoring as work psychologists in call centres or elsewhere.

THE END

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Appendix 1

Questionnaire Measures

Workload (Five items)

Based on Mullarkey, Jackson and Parker (1995).

To what extent:

1. Is your work mentally demanding?
2. Do you find that work piles up faster than you can complete it?
3. Do you find yourself working faster than you would like in order to complete your work?
4. Do you feel under pressure at work?
5. Do you feel that you are expected to answer too many calls?

Response Anchors and Scoring: *Rarely or Never* (1); *Occasionally* (2); *Often* (3)

Very Often (4) and (5) *Constantly*.

Autonomy (Four items)

Based on Jackson, Wall, Martin and Davids (1993)

To what extent:

1. Can you control how many calls you answer?
2. Can you control how many calls you make?

3. Can you vary how you do your work?
4. Can you choose the methods to use in carrying out your work?

Response Anchors and Scoring: *Not at all* (1); *Just a little* (2); *A moderate amount* (3) *Quite a lot* (4) and (5) *A great deal*.

Psychological Strain (6 items)

Warr (1990)

Thinking of the past few weeks, how much of the time has your job made you feel each of the following:

Job-related Anxiety

1. Tense
2. Worried
3. Uneasy

Job-related Depression

1. Miserable
2. Depressed
3. Gloomy

Response Anchors and Scoring: *Never* (1); *Occasionally* (2); *Some of the time* (3) *Most of the time* (4) and (5) *All of the time*.

Musculoskeletal Disorders

Based on Dickinson, Champion, Foster, Newman, O'Rourke & Thomas (1992) and Kuorinka, Jonsson, Kilbom, Vinterberg, Biering-Sorenson, et al. (1987).

In the last 7 days have you experienced musculoskeletal trouble caused by your work in any part of your body? (By musculoskeletal trouble we mean any pain, ache, discomfort, numbness. By body we mean your neck, shoulders, elbows, wrists/hands, upper back, lower back, hips/buttocks/thighs, knees, ankles/feet).

Response Anchors: *Yes or No*

If 'Yes' please give details of which part (s) of your body and the nature of the musculoskeletal trouble. Also, please indicate (by shading or circling) the parts of your body you have had trouble with on the diagram below.

Beneath this was a body map with the following parts indicated on it: Neck; Shoulders; Upper Back; Elbows; Low Back; Wrists/Hands; Hips/Thighs/Buttocks; Knees; and Ankles/Feet.