**UNIVERSITY OF SOUTHAMPTON**

FACULTY OF MEDICINE, HEALTH AND LIFE SCIENCES

School of Psychology

# The Psychological Impact of Physical Injury on Recovery in Royal Marines' Recruit Training

by

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ABSTRACT

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THE PSYCHOLOGICAL IMPACT OF PHYSICAL INJURY ON RECOVERY IN ROYAL MARINES' RECRUIT TRAINING

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Many Royal Marine recruits are plagued by physical injuries during the arduous 32 week training course at Commando Training Centre. Not all recruits recover from their injuries; some choose to leave the rehabilitation unit prematurely. Furthermore, some recruits experience unnecessarily lengthened recovery times that are unexplained by physical factors. As such, it seemed plausible that psychological theory might explain variance in rehabilitation outcome and recovery time. A number of empirically well-tested and validated psychological theories were reviewed and protection motivation theory was selected as the over-arching theoretical framework to guide this programme of research. The model was extended to include the constructs fear-avoidance, athletic identity (modified to measure marine identity) and organisational commitment. Measures of the intensity and impact of pain were also incorporated into the extended model. These constructs were identified as being potentially important in the prediction of behaviour, as well as being complementary to the model as a whole.

The primary purpose of this research programme was to establish the effectiveness of the extended model of protection motivation theory. This was achieved through a large-scale, prospective study. The secondary purpose was to develop and test measures of implicit attitude in order to combat some of the difficulties associated with traditional methods of attitude measurement such as social desirability response bias. This was achieved through three method development studies, a cross-sectional study, and a prospective study. Analysis of the longitudinal data revealed that each of the components of the extended model of protection motivation theory predicted outcome of rehabilitation. Self-efficacy and perceived severity of the injury explained 16.1% of the variance in outcome of rehabilitation. Furthermore, 10.4% of the variance in extended recovery time was explained by a combination of age and perceived severity. The implicit measure of organisational commitment explained 69% of successful training outcome in the cross-sectional study, which is remarkable in implicit attitudinal research.

Despite the vast literature linking attitudes and rehabilitation adherence behaviours, until now, the psychological effects of injury on rehabilitation outcome and recovery time have rarely been investigated, and have never been examined in the context of Royal Marines' training. In addition, implicit measures have never been applied in a specific health psychology context, nor have they ever been developed in such a bespoke way. Thus it is concluded that this thesis has made a theoretical as well as applied contribution to the study of psychology, injury and rehabilitation.

List of Contents

List of Tables

List of Figures

## Author’s Declaration

I, Kathleen Fay Munnoch, declare that the thesis entitled ‘The Psychological Impact of Physical Injury on Recovery in Royal Marines’ Recruit Training’ and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University;
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or at any other institution, this has been clearly stated;
- Where I have consulted the published work of others, this is always clearly attributed;
- Where I have quoted from the work of others, the sources is always given. With the exception of such quotations, this thesis is entirely my own work;
- I have acknowledged all main sources of help;
- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
- Parts of this work are in preparation for publication as:

Munnoch, K., & Yardley, L. Predicting recovery from injury: the role of identity, organisational commitment and beliefs about injury and rehabilitation. *Annals of Behavioral Medicine, in preparation.*

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Munnoch, K. (2007). Identity, commitment and the Royal Marines: Validation of an implicit measure. *Unpublished MoD Report No 2007.041.*

Munnoch, K. (2006). The development of a test to measure organisational commitment in Royal Marine recruits: Selection of stimuli. *Unpublished MoD Report No 2006.004.*

Munnoch, K. (2005). Fear-avoidance: Selection of stimuli for incorporation into an implicit measure for use with injured Royal Marine recruits at CTCRM. *Unpublished MoD Report No 2005.027.*

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Munnoch, K. The operational effectiveness of Hunter Company. Royal Society of Medicine, United Services section. Wimpole Street, London, 16th October 2008.

Munnoch, K. The development and validation of two tests of implicit attitude. Surgeon General, Ministry of Defence. Institute of Naval Medicine, Gosport, Hampshire, 30th July 2008.

Munnoch, K. Attitude, commitment and the Royal Marines: The validation of an implicit measure of commitment. Southampton University Faculty of Medicine Health and Life Sciences' annual conference. Southampton, Hampshire, 3rd-4th June 2008.

Munnoch, K. Using implicit attitude measurement in Royal Marines' selection and outcome of rehabilitation. BASHERS Ergonomics Society. Institute of Naval Medicine, Gosport, Hampshire, 24th January 2008.

Munnoch, K. Smoking and injury in Royal Marines' training. British Psychological Society Division of Health Psychology annual conference. Coventry, Warwickshire, 7th-9th September 2005.

Munnoch, K. Psychology and injury: The prediction of recovery time and rehabilitation outcome. Hunter Company and Sickbay, Commando Training Centre Royal Marines. Lympstone, Devon, 8th July 2005.

Munnoch, K. Psychological aspects of injury in Royal Marines' training. Commando Training Centre Royal Marines Research Steering Group. Lympstone, Devon, 21st July 2005.

Munnoch, K. The operational effectiveness of Hunter Company. The Royal Navy's Training Education and Management Advisory Group. Headley Court, Surrey, 21st June 2005.

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# Chapter 1
# Introduction

## *1.1 Preface*

The main objective of this research programme was to offer insight into the psychological impact of injury and rehabilitation in Royal Marine recruits. Specifically, implicit and explicit attitudinal measures were developed and utilised to investigate the effects of attitude on rehabilitation outcome. The guiding framework selected was an extension of protection motivation theory, incorporating the constructs fear-avoidance, organisational commitment and athletic identity. This thesis begins with an introductory chapter that gives an overview of the background to the problem and subsequent programme of work. It offers an insight into Royal Marines' training, what is involved and it provides an outline of the difficulties faced by the Headquarters in terms of achieving the number of trained marines required, and the difficulties faced by the recruits themselves in terms of hardship and injury. This chapter culminates in an outline of the thesis and details the main objectives of each of the eight chapters that follow.

## *1.2 The Royal Marines*

The Royal Marines are the amphibious fighting unit of the Royal Navy. Permanently on high alert, the Royal Marines comprise the central components of the Joint UK Rapid Reaction force; able to fight in all-terrain and deploy anywhere in the world. To satisfy this demanding role, the Royal Marine recruits must successfully complete a mentally and physically challenging 32-week training course. The course is recognised as the longest and one of the most arduous all-male basic military training courses of any NATO combat infantry and, at present, no female has ever completed the basic training course. During the course, potential Royal Marines undertake physical and tactical training designed to test their physical and mental robustness, as well as to train them to the elite standards expected of a trained Royal Marine Commando. Throughout the course, physical and professional tests are undertaken by recruits which they must pass in order to progress onto the next phase of training. The lack of quality personal time and lack of sleep combined with a steep learning curve of soldiering skills and heavy physical training demands are notoriously related to a high number of recruits choosing to leave Commando Training Centre (approximately 36%, see chapter 2). On completion of the 32-week course, the successful recruit is awarded the coveted 'green beret' with its globe and laurel cap badge – part of the Royal Marine uniform that signifies that he has completed training and has 'got what it takes'. The competition is fierce and a recruit who exposes his weaknesses often finds training harder than those who disguise the fact that they are struggling and persevere. The elite nature of the Royal Marines has historically encompassed a strong ethos and core values. The psychological impact of training is well recognised at Commando Training Centre; characteristics anecdotally said to be vital for success in training include courage, unity, determination, adaptability, unselfishness, humility, cheerfulness, fortitude, and humour (www.royalmarines.mod.uk/history-and-ethos/ethos-and-beliefs.php). Recruits undertaking training develop strong bonds with their training troop and cohesion within the troop and with the training team is often reported as an important component of success.

Despite the superb facilities and dedicated training staff, the relentless physical and mental pace of Royal Marines' training inevitably results in a number of physical training injuries. The process a recruit goes through on acquiring an injury can be extremely traumatic. When a recruit becomes seriously physically injured during training, it necessitates his removal from the training troop and transferral to 'Hunter Company', a company designated for rehabilitating injured recruits. For the injured recruit, this means the 'steam train' of mainstream training comes to an abrupt halt and is replaced with rest and recuperation to begin with, followed by an often long and challenging physical rehabilitation programme designed to promote healing of the injury, followed by remedial training to enable the recruit to achieve the physical fitness levels he had prior to injury. For many, this time is emotionally and physically draining, as the injured recruit must watch the rest of his original troop and training team progress through training without him. It can be incredibly frustrating knowing that your friends have moved on and the huge investment each recruit put in to achieve cohesiveness with his original troop, must be repeated all over again from the beginning with another troop. As injured recruits rejoin training from the point at which they became injured, bonding with a new troop and training team who have already made that investment and achieved a group dynamic prior to the new recruit's arrival can be very daunting.

One in six recruits becomes injured during Royal Marine recruit training and a total of up to 40% (see chapter 2) of injured recruits leave Royal Marines' training without having completed their rehabilitation, let alone having completed their training. Furthermore, evidence shows (see chapter 2) that those who do complete their rehabilitation take substantially longer than the physicians' predicted recovery time. There is anecdotal speculation that extended recovery time and failing to complete rehabilitation may be largely for psychological reasons and not physical ones. Qualitative studies did not form any part of this thesis. This was due to resource limitations and the requirement to deliver as comprehensive applied and theoretical answers as possible. Despite this, the Principal Investigator spent extensive time with the remedial instructors, physiotherapists, medical officers and Hunter Company staff prior to this research programme and during many other research programmes. Informal discussions revealed that reasons for a recruit's extended or non-completion of rehabilitation could range from being despondent about rehabilitation and pessimistic about the likelihood of successful return to training, to homesickness or a change of heart regarding future career direction.

Previous research has shown that the beliefs and attitudes an injured or ill person has about their injury, illness or rehabilitation can have a substantial influence on their subsequent behaviour, adherence to prescribed rehabilitation and physical and mental outcome. Likewise, literature on commitment and identity has demonstrated a relationship with turnover in the workplace. Whilst this empirical evidence is based on civilian life, well-validated and reliable models can be theoretically extrapolated to contribute to the explanation of why some Royal Marine recruits fare better in rehabilitation than others.

A potential difficulty with measuring psychological factors in recovery from military training injuries is the possible confounding effect of the training environment itself. The response biases associated with self-report measures of attitude are particularly likely to occur in a military training environment, where recruits are under constant mental and physical pressure to be, or to give the impression that they are, committed, motivated, elite performers (Hardy, Shariff, Jones & Allsopp, 2000). Therefore, Royal Marine recruits may be unwilling to openly admit their true feelings and beliefs for fear of repercussions associated with the stigma of failure. Given this potential reluctance, implicit measures may be of particular interest to military psychologists wishing to measure attitude and beliefs. Given the difficulties associated with measuring attitude in a military environment, where there is a strict code of conduct and an unspoken dislike of voicing negative opinions, it seems plausible that the implementation of implicit measures to complement traditional questionnaire measures may resolve some of these problems.

### *1.3 Thesis Outline*

This thesis begins with a chapter which provides an overview of the current situation with regards to injury, opt-out and course completion in recruit training. Data were collected from databases at the Commando Training Centre including a training database, medical database, rehabilitation database and recruitment database. The data were analysed and a flow diagram was developed depicting a year in training. The data were further analysed to give a breakdown of types of injury, average recovery times, predictors of injury and predictors of recovery time and rehabilitation outcomes.

A critical overview of the available literature pertaining to commitment and identity is then presented in the third chapter. Organisational commitment and athletic identity are identified as potential contributors in the study of variation in recovery times and rehabilitation outcome in Royal Marine recruits. In the fourth chapter, the focus moves towards current psychological research in injury and rehabilitation and the literature detailing available theoretical models and possible frameworks is reviewed. Protection motivation theory combined with fear-avoidance theory is identified as an appropriate overarching framework for the research presented in this thesis.

The methodological approaches to be used are considered in the fifth chapter. In particular, the limitations of explicit measures of attitude are examined and the potential relative merits of applying implicit attitude measurement techniques with a military sample are discussed. As suggested earlier, the culture of Royal Marines' training is particularly adversarial and authoritarian. It is intuitive and anecdotally reported that, when asked questions, recruits tend to give the answers they believe the person wants to hear, rather than the truth necessarily. Therefore, the investigation of methods of measuring attitudes implicitly, and counteracting the limitations of traditional attitude measurement, could be of academic and managerial benefit. Specifically, the Implicit Association Test (IAT) and Timed Antagonistic Response Alethiometer (TARA) are identified as potential implicit measures of attitude that could be adapted to measure constructs that may be helpful in determining why some injured recruits respond better to rehabilitation than others.

A total of five separate studies are then detailed in chapters 6, 7 and 8. The first three (chapter 6) concern the development of two IATs and a TARA to measure commitment to/identity with Royal Marines' recruit training and fear-avoidance in rehabilitation respectively. For the development of the IATs, positive and negative images of Royal Marines' training were presented, along with images of civilian life, to 134 injured Royal Marine recruit participants. They were asked to rate the images in terms of whether they were perceived as positive or negative. This study resulted in the identification of twelve neutral civilian images and six positive Royal Marines photographs, but failed to identify six negative photographs of recruit training. Following some discussion and the capturing of new images in collaboration with the photographics department at Commando Training Centre, the study was repeated and six images perceived as positive and six images perceived as negative by 61 injured and 39 opt-out Royal Marine recruit participants. These images formed the stimuli for two IATs; one positive and one negative. A third trial was conducted whereby Royal Marine recruit participants were asked to rate a series of statements (based on an existing, validated fear-avoidance questionnaire) pertaining to their perceptions of injury and rehabilitation. The study resulted in the identification of six positive and six negative statements by 142 injured Royal Marine recruit participants. These statements formed the basis of the stimuli for the TARA.

The next study (chapter 7) established the concurrent and construct validity of the IATs. Recruits who pass all the test criteria in Royal Marines' training are known as the 'King's Squad'. The King's Squad refers collectively to recruits in the last two weeks of training and culminates in their pass out parade. Recruits who decide to leave training of their own volition and therefore fail recruit training are known as 'opt-outs'. One hundred and seventy nine King's Squad and 73 opt-out recruits took part in this cross-sectional study that aimed to establish whether the positive and negative image IATs could differentiate between the two groups. It also examined the construct validity and reliability of the measures. Alternative methods of scoring the IATs were considered. It was found that the IATs' concurrent validity was good. Construct validity was also good in that both IATs related to the explicit measures of commitment and athletic identity measured in the study. Finally, the reliability of the IATs and the explicit measures was also established.

The final study (chapter 8) was a prospective study and investigated the role of psychological constructs in relation to recovery time from physical injury and rehabilitation outcome. The hypothesis was that the extension of protection motivation theory encompassing the constructs fear-avoidance, organisational commitment and athletic identity would explain some of the variance in rehabilitation outcome and recovery times of injured Royal Marine recruits. A further hypothesis was that the IATs and the TARA would predict variance over and above that explained by the explicit measures used in the study. Injured recruit participants completed a battery of psychological tasks and tests comprising the two IATs, the fear-avoidance TARA, the explicit commitment questionnaire, the explicit athletic identity questionnaire (modified to measure marine identity), and a validated scale that measures the four main components of protection motivation theory; self-efficacy, treatment efficacy, vulnerability and susceptibility. One item on rehabilitation value was also measured. A pain measurement was taken for each participant at the beginning of rehabilitation and after the first phase of physiotherapy.

A final overall discussion (chapter 9) ties together the findings of the studies and relates them to the literature. This thesis' unique contribution to health psychology is threefold. First, the studies provided insights into the application of the extension of protection motivation theory as a framework for examining why some individuals recover better from physical injury than others. The second unique contribution of this thesis was the application of implicit measures specifically in the field of health psychology, as this has never been done before: Implicit measures' development is still at an early stage and has largely been restricted to social psychology and the measurement of controversial beliefs such as racism or sexism. Third, the effects of psychological factors on rehabilitation outcome have never been studied in a Royal Marine recruit training population before. The application of health psychology in a military setting is extremely useful and could guide interventions and help health professionals assist individuals to recover from their injuries.

# Chapter 2

# Physical Injury in Royal Marines' Recruit Training: Current Status

## *2.1 Preface*

The purpose of this chapter is to provide background information on Royal Marines' training with a particular focus on the administration and rehabilitation process undertaken by recruits who become physically injured during mainstream training. The chapter begins with an introduction to the study that follows. Hunter Company is described in terms of its role and position within Royal Marines' training. The psychological hardship anecdotally reported by recruits who become injured and have to leave their troop and training team to undergo rehabilitation in order to return them to fitness and, eventually, training is described. The introduction proceeds to explain how the analysis of existing data routinely collected provides a useful statistical backdrop to this thesis. The aims of the study are then outlined. The methods section outlines the design of the study and details the data collected. The results section reports the findings of the statistical analyses undertaken, and the discussion section considers the findings in the context of investigating the influence of psychological factors on outcome of rehabilitation, and time taken to recover from physical injury and rehabilitation outcome.

## *2.2 Introduction*

Hunter Company is one of four Companies within Commando Training Wing that are collectively responsible for training all Royal Marine recruits. Portsmouth, Chatham and Deal Companies house Royal Marine recruits in mainstream training. Hunter Company comprises two discrete troops and is where all injured recruits are housed (in '1 troop' after initial, major injury), rehabilitated (moving to '2 troop' as rehabilitation progresses) and then returned to mainstream training. After consultation and diagnosis from the physician, recruits join 1 troop immediately they are released from the medical centre. This is where the injured recruit works directly with the physiotherapists and remedial training instructors to facilitate the healing process. Time spent in 1 troop is anecdotally a stressful time, as removal from their training troop, training team and friends and insertion into an entirely new environment can result in despondency and depression. Further to the environmental changes, they must undertake physical challenges that are seemingly alien to their primary goal of passing Royal Marine recruit training and obtaining the coveted Green Beret.

Recruits are then transferred to 2 troop as their injury heals and they can begin weight-bearing remedial exercises. Again, this is described by many as a stressful time, as the final goal of returning to training still seems hard to achieve. Enduring despondency and anxiety cause some to quit rehabilitation and training and leave the Royal Marines altogether. '2 troop' is divided into a further two troops; 2 Alpha and 2 Bravo. 2 Alpha troop is where recruits begin their weight-bearing rehabilitation and are transferred to 2 bravo only when their injury has healed sufficiently that they can progress to a more demanding level of training. 2 Bravo troop brings with it an entirely different set of stressors. Recruits leaving the comfort of rehabilitation find the step up in physical remedial training very difficult, and the looming prospect of rejoining mainstream training with an entirely different peer group and training team is, for many, extremely daunting.

Previous estimates have indicated that approximately one in six recruits is injured and transferred to Hunter Company at some point during the 32-week course. This means that the prevalence of injury during Royal Marines' training is potentially vast and highly problematic not just for the individual, but for the organisation as a whole.

Although there is a large body of data continually being collected at Commando Training Centre, the 'picture' is always changing. Prior to investigating the influence of psychological constructs on recovery from physical injury, it was first necessary to quantify and map the progress of injured recruits. This was in order to establish the extent of variability in recovery times, and whether success or failure at rehabilitation could be explained entirely by physical factors or whether there was unexplained variance that might be due to psychological factors. Knowledge of the proportion of recruits with delayed recovery was also necessary for estimation of whether it would be logistically possible to recruit sufficient a sample size to investigate the role of psychological factors influencing recovery. It was also important to establish whether there were any differences between recruits who became injured and those who did not, in case there were any predisposing factors that could confound the results of studies of outcome of rehabilitation. Therefore, the purpose of this chapter was to collect data to chart the rehabilitation process and to determine the characteristics and progress of injured recruits. It was also of interest to identify existing variables predictive of injury and recovery.

Whilst there have been previous attempts to investigate the progress of injured marines, these have not been systematic and have been confounded by other variables such as changes to the physical entry standards and changes to the recruitment tests. The work reported here was the first attempt to perform a systematic investigation of progression of recruits through rehabilitation and to accurately establish basic facts. The aims of the present study were:

1. To characterise the throughput of recruits in Hunter Company in relation to mainstream training and outcome of training.
2. To establish whether injured recruits differed from those who remained uninjured during mainstream training.
3. To examine the variability in recovery times for different injuries and investigate the predictive value of existing variables.

## *2.3 Methods*

### *2.3.1 Design and participants*

The study design was a retrospective, longitudinal study. Data were collected from 1115 of a total of 1132 (a participation rate of 98.5%) recruits who joined training in September 2001 to August 2002. This was to ensure enough time had elapsed to guarantee that all recruits from the sample had completed or left training. Recruits residing in Hunter Company for reasons other than physical injury (e.g. prior to discharge for professional reasons) were excluded from the study.

### *2.3.2 Measures*

Four military databases were interrogated for data collated and used in this study. The Training And Financial Management Information System - Training (TAFMIS-T) contains training related information. Data collected from TAFMIS-T included outcome of training. The main outcomes of training were; ‘pass out’ (successfully complete training), ‘opt-out’ (leave training of one’s own volition), ‘discharge medical’ (where a recruit is badly injured and requires medical attention, rest and recuperation beyond the remit of Hunter Company), and ‘discharge unsuitable’ (where a recruit is asked to leave because of his inability to reach a required performance standard in mainstream training, or because of his lack of motivation and consequent negative effect on his peers in rehabilitation). The number of weeks each recruit spent in training was also obtained from this database. It is important to note that the Royal Marines’ training course totalled 30 weeks at the time of data collection, rather than the current 32 week course.

The Egton Medical Information System (EMIS) database located in the medical centre at Commando Training Centre contains medical notes on Armed Forces personnel. Data collected from EMIS included physiological and medical data such as smoking status, height, weight and body mass index for the whole sample. It is worth noting that smoking data referred to smoking status *on entry* to Royal Marines’ training and did not necessarily reflect actual behaviour in training or rehabilitation at a later stage. Medical diagnoses and the physician’s predictions for recovery times were obtained for all injured recruits. The medical centre physicians routinely record an estimated recovery time, in weeks, for each injured recruit in their consultation notes. Their estimate of each recruit’s prognosis is based on a combination of their clinical knowledge, knowledge of training and physical fitness requirements for Royal Marines’ training, experience of treating the injury concerned, and interpretation of the individual’s injury in terms of its location and severity. In this study ‘injury’ was classed as a physical injury obtained through Royal Marines’ training of sufficient severity to warrant an individual to leave his old troop and join Hunter Company for the duration of his injury and rehabilitation, until he was able to rejoin mainstream training with a different troop. Recruits experiencing minor injuries may have attended the medical centre and have been granted sick leave on the ward, or been backtrooped (where a recruit fails to perform at the required standard and is removed from his troop and placed in a troop at an earlier stage of training) without entering Hunter Company; these individuals were not classed as having been injured for the purpose of this study. Unfortunately, it was not possible to identify the number of uninjured recruits who experienced minor injuries or failed criterion tests, and were therefore backtrooped.

The Hunter Company database is a medical database maintained by physiotherapists and remedial instructors containing information regarding injured Royal Marine recruits. The remedial training team routinely record the date an injured recruit joined the Company, the date he left, his diagnosis and his rehabilitation outcome in terms of whether he rejoined training, opted-out of training, was discharged as unsuitable or was discharged prematurely for medical reasons. For information, medical discharge occurs on the rare occasion a recruit's injury warrants his leaving the Royal Marines altogether instead of remaining in the Royal Marines environment, in order that he rejoin at a later date once he has recovered physically and has regained his previous fitness. Diagnoses and recovery times were collected from this database and cross-referenced with the information obtained from EMIS in order to ensure its accuracy. For the purposes of this study 'recovery' was defined as the time it took to rehabilitate a recruit from injury back to full health and to return him to training. Specifically, recovery time was calculated from the date an injured recruit was transferred to Hunter Company from the medical centre, to the date he left the Company and rejoined mainstream training. It is important to note that recruits with injuries warranting transfer to Hunter Company are usually discharged from the medical centre the same day they arrive.

As part of the selection process, potential recruits spend two days at Commando Training Centre where they undertake a series of physically and mentally gruelling tasks. The collective tasks have been designed to reflect some of the tasks they may face during the 32-week training course, should they be recruited. Their performance on the tasks contributes to whether or not they can be accepted as recruits into mainstream training and these data were collected with a view to investigate whether they were predictive of injury or recovery time. Task performance data are recorded in the Potential Royal Marines Course database. Physiological task performance data retrieved from the Potential Royal Marines Course database included each recruit's multi-stage fitness test decimal bleep score (a score representing attainment in the multi-stage fitness test represented as a decimal score of stages and shuttles completed) and their assault course time in minutes and seconds. Candidates also sit a number of paper and pencil tests including numeracy, literacy, reasoning and mechanical comprehension. These tests are collectively known as the recruit tests and contribute (along with the physiological test scores) to the selection decision process. Each recruit test results in a raw score out of a total of 30. The recruitment test total comprises the total combined score of each of the four recruit test scores and is therefore out of 120. The personal qualities assessment score is a subjective score awarded by an interviewer based on a candidate's performance at interview. The personal qualities assessment is out of 40. The higher the recruit test scores and personal qualities assessment, the better the candidate. A summary of the variables collected is listed in Table 1.

Table 1

*A summary of data collected for each recruit that joined training at Commando Training Centre September 2001 to August 2002*

| Database | Data |
|---|---|
| Training database (TAFMIS-T) | Surname, forename, service number, date of birth<br>Age on joining<br>Original joining date<br>Weeks in training at disposal date<br>Outcome of training |
| Medical database (EMIS) | Surname, forename, service number, date of birth<br>Height in centimetres (on entry)<br>Body mass in kilograms (on entry)<br>Body mass index (on entry)<br>Smoking status (on entry)<br>Initial/primary injury diagnosis<br>Subsequent/secondary injury diagnosis<br>Physician's estimated predicted recovery time in weeks<br>Injured recruit's actual recovery time in weeks |
| Rehab database (Hunter Company) | Surname, forename, service number, date of birth<br>Hunter Company injury diagnosis<br>Weeks in Company (recovery time) |
| Recruitment database (PRMC) | Surname, forename, date of birth<br>Assault course time in minutes and seconds<br>Multi-stage fitness test score expressed as a decimal: level and stage (Ramsbottom, Brewer & Williams, 1988)<br>Recruitment test scores<br>Personal qualities assessment score |

*2.3.3 Procedures*

A protocol was submitted to the Ministry of Defence Personnel Research Ethics Committee and the Southampton University ethics committee, and ethical approval was obtained.

#### *2.3.3.1 Data Protection Act 1998*

Changes in the Ministry of Defence's interpretation of the Data Protection Act (1998) required the following procedures to be adhered to and for the following authority and consent to be obtained prior to data collection. First, all participants still serving in the Armed Forces were contacted by post, informed of the nature and purpose of the study, reassured that the database would be completely anonymous and given the opportunity to object to their data being used (within two weeks of the postmark on the letter). The serving personnel contacted were allowed a further two weeks to consider their participation as a 'cool-off' period. Second, all participants no longer serving in the Armed Forces were contacted by post, informed of the nature and purpose of the study, reassured that the database would be completely anonymous and given the opportunity to object to their data being used (within two weeks of the postmark on the letter). The ex-service personnel contacted were allowed a further two weeks to consider their participation as a 'cool-off' period. Third, official authority to access each of the databases was obtained from the 'local' and 'overall' data controllers. As the local data controller, a letter was sent to the physician of each individual still serving in the Armed Forces. Each data controller gave written permission by completing a form and returning it prior to the data being collected. Finally, given the retrospective nature of the study, expressed consent was obtained from the Deputy Medical Director General for the Royal Navy (the overall data controller for medical information) that the medical content of data could be used for the purposes of this study only, and that individuals would not be named or identifiable in any way. This was in accordance with the Medical Research Council guidelines (2000).

Sixteen letters were returned as 'undeliverable' and one recruit telephoned to say that he preferred his data not to be included in the study. Subsequent to satisfactory adherence to the stipulations of the Data Protection Act (1998), participants were informed of the study and given a two week opportunity to opt-out. Local and overall data controllers for each database were contacted and authority to access the required data were obtained. The majority of the data were administrative information only.

*2.3.3.2 Data collection and cross-referencing*

As the data were collected from four sources, it was necessary to cross-match individuals using their names, service numbers and dates of birth. Recruits had not been allocated service numbers at the time of selection, so surname and date of birth were used for cross-referencing information from the recruitment database. On completion of cross-matching, all identifying markers were removed in order that all recruits remained anonymous. The collection of data and cross-matching of participants was piloted using information from 20-30 individuals to ensure that the data collection for the main study would run smoothly.

*2.3.4 Data analyses*

*2.3.4.1 Throughput of rehabilitation*

Descriptive statistics were generated from the raw data using SPSS to describe the whole sample. The dataset was split into Hunter Company (injured) recruits and non-Hunter Company (uninjured) recruits, in order to compare the two groups, and descriptive statistics were generated. For comprehensibility, Hunter Company recruits are described as 'injured' and non-Hunter Company recruits will be described as 'uninjured' throughout the results and discussion. The flow diagram (Figure 1) was populated through the production of frequencies from the data in SPSS. This was in order to characterise the movement of injured Royal Marine recruits through the rehabilitation process.

*2.3.4.2 Comparisons of injured and uninjured recruits*

Independent samples *t* tests were used to compare the characteristics of the injured and uninjured recruits. Following these bivariate analyses, multivariate analyses were used to identify the combination of factors associated with injury. Factors identified in the bivariate analyses were analysed using logistic regression to determine which were significantly related to injury, and to estimate the variance in outcome explained by those factors. If smoking were found to be influential in the occurrence of injury, it would be valuable to establish the extent and nature of this relationship. Therefore, smoking behaviour was investigated using Chi-square analysis first to confirm whether a significant relationship between smoking status and injury existed, and then to look specifically at different types of injury. Relative risks were calculated (including 95% confidence intervals) in order to assess the extent of the influence of smoking on injury.

*2.3.4.3 Variability in recovery time and prediction of recovery time*

Injuries were categorised according to injury type. Each broad injury type was then coded in the database to enable calculations by injury (as well as for the whole sample). Measures of central tendency regarding rehabilitation time in Hunter Company were calculated and the physician's estimates were correlated with actual time taken to recover from injury. Factors associated with recovery time were investigated using correlations and *t* tests.

## *2.4 Results*

### *2.4.1 Throughput of rehabilitation*

The whole sample consisted of 98.5% of the 01-02 Royal Marine intake ($N$ = 1115 Royal Marine recruits). The mean age of the sample was 20 years ($SD$ = 3.0). A summary of the descriptive information collected on the whole sample is given in Table 2. The body masses of recruits ranged from relatively lightweight (54kg) to substantially heavier (102kg).

Table 2

*Descriptive statistics for the whole sample*

| | Mean | *SD* | Min | Max | *N* |
|---|---|---|---|---|---|
| Age on joining* | 19.7 | 3.0 | 16 | 31 | 1115 |
| Height (cm) | 177.5 | 6.2 | 153 | 198 | 1040 |
| Body mass (kg) | 73.5 | 8.2 | 54 | 102 | 1089 |
| Body mass index (kg per $m^2$) | 23.3 | 2.2 | 17 | 37 | 1035 |

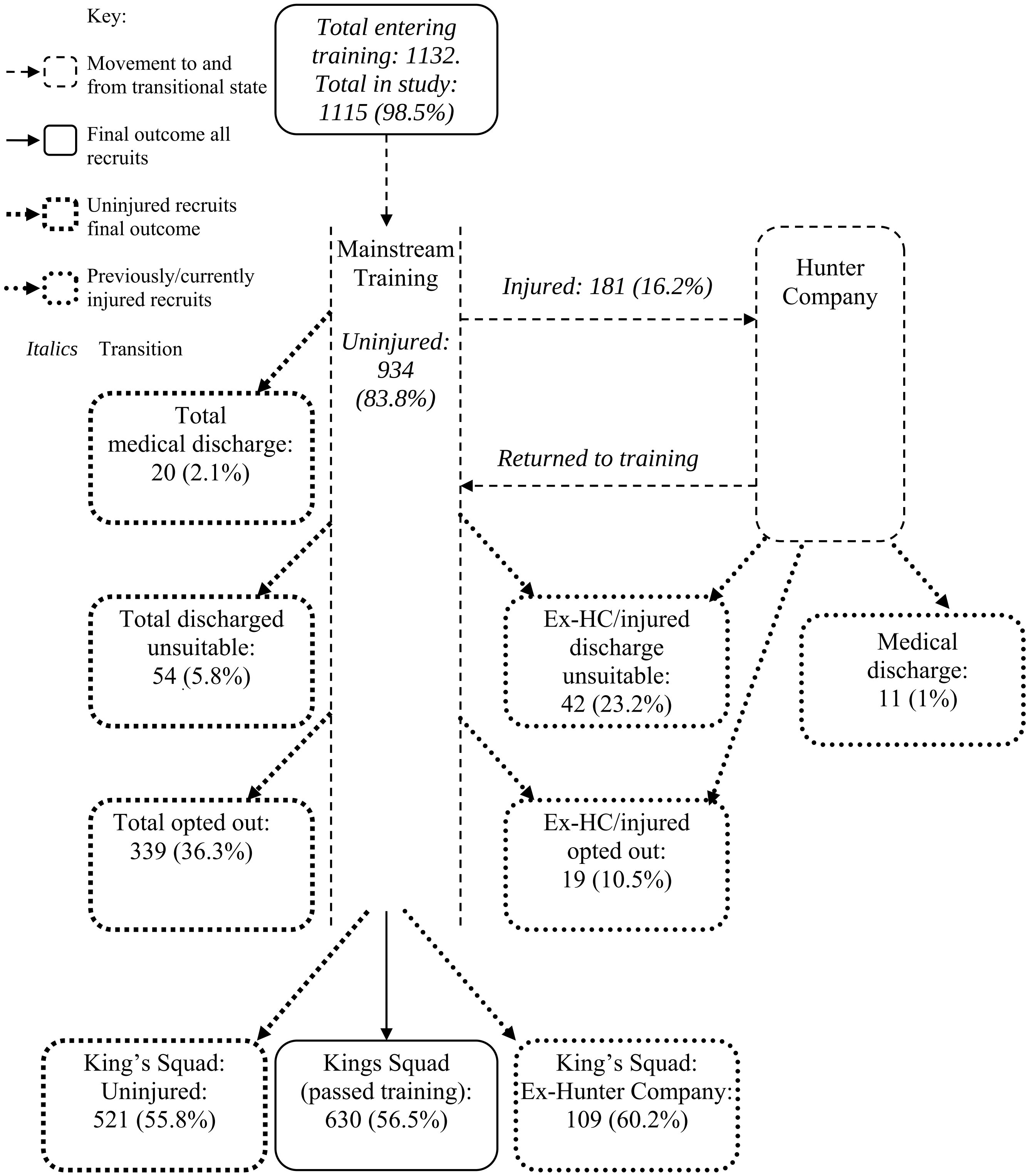
*Age in years.

Figure 1 depicts the training year from September 2001 to August 2002. The flow of recruits through training and the remedial system is presented as a number and also as a percentage of the total of either the injured or uninjured groups, or the whole sample where appropriate. Likewise, the percentage of recruits reaching each outcome can be seen as a number and as a percentage of the total of either the injured or uninjured groups, or the whole sample where appropriate. The ‘key’ indicates which group or sample the corresponding percentage refers to. The flow model shows that approximately one in six recruits become injured seriously enough to warrant being removed from his training troop and transferred to the rehabilitation unit until such time as he recovers and can rejoin training with a different troop, or chooses to leave training altogether.

It should be noted that it was not possible to calculate the number and percentage of recruits who returned to training from Hunter Company, nor was it possible to distinguish between the number of recruits who left through opt-out or were discharged unsuitable *direct* from Hunter Company and those who left from mainstream training having returned to training from Hunter Company. This is because information needed to make this distinction was not recorded. Consequently, total numbers (and percentages) of recruits reaching each outcome are presented.

Figure 1

*A flow model depicting a year in training*



The total pass out rate for recruits having successfully completed rehabilitation was similar to that of recruits who had remained uninjured (60.2% as opposed to 55.8%, respectively). The pass out rate for recruits who had been injured twice was similar at 57.2% (24 of the 42 recruits), but further analysis of the data revealed that the pass out rate of recruits who had been injured and transferred to Hunter Company three times markedly reduced to only 16.7%, although this was based on a very small sample size (one out of six recruits who were injured three times passed out of training). The opt-out rate of recruits who had been injured was lower than that of the uninjured recruits (10.5% compared with 36.3% overall), whereas the discharge unsuitable rate was higher (23.2% compared with 5.8%). Chi-square analysis revealed that the outcome categories of the injured recruits significantly differed from the main sample ($\chi^2$ (3, N = 1115) = 93.86, $p$ < .001).

### *2.4.2 Comparisons of injured and uninjured recruits*

Table 3 outlines the differences between recruits who became injured and entered the Hunter Company remedial system and those who continued through training without injury.

Table 3

*Description of recruits who were not injured during training, and recruits who were injured during training*

| | Recruits uninjured | | | Recruits injured | | |
|---|---|---|---|---|---|---|
| | Mean | *SD* | *n* | Mean | *SD* | *n* |
| Age on joining (years) | 19.6 | 2.9 | 934 | 20.1 | 3.0 | 181 |
| Reasoning recruitment test | 20.7 | 4.5 | 898 | 21.0 | 4.6 | 173 |
| Literacy recruitment test | 19.1 | 5.4 | 898 | 20.3 | 5.6 | 173 |
| Numeracy recruitment test | 18.6 | 5.0 | 898 | 18.6 | 5.0 | 173 |
| Mechanical comprehension recruitment test | 18.6 | 4.3 | 898 | 18.8 | 4.2 | 173 |
| Recruitment test totals | 77.0 | 14.9 | 898 | 78.8 | 15.2 | 173 |
| Personal qualities assessment score | 27.0 | 2.9 | 896 | 27.0 | 2.9 | 173 |
| Height | 177.7 | 6.3 | 869 | 176.8 | 6.1 | 171 |
| Weight | 73.5 | 8.1 | 912 | 73.5 | 9.1 | 177 |
| Body mass index | 23.3 | 2.2 | 864 | 23.4 | 2.5 | 171 |
| Multi-stage fitness test score | 11.45 | .93 | 898 | 11.3 | .84 | 173 |
| Smokers | 36 (20%) | | | 112 (12%) | | |

Comparison of the mean values of injured with uninjured recruits' available descriptive and performance data revealed significant differences with respect to age ($t$ = -1.96, $p$ = .05), whether or not a recruit was a smoker ($t$ = -2.49, $p$ = .01), literacy score ($t$ = -2.65, $p$ = .01) and multi-stage fitness test score ($t$ = 2.17, $p$ = .03). Further analysis (logistic regression) on the above variables identified that age and smoking combined accounted for 4% of the variance in prediction of transfer to Hunter Company.

The number of smokers in the whole sample was 148 (13%) and similarly for the uninjured recruits was 112 (12%). However, for the injured group the number of smokers was 36 (20%). Chi-square analysis revealed a significant difference between the smoking status (whether they were non-smokers, smoked 1-9 cigarettes a day, 10-19 cigarettes a day, 20-29 cigarettes a day, 30-39 cigarettes a day, or over 40 cigarettes a day) of those recruits who were injured and those who were not ($\chi^2$ (1, N = 1115) = 8.2, $p < .01$).

Smoking habit was further investigated; first by examining it in relation to specific injury categories, and second by categorising recruits by how many cigarettes they consumed each day and relating it to injury occurrence. Smoking habit was examined in relation to specific injury types (fracture/stress fracture etc), but no significant relationships were observed.

These data were then broken down into categories of how many cigarettes were smoked each day and the relative risks were calculated to assess how dangerous smoking was for recruits, in relation to injury occurrence. The percentage of recruits injured during training smoking 10-19 cigarettes a day on entry was approximately double that of uninjured recruits (14.4% and 7.7%, respectively).

The relative risks for smoking and injury were as follows:
Smoking in general = 1.7 (95% confidence interval: 1.2 – 2.8);
1-9 cigarettes a day = 1.2 (95% confidence interval: .6 – 2.6);
10+ cigarettes a day = 1.9 (95% confidence interval: 1.3 – 2.8).

*2.4.3 Variability in recovery time and prediction of recovery time*

Prior to analysing predictors of recovery time, it was first necessary to identify the most common injuries experienced by recruits. Table 4 illustrates that stress fractures were the most common injury, accounting for approximately one-third (28.9%) of all injuries.

Table 4

*Most common injuries of recruits in rehabilitation*

| Injury | Frequency | Percentage |
|---|---|---|
| Stress fracture total | 66 | 28.9 |
| Metatarsal stress fracture | 26 | 11.4 |
| Tibia stress fracture | 19 | 8.3 |
| Unspecified stress fracture | 13 | 5.7 |
| Fibula stress fracture | 5 | 2.2 |
| Neck of femur stress fracture | 3 | 1.3 |
| Knee injury | 36 | 15.7 |
| Fracture – other | 18 | 7.9 |
| Ankle injury | 17 | 7.4 |
| Soft tissue injury | 16 | 7.0 |
| Shin splints | 13 | 5.7 |
| Respiratory | 10 | 4.4 |
| Tendon | 9 | 3.9 |
| Back injury | 8 | 3.5 |
| Psychological | 5 | 2.2 |
| Other | 31 | 13.5 |
| Total | 229 | 100.0 |

Table 5 shows the median recovery time for the most common injuries. The overall median recovery time was 14.3 weeks. Although stress fracture of the neck of femur (hip) appears to take the longest recovery time, this was based on only 3 individuals and so should not be relied on as an accurate estimate. The slight skew in the data can be seen when comparing the median to the 25$^{th}$ percentile and 75$^{th}$ percentile values; hence the median was calculated rather than the mean.

Table 5

*Recovery time in weeks for the five most common injuries, with stress fractures divided into subgroups*

| Injury | *N* | *P25* | *Median* | *P75* |
|---|---|---|---|---|
| Stress fracture breakdown | | | | |
| Metatarsal stress fracture | 26 | 11.5 | 14.9 | 19.3 |
| Tibia stress fracture | 19 | 19.6 | 21.4 | 22.6 |
| Unspecified stress fracture | 13 | 7.7 | 17.6 | 25.6 |
| Fibula stress fracture | 5 | 6.0 | 11.6 | 18.6 |
| Neck of femur stress fracture | 3 | 25.6 | 34.5 | 43.4 |
| Metatarsal stress fracture | 26 | 11.5 | 14.9 | 19.3 |
| Knee injury | 36 | 15.3 | 18.8 | 30.0 |
| Fracture – other | 18 | 5.6 | 14.0 | 32.4 |
| Ankle injury | 17 | 8.6 | 15.6 | 16.9 |
| Soft tissue injury | 16 | 13.4 | 17.9 | 23.6 |

There was no significant correlation between the physician's estimated and actual recovery times for these injuries ($r$ = .16, $p$ = .12). The physician's estimated recovery time was, on average, ten weeks less than the actual time it took for a recruit to recover from an injury (the maximum underestimate was 68 weeks less than the actual time taken).

Only age was positively associated with actual recovery time ($r$ = .13, $p$ = .05). Smoking was not significantly related to recovery time ($t$ = -.53, $p$ = .6).

## *2.5 Discussion*

Four findings support the hypothesis that psychological factors may predict some of the variance in recovery times and rehabilitation outcome of injured Royal Marine recruits.

First, the slight skew of the data and large spread in recovery times for the same injury suggest that the duration of rehabilitation for recruits with similar injury types varies greatly. It is possible that some of the range of recovery times could be accounted for by the severity of the injury concerned, although it is likely the variance explained would be limited given that the physician's estimated recovery times (despite not being predictive of actual recovery time) were calculated on an individual basis with severity taken into account. Consequently, if individual differences in recovery time were mainly due to variability in injury severity, a stronger, significant correlation between the physician's estimated recovery times and actual recovery times would have been more likely to be found. Since there was not, it is plausible that some of the differences in rehabilitation times could therefore be due to psychological factors.

Second, estimates of recovery time were on average 10 weeks less than the actual time taken for a recruit to recover. An explanation for this could be that the predicted recovery times for injured recruits underestimate the level of performance that needs to be reached by a recruit, prior to his return to training. Although this explanation seems possible given that medical advice is based on remedial protocols and clinical expertise, it is unlikely because the physicians employed in the medical centre have often been through training themselves and are acutely aware of the additional training required in order to prepare a recruit to rejoin mainstream training. It is likely that this additional training is factored into the physician's estimated recovery time in order to avoid giving the injured recruit false hope. Current predictions of physical recovery time by the physicians, however, do not take into account the psychological impact of the injury and the psychological consequences of the prospect of returning to mainstream training. It is possible that overlooking these psychological factors may account for part of the underestimate of actual recovery times.

Third, analysis of all the available demographic, recruitment and performance data continuously collected by Commando Training Centre only revealed age as being related to recovery time, meaning older recruits take longer to recover, although the correlation was very small. Nevertheless, more than 95% of the variance remains unexplained. This finding also lends itself to the possibility that psychological variables might have the potential to explain some of the variance in recovery times.

Fourth, the proportion of recruits who eventually pass out of training having previously been injured and rejoined training from the Hunter Company system is greater than the proportion of recruits who pass out of training having never been injured, although it was not significantly greater. However, the proportion of recruits who had been injured that were discharged as unsuitable was significantly greater than that of recruits who had never been injured. This suggests that non-recovery and therefore non-return to training may partly reflect low motivation.

There were some indicators from the demographic data that recruits who were unfortunate enough to become injured and those who remained uninjured were different. When predictors of injury were examined, age, literacy score, multi-stage fitness test decimal bleep score and smoking were associated with its occurrence. Of these, smoking was the most important with respect to prediction of injury, although smoking status only explained 4% of the variance. Those recruits who smoked more than ten cigarettes a day were one and a half to two times more likely than non-smokers to become injured. There are several explanations as to why smoking should be related to injury. For example, the detrimental effects of smoking on physical fitness may partly explain subsequent injury. It is recognised that poor physical fitness is a precursor to injury (Gregg, Banderet, Reynolds, Creedon & Rice, 2002). There is also the possibility that smoking may be detrimental to the immune system and compromise the body's ability to fight illness (Jones, Bovee, Harris & Cowan, 1993). A recruit's performance is likely to be less than optimal if he is weakened due to illness. It has been suggested that smoking affects bone strength (Rhee et al., 2004), although the results revealed that smoking is not significantly predictive of fracture or stress fracture. Finally, there is evidence that smoking was indicative of risk taking behaviour and that those who smoke are more likely to also take physical risks during training that may result in an injury (Knapik et al., 2001).

There are four main limitations of this study (for the purpose of ascertaining the extent to which there is unaccounted variance in recovery times that might be explained by psychological factors). The first is the limited reliability of the assessment of physical injury. Because no discrete measure of the severity of each injury is recorded, it is difficult to know whether differences between estimated and actual recovery times are due to psychological factors, or to inaccuracy in predicting time needed for physical recovery. It has been anecdotally asserted by Hunter Company physicians that, where necessary, the severity of each recruit's injury is taken into account when estimating their prognosis. However, investigation of the accuracy of severity estimate could not be achieved. In order to create a sensible outcome measure for further empirical studies of the psychological influences on rehabilitation, it would be necessary to subtract the predicted recovery time from the actual recovery time in order to assess unexplained delay in recovery. The resulting dependent variable would represent the weeks of rehabilitation required over and above (or indeed under) each recruit's original prognosis, and therefore take type of injury and severity into account. However, this way of formulating a dependent variable would be highly reliant on the clinical skills, educated judgement and experience of the physicians who forecast the recruits' recovery times, as it would be very difficult to objectively prove its accuracy.

Second are the limitations imposed by the broadbrush approach to injury categorisation. Clearly, the categorisation of injuries afforded by EMIS is somewhat crude, as some categories are very broad and could include a range of different injury typologies, let alone different severities (for example, ankle injuries). Furthermore, it is likely that exactly the same tissue damage in recruits of similar height, weight and fitness would not be experienced similarly, nor would they heal at the same time. As such, the prediction of recovery time is not an exact science, as large fluctuations in expected recovery times have been observed for similar, better categorised, injuries (such as metatarsal stress fractures). Until now, injury and recovery time information recorded routinely by medical staff at CTC has never been utilised in empirical research before. Occasionally data are used to produce rudimentary statistics on numbers of injury and recovery times, but there is no quality control mechanism for these ad-hoc managerial audits, so the problems associated with the current medical system have only just materialised. With some refinement and scientific guidance, the current system could be vastly improved upon to make it more usable and to enable future researchers to draw more meaningful results.

Third, exacerbating the potential difficulties with recovery time prediction are the confounding influences of the beliefs and perceptions of remedial staff at CTC. 'Recovery time' was considered to be the length of time, in weeks, spent in Hunter Company by an injured recruit. The decision to progress a recruit from 1 troop to 2 alpha troop, 2 bravo troop and then to return him to training was decided upon by the remedial team comprising physicians, physiotherapists, remedial training instructors and Hunter Company managerial staff. Whilst the recruit is in regular contact with the team, he is not involved in the weekly decision-making meetings. As such, recovery time should be considered with a caveat in that the personal beliefs and perceptions of the individuals making up the remedial team could also influence their decisions regarding the future of each recruit.

Finally, fourth, whilst it is likely that some variance in recovery time might be explained by psychological factors, it is also recognised that extraneous physical variables not currently measured, or indeed other physical variables that cannot be measured, might also explain more of the variance than do psychological factors. That said, it is speculated as well as anecdotally reported that some recruits will adopt more adaptive approaches to their injury, rehabilitation, pain and the prospect of returning to training, than others, based on their psychological characteristics. The high pressure environment of Royal Marines' training coupled with the stress and trauma endured on becoming injured mirrors the high pressure performance environment of some sporting arenas (discussed in chapters 3 and 4), so there is also some empirical evidence suggesting differences in psychological approach to injury could impact on physical recovery. Therefore, it is important that as much of the variance that could be attributable to psychological variables be explained through the careful selection of psychological measures in the main studies.

Despite the difficulties associated with estimating recovery time and accounting for severity, the Principal Medical Officer at Commando Training Centre suggested that differences in severity of injury were not likely to confound the findings of empirical studies investigating the role of psychological factors in recovery from injury. She reported that the medical centre's principle routine is to remove an injured recruit from training as soon as he presents with a problem that might be exacerbated by continuing to train. Therefore, most injuries are diagnosed and treated at a very early stage meaning that quantifying their severity is unnecessary as the most common injuries are usually very similar. That said, it is important to control for severity as much as possible to reduce its possible extraneous effects on any potential findings. Although this may not be possible *within* each injury category, it is desirable to control for severity *between* injury types. This could be achieved through calculating median and 75$^{th}$ percentile recovery times by injury of recruits who have already passed through the Hunter Company rehabilitation system; which would facilitate estimation of *usual* and *lengthened* recovery times expected of a specific injury. These data could then be included in analyses and subtracted from participants' actual recovery times.

A further limitation of this study was its retrospective design, which meant that only data already systematically collected by Commando Training Centre could be collected and analysed. The data were collected in 2004 at the onset of this programme of work and comprised a year's worth of recruits having undertaken the training course. Data from the training year 2001-2002 was collected to ensure that all recruits had either completed or left training by the time of data capture in 2004. This, coupled with the hugely time-consuming tasks undertaken in order to satisfy the Data Protection Act (1998) stipulations, have resulted in the dataset used being somewhat more historical than would be ideal. However, it has been anecdotally reported that little has changed in terms of the injury rate in mainstream training, or how the staff of Hunter Company conduct its rehabilitation. Therefore, confidence prevails in terms of the relevance of the data reported here and the direction this programme of research takes because of it.

It has been asserted by remedial staff that a proportion of injured Royal Marine recruits experience psychological difficulties in coping with their injury, pain and rehabilitation such that their physical progress is hindered. This chapter presented empirical evidence that is not inconsistent with this assertion. In conclusion, it seems unlikely that the variability in recovery times, and success or failure at rehabilitation, for different injuries is purely explained by physical differences in injured recruits. It is possible that a proportion of the variance in success or failure, and recovery times could be due to influential psychological factors. Likewise, it is possible the lack of relationship between the estimated and actual recovery times for injured recruits experiencing different injuries could be explained by psychological factors. Therefore, it is argued that psychological constructs that may be influential in how a recruit recovers from a physical injury should be identified, measured and their influence investigated.

# Chapter 3

# Psychological Constructs Influential in Recovery from Injury and Successful Return to Activity: Attitude to the Military

## *3.1 Preface*

It could be argued that adherence to rehabilitation *per se* should be unproblematic within the military training environment due to the autocratic nature of training and the directive style of any subsequent necessary rehabilitation due to injury. Moreover, recruits themselves are more often than not extremely motivated and committed to their training objective (Scott, 1998; Hardy, Shariff, Jones & Allsopp, 2000). Remedial facilities in Hunter Company (a training unit dedicated to rehabilitating physical injuries) and staff at the Commando Training Centre are effective at rehabilitating the vast majority of injured recruits (Munnoch & Bridger, 2008). Nevertheless, chapter 2 provides evidence that there can be up to 150 injured recruits residing in Hunter Company at any given time. With only one Chief remedial instructor running a team of up to seven further remedial instructors, resources dictate that it is not possible for the team to observe every injured recruit performing remedial exercises. There is only one dedicated physiotherapist working within Hunter Company.

Physical injury is an undesirable but unavoidable consequence of the arduous training course for some Royal Marine recruits. Whilst a recruit is residing in Hunter Company, he is no longer progressing in training and as such is a drain on the financial and time resources of the Commando Training Centre. As well as being undesirable for the Commando Training Centre as a whole, the recruits themselves unanimously believe that physical injury during training is one of the most dreaded experiences, alongside ‘backtrooping’ (where a recruit fails to perform at the required standard and is removed from his troop and placed in a troop at an earlier stage of training). The consequence of both injury and backtrooping is that the recruit must leave behind his troop and training team, and join a new troop. This means forming relationships and bonding with an entirely new group of people. It is particularly challenging for recruits who are several weeks into training, when the exercises and tasks are becoming increasingly complex and stressful. At these more advanced stages, the recruits rely heavily on each other for support, making it even more difficult for a newcomer to 'fit in' and bond. Many recruits find the social demands of joining a new troop extremely challenging and difficult. For these reasons, the devastating psychological effect of injury on a recruit's morale and attitude has often been described as catastrophic. Consequently, it is possible that the strong social cohesion experienced by recruits in a troop (Hardy et al., 2008; Hardy, Shariff, Munnoch & Allsopp, 2004) may actually contribute to problems adjusting if a recruit does becomes injured or is backtrooped for professional reasons.

Clay and Hopps (2003) have suggested that due to the profound life changes that occur post injury/illness necessitating complicated rehabilitative procedures, limitations of the effectiveness of the rehabilitation can often be seen, rendering it less than optimal. Indeed, Clay and Hopps state that if exacting adherence to rehabilitative procedures is not evident during critical treatment windows, the 'limiting effects' on the success of treatment can be permanent. Whilst deliberate non-adherence may not be a problem at the Commando Training Centre, it is possible that the 'exacting' adherence to treatment plans required for a full recovery may not always be achieved, and that the negative psychological impact of injury as described above may play an important role in injured recruits' successful recovery. Chapter 2 described a substantial difference between recovery times (defined in this instance as the time taken in weeks to proceed through the rehabilitation process and to rejoin training) in recruits with similar injuries as diagnosed by the medical staff of the Commando Training Centre, despite the physical and demographic profiles of those recruits being similar. It is plausible that differences in rehabilitation time may be due to individual differences in psychological reactions to the injury and prescribed rehabilitation.

Whilst personality may play an important role in effective adherence to rehabilitation for some patients (Hershberger & Robertson, 1999), it will not be a major focus of this thesis. In part, this is due to the limited variability of the population in the reported studies in terms of personality characteristics (Shariff, Kemsley, Lombardo

& Pethybridge, 2001). In addition, the purpose of this research programme is to identify, and investigate, modifiable influences on recovery; arguably, personality factors are less modifiable than attitudes, perceptions and beliefs.

### *3.2 Selection of Potentially Relevant Theory/Literature for Review*

When considering the psychological consequences of physical injury for Royal Marine recruits, a variety of theories and models from the health psychology literature may be applicable. This section will describe the rationale for the selection of models relevant to investigating the psychological effects of injury on Royal Marine recruits for review in this chapter and the following chapter. The collective clinical experiences of the physicians, remedial instructors and physiotherapists with this target population were drawn upon as a starting point from which potentially influential factors were identified (Munnoch, 2004; Munnoch & Bridger, 2008). The author of this thesis has seven years of experience working with Royal Marine recruits in training as well as those injured in rehabilitation and is a Chartered health psychologist. The author's personal experience and the informed opinions of colleagues including psychologists and physiologists as well as the Commando Training Centre staff, suggested that three discrete attitudinal areas may collectively contribute to an understanding of how a recruit interprets and copes with a physical injury and rehabilitation during training. These are: attitude to the military (detailed in this chapter); attitude to injury and illness (chapter 4); and attitude to rehabilitation (chapter 4). Initial selection of relevant models was drawn from the literature relating to adherence to treatment and rehabilitation in chronic illness and disability. However, given that Royal Marine recruits tend generally to suffer from acute physical injury rather than chronic disability or illness, the mainstream rehabilitation literature is only partly relevant. Also, this body of literature focuses on an older population, which is less relevant given that Royal Marine recruits' ages range from sixteen to thirty-two, and the mean age of a recruit is twenty years old (see chapter 2). Focusing specifically on injury and pain experienced by competing athletes, the sports psychology literature usefully supplements the more general literature, since it also focuses on acute physical injury in a fit, young age-group.

Relevant papers from respected peer-reviewed journals were identified by searching Southampton library's online Psychinfo, Medline and Embase search engines. Search terms were used that pertained to the three main themes identified at the start of the review. Papers were scrutinised by the calibre (evaluated in terms of impact factor) of the journal and how closely they were related to the current topic in question, and it was ensured that they were as recent and therefore as reflective of current thinking as possible.

The purpose of the review presented below and in chapter 4 was to identify credible, well-researched theories or models of relevance to the psychological difficulties experienced by Royal Marine recruits who become injured during training, taking into consideration the unusual environment in which recruits train. Each model was therefore reviewed for its appropriateness and the strength of support for the model was both theoretically and empirically evaluated. Thus, each potentially relevant theory will first be described, the general literature will be reviewed, then the empirical evidence supporting the theory related to injury and rehabilitation will be examined, and its overall relevance and applicability to recruits residing in Hunter Company will be discussed.

### *3.3 Overview of the Relevant Theories*

As the literature available for each of the three relevant areas identified is extensive and diverse, it will be reviewed in the current chapter and the following chapter. The focus of the present chapter will be on attitudes to the military, while the focus of the following chapter will be on attitudes to injury, illness and rehabilitation. An overview of the theories and models covered in each of the two theoretical chapters can be found below, whilst an overall summary of the review and its implications for the research pertaining to this thesis can be found concluding chapter 4.

The theories reviewed in the present chapter concern attitudes to the military. The *three component commitment model* (Allen & Meyer, 1990; Meyer & Allen, 1987) is one of the most thoroughly empirically tested theories of commitment. The review below explains how commitment could affect injured recruits in terms of both training retention and recovery from injury. However, the majority of research conducted on commitment is from occupational psychology and workplaces primarily involving offices, and not in the physical activity arena. Royal Marines' training is physically and mentally arduous (Hardy et al., 2000). It was therefore appropriate to draw on theories of commitment from a sporting context. Consequently, from the sub-discipline of sports psychology, the theories of *burnout* (Silva, 1990; Smith, 1986) and *athletic identity* are also reviewed. In the review it is proposed that components that contribute to burnout and the components that are inherent to commitment theory may be similar, and that both may be of use in a military training environment. Likewise, *athletic identity* (Eldridge, 1983), is an important construct for theorists researching commitment to sport and rehabilitation. The Royal Marines have a very strong identity, defined by their crest and cap badge (the globe and laurel) and their famous green berets (an item achieved ceremoniously following successful completion of the demanding training course). This chapter concludes with a brief summary of the findings.

Chapter 4 begins with the second area to be reviewed; attitudes to injury and illness. This section includes an overview of the *common sense model of illness representations* (Leventhal, Meyer & Nerenz, 1980), the *stage model of the return to sport* (Taylor & Taylor, 1997), the *integrated model of response to sport injury* (Wiese-Bjornstal, Smith, Shaffer & Morrey, 1998) and the *biopsychosocial model* of sport injury rehabilitation (Andersen, 2001; Brewer, Andersen & Van Raalte, 2002). This section will consider how injured and ill individuals form attitudes towards their illness or injury and how these attitudes or representations may affect their subsequent behaviour. The common sense model of illness representations, informs the understanding of how individuals conceptualise illness and this may prove to be a relevant model by which to explain how injured Royal Marine recruits conceptualise physical injury. The stage model of return to sport, the integrated model of response to sport injury and the biopsychosocial model of sport injury rehabilitation are relevant as these theories were specifically designed to explain attitudes toward injury during rehabilitation from an acute injury (Andersen, 2001; Brewer et al., 2002; Taylor & Taylor, 1997).

Chapter 4 continues with a review of the third area to be examined; attitude to rehabilitation. First, the well documented and supported *theory of reasoned action and the theory of planned behaviour* (Ajzen, 1985; Ajzen & Fishbein, 1980) will be reviewed in terms of their applicability in predicting rehabilitation behaviour. *Personal investment theory* (Maehr & Braskamp,1986), is briefly reviewed as a model that explains motivation to take a particular course of action. *Self-determination theory* is explored in terms of its explanation of motivation to perform specific activities (Ryan & Deci, 2000). Finally, *social cognitive theory* (Bandura, 2003), is explored in terms of contributing to understandings of whether individuals' perceptions of their own capability for rehabilitation, coupled with its likely outcome, could affect successful recovery.

A further section of chapter 4 considers two models which encompass both attitudes to illness and to rehabilitation. *Protection motivation theory* (Rogers, 1983), was originally developed to explain how protective behaviour is motivated in individuals. It has also been applied in a rehabilitative environment to predict adherence behaviours (Taylor & May, 1996). An overview of *fear-avoidance theory* (Asmundson, Norton & Norton, 1999) will be presented, as its relevance is suggested by clinical observations at the Commando Training Centre. The fear experienced by injured recruits facing the prospect of returning to training, having been rehabilitated from an injury serious enough to necessitate being withdrawn from their troop, is highly noticeable and has been regularly reported. It has been reported not only by physiotherapists and remedial staff, but also by the recruits themselves in informal focus group discussions. Literature focusing on the role of *pain* will also be reviewed in this section, both in relation to fear-avoidance and also as a discrete, potentially predictive construct.

Chapter 4 closes with an examination of the applicability of the theories reviewed to recovery from injury and successful return to training in Royal Marine recruits. The most appropriate and practically viable theoretical frameworks are identified and described in order to provide a foundation for the empirical studies presented in this thesis. A comparison of the selected models is outlined and conclusions drawn in terms of their representative merit in exploring constructs relevant to successful recovery from injury in Royal Marines' training. The chapter culminates with an illustration of how the models selected may fit together and explain differences in recovery outcome for injured Royal Marine recruits undergoing rehabilitation.

## *3.4 Attitude to the Military*

Attitude to the military can be investigated using generic theories detailing why a person commits to an organisation or career path, or more focused theories developed on a similar population such as competitive sports performers. As there is a paucity of research specifically on attitude to the military, this chapter identifies, describes and explores the validity and relevance of both generic and focused theories that could contribute to explaining how attitude to the military might assist or hinder an injured recruit's successful recovery.

### *3.4.1 Commitment in the workplace*

It has long been considered within Royal Marines' training that organisational commitment is important in maintaining recruits' motivation to complete the training course (Hardy et al., 2000; Scott, 1998). This is not only recognised by the training and rehabilitation teams at the Commando Training Centre, but 'organisational commitment' as a psychometric construct has also been recognised as a predictive factor for occupational retention (Podsakoff, Mackenzie, Moorman & Fetter, 1990) and as an important factor determining mental well-being in the military (Bridger & Kilminster, 2004). Bridger, Kilminster and Slaven (2007) examined factors related to the prevalence of stress in the Royal Naval service and the Royal Marines, and found low organisational commitment to be the main correlate of psychological strain. With a training attrition rate of just under 50% (chapter 2 and Munnoch & Bridger, 2008), considerable attention is being focused by management on Royal Marines' training. Coupled with the high attrition rate, Royal Marines in training also have a high injury rate with one in six recruits incurring a physical injury during training (chapter 2). The financial and operational problems caused by high attrition from training and high injury levels have necessitated urgent action from management, including the encouragement and support of research. The measurement of recruits' commitment to the organisation could play a key role in improving the retention of recruits in training through more stringent selection and management of recruits, as well as the development of appropriate interventions (Munnoch & Bridger, 2007). If injured, it is intuitive that a recruit who is more committed to training is potentially more likely to commit to the rehabilitation and to return to training as soon as possible. A recruit who lacks commitment to the organisation may be more likely to view an injury as a fatal impediment to his continuing training. Such a recruit might procrastinate his own recovery, possibly by not adhering correctly to a rehabilitation programme, or even by leaving the organisation prematurely.

Attitudinal commitment as a psychological construct has been modelled and measured in a variety of ways. These can be differentiated into three broad categories, originally termed affective attachment, perceived costs, and obligation (Meyer & Allen, 1987). Allen and Meyer (1990) subsequently renamed these categories affective commitment (want to), continuance commitment (need to) and normative commitment (ought to). Affective commitment reflects an individual's emotional attachment to a particular organisation, that is, the extent to which an individual identifies with an organisation and it 'feels good' to be a part of that organisation. This strength of identity is indicative of the strength of commitment. Continuance commitment refers to an inherent need to continue working for an organisation, a need that is driven by the relative costs associated with failing to continue in the organisation. The costs incurred might be described in financial terms, or loss of a sense of self or sense of identity, or challenge or disapproval from salient others such as family or peers. Continuance commitment is characterised by a constant awareness of the difficulties associated with a change in identity. As such, it is the opposite of affective commitment, in that the costs associated with leaving the organisation are what maintains commitment as opposed to the emotional benefit of staying. Finally, normative commitment refers to the desire to remain in an organisation that is driven by other moral beliefs concerning appropriate behaviour and fulfilling expectations. If an individual believes they have a moral obligation and responsibility to the company or organisation, it might manifest itself as a perceived obligatory commitment. Allen and Meyer consider the three categories as discrete types of commitment, rather than related components of an overall commitment construct.

A recent meta-analysis conducted by Cooper-Hakim &Viswesvaran (2005) analysed 997 published studies of commitment. Four dimensions of commitment were identified, and these were then related to outcomes such as turnover intentions, actual turnover, job satisfaction and job performance. Turnover intentions refer to individuals' proposed course of action, as opposed to the actual course of action carried out. The dimensions identified were organisational commitment (defined as a commitment to an organisation), career commitment (defined as commitment to a chosen occupation, and therefore detached from the organisation itself), work ethic endorsement (defined as a commitment to the ethos or ethic of a chosen line of career with a disregard for personal well-being) and union commitment (a dedication to one's union).

Within the dimension of organisational commitment, empirical support for Allen and Meyer's (1990) three component model of commitment was extensive, with a sample size of nearly 224,000. The three components were found to be highly correlated with Allen and Meyer's (1996) later, adapted model that assesses occupational (rather than organisational) commitment (correlation coefficients range from $r = .61$ to $r = .93$), which suggests that measurements of organisational commitment originally based upon the model proposed by Meyer and Allen (1987) may also encompass elements of occupational or career commitment. The results of the meta-analysis give confidence that some of the constructs inherent in the three-component model of commitment have been found to be predictive of behaviour in many studies.

When researching retention in the Royal Marines, it might be important to measure both recruits' commitment to the organisation (or Corps), as well as to the training regime. Cooper-Hakim & Viswesvaran (2005) identified two older studies that investigated the role of commitment in the military. Guimond (1995) described military ‘ethos’ which was coded as ‘work ethic’ for meta-analysis purposes, whilst Mathieu (1988) investigated satisfaction with military training. It is possible that the construct of work ethic may best relate to Royal Marines’ training, as it maps onto the ethos and values held as being important by the Corps (see chapter 1). Furthermore, in its inception this construct was intended for use with uniformed services.

Whilst it may be of academic interest to measure commitment in Royal Marines’ training, it is of practical importance to consider whether there is a causal relationship between commitment, turnover intentions and actual behavioural turnover. This issue was specifically investigated in Cooper-Hakim and Viswesvaran’s (2005) meta-analysis, which examined both intentions and actual behaviour as outcome measures. Although work ethic demonstrated a good correlation with job performance ($r = .47$), its relationship with turnover and turnover intentions was small ($r = -.14$ and $r = -.27$ respectively). Correlations between continuance and normative commitment with turnover and turnover intentions ($r = -.25$, $r = -.19$ and $r = -.16$, $r = -.37$) were also fairly small. Affective commitment correlated ($r = -.20$) with turnover, and its relationship with turnover intentions was stronger ($r = -.58$).

In the case of Royal Marines and commitment, both the three component model of commitment, and the work ethic dimension of commitment, might be useful approaches. Given that only a finite amount of time was available for test administration, coupled with the strength of empirical supporting work available, Meyer and Allen’s (1987) three component model of commitment better served the purposes outlined in this thesis (chapter 5). Furthermore, the three component model of commitment encompasses three discrete subscales of commitment to the organisation, and these subscales correlate highly with the same aspects of an individual’s commitment to their occupation (namely affective, continuance and normative commitment). Thus more information could be obtained by employing a more generic, yet comprehensive, questionnaire which measures those aspects and therefore serves both purposes, than focusing on the work ethic component of commitment alone. It is suggested that work ethic is most closely related to affective commitment and so the three component commitment model questionnaire could indirectly measure aspects of the work ethic component of commitment.

It is hypothesised that a recruit's commitment to the Royal Marines and identity as a Royal Marine may be threatened by injury, and consequently a recruit's strength of commitment to the Corps may be tested. It may therefore prove important to understand how commitment levels to training differ between Royal Marine recruits in order to allow an insight into what factors might hinder recovery. Commitment might impact on a recruit's recovery from physical injury through two possible mechanisms. First, commitment may mediate the effects of an injury, in that a recruit's commitment might wane post injury. It is intuitive that this lowered commitment could contribute to a reduced adherence to remedial training regimens, resulting in an increased recovery time, or increased attrition from rehabilitation and training. Alternatively commitment may moderate a recruit's response to injury. A recruit with higher commitment would thus be more likely to adhere to remedial training regimens, and have the motivation and commitment to return to training as soon as possible, as opposed to an elongated recovery time or opting-out of training altogether by a less committed recruit.

### *3.4.2 Burnout*

In the same way that low retention poses a potential problem for employers, athletic 'burnout' poses a potential problem for sports coaches. Raedeke (1997) defines burnout as a syndrome resulting in reduced athletic accomplishment caused by physical and emotional exhaustion, and sport devaluation. Burnout can result from a combination of overtraining (defined as training beyond the ideal level for maximum benefit) and staleness (defined as a 'plateau' reached when an athlete does not perceive progress) (Cox, 2002). This combination can be influential enough to cause an athlete to leave their chosen sport. Research into burnout has resulted in the development of a number of models, such as Silva's (1990) training stress model and Smith's (1986) cognitive-affective model of burnout. These models view burnout as a result of stress experienced by the athlete during training. Silva's model emphasises the necessity of training stress for improvement in performance. Silva then highlights the importance of a positive adaptation to training stress and proposes that a negative adaptation could result in burnout. Smith suggests that personality and motivation to perform interact with the four stages of the cognitive-affective model of burnout, namely situational, cognitive, physiological and behavioural burnout.

The investment model of burnout (Raedeke, 1997) views it as a discord between the costs and benefits associated with athletic participation, whereby burnout results if the costs outweigh the benefits of sport participation and competition. Although not explicitly evaluated in relation to injured athletes, the theory could be applied to the context of injury. For example, an injury could be viewed as a significant cost to an athlete, exacerbating the dissonance between the costs and benefits of partaking in one's chosen sport. The model comprises five components that contribute to the overall explanation of an athlete's commitment to their sport. The components are: rewards; costs; satisfaction; investment; and alternatives. A combination of these will result in an athlete's commitment being either due to enjoyment or entrapment. Commitment through enjoyment can be likened to affective commitment as detailed in the three component model of commitment (Allen & Meyer, 1990). Likewise, entrapment can be likened to the more extreme end of continuance and normative commitment, in that the person feels trapped due to the investment made in the organisation or sport, the expectations of themselves and others, and the abundance of difficulties associated with leaving and changing identity.

Coakley's (1992) empowerment model of burnout, explains the process as being one of regaining control over an essentially constraining situation. Coakley argues that the social control held over the athletes by the infrastructure around them can be suffocating, and that burnout and leaving the sport is a way of the athlete empowering themselves through self-determination. Coakley's contention is that stress is a symptom of burnout and not a cause. Therefore, burnout could be viewed as a way of resisting normative commitment, although it is unclear as to whether normative commitment in general is good or bad.

Whilst research into athletic burnout has focused primarily on the effects of pressures on healthy athletes, the theories of burnout are general enough to be equally applicable to burnout experienced by sportspeople undertaking rehabilitation from athletic injury. It is plausible to assume that the physiological and psychological effects of burnout, as indicated by scales such as the Maslach Burnout Inventory (Maslach & Jackson, 1986), could predispose an individual to the occurrence of an injury. Likewise, it could be assumed that burnout may hinder an injured athlete's recovery, through physiological symptoms such as sleep loss, loss of body weight due to loss of appetite, increased heart rate and blood pressure, as well as psychological symptoms such as mood disturbance, chronic fatigue, decreased self-esteem, general negative affect and maladaptive coping responses (Cox, 2002).

Although this review suggests that models of burnout could contribute, theoretically, to the investigation of the psychological factors that may influence an injured Royal Marine recruit's recovery, no one model seems particularly advantageous. Whilst it is plausible that models of burnout may be applicable in an injury setting, none of the models outlined have previously been applied to explaining the psychological effects of injury. Therefore, only limited confidence can be assumed in terms of the models' likely effectiveness when applied in this context. Moreover, elements of commitment appear to be encompassed in models of burnout. Therefore the more generic, empirically tested model of commitment may be more useful to explain recruits' attitudes and rehabilitation outcome.

### *3.4.3 Athletic identity*

Eldridge (1983) suggested that individuals who partake in sport and exercise often attach a high level of psychological significance to their involvement and identify strongly with an athletic role. When studying the psychological and behavioural impact of physical injury in a military training environment, comparisons can be drawn between the athletic world and Royal Marines' training. This is because Royal Marines' training is very physically and mentally demanding (Hardy et al., 2000).

Lamont-Mills and Christensen (2006) observed that athletic identity scores differentiated between elite athletes and recreational athletes, suggesting that the higher the level that athletes work at, the more their identity is congruent with their sport. Likewise, Martin, Adams-Mushett and Smith (1995) reported that disabled swimmers exhibited a very strong athletic identity as part of their achievement motivation. Larry and Kerr (2005) reported that the high level of athletic identity initially displayed by university athletes actually diminished over time as they simultaneously developed a student identity. This student identity then allowed the athletes to explore alternative career paths other than sports competition.

In contrast, Tušak, Faganel and Bednarik (2005) observed no difference between the athletic identity scores of high level and amateur sports performers. Nevertheless, high level of athletic identity was observed in elite sports performers and this appeared to be related to social status, power and rewards. Brewer, Van Raalte and Linder (1993) reported that people with high levels of athletic identity may favour their sport over and above other aspects in their lives, which could be detrimental to their overall well-being. Horton and Mack (2000) further developed Brewer et al.'s work and debated whether athletic identity is a 'functional focus' or 'dysfunctional commitment'. Contrary to the assumptions of Brewer et al., Horton and Mack reported that marathon runners exhibiting high athletic identity did not neglect other aspects of their lives in favour of competing in marathons. Rather, the marathon runners with high athletic identity generally performed better, had greater commitment to running, a wider social network, and more frequently reported experiences of both the positive and negative effects of running. This research suggests that a strong identity could be beneficial when it comes to commitment and performance. Considering the effects of athletic identity on performance in training, Werthner and Orlick (1986) suggested that someone who identifies strongly and positively with their role will perform better in training and competition and it has also been reported that a strong athletic identity has a positive association with mood and lowered anxiety (Campbell, 1990; Marsh, 1995; Masten, Tušak & Faganel, 2005).

The sports related literature, in the main, focuses on the negative consequences of physical injury. However, some studies have focused on the possible benefits of experiencing an injury, in terms of the positive effect that overcoming an injury can have on future performance. For example, Udry, Gould, Bridges and Beck (1997) reported on the positive beliefs about injury as voiced by United States ski team members. First, the skiers identified personal growth as being a positive outcome of the injury; it was felt that they had gained perspective and the experience had benefited their personality growth in general. They also felt that their time management skills had improved as a result of their rehabilitation and that they had developed other areas of interest, which were complementary, but different, to skiing. Second, the majority of the skiers believed they had developed psychological techniques to enhance their performance. They felt their mental toughness or resilience had improved along with their feelings of self-efficacy, motivation and general outlook and expectations. Third, approximately half the sample said that their actual skiing had improved as a result of their injury, in that they had learned to ski more technically and intelligently, and that they felt their overall physical health had improved.

In contrast, some researchers have suggested that a strong athletic identity may exacerbate negative psychological reactions to injury and have an overall negative impact on recovery and subsequent performance. Brewer et al. (1993) proposed that sports performers, with a strong athletic identity, attribute greater importance to a physical injury than those with a weak identity because it threatens their sense of self. Empirical support is provided by Tušak, Faganel and Bednarik (2005), who observed that people with a clear athletic identity are more likely to evaluate a given event (such as an injury) in terms of its consequences for their sport involvement. A career threatening injury could therefore disrupt an individual's sense of identity and sense of self, resulting in a negative, and possibly enduring, effect (Brewer et al.; Pearson & Petitpas, 1990). The subsequent negative impact on an individual's sense of self may impact on how injured athletes approach their rehabilitation and recovery (Brewer et al.).

There is conflicting evidence concerning how enduring the construct of athletic identity actually is. Grove, Fish and Eklund (2004) reported that athletic identity decreased over a period of two weeks when measured in sports performers who were not selected for their chosen sport's team. In contrast, for those who had to leave their chosen sport, Cecić Erpić, Wylleman and Zupančič (2004) found that sports people with a stronger athletic identity found disengaging from their career far more psychologically difficult than those with a less clear identity. There is a dearth of research investigating whether or not athletic identity changes further over longer periods of time, and the effect of physical injury on athletic identity, and vice versa. Whilst evidence thus far suggests that associations are likely, the nature and direction of those associations remain unclear.

The literature suggests support for both the positive and negative influences of a strong athletic identity on performance, mood, anxiety and engagement. As such, research findings are inconclusive regarding the effect of a strong athletic identity in the process of recovering from an injury. Research investigating the role of athletic identity in the rehabilitation process is in its infancy, and the scientific argument is still unclear at this stage. Nevertheless, athletic identity (or the military equivalent in the context of this thesis) may be of importance in the rehabilitation process undertaken by injured Royal Marine recruits, and could be a useful hypothesis to test. This is because the powerful image the Royal Marines portrays, and encourages its men to portray, might be expected to influence responses to adversities experienced, such as injury. With regards to Royal Marines' training, the devastating effect injury has on the morale and outlook of recruits has been anecdotally reported by clinicians over a number of years (Hardy et al., 2000; Munnoch, 2004).

There is some overlap in the constructs of commitment and athletic identity. As well as Horton and Mack's (2000) observations about the possible relationship between athletic identity and commitment, Nasco and Webb (2006) also reported that numerous research projects have recognised the relationship between a clear athletic identity and commitment. Although this relationship is apparent and logical, there is a dearth of supporting evidence in the literature.

Extrapolating the above discussion to the context of injury and rehabilitation, it seems intuitive that a recruit with a strong identity may strive harder to recover in order to return to their primary goal (successful completion of Royal Marines' training). It might further be hypothesised that recruits with a weaker identity as a Royal Marine may feel less inclined or motivated to strive for a quick recovery, with reintroduction into 'civvy street' as an equally rewarding alternative. In terms of how recruits may interpret and evaluate their predicament when injured, it is possible that those with a weak identity may also be more aware of desirable alternative paths or identities available to them at the time of injury and therefore be more willing to explore other opportunities, as the Corps of the Royal Marines may not form their singular identity.

### *3.5 Conclusions from this Chapter*

Theory pertaining to commitment, burnout and athletic identity has been reviewed and available evidence supporting the models and theories detailed has been cited and discussed. Empirical evidence in support of the theories of commitment and athletic identity was abundant, and provide early indications that these theories could contribute to an explanation of how injured Royal Marine recruits approach their remedial training such that it impacts on their rehabilitative outcome. Although theories of burnout were relevant to the physical aspects of Royal Marines' training (as they were developed on a sporting population), literature detailing the empirical testing of these models was less convincing. As Royal Marines recruits have not been studied before in the context of health psychology, it is concluded that only well validated, generically applicable models should be employed and so commitment and athletic identity were selected for the research presented in this thesis.

# Chapter 4

# Psychological Constructs Influential in Recovery from Injury and Successful Return to Activity: Attitude to Injury, Illness and Rehabilitation

## *4.1 Preface*

Chapter 3 focused on the literature that may be important when investigating injured Royal Marine recruits' attitude to the military. Theories of commitment, burnout and athletic identity were described and discussed and their relevance to the current context was extrapolated. This chapter focuses on attitudes to illness, injury and rehabilitation and aims to evaluate the relevance and strength of empirical work supporting the theories and models identified. Theories that focus primarily on illness, injury or rehabilitation are considered first, followed by models that encompass both attitude to injury and also rehabilitation.

## *4.2 Attitude to Injury and Illness*

The following models have been selected and reviewed because of their potential to explain Royal Marines recruits' attitude to injury when undergoing rehabilitation. Where available, empirical literature has been drawn upon and reviewed in terms of its strength and its support for the reliability and validity of the models described. Each model has been considered in the context in which it was developed, as well as in the context of the current research.

### *4.2.1 The common sense model of illness representations*

Leventhal, Meyer and Nerenz's (1980) common sense model of illness representations, explains how an individual's decision making processes on health related issues are based on the interpretation of available information. Individuals draw on their own existing lay understanding of the illness, information provided by health professionals, significant others and authoritative figures, and from their ongoing, current appreciation of symptoms and knowledge of treatment effectiveness. Their representations of the illness formed by interpretation of available information influences formation of coping strategies and participation in health related regimens. Leventhal et al. (1980) proposed that information assimilated from concrete (personal experience of symptoms) and abstract sources (previously assimilated information and information from others) is combined, resulting in a representation of the illness. Leventhal (1990) further suggested that the theory is a parallel-processing model, in that people form cognitive and emotional representations about the cause, consequences, identity, timeline, cure and controllability of their illness at the same time.

Hagger and Orbell (2003) conducted a meta-analytic review of forty five empirical studies utilising the common sense model of illness representations and observed a good level of support for the discriminant and construct validity of its main components. Perceived feelings of control over an individual's illness were positively related to adaptive coping strategies, psychological well-being and social functioning. Although evidence supporting the common sense model of illness representations is abundant, its effectiveness in explaining psychological responses to physical injury rather than illness *per se* is limited. Only one empirical study focused on musculo-skeletal injuries and the prediction of injury-related behaviour through the common sense model of illness representations (Hagger, Chatzisarantis, Griffin & Thatcher, 2005). As the population of interest (injured Royal Marine recruits) has not previously been studied in the health psychology literature, it was considered prudent to use theoretical approaches that have been used previously in similar, albeit not identical, populations.

In terms of the Royal Marines and injury, the population itself is range limited (due to stringent selection criteria including educational, psychological and physiological variables) and highly regulated in terms of the information received regarding a particular illness or injury. Most recruits are young ($M$ = 20 years of age, $SD$ = 3.0, chapter 2), such that their life experience and experience of illness and injury may be limited. The common sense model of illness representations might therefore be of less use in this environment as it is most relevant to situations in which more variation is available in terms of the injured individual's decision making process and more freedom exercised in terms of sources of information from which recruits' representations are formed. Furthermore, the common sense model of illness representations focuses principally on the individual's interpretation of information regarding the injury, and less on the other external sources of pressure and motivation surrounding recruits in Royal Marines' training, therefore suggesting it may be potentially less comprehensive than other models in explaining success in rehabilitation or lengthened recovery time.

### *4.2.2 Sports injury models*

Taylor and Taylor's (1997) model of the return to sport following injury, comprises psychological stages including: the initial return; recovery confirmation; return of physical and technical abilities; high intensity training; and return to competition. Taylor and Taylor argue that passing from one stage to the next is dependent on physical healing and conditioning as well as psychological rehabilitation. This can be likened to Royal Marines' training, in that the return to competition stage is similar to rehabilitated recruits' return to mainstream training and the other stages have parallels with the rehabilitation processes that are provided for injured recruits within Hunter Company. As will be discussed in the review of self-determination theory (Section 4.3.3), it is important to note that the rehabilitation process undergone by injured recruits includes physical conditioning as well as training to achieve the required performance levels to rejoin mainstream training at the point at which the injury was incurred.

The model serves as a useful reminder for health professionals and coaches of the possible stages a recuperating athlete may experience when rehabilitating from an injury and returning to sport. Nevertheless, the model has serious limitations that have been discussed at length in a review by Podlog and Eklund (2007) and ultimately lacks sufficient detail to render it useful as a research tool. Difficulties include a lack of detail regarding exactly what each stage psychologically entails. Also, the model does not offer an explanation of how and why a recovering athlete may progress from one stage to the next (Eklund & Bianco, 2004), or whether each stage is necessarily achieved consecutively, or whether there may be movement in both directions between the stages. Podlog and Eklund further criticised the model in that it might explain where an athlete should be, but does not ascertain whether or not the athlete has achieved the required stage. The model is also limited in terms of the mediating and moderating effects of external sources of information, such as feedback from the health professionals involved in rehabilitation.

An enduring model of sports injury that evolved as an extension to an existing model of psychological antecedents to injury (Andersen & Williams, 1988; Williams & Andersen, 1998), is the integrated model of response to sport injury (Wiese-Bjornstal, Smith, Shaffer & Morrey, 1998). As well as encompassing some of the most important psychological phenomena that may predispose a person to acquiring an injury (such as history of stress and coping style), it also includes the most important aspects of the stage theories of response to athletic injury (such as the psychosocial and physical recovery outcome). Notably, the integrated model of response to sport injury has been subjected to greater empirical evaluation than some of the stage theories (Wiese-Bjornstal, Smith & LaMott, 1995; Wiese-Bjornstal et al., 1998), and includes pre-injury factors in the evaluation of post-injury psychological and behavioural reactions (Andersen & Williams; Williams & Andersen).

The integrated model of response to sport injury is dynamic, in that it recognises that injurious setbacks may alter an individual's emotional, cognitive and behavioural processes (Wiese-Bjornstal et al., 1998). However, available empirical research into the model is limited and so it has not been validated adequately to justify its use. At present, the model appears to be used more frequently to describe the potential phases a rehabilitating sports person will progress through, rather than as a predictive tool (Cox, 2002). Whilst the model could potentially contribute some useful insights into constructs and their impact on recovery from injury, confidence is lacking in the model's relevance and robustness for use in the novel environment of Royal Marines' training.

It was also decided that the model was too complex for use at Commando Training Centre. This is because to use the model comprehensively requires the administration, scoring and interpretation of a multitude of psychometric tests. Royal Marines' training is time urgent, where every minute of every day is accounted for in training related activities. In order to conduct studies of the effects of psychological factors on rehabilitation, it was imperative that any assessment procedures were as brief as was compatible with measuring the important constructs validly and reliably.

Similar in complexity to the integrated model of response to sport injury, the biopsychosocial model (Andersen, 2001; Brewer, Andersen & Van Raalte, 2002), also provides a useful framework for investigating the effects of injury and return to sport after an injury and rehabilitation. However, similar to the former, the biopsychosocial model has not been empirically tested and has been developed more for use by practitioners working with injured athletes than for researchers studying injury and recovery. Also, it was considered too complicated and too time-consuming, with too great an emphasis on biological factors to be useful given the logistical circumstances and the psychological basis of the thesis. In summary, several different sports injury rehabilitation theories have been developed but although potentially very relevant, none have been sufficiently tested empirically.

## *4.3 Attitude to Rehabilitation*

When drawing on psychological theory to explain attitude towards rehabilitation, it is important to review the potential of generic theories that have been well validated in a wide range of contexts. A number of the following theories have been tested in the rehabilitation field. Some have not, but research supporting these theories can often be extrapolated to the context of rehabilitation from injury.

### *4.3.1 Theory of reasoned action and planned behaviour*

The theory of reasoned action (Ajzen & Fishbein, 1980), supposes that engaging in a particular behaviour is determined by intentions to partake in the behaviour. The process of forming intentions is determined by two simultaneous cognitive processes. First, attitudes toward the behaviour are formed, and second, social norms and beliefs held by salient others are considered. Where the two are congruent, a person forms an intention to perform the considered behaviour. A weakness in the model was addressed at a later date by Ajzen (1985). The original theory of reasoned action assumed that a person had the necessary ability and resources to carry out a particular behaviour. As this is not always the case, a third element, 'perceived behavioural control' was added to the model, giving rise to the theory of planned behaviour.

The theory of planned behaviour, has been used as a theoretical framework to predict behaviour in many health related studies (Armitage & Connor, 2001), including exercise participation (Norman & Smith, 1995). The theory has also been used to explain adherence to rehabilitation, for example, in two studies of phase II cardiac rehabilitation (Blanchard, Courneya, Rodgers, Daub & Knapik, 2002; Blanchard et al., 2003). The theory of planned behaviour accounted for 23% (2002) and 12% (2003) of the variance in adherence behaviour.

Whilst the theory of reasoned action and the theory of planned behaviour may be useful in explaining some of the variance in behavioural outcome in civilian health settings, it is argued that this model could be of less value when investigating long-term new experiences than other models, such as protection motivation theory. The reason for this is that other models such as protection motivation theory and fear-avoidance theory are more defined and can be used to assess beliefs about the injury as well as beliefs about the rehabilitation. As these theories encompass more of the specific and fundamental issues faced by injured Royal Marine recruits, it is intuitive that they may be more relevant and of more value when explaining injured recruits' attitudes and behaviours.

### *4.3.2 Personal investment theory*

Developed specifically in the sporting context for application with sports performers, personal investment theory (Maehr & Braskamp, 1986), assumes that there are three drives that essentially determine motivation to take a particular course of action in any given situation. These are personal incentives, sense of self, and perceived options. First, personal incentives can be divided into four general categories of task incentives, ego incentives, social incentives and extrinsic rewards. Task incentives refer to the perceived importance of being involved in or mastering a particular task. Ego incentives include competitiveness and power. Social incentives include a sense of belonging, group identity or affiliation. Extrinsic rewards refer to recognition or achievement of a particular status. Second, there is the individual's sense of self. Maehr and Braskamp (1986) argue that the sense of self is fundamentally the individual's collection of thoughts, feelings and beliefs about who they are, their own identity and ability. These include aspects of efficacy in terms of a person's assessment of their own competence or ability at performing a particular task, their assessment of their ability to take responsibility for their own actions, their own personal goals and desired direction and their identity in relation to peers and reference groups. Third, perceived options are described as alternative courses of action available to an individual. For these courses of action to be viable, they must satisfy three requirements: be realistically available; be appropriate in terms of societal acceptability; and they must be of interest or worth the investment to the individual.

Personal investment theory, has been observed to be predictive of intention to exercise (Duda & Tappe, 1989), self-reported exercise behaviour among older adolescents (Tappe, Duda & Menges-Ehrnwald, 1990) and related to achievement motivation in basketball and cross-country athletes (Schilling & Hayashi, 2001). Duda, Smart and Tappe (1989) reported that each dimension of personal investment theory significantly predicted adherence behaviour for sports performers experiencing athletic injury. Athletes who exhibited greater adherence to their treatment regime demonstrated greater treatment efficacy and higher perceived social support, were focused on their goals and highly motivated, and put more importance on mastery and task-involved goals in their chosen sport.

Some elements of personal investment theory are relevant to the environment of Royal Marines' training, however, the model has not been widely applied and tested and many of the elements are already covered in better validated, more appropriate models, described in this chapter. These include commitment (Meyer & Allen, 1987), identity (Eldridge, 1983) and self-efficacy (Bandura, 2003).

### *4.3.3 Self-determination theory*

The fundamental premises of self-determination theory, are that people have an innate need for competence (a feeling of proficiency in conducting a course of action) (Kilpatrick, Hebert & Jacobsen, 2002), autonomy (to maintain a personal locus of control) and relatedness (a sense of belonging and connecting) in everything they do (Ryan & Deci, 2000). Self-determination theory proposes that motivation lies across a continuum with intrinsic motivation (performing an action for the pure enjoyment of it) representing the most self-determined form of motivation, and amotivation (lack of intention) representing the other end of the spectrum (Ryan & Deci). Extrinsic motivation (an action performed for external reward) bridges the continuum between intrinsic motivation and amotivation. Extrinsic motivation is regulated across the continuum, in increasingly self-determined ways. These include externally regulated extrinsic motivation (acting in order to obtain reward or avoid negative consequences such as criticism), introjected regulation (performing an action to avoid anxiety or guilt, or to achieve a feeling of pride), identified regulation (where an action is performed because of the value an individual places on it) and integrated regulation (whereby identified regulations are considered part of the self), with the latter being the most self-determined form of extrinsic motivation. Identified and integrated regulated extrinsic motivations are still considered extrinsic rather than intrinsic, because actions are performed for external reasons (in other words, not purely for the enjoyment associated with performing the action).

Podlog and Eklund (2007) reviewed the general, available literature of Ryan and Deci's (2000) self-determination theory as a potential theoretical framework for researching return to sport following an injury. It was concluded that impending return to sport following an injury may cause an individual competency issues in terms of the fear associated with the possibility of re-injury, lack of certainty in terms of performing at the required standard or the replication of pre-injury performance standards, fear of the inability to live up to personal or external expectations, and competence anxiety caused by a loss of confidence (Podlog & Eklund, 2007). A recent study by Levy, Polman and Borkoles (2008) found that sport injury patients whose physical therapists fostered an autonomy supportive relationship, exhibited better adherence to their rehabilitation. Furthermore, Levy et al. emphasise the importance of empathy in facilitating adherence to rehabilitation through encouragement of autonomy in a sport injury remedial setting, a notion that is supported by previous research (Kim, Kaplowitz & Johnston, 2004; Newton et al., 2000; Silvester, Patterson, Koczwara & Ferguson, 2007; Williams & Deci, 1996, Williams, Gagné, Ryan & Deci, 2002; Zachariae, 2003). For Royal Marine recruits returning to training, their own performance anxiety may well cause problems in terms of their perceived ability and potential performance. That said, competency issues that may be experienced will be potentially moderated by the way the Hunter Company rehabilitation system works (Munnoch, 2004). Injured recruits are not simply returned to training, but undergo extensive physical conditioning and skill training prior to the making of any decision being made. In terms of autonomy issues, Podlog and Eklund (2007) concluded that the main threat to an athlete's autonomy is primarily caused by pressures from external sources such as team mates and coaches. Injured recruits are also likely to experience issues to do with autonomy because of external pressures from remedial instructors, physiotherapists and training teams, who may wish for a recruit to return to training despite his lack of psychological readiness.

One of the most common anecdotally reported negative consequences of injury for a Royal Marine recruit is the isolation felt at being removed from his troop and being placed in a large company of other injured recruits, all experiencing different injuries (chapter 2). This problem is echoed in the sports literature reviewed by Podlog and Eklund (2007) in relation to the relatedness component of self-determination theory. In essence, the lack of interaction with team mates and a sense of alienation experienced during the rehabilitative period make returning to sport harder. In military training, this is coupled with the fact that Marine recruits are unlikely to rejoin the troop they left at the time of injury and therefore have to effectively start again in terms of establishing friendships and cohesion with colleagues in the new troop; the associated sense of alienation makes returning to training even more disheartening (Munnoch, 2004).

Self-determination theory could contribute to the investigation of the psychological consequences of returning to sport for injured sports performers (Podlog & Eklund, 2007), although its application in the sporting context is still speculatory and empirical evidence supporting its use minimal (Podlog & Eklund, 2006; Podlog & Eklund, 2007). Comparisons have been drawn with the potential problems encountered by Royal Marine recruits returning to training from injury and the potential of self-determination theory as a guiding framework have been highlighted. Whilst issues pertaining to autonomy and relatedness may be highly relevant to recruits returning to training, it is argued that issues pertaining to competence may be moderated by the conditioning and training received by rehabilitated recruits prior to their return to training. Thus, it is concluded that although self-determination theory offers a potential guiding framework for the work undertaken in this thesis, the main components encompassed in the model are in fact, also covered by other models (yet to be discussed), which may offer a more comprehensive approach to investigating the psychological aspects of recovery from injury in Royal Marine recruits.

#### *4.3.4 Social cognitive theory and self-efficacy*

Bandura’s (2003) social cognitive theory, explains how behaviour performance is influenced by social cognitions, with self-efficacy forming the central construct to the theory, along with outcome expectancies. The construct of self-efficacy can be defined simply as one’s assessment of one’s own capabilities to effectively conduct a behaviour (Bandura, 2003). Efficacy beliefs can be generalised (I can cope with most events) or specific (I can give up smoking), but the latter tends to be most predictive. Outcome expectancies refer to an individual’s belief that a particular course of action will result in a desired outcome that is of value to them.

It has been proposed that the predictive value of self-efficacy beliefs for health promoting behaviour can also be applied to rehabilitative behaviour (Taylor & May, 1996). There is a large body of research that has investigated the role of self-efficacy in predicting psychological and behavioural responses in health (Bandura, 2003). For example, Rogers et al. (2004) reported that components of social cognitive theory, including self-efficacy, were related to adherence to exercise regimes in breast cancer patients. Studies examining physical rehabilitation using a social cognitive theory framework date back to the 1980s. For example, Klepac, Dowling and Hauge (1982) reported that individuals who exhibit a low self-efficacy for coping with pain may not adhere correctly to rehabilitative treatments in order to reduce subsequent pain experience. Tijou, Yardley, Sedikides and Bizo (2008) found that adherence to simulated rehabilitation sessions was predicted by a combination of social cognitions concerning the costs and benefits of adhering to the prescribed rehabilitation exercises, and aversive feedback (in the form of simulated pain). These findings were confirmed in a second observational study in a clinical setting, which observed that recovery and adherence was predicted by a combination of social cognitions and pain (Tijou et al.).

Koivula, Hassman and Fallby (2002) reported an increase in cognitive anxiety experienced by sports performers with what the authors described as the performance aspects of low self-esteem or, in other words, low self-efficacy. Relating these findings to injury, Thomeé et al. (2007) investigated the role of self-efficacy and amelioration of symptoms in patients undertaking rehabilitation for anterior cruciate ligament injury. Self-efficacy increased as symptoms improved; the biggest changes in self-efficacy (according to age, gender and prior physical activity) were to be found at the beginning of the rehabilitative process, however, initial self-efficacy was not regressed against recovery time.

Milne, Hall and Forwell (2005) reported that measures of self-efficacy predicted adherence, in terms of duration and frequency of exercise, in injured athletes' rehabilitation programmes. Indeed, Milne et al. (2005) reported that self-efficacy appeared to be a key factor in predicting adherence to rehabilitation in injured athletes. Therefore, self-efficacy measures may be useful in the prediction of recovery times, assuming that self-efficacy is directly related to adherence to recruits' prescribed remedial training. Low self-efficacy may also be related to a number of maladaptive biological responses which are out of the direct control of the individual, such as activation of the neuroendocrine catecholamine and opioid systems which can suppress immune function (Bandura, 1991).

From the above discussion, it is evident that self-efficacy may play an important role in recruits adhering to their medical regime and returning to training. If adherence to prescribed treatment is altered by a recruit's maladaptive response due to low self-efficacy (in terms of how he views his own ability), it is likely that this will have a negative effect on a recruit's treatment outcome, as evaluated in terms of recovery time or successful return to training.

### *4.4 Attitudes to Injury and Rehabilitation*

The theories reviewed so far have all focused on attitude to just one aspect of injury and recovery; either attitude to illness and injury or attitude to rehabilitation. The purpose of this section is to review models that encompass the potential influence of attitudes to both injury and also rehabilitation.

#### *4.4.1 Protection motivation theory*

Protection motivation theory was developed from two validated models; social cognitive theory (Bandura, 2003) and the health belief model (Becker, 1974). Protection motivation theory provides a model of how health-related fear inducing information is interpreted and subsequently acted upon (Rogers, 1983). It explains how adaptive and maladaptive modes of coping (Figure 2), come about as a result of two parallel cognitive processes, namely, threat appraisal and coping appraisal (Boer & Seydel, 1996). As in the health belief model, threat appraisal is assessed in terms of an individual's perceived susceptibility to a threat to health and its perceived severity. Coping appraisal includes a cost versus benefit analysis of adopting adaptive as well as maladaptive responses and is a function of treatment efficacy and self-efficacy (Figure 3). Fear is a fundamental component of protection motivation theory (Ho, 2000; Umeh, 2004).

Figure 2

*Model of protection motivation theory (from Floyd, Prentice-Dunn & Rogers, 2000)*

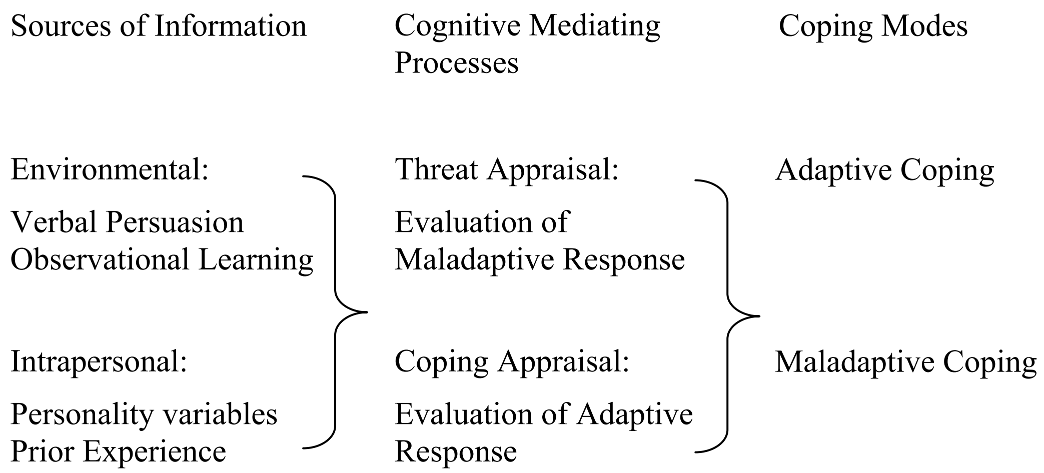
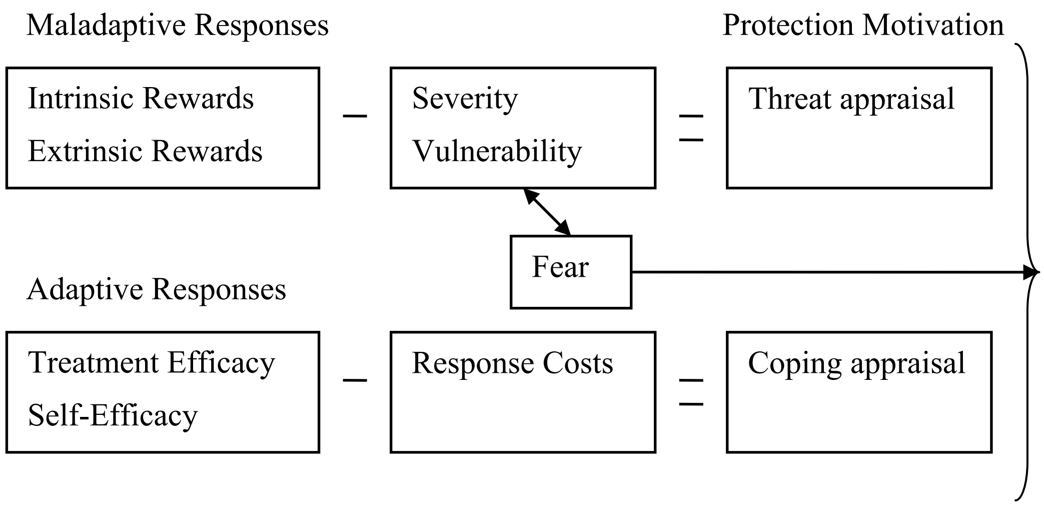



Figure 3

*Cognitive mediating processes of protection motivation theory*

*(from Floyd, Prentice-Dunn & Rogers, 2000)*




Whilst protection motivation theory and the health belief model appear similar in their approach, there are two important differences. First, protection motivation theory is a model originally designed to explain reactions to fear arousing information, as opposed to a general decision-making model as in the case of the health belief model. In the context of Royal Marines' training, it is speculated that it is specifically the fear experienced by injured Royal Marine recruits that can affect their behaviour when it comes to recovery from injury and returning to training. Second, the efficacy judgements encompassed in protection motivation theory are more defined and explicit than those laid out in the health belief model. Much of the empirical work testing the model has been based on a randomised control trial design, providing a strong test of the models (as reported in the following two meta analyses by Floyd, Prentice-Dunn & Rogers, 2000 and Webb & Sheeran, 2006).

Protection motivation theory has principally been used to explain preventative health behaviours (Brouwers & Sorrentino, 1993; Rippetoe & Rogers, 1987; Sturges & Rogers, 1996). In relation to physical exercise, Plotnikoff and Higginbotham (2002) observed that elements of protection motivation theory were significantly associated with exercise behaviour change for the prevention of coronary heart disease. Courneya and Hellsten (2001) found protection motivation theory to be a useful framework for investigating the effect of cancer prevention as a motivator of exercise. As well as explaining preventative health behaviours, protection motivation theory has also been used to predict adherence to rehabilitation or medical regimens. Two studies found protection motivation theory to be predictive of parents' compliance in the context of children who had to wear eye patches for amblyopia (Norman, Searle, Harrad & Vedhara, 2003; Searle, Vedhara, Norman, Frost & Harrad, 2000). Bennet, Rowe and Katz (1998) reported that 22% of the variance in adherence to corticosteroid use in asthmatics was explained by two elements of the protection motivation theory.

A meta-analysis of empirical research identified and evaluated the findings of sixty five studies using protection motivation theory as a guiding framework (Floyd et al., 2000). Of these, seventeen percent (eleven studies) focused on adherence to medical regimens, diet, exercise and healthy living. These areas were considered to be of most theoretical interest to the work presented in this thesis. The meta-analysis identified stronger relationships between coping variables and remedial behaviour than studies investigating the prediction of preventative behaviour, as was the model's original intention (Rogers, 1983). Further analysis of protection motivation theory components by Milne, Orbell & Sheeran (2002) found that protection motivation theory combined with volitional interventions had a large effect on exercise behaviour in a study intended to increase exercise behaviour that was included in the analysis. The potential of protection motivation theory to explain rehabilitation adherence and associated behaviours was echoed in a review article by Grindley and Zizzi (2005). Whilst the primary interest of their work was adherence to prescribed physical rehabilitation in older people, Grindley and Zizzi reviewed the potential use of protection motivation theory as a framework in physical rehabilitation studies, most of which have been conducted in a sporting context, with participants similar in demographics to the current population of Royal Marine recruits. They examined available data and literature that explored individual constructs reported to contribute to protection motivation theory (for example, self-efficacy research and studies of coping strategies, and combined them to form an overall framework explaining motivation and adherence behaviours). It was concluded that protection motivation theory is a viable framework to help researchers understand rehabilitation adherence.

Most relevant to this thesis, Taylor and May (1996) proposed that protection motivation theory could be applied to the prediction of compliance with sport's injury rehabilitation. To explore this hypothesis, the Sports Injury Rehabilitation Beliefs Survey (SIRBS) was developed, which measured components of protection motivation theory in the context of rehabilitation (Taylor & May, 1993). The SIRBS measures two fundamental components of protection motivation theory as self-efficacy and treatment efficacy. There is also one item that measures rehabilitation value, which refers to the value an individual places on an expected outcome. As well as elements of social cognitive theory (the coping strand of protection motivation theory), the SIRBS also assesses the other main process in protection motivation theory and the health belief model; threat appraisal in terms of susceptibility and severity. Taylor and May (1993) applied their measure in a study that examined compliance with rehabilitation for sport injury and found all five constructs measured by the SIRBS as being predictive of adherence. A follow-up study by Brewer et al. (2003) identified self-efficacy, treatment efficacy, perceived severity and susceptibility to future difficulty as being predictive of adherence to sport injury rehabilitation. Brewer et al. agreed with the sentiments voiced in the meta-analysis conducted by Milne et al. (2002), which posited protection motivation theory as being a viable framework for understanding and exploring injured individuals' rehabilitation activities.

Finally, the use of protection motivation theory as a guiding framework for this thesis was further supported by Webb and Sheeran's (2006) meta-analysis that examined effect sizes generated by different theoretically based interventions. Protection motivation theory interventions on behaviour, as well as intentions, exceeded the effect size of any other theoretically based intervention including the theory of planned behaviour, the health belief model, stage models and social cognitive theory. Furthermore, it has been reported that athletes can use self-efficacy techniques based on the tenets of social cognitive theory to reduce their fear of injury (Chase, Magyar & Drake, 2005). Knowing that protection motivation theory based interventions are some of the most effective supports its use as a guiding framework at the investigative stage (Webb & Sheeran, 2006).

In terms of Royal Marine recruits, it is proposed that reluctance to rejoin training may be a maladaptive coping strategy adopted due to their experience of pain during injury and the perceived potential for that pain to return once rehabilitated. Injured recruits are arguably bombarded with implicit fear arousing messages regarding the severity of their injury and vulnerability from their remedial instructors, their physiotherapy team and fellow recruits, as well as from themselves. Relating Royal Marine recruits' experiences to the constructs measured in the SIRBS, beliefs indicative of severity could include "It'll take a long time to recover", beliefs indicative of vulnerability could include "I'll get injured again", beliefs indicative of low self-efficacy could include "I can't do this rehabilitation exercise" and beliefs indicative of treatment efficacy could include "This rehabilitation is not going to work". Fear at the prospect of using the rehabilitated limb and the potential to be re-injured, or experience further pain, might become a driving force behind a recruit's decision regarding whether he is strong enough to face the challenges of mainstream training, and may contribute to the recruit's response costs evaluation in the coping appraisal process. The threat appraisal process of the model refers to their perceived susceptibility to injury, which could result in an inability to rehabilitate, to recover and to complete Royal Marines' training. This will be discussed later in this subsection in relation to the work of Taylor and May (1996).

These considerations support the use of protection motivation theory as a guiding framework for rehabilitation adherence and subsequent behaviour in Royal Marines' training. In this population the key issue is adherence to prescribed rehabilitation regimens and return to training. Protection motivation theory was therefore selected as an appropriate framework to guide this area of work and to inform the choice of measures applied in the studies.

### *4.4.2 Fear-avoidance and Pain*

Fear-avoidance is a theory that may explain an individual's reluctance to return to activity even when the physical symptoms of an injury have seemingly resolved (Leeuw et al., 2007; Lethem, Slade, Troup & Bentley, 1983; Vlaeyen & Crombez, 1999, Vlaeyen & Linton, 2000; Waddell, Newton, Henderson, Somerville & Main, 1993). The theory was developed from the observed relationship between injured individuals' interpretations of pain, perceptions of physical remedial exercises, perceived progress through rehabilitation and their subsequent behaviour. There is a large body of literature pertaining to the empirical testing of this theory. Gatchel, Bo Peng, Peters, Fuchs and Turk's (2007) recent comprehensive review of the effects of chronic pain from a biopsychosocial perspective describes the exacerbating impact of pain on fear, affect, depression, anger, anxiety, perceived vulnerability, perceived control and self-efficacy, catastrophising and pain appraisal.

More recently, Thomas and France (2007) reported that fear of pain delayed the recovery of individuals with low back pain due to maladaptive avoidance behaviour, and they reiterated the importance of measuring pain-related fear in terms of assessing its promotional or delaying effects when it comes to recovery times.

McCracken, Gross, Sorg and Edmands (1993) observed that individuals' anxiety levels were directly related to a fear of pain and that this had an effect on their avoidance of motion in order to maintain reduced perceived pain levels. The expected severity of pain was correlated with fear of pain, and was associated with unnecessary reductions in motion hindering rehabilitation progression. This reduction in motion resulted in lower perceived pain, thus confirming their hypothesis that the pain would have been worse had movement not been adjusted. However, it is possible that individuals overestimated the severity of movement-induced pain, and thus over-restricted their motion.

As established in chapter 2, the median recovery time for physical injuries endured during basic training was 14.3 weeks. This means that the pain and disability associated by the majority of injured recruits could be considered more acute than it is chronic, but that a number of recruits may be in the transitional period between acute and chronic disability. The relationship between chronicity and successful completion of rehabilitation and return to training is explored later in this thesis, in chapter 8 but it is therefore important to review here some of the recent literature that focuses on the transition from acute and subacute pain and disability to chronicity. This is in order to evaluate which psychological factors are catalysts and which are most influential in an individual developing chronic pain and disability.

Burton and Waddell (2004) identified a range of individual, socioeconomic, physical environmental and psychosocial risk factors that might predispose an individual to back pain in the first instance. They continue by describing physical and psychosocial risk factors (known as yellow flags, Kendall, 1999) known to be predictive of chronic back pain and disability. These include maladaptive interpretation of the meaning of pain, fear-avoidance behaviour, tendency to depressed mood, and maladaptive treatment expectation. Linton et al. (2005) reviewed available literature on the prognosis of disability in an occupational setting, the findings of which echoed the back pain risk factors identified by Burton and Waddell. Linton et al. emphasised the multidimensional nature of chronicity prediction by listing a number of predictive demographic (age, gender, smoking behaviour), medical (radiating pain, images, history of back pain), physical (heavy work), occupational (job satisfaction), social (social support, financial status), psychological variables (depression, fear-avoidance beliefs) and system factors (insurance available, legal claims) that have been investigated with the aim of explaining variance in chronic disability outcomes. Linton et al. continue by describing how some factors associated with the transition to chronic pain and disability have been combined into comprehensive explanatory models such as the biopsychosocial model (Turk & Gatchel, 2002; Turk, 1996). Others have been combined to form screening tools to identify individuals at higher risk of chronic pain and functional impairment (such as those developed and tested by Boersma & Linton, 2005; Feuerstein, Huang, Haufler & Miller, 2000; Hurley, Dusoir, McDonough, Moore & Baxter, 2001) although their accuracy in support of clinical application is still questionable. Interestingly, reviews of studies included in Linton at al.'s paper reveal only a very small correlation, if indeed any correlation at all, between injury severity and reported pain intensity. This is of particular relevance to the current context, given the difficulties in accurately measuring and controlling for injury severity in Royal Marines' recruit training. Indeed, the lack of relationship between injury severity and pain in the literature strengthens the argument that psychological factors play an important role in pain perception and interpretation.

Shifting the focus from general review papers, specific empirical examples of studies investigating the transition from acute to chronic disability are now discussed. Boersma and Linton (2005[a]) studied the relationship between psychological factors and chronicity. They postulated that whilst fear-avoidance theory clearly explains why some individuals' initial interpretations of pain and disability might exacerbate their physical and behavioural symptoms, at what time point in the acute to chronic transition fear-avoidance variables become prominent is far more ambiguous. They studied patients with back pain sufficiently interruptive of daily activities that it had resulted in at least one sick day off in the last year. The sample was divided into three different stages of chronicity (less than one year, one to three years and over three years). Boersma and Linton found that different psychological variables were more prominently related to function according to what stage of chronicity the participants had reached. They reported that only pain intensity was related to function in participants who had experienced less than a year of back pain. That said, this group may have included both acute and chronic pain patients, as well as patients in transition between the two. For participants who had experienced 1-3 years of back pain, pain intensity, gender and fear of movement were related to function. In the final regression with participants having experienced pain for over 3 years, pain intensity, gender, depression and fear of movement were significantly related to function. This study suggests that different psychological variables may be related to functional outcome at different stages of chronicity. This is important to consider in the current context, as the recovery time for injured Royal Marine recruits spans from a few weeks to over two years.

Boersma and Linton (2005[b]) continued their research into predictors of chronicity by investigating the application of a screening tool aimed at identifying sub-populations more at risk of chronic disability. They asked patients experiencing acute/subacute non-specific back or neck pain who were seeking treatment to complete the Örebro Muskuloskeletal Pain Screening Questionnaire (Linton & Halldén, 1998). They then related baseline data on pain intensity, fear-avoidance beliefs, function and mood to outcome measures obtained a year later. The results indicated four discrete cluster profiles of individuals ranging in risk of propensity to develop chronic disability. The profile for the highest risk group (62% of whom developed chronic pain-related disability) were characterised by high fear-avoidance beliefs, greater pain intensity, reduced function and depressed mood. The low-risk group (almost none of whom were on sick leave at time 2) were characterised by low fear-avoidance beliefs, lower pain intensity, normal functioning and normal mood. In the context of the current research programme, it seems plausible that some of these variables might also be predictive of future pain and chronic disability, and therefore non-completion of rehabilitation, in injured Royal Marine recruit.

Interestingly, there appears to be some discrepancy between these two papers in the role of fear-avoidance. The cross-sectional study suggests that pain was the most influential factor in patients suffering pain and disability for less than a year. Yet the prospective study suggests that fear-avoidance was a predictor of chronicity. A similar theme is reported by Pincus, Burton, Vogel and Field (2002) in their systematic review of predictors of chronicity and disability. Their review revealed depressed mood, distress and somatisation to be the best predictors of chronicity. The role of fear-avoidance was also questioned, as it was not found to predict outcome independently of other psychological variables. Despite this, Pincus et al. (2002) reported methodologically robust studies that found manipulation of fear-avoidance beliefs through intervention as having a positive influence on outcome. Pincus et al. also argue that difficulties in reviewing empirical evidence include confounding information such as different outcome measures and different clinical environments. As such, an advantage of studying the role of fear-avoidance and pain in injured Royal Marine recruits is that they operate in a very controlled, well-defined environment.

It is therefore argued that fear of pain can influence physical behaviour as well as the perception of pain and that ongoing avoidance behaviour can manifest itself potentially as chronic pain in injured Royal Marine recruits. Waddell, Newton, Henderson, Somerville and Main (1993) found that fear of pain was a better predictor of pain chronicity and avoidance behaviour than biological indicators of pain, which suggests that psychological factors may be more predictive of disability than medical measures.

Whilst research in the area of chronic pain affords an insight into the potential fear-avoidance related obstacles that may be experienced by injured Royal Marine recruits, it is important to note that not all chronic pain has the same avoidant behavioural outcomes. For example, most sufferers of chronic headache are not incapacitated by their pain experiences, whereas chronic back pain sufferers spend up to 30% of their daytime lying down because of the pain (Follick, Ahern, Laser-Wolfton, Adams & Malloy, 1985). Follick et al. speculated that this is possibly because headache sufferers do not relate activity to worsened symptoms, whereas chronic back pain sufferers do.

Applying fear-avoidance theory to Royal Marine recruits, it could be hypothesised that a reluctance to rejoin mainstream training may be an avoidance coping strategy adopted arising from experiences of pain during injury. Fear of the prospect of using the rehabilitated limb and becoming re-injured, or experiencing further pain, then becomes the driving force behind recruits' decisions concerning rejoining mainstream training or alternatively leaving the Corps.

The mechanisms underlying how interpretation of pain may impact on attitudes and beliefs have been debated over the years (Asmundson, Norton & Jacobsen, 1996, Asmundson, Norton & Norton, 1999; Craig & Hadjistavropoulos, 2004; Eccleston, 1999; Melzack, 1995; Melzack, 2001; Sharp, 2001). Fordyce, Shelton and Dundore (1982) suggested that sustained or chronic pain related behaviour may manifest itself as a result of avoidance learning. As well as the obvious rewards of avoiding returning to activity, such as the maintenance of a reduction in perceived pain, theorists suggest avoidance behaviour may also result in social rewards (Asmundson, Norton & Jacobsen). The avoidance of a particular behaviour in the social context may reward an individual if their social anxiety decreases as a result of the decrease in social responsibility achieved through avoidance (Asmundson, Norton & Jacobsen).

Informal focus group discussions undertaken with recruits, physiotherapists and remedial instructors at the Commando Training Centre were in general agreement that fear-avoidance could explain the reluctance of some physically able recruits to re-join training at the earliest opportunity. Likewise, the avoidance of rejoining training and the potential reduction in social anxiety (reward) may reinforce this maladaptive behaviour through the mechanisms of operant conditioning, resulting in a vicious circle and apparent chronicity of the injury. Moreover, once in Hunter Company, a recruit may find the experience socially rewarding, in that he knows the Company, the staff and the routine, and is 'comfortable' with this new social situation. The thought of leaving this familiar environment may be undesirable and exacerbated by previous experiences of being forced into leaving mainstream training in the first place. Interestingly, remedial and physiotherapy staff describe many injured recruits exhibiting unexplained chronicity as being ‘in their comfort zone’.

This observation is congruent with the fundamental premises of fear-avoidance theory, in that activity is avoided due to fear of negative consequences of the activity (Vlaeyen & Linton, 2000). Examples of negative consequences include: embarrassment in front of their new troop and training team through poor performance; fear of joining a new troop due to rumours regarding the strictness of the new training team and being the outsider when the rest of the troop and training team have had time to bond and work as a cohesive unit, such that a new member of a troop may find it difficult to be included. There are also potentially negative physical consequences of rejoining training, such as re-injury, further pain, or even just the general hardship and discomfort associated with Royal Marines’ training including fatigue, poor health, stress, depression, anxiety and frustration.

It is not just the experience of direct pain that exacerbates people’s avoidance behaviours. For example, Philips and Jahanshahi (1986) observed that the avoidance social situations by chronic headache sufferers accounted for over 21% of a total variance in avoidance behaviours of 43%. Similar findings were reported in later studies (Asmundson, Norton & Jacobson, 1996; Vlaeyen, Kole-Snijders, Boeren & van Eek, 1995). Furthermore, Asmundson et al. found that the avoidance behaviours displayed by chronic musculoskeletal pain sufferers satisfied the DSM-IV (American Psychiatric Association, 1994) criteria for a diagnosed social phobia.

Coupled with this ‘social phobia’ is the potential for exacerbation or mediation of pain by sufferers’ affective and behavioural responses. Two theories explaining differing pain intensity experienced by sufferers are those of selective attention and distraction (Asmundson, Norton and Norton, 1999; Leeuw et al., 2007; Vlaeyen & Linton, 2000). The selective attention theory explains enhanced pain sensitivity in terms of how an individual allocates selective attentional resources; if attention is focused on the pain instead of a current task, the pain sensation experienced would be greater than if the individual’s attention was focused solely on the task (Eccleston

& Crombez, 1999). The distraction theory explores the opposite implication of the attention theory; chronic pain sufferers can reduce the levels of pain experienced by distracting their concentration away from the pain and onto other tasks (Eccleston, 1995). Speed and reaction time tests have demonstrated that the response times to stimuli presented to a chronic pain sufferer reporting a high level of perceived pain are slower than those of someone reportedly suffering from lower levels of pain (Crombez, Eccleston, Baeyens & Eelen, 1996). Asmundson et al. (1999) argued that it is the division of selective attention between the task and the pain signals that is responsible for the reduction in reaction time. Therefore, the attentional resources one directs toward the symptoms of pain could actually exacerbate the perceived pain levels. An alternative explanation for this phenomenon is that those perceiving lower levels of pain during the task were in fact directing more of their attentional resources on the task, which in turn was distracting them from the pain and not allowing pain stimuli to be processed to the same extent.

The relationship between perceived pain and psychological constructs other than fear-avoidance is also well documented; these include negative affectivity and social support (Gheldof, Vinck, Vlaeyen, Hidding & Crombez, 2007), depression (Alizadehkhaiyat, Fisher, Kemp & Frostick, 2007; Hill, Lewis, Sim, Hay & Dziedzic, 2007; Woby, Roach, Urmston & Watson, 2007), anxiety and neuroticism (Asghari & Nicholas, 2006), catastrophising and treatment expectations (Hill, Lewis, Sim, Hay & Dziedzic, 2007). Outcome measures other than just disability have been used in pain research. As well as disability as an outcome measure, Keeley, Creed, Tomenson, Todd, Borglin and Dickens (2007) found fear-avoidance beliefs combined with depression and anxiety as predicting health-related quality of life and number of contacts made with healthcare organisations. Of particular note is the literature relating higher levels of self-efficacy to lower perceptions of pain. Woby, Urmston and Watson (2007) researched the role of self-efficacy as a mediator of the relationship between perceived pain and other variables and proposed a model that suggests that high levels of self-efficacy negate the negative consequences of other influential psychological variables such as fear-avoidance, thereby moderating the relationship between the two. They also found that the variance shared between self-efficacy and fear-avoidance was only 16%, which suggests that the constructs are different and serves to highlight the importance of measuring self-efficacy as well as fear-avoidance and pain. These findings have been echoed in other studies (for example Denison, Åsenlöf & Lindberg, 2004; Miró, Nieto & Huguet, 2008). Despite the support for self-efficacy and fear-avoidance as being two, discrete constructs, there is also evidence that there is a degree of overlap between them. Ayre and Tyson (2001) investigated the roles of self-efficacy and fear-avoidance in the prediction of disability behaviour. They found that fear-avoidance only accounted for 3% of the variance in disability after controlling for self-efficacy (which accounted for 21% of the variance).

As well as being related to other psychological constructs, the role of perceived pain in directly influencing behaviour in injured individuals is also well documented. For example Kongsted et al. (2008) found perceived pain recorded at Time 1 was associated with physical avoidance behaviours such as restricting mobility. In turn, unnecessary restricted mobility in back pain sufferers has been found to exacerbate the pain experienced through rehabilitation and trying to increase mobility, therefore prolonging rehabilitation as a 'vicious circle' (Prkachin, Schultz & Hughes, 2007).

Some studies have highlighted the importance of other potential confounders that could influence the effect of pain on disability. For example, pain patients may be under financial pressure to return to work as soon as possible, whereas others may be the recipients of compensation payments, disability allowances and sick pay (Crook, Milner, Schultz & Stringer, 2002; Landers et al., 2007; Margison & Landers, 2007; Waddell, Aylward & Sawney, 2002). In the case of Royal Marine recruits, they continue to receive wages regardless of whether they are in mainstream training or in rehabilitation. Indeed, physical injury has become such a common occurrence that time spent in rehabilitation is viewed by management as part of mainstream training, and not as a separate event. Therefore, recruits arguably have a financial incentive to remain in training and complete their rehabilitation regardless of how long it takes, or face failing their rehabilitation, losing their job and losing their income.

Studies have shown that there is clearly a relationship between perceived pain and psychological factors influencing rehabilitation and recovery. Therefore it is arguable that perceived pain might be a useful variable to include in the investigation of injury and rehabilitation in Royal Marines' recruit training. Whilst the constructs of pain and fear-avoidance are closely related, it is argued that perceived pain is a discrete variable with predictive potential, but is also complementary to fear-avoidance. In terms of its use in the current context and in particular how it might contribute to future interventions in military rehabilitation, studies have shown pain reduction interventions to be very effective. For example, Sullivan and Stanish (2003) applied a pain-disability prevention programme to assist low back pain sufferers, which was so successful that it resulted in 60% either intending to return to work, or actually returning to work. If pain were found to be contributory to lengthened recovery time or failed rehabilitation, the development and implementation of a pain reduction intervention could be potentially beneficial in returning injured recruits to training, or assisting them in completing their rehabilitation course. Furthermore, an exploratory examination of the role of pain in rehabilitation outcome may begin to address the requirement for more prospective studies (Main & Williams, 2002).

### *4.5 Conclusions from this Review*

Due to its elite fighting force status, Royal Marines' training is physically and mentally challenging (Hardy et al., 2000). As a consequence, a large number of recruits become injured during training and are removed from their troop, training team and comrades and placed in a rehabilitative company (chapter 2). This has anecdotally been reported as having a deleterious effect on many injured recruits' level of motivation, which may in turn affect their recovery, since this cannot be explained entirely by physical factors (chapter 2). To further investigate the attitudinal and behavioural predictors of the outcomes of recovery time and return to training, it was first necessary to examine existing theory and its potential applicability to recovery and rehabilitation.

Chapter 3 began with a preface that considered current theory on adherence to rehabilitation. Personality was considered influential on an individual's decision making process and behaviour, but was an inappropriate focus. The focus of the research presented in this thesis was to identify modifiable constructs to inform the Commando Training Centre in the best practice treatment of injured Royal Marine recruits. Whilst personality may prove useful in recruitment exercises, it is less useful in an environment such as Royal Marines' training where the recruits have already been selected and undertaken a certain amount of training prior to becoming injured. An introduction and rationale for how the literature was selected followed. Information was drawn from health psychology, occupational psychology and sport psychology. The main areas of interest were outlined. These were attitude to the military, attitude to injury and illness, and attitude to rehabilitation. Attitude to the military was reviewed in chapter 3 and attitude to injury, illness and rehabilitation were reviewed in chapter 4.

Under each of these subheadings, first, potentially relevant theories and models were described. Second, the empirical evidence for each of the models was considered, including evidence pertaining specifically to physical injury and rehabilitation. Third, conclusions were drawn with reference to the model or theory's applicability and suitability for the military context of this research.

This review initially addressed attitudes to the military in chapter 3, and examined the literature on commitment. In particular, the three component model of commitment (Meyer & Allen, 1987) was outlined and the merits of the three elements that contribute to overall commitment to an organisation were highlighted. Empirical evidence in support for the three component model of commitment was abundant and the quality of research was good. Although it has not been applied in the context of military training, its generic applicability as well as its specific relevance to injured Royal Marine recruits' attitude to the military was clear. Burnout theory (Silva, 1990; Smith, 1986) from the sports psychology literature was described in brief and examined as supplementary to the general discussion on commitment and parallels were also drawn between commitment and burnout. Models of burnout were clearly relevant as that they were developed on a sporting population and Royal Marines' training is physically arduous. However, the empirical evidence available supporting the models was minimal and therefore too great a risk to rely on to explain outcome in recruits' rehabilitation outcomes. Athletic identity (Eldridge, 1983) was explored in relation to commitment, with an emphasis on how an individual's identity can impact on behaviour in the sporting context. Although empirical work generally supported the notion that a greater athletic identity is related to improved performance (Werther & Orlick, 1986), further research is needed to examine the role of athletic identity in sports performers' responses to injury and adherence to rehabilitation. At present empirical studies are few and results are inconclusive. The theory underpinning commitment, burnout and athletic identity was extrapolated to the environment of Royal Marines' training to establish whether the constructs may be relevant to this social context and to identify whether they have been observed and reported anecdotally. As a result, commitment was identified as a possibly important construct. Athletic identity also appeared to be a potentially relevant construct; whilst it is currently unclear how a Royal Marine recruit's identity may impact on his performance in training and possible adherence to rehabilitation, it could be important to examine its role in injury rehabilitation in order that future interventions are correctly designed and specifically targeted. Chapter 3 concluded with a summary of the support and relevance of models of commitment, burnout and athletic identity.

Chapter 4 began with an opening preface which aimed to remind the reader of the purpose of the previous and current chapters. The review then went on to consider individuals' attitudes to injury and illness. The common sense model of illness representations (Leventhal et al., 1980) was introduced, which revealed that the ill or injured individuals' mental representations of their illness or injury and its identity, shaped their subsequent behaviour. However, there was overlap between the constructs encompassed in the common sense model of illness representations, and other theoretical frameworks (in terms of the individual's appraisal of the injury) that measured elements of peoples' understanding of their illness or injury, as well as other social factors (such as self-efficacy and treatment efficacy) as contributory to protection motivation theory (Rogers, 1983). The section continued with a description and consideration of the stage model of the return to sport (Taylor &

Taylor, 1997), the integrated model of response to sport injury (Wiese-Bjornstal et al., 1998) and the biopsychosocial model (Andersen, 2001; Brewer et al., 2002). Whilst the integrated model of response to sport injury has its merits, it was not selected for two reasons. First, there was a dearth of empirical evidence in support of it and, second, the logistics of measuring the number of constructs required to effectively model the theory were impractical in the Royal Marines' setting due to time constraints. Furthermore, additional constructs encompassed in other theoretical frameworks may be more relevant and of more practical use in the future with injured recruits, such as those encompassed in protection motivation theory and fear-avoidance theory, as their components are workable and are of practical use in such an applied setting as Royal Marine recruit training.

Generic theories potentially relevant to understanding Royal Marine recruit injury and successful return to mainstream training were considered. The theory of reasoned action and theory of planned behaviour (Ajzen & Fishbein, 1980; Ajzen, 1985) were introduced, and evidence of their predictive value was explored. Whilst the theory yields some predictive power in terms of behaviour, these successes were largely based on self-reported behavioural outcome (Webb & Sheeran, 2006). These theories were not selected as frameworks for this thesis because other, more relevant theories were available that seem to address constructs more specific to the context in question. Personal investment theory (Maehr & Braskamp, 1986) was similarly disregarded as a potential framework for this thesis as there is presently minimal empirical support. Self-determination theory was reviewed in terms of its potential contribution, but in this instance most of this theory's components were encompassed in other, more applicable models. Bandura's (2003) social cognitive theory and in particular self-efficacy were examined. The literature provided evidence of the well validated and researched status of the theory. When coupled with anecdotal evidence from the physiotherapists from Hunter Company that suggested the frequent witnessing of self-doubting behaviour from injured recruits in themselves and the efficacy of the treatment, the efficacy components of social cognitive theory were concluded to be an essential part of further studies in this thesis.

Finally, two well documented theories were highlighted and investigated in terms of their appropriateness to form the main framework which would guide this thesis. Protection motivation theory (Rogers, 1983) was discussed, with particular emphasis on its application to predict behaviour in the field of exercise and rehabilitation. As the theory was originally developed from the very well validated social cognitive theory and the health belief model, there was little concern over applying the theory to the new context of military training and physical injury. Its relevance to the current context was clear and empirical research available supported its use as a guiding theoretical framework. Likewise, fear-avoidance theory (Asmundson et al., 1999) was outlined and examined, and some interesting elements were discussed. For example, the social component of fear-avoidance, whereby a recruit may not wish to return to training, was discussed as a possible contributor to the elongated recovery time experienced by some 'chronically' injured recruits. As well as considering fear-avoidance and pain as related constructs, attention was also paid to perceived pain as a potentially influential psychological factor in itself. Given that fear is a fundamental component contributing to the cognitive mediating processes in protection motivation theory and that the interpretation of pain is fundamental in the formation of fear-avoidance beliefs, it was clear that pain and fear-avoidance would compliment the approach taken to the research detailed in this thesis.

### *4.5.1 Selected theories*

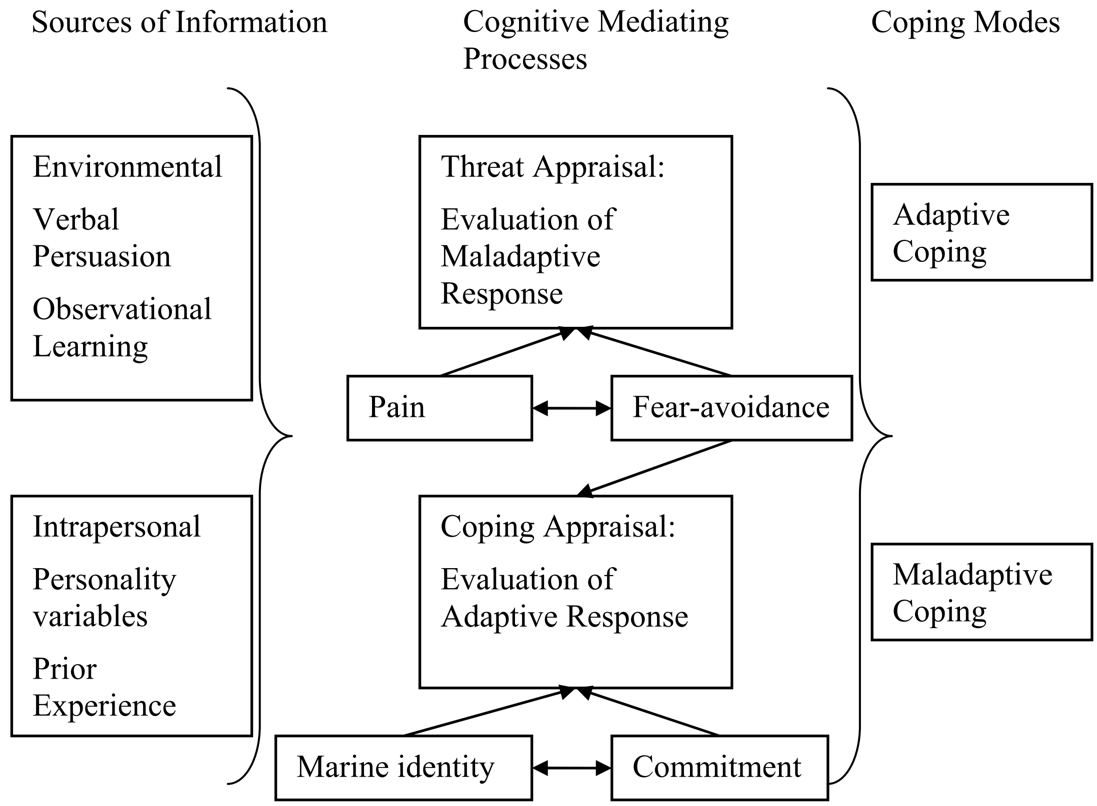
It has been argued that protection motivation theory and fear-avoidance theory are the unifying theoretical frameworks that encompass the most potentially important and influential aspects of recruits' experiences of recovery from injury in Royal Marines' training. Therefore, protection motivation theory should be the guiding theoretical framework for this thesis, with particular emphasis on fear-avoidance and efficacy related issues. As such, tools that measure the fundamental constructs informing both fear-avoidance and protection motivation theory were selected and adapted to explore how these elements impacted on an injured recruit's attitudes toward pain, injury, rehabilitation and subsequent return to training. Athletic identity and commitment have also been identified as potentially influential constructs in the behavioural responses of injured Royal Marine recruits. Athletic identity has been measured in athletes from varied backgrounds with mixed results; the existence of a relationship is clear, although the direction of the relationship is not. In this case, athletic identity will be adapted to measure identity as a Royal Marine recruit. The Corps considers one of the fundamental premises behind successful outcome to be the strong image of the Green Beret and all that it represents. Likewise, a commitment test was adapted for specific use with the Royal Marines to measure their reported commitment to the Corps.

### *4.5.2 Comparison of selected theories*

Overlaps between protection motivation theory, fear-avoidance theory and the other constructs (described below) applied in the context of this thesis are supplementary rather than duplicitous (Figure 4). Before investigating the other frameworks detailed in this thesis, it is first necessary to focus on protection motivation theory in the context of rehabilitation and injury, and particularly the measurement of its components using the Sport Injury Rehabilitation Beliefs Scale (SIRBS, Taylor & May, 1996). The SIRBS consists of five subscales that measure attitudes important in protection motivation theory. These consist of the perceived severity of the injury, susceptibility to future difficulty, rehabilitation value, treatment efficacy and self-efficacy.

Figure 4

*Model of protection motivation theory (adapted from Floyd, Prentice-Dunn & Rogers, 2000) incorporating commitment, athletic identity, fear-avoidance and pain*




Whilst the components of the threat appraisal and the coping appraisal processes are largely covered by the subscales of the SIRBS, the additional element of fear is not. Coupling the SIRBS with a measure of fear-avoidance enhances the model and covers a more complete array of constructs that may inform an injured recruit's behavioural outcomes. Likewise, this review has highlighted the potential importance of identity in Royal Marines' training and the Corps, and affective, normative and continuance commitment in the rehabilitation process. Therefore the addition of tests that measure athletic identity and commitment could provide relevant information contributing to a more comprehensive understanding of the effect recruits' attitudes may have on their rehabilitation outcome. In particular, such attitudes may be key to more fully assessing recruits' evaluation of the intrinsic and extrinsic reward elements of protection motivation theory; constructs which at present are not measured by the SIRBS.

As extrapolated from research into the construct of fear-avoidance (Boersma & Linton, 2006; George, Fritz & McNeil, 2006), pain experienced by an injured recruit may confound or moderate the results of other measures, as it is likely that pain may influence a recruit's attitudes as measured by the scales to be applied in this thesis. The SIRBS does not measure pain (Taylor & May, 1996). To examine any moderating or confounding effects on pain, it is proposed that a baseline measure of pain be taken on entry to Hunter Company.

Relating these measures, once again, to the overarching framework of protection motivation theory, it can be seen that the proposed extension complements and supplements the main assumptions of the theory.

### *4.5.3 Overall conclusions*

In conclusion, the unifying frameworks of protection motivation theory and fear-avoidance theory, combined with measures of affective, normative and continuance commitment, athletic identity and pain will be applied to investigate the role of attitudes in the rehabilitation, recovery and return to training of injured Royal Marine recruits.

# Chapter 5
# Implicit and Explicit Measures of Attitude

## *5.1 Introduction*

In order to evaluate psychological constructs with a view to examining their relationship with another variable, or to develop and implement an appropriate intervention, the construct must first be measured. Traditional psychological instruments designed to measure beliefs and perceptions have involved a variety of techniques (e.g. Likert scales, Thurstone scales, or semantic differentials) as well as semi-structured interviews (Hicks, 2004). Despite the abundance of measures available, most attitude measures take the form of self-report instruments. Although not without psychometric merit, these instruments have limitations (Coolican, 1996). Common peculiarities of response (i.e., *response sets*) include social desirability bias (responding to please an administrator) and acquiescence bias (affirming the statement asked) (Kiesler, Weisb & Drasgow, 1999).

Scientists working in the field of social psychology have pioneered indirect methods of attitude assessment less vulnerable to the response biases that typically compromise self-report measures. Many of these *implicit measures* are run on computers and involve measuring reaction times to presented stimuli (Farnham, Greenwald & Banaji, 1999). Some, such as the Implicit Association Test (IAT), are designed to assess respondents' automatic positive or negative associations to stimuli such as words and pictures (Bargh, Chaiken, Govender & Pratto, 1992). Others, such as the Timed Antagonistic Response Alethiometer (TARA), are designed to assess whether respondents are telling the truth or lying. The IAT has the capacity to indicate whether respondents have a fundamental liking of or dislike for particular things, which might not correspond to what they explicitly claim, while the TARA has the capacity to indicate whether respondents are reluctant to admit particular beliefs (Greenwald, McGhee & Schwarz, 1998).

The present research intends to explain some of the variance in Royal Marine recruits' recovery times from physical injuries incurred during the arduous training course. However, recruits may not be forthcoming with their true thoughts and beliefs due to the autocratic nature of training, as is necessitated by the military. It is likely that many may respond to attitude probing questions in a socially desirable way to avoid appearing weak, and to avoid receiving any associated retribution from peers or training teams. The development of IATs to measure constructs that are potentially instrumental in the successful completion of Royal Marines' training could be of benefit over and above insight offered by traditional, explicit measures.

This chapter aims to describe two methods of attitude measurement that use respondents' latent reaction times in computer-based stimuli categorisation tasks, namely, the IAT and the TARA. A further aim is to explore existing general application of IATs, their psychometric properties, and specific applications within the field of health psychology. An outline of intended applications of the IAT and the TARA in the current research programme will be provided. Finally, an outline will be provided of the explicit measures selected to examine important constructs identified in the previous two chapters. Selection and application of the selected measures will be considered in the context of attempting to explain variance in recovery times of injured Royal Marine recruits.

### *5.2 The Implicit Association Test (IAT)*

The development of a measure of implicit attitudes historically stemmed from research in cognitive psychology and in particular the neural network model of the brain (Schneider & Shiffrin, 1977). The assumption was that information is stored in the brain hierarchically in accordance with semantic relationships. This means two related items should therefore be easier to process in quick succession than two unrelated items (Collins & Loftus, 1975). This is in part explained physiologically by the distance taken to travel from one site in the brain to another. The IAT is based on the premise that it is easier for an individual to co-classify two items of information that are evaluatively similar than two items that are evaluatively different on successive blocks of multiple items or *trials* presented to them. Accordingly, individuals find it easier to complete two alternating tasks that are evaluatively congruent than two alternating tasks that are not. Hence, their reaction times tend to be faster on congruent tasks and slower on incongruent ones when holding the error rate constant. The time difference between responses to alternating congruent and then incongruent tasks usually equates to only milliseconds, but it is the contrast between the two that distinguishes the spread of activation between two associated items within a block (a semantic and evaluative item) and two disassociated items within a block. This time difference becomes very apparent when administering an association test by computer, where the computer records the individual's response time. The evaluations or judgements are relatively resistant to conscious control. That is to say, that whilst the respondent may be aware of any difference in the way they evaluate different stimuli, there is little they can do to control it.

The IAT is a binary classification task that measures differences between the evaluations of varying stimuli. The canonical form of the IAT is administered by means of five different blocks, always using single words or pictures for the target-concept, associated attribute and stimuli. Each block is to be completed as quickly as possible whilst avoiding errors.

### *5.2.1 Block 1: Initial target-concept discrimination*

The individual is presented with the *initial target-concept discrimination*. For example, this could be *male* and *female*. The respondent is then presented with a series of stimuli that he/she must categorise according to the target-concept. In this example, stimuli could be alternating male or female names. These would flash up in the centre of the screen, with the label *male* in the top left corner of the screen, or *female* in the top right corner, indicating relevant response options. The respondent would then discriminate each stimulus according to the target-concept, by pressing on a corresponding ipsolateral key. There are usually 5-8 stimuli presented in each block.

### *5.2.2 Block 2: Associated attribute dimension*

This block is essentially the same as block 1, except that the target-concept is exchanged for the attribute which the experimenter wishes the respondent to eventually associate with the target-concept. In this example, the attribute dimension could be *pleasant* and *unpleasant*, and the stimuli could consist of words that are obviously pleasant or unpleasant (e.g. flowers and insects). Again, the respondent is presented with a series of stimuli on the computer screen and must discriminate between each one by either clicking the top left button on the keyboard that corresponds to the *pleasant* label in the top left corner of the computer screen, or *unpleasant* by using the top right button on the keyboard that corresponds with the *unpleasant* label in the top right corner of the computer screen.

*5.2.3 Block 3: Initial combined task*

Block 3 is a combination of blocks 1 and 2. In the top left corner of the computer screen are the labels for the target-concept and the associated attribute. In this example *male* and *pleasant* (in one corner of the screen), and *female* and *unpleasant* (in the other corner) are represented as the labels. The respondent is presented one-by-one (in a random order) with both the target-concept stimuli (male names and female names) and the associated attribute stimuli (flowers and insects). The respondent then categorises each of the stimuli as they occur as male, female, pleasant or unpleasant.

*5.2.4 Block 4: Reversed associated attribute dimension*

This block sees the respondent having to categorise the associated attribute stimuli again, but with the labels and corresponding keys on the keyboard reversed (pleasant is now right and unpleasant is now left).

*5.2.5 Block 5: Reversed combined task*

This final block is essentially an amalgamation of blocks 2 and 4 and requires the respondent to categorise random target-concept and associated attribute stimuli, but with the target-concept keys reversed (as learned and practiced in block 4) and the associated attribute not reversed.

*5.2.6 Analysis*

After eliminating outliers and otherwise normalising within-subject distribution of response times, the respondents' averaged response times for each of the blocks are calculated. Blocks 1, 2 and 4 are *practice blocks*. Blocks 3 and 5 are the *critical blocks*. Of particular interest is the difference between the mean reaction times for blocks 3 and 5. This is because one of the blocks features a pair of alternating tasks that are more compatible than the other critical block, depending on each respondent's underlying associations. In this example, a male whose preference in the working environment is to work with other males, should demonstrate a faster response time to block 3 than to block 5, given that the associative mapping in block 3 is male and pleasant (and therefore stronger), whereas in block 5 in this example, it is female and pleasant (and therefore the associative mapping should be weaker). Therefore a male whose preference is to work with other men should find block 3 (the compatible task block) easier to complete than block 5 (the incompatible block). This mean difference in response times is known as the *IAT effect*. The size and sign of the IAT effect allows individual differences in implicit associations between the target-concepts and associated attribute to be identified. Two methods of IAT index calculation were used in this programme of research: Greenwald, Nosek and Banaji's (2003) conventionally accepted method and an optimised method designed intentionally to maximise the IAT effect size by removing extreme response times. Calculation of the IAT effect or *index* using these methods is detailed in chapter 7.

*5.2.7 Application of IAT methods in the current context*

Chapters 3 and 4 reviewed the literature in terms of its relevance and potential to explain variance in recovery from physical injury in injured Royal Marine recruits. Organisational commitment (Meyer & Allen, 1987) was identified as a fundamental predictor of turnover and turnover intentions. This finding was supported anecdotally by Royal Marine training teams and remedial training staff alike. As such, this research programme aims to develop and test IATs developed to indicate commitment to, or identification with, the Royal Marines in injured Royal Marine recruits. This was achieved by using the target-concept dimensions *Royal Marines* and *civilian life* to distinguish between images of the Royal Marines and civilian life, and *self* as the associated attribute dimension; specifically the categories *me* and *not me* were used to discriminate between *me* and *not me* words. Given that the IAT required contrasting categories for both the target concept dimension and the associated attribute dimension, and that Royal Marines' identity/commitment was to be measured, the categories *not me* and *civilian life* were the most appropriate choices.

### *5.2.8 Examples of IAT application and critical analysis of its psychometric properties*

The IAT has been used to measure associations between the target-concept and an associated attribute. Greenwald, McGhee and Schwarz (1998) tested this method of measurement using three discrete experiments. The first study entailed testing the IAT effect using known associations. In this case, participants' associations between an attribute (pleasant and unpleasant) and a target-concept already known to be pleasant or unpleasant (flowers and musical instruments as pleasant and insects and weapons as unpleasant) were assessed. It was found that the mean time taken for participants to categorise pleasant and unpleasant meaning words where the tasks were compatible was significantly less than the mean time taken to categorise words where the dual task was incompatible. The order in which the blocks were presented to participants was analysed with a view to assessing its moderating effect on response time. It was concluded that the IAT effect was slightly less when the incompatible dual task was completed prior to the compatible dual task.

Other procedural variables such as intertrial interval time, number of items per category within a block, and assignment of response key were also analysed for a moderating effect. Unexpectedly, it was found that manipulation of these procedural variables made little difference to their role in moderating the IAT effect size. Finally correlations between explicit measures and the implicit measure were low. A number of explanations were suggested. The low correlations could reflect a difference in the construct being measured and therefore explicit measures may be inappropriate for validation of implicit measures. The lack of variability in the attitudes being assessed may also have contributed to low correlations. Of course, theories of implicit cognition in comparison to explicit self-report may also go some way to explaining the low correlations, in that they do not necessarily measure the same construct (Fazio, Jackson, Dunton & Williams, 1995; Greenwald & Banaji, 1995).

The second study also tested the IAT effect using known group associations, but this time the IAT was tested in an applied context. The study required Korean and Japanese participants to categorise Korean and Japanese surnames as pleasant and unpleasant. It was hypothesised that the IAT would reveal implicit attitudes of antipathy toward the opposing ethnic group greater than was reported in self-report measures of racial attitudes. This was proposed on the basis of continued hostility between the two nations at the beginning of the 20th century. A substantial IAT effect was found in the response time for Japanese and Koreans to classify the opposing nation's surnames where the task was incompatible. It was also found that the IAT distinguished between Korean and Japanese participants better than most of the self-report measures. Semantic differentials and the IAT did not correlate, thus suggesting that they measure different constructs.

The third study took the second study one stage further and asked self-confessed non-racist participants to complete the dual task of categorising black and white names whilst categorising pleasant and unpleasant meaning words. The results supported the hypothesis that white participants would demonstrate a preference for white over black through the increased speed of response to white and pleasant as opposed to black and pleasant. Although the IAT effect was greater for the first study, the ordering of the compatible and incompatible tasks did not moderate the effect for this study. Given that the participants disavowed any prejudice explicitly, it was suggested that the IAT did indeed measure an implicit racial antipathy. The results of all three studies suggested that the IAT has greater immunity to social desirability than do the explicit measures, and/or (in this particular case) that the IAT reflects common knowledge, not necessarily endorsement, of stereotypes.

Farnham, Greenwald and Banaji (1999) measured implicit self-esteem using the IAT. Participants were asked to categorise words as *pleasant* or *unpleasant* and then terms associated with the respondents as *me* and *not me*. The two tasks were combined and then the target-concept keys were reversed and the two tasks were recombined for a final stage. It was found that participants were faster at categorising me terms whilst categorising pleasant words using the same key than when they had to categorise me terms and unpleasant words at the same time. Participants were also asked to complete seven self-report measures, four measuring explicit self-esteem and the other three measuring social desirability. It was found that the IAT was poorly correlated with all of them. Farnham et al. suggested this was probably because the convergent and construct validity were low, as validity calculation for this type of method is difficult because the constructs being measured by the IAT are inherently different to those being measured by explicit self-report measures. The implication of this finding is that IATs may go beyond self-report. Farnham and her colleagues progressed the study to compare implicit self-esteem of females with an implicit measure of identification with being female and the implicit favouring of females. They hypothesised that if the IAT was measuring self-esteem in females, the results would correlate with in-group bias. They found that self-esteem was related to in-group bias and was moderated by the extent to which the participants identified with being female. It was concluded that in-group favouritism could be an effect of implicit self-esteem. Similarly, this programme of research intended to measure in-group bias in the Royal Marines as an indication of identification with, and commitment to, the Corps and Royal Marines' training. This was made possible because of the flexibility of the IAT across different uses, and therefore its adaptability.

As well as self-esteem (Farnham, Greenwald & Banaji, 1999) other, psychological constructs have been measured using IATs. For example, Egloff and Schmukle (2002) developed an IAT that measured anxiety. In a series of four studies, they explored the test's psychometric properties, ability of participants to fake results, construct validity, and predictive validity. The results suggested the anxiety IAT was stable, reliable, unsusceptible to faking, related to explicit measures of anxiety, and predictive of behavioural performance decrements during an anxiety provoking task. Finally, an IAT developed to measure associations between self-injury and oneself revealed negative associations with self-injury for non-suicidal individuals, a slight positive association for suicide ideators and a strong positive association for participants who had previously attempted suicide. Again, the results indicated that IATs predict above and beyond the results of measured known risk factors. This is important in terms of the current research programme, as it was intended to measure commitment to, and identification with, the Royal Marines over and above the results obtained from explicit measures, using IATs developed specifically for this research.

Mellott (2003) investigated the convergent validity of the IAT by comparing the IAT effects for age attitudes and gender stereotypes with two other latency based implicit measures – category priming and response priming. She found that the correlations between the IAT effects and the two priming methods were small, but that the internal consistency of the priming methods was also low. Across all three experiments, IAT effects were found to be larger, had greater sensitivity to known group effects and demonstrated a higher internal consistency than did the two priming measures. Following correction for measurement error using confirmatory factor analysis, correlations between all three measures were high and supported the convergent and construct validity of the IAT.

Kim (2003) asked participants to try to fake their responses to the IAT in order to appear more favourable towards flowers than insects. Comparison of a baseline IAT with the 'faked' IAT revealed that participants could not fake their responses simply when requested to do so. They could only fake their responses when they were told exactly how the test worked, and when instructed how to modify their responses.

Implicit attitude measurement has scarcely been applied in the field of health psychology. Thus far, IATs have mostly been applied in research into addictive behaviour such as drinking, smoking (McCarthy & Thompsen, 2006) and marijuana use (Ames et al., 2007), where the individuals' true beliefs may not be socially desirable, and therefore traditional techniques may exhibit bias in evaluating beliefs. Implicit associations in the context of health psychology have largely been based on controversial attitudes and beliefs surrounding topic such as alcohol consumption (as described above), smoking and drug usage. This is also true of the constructs measured implicitly in this programme of research, that is, injured recruits who lack commitment or avoid/elongate elements of their remedial training due to fear of pain, rehabilitation or re-injury are unlikely to openly admit so.

Palfai and Ostafin (2003) asked participants with a known hazardous drinking habit to complete a modified IAT designed to assess their associations between alcohol and behavioural categories (such as binge drinking or avoiding alcohol consumption). The modified IAT was indeed found to measure alcohol related memory associations for individuals who may be at risk of harming themselves through alcohol abuse. Other studies have investigated the role of implicit associations toward alcohol on drinking behaviour and have found implicit associations to be predictive of behaviour over and above the variance explained by explicit measures of attitude to alcohol (Jajodia & Earleywine, 2003; Thush et al., 2007; Wiers, van Woerden, Smulders & de Jong, 2002). The results are encouraging and support the IATs' predictive validity in this context as well as suggesting its potential for predicting behaviours in other health related contexts.

Another controversial health-related topic that has been examined through the measurement of implicit associations is obesity. For example, two studies employed IATs to measure attitude toward the concept obesity (Ahern & Hetherington, 2006) and attitude toward obese people (Chambliss, Finley & Blair, 2004). Both found a strong negative association. Ahern and Hetherington further explored the concurrent validity of the IAT by analysing the extent to which the tool could discriminate between individuals with differing body images, although it was concluded that the IAT was insufficiently sensitive to predict dissatisfaction with body. Roefs and Jansen (2002) examined the relationship between obesity and implicit attitude toward high-fat foods. Interestingly, they found that obese participants' attitudes toward high-fat foods were negative according to IAT results, which contradicted their preferences and eating behaviours.

There is a limited body of research on IATs measuring constructs other than those inherent in social psychology, addictive behaviours or controversial subject matters.

Constructs specific to health psychology and the prediction of recovery have not been measured before, although the method's potential usefulness has been recognised and suggested specifically in health psychology (Teasdale & Hill, 2006). There is currently a need for more basic research into the IAT (Wentura & Rothermund, 2007). This programme of research intends to add to the growing body of literature by investigating the development and application of IATs in the applied context of Royal Marines' training, injury and rehabilitation, a domain not previously investigated.

## *5.3 The Timed Antagonistic Response Alethiometer (TARA)*

Gregg's (2007) Timed Antagonistic Response Alethiometer, or *TARA*, also works on the premise that individuals are less proficient at performing two alternating incongruent tasks than performing two alternating congruent tasks (without substantially increasing the time taken to respond), whilst maintaining a constant error rate. The TARA is also a binary classification task administered by a computer, but it differs from the IAT in that it features the use of statements rather than single words. The statements are either personal to the individual (i.e. about themselves) or impersonal (i.e. about the world in general). The TARA does not require individuals to differentiate between statements based on an associated attribute, but on either an evaluative or semantic property (i.e. true or false). This means the TARA comprises only two categories, as opposed to the four categories presented on the IAT's screen. Finally, the compatibility of the task within each block of the TARA stems from the response strategy adopted by the respondent rather than the category labels as in the IAT. This means that the TARA measures whether a respondent adopts an honest or dishonest strategy by the mean time taken to respond to relevant statements.

### *5.3.1 Block 1: Irrelevant statements*

The respondent is presented with a list of statements irrelevant to them, such as statements about the world in general. He/she is required to respond to each statement by clicking on the corresponding keyboard buttons to the labels in the top left (true) and top right (false) corners of the screen.

### 5.3.2 Block 2: Relevant statements

This block is identical to block 1, except that the statements presented to the respondent are relevant to them. Two variants of each statement are presented; the original, and a similarly worded statement that is opposite in meaning. This is to complicate the task for the respondent who, if lying, will have to concentrate more on alternating their response strategy.

### 5.3.3 Block 3: Initial combined task (amalgamation of 1 and 2)

Relevant and irrelevant statements are presented to the respondent, who must categorise each one, truthfully, as true or false.

### 5.3.4 Block 4: Relevant statement dishonesty

A repeat of block 2, although this time respondents are instructed to respond dishonestly – so where a relevant statement is true, they must label it as false.

### 5.3.5 Block 5: Reverse combined task (amalgamation of 1 and 4)

This block combines the requirement for respondents to categorise irrelevant statements truthfully and relevant statements dishonestly by pressing left for true and right for false.

### 5.3.6 Analysis

The incompatible part of the task is encompassed in block 5. Block 3 allowed the individual to respond by consistently using one key to truthfully classify irrelevant and relevant statements as true (left key) or false (right key). However block 5 requires individuals to categorise statements using both the left and right keys for both the responses, as they have been asked to respond dishonestly to relevant statements. Therefore, the left key would be used for true irrelevant and false relevant statements, and the right key would be used for false irrelevant and true relevant statements. This incompatibility between response keys means block 5 contains two incompatible tasks and, therefore, the individual must progress through this block at a slowed pace. It is the difference in latencies in block 3 and block 5 that allows dishonesty to be distinguished from honesty. The extent to which a respondent is lying or telling the truth should be evident by the significance and sign of the difference in reaction times between block 3 and block 5. In general, where individual differences in mean response times have been accounted for, faster response times are more predictive of honesty and slower response times are more predictive of dishonesty.

Calculation of the TARA indices when applied in a real-world scenario involves participants' completion of only the first three blocks. This is because deliberate manipulation of response strategy by the researcher is unnecessary, as it is the participant's undisclosed choice as to whether they wish to tell the truth or not. Therefore, the TARA indices for real-world applications of the TARA involve calculating the mean response time for block 3 only. The theory is that a respondent telling the truth for both irrelevant and relevant statements will exhibit a quicker mean response time than a participant who has chosen to alternate between a truth-telling and a lying response strategy.

The TARA can be tailored to suit a particular context. Prior to completing the TARA, participants can be presented with a series of statements and can be asked to explicitly rate those statements in accordance with whether they agree or disagree with each one. The same statements can then be presented as part of the TARA and the individuals' TARA effects can be compared with their explicit ratings. This provides the researcher with an indication of whether the participant had responded truthfully when they explicitly rated the statements. This makes the TARA highly adaptable and therefore suggests it has good potential for measuring attitudes and beliefs of Royal Marine recruits, who may not be explicitly forthcoming with their true beliefs.

### *5.3.7 Application of TARA methods in the current context*

Chapter 4 identified fear-avoidance (Lethem, Slade, Troup & Bentley, 1983) as a potentially important contributor to the explanation of variance in recovery times of injured Royal Marine recruits. Fear-avoidance was also discussed in terms of its potential to supplement the overarching framework of protection motivation theory that guides the main study in this thesis. Fear-Avoidance lends itself well to implicit measure adaptation for two reasons. First, it is likely that Royal Marine recruits may be more reluctant to admit to experiencing fear than most, lest they appear to manifest cowardice. Second, its explicit measurement involves a short scale, ideal for adapting. Development of an implicit test to measure all the components of protection motivation theory would be cumbersome, and it was logistically unfeasible to collect response times on every component of protection motivation theory. Therefore, it was intended to develop and test a TARA that measures some of the main components of the construct of fear-avoidance, that is, fear of re-injury, fear of pain and fear of rehabilitation.

The description of Gregg's (2007) TARA was the five block configuration. This configuration was used in his research to establish the TARA effect, and was described for background information. In the context of the current programme of research, a three block TARA was developed (blocks 1, 2 and 3 only). This was because forced manipulation of response strategy (as described in blocks 4 and 5) was not necessary due to the applied nature of the studies. It was expected that recruits who were dishonest regarding their beliefs about pain, injury and rehabilitation would respond quickly to the irrelevant statements presented in block 1, respond slightly slower to relevant statements in block 2, and respond noticeably slower again to the relevant statements presented in block 3, where they alternate with irrelevant statements. Contrastingly, it was anticipated that truth-telling recruits would respond quickly in all three blocks, but noticeably faster than the dishonest recruits to the relevant statements presented in block 3.

*5.3.8 Examples of TARA usage and critical analysis of its psychometric properties*

Gregg (2007) examined the TARA through a series of studies. He first wanted to investigate the method's capacity to determine within-subject lying and truth-telling. Participants were asked to categorise statements as either true (world) or false (world) for irrelevant statements about the world in general, and true (me) or false (me) for relevant statements about the participant. The first three blocks comprised the *truth-telling* phase of the study. The first block involved participants categorising irrelevant statements as true (world) or false (world). The second block involved the participants categorising control statements as true (me) or false (me), as did the fourth block. Blocks 1 and 2 were the combined tasks and the true (world) and true (me) categories shared the same response key. The final two blocks comprised the *lying* phase of the study. Participants were instructed to classify relevant (target) statements dishonestly in blocks 4 and 5 (one of the differences between the IAT and the TARA). Within-subject comparisons were calculated to test whether the method worked.

The results supported Gregg's hypothesis that a comparison of the mean latencies would reveal a substantial difference between the compatible dual block and the incompatible dual block, with the latter mean response time being slower. Also, an unexpected difference was found between the latent reaction times of single task blocks (one where instructed to lie, and one where instructed to tell the truth). Although smaller than the dual task differential, this *single differential* was substantial and in the same direction as the dual differential. The incompatible and compatible dual tasks both exhibited significantly longer response times when compared to the single tasks. Analysis of individual responses revealed a consistent increased latent response time for block 5 when compared to block 3. The sensitivity and specificity of the TARA were analysed and an overall accuracy rate of 87.5% was estimated. Gregg also suggested that the distinguishing capacity of the TARA may be moderated by idiosyncratic cognitive ability or task motivation. Variability was found to be low in the truth telling block, but higher in all of the other single task blocks and the dishonest block. Internal consistency was found to be acceptable.

Gregg furthered his investigation of the TARA method by setting out to find out how well it could distinguish between lying participants and truth-telling participants (between group differences as opposed to within-subject differences examined in experiment 1). He studied this distinction using a more standard version of the TARA. He started by using matched sets of only 6 of each true and false statements in each block. In order to examine the effect of block order, participants completed the task either *sequentially* where the blocks followed in the same order as outlined earlier, or *shunted* where blocks 4 and 5 were completed before blocks 2 and 3. The number of trials per block was increased from 36 to 48, thus the 12 irrelevant items were presented 4 times in block 1 and so on. Practice trials were reduced from four to just one, as Greenwald, Nosek and Banaji (2003) found all trials other than the first provided valid responses. It was ensured that all statements within a block had been presented once before repetition, and that the same statement or its opposing statement did not appear one after the other. Finally, the categorisation labels only consisted of *true* and *false*. Subcategories (me or world) were removed. Contrary to some of the IAT findings, it was revealed that block order did not moderate response times. In accordance with the hypotheses, the dual task time differentials exceeded the single task time differentials, and the incompatible task condition differential exceeded the compatible task differential. Average discriminatory accuracy was 79%. Interestingly, there was no overlap in response times for the first dual task, supporting the TARA's potential discriminatory power between liars and truth-tellers. Adjustment by controlling for baseline response time slightly improved the TARA's discrimination accuracy.

The third study used the TARA method in an applied context, but where known groups were predetermined. This time a more varied sample in terms of demographic factors was recruited, individuals' abstract beliefs about religion were tested using more varied and complex statements. Analysis of the shunted and sequential conditions revealed that the early adoption of an honest response strategy facilitated a dishonest strategy adopted later on. In other words, participants found it easier to lie in the sequential condition rather than the shunted condition. This could be because the sequential condition allowed participants to practice responding truthfully prior to the requirement to lie. It was also found that block order moderated the discrimination accuracy of the TARA. In line with the findings of the previous studies, it was found that response times in the incompatible condition evoked a significantly slowed response time when compared to the compatible condition, and that the estimated accuracy was the same as was established in the first study. However, this time no significant difference was found between the single and dual differentials. Adjustment according to baseline response times made little difference to the discriminatory power of the TARA.

Development of the TARA is still very much in its infancy. As such, it has only been utilised to measure attitudes encompassed in specific social psychology contexts.

## *5.4 Explicit Attitude Measurement*

In order to fully investigate variance in recovery times of injuries incurred by recruits undergoing Royal Marines' training, explicit measures were also utilised, with a view to measuring the components of protection motivation theory, commitment, athletic identity, fear-avoidance and pain. Furthermore, the use of explicit tests was instrumental in the evaluation of the construct and content validity of the IATs and TARA.

### *5.4.1 Protection motivation theory*

The components of protection motivation theory were assessed using the Sports Injuries Rehabilitation Beliefs Scale, or SIRBS (Taylor & May, 1993). The total measure comprises nineteen items, with five discrete scales. Taylor and May (1996) administered the SIRBS to sixty two patients from a university-based sports-injury clinic and related the results to estimates of adherence to rehabilitation regimes. A relationship was observed between scores on the threat and coping appraisal variables of the SIRBS and the physiotherapists' estimate of adherence to prescribed activities. Although empirical evidence is moderate, the SIRBS has been identified as one of a few good examples of a soundly developed psychometric test for specific use in a sports injury rehabilitation context (Levy, Polman, Clough & McNaughton, 2006), and this application of the scale clearly supports its relevance to the context of

Royal Marines' training and injury. The SIRBS can be found in Appendix A.

### *5.4.2 Commitment*

Allen and Meyer's (1990) three component model of commitment was previously described and the supporting empirical evidence was evaluated in chapter 3. Due to the substantial empirical supporting evidence, the three component model of commitment was the best validated and most reliable model to apply in the current research programme. Therefore, Allen and Meyer's three component of commitment questionnaire was selected to examine the role of organisational commitment in the context of Royal Marine recruit training and to investigate the construct validity of the organisational commitment IATs. The scale comprises eighteen items with three subscales of six items each. The subscales measure normative, affective and continuance commitment, as detailed in chapter 3. A modified three component model of commitment questionnaire can be found in Appendix A. The wording of the subscales was amended in order to improve the scale's face validity.

### *5.4.3 Athletic identity*

When considering the measurement of athletic identity, Brewer, Van Raalte and Linder's (1993) Athletic Identity Measurement Scale (or AIMS) has been widely applied in the sport psychology literature (see Brewer & Cornelius, 2001). There has been some debate as to the factor structure of the AIMS (Anderson, Mâsse & Hergenroeder, 2007; Hale, James & Stambulova, 1999; Stephan & Brewer, 2007), resulting in its further development (Cieslak, Fink & Pastore, 2005). However, the original AIMS is more parsimonious and better empirically tested than newer measures (Nasco & Webb, 2006). Cieslak et al.'s (2005) 22 item scale (the AIMS-Plus) was too long given the time allowed to conduct the study. Moreover, it measures four constructs in total, including athletic identity, but for the purposes of this thesis only athletic identity is relevant. This is because it is to be used as part of the construct validation procedures for the implicit measure of commitment/identity. Anderson (2004) recently developed a 24 item Athletic Identity Questionnaire (AIQ) based on the modified and refined premises of the AIMS. Whilst Anderson's measure is more recent, its intention was to measure influences on long term physical activity (Anderson et al., 2007). Consequently, the items reflect motivation to exercise and perceptions of physical fitness rather than identity and, as such, are less relevant to this thesis.

Nasco and Webb's (2006) Public-Private Athletic Identity Scale (PPAIS) was intended to improve the measurement of the public aspects of athletic identity (such as external reward factors) over and above the AIMS. Nasco and Webb proposed that athletic identity has a public component (everyone sees me as an athlete) and a private component (I see myself as an athlete). However, when the public and private facets of athletic identity are considered in the context of this thesis, it is argued that the private component of athletic identity may be more important for a Royal Marine recruit recovering from injury. Although the rehabilitation process was described as 'social' earlier in chapter 4, this was specifically referring to the fact that recruits do not undergo remedial training in physical isolation, rather that they are surrounded by other recruits also undergoing rehabilitation. However, the rehabilitation itself is a very personal experience, with minimal input from the outside, as each and every injury is different. Outside motivators are therefore possibly less likely to affect how a recruit recovers from injury.

Brewer et al.'s (1993) original ten item AIMS was selected to measure the impact of athletic identity on Royal Marine recruit training and rehabilitation from injury. Given the similarities in construct between athletic identity and commitment as identified in chapter 3, the AIMS was also used as a tool to investigate the construct validity of the commitment IATs. Prior to its application, the AIMS was modified in order to improve its face validity. Details of the modifications can be found in Appendix A.

*5.4.4 Fear-avoidance*

The participants' response times when categorising each statement formed the basis of the TARA and a combination of the explicit classification of the same statements and error rates in the second practice block formed the basis of a bespoke explicit measure of fear-avoidance (see chapter 8, section 8.2.2.3 for details). In order to develop the fear-avoidance TARA, appropriate positively and negatively phrased statements were required. The Fear-Avoidance Beliefs Questionnaire (FABQ, Waddell et al., 1993) was selected as a well validated and reliable measure of fear-avoidance on which to base the subject matter of the positive and negative statements (Appendix E). The development of the fear-avoidance TARA is described in chapter 6. The development of the explicit measure of fear-avoidance is detailed in chapter 8. The statements comprising the fear-avoidance TARA can be found in Appendix E.

#### *5.4.5 Pain*

Finally, a modified version of the Brief Pain Inventory (Keller et al., 2004) was selected as an empirically tested tool in order to investigate the influence of pain levels on recovery times from injury (Appendix A). Permission to use the BPI was gained from the copyright holder prior to its administration (Appendix A).

### *5.5 Conclusions*

Implicit measures have been used successfully in various settings as an alternative to traditional self-report explicit measures of attitude, as they are less susceptible to problematic socially desirable responses. As well as the general structure of the IAT and TARA, some recent examples of use and findings have been outlined, as well as information regarding the psychometric properties of the IAT and TARA methods.

The previous two chapters provided a review of literature that may be relevant to the investigation of recovery times of injured Royal Marine recruits. Specific measures selected for the empirical studies in the thesis have been identified and described in this chapter. Their use is twofold. First, they facilitate the investigation of variance in recovery times of injured Royal Marine recruits, using the overarching framework of protection motivation theory. Second, they facilitate the investigation of the construct validity of the implicit measures developed and applied in this thesis. This is the first time that implicit measures have been utilised in a truly applied, unique, real-world context, and it is anticipated that their development and application will serve to enrich the findings of this health psychology research programme.

# Chapter 6
# Development of Implicit Tests

## *6.1 Preface*

This chapter reports three studies that aimed to identify stimuli for inclusion in three measures of implicit attitudes; two Implicit Association Tests (IATs) of commitment (one based on positive images and one based on negative images of the Royal Marines), and a fear-avoidance Timed Antagonistic Response Alethiometer (TARA). These implicit measures were designed specifically for this programme of research. As such, it was important that the stimuli used in the tests were salient to the population intended to be tested. Therefore, Royal Marine recruits were asked to rate potential stimuli according to how they perceived and evaluated each stimulus. This was to facilitate the later selection of appropriate and meaningful stimuli for inclusion in the measures in order to maximise the validity of the resulting tool. The first study reported in this chapter required injured Royal Marine recruits to rate a selection of photographs, of images of life in the Royal Marines and images depicting civilian life, according to whether they perceived each image as positive, negative or neutral. This study was repeated using some new stimuli and a second sample of opt-out recruits for comparative purposes. The third study required injured Royal Marine recruits to rate how well each of a series of fear-avoidance related statements represented their perceptions of their injury, pain and rehabilitation in order to identify six pairs of statements, semantically opposite from one another.

## *6.2 Study 1: Implicit Association Test Development*

### *6.2.1 Introduction*

As examined in chapters 3 and 5, the link between commitment and motivation in the workplace is well documented (Allen and Meyer, 1990; Cooper-Hakim & Viswesvaran, 2005). This relationship is not only evident in theory, but has also been anecdotally asserted by the training and rehabilitation teams at Commando Training Centre. Indeed, the belief among Royal Marines’ training teams and medical staff that organisational commitment is important in maintaining recruits’ motivation to complete the thirty-two week training course has also been documented in Ministry of Defence reports (Hardy, Shariff, Jones & Allsopp, 2000; Scott, 1998). Although limited in number, studies of organisational commitment in the military have supported the hypothesis that a lack of commitment can result in psychological strain and decreased retention (Bridger, Kilminster & Slaven, 2007; Hardy et al., 2008; Hardy, Shariff, Munnoch & Allsopp, 2004). Anecdotal reports and empirical applied studies, coupled with the vast theoretical literature, make a compelling argument in favour of the potential influence of commitment in the context of rehabilitation from physical injury.

In order to determine whether organisational commitment influences the outcome of training and recovery from injury, it first needs to be measured. As described in chapter 5, IATs measure implicit associations between target stimuli and an associated attribute by comparing the difference between individuals' response times for incompatible and compatible computer-based binary classification tasks. IAT methodology dictates that the target-concept stimuli presented to participants must be evaluatively different from one another, therefore enabling the measurement of preference for one set of stimuli over another. The size and direction of the preference, as measured by the difference in response times to the compatible and incompatible task blocks, could then be used to indicate an inherent fondness of or fundamental dislike of either of the target-stimuli.

The mode of presentation media for the target-concept stimuli also had to be decided upon. Images have previously been used as target-stimuli in IAT studies successfully. It is plausible that photographs might depict a topic more completely than words, as more information could be conveyed in as short a time. Or in layman's terms; a picture is worth a thousand words. In the context of the current research programme, it was anticipated that the use of photographs as the target stimuli might convey more meaning for recruits than words, and therefore invoke more pronounced response times, potentially greater differentials and, therefore, more robust results.

It was decided that the target stimuli would be photographs, and that two IATs would be developed; one using images depicting aspects of the Royal Marines perceived as positive, and one using images depicting aspects perceived as negative as the target-concept stimuli. The alternating, opposing target-concept stimuli would be images of civilian life. Images of civilian life perceived as neutral were required for the IATs. This was because the IATs were required to measure commitment (or lack of) based on participants' responses to the Royal Marine images, rather than responses towards seemingly positive or negative aspects of civilian life. It was decided that the associated attribute dimension would be words related to the concept of self ('me' words) and the concept of others ('not me' words). This was in order to estimate recruits identification with, and therefore potentially commitment to, the Royal Marines. One experimental block would require participants to co-classify images of the Royal Marines and 'me' related words, and images of civilian life and 'not me' related words in one block. The other would require participants to co-classify images of the Royal Marines and 'not me' related words, and images of civilian life and 'me' related words. It was anticipated that participants would find one block more difficult than the other, and that this would be evident in the differential calculated between the two blocks. This would indicate which block they showed a preference for, which would potentially indicate identity with, or commitment to, the preferred combination of target-stimuli and associated attribute. The reason for developing two IATs (one positive, one negative) was in order to identify the type of stimuli that best discriminated between recruits with high levels of commitment and recruits with low levels of commitment. It was hypothesised that uncommitted recruits would exhibit a greater difference in reaction times when responding to photographs depicting negative images of the Royal Marines. Conversely, it was expected that committed recruits would exhibit a greater difference in response times to photographs depicting a positive image of the Royal Marines.

According to psychometric testing theory, the reliability, validity and meaningfulness of tests are reliant upon the items that comprise them (Anastasi & Urbina, 1997). Similarly, it is intuitive that the reliability, validity and meaningfulness of an IAT are dependent upon the stimuli that form the basis of its binary classification tasks.

Despite this logical and theoretical assumption, IAT researchers and developers have not previously conducted separate studies to select the stimuli encompassed in the tests. This is the first study of its kind that used its target population's perceptions and evaluations of stimuli to contribute directly to the development of two bespoke IATs. It was not known which images would be perceived as positive, negative or neutral by injured Royal Marine recruits. Therefore, prior to selecting the stimuli, they first needed to be evaluated by the target population, so that only stimuli evaluated similarly by most recruits were then encompassed in the two final, developed IATs.

The aim of study 1 was to assess how positive, negative or neutral injured Royal Marine recruits perceived a selection of photographic images of life in the Royal Marines and civilian life.

*6.2.2 Methods*

*6.2.2.1 Design*

The study used a cross-sectional questionnaire design.

*6.2.2.2 Participants*

All recruits residing in Hunter Company and undergoing rehabilitation for a physical injury acquired during mainstream Royal Marines' training took part in the study (*N* = 134). Injured recruits were asked to participate as the aim of later use of the IAT stimuli was to test the commitment of injured recruits to Royal Marines' training.

*6.2.2.3 Measures*

Participants were given a questionnaire each, comprising 100 photographs (50 depicting different aspects of life in the Royal Marines and 50 depicting different aspects of civilian life, six images per page) with a scale adjacent to each image (+1 = positive, 0 = neutral and -1 = negative; Appendix B). The photographs were presented on the form in no particular order, although care was taken to alternate Royal Marines images with civilian images to avoid response sets and large numbers of similar photographs being rated consecutively. The photographs were given an identification number from 1 to 100 in order that individual photographs could be referred to in the results section.

Two alternate forms, that presented the photographs in different orders, were employed in order to minimise presentation order effects. This number of photographs was used in order to maximise choice for the participants and options for the researchers. The military photographs were obtained from the Ministry of Defence image directory (Crown Copyright) and the civilian lifestyle images were obtained from freefoto.com (see Appendix B for permission to use these images for research purposes). Each photograph was selected for *a priori* reasons, in that the researcher wanted to provide the participants with what was considered to be a range of different images with the expectation that some would be perceived as positive, some as negative and some as neutral.

*6.2.2.4 Procedures*

A protocol was submitted to the Ministry of Defence Personnel Research Ethics Committee and the Southampton University ethics committee, and ethical approval was obtained. The participants were informed about the general aim of the study by the Officer Commanding Hunter Company and the researcher, prior to the task date, on routine orders (mandatory reading for recruits, detailing instructions and events, published weekly) for Hunter Company. Injured recruits residing in Hunter Company were invited to participate in the study and were allowed two weeks to consider; this also acted as a cool-off period.

The data were collected in person by the researcher. Training staff from Commando Training Centre did not assist with the trial, in order that the study remained divorced from Royal Marines' training. This was to minimise the possibility of socially desirable responses from the participants, as they may have felt it necessary to respond in a particular way had their training team been present. The participants were seated in a classroom. In accordance with the Declaration of Helsinki, they were provided with detailed instructions concerning the purpose of the task and how to complete it (Appendix B). They were also given the opportunity to ask questions and a second opportunity to opt-out of the study. When they were satisfied with the purpose of the study and the way in which it was to be conducted, they were provided with a consent form and asked to sign it whilst another recruit witnessed the signature (Appendix B).

Participants were asked to give their age, week of training at time of injury and time spent in Hunter Company at the time of participation at the top of the first page of the form. Using a pencil and the scale provided, participants were then asked to rate each photograph according to how positive or negative they perceived the image portrayed.

*6.2.2.5 Statistical analyses*

Statistics were generated to describe the sample in terms of age, week of training on entry to rehabilitation and time spent in Hunter Company. As the entire Company participated in the study, variances in type and severity of injury were accounted for, thus eliminating any sampling bias due to these factors.

The frequencies of positive, negative and neutral responses by the participants were calculated for each image, and were translated into percentages to indicate what proportion of participants rated the civilian images as neutral, and the Royal Marine images as positive or negative. Each image was ranked in order of percentage agreement when presented in the results tables.

The initial intention was that only where participants' responses consistently rated the Royal Marines images as either positive or negative 85% of the time (referred to as an 85% agreement level for the purposes of the results and discussion), would they be considered for use as stimuli in the final IATs. However, a post-hoc agreement level of 75% was instead necessitated where the higher percentage rate was not achieved. Since agreement levels proved even lower for the images of civilian life, a post-hoc agreement of a 'majority' or highest in agreement as being neutral was used for the civilian life images (i.e. more participants rated the image as neutral than positive or negative).

*6.2.3 Results*

*6.2.3.1 Descriptive statistics*

Table 6 presents demographic details of the participants. The median number of weeks recruits had been in Hunter Company at the time of data collection was 10 weeks. Most recruits were over half way through the 32 week training course at the time their injury occurred. Missing data points were due to some participants not answering the relevant question on the response form.

Table 6

*Demographic descriptive statistics*

| | Mean | Median | *SD* | *N* |
|---|---|---|---|---|
| Age* | 21.3 | 21.0 | 3.1 | 127 |
| Week of training at time of injury | 18.9 | 20.0 | 7.5 | 126 |
| Number of weeks in rehabilitation | 16.3 | 10.0 | 18.2 | 119 |

*Age in years.

*6.2.3.2 Image ratings and selection*

The results are presented in Table 7 for the neutral civilian lifestyle photographs and positive Royal Marines photographs. The participants rated nearly all of the Royal Marine images as positive. Interestingly, only a very small proportion of the photographs depicting Royal Marines' life were perceived as negative by any participants, and the number of participants who perceived the images as negative only made up a small percentage. Hence no data for negative Royal Marine images are presented. The participants rated most of the civilian images as neutral; inspection of the frequencies revealed normal distribution with the majority of respondents rating each image as neutral.

Table 7

*Ratings of civilian photographs as neutral and Royal Marines photographs as positive*

| Photo ID number: Civilian images | % rating image as neutral | Photo ID number: RM images | % rating image as positive |
|---|---|---|---|
| 40 | 68.7† | 93 | 96.3* |
| 72 | 68.7† | 15 | 96.3* |
| 70 | 66.4† | 87 | 94.8* |
| 86 | 64.9† | 99 | 93.3* |
| 58 | 61.2† | 81 | 93.3* |
| 82 | 60.4† | 77 | 91.0* |
| 60 | 59.7† | 45 | 91.0* |
| 98 | 59.7† | 47 | 90.3* |
| 74 | 59.0† | 29 | 88.8* |
| 100 | 56.7† | 31 | 88.1* |
| 92 | 55.2† | 79 | 87.3* |
| 68 | 54.5† | 35 | 85.8* |
| 76 | 53.7† | 1 | 85.1* |
| 34 | 53.0† | 75 | 79.9˜ |
| 38 | 52.2† | 19 | 79.9˜ |
| 84 | 52.2† | 21 | 79.9˜ |
| 26 | 49.3 | 27 | 79.1˜ |
| 42 | 48.5 | 49 | 79.1˜ |
| 62 | 48.5 | 9 | 79.1˜ |
| 2 | 46.3 | 23 | 77.6˜ |
| 24 | 44.8 | 89 | 77.6˜ |
| 78 | 44.8 | 33 | 76.9˜ |
| 30 | 44.0 | 11 | 75.4˜ |
| 36 | 44.0 | - | - |

† Majority agreement (majority of participants perceived image as neutral).* More than 85% participants perceived image as positive.˜ More than 75% of participants perceived image as positive. Shading indicates images selected for the IAT.

In accordance with the selection criteria, 24 neutral civilian lifestyle photographs were all perceived as neither positive nor negative by the majority of participants. The 12 images highest in agreement of neutrality were selected for inclusion in the implicit measure. Selection of images rated as positive by at least 85% of participants resulted in the identification of 23 positive Royal Marine photographs. Given that only a few of the photographs depicting life in the Royal Marines were rated negative and by only a small proportion of the participants, it was not possible to select any negative Royal Marine images according to this selection criterion. Reduction of the selection criterion to ≥ 75% agreement still resulted in no negative Royal Marine images being identified, although a further ten positive Royal Marine photographs were identified by lowering the agreement criteria. The twelve selected neutral civilian images can be found in Appendix C, with an example of how they were presented in the IATs in Appendix D.

*6.2.4 Discussion*

The results revealed that participants perceived a number of the photographs depicting aspects of civilian life as neutral, and a large number of the photographs depicting aspects of life in the Royal Marines as positive, but none as negative. Following assessment of the sample of injured recruits' perceptions of the images presented to them, it was necessary to further scrutinise their ratings in order to identify images for inclusion in the IATs. Whilst this was achieved for both the neutral civilian images and also the positive Royal Marines images, it was not possible to select any negative images for the negative image IAT due to only minimal ratings of the images' perceived negativity. Even after lowering the agreement rate post hoc, it was still not possible to identify any images that were rated as negative by a majority of participants.

There are several theoretical explanations for this. It is possible that of the fifty photographs depicting life in the Royal Marines, there were simply too few portraying the negative aspects. The images used for the study were originally selected from the 'Ministry of Defence image directory'. As such, it can be assumed that the images collated in the directory were primarily taken for Armed Forces marketing purposes, in which case one would not expect to find overly negative photographs. It is also possible that the prevailing attitude of the recruits who took part in the study was positive, which may have influenced how they rated the images presented to them. The overriding ethos of the Royal Marines is positive and characterised as; ‘cheerfulness in the face of adversity’. The sample consisted entirely of recruits in Hunter Company, most of whom are keen to recover from their injury and return to training. This assumption is supported by the data presented in chapter 2, which indicated that only a minority of injured recruits opted-out directly from Hunter Company. The lack of direct opt-outs from rehabilitation suggests a prevailing level of commitment, despite the adversities of rehabilitation. Alternatively, their responses may be indicative of the biases associated with explicit measures, given that the task they were asked to complete involved the explicit rating of images. Biases may have included a desire to please the administrator by rating the majority of Royal Marine photographs as positive, but also fear of reprisals from the training team may also have impacted on their responses (despite the reassurances given in the preamble to the studies). Whilst this may serve to emphasise the need for the development of implicit measures, it failed to assist with the stimuli selection element of this task.

To summarise, there were two main limitations of this study. The first was that the images presented to the participants simply did not contain any material that was likely to be rated as negative by most recruits. Despite this, it supports the necessity of asking the intended target audience to rate (and therefore select) the stimuli to be included in the final IATs. Usually, the researcher selects stimuli for inclusion in their IATs. The lack of negative images suggests that, on this occasion, inappropriate material would have been selected had it been the researcher’s choice. The second limitation of this study was that the sample of recruits who took part were still in training (albeit temporarily removed for rehabilitation), and therefore presumably still motivated and committed and potentially less likely to view the images portrayed in the photographs as negative.

The implications of these findings were that a second study was necessary in order to achieve the aim of identifying six positive and six negative images for the positive image and negative image IATs. The problems associated with limitations observed in this study could be minimised in a subsequent trial through the careful selection of new material to be presented to participants, and through the recruitment of a sample of ‘opt-out’ recruits, who have chosen to leave training of their own accord. Although Royal Marine recruits opt-out of training for a number of reasons, suffice to say some of them choose to leave training due to a lack of commitment.

### *6.3 Study 2: Implicit Association Test Development*

#### *6.3.1 Introduction*

As the identification of negative images proved problematic, it was necessary to run a second trial with some new images captured by the researcher, and the photographics section at Commando Training Centre, specifically for the task. This study also included a sample of opt-out recruits who participated alongside the injured recruits; opt-out recruits at the time also resided in Hunter Company for administration. As such, it was feasible for both groups to take part in parallel. A group of opt-out recruits were recruited for this study because it was assumed that recruits who had chosen to opt-out would have a more negative outlook on recruit training, and it was anticipated that they would be more likely to rate some aspects of Royal Marines’ training depicted in the images presented to them as negative. It was also supposed that opt-out recruits may feel less pressure to conform in the way those still in training may feel, and therefore may be more likely to respond honestly. Because they had elected to opt-out of training, by definition, it was also assumed their commitment had waned. Finally, another justification for the participation of opt-out recruits was that the tests were being designed to differentiate between motivated and unmotivated recruits. Therefore, the selected images needed to be perceived as being positive for the positive image IAT and negative for the negative image IAT by both motivated and unmotivated recruits.

The identity and image of the Corps is an integral part of recruitment campaigns and may impact on why many recruits choose to join up in the first place. Therefore the iconicity, or how well an image stereotypically represents life in the Corps and Royal Marine training, was important alongside the positivity/negativity of the images. This was because the images depicting aspects of the Royal Marines had to portray aspects of life/training in the Corps that were salient to recruits, as opposed to representing aspects of military life that were irrelevant to the recruits or seemed atypical of Royal Marines' life. The conduct of a second study afforded the opportunity to measure perceived iconicity of the images portrayed in the photographs.

Therefore, the aims of study 2 were as follows. The first aim was to assess the perceptions held by injured and opt-out Royal Marine recruits of a selection of photographs depicting different aspects of life in the Royal Marines. This was with a view to selecting six negative images and six positive images for inclusion in two IATs. A second aim was to check the inter-group agreement of the ratings of the positive and negative images. A third aim was to examine the iconicity of each image selected and confirm that each selected image was a stereotypical and salient representation of life in the Royal Marines. The fourth aim was to establish the internal consistency for the final set of selected images, to ensure they would all pertain to as similar a construct as possible.

*6.3.2 Methods*

*6.3.2.1 Participants*

Sixty one injured recruits residing in Hunter Company and thirty nine opt-out recruits participated in the trial.

*6.3.2.2 Procedures and measures*

An amendment was submitted to the ethics committees and approval was obtained for the proposed extension of study 1. The second study was procedurally identical to the first, other than the materials presented. Following distribution of the instructions sheet (Appendix C) and consent forms (Appendix C), participants were shown 61 photographs depicting aspects of Royal Marine lifestyles and asked to rate them (some positive, some negative). These included the 23 positive images identified in the first study, with 38 new negative images. Six of the new photographs presumed to be negative were deliberately staged and taken by the researcher and photographic section at Commando Training Centre specifically for the trial, and the other thirty two were taken from the photographic section's image database. The images were presented in no particular order. Two alternate forms were produced in order to control for order effects and control for response sets. Participants were administered one of the alternate forms (an example can be found in Appendix C). The staged photographs attempted to depict typical aspects of life in the Royal Marines that may be perceived negatively by some. These included aspects of the more mundane, administrative side of training such as a recruit making his bed or ironing his rig. The participants were also asked to rate each image's iconicity by answering the question: 'How well do you think it represents the Royal Marines to you?' on a Likert scale where 1 = not at all, 2 = a little, 3 = quite well, 4 = very well and 5 = extremely well.

*6.3.2.3 Statistical analyses*

Statistical analyses were the same as for study 1 in terms of the description of the samples, and the calculation of response frequencies and agreement percentages for each image. However, some amendments were made to the selection criteria. The positive image selection was based on the injured samples' ratings of their perceptions of each image, and the negative image selection was based on the opt-out sample's ratings of their perceptions of each image. This was because it was more important to consider what the more committed sample (injured, but still in training) viewed as positive and what the sample who had chosen to leave training of their own accord (opt-outs) viewed as negative in order to maximise response time differences in the final test. The selection criteria for the Royal Marine images perceived as negative was amended to a between-participant agreement level of 'majority', or in other words, where the majority of participants perceived the image portrayed in the photograph as being negative. This was to maximise the opportunity of identifying images rated as negative which had previously proven problematic. To check that the results were similar between the injured and opt-out samples, Mann-Whitney U tests were used to compare the distributions for each of the positive and negative items. To check that each of the selected images was an iconic portrayal of life in the Corps, it was decided that each of the selected photographs should have a median iconicity of 3 or above (rated on a Likert scale of 1 – 5). Cronbach's alpha was calculated to indicate the degree of internal consistency in responses to the set of images that made up the final scales.

### *6.3.3 Results*

#### *6.3.3.1 Descriptive statistics*

Tables 8 and 9 present descriptive statistics for the demographic details of the Hunter Company sample and the sample of recruits opting-out. The opt-out sample were slightly younger than the injured recruit sample (median years of age; 18 and 20 respectively). As in the previous study, most participants were over half way through training when they took part in the study.

Table 8

*Demographic characteristics of the injured recruit group*

| | Mean | Median | *SD* | *n* |
|---|---|---|---|---|
| Age in years | 20.6 | 20 | 2.9 | 58 |
| Week of training at time of injury | 20.9 | 22 | 7.0 | 58 |
| Number of weeks in rehabilitation | 7.4 | 5 | 6.9 | 57 |

Table 9

*Demographic characteristics of the opt-out recruit group*

| | Mean | Median | *SD* | *n* |
|---|---|---|---|---|
| Age in years | 19.5 | 18 | 2.9 | 25 |
| Week of training at time of opt-out decision | 7.9 | 6 | 5.0 | 28 |

#### *6.3.3.2 Royal Marine photographs perceived as positive*

The injured and opt-out sample participants both perceived a number of the photographs presented to them as portraying positive images of life in the Royal

Marines. The injured sample perceived a greater number of the photographs as depicting positive images than the opt-out sample.

Twenty two and nine positive photographs were perceived as positive by the injured sample and the opt-out sample, respectively. The percentage agreement results can be found in Table 10 for the top photographs ranked highest in perceived positivity by each of the two samples. Seventeen of the twenty two images were also rated positive in study 1. The other five were new images introduced in this study.

In accordance with the selection criteria, the six photographs perceived by the most injured participants as portraying positive images of the Royal Marines were selected for inclusion in the IAT. Four of the images perceived by the injured sample as positive were also perceived as such by the opt-out sample. The percentage of recruits rating photographs 6, 46, 52, 36, 28, and 18 as positive differed between the samples ($U$ = 790, $p$ = .01). Five of the final six selected images were also the top five rated images in the first trial, indicating good cross-sectional test-retest reliability of the material. The sixth photo was the seventh most positive image identified in the first trial. The median iconicity scores for each item are also presented. All of the median iconicity scores for the selected images equalled three or above.

Table 10

*Injured and opt-out groups' ratings of Royal Marine photographs as positive*

| Injured group | | | Opt-out group | | |
|---|---|---|---|---|---|
| Photo ID number | % rating image as positive | Median iconicity rating | Photo ID number | % rating image as positive | Median iconicity rating |
| 6 | 96.7[a] | 4 | 18 | 86.5[b] | 4 |
| 46 | 93.4[a] | 4 | 6 | 84.2[b] | 4 |
| 52 | 91.8[a] | 4 | 36 | 84.2[b] | 4 |
| 36 | 91.8[a] | 5 | 3 | 78.9[b] | 4 |
| 28 | 91.8[a] | 4 | 28 | 78.9[b] | 4 |
| 18 | 91.8[a] | 5 | 27 | 78.9[b] | 3 |
| 14 | 91.8[a] | 5 | 42 | 76.3[b] | 3 |
| 3 | 91.8[a] | 4 | 48 | 76.3[b] | 4 |
| 48 | 90.2[a] | 4 | 52 | 76.3[b] | 4 |
| 42 | 90.2[a] | 4 | 14 | 75.7[b] | 4 |
| 8 | 88.5[a] | 4 | - | - | - |
| 58 | 86.2[a] | 4 | - | - | - |
| 2 | 85.2[a] | 4 | - | - | - |
| 20 | 83.6[b] | 4 | - | - | - |
| 27 | 83.6[b] | 4 | - | - | - |
| 38 | 81.7[b] | 3 | - | - | - |
| 12 | 80.3[b] | 4 | - | - | - |
| 23 | 80.3[b] | 4 | - | - | - |
| 13 | 80.0[b] | 4 | - | - | - |
| 31 | 78.7[b] | 4 | - | - | - |
| 9 | 77.0[b] | 4 | - | - | - |
| 30 | 75.4[b] | 4 | - | - | - |

[a] More than 85% participants perceived image as positive.

[b] More than 75% of participants perceived image as positive.

Shading indicates images selected for inclusion in the IAT.

*6.3.3.3 Negative image selection*

The same six Royal Marines photographs were perceived as portraying negative images by both the injured sample and the opt-out sample. All of the photographs rated by the participants as portraying a negative image of life in the Royal Marines were the new, staged photographs. The percentage each photograph was rated negative can be found in Table 11. Although three of the six photographs most negatively rated did not reach the criterion of being rated negative by a majority of recruits, it is important to note that none of them were rated *positive* by a majority. There were no differences between the ratings of the injured and opt-out samples ($U = 929$, $p = .55$). The median iconicity scores for each item can also be found in Table 11. All of the median iconicity scores of the selected images equalled three or above.

Table 11

*Injured and opt-out groups' ratings of Royal Marine photographs as negative*

| Injured group | | | Opt-out group | | |
|---|---|---|---|---|---|
| Photo ID number | % rating image as positive | Median iconicity rating | Photo ID number | % rating image as positive | Median iconicity |
| 41 | 52.5 [a] | 2 | 35 | 57.9 [a] | 4 |
| 10 | 50.8 [a] | 3 | 41 | 52.6 [a] | 3 |
| 34 | 50.8 [a] | 2 | 34 | 47.4 | 3 |
| 53 | 50.0 [a] | 2 | 10 | 45.9 | 3 |
| 61 | 49.2 | 2 | 61 | 44.7 | 4 |
| 35 | 42.6 | 3 | 53 | 36.8 | 4 |

[a] Majority agreement (more than 50% perceived image as negative).

Shading indicates images selected for inclusion in the IAT.

*6.3.3.4 Reliability of sets of selected images*

The two samples' data were combined in order to maximise the sample size. Cronbach's alpha was calculated for the final, positive six image scale and the final negative six image scale. The alpha values were .77 and .87 respectively, indicating an acceptable level of internal consistency.

### *6.3.4 Discussion*

Both the injured sample and the opt-out sample rated a number of Royal Marines photographs as positive and also as negative. This was encouraging given that new photographs were staged, taken and introduced into the study specifically in the hope of them being perceived as negative. Trends in the data revealed that the opt-outs sample evaluated all of the photographs as being less positive than the injured sample. This is not surprising given that the participants comprising the opt-outs sample only remained in the establishment for administrative reasons prior to their departure from Royal Marines' training.

The second study achieved its aims; six positive and six negative Royal Marine images were identified for use in development of the positive image and negative image IATs. The calculation of average iconicity scores indicated that each of the twelve selected images were an accurate portrayal of life in the Royal Marines. The internal consistency of the images selected confirmed an acceptable level for the final two scales.

Some of the positive images identified from the injured sample were different to those identified by the opt-out sample. Comparisons of the ratings of the final, selected items revealed that there was a significant difference between the two samples responses, although this difference can be explained by the opt-outs rating all photographs as less positive than the injured participants. The twelve neutral civilian lifestyle photographs identified in study 1, and the six positive and six negative Royal Marines' photographs identified in study 2 were incorporated into the two IATs.

## *6.4 Study 3: Timed Antagonistic Response Alethiometer Development*

### *6.4.1 Introduction*

Chapter 4 highlighted fear-avoidance as having potential to explain prolonged recovery times in injured Royal Marine recruits. The possibility of the adoption of avoidance coping strategies was explored in relation to the fear injured recruits experience when faced with rehabilitation, pain, the possibility of re-injury and the daunting prospect of having to rejoin training with a new troop and new training team. It was speculated in chapter 5 that when questioned, injured recruits may feel under pressure to respond in a certain way so as not to incur perceived potential repercussions from the remedial training staff, physiotherapy team, and their peer group. Therefore, Royal Marine recruits may be unwilling to openly admit to their beliefs about pain, fear of re-injury and fears associated with the rehabilitation process. Accordingly, it was proposed that fear-avoidance should be measured *implicitly*, in order to avoid the biases associated with explicit attitude measurement.

As described and discussed in chapter 5, the TARA is a computer-based task designed to measure whether respondents have frankly indicated self-relevant statements as true or false. This method has the capacity to indicate whether respondents are implicitly reluctant to admit particular beliefs, based on their response times to complete a binary classification task (Gregg, 2007). The development of the TARA relies on the choice of appropriate stimuli. TARA methodology requires target-stimuli in the form of statements that are relevant to the individual. The relevant statements are then alternated with irrelevant statements and presented to the individual on a computer screen. In the case of this research programme, an honest recruit's response times during the binary classification tasks should be quicker than a dishonest recruit's response times. This is because an honest response strategy should mean that it is easier for a recruit to switch between categorising relevant and irrelevant statements as true or false, whereas switching between an honest and dishonest response strategy should mean that completion of the task is more difficult and therefore should take longer.

In order to develop a TARA for measuring fear-avoidance in injured Royal Marine recruits, careful selection of the stimuli was important. It was decided that short statements derived and adapted from a well-validated and reliable fear-avoidance measure (the FABQ; Waddell, Newton, Henderson, Somerville & Main, 1993, Appendix E) would be the most appropriate choice of stimuli. Having decided on the basis of the stimuli, it was then necessary to develop those stimuli for incorporation into the TARA. A prerequisite to developing the TARA was the identification of six opposing sets of short statements. Statements opposite in meaning from one another were required to complicate the task for recruits who were lying to the relevant statement. The alternating direction of the relevant statements intentionally complicates the task for recruits lying to the relevant statements. The increased concentration required to maintain minimum response time without making errors then enhances the resulting TARA index, making the difference between lying and truth-telling participants more pronounced. A further purpose of the opposite pairs of statements for the TARA was much the same as reverse phrasing questions in an explicit measure of attitude; to avoid response sets. Therefore a number of opposing sets of statements were developed from the FABQ and presented to injured Royal Marine recruit participants in order that they evaluate the statements for semantic opposition. The results would then be used to select the final statements for the TARA and comprise the target-stimuli. The statements would also form the basis of a quick, simple, easily administered explicit measure of fear-avoidance for comparison with the TARA indices as well as its use as a predictor variable in its own right. This would be achieved by asking recruit participants to explicitly select a statement from each pair which was most true to their situation and beliefs and combining it with the error rate obtained from the first, practice TARA block. This resulted in an explicit fear-avoidance score of 0-48. Details can be found in chapter 8.

The purpose of this study was to select stimuli for use in the implicit measurement of fear-avoidance. Specific aims were to identify 12 fear-avoidance statements from a total of 16 that were as highly, inversely correlated as possible, that measured the dimension of fear-avoidance and to ensure that presentation of the statements to the selected sample resulted in a range of responses. The factor structure of the selected items was examined and the test-retest reliability of the ratings of the items was also established.

*6.4.2 Methods*

*6.4.2.1 Design*

The study used a cross-sectional questionnaire design.

*6.4.2.2 Participants*

One hundred and forty two male participants took part in this trial. The participants were injured Royal Marine recruits undergoing rehabilitation in Hunter Company. The recruits completed the task in three groups (1 troop, 2 alpha troop, 2 bravo troop), for ease of administration.

*6.4.2.3 Measures*

The participants were presented with a list of 16 short statements designed to assess their fear-avoidance beliefs relating specifically to their injury, rehabilitation and experienced pain (see Table 12 for the 16 statements used). Eight of the statements were developed using an existing measure of fear-avoidance as a basis. The *Fear-Avoidance Beliefs Questionnaire* (FABQ, Appendix E) is a validated explicit measure of fear-avoidance in injury that is known to be predictive of recovery in non-military populations (Waddell, Newton, Henderson, Somerville & Main, 1993). It was observed that within the overall construct of fear-avoidance, three specific themes were apparent in the FABQ. These were fear of pain, fear of rehabilitation and fear of re-injury. These three themes provided the researcher with a guide for development of the statements required to comprise the stimuli for the present study. The constructs of fear of re-injury and fear of rehabilitation were considered the more important dimensions, as fear of pain was already included as a separate construct in the extended protection motivation theory model applied in a subsequent empirical study. Statements were constructed based on the themes outlined above, and modified to be short (to enable presentation on a computer screen) and similar in length to one another (to control for length of statement as a possible confounder). The other eight statements were compiled by amending the phrasing of the first set of eight statements so that they were the exact opposite sentiment. Thus each statement was paired with its opposite. The statements were presented in no particular order, although care was taken to separate opposing statements. Two alternate forms were produced in order to control for order effects and control for response sets. Participants were administered one of the alternate forms (see Appendix E for an example). A Likert scale was located adjacent to each statement (where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree).

Table 12

*Fear-avoidance statements used in the study*

| | |
|---|---|
| I welcome remedial exercise. | I'm afraid of remedial exercise. |
| Remedial exercise makes my injury worse. | Remedial exercise makes my injury better. |
| I feel fine doing remedial exercises. | I find remedial exercises very painful. |
| If I go back to training, I'll get injured again. | When I go back to training, I'll stay injury free. |
| I'll never fully recover from my injury. | I'm sure I'll make a complete recovery. |
| I can't stand doing remedial exercises. | I'm very willing to do remedial exercises. |
| If I go back to training, I won't re-injure myself. | When I go back to training, I'll re-injure myself. |
| Remedial exercise does me good. | Remedial exercise is bad for me. |

*6.4.2.4 Procedures*

Preparation and administration for study 3 were identical to studies 1 and 2 (see Appendix E for the instruction sheet and for the consent form).

The participants were asked to rate each of the statements according to how it related to them. A sub-sample ($n$ = 28) repeated the trial three weeks later for test-retest purposes. The sub-sample was administered one of the alternate forms at the first data collection point and administered the other three weeks later.

*6.4.2.5 Statistical analyses*

Descriptive statistics were generated for the sample in terms of participants' age, week of training on entry to rehabilitation and time spent in Hunter Company. As the entire Company was invited to take part in the study, variance in type and severity of injury was accounted for, thus sampling bias was not anticipated.

Spearman's rho correlation coefficients were generated between pairs of statements in order to assess whether the ratings recruits had given the pairs of statements inversely correlated with one another. The adequacy of the range of scores for each of the selected statements was checked. To ensure the items were related to the same underlying construct, the opposing statement in each selected pair was reverse scored and factor analysed using principal axis factoring extraction. This was in order to distinguish between common and unique error, as the analysis was intended to identify underlying subscales or dimensions, rather than purely as a data reduction exercise. Oblique rotation was used in the analysis, as it allowed for shared variance between the variables and components identified. The analysis was restricted to the identification of two components. This was because the topics covered by the selected statements, coupled with the literature, suggested two prominent underlying dimensions would be evident (Waddell. Newton, Henderson, Somerville & Main, 1993). Cronbach's alpha was generated on the overall scale and sub-scales that emerged, to establish internal consistency of the items. The test-retest reliability of the final scale was calculated using Spearman's rho.

### *6.4.3 Results*

#### *6.4.3.1 Descriptive statistics*

Table 13 reveals that the sample's descriptive data were largely similar to that of studies 1 and 2. This was because many of those who took part in studies 1 and 2, subsequently also took part in study 3. Indeed study 3 was conducted approximately one fortnight after study 1, which is apparent from the increase in the number of weeks recruits had resided in Hunter Company.

Table 13

*Demographic descriptive statistics for the sample*

| | Mean | Median | *SD* | *N* |
|---|---|---|---|---|
| Age in years | 21.7 | 21.0 | 3.2 | 122 |
| Week of training at time of injury | 18.6 | 18.0 | 7.7 | 123 |
| Number of weeks in rehabilitation | 18.7 | 11.0 | 21.7 | 115 |

*6.4.3.2 Item ratings*

Each item was correlated with its counterpart in order to identify the six most inversely correlated pairs of statements of the eight presented. The coefficients can be seen in Table 14. Coefficients ranged from .04 to -.48; all but two pairs of statements were significantly negatively correlated. In accordance with the selection criteria, the pairs of statements most inversely correlated were selected for inclusion in the implicit measure of fear-avoidance. Therefore items one and two, and items five and six were discarded from further analysis. The range of the selected items was calculated. Each of the twelve selected items' maximal range was one to five, confirming that each of the possible ratings had been used by the participants.

Table 14

*Correlation coefficients for pairs of statements*

| Statement Pairs | Coefficient | *N* |
|---|---|---|
| Items 1 and 2: | | |
| I welcome remedial exercise. | .04 | 142 |
| I'm afraid of remedial exercise. | | |
| Items 3 and 4: | | |
| Remedial exercise makes my injury worse. | -.36* | 142 |
| Remedial exercise makes my injury better. | | |
| Items 5 and 6: | | |
| I feel fine doing remedial exercises. | -.15 | 141 |
| I find remedial exercises very painful. | | |
| Items 7 and 8: | | |
| If I go back to training, I'll get injured again. | -.42* | 141 |
| When I go back to training, I'll stay injury free. | | |
| Items 9 and 10: | | |
| I'll never fully recover from my injury. | -.43* | 142 |
| I'm sure I'll make a complete recovery. | | |
| Items 11 and 12: | | |
| I can't stand doing remedial exercises. | -.40* | 142 |
| I'm very willing to do remedial exercises. | | |
| Items 13 and 14: | | |
| If I go back to training, I won't re-injure myself. | -.27* | 142 |
| When I go back to training, I'll re-injure myself. | | |
| Items 15 and 16: | | |
| Remedial exercise does me good. | -.48* | 142 |
| Remedial exercise is bad for me. | | |

*$p < .01$

### *6.4.3.3 Factor analysis*

The opposing item for each of the pairs of statements was reverse scored. This was to ensure the statements were related to one another in terms of the construct measured.

The results of the factor analysis loaded six of the items onto one component and the other six onto a second component. The components have been titled *injury fears* and *remedial exercise fears*, as these terms best represented the subject matter of the items that load onto them and concur with the literature. These two components explained 47% of the variance within the sample. The results can be seen in Table 15.

Table 15

*Factor loadings of fear-avoidance statements*

| | Component | |
|---|---|---|
| Statements | Injury fears | Remedial exercise fears |
| When I go back to training, I'll stay injury free. | **.82** | -.05 |
| When I go back to training, I'll re-injure myself. (r) | **.68** | -.05 |
| If I go back to training, I'll get injured again. (r) | **.61** | -.01 |
| I'm sure I'll make a complete recovery. | **.53** | .23 |
| If I go back to training, I won't re-injure myself. | **.41** | .07 |
| I'll never fully recover from my injury. (r) | **.41** | .37 |
| Remedial exercise is bad for me. (r) | .01 | **.67** |
| Remedial exercise does me good. | .15 | **.67** |
| Remedial exercise makes my injury better. | -.09 | **.59** |
| Remedial exercise makes my injury worse. (r) | -.22 | **.57** |
| I'm very willing to do remedial exercises. | .15 | **.56** |
| I can't stand doing remedial exercise. (r) | .18 | **.35** |

(r) indicates reverse-scored items.

### *6.4.3.4 Reliability*

The selected items' internal consistency as a scale of fear-avoidance and as two subscales was calculated. The Cronbach's alpha obtained for the scale overall was .70. The alpha for the *injury* subscale was .73 and for the *remedial exercise* subscale was also .73. The internal consistency of the scale and subscales was acceptable (between .60 and .90; Coolican, 1996).

Scores obtained for each of the items at Time 1 were correlated with the scores from the same item at Time 2 (three weeks later). Despite the small sample size ($n = 28$), an average correlation of .61 was obtained and Spearman's rho correlation coefficients of above .3 were obtained for all the items. A correlation of .3 and above is conventionally indicative of acceptable test-retest reliability (Clark-Carter, 1999). The results are presented in Table 16. The correlation coefficient for the total scale scores for Times 1 and 2 was .56 ($p = .002$).

Table 16

*Test-retest data for each of the selected items*

| Statements | Coefficient |
|---|---|
| When I go back to training, I'll stay injury free. | .66* |
| When I go back to training, I'll re-injure myself. | .69* |
| If I go back to training, I'll get injured again. | .67* |
| I'm sure I'll make a complete recovery. | .67* |
| If I go back to training, I won't re-injure myself. | .58* |
| I'll never fully recover from my injury. | .63* |
| Remedial exercise is bad for me. | .68* |
| Remedial exercise does me good. | .63* |
| Remedial exercise makes my injury better. | .78* |
| Remedial exercise makes my injury worse. | .49* |
| I'm very willing to do remedial exercises. | .31* |
| I can't stand doing remedial exercises. | .55* |

*$p < .001$.

### *6.4.4 Discussion*

The aim of study 3 was to select stimuli for inclusion in an implicit attitude test to measure fear-avoidance in injured Royal Marine recruits. It was intended to develop a TARA specifically to measure the construct implicitly as well as explicitly by developing a bespoke measure based on participants' explicit selection of statements from each pair that best described their situation and beliefs, combined with their error rates from the first block. It was important that the data collected were from a representative sample. The results indicated a good spread of representative data in terms of age, week of training and time spent in rehabilitation. This was expected as most of the Company took part in the study.

Initial analysis revealed that six of the eight pairs of statements were significantly inversely correlated with one another. In accordance with the first aim of the study, these items were selected for further analysis to assess suitability for inclusion in the TARA. The remaining two pairs of statements were not selected for further analysis. The statements *I welcome remedial exercise* and *I'm afraid of remedial exercise* were not significantly correlated. It is likely that these statements did not correlate because the meaning of each did not oppose the other. Likewise, the statements *I feel fine doing remedial exercise* and *I find remedial exercises very painful* may also not be semantically opposite. Frequency tables confirmed that the range of scores within the datasets for each of the selected items was adequate.

The second objective of the study was to examine the factor structure of the items selected. Factor analysis identified two components on which the selected items loaded. These factors were *injury fears and remedial exercise fears*. It was not surprising that these factors were identified, as it is reported in the literature that these constructs comprise components of fear-avoidance construct (Waddell, Newton, Henderson, Somerville & Main, 1993). On observing the content, the factor onto which each item loaded was intuitive and based on the meaning encompassed within the statement. For example, the statements *I can't stand doing remedial exercises* and *I'm keen to do remedial exercises* required participants to assess their attitude toward remedial exercises; i.e. whether or not they liked and enjoyed their rehabilitation activities, thereby measuring their fear of remedial exercise as a construct. Likewise, the statements *If I go back to training I won't re-injure myself* and *I'm sure I'll make a complete recovery* pertain to a recruit's fear of the possibility of re-injury or an inability to recover from the present injury.

The internal consistency of the selected statements was acceptable for both the injury and remedial exercise subscales, and the fear-avoidance scale as a whole. The internal consistency could not be improved for the subscales or overall scale by removing any of the items. The test-retest (temporal) reliability for each of the items was acceptable across the two time points. The six pairs of statements were incorporated into the fear-avoidance TARA.

### *6.5 Overall conclusions*

In conclusion to this chapter, the first two studies resulted in the identification of six positive images and six negative images depicting aspects of life in the Royal Marines and training, as rated by injured Royal Marine recruits and a second sample of opt-out recruits. The iconicity of the selected images was also considered and it was concluded that each selected image adequately represented real aspects of Royal Marines' life that the recruits related to. A further twelve images depicting images of civilian life rated as neutral by the recruits were identified from the selection presented. The civilian images would be used as the alternating target stimuli in the IAT, in order to increase its difficulty. The six positive images and twelve civilian images were incorporated into a positive image IAT, and the six negative and twelve civilian images formed a second, negative image IAT.

The third study resulted in the identification of six pairs of fear-avoidance related statements being identified by injured Royal Marine recruits. Each of the six statements was phrased in the opposite way to its counterpart, but still retained the same semantic content. The statements were further analysed to reveal two underlying subscales, and the internal consistency and test-retest reliability for the subscales and the scale as a whole was established. The six opposing pairs of statements were incorporated into a fear-avoidance TARA and a bespoke explicit measure of fear-avoidance.

The IATs and the TARA were to be applied in a later study (chapter 8) to measure the influences of commitment/identity and fear-avoidance (respectively) in the prediction of recovery from injury in physically injured Royal Marine recruits. Prior to the prospective study, it was first necessary to establish the construct and concurrent reliability of the IATs by way of a cross-sectional study. The results of which are reported in the next chapter (chapter 7).

# Chapter 7
# Validation of the Commitment Implicit Association Test

## *7.1 Introduction*

The aim of this study was to establish the reliability and investigate the validity of all commitment and identity measures to be used in the prospective study reported in chapter 8. These included two implicit tests of commitment/identity developed specifically for this programme of research and two explicit measures selected for their relevance; one of commitment and one of identity. Explicit measures require the participant to declare their attitudes; participants impart their thoughts *directly,* by issuing self-rating responses to questions and, as such, are in control of the responses given. As discussed in chapter 5, a more *indirect* technique developed to assess beliefs/attitudes is a testing method known as the Implicit Association Test (IAT; Greenwald, McGhee & Schwarz, 1998). The main potential benefit of the development of IATs to measure identity/commitment in Royal Marine recruits is that implicit attitudes will be assessed, which should overcome the difficulties of self-presentation bias associated with traditional measures of attitudes as described previously. However, the advantages of measures of implicit attitude can only be realised if the tests are reliable and valid.

Six positive and six negative images of life in the Corps, and twelve civilian life images rated as neutral, were identified as suitable stimuli for use in two novel IATs; a positive image and a negative image IAT (chapter 6). Before these implicit measurement tools could be used in a longitudinal trial or practical setting, it was first necessary to ensure that they measured what they purported to measure by investigating their reliability and validity. Thus, the main aim of this study was to evaluate the diagnostic accuracy of the implicit measures in differentiating between recruits who had completed training (*King's Squad*) and those who had chosen to leave training of their own accord (*opt-outs*), and therefore the tests' concurrent validity.

The King's Squad consists of Royal Marine recruits who have passed all the necessary tests and have reached the standards required of trained Royal Marines. In contrast, recruits who are in the process of opting-out (Premature Voluntary Release; PVR) have freely chosen to leave training prior to completion. It is important to note that recruits who fail physical and professional criterion tests and are therefore being discharged from training are *not* classed as *opt-out* recruits. Recruits who leave training due to injury are also not classed as *opt-out* recruits.

A second aim was to compare the results of the implicit tests with the results of explicit tests purporting to measure similar constructs, thus establishing the IATs' construct validity. The Athletic Identity Measurement Scale (AIMS) and three component model of organisational commitment questionnaire (TCM) were selected as appropriate comparative tools, as they are frequently used, well documented and have good reliability and validity (Allen & Meyer, 1990; Brewer, Van Raalte & Linder, 1993). It was also intended to establish the explicit measures' concurrent validity by investigating their ability to differentiate between the two groups, as well as to examine the reliability and factor structure of the questionnaire. Therefore, the aims of the present study were to:

1. Test the concurrent validity of the IATs, through how effectively they differentiate between successful recruits and unsuccessful recruits (King's Squad and opt-outs, respectively), and to compare the effectiveness of the AIMS and TCM in differentiating the King's Squad and opt-out recruits.
2. Test the construct validity of the IATs against the TCM and AIMS.
3. Examine the reliability (internal consistency) of the organisational commitment Implicit Association Tests (IATs), the AIMS and the TCM and to test the factor structure of the AIMS and TCM for use with an RM training population.

## *7.2 Methods*

### *7.2.1 Design and sample size*

This study featured a cross-sectional, between groups design. It is estimated that the size of the effect would be "large" according to Cohen's (Clark-Carter, 1999) conventional criteria, that is, $d = .7$, where $d$ is the difference between the IAT scores of the King's Squad and Opt-Out samples, divided by their pooled standard deviation. To achieve a power of .9 (i.e. to have a 90% chance of rejecting the null hypothesis when false), the sample size for each group in the between-group comparison planned should be $n = 44$ (i.e., overall degrees of freedom (df) = 86). To achieve a power of .99, the sample size for each group should be $n = 76$ (i.e. overall df = 150). The opt-outs group contained 73 recruits and the King’s Squad group was 179 recruits, resulting in an overall combined-group sample size of 252. Comparison between the name lists of potential participants available and actual participants recruited revealed the participation rate to be 99%. Data from both groups were collected over the same period of time from October 2006 to May 2007.

### *7.2.2 Measures*

A summary of the data collected is listed below in order of presentation.

1. Age (years)
2. Ethnicity
3. Self-reported computer literacy
4. Positive image organisational commitment IAT
5. Negative image organisational commitment IAT
6. Athletic (Marine) Identity Measurement Scale (AIMS)
7. Three Component Model of Commitment Questionnaire (TCM)

#### *7.2.2.1 The IATs – description and explanation*

Each of the two IATs consisted of five blocks presented in the following order. Table 17 illustrates how the IATs were constructed and presented to participants.

##### *7.2.2.1.1 Block 1: Initial target-concept discrimination*

Participants were presented with the categories *civilian life* and *Royal Marines* in blue font on the computer screen in the top left and top right corners, respectively. These categories constituted the *target-concepts*. These labels remained in place for the duration of the block. A series of target stimuli in the form of randomly alternating images of either the Royal Marines or civilian life were then briefly presented in the centre of the screen. Participants were required to discriminate each stimulus by pressing the keyboard button corresponding to the correct category. This block consisted of twelve stimuli, or 'trials' in total; six repeated positive or negative Royal Marine images and twelve images of civilian life (Appendix D). Each block was to be completed as quickly as possible, whilst avoiding errors. Should a participant make an error, a red cross flashed up in the centre of the bottom of the screen to alert them to their mistake. This visual feedback was intended to emphasise the importance of accuracy when completing the task. As this block was a practice block and not an experimental block, the reaction times and error rates were not used in any subsequent analyses. Calculation of the IAT indices is explained later in this chapter.

*7.2.2.1.2 Block 2: Associated attribute discrimination*

This block was almost identical to the previous block, except that the target-concept labels were exchanged for the attribute labels *not me* and *me* in black font, in the top left and right corners of the computer screen, respectively. These attributes were selected because, eventually, participants would be required to inadvertently use these attributes to categorise the target-concept stimuli. At this stage however, participants were simply asked to categorise twelve stimuli consisting of *me* and *not me* words according to the appropriate label (Appendix D). This block was also a practice block and as such, did not contribute to the final analyses.

*7.2.2.1.3 Block 3: Initial combined task*

Blocks 1 and 2 were amalgamated to form block 3. The labels for the target-concept and the associated attribute were co-located in the top left and right corners of the computer screen (Figure 5). *Civilian life* in blue font and *not-me* in black font were located in the top left corner and *Royal Marines* in blue font and *me* in black font were located in the top right corner of the screen. A total of forty-eight stimuli were then randomly presented, one by one, including both the target-concept stimuli (images of positive or negative Royal Marines and civilian life) and the associated attribute stimuli (*me* and *not me* words). Recruits categorised each stimulus as it occurred to the corresponding label *civilian life*, *Royal Marines*, *not me* or *me* using the assigned keys on the keyboard. This block was the *compatible task* block, as it was anticipated that a committed Royal Marine recruit, who identified with the Corps would find it easy to categorise stimuli where the categories *Royal Marines* and *me* were co-located. This block was an experimental block and therefore contributed to the final analysis.

*7.2.2.1.4 Block 4: Reversed associated attribute discrimination*

Participants were required to categorise twelve *me* and *not me* words, but with the *me* and *not me* labels and corresponding keys on the keyboard reversed (*me* is now left and *not me* is now right). This block was only for practice and did not contribute to the analysis.

*7.2.2.1.5 Block 5: Reversed combined task*

Blocks 1 and 4 were amalgamated to form block 5. This block required participants to categorise random target-concept and associated attribute stimuli, but with the associated attribute labels and keys reversed (as learned and practiced in block 4). Block 5 comprised forty-eight trials altogether and was the *incompatible task* block as it was expected that a committed Royal Marine recruit who identifies with his training and the Corps would find it much more difficult to categorise stimuli where the labels *Royal Marines* and *not me* were co-located (Figure 6). This block was an experimental block and therefore contributed to the final analysis. Section 7.2.4.1 details the IAT index calculation procedures.

Of the two experimental blocks, one was designed to be easier if both the link between *me* and *Royal Marines* and the link between *not me* and *civilian life* was pronounced. The other was designed to be easier if both the link between *me* and *civilian life* and the link between *not me* and *Royal Marines* was more pronounced. Given that Greenwald, McGhee and Schwarz (1998) found the IAT effect to be greater when the compatible block preceded the incompatible block (chapter 5), both IATs in this study presented block 3 first, followed by block 5.

Table 17

*Format of the Implicit Association Tests*

| Sequence | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Task description | Initial target-concept discrimination | Associated attribute dimension | Initial combined task | Reversed associated attribute dimension | Reversed combined task |
| Task instructions | X Royal Marines<br>Civilian life X | X Me<br>Not me X | X Royal Marines<br>X Me<br>Civilian life X<br>Not me X | X Not me<br>Me X | X Royal Marines<br>X Not me<br>Civilian life X<br>Me X |
| Sample stimuli | X <br> X | X I<br>They X | X <br>They X | X They<br>I X | X <br>I X |

Figure 5

*The IAT compatible block screen*

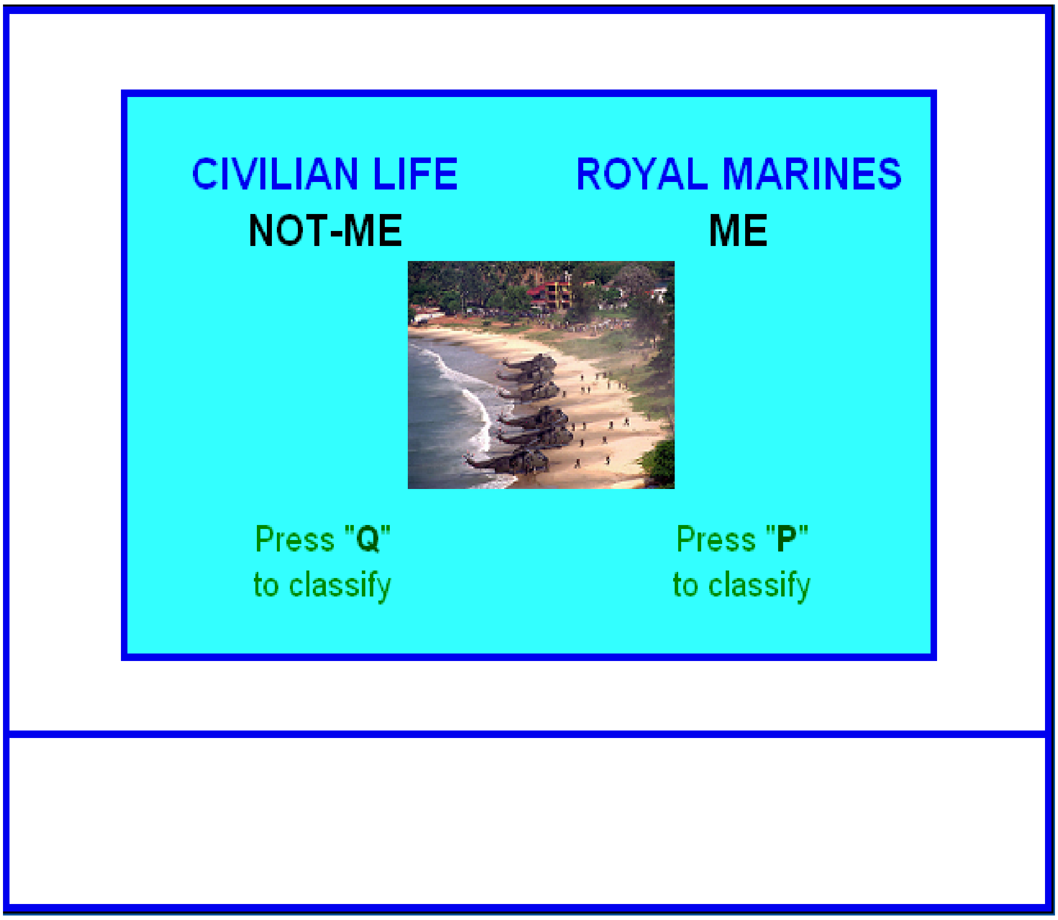
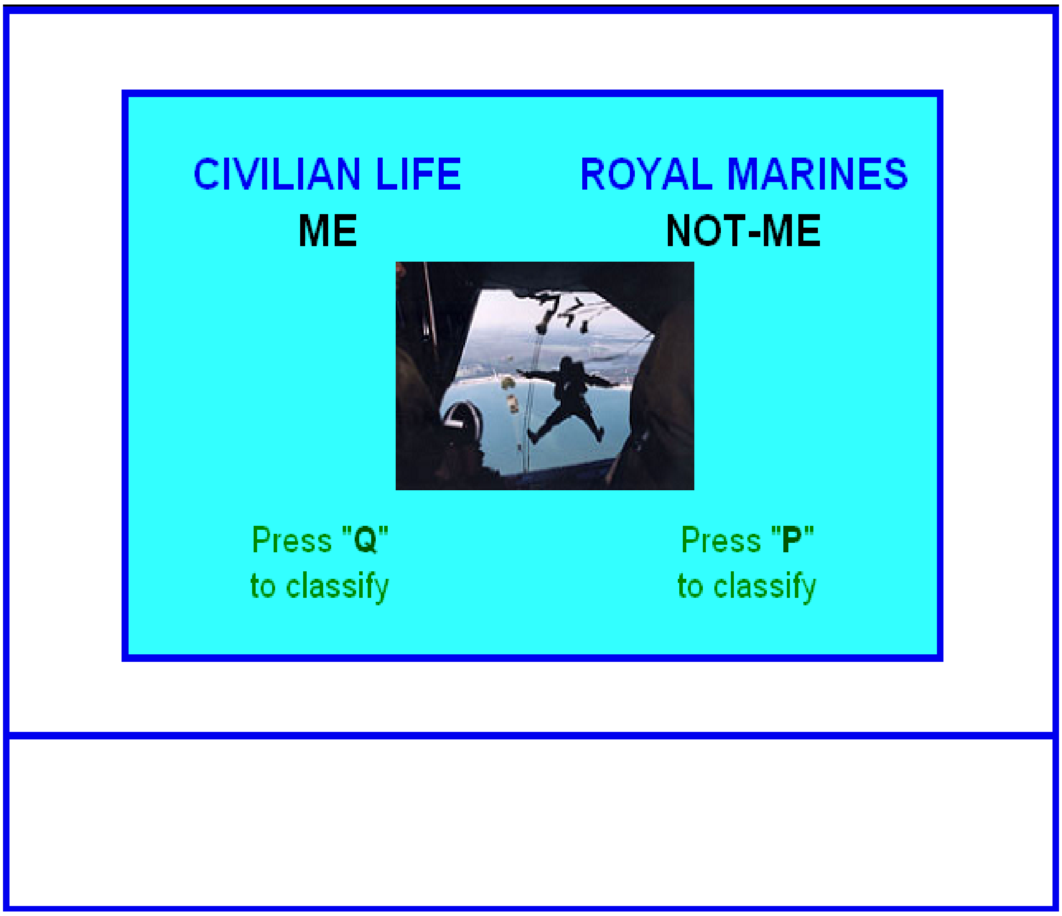


Figure 6

*The IAT  incompatible block screen*




The difference in mean reaction time (in ms) between the two blocks (i.e. the incompatible minus the compatible block) is known as the IAT index, and it is this figure that was used in the IAT analyses. The exact calculation of the IAT index is described in the data preparation and statistical analyses section of this chapter. It was expected that the more committed recruits would find the compatible condition easier (and therefore complete it more quickly) and the incompatible condition harder (therefore complete it more slowly) than their less committed counterparts. Theoretically, the greater the IAT index, the more committed the recruit to the Royal Marines, as a lengthened reaction time is indicative that he found the incompatible task (i.e. relating himself to images of civilian life rather than military life) more difficult to complete accurately and quickly.

*7.2.2.2 Marine identity*

The extent to which recruits explicitly identify with the Corps was measured using the Athletic Identity Measurement Scale (AIMS; Brewer, Van Raalte & Linder, 1993). This scale was slightly modified to improve face and content validity. This was achieved by substituting original terms such as *athlete* and *sport* with *Royal Marine recruit* and *recruit training*. Modification details and the scale items can be found in Appendix A. The AIMS was designed to measure athletic identity in sportspeople, with a view to investigating identity as a construct influential in performance. Given that the scale was adapted for the purposes of this study; athletic identity will be referred to as marine identity from this point forward. The scale was obtained from open literature, so there were no concerns over copyright. The AIMS responses were totalled resulting in an overall score for the AIMS. The higher the score, the more the individual identified with the Royal Marines (scores ranged from -30 to +30). Although the AIMS was originally developed as paper and pencil tests, it was administered by computer for consistency and ease of data collection for the purposes of the present study.

*7.2.2.3 Organisational commitment*

Explicit organisational commitment was measured using the Three Component Model of Commitment Questionnaire (TCM; Allen & Meyer, 1990). This scale was slightly modified to improve face and content validity. This was achieved by substituting original terms such as *organisation* with *the Royal Marines*. Modification details and the scales' items can be found in Appendix A. The TCM was designed to measure three aspects of organisational commitment within three sub-scales. These are affective commitment (I want to work here), normative commitment (I ought to work here) and continuance commitment (I need to work here). These scales have been used in previous Institute of Naval Medicine research and permission for use was obtained from the copyright holders (Institute of Naval Medicine's letter in pack 150/097 dated 10$^{th}$ June 2005). For the TCM, reversed items were recoded accordingly and totals were calculated for each of the subscales as well as a total score. The higher the scale totals, the more committed the individual was to the Royal Marines (scores ranged from -54 to +54). Although the

TCM was originally developed as paper and pencil tests, it was administered by computer for consistency and ease of data collection for the purposes of the present study.

### *7.2.3 Procedures*

A protocol was submitted to the Ministry of Defence Personnel Research Ethics Committee and the Southampton University ethics committee and ethical approval was obtained. The Company clerk of Commando Training Wing provided the researcher with a fortnightly list of the names and service numbers of King’s Squad recruits who had completed training and were shortly due to pass out of training. The Company clerk of Hunter Company provided a weekly list of names and service numbers of recruits who had decided to opt-out of training. An information sheet detailing the study was given to recruits on entry to the Company as part of their joining routine by the Officer Commanding Hunter Company for the opt-out recruits, and the Troop Commander for the King’s Squad recruits. This was for information only, as it was made explicit that participation in the study was voluntary. It was then the recruit’s choice as to whether he decided to take part or not.

To satisfy the aims of the study, all of the psychometric tests (including the explicit measures) were administered by computer in the adult learning centre at the Commando Training Centre. The data were automatically collected, collated and encoded by the computer programme. Participants who volunteered were asked to attend the adult learning centre at a convenient time. Recruit training teams and administration staff allowed time for this in their training/leaving routine.

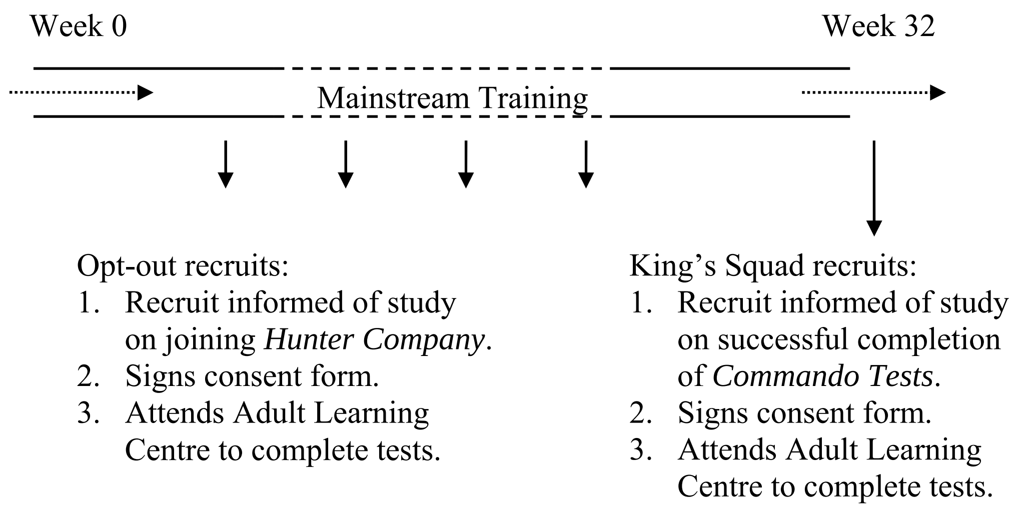
On arrival at the adult learning centre, participants were given detailed instructions concerning the purpose of the task and how it was to be completed (Appendix F). When volunteer recruits were satisfied with the purpose of the study and the way in which it was to be conducted, they signed a consent form while another recruit witnessed the signature (Appendix F). The consent forms were posted into a sealed box and collected by the researcher. Consent was also sought a second time when recruits logged-on and began the computer programme, by ticking a box to agree to take part in the study. Each recruit was able to access the computer programme by entering his service number and age. This information was stored in order to check that only opt-out and King's Squad recruits had taken part in the study by cross-referencing each participant's details with the name lists provided by Commando Training Wing and Hunter Company, after which any identifiers were irreversibly removed. All data captured by the computer programme were encrypted and password protected, and only the researcher had access to it.

Each step in the procedure was discussed with the relevant staff at the Commando Training Centre, who also granted their consent. Equipment required for the study was discussed and housed with the information technology department at the Commando Training Centre, and provided by the Institute of Naval Medicine.

Participants were asked to answer questions and complete computer-based tasks designed to assess their attitudes and beliefs toward Royal Marines' training and life in the Corps. A summary of the procedures can be found in Figure 7 and details of the demographic and psychometric tests administered are listed below in the order in which they were presented.

Figure 7

*Summary of cross-sectional study procedures*



### *7.2.4 Data preparation and statistical analyses*

The data were automatically collated in a WordPad document and transposed into an Excel spreadsheet and SPSS spreadsheet.

#### *7.2.4.1 IAT indices*

Two, separate indices were calculated for the IATs. First, results were calculated in SPSS and Excel using the original dataset. This was important in order to ensure that the tests were usable in a real-world, applied environment. The computer programme automatically recorded the time taken in milliseconds (ms) by each participant to categorise each stimulus with the appropriate label. It also recorded each time a participant categorised a stimulus incorrectly and calculated the total number of errors made within each block (the error rate). The mean reaction times in ms for each of the compatible (Block 3) and incompatible blocks (Block 5) were calculated. Mean reaction times and error rates were calculated for the whole block, and not just the target-concept items. Data sets for individuals that exhibited error rates of over 20% for either block were removed. From the cleaned data set, the mean reaction times for the compatible block were subtracted from the mean reaction times for the incompatible block. The difference between the two blocks (known as the IAT index) was used in the first IAT analyses, termed the *simple* IAT results and indicated by a (S) in brackets.

#### *7.2.4.2 Optimised data results calculation*

Algorithms written specifically for the study in Authorware were used to clean and optimise the data and calculate a second IAT index (the positive image and negative image IAT optimised data, as indicated by the letter (O) in brackets). The simple (S) and optimised (O) IATs were compared.

Data optimisation procedures were as follows:

1. *Correcting for absolute reaction time outliers*: Absolute reaction time outliers (defined as over 5 seconds and less than 300ms) were identified and replaced with the individual's median reaction time calculated within the original set

of data for the block being analysed. This was because these values could not possibly be correct.

2. *Correcting for individually calculated reaction time outliers*: Idiosyncratic reaction time outliers were identified using Tukey's box and whisker approach. The interquartile range was calculated by dividing the range between the 25$^{th}$ percentile and the 75$^{th}$ percentile. The range was multiplied by 1.5. The resulting value was added to the 75$^{th}$ percentile and subtracted from the 25$^{th}$ percentile to establish the idiosyncratic upper and lower bounds for response time. This is known as Tukey's 'fence' (the end of the whiskers). Any values falling outside these bounds were replaced by the individual's median reaction time from within the block concerned. Most replacements were made at the higher end.
3. *Penalising incorrect responses*: A response time penalty was imposed for erroneous responses. In particular, mean block reaction times were increased in exact proportion to the percentage of errors made. For example, a mean block reaction time of 1000milliseconds, given an error rate of 20% would be increased by 20% to 1200milliseconds.

The IAT indices for each participant were then calculated using the optimised data and the standard algorithm for IAT result calculation; i.e. the mean reaction times for the compatible and incompatible condition blocks was calculated and the difference between the blocks was computed. The difference was then divided by the individual participant's inclusive standard deviation calculated across both the incompatible and compatible blocks to control for individual differences in reaction time, as is the conventional process of IAT index calculation (Greenwald, Nosek & Banaji, 2003).

*7.2.4.3 Reliability*

Split-half reliability was computed for the positive image and negative image IATs' indices to establish internal consistency, correcting using the Spearman Brown formula. The whole sample combined was used to generate these statistics in order that the largest and most heterogeneous sample possible was used. Split-half reliability using alternate pairs of items reflects current best practice in IAT analysis, in preference to other reliability calculation methods (Nosek, Greenwald & Banaji, 2007). Cronbach's alpha was calculated for the TCM and its subscales, and the AIMS. Factor analysis was used to verify the subscales of the TCM, using principal axis factoring extraction and varimax rotation. Principal axis factoring was used because it seeks to identify the least number of factors possible to explain the common variance among a set of variables. Varimax rotation was used because it contributes to the minimisation of the number of factors required to explain the variance among a set of variables. This was because the rotation aided interpretation by transforming the solution toward a simple structure. The AIMS was also factor analysed.

#### *7.2.4.4 Comparisons*

To investigate the construct validity of the measures, Pearson's product moment correlation coefficients were calculated between the two implicit measures, between the two explicit measures (to compare the TCM with the AIMS in terms of their construct validity) and then between both the two implicit measures and two explicit measures. The concurrent validity of the IATs was established by conducting *t* tests to examine the difference in implicit and explicit attitudes of opt-out and King's Squad recruits. Cohen's *d* was calculated to indicate the effect size of the tests in differentiating between the two groups. *T* tests were also used to further explore differences in response within and between participants. Logistic regression (Nagelkerke) was used to assess the extent to which membership of the King's Squad and opt-out groups could be explained by the tests. Given the unstable nature of logistic regression where covariance exists, separate regressions were run for each independent variable. They were then re-run adding each IAT index hierarchically to each of the explicit measures in turn, in order to investigate all possible combinations of the implicit and explicit tests.

## *7.3 Results*

### *7.3.1 Participants*

Table 18 presents demographic details of the two groups. Participants' demographic data revealed the majority of participants were white and computer literate. There were no significant differences between the two groups with regard to these variables.

Table 18

*Demographic description of the groups*

| | Opt-outs group ($n$ = 73) | King's Squad group ($n$ = 179) |
|---|---|---|
| Median age* | 19 | 20 |
| White ethnicity | 99% | 96% |
| Computer literate | 97% | 92% |

*Age in years.

*7.3.2 Descriptive statistics*

Tables 3 and 4 detail the mean and median indices obtained from the IATs and the mean and median scores obtained from the explicit measures. The positive image and negative image IATs will be referred to in shorthand in the tables (+ve and -ve IATs). To reiterate, the positive image IAT was developed using positive images of Royal Marines' training and the negative image IAT was developed using negative images of Royal Marines' training.

It can be seen in Table 19 that the mean and median IAT indices for the King's Squad group was greater than the mean and median IAT indices for the opt-outs group in both the simple and optimised IAT indices. As anticipated, this indicates that the King's Squad group found the incompatible condition (block 5 of the IAT) more difficult than the compatible condition (block 3). The differences in response times for the opt-out recruits were smaller, which indicates they experienced fewer difficulties in completing the incompatible task. Indeed, the mean and median for the simple calculation of the negative image IAT index suggest that, on average, the opt-out participants found the compatible condition the easier of the two conditions to complete. Reaction time differences between the compatible and incompatible blocks were greater for the King's Squad when tested by the positive image IAT, whereas the opt-out group exhibited greater differences when tested by the negative image IAT.

Table 19

*Mean, median indices and standard deviations (SD) obtained from the IATs*

| | Opt-outs group ($n$ = 64) | | | King's Squad group ($n$ = 120) | | |
|---|---|---|---|---|---|---|
| | Mean | Median | *SD* | Mean | Median | *SD* |
| +ve IAT (S)* | -13.03 | 7.50 | 193.95 | 213.32 | 203.50 | 198.83 |
| +ve IAT (O)** | .07 | .10 | .68 | .90 | .99 | .61 |
| -ve IAT (S)* | 11.26 | -15.00 | 133.73 | 138.01 | 136.50 | 139.64 |
| -ve IAT (O)** | .12 | .32 | .64 | .73 | .84 | .60 |

* milliseconds; ** milliseconds divided by inclusive *SD*.

Table 20 shows that the King's Squad recruits reported a higher level of commitment and a stronger marine identity than the opt-out participants.

Table 20

*Median scores and standard deviations (SD) obtained from the explicit measures*

| | Opt-outs group ($n$ = 64) | | King's Squad group ($n$ = 120) | |
|---|---|---|---|---|
| | Median | *SD* | Median | *SD* |
| AIMS* | -6 | 12.21 | 10 | 11.78 |
| TCM** | -12 | 16.58 | 17 | 13.32 |

* Maximum score possible = 30, minimum score = -30; **Maximum score = 54, minimum score = -54; Both AIMS and TCM measured on a 7 point scale.

*7.3.3 Internal consistency*

All correlation coefficients were acceptable, i.e. between .60 and .90 as is convention (Coolican, 1996). Split-half reliability was calculated for the simple and optimised IATs (correcting using the Spearman Brown formula). The split-half coefficients can be found in Table 21.

Table 21

*Split-half correlation coefficients (N = 184)*

| | +ve IAT | -ve IAT |
|---|---|---|
| Simple index | .87 | .91 |
| Optimised index | .84 | .80 |

The internal consistency of the items comprising each of the five measures (the AIMS and the TCM and its three subscales) was acceptable (i.e. between .60 and .90). Cronbach's alpha values for the explicit measures (and the subscales of the TCM) are presented in Table 22.

Table 22

*Cronbach's alpha values for each explicit measure and its subscales (N = 184)*

| | AIMS | TCM | Affective | Continuance | Normative |
|---|---|---|---|---|---|
| Cronbach's α | .89 | .90 | .76 | .79 | .81 |

*7.3.4 Factor analysis*

A factor analysis of the TCM into its sub-components (A, C and N) is presented in Table 23. This revealed that the items comprising the TCM did not load onto the three subscales as proposed by Allen and Meyer (1990). The results obtained from the factor analysis favour the test's use as a single dimension measure of commitment. Twelve of the 18 items from the TCM loaded onto a single factor. A further 5 items (4 reverse scored) loaded onto a second factor. Interpretation of the factor analysis suggests that item 11 does not sit with either of the two factors. The value for item 14 was high, but negative (-.63) which indicates that perhaps it should have been reverse-scored. Reasons for the spurious results obtained for items 11 and 14 are explored in the discussion.

Table 23

*Factor loadings of the TCM and its subscales' items (N = 184)*

| Item | Factor | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| 1. I would be very happy to spend the rest of my career in the Royal Marines. A | **.77** | .21 | -.05 |
| 2. Right now, staying in the Royal Marines is a matter of necessity as much as desire. C | **.71** | -.04 | .09 |
| 3. I do not feel any obligation to remain in the Royal Marines. N (r) | .11 | **.44** | -.16 |
| 4. I really feel as if the Royal Marines' problems are my own. A | **.69** | -.07 | -.10 |
| 5. It would be very hard for me to leave the Royal Marines right now, even if I wanted to. C | **.73** | .13 | .04 |
| 6. Even if it were to my advantage, I do not feel it would be right to leave the Royal Marines now. N | **.84** | .15 | -.01 |
| 7. I do not feel a strong sense of "belonging" to the Royal Marines. A (r) | .20 | **.79** | .06 |
| 8. Too much in my life would be disrupted if I decided I wanted to leave the Royal Marines now. C | **.73** | -.03 | .11 |
| 9. I would feel guilty if I left the Royal Marines now. N | **.69** | -.07 | -.07 |
| 10. I do not feel "emotionally attached" to the Royal Marines. A (r) | .27 | **.54** | -.14 |
| 11. I feel that I have too few options to consider leaving the Royal Marines. C | .53 | -.30 | **.76** |
| 12. The Royal Marines deserves my loyalty. N | **.77** | .10 | .06 |
| 13. I do not feel like "part of the family", in the Royal Marines. A (r) | .07 | **.75** | .05 |
| 14. If I had not already put so much of myself into the Royal Marines, I might consider working elsewhere. C | .22 | **-.63** | -.07 |
| 15. I would not leave the Royal Marines right now because I have a sense of obligation to the people in it. N | **.76** | -.06 | -.16 |

| | | | |
|---|---|---|---|
| 16. The Royal Marines has a great deal of personal meaning for me. A | **.80** | .19 | -.08 |
| 17. One of the negative consequences of leaving the Royal Marines would be the lack of alternatives. C | **.56** | -.21 | .35 |
| 18. I owe a great deal to the Royal Marines. N | **.69** | .09 | .12 |

(r) indicates reverse-scored items. A = Affective commitment subscale item, N = Normative commitment subscale item, C = Continuance commitment subscale item.

Factor analysis of the AIMS data revealed that all ten AIMS items load onto one factor (Table 24). This means that the AIMS measured marine identity as a unidimensional construct.

Table 24

*Factor loadings of the AIMS items (N = 184)*

| Item | Factor | |
|---|---|---|
| | 1 | 2 |
| AIMS1 | **.48** | .36 |
| AIMS2 | **.72** | .42 |
| AIMS3 | **.58** | .27 |
| AIMS4 | **.82** | .26 |
| AIMS5 | **.78** | .04 |
| AIMS6 | **.80** | -.28 |
| AIMS7 | **.56** | -.09 |
| AIMS8 | **.52** | -.07 |
| AIMS9 | **.66** | -.28 |
| AIMS10 | **.77** | -.08 |

*7.3.5 Construct validity*

Analyses indicated that there was a strong relationship between both the simple and optimised datasets for the positive image and negative image IATs. There was a strong, significant association between the positive image and negative image IAT (S) indices ($r$ = .64, $p$ < .001, $N$ = 185), and similarly, the IAT (O) indices ($r$ = .66, $p$ < .001, $N$ = 184). The two IAT indices were correlated; there was a very strong relationship between both indices (IAT (S) and IAT (O)) for both the positive image and negative image sets (positive image IAT: $r$ = .83, $p$ < .001, $N$ = 184; negative image IAT: $r$ = .80, $p$ < .001, $N$ = 184).

Correlations between the IATs, AIMS and TCM scores are presented in Table 25 and indicate that the construct measured by the positive image IAT is more related to commitment than to marine identity, whereas the construct measured by the negative image IAT is related similarly to both commitment and marine identity. The AIMS and TCM scores also correlated highly and significantly ($r = .70$, $p < .001$, $N = 252$).

Table 25

*Correlations between implicit to explicit measures (N = 252)*

| | +ve IAT (S) | +ve IAT (O) | -ve IAT (S) | -ve IAT (O) |
|---|---|---|---|---|
| AIMS | .28 | .39 | .32 | .40 |
| TCM | .42 | .49 | .34 | .40 |

All correlations significant to $p < .001$.

*7.3.6 Concurrent validity*

Unrelated *t* tests between the King's Squad and opt-out groups are presented in Table 26. These indicate that all four of the positive image and negative image IAT indices (simple calculation and optimised calculation) differentiated between the King's Squad and opt-out groups. The effect sizes indicate that the positive image IAT was the better discriminator between King's Squad and opt-out groups compared with the negative image IAT. Both the AIMS and the TCM differentiated between the King's Squad and opt-out groups, with the TCM being the better differentiator. Both the AIMS scores and TCM scores were greater for the King's Squad than for the opt-outs.

Table 26

*Unrelated t tests between King's Squad and opt-outs groups*

| | *t* | Cohen's *d* |
|---|---|---|
| +ve IAT (S) [a] | -7.33* | -1.09 |
| +ve IAT (O) [a] | -8.45* | -1.25 |
| -ve IAT (S) [a] | -5.81* | -.86 |
| -ve IAT (O) [a] | -6.36* | -.94 |
| AIMS[b] | -7.96* | -1.01 |
| TCM[b] | -15.01* | -1.90 |

*$p < .001$; [a]$N = 184$, [b]$N = 252$.

### *7.3.7 Regression analyses*

A series of separate regressions were run, followed by a second series where pairs of variables were entered into the regression. The total variance explained by each of the independent variables individually and then in pairs is presented in Table 27. Of the implicit measures, the optimised index calculation for the positive image IAT explained the most variance between the two groups (36%). Of the explicit measures, the TCM accounted for the most variance (65%). When pairing the variables, it was found that the combination of the positive image IAT index (simple and optimised calculation equally) combined with the TCM explained the most variance in outcome of all the pairs of implicit and explicit variables (69%).This means that adding implicit measures to explicit measures improved prediction, and that the implicit measures explain some of the variance not accounted for by the explicit measures.

Table 27

*Summary of individual bivariate logistic regressions to predict opt-out or King's Squad group membership (N = 184)*

| | | | | | Exp(B) 95% CI | | | |
|---|---|---|---|---|---|---|---|---|
| | B | *SE* | Wald | Exp(B) | Lower | Upper | $R^2$ | *N* |
| +ve IAT (S) | .01 | .01 | 31.45** | 1.01 | 1.01 | 1.01 | .35 | 184 |
| +ve IAT (O) | 1.84 | .30 | 38.76** | 6.27 | 3.52 | 11.17 | .36 | 184 |
| -ve IAT (S) | .01 | .01 | 25.25** | 1.01 | 1.01 | 1.01 | .24 | 184 |
| -ve IAT (O) | 1.50 | .28 | 28.45** | 4.48 | 2.58 | 7.78 | .24 | 184 |
| AIMS | .11 | .02 | 39.13** | 1.12 | 1.01 | 1.15 | .37 | 252 |
| TCM | .14 | .02 | 43.61** | 1.14 | 1.10 | 1.20 | .65 | 252 |
| +ve IAT (S) | .01 | .01 | 20.77** | 1.01 | 1.01 | 1.01 | .53 | - |
| and AIMS | .02 | .02 | 27.03** | 1.10 | 1.01 | 1.14 | | |
| +ve IAT (O) | 1.51 | .31 | 23.19** | 4.53 | 2.45 | 8.37 | .52 | - |
| and AIMS | .09 | .02 | 23.36** | 1.09 | 1.06 | 1.14 | | |
| +ve IAT (S) | .01 | .01 | 9.11** | 1.01 | 1.01 | 1.01 | .69 | - |
| and TCM | .12 | 0.2 | 33.95** | 1.13 | 1.08 | 1.18 | | |
| +ve IAT (O) | 1.07 | .36 | 8.84** | 2.91 | 1.44 | 5.89 | .69 | - |
| and TCM | .12 | .02 | 33.51** | 1.13 | 1.08 | 1.18 | | |
| -ve IAT (S) | .01 | .01 | 10.54** | 1.01 | 1.01 | 1.01 | .44 | - |
| and AIMS | .09 | .02 | 26.64** | 1.10 | 1.10 | 1.14 | | |
| -ve IAT (O) | .99 | .30 | 10.63** | 2.69 | 1.48 | 4.87 | .43 | - |
| and AIMS | .09 | .02 | 25.70** | 1.10 | 1.06 | 1.14 | | |
| -ve IAT (S) | .01 | .01 | 4.73* | 1.01 | 1.00 | 1.01 | .67 | - |
| and TCM | .13 | .02 | 37.47** | 1.14 | 1.01 | 1.18 | | |
| -ve IAT (O) | .82 | .37 | 4.97* | 2.28 | 1.10 | 4.69 | .67 | - |
| and TCM | .13 | .02 | 37.40** | 1.13 | 1.09 | 1.18 | | |

**p* = .03; ***p* < .001.

## 7.4 Discussion

This study established the concurrent and construct validity of two IATs specifically developed to measure implicit aspects of commitment and marine identity in Royal Marine recruits. This section intends to discuss each of the main aims outlined in the introduction. The aims will be discussed in terms of the findings reported in the results section of this chapter, whilst considering the findings of comparable studies. This section will first discuss the concurrent validity of the tests and calculation of the IAT indices. The construct validity of the tests will then be focused upon, followed by a discussion of their reliability. Finally, limitations will be considered, future implications will be suggested and conclusions will be drawn.

### 7.4.1 Concurrent validity of the tests

Both the IATs were found to have concurrent validity in that they accurately differentiated between the King's Squad and opt-out groups. The effect size was greater for the positive image IAT, identifying it as the better differentiator. Optimisation of the data resulting in a refined data set and corresponding index also generated a larger effect size than the simple index. This is useful when assessing the potential differentiating ability of the test in terms of its future use. Overall, the results of the two IAT indices were largely similar, with the effect size of the optimised data usually slightly greater. The similarity in results can probably be explained by the homogeneity of the sample; the less the heterogeneous the sample, the less need for variance-weighted indices. The same general conclusions are drawn from both indices indicating that either index can be used.

The effect size generated by the optimised positive image IAT index ($d$ = 1.25) is conventionally classed as 'large' ($d$ = .8 in considered to be a large effect size; Coolican, 1996). In comparison to the results of other studies investigating IAT concurrent validity, the results of this study are encouraging. Applications of the IAT in real-world scenarios appear to be limited in number. Most IATs have been investigated in a laboratory setting. However, a recent study looking at the IAT's ability to differentiate between known groups, in this case white people and black people categorising white names and black names, found the effect size $d$ = .73

(Rudman & Ashmore, 2007). A study investigating positive attitude to alcohol in heavy drinkers found an IAT effect size of $d = .78$ (Houben & Wiers, 2006). Comparatively, the effect size obtained in this study was large. Overall, these results are promising for the future development and potential implementation of the IATs, as their concurrent validities were far greater than expected. The optimised positive image IAT explained a similar proportion of the variance as the AIMS, which is remarkable in implicit attitudinal research (Greenwald, McGhee & Schwarz, 1998).

Evidence from the results suggests that the optimised positive image IAT index is the most useful of the implicit measures in terms of explaining variance in outcome. A slight improvement in prediction of group membership was seen when combining implicit and explicit variables. This increase suggests that the predictive properties of these measures do not fully overlap and that their combination extends their utility. This is promising for the future development of this method of psychometric testing. The optimised/simple positive image IAT index coupled with TCM score are the most useful combination of implicit and explicit measures in explaining variance in outcome. This is important as it is intended to use the tests to explain variance in outcome of injured Royal Marine recruits prospectively.

*7.4.2 Construct validity of the tests*

All the measures correlated with one another to a greater or lesser extent, confirming their construct validity. It is important to note that the relatively low correlations obtained between the explicit measures and the IATs are to be expected, and may partly reflect the absence in the IAT data of the methodological problems associated with questionnaires (Fazio et al., 1995; Greenwald & Banaji, 1995). The inter-method correlations observed in this study are comparable to correlations calculated in other studies investigating the construct validity of specifically developed IATs. For example, Nosek and Smyth's (2007) recent multitrait-multimethod validation of the IAT found correlations ranging from $r = .12$ to $r = .56$. Closer scrutiny of these findings reveals that lower correlations tend to be obtained where the subject matter is either more provocative or controversial (such as studies of perceptions of ethnicity or perceptions of obesity). It could be hypothesised that correlations between implicit and explicit measures of controversial subject matter could be moderated by effects of social-desirability bias. It was speculated in chapter 5 that social desirability bias may impact on the results obtained from Royal Marine recruit attitudinal measures; given the regimented and authoritarian situation in which they reside, they may feel obliged to answer in a way that they perceive would be expected of a marine. It is also possible that the IATs are only partially measuring the same attitudes as the TCM and the AIMS. As discussed, the regression analysis revealed additional variance explained by the implicit measures over and above that explained by the explicit measures. With these considerations in mind, it is not surprising that explicit to implicit correlations exist, but are not particularly strong ($r = .4$).

In this study, both IATs were found to be more related to the TCM scores than to the AIMS, although no difference was found for the optimised negative image IAT. This indicates the IATs measure components of organisational commitment possibly more than they do marine identity. However, it could be argued that there are elements of identity and commitment encompassed in both the AIMS and the TCM given that they correlated highly with one another.

*7.4.3 Descriptive data and reliability*

The results were not confounded by demographic differences between the King's Squad and opt-out groups, as there were no differences in descriptive data between the groups. The internal consistency within both implicit and both explicit measures was acceptable, with the implicit measures' split-half reliability statistics similar to those revealed in other IAT studies. For example, Nosek and Smyth (2007) developed seven different IATs and observed the internal consistency to be between $\alpha = .8$ and $\alpha = .87$. The median split-half was $\alpha = .81$ for the seven IATs and was .86 for the current study. This confirms that the internal consistency of the individual stimuli was good.

The factor structure of the TCM does not support the existence of three discrete subscales for this population. Either the TCM scale measures one aspect of commitment or the three measures are highly correlated (in which case some items may be redundant). These observations are contrary to previous research using the TCM. When the TCM was developed, Allen and Meyer's (1990) factor analysis suggested the existence of three discrete subscales. Despite this, the correlation observed between normative commitment and affective commitment was strong ($r$ = .51). While some other reported studies have also observed three subscales (Allen & Meyer, 1996), others have not (Irving, Coleman & Cooper, 1997). It is possible that the characteristics of the sample used to design the scales (employees of a university and two manufacturing firms) did not generalise well to the current sample of Royal Marine recruits. Perhaps the limitations in demographic range of the current participants, coupled with a lesser appreciation of the subtle differences between each item, may have reduced the sensitivity of the scales, thus resulting in one, overall indication of commitment rather than three separate categories.

Factor analysis also identified item 11 as loading onto a different factor than the majority of items. It is suggested that this particular item is phrased in a confusing way and so was answered differently to the other, more straightforward questions. Observation of the item revealed that it was somewhat ambiguous and could be perceived as either positive or negative. Likewise, item 14 appeared to load onto the same factor as the reverse-scored items. Contrary to Allen and Meyer's (1990) scoring instructions, observation of the item revealed that it could indeed have been reverse-scored and the negative value obtained in the factor analysis supports this observation. This finding was contrary to the test's authors' scoring recommendations. Given that only the total TCM results were used in this study, inclusion of items 11 and 14 were not problematic. However, in future studies, their deletion may require consideration, particularly if the intention is to use the subscales, or if it negatively affects the Cronbach's alpha value or factor loadings too greatly. Nevertheless, in this instance, the Cronbach's alpha was not notably improved through the removal of the questionable items, therefore it was decided to continue using the test in its entirety to comply with the original scoring instructions and to facilitate comparisons of the results with similar studies. All four reverse-scored items also loaded onto the second factor. This is indicative of response-sets caused by participants' carelessness while completing the tasks.

The factor analysis of the AIMS revealed all the items as loading onto the same factor. Coupled with the good level of internal consistency, this meant it was acceptable to continue to use the AIMS in the remaining analyses. Although Hale, James and Stambulova (1999) suggested that the AIMS comprises three subscales, this is contrary to the consensus reached in many other studies (Brewer, Van Raalte & Linder, 1993; Murphy, Petitpas & Brewer, 1996). Hale et al. (1999) suggested that this could be due to the range limitations of the samples employed in such studies. Brewer and Cornelius (2001) addressed Hale et al.'s (1999) concerns in their recent, extensive factor analyses that were conducted on large sample sizes (3000 respondents). They argued that the AIMS should continue to be utilised as a single, composite measure as the subscales suggested have not been empirically validated, and too few items comprise each of the subscales for the AIMS to be reliably used as a multidimensional measure.

*7.4.4 Limitations*

The key limitation of this study is that there are few social desirability pressures on marine recruits who have already explicitly said that they were leaving. The implicit measures might relate better to recovery times than the explicit measures in a prospective study at a time-point where some recruits have developed, but not expressed, less positive attitudes towards the Corps and training. The main benefit of this study, however, was that it was relatively quick to conduct and obtain results and gives a very useful gauge of the potential of psychometric tests for predicting future behaviour. In this case, both IATs have been found to differentiate the groups (with the positive image IAT holding the most promise for future use) and therefore a further, prospective study is justified using the AIMS and TCM once again for construct validation purposes, as the correlations between the implicit measures and both explicit measures were good. Without this present study, time and resources could have been wasted on a prospective study that may have not yielded very useful results.

Another methodological limitation of this study was the possibility of order effects influencing the findings. The comparison of the positive image and negative image IATs revealed the positive image IAT to have the greater concurrent validity. However, the complexity of the data collection system set up at Commando Training Centre meant it was impractical to counter-balance the order in which the psychometric tests were presented. This meant that recruits who took part completed the positive image IAT first, followed by the negative image IAT. Given that the tests require sustained attention over a twenty minute period of time, it seems conceivable that some participants may have experienced fatigue and a lapse in their concentration during the second, negative image IAT. This suggestion is supported by Nosek, Greenwald and Banaji (2007) who suggest that counter-balancing may reduce extraneous order effects. This is a useful lesson to learn, not just for this study, but for implicit association test studies where the scientist proposes to administer more than one IAT in a session. Alternatively, it could simply be that the positive image IAT presented images that the committed recruits related to better and that the negative images presented during the negative image IAT were more ambiguous and so did not generate as extreme responses as the positive image IAT. Indeed, evidence from the results suggests the latter is the case, as the iconicity scores for all the stimuli were good (chapter 6), and the opt-out group exhibited a greater median index for the negative image IAT.

### *7.4.5 Implications*

This investigation of the validity and reliability of IATs for use with Royal Marine recruits suggests that they may be an effective tool for measuring commitment in Royal Marine recruits. Early indicators of the IATs' concurrent and potential predictive power are good and are promising for the next prospective programme of work. The administration of the trial was effective and supports the use of this method in future psychometric studies based at Commando Training Centre or the implementation of developed methods.

### *7.4.6 Conclusions*

It is concluded that the concurrent validity of the positive image and negative image IATs in discriminating between the King's Squad and opt-out groups was good, and explained a high proportion of the variance. The positive image IAT was the better differentiator. Examination of the construct validity of the tests revealed that the positive image IAT was more strongly related to the TCM than the AIMS, suggesting that it measures more commitment related elements than it does elements of identity. The negative image IAT related similarly to both the TCM and AIMS suggesting it measures elements of both commitment and identity. Both tests exhibited construct validity with both explicit measures. Investigation of the reliability of the tests revealed the internal consistency was acceptable. The overall reliability of both the TCM and AIMS was good, but no subscales were found for the TCM.

# Chapter 8
# A Prospective Study of Psychological Factors and Rehabilitation Outcome in Royal Marines' Recruit Training Injuries

## *8.1 Introduction*

This chapter reports a prospective study of the psychological variables predicting injured Royal Marine recruits' recovery. Chapter 2 reported large variability in the recovery times of different injuries acquired during Royal Marines' training, which was largely unexplained by data routinely collected at Commando Training Centre. It was also noted that a substantial number of injured recruits never complete their rehabilitation and leave Royal Marines' training prematurely by either opting-out or by being discharged by management. The literature reviewed in chapters 3 and 4 highlighted a paucity of research investigating variance in recovery from injury in the sport and adherence literature. A selection of theoretical approaches was therefore reviewed as to their suitability, adaptability and potential for explaining why some individuals might recover more quickly than others from Royal Marine training injuries. Theories reviewed included protection motivation theory (Rogers, 1983) and fear-avoidance theory (Lethem, Slade, Troup & Bentley, 1983).

Derived from social cognitive theory, protection motivation theory identifies a number of psychological constructs important in positive psychological adaptation to physical rehabilitation and reduction in fear responses. These include perceived severity of the injury, susceptibility to future difficulty, rehabilitation value, treatment efficacy and self-efficacy. Complementary to the premises of protection motivation theory is the concept of fear-avoidance (Lethem, Slade, Troup & Bentley, 1983). Fear-avoidance theory was developed from the observed relationship between injured individuals' interpretation of pain, evaluation of the effects of physical activity, and their subsequent coping strategy. In terms of Royal Marine recruits, it was hypothesised that some recruits' reluctance or failure to rejoin mainstream training may be an avoidance coping strategy adopted due to their responses to pain during injury, and the perceived potential for that pain to recur during and after rehabilitation. Fear at the prospect of using the rehabilitated limb and becoming re-injured, or experiencing further pain, could be part of the driving force behind a recruit's decision as to whether he is strong enough to face the challenges of returning to mainstream training. Indeed, fear-avoidance theory lends itself well to the context of Royal Marines' training, as Vangronsveld, Peters, Goossens, Linton and Vlaeyen (2007) argued that fear-avoidance beliefs are more salient in individuals undergoing rehabilitation for traumatic injury, as their belief that pain is a consequence of physical damage and therefore signifies harm to the body is stronger than in pain patients whose pain origin is less defined. It was concluded that a extended model encompassing the overarching theoretical framework of protection motivation theory (Rogers, 1983) combined with the additional constructs of fear-avoidance (Lethem, Slade, Troup & Bentley, 1983), organisational commitment (Meyer & Allen, 1987), athletic identity (Eldridge, 1983) and pain (Keller et al., 2004), has potential to explain some of the variability in recovery times and rehabilitation outcome.

The focus later shifted to consider methodological issues important when measuring psychological constructs in a military environment. Chapter 5 hypothesised that implicit measures might capture aspects of injured recruits' attitudes that are possibly undetected by traditional, explicit measures. To facilitate a more in-depth approach to the current study, two Implicit Association Tests (IATs) to measure commitment and a Timed Antagonistic Response Alethiometer (TARA) to measure fear-avoidance were designed. The bespoke IATs and the TARA were developed using stimuli selected through three empirical studies reported in chapter 6, and the IATs' concurrent validity, construct validity and reliability were examined in chapter 7.

To test the proposed model and implicit methods, it was necessary for injured Royal Marine recruit participants to complete the tests during their rehabilitation. As described in chapters 1 and 2, the rehabilitation process at Commando Training Centre is quite methodical, in that recruits are organised into two discrete troops according to their rehabilitation progress. Recruits transferring from the medical centre first join 1 troop in Hunter Company. Historically, 1 troop consists mostly of rest for injured recruits, who tend to be injured severely enough at this stage so as to make weight-bearing rehabilitation problematic, or impossible. Only once the medical centre's physician agrees that a recruit's injury has healed enough for him to be able to conduct rehabilitative exercises prescribed by the remedial training staff is he then transferred to 2 troop. On joining 2 troop, an injured recruit is first placed in 'alpha' group, where the remedial exercises prescribed are primarily focused on improving the strength and mobility of the injured limb, combined with some gentle increasing to moderately demanding physical training to recover the individual's fitness. Following successful completion of this stage, the recruit must once again attend the medical centre. If the physician concludes that the injury has healed, the recruit may then progress to 'bravo' group, where the physical training becomes increasingly challenging to prepare him for rejoining training. Although the injury has technically healed by this time, the physical and mental rehabilitation continues relentlessly, as the standard of physical fitness and mental robustness required by mainstream training is very high. Once the remedial training team and medical centre physician have agreed that a recruit is physically fit and psychologically robust enough to return to training, he is informed of this and prepares to transfer to his new troop.

Although the rehabilitation process is methodical in organisation, the remedial staff and physician base their prognoses not only on the physical symptoms presented before them, but also on information provided by the recruit himself. It has been anecdotally reported that if a physically fit and healthy recruit does not feel psychologically ready to rejoin training for whatever reason, his reluctance may manifest itself in physical symptoms being reported such as pain or discomfort, or lack of mobility. Until now, psychological measures have never been collected and examined in this environment and the focus of research has always been on the physical components of rehabilitation. The proposed extended model of protection motivation theory might contribute to the explanation of why some injured Royal Marine recruits have a more favourable rehabilitation outcome than others, which has far-reaching practical applications as well as important academic implications.

This chapter builds on the findings from the previous literature and empirical chapters, and intends to test the proposed model using selected explicit measures and the bespoke implicit measures developed specifically for this programme of research. Therefore, the primary aims of the present study were to:

1. Test the ability of the components encompassed in the extended model of protection motivation theory, including fear avoidance, organisational commitment, marine identity and pain, to explain variance in *recovery time* of injured Royal Marine recruits (both singly and in combination).
2. Test the ability of the components encompassed in the extended protection motivation model, including fear avoidance, organisational commitment, marine identity and pain, to explain variance in *rehabilitation outcome* (success/failure) of injured Royal Marine recruits (both singly and in combination).

## *8.2 Methods*

### *8.2.1 Design and sample size*

This study featured a prospective design. Tabachnik and Fidell (2001) suggested examination of multiple interacting variables requires $N > 50 + 8$ x the number of variables, hence it was estimated that with 10 predictor variables, 130 participants would be sufficient for statistical analytical purposes. The total number of participants was 214. Cross-referencing of name lists provided by Commando Training Centre revealed a 97.7% participation rate for the data collected at Time 2. The 2.3% missing was due to administrative errors in terms of newly injured recruits failing to be informed of the study and therefore not being given the opportunity to participate. This gives confidence that the sample was representative. Recruits who had been transferred to Hunter Company and taken part in the study for professional failure reasons and not for injuries, and duplicates, i.e. participants who had unnecessarily taken part in the study more than once, were identified by cross-referencing their study data with their injury records and the data not pertaining to their actual injury dates were deleted. This resulted in an overall sample size of 189. The participants were all injured Royal Marine recruits residing in Hunter Company for physical injuries acquired during mainstream training from April 2007 to

February 2008. Of the 189 participants, a total of 83 (44%) also completed the baseline pain measure at Time 1 between July 2006 and December 2007. The main reason for this smaller sample size was due to administrative errors and key position changes at Commando Training Centre and not because of recruits choosing not to partake at Time 1.

### *8.2.2 Measures*

A summary of the data collected is given below in order of presentation to participants.

1. Age (years).
2. Ethnicity.
3. Self-reported computer literacy.
4. Positive image organisational commitment IAT.
5. Negative image organisational commitment IAT.
6. Fear-avoidance TARA (including explicit rating).
7. Brief Pain Inventory (BPI).
8. Athletic (marine) Identity Measurement Scale (AIMS).
9. Three Component Model of Commitment Questionnaire (TCM).
10. Sports Injury Rehabilitation Belief Survey (SIRBS).

Additional data and outcome variables that were collected from medical records comprised the following:

1. Medical diagnosis of injury.
2. Recovery time (time spent in Hunter Company in weeks).
3. Recovery outcome (succeeded/failed rehabilitation).

Further variables were calculated to control for injury type in the analysis:

1. Recovery time for each injury type based on existing Hunter Company data;
    a. Median recovery times in weeks, calculated from 5 years of data collected routinely by Hunter Company.
    b. $75^{th}$ percentile recovery times in weeks, calculated from 5 years of data collected routinely by Hunter Company.

*8.2.2.1 The IATs*

See chapter 7 (section 7.2.2.1) for a description and explanation of the positive image and negative image IATs.

*8.2.2.2 The TARA – description and explanation*

Table 28 illustrates how the TARA was constructed and presented to participants, in terms of its stimuli. The TARA consisted of three blocks presented in the following order.

*8.2.2.2.1 Block 1: Irrelevant statements*

Participants were presented with the categories *True* and *False* in dark green font on the computer screen in the top right and top left corners, respectively. They were presented with a series of twenty-four statements one at a time that were ‘irrelevant’ to them personally, but with a known correct or incorrect response, e.g. ‘A is a letter’ is known to be true and ‘2 is a letter’ is known to be false. Six statements known to be true were presented twice and six statements known to be false were presented twice. The statements were presented in blue font. Participants were required to click on the corresponding keyboard buttons (q for false and p for true) to the labels in the top right (true) and top left (false) corners of the screen. The labels true and false remained in the same position with the same corresponding keyboard keys for the entire duration of the TARA. Response times and error rates were recorded per item. This was a practice block and so did not contribute to the final analyses. See Figure 8 for an example screen from block 1.

*8.2.2.2.2 Block 2: Relevant statements*

This block was identical to block 1, except that the twenty-four statements (twelve statements, each presented twice) presented one at a time to the respondents were relevant to their individual situation regarding their injury and rehabilitation (as developed and selected by the study reported in chapter 6, section 6.4). For example ‘I’m sure I’ll make a complete recovery’ may be perceived as true for some recruits, but not for others, depending on their beliefs and attitudes toward their injury and rehabilitation regime. Two variants of each statement were presented in black font;

the original (derived from the main subject areas identified in the fear-avoidance beliefs questionnaire; Waddell, Newton, Henderson, Somerville & Main, 1993, as detailed in chapter 6), and a similarly worded statement that was opposite in sense but had the same meaning. This was to complicate the task for the respondent who, if giving socially desirable rather than genuine positive responses, would not be able to simply select the corresponding response key but would have to devote additional attentional resources to responding to each item dishonestly. Response times and error rates were recorded per item. This was a practice block and so did not contribute to the final analyses. See Figure 9 for an example screen from block 2.

*8.2.2.2.3 Block 3: Combined task*

Relevant (in black font) and irrelevant (in blue font) statements were presented one at a time, randomly, to the respondent, who had to categorise each one as true or false. Ninety-six items were presented to each participant in total. The ninety-six items comprised the six relevant positively phrased statements four times each, the six relevant negatively phrased statements four times each, the twelve, true irrelevant statements twice each and the twelve false irrelevant statements twice each. This was the experimental block and index calculation was based on recruits' response times and error rates for this block. Theoretically, this block should be easier for a truthful recruit (regardless of whether or not they have a positive outlook toward their rehabilitation), and difficult for a recruit with who was not accurately representing his attitude toward his injury and rehabilitation, as he would have to continuously alter his response strategy from truthful to dishonest. For example, if a positive phrase were presented that the participant in truth disagreed with, he would have to make a conscious effort to click the 'p' key in order to appear positive, rather than automatically clicking it as he would if he were genuinely positive. He would then have to alter his response strategy if the statement were followed by a personally irrelevant, but factually based statement such as 'A is a letter'. In order to respond correctly he would need to click 'p' to label this statement as true. The importance of negative recruits wishing to appear positive and the importance of altering response strategy can be further exemplified by considering the subsequent presentation of a negative statement. If the next statement presented were a negative statement, the recruit would again have to alter his response strategy from honest to dishonest in order to label the statement as false and click ‘q’. Positive and negative relevant statements and true and false irrelevant statements were alternated in order to increase the complexity of the task for recruits who wished to appear more positive than perhaps they really were. Response times and error rates were recorded per item. Section 8.2.4.1 details the TARA index calculation procedures.

Table 28

*Format of the TARA*

| Sequence | 1 | 2 | 3 |
|---|---|---|---|
| Task instructions | Irrelevant statements | Relevant statements | Combined task |
| Task description | X False<br>True X | X False<br>True X | X False<br>True X |
| Example stimuli | X A is a letter<br>B is a number X | X I’m sure I’ll make a complete recovery<br>Remedial exercise makes my injury worse X | X A is a letter<br>Remedial exercise makes my injury worse X |

Figure 8

*TARA block 1 example*

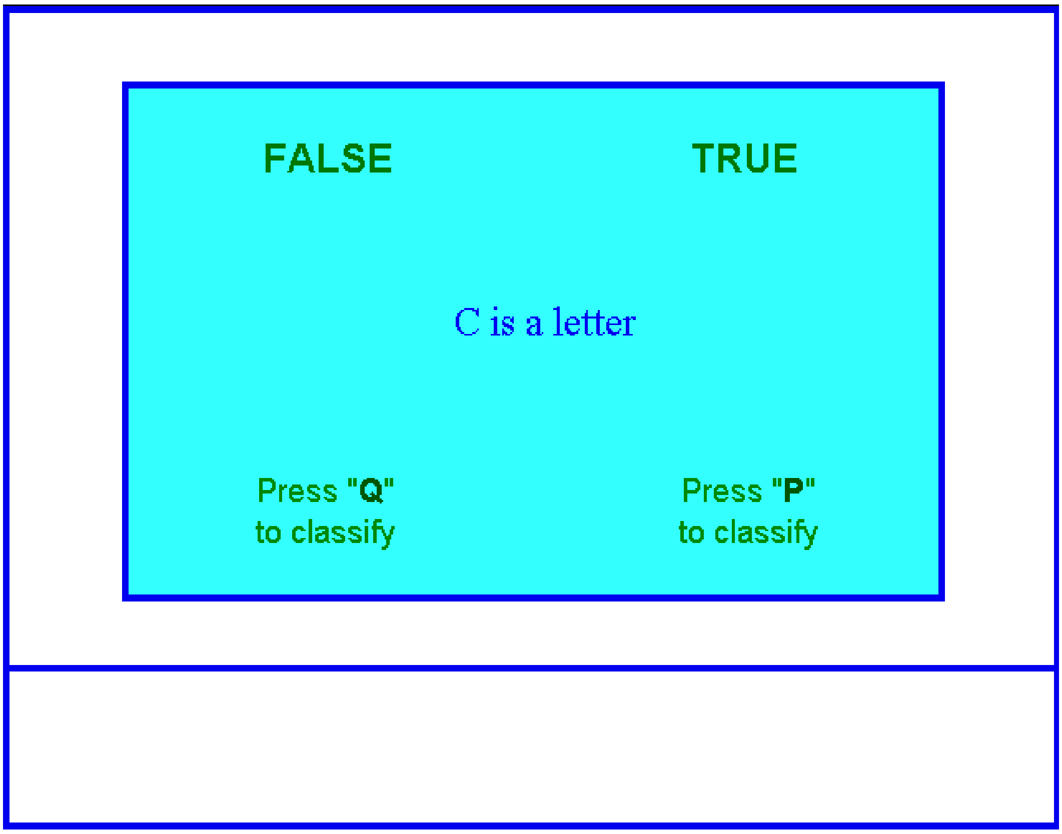
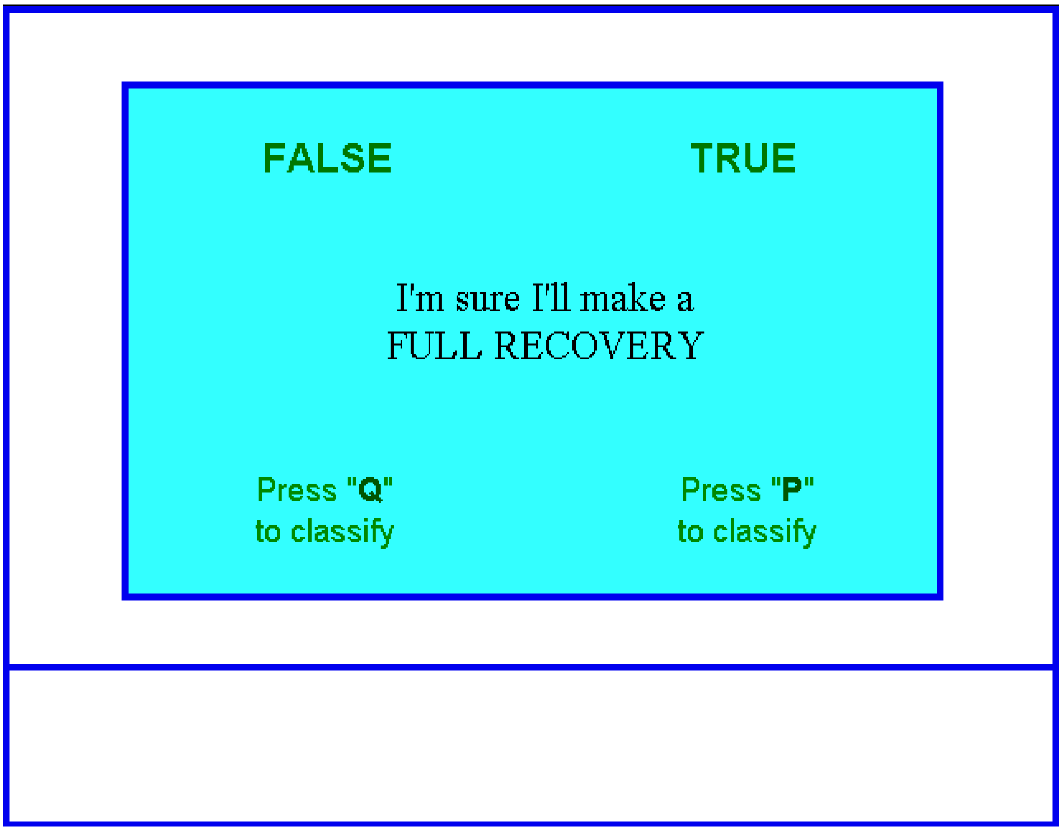


Figure 9

*TARA block 2 example*




*8.2.2.3 Explicit fear-avoidance*

Prior to completing the TARA, participants were asked to rate the six pairs of statements comprising positive and negative fear-avoidance beliefs used in the TARA. The statements were presented in pairs; the original and the similarly worded statement opposite in sense (as developed, empirically validated and selected in chapter 6; see section 6.4.3.3 for the selected statements) and participants were asked to select which statement of the two was most true to their situation and beliefs (see Figure 10 for an example). This automatically meant that the remaining statement was assumed to be false (see Figure 11 for an example of a list of statements rated as 'all true').

The classification of these pairs of statements was then combined with the individual error rate per item from block 2 of the TARA (see section 8.2.2.2.2). Data were recoded as follows:

- If an item from a statement pair was rated 1 explicitly (positive), and the error for that item was 0 (no error; whereby the participant later categorised the statement as true in the context of his own injury and rehabilitation) then score = 2 (participant more positive than negative toward rehabilitation and injury). Of all the individual scores comprising the scale total, a score of 2 made up 91.3% of the responses.
- If an item from a statement pair was rated 1 explicitly (positive), and the error for that item was 1 (error; whereby the participant later categorised the statement as false in the context of his own injury and rehabilitation) then score = 1 (participant no more positive than negative, therefore could be ambivalent/conflicted). Of all the individual scores comprising the scale total, a score of 1 made up 3.9% of the responses. This also accounts for scores of 1 as calculated below.
- If an item from a statement pair was rated 0 explicitly (negative), and the error for that item was 1 (error; whereby the participant later categorised the statement as true in the context of his own injury and rehabilitation) then score = 1 (participant also no more positive than negative, therefore could be ambivalent/conflicted).
- If an item from a statement pair was rated 0 explicitly (negative), and the error for that item was 0 (no error; whereby the participant later categorised the statement as true in the context of his own injury and rehabilitation) then score = 0 (participant more negative than positive toward rehabilitation and injury). Of all the individual scores comprising the scale total, a score of 0 made up 4.8% of the responses.

This recoding procedure was repeated for each item and the score for each item was totalled resulting in an overall fear-avoidance score ranging from 0-48. The higher the score, the more positive the recruit toward his injury and rehabilitation.

Figure 10

*Example of statement selection task for the explicit fear-avoidance measure and TARA*

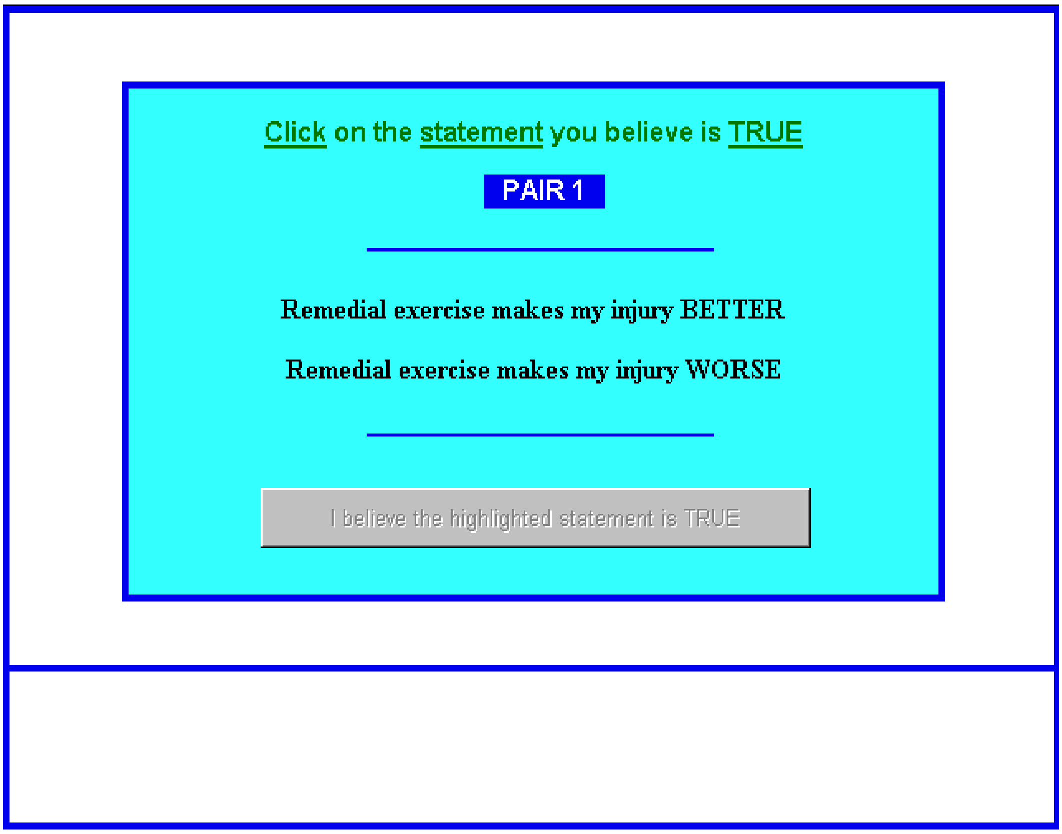
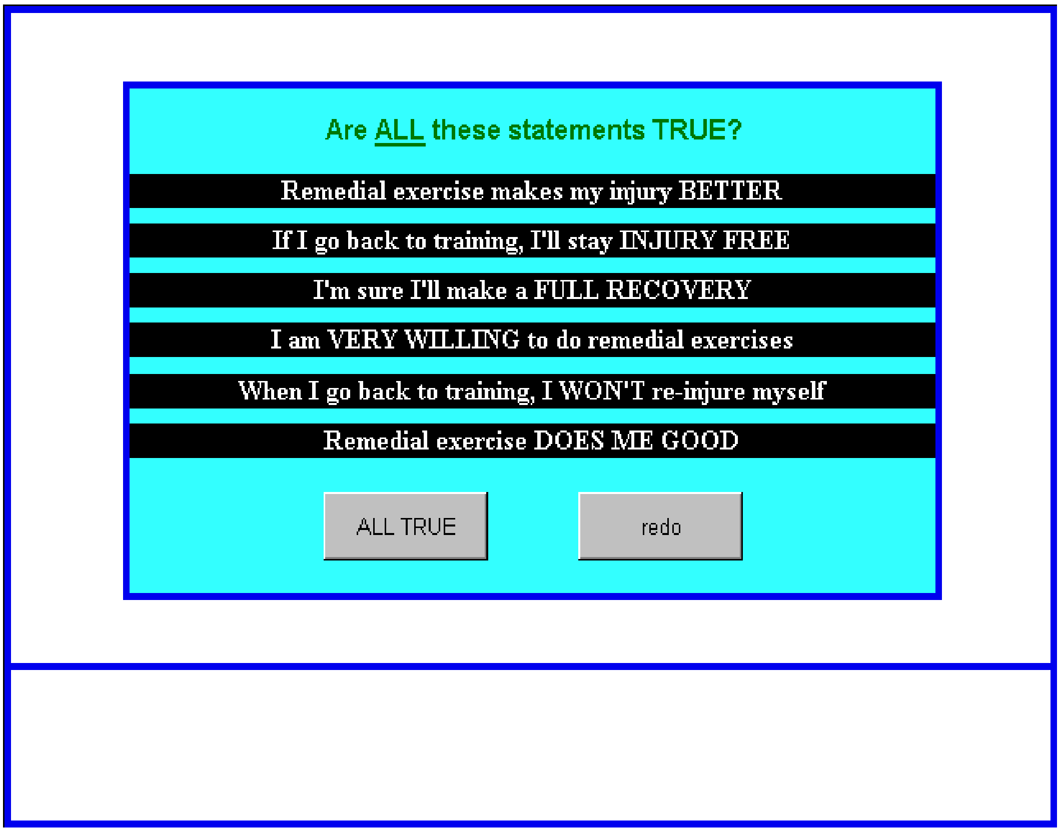


Figure 11

*Example of list of statements all classified as 'true' by a participant*




*8.2.2.4 Pain (BPI)*

Pain was measured using a modified version of the Brief Pain Inventory (BPI; Keller et al., 2004). The BPI was adapted to enable administration by computer, and provided a measure of perceived pain intensity and perceived disruptive impact caused by pain (Appendix A). These subscales are well validated and reliable and were selected to facilitate comparison of the current study with other health psychology studies using the same measures. Pain was first measured at the beginning of each recruit's rehabilitation (on entering 1 troop, Time 1) and again when the other explicit measures were administered (on entering 2 troop, Time 2). The mean scores of the items within the BPI subscales (perceived intensity and perceived impact of pain) at Time 1 and Time 2 were calculated, resulting in a score for each subscale ranging from -3 to +3. The lower the score, the greater the intensity and impact of the pain perceived by the participant.

*8.2.2.5 Marine identity (AIMS)*

Identity was measured using the Athletic Identity Measurement Scale (AIMS; Brewer, Van Raalte & Linder, 1993) as described in chapter 7, which was slightly modified to measure marine identity (Appendix A). The AIMS total scores were calculated identically to chapter 7. The tests were administered by computer for ease of data collection and collation. The higher the AIMS score (range of -30 to +30), the more the individual identified with the Royal Marines.

*8.2.2.6 Organisational commitment (TCM)*

Organisational commitment was measured using the Three Component Model of Commitment Questionnaire (TCM; Allen & Meyer, 1990), as described in chapter 7 (Appendix A). The TCM total scores were calculated identically to chapter 7. The tests were administered by computer for ease of data collection and collation. The higher the TCM score (range from -54 to +54), the more committed the individual was to the Royal Marines.

*8.2.2.7 Protection motivation theory (SIRBS)*

The Sports Injury Rehabilitation Beliefs Survey (SIRBS, Appendix A) measures explicit attitudes important in protection motivation theory; these are perceived severity of the injury, susceptibility to future difficulty, rehabilitation value, treatment efficacy and self-efficacy (Taylor & May, 1996). The scale is available in the open literature, so there were no concerns over copyright. The SIRBS subscales (perceived severity of the injury ranging from -15 to +15, susceptibility to future difficulty ranging from -15 to +15, rehabilitation value ranging from -3 to +3, treatment efficacy ranging from -12 to + 12 and self-efficacy also ranging from -12 to +12) were calculated by totalling the scores obtained for the items within each subscale. Higher scores indicated greater perceived severity, lower perceived susceptibility to future difficulty, higher treatment efficacy beliefs, higher self-efficacy beliefs and greater value placed on rehabilitation.

*8.2.2.8 Outcome measures*

Relative recovery time: Two outcome variables were calculated in order to examine the relationship between psychological factors and recovery from injury. First, the actual recovery time in weeks of participants who had successfully completed their rehabilitation and returned to mainstream training was calculated by subtracting the date each individual joined Hunter Company from the date the individual left Hunter Company. Injured recruits present immediately to Hunter Company subsequent to the physician's diagnosis, and leave Hunter Company to return to mainstream training immediately they are fit and well enough. Therefore, time spent in Hunter Company was considered to be the most accurate possible reflection of time spent in rehabilitation and, therefore, recovery time. Of course, this variable excluded those who did not return to training.

In order to control for the effects on recovery time of differences in individuals' injury; the median recovery time in weeks for their particular injury was then subtracted from their actual recovery time. This was in order that the outcome variable 'relative recovery time' reflected whether a recruit took longer or less time than usual to recover. As discussed in chapter 2, it was not possible to control for the differences in severity *within* an injury group, therefore, care was taken to ensure differences in the expected recovery time were accounted for *between* each injury type. Injuries were categorised by injury type using the same codes as were used in chapter 2. The physician's medical diagnosis was obtained from the Hunter Company database and cross-referenced with the medical database in sickbay to ensure accuracy. The median recovery time for each injury type was calculated by auditing the last five years of medical and rehabilitation data routinely collected at Commando Training Centre.

Outcome of rehabilitation: The second outcome variable comprised each injured recruit's final outcome of rehabilitation. Specifically, a dichotomous outcome of 'successful rehabilitation' and 'failed rehabilitation' was calculated. Outcome of rehabilitation was collected from the Hunter Company database and EMIS database, to ascertain who had successfully returned to mainstream training and therefore succeeded in rehabilitating, and who had not completed their rehabilitation and had therefore failed in their rehabilitation. The latter included injured recruits who had been medically discharged or discharged unsuitable, opted-out of rehabilitation prematurely by leaving the Royal Marines of their own volition, or were still in Hunter Company, but had exceeded the maximum time taken previously by recruits who had successfully returned to training with a similar or the same injury. It is important to note that recruits who had simply decided they no longer wanted to be a Royal Marine had the opportunity to leave immediately after they were injured, or during the early stages of 1 troop, before they were recruited for this study. Therefore, all recruits taking part in this study had initially been motivated to complete rehabilitation and return to training.

### *8.2.3 Procedures*

A protocol was submitted to the Ministry of Defence Research Ethics Committee and the Southampton University ethics committee, and ethical approval was obtained. The Company Sergeant Major of Hunter Company provided the researcher with a weekly list of the names and service numbers of recruits who had joined Hunter Company due to injury, and those who were to progress from 1 troop to 2 troop. 1 troop is where injured recruits are housed immediately they become injured and have to rest as they are unable to embark on physical rehabilitation. Recruits then progress to 2 troop as soon as they are ready to undertake more physically demanding remedial exercises. An information sheet detailing the study was given to recruits on entry to the Company as part of their joining routine by the Officer Commanding Hunter Company. This was for information only, as it was made explicit that the trial was voluntary. It was then the recruit’s choice as to whether he subsequently took part. Only injured recruits residing in Hunter Company were invited to participate in the study.

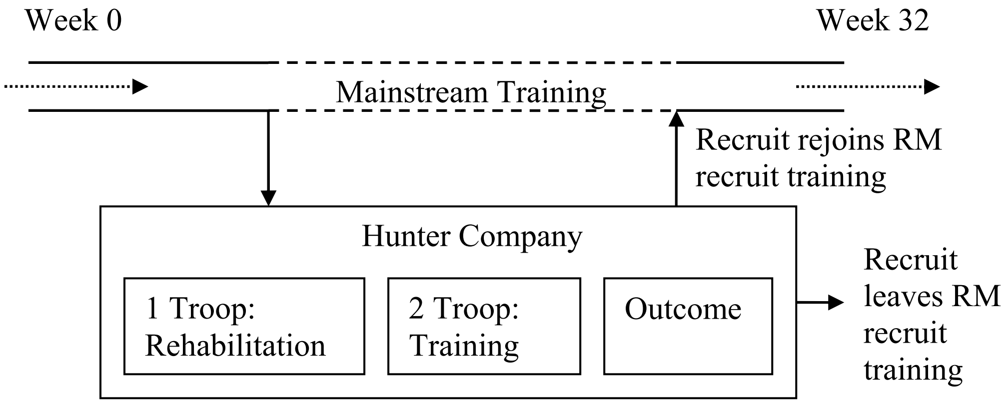
As in the empirical study reported in chapter 7, all of the psychometric tests (including the explicit measures) were administered by computer in the adult learning centre at the Commando Training Centre. The data were automatically collected, collated and encoded by the computer programme. Participants who volunteered attended the adult learning centre as soon as possible after transferring to Hunter Company, and then a second time on progressing from 1 troop to 2 troop. The median time spent between Time 1 and Time 2 was 14 weeks (minimum 1 week, maximum 59 weeks). On arrival, participants were given detailed instructions concerning the purpose of the task and how it is to be completed (Appendix G for Time 1 and for Time 2). When volunteer recruits were satisfied with the purpose of the study and the way in which would be conducted, they were provided with a consent form (Appendix G for Time 1 and for Time 2) and were requested to sign the consent form while another recruit witnessed the signature. The consent forms were posted into a sealed box and collected by the researcher. Consent was also sought a second time when recruits logged-on and began the computer programme, by ticking a box to agree to take part in the study. Each recruit was able to access the computer programme by entering his service number, surname and date of birth. Subsequent to cross matching of data over time points, collection of outcome data, and cross-referencing with the lists of names provided by the Company Sergeant Major, all identifiers were irreversibly removed. Recruits who were transferred to Hunter Company due to re-injury were identified by their service numbers and were not invited to take part a second time in the study. All data associated with the computer programme were encrypted and password protected, and only the researcher had access to it. Participants' rehabilitation outcome data were collected from the medical centre database once they had completed their remedial training or left Commando Training Centre.

Each logistical step in the procedures was discussed with the relevant staff at Commando Training Centre, who granted their consent and support. Equipment required for the study was discussed and housed with the information technology department at the Commando Training Centre, and provided by the Institute of Naval Medicine.

Participants were asked to answer questions and complete the tasks designed to assess their attitudes and beliefs toward their injury, pain, rehabilitation and toward Royal Marines. A summary of the procedures can be found in Figure 12.

Figure 12

*Summary of prospective study procedures*




Time 1:
1. Recruit informed of study on joining Company.
2. Signs consent form.
3. Attends Adult Learning Centre to complete baseline pain measure.
4. Data collected from July 2006 to December 2007.

Time 2:
1. Recruit informed of part 2 on joining 2 Troop.
2. Signs consent form.
3. Attends Adult Learning Centre to complete remaining tasks as detailed in section 8.2.2.
4. Data collected from April 2007 to February 2008 (Time 2 completed median 14 weeks after Time 1).

Time 3:
1. Outcome data collected.
2. Audit of existing Hunter Company data conducted to calculate median recovery times and *P75* recovery times by injury as detailed in section 8.2.2.
3. Data collected March 2008.

*8.2.4 Data preparation and statistical analyses*

The data were automatically collated in a WordPad document and transposed into an Excel spreadsheet and SPSS spreadsheet.

*8.2.4.1 Implicit measures indices calculation*

The optimised algorithm written in Authorware was once again applied to the data in the present study to calculate the indices, since this yielded a slightly better concurrent validity of the optimised IAT indices in the study reported in chapter 7. This was also in accordance with index calculation recommendations by Greenwald, Nosek and Banaji (2003), and so better enabled comparison with other IAT studies. Once again, both the positive and negative image IATs' indices were calculated.

The data cleaning procedures employed prior to the IAT index calculation process were also applied to the TARA data (see chapter 7, section 7.2.4.2). Subsequent to this, indices were generated using an algorithm specifically written for the study in Authorware. The mean response times were calculated for block 3 after controlling for absolute outlier response times, idiosyncratic outlier response times, and after penalising for errors. It is important to note that only recruits who had rated their explicit fear-avoidance beliefs as entirely positive (i.e. explicit fear-avoidance score = 48) were selected for the purposes of analyses involving the TARA. The reason for this was that the purpose of the TARA was to discriminate between individuals who were genuinely and falsely rating their explicit fear-avoidance beliefs as positive. Therefore, individuals who were honest about their explicit fear-avoidance beliefs being less than positive were not included.

*8.2.4.2 Reliability and data distribution*

Cronbach's alpha was calculated for the BPI subscales, the AIMS, the TCM and the SIRBS subscales. Split-half reliability was computed for the positive image and negative image IATs' indices, and for the TARA indices to establish internal consistency, correcting using the Spearman Brown formula. Median, 25$^{th}$ percentile, 75$^{th}$ percentile, skewness and kurtosis were calculated to check for distribution normality, and histograms were generated and checked visually. Log transformation of the skewed data did not improve its distribution; therefore, these variables were ranked for calculating correlations and all other analyses using these measures were non-parametric. Factor analysis was conducted to verify the subscales of the BPI, the TCM and the SIRBS using principal axis factoring extraction and varimax rotation.

*8.2.4.3 Inter-relationships between predictor variables*

The construct validity of the implicit measures was examined by calculating Pearson's product moment correlation coefficients between the implicit and explicit measures. The inter-relationships between the explicit measures were examined by calculating Pearson's product moment correlation coefficients.

*8.2.4.4 Predicting recovery time*

Descriptive, quartile data on injury type and recovery time of the injured sample were calculated. Descriptive, quartile data on injury type and recovery time used to calculate the relative recovery time can be found in Appendix G. To satisfy the first main aim of the study, Pearson's correlation coefficients were calculated between relative recovery time and the predictor variables. Only recruits who had successfully returned to training were included in the analyses in order that recruits who failed rehabilitation did not confound the findings. Each of the variables identified by the bivariate analyses were then entered into a forward stepwise linear regression in order to establish what proportion of the variance in relative recovery time was explained by each variable.

*8.2.4.5 Predicting rehabilitation outcome*

To satisfy the second main aim, individual logistic regressions were conducted on the data to examine the relationship between each of the predictor variables and whether an injured recruit succeeded or failed at rehabilitation. Non-parametric tests were used as the sample sizes for each group were very dissimilar and the outcome variable was binary. Where associations were found, their combined contribution to the overall explanation of variance in recovery outcome was examined using forward stepwise logistic regression.

On consideration of the extended model of protection motivation theory model, it was possible that there could be an interaction effect between self-efficacy and perceived severity identified in the multivariate analysis. The possible interactions between identified predictor variables were carried out by centering the variables identified in the bivariate analyses and then calculating an interaction variable by multiplying the centred predictor variables with one another (Baron & Kenny, 1986). In accordance with the approach recommended by Baron and Kenny (1986), the interaction variable was then entered into a stepwise logistic regression following the centred predictor variables to establish whether additional variance could be explained.

Following logistic regression, the overall fit of the model was tested using path analysis based in structural equation modelling (SEM). Following testing of the hypothesised model proposed in chapter 4, and reiterated in section 8.3.4 of the current chapter, modifications were made to the *a priori* model based on theoretical contemplation. Consideration was also given to the semantics of the items comprising the measures applied in the study. The fit of the revised model was tested and compared to the original model, and the indirect relationships between predictor variables and outcome of rehabilitation were further investigated using path analysis. All analyses were conducted using Mplus Version 5 (Muthén & Muthén, 1998-2008). The modification indices were examined, and the model was further refined, through the addition of pathways between variables where the modification indices were conducive to the theory underlying the model. Several indicators of fit are provided; these include chi-square ($\chi^2$), the ratio of chi-square to degrees of freedom ($\chi^2$:df), the root mean square error of approximation (RMSEA) and the comparative fit index (CFI). It has been suggested that a model that fits the data well would obtain a chi-square of no more than four times the degrees of freedom, a CFI of greater than .9 and a RMSEA of less than .08 (Byrne, 2001).

*8.2.4.6 Perceived intensity and impact of pain*

The sub-sample of recruits who completed the pain scales at Time 1 as well as Time 2 consisted of 83 participants. Mann-Whitney U tests were conducted to ensure that recruits who completed Time 1 and 2 did not differ from those who only completed tests at Time 2, therefore ensuring that this sub-sample was representative of the total sample. To investigate the relationship of perceived intensity of pain and perceived impact of pain to the predictor variables, Pearson's correlation coefficients were calculated between measures of pain taken at Time 1 and 2 and with the implicit and explicit psychological variables. Associations were further examined by partialling out the influence of pain at Time 1, in order to investigate the relationship between the psychological variables and change in pain intensity and impact over time.

## *8.3 Results*

### *8.3.1 Participants*

Participants' demographic data revealed the majority of participants were white and computer literate. Table 29 presents demographic details of the sample.

Table 29

*Demographic description of sample (N = 189)*

| | Injured sample |
|---|---|
| Median age* | 21 |
| White ethnicity | 97% |
| Computer literate | 95% |

*Age in years.

As in chapter 2, Table 30 illustrates that stress fractures were once again the most common injury (18% of all injuries). The overall median recovery time for an injured recruit was 19 weeks.

Table 30

*Recovery time in weeks for the sample's injuries*

| Injury | *N* | % of sample | *P25* | *Median* | *P75* |
|---|---|---|---|---|---|
| Stress fracture total | 29 | 18 | 24 | 36.8 | 48 |
| Unspecified stress fracture | 20 | 12.4 | 10 | 14.0 | 20.0 |
| Tibia stress fracture | 4 | 2.5 | 22 | 23 | 48 |
| Metatarsal stress fracture | 4 | 2.5 | 9 | 32.5 | 41 |
| Femur stress fracture | 1 | 0.6 | 55 | 55 | 55 |
| Knee injury | 28 | 17.3 | 10 | 14 | 25.8 |
| Ankle injury | 22 | 13.6 | 11 | 19 | 37.5 |
| Soft tissue injury | 13 | 8 | 10 | 25 | 37 |
| Back injury | 12 | 7.4 | 11.5 | 23.5 | 30 |
| Leg injury | 10 | 6.2 | 13.5 | 16 | 37 |
| Heat/cold injury | 7 | 4.3 | 3.8 | 20 | 31.5 |
| Foot injury | 6 | 3.7 | 12.5 | 14.5 | 22.8 |
| Hip pain | 6 | 3.7 | 9.5 | 12.5 | 28 |
| Tendon injury | 6 | 3.7 | 16.8 | 18.5 | 26.5 |
| Fracture (foot) | 4 | 2.5 | 9 | 13 | 17 |
| Shin splints | 3 | 1.9 | 20 | 31 | 43 |
| Fracture (finger) | 3 | 1.9 | 13.8 | 20.5 | 29.9 |
| Shoulder injury | 2 | 1.2 | 5 | 6.5 | 8 |
| Hand/finger injury | 2 | 1.2 | 7 | 24.5 | 42 |
| Respiratory | 2 | 1.2 | 9 | 10 | 11 |
| Fracture (leg) | 2 | 1.2 | 22 | 24 | 26 |
| Fracture (metatarsal) | 2 | 1.2 | 12 | 15.5 | 19 |
| Compartment syndrome | 1 | 0.6 | 11 | 11 | 11 |
| Fracture (unspecified) | 1 | 0.6 | 30 | 30 | 30 |
| Fracture (skull) | 1 | 0.6 | 34 | 34 | 34 |
| Total | 162 | 100 | 11 | 19 | 30 |

*8.3.2 Reliability and data distribution*

The internal consistency of the measures was mainly very good or excellent (>.8; see Table 31). The reliability of the SIRBS severity and TCM scales was lower but still adequate (.69 and .75 respectively). The SIRBS severity subscale could have been improved to .84 by removal of the last item ‘injuries like this are minor interruptions to my involvement in recruit training’. However, the alpha obtained for the severity subscale was substantially better than that obtained by its developers (.52). Therefore, in order to apply the scale in the way in which was intended by the authors and because of the scale’s overall acceptable alpha, the item was not removed. Furthermore, a study conducted by Brewer et al. (2003), also reported that deletion of the same item improved the alpha to .80. They conducted two sets of analyses; one using the original perceived severity subscale, and a second using the modified subscale. The two sets of results correlated highly (r = .93) and the results obtained from the analyses were identical in terms of significant findings. They too only reported the findings of the original subscale for comparative purposes.

Table 31 presents the 25$^{th}$ percentile, median and 75$^{th}$ percentile values for each of the measures. It can be seen that injured recruits tended to report their pain as being at the upper end of the scale, as evidenced by the negative skew in the data for BPI intensity for Time 2, and impact for Time 1 and 2 of the pain subscales. Recruits tended to rate their marine identity as strong, as the AIMS scale was also negatively skewed. Recruits tended to self-report their susceptibility to future difficulty as being lower rather than higher, and their beliefs in the efficacy of treatment and their self-efficacy as higher rather than lower, as the SIRBS susceptibility to future difficulty, SIRBS treatment efficacy, SIRBS self-efficacy and SIRBS rehabilitation value subscales were all negatively skewed. The fear-avoidance data were also negatively skewed. However, it is important to note that observations were obtained for every available score from 16 through to 48. The remaining explicit measures and all of the implicit measures data were not substantially skewed or were normally distributed. The proportion of recruits who successfully completed their rehabilitation and returned to training was 83.6% ($n$ = 133) and the proportion of recruits who failed their rehabilitation and left the establishment was 16.4% ($n$ = 26).

Table 31

*Reliability and distribution data for each of the dependent variables*

| | Internal consistency[a] | *P25* | *Mdn* | *P75* | *N* |
|---|---|---|---|---|---|
| +ve IAT | .81 | .52 | .91 | 1.16 | 172 |
| -ve IAT | .83 | .65 | 1.04 | 1.22 | 160 |
| TARA | .95 | 1379.81 | 1602.11 | 1817.69 | 148 |
| BPI | | | | | |
| Intensity T1 | .87 | .50 | 1.25 | 1.75 | 83 |
| Impact T1 | .88 | .57 | 1.29 | 2.14 | 83 |
| Intensity T2 | .83 | 2.25 | 3.00 | 3.00 | 189 |
| Impact T2 | .90 | 2.43 | 3.00 | 3.00 | 189 |
| AIMS | .84 | 15.00 | 20.00 | 25.50 | 189 |
| TCM | .75 | 13.00 | 22.00 | 30.00 | 189 |
| SIRBS | | | | | |
| Severity | .69 | -3.00 | 1.00 | 7.00 | 189 |
| Susceptibility | .93 | 8.00 | 10.00 | 15.00 | 189 |
| Treatment efficacy | .89 | 5.00 | 8.00 | 12.00 | 189 |
| Self-efficacy | .94 | 8.00 | 9.00 | 12.00 | 189 |
| Rehabilitation value | NA[b] | 2.00 | 3.00 | 3.00 | 189 |
| Explicit fear-avoidance | .84 | 46 | 48 | 48 | 189 |
| Outcome | | | | | |
| Relative recovery time | - | -.25 | 3.25 | 14.00 | 159 |

[a] Cronbach's alpha was calculated for the explicit measures and split-half coefficients ($r$) were calculated for the implicit measures. [b] Cronbach's alpha could not be calculated for SIRBS rehabilitation value, as the scale consisted of only one item.

Note. +ve IAT = positive image Implicit Association Test, -ve IAT = negative image Implicit Association Test, TARA = Timed Antagonistic Response Alethiometer, BPI = Brief Pain Inventory, T1 = Time 1, T2 = Time 2, AIMS = marine identity, TCM = organisational commitment, SIRBS = Sports Injury Rehabilitation Belief Survey.

The subscales of the BPI, TCM and SIRBS were factor analysed to support their use as multi-dimensional scales. In accordance with Keller et al. (2004), factor analysis of the BPI items supported the existence of two subscales. The first subscale (factor 1) appeared to measure the perceived intensity of the pain and the second subscale (factor 2) appeared to measure the perceived impact that pain has on an individual's lifestyle. Factor analysis of the TCM into its sub-components (A, C and N) supported the findings presented in section 7.3.4 in chapter 7, which suggested that the TCM would be better applied as a unidimensional measure of organisational commitment, as the items load onto one factor rather than three, discrete factors as originally proposed by Allen and Meyer (1990). Finally, in accordance with Taylor and May (1996), factor analysis of the SIRBS items supported the existence of five subscales. A slight overlap was observed between the loadings of three of the items measuring susceptibility to future difficulty and the treatment efficacy factor, one of the items measuring susceptibility overlapped with the self-efficacy factor, and the item measuring rehabilitation value also overlapped with the self-efficacy factor. Despite the overlaps, the items loaded predominantly onto the five expected factors correctly.

*8.3.3 Inter-relationships between predictor variables*

The inter-relationships between implicit and explicit measures were investigated in order to explore the construct validity of the implicit measures (see Table 32). The results indicated that, once again, the greater recruits' commitment and marine identity, the more significantly difficult they found completing the incompatible blocks in the IATs and therefore the larger the difference in response times between the compatible and incompatible blocks (and their corresponding IAT indices), as previously found and reported in chapter 7 (sections 7.3.2 and 7.3.6). In comparison however, the correlations were lower than those obtained in the previously study (.28 and .20 between the positive image IAT in this study and the AIMS and TCM respectively compared with .39 and .49 obtained in the previous study, and .23 and .16 between the negative image IAT and the AIMS and TCM respectively (compared with .40 and .40 obtained in the previous study). Once again, the correlation obtained between the positive image and negative image IATs was high ($r = .62$, $p < .001$, $N = 155$). The negative correlation obtained between the IATs and the SIRBS perceived severity subscale, and the positive correlation observed between the positive image IAT, self-efficacy and rehabilitation value indicates that recruits were not concealing their beliefs. This is because the apparent relationship between the IATs and these explicit measures could only have been obtained had the recruits responded honestly. This has two positive implications. First, it gives confidence that the explicit results are reliable and that participants have responded truthfully. Second, it gives confidence that the IATs might reveal recruits implicit attitudes if applied again in a more contentious context, where recruits were less likely to respond truthfully. The TARA did not correlate significantly with any of the other variables, nor did it correlate with the IATs ($r$ = -.09, $p$ = .26, $N$ = 169 with the positive image IAT and $r$ = -.14, $p$ = .08, $N$ = 158 with the negative image IAT).

Table 32

*Correlations between the implicit and explicit measures*

| | +ve IAT ($N$ = 172) | -ve IAT ($N$ = 160) | TARA ($N$ = 148) |
|---|---|---|---|
| BPI | | | |
| Intensity T1 | -.30[a] | .02[b] | -.08[c] |
| Impact T1 | -.13[a] | -.04[b] | .02[c] |
| Intensity T2 | .15* | .13 | .01 |
| Impact T2 | .14 | .22** | -.01 |
| AIMS | .28** | .23** | .11 |
| TCM | .20* | .16* | .06 |
| SIRBS | | | |
| Severity | -.27** | -.23** | .07 |
| Susceptibility | .13 | .13 | -.02 |
| Treatment efficacy | .08 | .06 | -.01 |
| Self-efficacy | .22** | .11 | -.06 |
| Rehabilitation value | .20* | .05 | .08 |
| Explicit fear-avoidance | .15 | .04 | NA[d] |

$*p < .05$, $**p < .01$ . [a]$N = 77$, [b]$N = 70$, [c]$N = 65$. [d]It was not possible to calculate a correlation as only participants who had maximum explicit fear-avoidance scores were selected for analyses with the TARA.

Inter-correlations between the explicit variables are presented in Table 33. Apart from the perceived severity subscale, injured recruits who scored highly on one of the SIRBS subscales tended also to score highly on the other four SIRBS subscales, meaning that a positive belief in one area such as high self-efficacy was related to positive beliefs in other areas, such as high treatment efficacy and low susceptibility to future difficulty. Self-efficacy and treatment efficacy appear to measure similar, related constructs as recruits high in self-efficacy also scored highly in treatment efficacy. Also, recruits who were high in the positive characteristics measured by the SIRBS were also higher in commitment and marine identity, meaning that if an individual has a positive outlook in one area, he is likely to have a positive outlook in most other areas. Finally, recruits who reported their pain as more severe also reported greater self-efficacy, greater treatment efficacy, greater rehabilitation value and less anticipated susceptibility to future difficulty.

Table 33

*Correlations between the explicit measures (N = 189)*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| BPI | | | | | | | | | | |
| 1 Intensity T2 | - | | | | | | | | | |
| 2 Impact T2 | .58** | - | | | | | | | | |
| 3 AIMS | .19** | .16* | - | | | | | | | |
| 4 TCM | .07 | .09 | .60** | - | | | | | | |
| SIRBS | | | | | | | | | | |
| 5 SIRBS Severity | -.10 | -.09 | .16* | .14 | - | | | | | |
| 6 SIRBS Susceptibility | .20** | .23** | .46** | .37** | .09 | - | | | | |
| 7 SIRBS Treatment efficacy | .27** | .27** | .47** | .36** | .01 | .76** | - | | | |
| 8 SIRBS Self-efficacy | .26** | .30** | .44** | .38** | .02 | .70** | .73** | - | | |
| 9 SIRBS Rehabilitation value | .07 | .21** | .29** | .28** | .05 | .40** | .36** | .53** | - | |
| 10 Explicit fear-avoidance | .30** | .20** | .10 | .06 | -.20** | .23** | .31** | .23** | .10 | - |

*$p < .05$, **$p < .01$.

*8.3.4 Predicting outcome of rehabilitation*

To test the first main hypotheses, and to establish whether the psychological variables were related to recovery time from injury, correlations between these variables and recovery time were examined. Of all the implicit and explicit measures, only perceived severity of the injury was related to outcome ($r$ = .22, $p$ = .005, $N$ = 159). Age was also related to relative recovery time ($r$ = .23, $p$ = .005, $N$ = 149). Linear regression analysis revealed a combination of age and severity explained 10.4% of the variance in relative recovery time (Table 34).

Table 34

*Linear regression results for predictors of relative recovery time*

| | | | | | 95% CI for B | | |
|---|---|---|---|---|---|---|---|
| | B | *SE* | Standardised B | *t* | Lower | Upper | *N* |
| Age in years | 1.085 | .364 | .233 | 2.978* | .365 | 1.805 | 148 |
| SIRBS | | | | | | | |
| Severity | .542 | .185 | .229 | 2.928* | .176 | .908 | 148 |

*$p$ = .005

To examine the second main hypothesis of the study, the predictive validity of the model was further tested using successful rehabilitation as the primary outcome measure. Marine identity, commitment, perceived severity of the injury, susceptibility to future difficulty, treatment efficacy, self-efficacy and explicit fear-avoidance were all found to be related to whether or not a recruit successfully completed his rehabilitation (see Table 35). In particular, self-efficacy, treatment efficacy and marine identity were found to relate strongly to whether a recruit completed his rehabilitation.

Table 35

*Summary of individual bivariate logistic regressions to predict of rehabilitation success*

| | | | | | Exp(B) 95% CI | | |
|---|---|---|---|---|---|---|---|
| | B | *SE* | Wald | Exp(B) | Lower | Upper | *N* |
| Age | .105 | .065 | 2.580 | 1.110 | .977 | 1.262 | 159 |
| +ve IAT | -.473 | .451 | 1.101 | .623 | .258 | 1.508 | 145 |
| -ve IAT | -.733 | .466 | 2.478 | .480 | .193 | 1.197 | 136 |
| TARA | .001 | .001 | 1.748 | 1.001 | 1.000 | 1.002 | 123 |
| BPI | | | | | | | |
| Intensity T1 | -.078 | .355 | .048 | .925 | .461 | 1.857 | 78 |
| Impact T1 | .160 | .291 | .304 | 1.174 | .664 | 2.075 | 78 |
| Intensity T2 | -.431 | .282 | 2.333 | .650 | .374 | 1.130 | 159 |
| Impact T2 | -.356 | .213 | 2.786 | .701 | .462 | 1.064 | 159 |
| AIMS | -.061 | .023 | 7.092** | .941 | .900 | .984 | 159 |
| TCM | -.033 | .016 | 4.429* | .968 | .939 | .998 | 159 |
| SIRBS | | | | | | | |
| Severity | .081 | .034 | 5.840* | 1.085 | 1.015 | 1.159 | 159 |
| Susceptibility | -.067 | .033 | 4.086* | .935 | .876 | .998 | 159 |
| Treatment efficacy | -.121 | .041 | 8.885** | .886 | .818 | .959 | 159 |
| Self-efficacy | -.142 | .048 | 8.655** | .867 | .789 | .954 | 159 |
| Rehabilitation value | -.338 | .220 | 2.367 | .713 | .464 | 1.097 | 159 |
| Explicit fear-avoidance | -.051 | .026 | 3.777* | .950 | .902 | 1.000 | 159 |

$^{*}p < .05$, $^{**}p < .01$.

The distribution of the data that contributed to the bivariate analyses was examined. There were up to 133 recruits in the successful rehabilitation group, but only 26 in the failed rehabilitation group. Table 36 presents the 25$^{th}$, median and 75$^{th}$ percentile data for the successful rehabilitation and failed rehabilitation groups.

Table 36

*Distribution data for each of the predictor variables by outcome group*

| | Successful rehabilitation group | | | | Failed rehabilitation group | | | |
|---|---|---|---|---|---|---|---|---|
| | *P25* | *Mdn* | *P75* | *n* | *P25* | *Mdn* | *P75* | *n* |
| Age | 19 | 21 | 23 | 133 | 19 | 20 | 26 | 26 |
| +ve IAT | .54 | .93 | 1.16 | 122 | .52 | .85 | 1.16 | 23 |
| -ve IAT | .67 | 1.06 | 1.27 | 114 | .59 | .90 | 1.17 | 22 |
| TARA | 1371.90 | 1592.77 | 1766.19 | 107 | 1418.31 | 1602.87 | 1841.71 | 16 |
| BPI | | | | | | | | |
| Intensity T1 | .50 | 1.25 | 1.75 | 67 | .50 | 1.00 | 1.75 | 11 |
| Impact T1 | .57 | 1.29 | 2.14 | 67 | .57 | 1.57 | 2.00 | 11 |
| Intensity T2 | 2.25 | 3.00 | 3.00 | 133 | 1.75 | 2.75 | 3.00 | 26 |
| Impact T2 | 2.50 | 3.00 | 3.00 | 133 | 1.89 | 2.93 | 3.00 | 26 |
| AIMS | 16.00 | 21.00 | 26.00 | 133 | 10.75 | 15.50 | 23.25 | 26 |
| TCM | 14.00 | 22.00 | 31.00 | 133 | 4.75 | 14.50 | 27.50 | 26 |
| SIRBS | | | | | | | | |
| Severity | -4.00 | 0.00 | 6.50 | 133 | 1.75 | 5.50 | 9.00 | 26 |
| Susceptibility | 8.00 | 10.00 | 15.00 | 133 | 1.75 | 10.00 | 13.25 | 26 |
| Treatment efficacy | 5.00 | 8.00 | 12.00 | 133 | -.50 | 7.00 | 8.25 | 26 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Self-efficacy | 8.00 | 9.00 | 12.00 | 133 | 5.50 | 8.00 | 11.00 | 26 |
| Rehabilitation value | 3.00 | 3.00 | 3.00 | 133 | 2.00 | 3.00 | 3.00 | 26 |
| Explicit fear-avoidance | 46.00 | 48.00 | 48.00 | 133 | 38.75 | 47.50 | 48.00 | 26 |

To establish what proportion of the variance in rehabilitation outcome could be explained by psychological factors, variables identified as being significantly related to outcome of rehabilitation were entered into a stepwise logistic regression (Table 37). The variance explained by self-efficacy and perceived severity was 16.1% in total. Logistic regression revealed that the interaction between self-efficacy and perceived severity did not contribute to the explanation of additional variance, where centered self-efficacy and centered perceived severity were entered on the first step, and the interaction variable was entered on the second step (B = -.015, $p$ = .23).

Table 37

*Summary of sequential logistic regression to predict rehabilitation success*

| | | | | | Exp(B) 95% CI | | |
|---|---|---|---|---|---|---|---|
| | B | *SE* | Wald | Exp(B) | Lower | Upper | *N* |
| SIRBS | | | | | | | |
| Severity | .093 | .037 | 6.206* | 1.097 | 1.020 | 1.180 | 159 |
| Self-efficacy | -.155 | .055 | 8.049** | .856 | .769 | .953 | 159 |

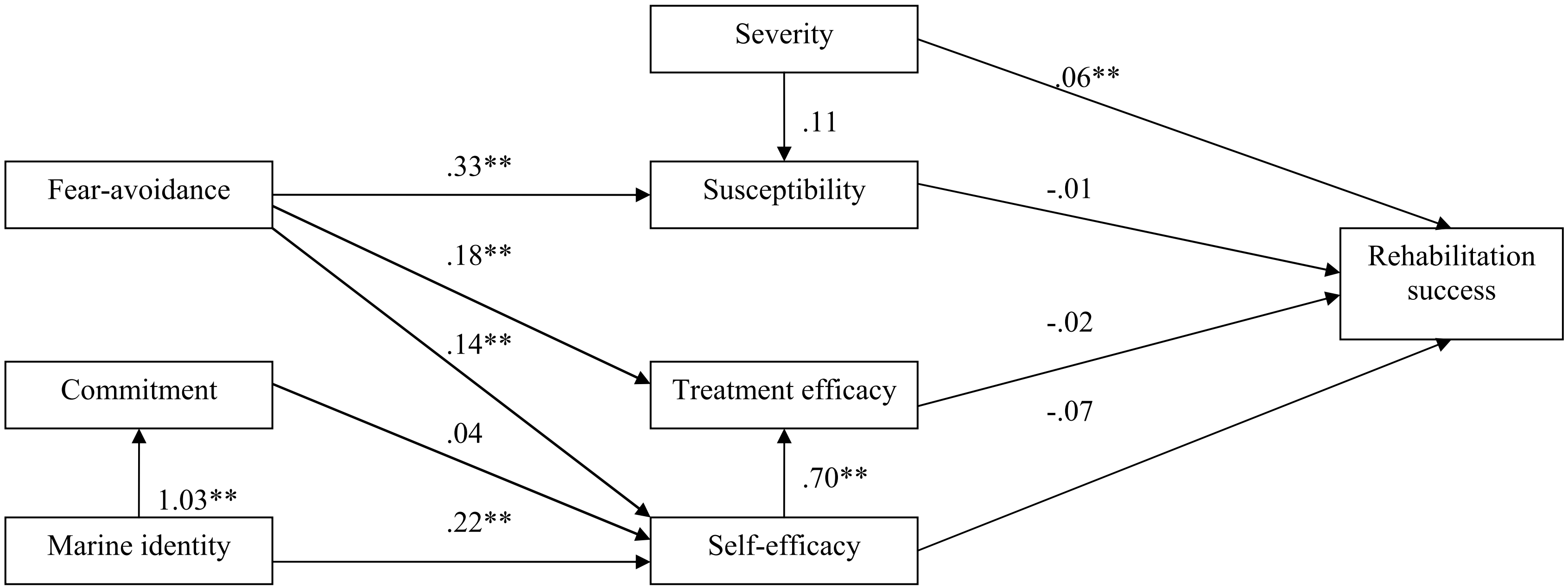
*$p$ = .01, **$p$ < .001.

*8.3.5 Post hoc analyses*

Exploratory path analysis was conducted on the *a priori* model proposed in chapter 4. The fit of the model was inadequate ($\chi^2$ (9, N = 189) = 122.32, $p$ < .001, CFI = .710, RMSEA = .258). The model and results are presented in Figure 13. In terms of explaining the outcome of rehabilitation, it can be seen that only the path from severity to the independent variable was significant. The paths from marine identity to commitment and to self-efficacy were significant, as was the path from self-efficacy to treatment efficacy, and the paths from fear-avoidance to self-efficacy, treatment efficacy and susceptibility to future difficulty. Because of the existence of significant pathways between some of the key predictor variables, it seemed plausible that revision of the model applied in the current context might yield a better overall fit to the present dataset, by further exploring the indirect pathways.

Figure 13

*Test of fit for hypothesised extended protection motivation theory model (N = 189)*




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

Note. The regression weights are shown beside each path.

A revised model comprising the same predictor variables, but with modifications made based on theoretical considerations, the measures' item content, and the results of Taylor and May's (1996) study is presented in Figure 14. The aim was to construct a model that could plausibly explain the pathways between variables that directly predict outcome and those that indirectly predict outcome. The rationale for inclusion and exclusion of each of the pathways is given below.

Taylor and May found a combination of perceived severity and self-efficacy explained the most variance in outcome of rehabilitation, over and above the remaining protection motivation constructs, as did Floyd, Prentice-Dunn and Rogers in their meta-analytic review (2000). Inspection of the item content revealed some discrepancy between the scale's label and the subject matter being measured. For example, items comprising the SIRBS susceptibility to future difficulty subscale such as 'A successful and lasting recovery may not be possible if I do not complete my rehabilitation programme' and 'In order to prevent a recurrence of this injury, my rehabilitation programme is essential' appear to be semantically related to items measuring treatment efficacy, such as 'Completion of my rehabilitation programme will guarantee that I recover from my injury' and 'I have absolute faith in the effectiveness of my rehabilitation programme'. Indeed, the results of the factor analysis of the SIRBS subscales corroborate this observation. It appears that the SIRBS susceptibility to future difficulty subscale could also be measuring the perceived longer-term treatment efficacy, whereas the SIRBS treatment efficacy subscale focuses on the perceived immediate benefits of complying with the prescribed rehabilitation regime. Therefore a pathway from susceptibility to future difficulty to treatment efficacy was included in the model.

The path from self-efficacy to treatment efficacy was reversed, as inspection of the item content suggested that treatment efficacy might influence self-efficacy, and not the other way round. For example, consider the treatment efficacy item 'I have absolute faith in the effectiveness of my rehabilitation programme' and the self-efficacy item 'I believe that I will stick with my rehabilitation programme despite any difficulties I may encounter'. It seems plausible that if an injured recruit has faith in his treatment, it might improve his perceived ability to conduct his remedial exercises. Alternatively, it is unlikely that a recruit whose perceived ability to conduct remedial exercises would impact on whether he considered those exercises to be effective.

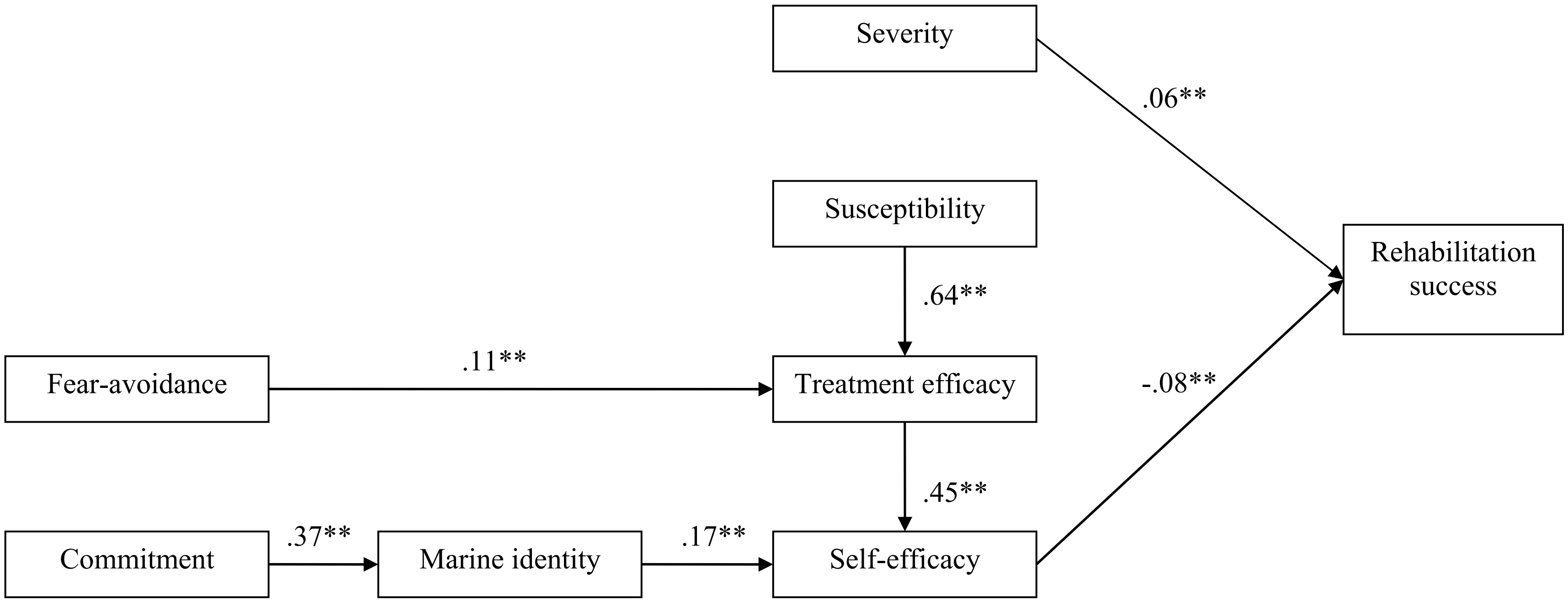
Careful consideration was given to the pathways between fear-avoidance and susceptibility to future difficulty, treatment efficacy and self-efficacy. On examining the items, it became apparent that the bespoke explicit measure of fear-avoidance related better to treatment efficacy than to self-efficacy or susceptibility to future difficulty. This was because the majority of items related to positive and fearful beliefs of the recruit's perceived ability to recover from the injury. For example, the fear-avoidance item 'Remedial exercise makes my injury better', is better related to SIRBS treatment efficacy items such as 'Completion of this rehabilitation programme will guarantee that I recover from my injury' than to SIRBS self-efficacy items such as 'I consider myself able to stick to my rehabilitation programme even though it may include activities which I do not enjoy', or to SIRBS susceptibility to future difficulty items such as 'I am making it more likely that I will be re-injured by not doing what my rehabilitation programme involves'. Furthermore, a more parsimonious application of fear-avoidance was to relate it directly to treatment efficacy, as previous amendments to the model had resulted in treatment efficacy now feeding directly into self-efficacy. As such, the pathway between fear-avoidance and treatment efficacy was maintained, but the pathways between fear-avoidance, self-efficacy and susceptibility were removed.

Marine identity was initially considered to be a centrally influential component of the extended model of protection motivation theory. However, examination of the items comprising the AIMS revealed a likelihood that in fact marine identity could be influenced by how committed a recruit was. For example, consider the organisational commitment item 'I would be very happy to spend the rest of my life in the Royal Marines' and the AIMS item 'Recruit training is the most important part of my life'. It stands to reason that a recruit who was committed to the Corps would consider his identity as being more related to the Royal Marines than a recruit who was more ambivalent as to his future career path. As such, the direct pathway from commitment to self-efficacy in the first model was removed, and the pathway from marine identity to commitment from the first model was reversed. These theoretical and item based modifications complete the revised model.

A large improvement in fit can be seen when comparing the revised model to the original proposed ($\chi^2$ (10, N = 189) = 41.92, $p < .001$, CFI = .872, RMSEA = .130). As found in the logistic regression, it can be seen that both pathways from severity of the injury and self-efficacy to outcome of rehabilitation were both significant. Likewise, the proposed pathways between the predictor variables were also significant.

Figure 14

*Test of fit for modified extended protection motivation theory model (N = 189)*




**$p$ < .001.

Note. The regression weights are shown beside each path.

The influence of variables assumed to be indirectly related to the outcome variable was further investigated. Evidence from the results suggests that each indirect pathway had a significant relationship to outcome of rehabilitation. The regression weight obtained for the indirect effect of fear-avoidance on outcome of rehabilitation was .004, ($p$ = .03). The indirect effect of susceptibility on outcome of rehabilitation was -.020, ($p$ < .01). And the indirect effect of commitment on outcome of rehabilitation was -.005 ($p$ < .01). This suggests all of the components account for some of the variance in outcome of rehabilitation.

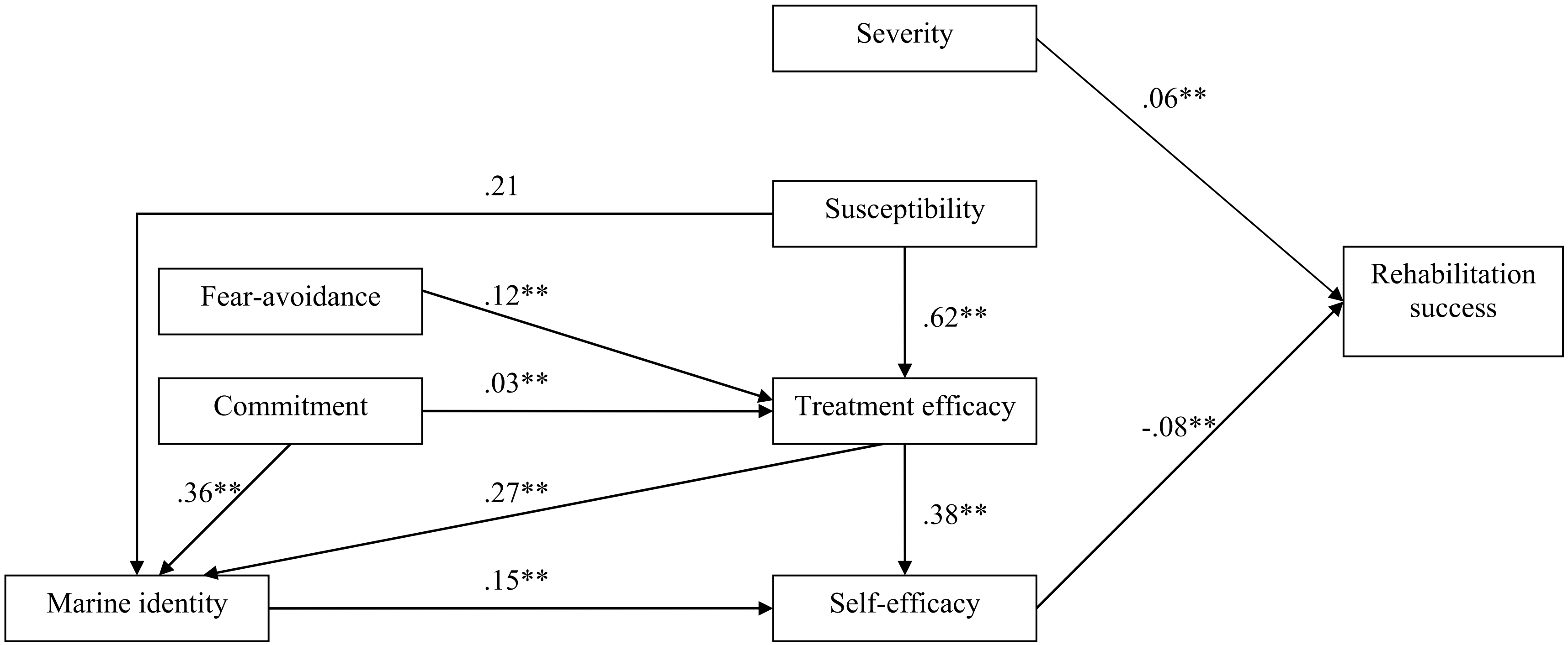
Despite the substantial improvement in fit in comparison to the original model (Figure 13), the fit of the revised model was not ideal. As such, the model was further refined through examination of the modification indices in conjunction with the underlying theory (Figure 15). The modification indices generated for the previous model (Figure 14) offered a number of feasible changes that could have been made. Two major and four moderate changes were indicated. Both major changes and one of the moderate modifications were implemented, but three of the possible moderate changes were not implemented, as they could not be theoretically justified, as explained below.

In accordance with the modification indices (MI), additional pathways from treatment efficacy and also susceptibility to future difficulty were added to marine identity (MI = 19.30 and 19.97 respectively). This change was conducive to a better understanding of the role of marine identity as being more of an outcome or mediator variable than a predictor variable in its own right. It was plausible that an injured recruit who does not appreciate the potential efficacy of his treatment might identify with the Royal Marines less. To illustrate using test items, it is intuitive that a recruit who disagrees with the SIRBS treatment efficacy item 'The rehabilitation programme designed for me will ensure my complete recovery from this injury' and disagrees with the SIRBS susceptibility to future difficulty item 'I am making it more likely that I will be re-injured by not doing what my rehabilitation programme involves' might also disagree with the AIMS statement 'Recruit training is the most important part of my life'. This is because it is plausible to assume that an injured recruit who lacks confidence in his treatment and prospects, may also re-prioritise his ambitions to reduce the dissonance between his original goal and present situation.

A pathway from commitment to treatment efficacy was also added (MI = 4.59). This was because commitment had emerged strongly as a predictor variable. It was plausible that where a recruit was committed to the Royal Marines and training, he was more likely to appreciate the value of his treatment and that he would hold the remedial training team in high regard. Although pathways from self-efficacy to marine identity (MI = 9.08) and from susceptibility to future difficulty to self-efficacy (MI = 6.39) were also possible amendments, they were not added to the model as it was not possible to justify the relationships theoretically. A substantial improvement in fit was achieved ($\chi^2$ (9, N = 189) = 17.06, $p$ = .05, CFI = .968, RMSEA = .069) and the resulting model was satisfactory.

Figure 15

*Test of fit for refined modified extended protection motivation theory model (N = 189)*




*$p$ < .05; **$p$ < .001.

Note. The regression weights are shown beside each path.

The indirect pathways were analysed in terms of their relationship to the outcome variable. Evidence from the results suggests that each indirect pathway had a significant relationship to outcome of rehabilitation. The regression weight obtained for the indirect effect of susceptibility to future difficulty on outcome of rehabilitation was -.005 ($p$ = .02). Marine identity on outcome of rehabilitation was -.01 ($p$ = .01). The indirect effect of commitment on outcome of rehabilitation was -.005 ($p$ = .01). The indirect effect of treatment efficacy on outcome of rehabilitation was -.035 ($p$ = .01). And the indirect effect of fear-avoidance on outcome of rehabilitation was -.004 ($p$ = .01).

*8.3.6 Perceived intensity and impact of pain*

Mann-Whitney U tests revealed that there were no significant differences between participants who had taken part in both Time 1 and Time 2 pain measures, and participants who had only taken part in Time 2 in terms of the predictor variables (all $p$ values > .13) Correlations did not reveal any significant relationships between perceived pain intensity and perceived impact of pain taken at Time 1, and the implicit and explicit psychological variables collected at Time 2 (see Table 38). However, analyses at Time 2 revealed that recruits who experienced higher levels of pain also reported higher scores on protection motivation theory components and fear-avoidance Interestingly, marine identity and commitment were not related to pain. Age was also not related to pain at Time 1 or Time 2.

Controlling for baseline pain revealed that the relationships between change in pain over time (i.e. the pain trajectory from Time 1 to Time 2) with the other variables was the same as the relationship between Time 2 pain and the other variables (presented in Table 38). Specifically, this means the greater the perceived decrease in pain intensity, the greater a recruit's self-efficacy and treatment efficacy, the greater the value he placed on rehabilitation and the more positive his fear-avoidance related beliefs. Also, a greater decrease in pain intensity was related to the injury being perceived as less severe, and the recruit's susceptibility to future difficulty as being lower.

Table 38

*Correlations between pain at Time 1 and 2, and implicit and explicit measures (N = 83)*

| | BPI Intensity T1 | BPI Impact T1 | BPI Intensity T2 | | BPI Impact T2 | | |
|---|---|---|---|---|---|---|---|
| | | | Original | Controlling for baseline pain | Original | Controlling for baseline pain | *N* |
| Positive image IAT | -.03 | -.13 | .15 | .15 | -.01 | -.01 | 74 |
| Negative image IAT | .02 | -.04 | .14 | .15 | .10 | .10 | 67 |
| TARA | -.08 | -.02 | -.05 | -.07 | -.11 | -.11 | 65 |
| AIMS | .11 | .08 | -.01 | .02 | -.01 | -.01 | 80 |
| TCM | .08 | -.10 | .02 | .04 | .02 | .02 | 80 |
| SIRBS | | | | | | | |
| Severity | .06 | -.02 | -.24* | -.23* | -.10 | -.10 | 80 |
| Susceptibility | -.15 | .01 | .33** | .30** | .25* | .25* | 80 |
| Treatment efficacy | -.05 | .15 | .39** | .40** | .35** | .35** | 80 |
| Self-efficacy | -.04 | .08 | .36** | .37** | .28* | .28* | 80 |
| Rehabilitation value | .04 | .04 | .25* | .27* | .29** | .29** | 80 |
| Explicit fear-avoidance | -.13 | .09 | .38** | .36** | .36** | .35** | 80 |

**p* < .05, ***p* < .008.

## *8.4 Discussion*

This section first discusses the findings of the current study in terms of its original aims and how the results relate to the literature. The first aim was to test the extended model of protection motivation theory, commitment, identity and fear-avoidance in explaining the variability in recovery times for different injuries (as identified in chapter 2). The second aim was to test the model's ability to explain variance in successful or failed rehabilitation cases. The discussion section will then consider the post-hoc, exploratory path analyses conducted on the *a priori*, and modified models. Then, application of implicit measures in a health psychology context will be discussed. The role of pain in the rehabilitation process will be explored, and the relationship between pain and the other variables measured in this study will be discussed. Finally, the limitations and implications of the study will be considered.

### *8.4.1 Predicting recovery time and rehabilitation outcome*

The results revealed that only the SIRBS subscale measuring the individual's perceived severity of their injury was related to the number of weeks they took to recover and return to training. This is most likely due to one of three reasons. First, it is possible that severity was not adequately controlled for by subtracting the median recovery time for each injury from each recruit's recovery time. Hence, severity may have continued to confound the results; a possibility that was originally highlighted and discussed in chapter 2. Second, it is possible that recruits who are eventually successful in rehabilitation do not have the negative beliefs of their unsuccessful counterparts. Analysis of recovery time data necessitated the inclusion of only recruits who had successfully completed rehabilitation and returned to training (see section 8.2.4.4 for rationale). Indeed, some of those who successfully return to training despite rehabilitation taking a long time due to physical reasons might be particularly determined and resilient (which would result in a positive correlation between length of recovery and positive psychological beliefs). These would then cancel out any who are slow to recovery due to negative psychological beliefs. Third, it is possible that perceived severity as a construct is different from actual severity. The way in which a recruit perceives the severity of his injury may in part be accurate in accordance with his diagnosis, but may also be due to negative appraisal.

This suggests that the construct of perceived severity may comprise a combination of physical and psychological appraisals of the injury. A study by Idler and Benyamini (1997) reported that subjective health is correlated with general psychological negativity, but is also actually the most accurate predictor of mortality, more so than medical evaluations. In other words, people's own ratings of their health can be very accurate. As such, it is likely that recruits who took longer to recover did so because their injuries were actually worse. Severity information would also have been reinforced by the medics.

Age was also found to explain some of the variation in relative recovery time. This finding echoes the results described in chapter 2, where older recruits were found to take a longer time to recover than their younger counterparts, as well as being more likely to be injured in the first place. It also supports previous research that age moderates adherence to rehabilitation (Weiss, 2003). The finding that only age and severity were related to relative recovery time suggests that it is primarily physical factors that are most important in the explanation of extended recovery time in recruits who successfully completed their rehabilitation.

On analysing the predictors of recruits who successfully completed their rehabilitation course and those who failed and left the training establishment, a different picture emerged. Treatment efficacy, self-efficacy, perceived severity, susceptibility to future difficulty, explicit fear-avoidance, marine identity and organisational commitment were all found to be related to whether or not a recruit had successfully completed rehabilitation and returned to training, or failed and left the Royal Marines. These results are comparable to Taylor and May's (1996) study, which found greater perceived severity and greater perceived susceptibility to future difficulty were predictive of non-compliance to rehabilitation regimens, whereas higher self-efficacy, stronger treatment efficacy beliefs and a greater value placed on the benefits of rehabilitation were predictive of adherence to rehabilitation prescribed for sports injuries. Likewise, the results of this study augment the findings of Brewer et al.'s (2003) study of adherence to prescribed rehabilitation for sports injuries. Their analysis also revealed the same four protection motivation components as being predictive of adherence. Self-efficacy, perceived severity, treatment efficacy and perceived susceptibility to future difficulty were found to predict 20% of the variance in adherence, with the former two variables exhibiting the stronger relationship with the outcome variable.

Further analysis conducted in the present study revealed self-efficacy and perceived severity in combination explained 16% of the variance in outcome of rehabilitation, further augmenting Brewer et al.'s findings. In terms of the implications for the construction of protection motivation theory, the results of this study favour its application as an additive model and not as an interactional model. This is because the interaction between severity and self-efficacy was not found to contribute any further explained variance. The dominance of self-efficacy in explaining behavioural outcome over and above other potential predictors such as fear-avoidance corroborates with the findings of previous research (Ayre & Tyson, 2001; Denison, Åsenlöf & Lindberg, 2004; Woby, Urmston & Watson, 2007). In terms of the application of protection motivation theory, the results of this study identified the same two protection motivation components as the results of Taylor and May's (1996) study of compliance with rehabilitation to sports injury. Taylor and May (1996) found only self-efficacy and perceived severity were independently predictive of the physiotherapist's estimation of patients' compliance with rehabilitation for sports injuries. In addition, the meta-analytic review conducted by Floyd, Prentice-Dunn and Rogers (2000) also found the largest effect sizes for the self-efficacy and threat severity components of protection motivation theory. The findings of the present study also support the use of protection motivation theory as contributory to the explanation of why some injured participants successfully completed rehabilitation and returned to mainstream recruit training, and why some did not. All four main components comprising protection motivation theory were found to relate to rehabilitation success or failure.

Explicit fear-avoidance was also found to relate to outcome of rehabilitation. The relationship between fear-avoidance and outcome of rehabilitation fits with the findings of previous studies outlined and discussed in chapter 4. Thomas and France

(2007) found that maladaptive avoidance behaviours adopted because of fear of pain caused delayed recovery in low back pain sufferers. Likewise, a recent study by Tripp, Stanish, Ebel-Lam, Brewer and Birchard (2007) found fear of re-injury was related to whether or not an individual returned to sport a year after anterior cruciate ligament surgery. The possible mechanisms explaining why fear-avoidance might increase recovery time are twofold. First, it has been suggested that fear-avoidance might moderate physical movement resulting in perceived chronic pain and reduced mobility. In other words, an injured recruit experiencing high fear-avoidance might unknowingly restrict his movement in order to prevent an increase in the perceived severity of the injury and intensity of pain. It is well-documented that restricting one's movement is likely to reduce mobility over time (Prkachin, Schultz & Hughes, 2007). If an injured recruit were to reduce his movement in the first instance, and then increase it again when he was nearing returning to training, it seems plausible that his pain and discomfort may also increase more than if he had maintained mobility throughout his rehabilitation. This explanation seems plausible in explaining behaviours observed in the current context, as perceived pain alone was not related to outcome of rehabilitation and therefore it is more likely that the fear of pain and avoidance behaviours contribute more to outcome of rehabilitation than just pain itself. The results of this study support this suggestion, as fear-avoidance was related to perceived severity of the injury. Second, an equally likely explanation of the relationship between fear-avoidance and outcome of rehabilitation is the social dimension of fear-avoidance (Asmundson, Norton & Jacobsen, 1996). A recruit may feel anxious about the prospect of rejoining training because of a fear of inability to perform to the standard required and the potentially negative 'evaluation anxiety' caused by being judged by his peers and training team. It is therefore possible that he may actively avoid these negative experiences by failing rehabilitation and leaving the Corps.

The marine identity and organisational commitment elements of the model were also related to outcome of rehabilitation. This supports the hypothesis proposed in chapter 4, that marine recruits who are more committed to the organisation and who have a stronger marine identity are more likely to persevere with their rehabilitation in order to achieve their primary goals, which are to return to mainstream training, complete it and obtain the coveted green beret. Indeed, this finding also supports the argument that organisational commitment is related to behaviour, as in leaving or completing rehabilitation, and therefore complements evidence in the literature that commitment predicts turnover. Here, organisational commitment has been found to be prospectively related to outcome of rehabilitation. In the literature reviewed in chapter 3, organisational commitment was found to be somewhat related to actual turnover, and more so related to turnover intentions (Allen & Meyer, 1990; Cooper-Hakim & Viswesvaran, 2005). Comparisons were made in chapter 3 between Raedeke's (1997) model of burnout in the sporting context, and Meyer and Allen's (1987) three component model of commitment in the context of the workplace. In particular, the similarities in construct were suggested between commitment due to entrapment and commitment due to enjoyment in the burnout model, and continuance and affective commitment in the three component model of commitment (respectively), which justified the applicability of measuring organisational commitment in the physically demanding context of military training, injury and rehabilitation. The findings of this study appear to support the notion that organisational commitment can impact on a Royal Marine recruit's ability to complete his rehabilitation.

The literature investigating the role of Eldridge's (1983) construct of athletic identity on performance, and its potential influence on recovery from training injuries was also reviewed in chapter 3. Whilst the evidence supported the relationship between strong athletic identity and performance, it was less conclusive when considering the effect of athletic identity on responses to physical injury and rehabilitation. The results of the present study suggest that a stronger athletic/marine identity positively influences how an injured recruit deals with an injurious setback and the prescribed remedial training. However, the path analysis conducted suggests athletic identity to be much less stable and directly influential than originally hypothesised (this will be discussed in more detail later). Brewer, Van Raalte and Linder (1993) argued that an injury experienced by someone exhibiting a strong athletic identity may be a greater threat to their sense of self than for someone with a lesser athletic identity, so much so that it could negatively and enduringly hinder rehabilitation. The findings of a recent study echoed their contention, when Brewer et al. (2007) found high athletic identity interacted with low optimism to result in a greater decrease in daily mood in post-operative anterior cruciate ligament patients. Contrary to this contention and when considering athletic identity in isolation, the associations obtained suggested that in the context of injured Royal Marines, a stronger marine identity is a positive attribute and appears to protect against the negative effects of injury and rehabilitation. That said, a caveat must be applied, as marine identity appears to be greatly influenced by some of the other variables, namely, susceptibility to future difficulty, treatment efficacy and commitment. These issues are discussed in the following section.

### *8.4.2 Post hoc exploration of the model*

All four main components of protection motivation theory (self-efficacy, treatment efficacy, perceived severity and susceptibility to future difficulty), and the additional elements comprising the extended model (fear-avoidance, commitment and marine identity) were found to be related to outcome of rehabilitation. However, only self-efficacy and perceived severity independently predicted outcome of rehabilitation, as established by the multiple regression results. Despite the promising bivariate and multivariate statistical results, structural equation modelling revealed that the overall fit of the *a priori* model introduced in chapter 4 (section 4.5.2) was inadequate. Consequently, modifications were made to the model to improve its fit. The revisions made resulted in a more parsimonious model whereby each of the pathways statistically contributed to the outcome of rehabilitation. Furthermore, exploratory analysis of the effects of the indirect pathways revealed each to have a significant effect on the outcome variable. Nonetheless, the fit of the modified model remained inadequate, so the modification indices were used to alter the existing pathways, or to add new ones. The final model's fit was good, and the indirect pathways were all significant. This final model suggested some interesting relationships between the variables. The modification indices obtained from the first modified model of rehabilitation outcome revealed three of the potentially best improvements could be achieved through the addition of pathways from susceptibility to future difficulty and treatment efficacy to marine identity. The author's original contention was that marine identity would be central to how a recruit forms his coping strategy to aid his recovery from training injury. As previously mentioned, its role was hypothesised as directly influential on outcome of rehabilitation as well as relative recovery time. Marine identity was also assumed to be a trait construct, in that it was assumed to remain relatively stable and not to fluctuate over time. The SEM model suggested that, instead, an injured recruit's perception of his injury coupled with his perception of the efficacy of his prescribed treatment may directly impact on his identity with the Royal Marines. As such, in terms of understanding and explaining injured recruits' protection motivation and coping strategies, marine identity as a construct is possibly not as useful as other psychological variables, such as self-efficacy. This could explain why the IATs did not predict outcome.

### *8.4.3 Implicit measurements of attitude*

The implicit measures of commitment were neither related to relative recovery time nor to rehabilitation completion. Once again, both the positive and negative image implicit association tests were related to commitment and marine identity, although the relationship was not as pronounced in the present study as it was in the previous study. The most likely explanation of the smaller relationship between the IATs and explicit measures of commitment and identity is that the recruits in this sample were less honest than the sample recruited in the previous study. It is plausible that some recruits may have felt more reluctant to tell the truth when responding to the explicit measures of commitment and identity, for fear of reprisals or repercussions during their rehabilitation programme. This is because no recruit had explicitly expressed a desire to leave the Royal Marines when they took part in the present study (in contrast to those who participated in the cross-sectional study reported in chapter 7). It is also possible that the range in IAT indices was somewhat limited by the sample recruited in the present study. The recruits who took part in this study were already committed enough to have joined the Royal Marines, and continued with their prescribed remedial exercises post-injury, rather than leaving Royal Marines' training, as approximately 43.5% of the original intake might have already done (chapter 2). As such, it is possible that a prospective study of Royal Marine recruits conducted at the beginning of training may have produced more variability in IAT indices, thereby increasing the test's predictive power.

The fear-avoidance TARA did not relate to rehabilitation outcome or any other variable. There are two potential explanations for the lack of TARA findings. First, it is possible that recruits might have adopted the heuristic of classifying positively phrased statements as true, instead of being truthful (which has a positive valence attached to it). This would have been possible due to the recruits' perceived value placed on their response strategy, in terms of whether they perceived more value in being truthful, or more value in rating positively phrased statements as true and negatively phased statements as false. An alternative explanation might be that the TARA was simply not sensitive enough to differentiate between those with high fear-avoidance and those without. Specifically, in comparison to the task difficulty arising from the conditions presented during the IATs, the TARA did not present different conditions, and the manipulation of items within the third block of the TARA were far more subtle than the manipulation of items within the third and fifth block of the IATs. Therefore, it was not as difficult to complete the TARA quickly and without making errors. Furthermore, TARA index calculation did not control for idiosyncratic variance in response times which, by virtue of its within-subject design, the IAT indices did. Considering the meaning behind the TARA indices, it is possible that a lengthened TARA index could indicate 'conflicted' recruits, i.e. those who are uncertain or ambivalent about their rehabilitation and their future in Royal Marine training.

### *8.4.4 Pain*

This section discusses the results and implications of the pain analysis. The section starts with some interesting observations of the Royal Marines' outlook on pain, which should be borne in mind when considering assertions made in the discussion. The discussion then starts with the correlations of the impact and intensity of pain measured at Time1 with the psychological variables at Time 2, thereby exploring the influence of early experiences of pain in the formation of future attitudes. The section continues by considering the relationship of impact and intensity of pain measured at Time 2 with psychological variables also collected at Time 2, thereby examining concurrent associations between pain and attitudes. Each construct is considered in the same order as they are presented in the discussion of the model. This section closes with a discussion of the relationships observed between Time 2 intensity and impact of pain with the psychological variables taken at Time 2, whilst controlling for intensity and impact of pain measured at Time 1. In other words, it focuses on the relationship of the pain trajectory with attitude formation. Each of these subsections reiterates the findings and considers their meaning in relation to the literature.

The Royal Marines have a noteworthy unusual outlook on pain. From the outset of mainstream training, recruits are taught to 'embrace' the pain they experience during training and to accept that the arduousness of such a training course inevitably brings some experiences of pain with it. Furthermore, the Corps employ certain mottos that could be considered almost intervention-like. For example, a large wooden placard on the main gym wall is inscribed with the words 'hurt-pain-love it!'. Indeed, in the final stretch of the mandatory Commando test, the 'nine mile speed march', a placard at the side of the road features a cartoon drawing of Royal Marine Sergeant with the words 'it's only pain!' inscribed next to it. The seeming acceptance of pain from a very early stage of training could buffer the injured recruit's interpretation of pain such that it weakens the relationship between pain and negative psychological beliefs and therefore response. This hypothesis supports recently debated notions of the importance of acceptance of pain (Esteve, Ramírez-Maestre & López-Martínez, 2007).

Contrary to the findings of Boersma and Linton's (2005[a]) cross-sectional study of chronic pain predictors, initial analysis revealed the intensity and impact of pain taken at Time 1 as being unrelated to any of the other predictor variables at Time 2. The finding that measures of intensity and impact of pain collected at Time 1 did not relate to the protection motivation variables collected at Time 2 supports the notion that early pain experience does not play a major role in the prediction of future attitude formation (discussed later in this chapter). It was anticipated that, if Time 1 pain were to relate to any of the variables, it would most likely relate to the future development of fear-avoidance beliefs. Yet fear-avoidance was also not related to Time 1 intensity nor impact of pain. The occupation-related measures of marine identity and organisational commitment were also unrelated to pain at Time 1.

Converse to the findings of the Time 1 pain and psychological variables investigation, lower pain intensity reported at Time 2 was related to greater self-efficacy, treatment efficacy, a greater perceived value of rehabilitation and a lower perceived susceptibility to future difficulty. The results obtained were consistent with studies that explored similar constructs. For example, greater treatment expectations (Hill, Lewis, Sim, Hay & Dziedzic, 2007) and self-efficacy (Woby, Urmston & Watson, 2007) were both related to reduced pain and disability. The results were similar when looking at the impact pain has on an individual's lifestyle at Time 2; the findings were the same for impact of pain as intensity of pain.

Pain intensity and impact were also correlated with fear-avoidance beliefs. This finding supports the relationship between pain and its interpretation in terms of fear-avoidance beliefs (Leeuw et al., 2007; Lethem, Slade, Troup & Bentley, 1983; Vlaeyen & Crombez, 1999, Vlaeyen & Linton, 2000; Waddell, Newton, Henderson, Somerville & Main, 1993), and that negative fear-avoidance beliefs are contributory to the development of chronic pain and disability (Boersma and Linton, 2005[b]). That said, the moderate correlation coefficient obtained between Time 2 intensity and impact of pain and fear-avoidance indicates that, whilst there may be some overlap, intensity and impact of pain and fear-avoidance are essentially different constructs. The lack of association between pain intensity and impact at Time 2 and marine identity and organisational commitment suggests that pain is influential only in the specific context of injury and rehabilitation and does not influence wider constructs unrelated to injury and rehabilitation *per se*.

Morley and Eccleston (2004) suggested that the deepest level of pain interference is exhibited by way of change to an individual's identity. However, an alternative suggestion is that pain might have disrupted identity by way of an indirect effect via fear-avoidance and treatment efficacy. This notion is supported by the findings of the structural equation modelling conducted in section 8.3.5 (figure 15), where a significant indirect effect of fear-avoidance on marine identity was found. This suggests pain might be a distal predictor of rehabilitation outcome, rather than proximal. The finding of associations between pain and constructs specific to injury and rehabilitation, but the lack of association of pain with wider, organisational constructs, has methodological implications, as it gives confidence that 'common method bias' did not interfere with the results obtained. Common method bias refers to associations between data sets for two or more constructs that were measured using the same data collection method (questionnaires for example). Whilst theoretical assumptions might be asserted by the researcher, common method bias means the relationship could actually be a reflection of individuals' response sets and not a real relationship between constructs (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). Furthermore, the relationship between intensity of pain at Time 2, but not impact of pain at Time 2 with perceived severity, indicates again that common method bias did not adversely impact on the study's results, as it is intuitive that intensity of pain rather than impact would be more closely related to perceived severity of the injury.

On controlling for pain intensity and impact at Time 1, and therefore examining the relationship of the pain trajectory from Time 1 to Time 2 on psychological variables collected at Time 2, a similar picture emerges. Indeed the correlations obtained for Time 2 pain and pain trajectory with the protection motivation variables and fear-avoidance collected at Time 2 are largely the same, with only slight fluctuations in the coefficients. Therefore it is argued that the pain trajectory and Time 2 pain measures are largely the same construct, and that it is the more immediate experience of pain that determines an individual's outlook on his injury and rehabilitation, and the change in that pain over time, rather than previous/initial experience of pain. This further supports the notion that pain is a fluid variable and has 'state' qualities rather than static 'trait' characteristics (Meyers & Diep, 2000).

It appears that recruits are resistant to the immediate effects of pain (Time 1), but that prolonged pain over time and a lower reduction in that pain experienced leads those still suffering to conclude that their injuries were such they were less likely to recover. The relationship between impact and intensity of pain with the other psychological variables highlights the ‘informational’ value of pain and its association with how people might interpret and cope with their injury and how they might therefore approach their rehabilitation. In other words, rather than contribute to the threat appraisal process in protection motivation theory as originally hypothesised in the extended model (chapter 4, figure 4), instead, perceived pain might contribute directly to the sources of information in the first step of the model (chapter 4, figure 2). The combined environmental and intrapersonal sources of information, including pain, are then subject to the cognitive mediation processes (threat and coping appraisal) illustrated as the second step in the model. As such, perceived pain is a source of information and fear-avoidance is the process that interprets that information. However, an alternative explanation is that recruits with higher levels of fear-avoidance and lower self-efficacy and treatment expectations perceive their pain as more severe.

### *8.4.5 Limitations*

The main limitation of this study was the potentially confounding influence of injury severity on recovery time. Chapter 2 outlined some of the difficulties in measuring severity. Evidence from the data showed that severity as measured in surrogate by the physician’s prognosis was unrelated to actual recovery time in weeks. Despite this, only perceived severity of the injury was found to be related to recovery time in weeks. Given that the physician’s prognosis was unlikely to be useful in controlling for severity, the median recovery time in weeks was calculated for each of 42 injury types from five years of Hunter Company data. Subtracting the median recovery time from each participant’s actual recovery time was the most accurate way to control for average recovery time, and therefore severity. However, even after controlling for average recovery time, perceived severity was still found to be related to relative recovery time, which suggests that actual severity may have been the main predictor of recovery time in weeks. None of the other psychological variables measured were related to severity. This suggests that perceived severity is measuring something else entirely from the other measures taken in this study. It seems psychological factors are predictive of something different and more significant than recovery time taken; they predict whether or not a recruit will be successful in their completion of prescribed remedial training and subsequent successful return to training. Another important consideration is that a large proportion of the variance in recovery time and outcome of rehabilitation might be attributable to other physical variables not measured by CTC at present, nor by the principal investigator in the current research programme, or physical factors that might not be measurable at all. Also, as discussed in chapter 2, the decision for a recruit to transfer from 1 troop to 2 alpha, then 2 bravo, and then finally back to training is made by a combined rehabilitation team. As such, individuals' beliefs about pain, injury and rehabilitation, coupled with their perceptions of the individual concerned might influence the decision making process.

The main limitation of the implicit measures is that they did not explain any of the variance in outcome of rehabilitation or relative recovery time. Reasons for this have been discussed in section 8.4.3 of this chapter. Despite the tests not predicting in the current context, it is worth reminding the reader of the success of the implicit association tests in the study reported in chapter 7. As such, it is suggested that the application of the implicit association tests measuring commitment may be better applied in a recruitment context rather than a rehabilitation context. Further discussion is reported in chapter 9, section 9.2.4.

A conceivable limitation of the exploratory study of pain might have been that the psychological variables used in the study were only collected at Time 2 and not Time 1. However, the decision was taken not to collect psychological data at the onset of injury. The reason for this was that recruits at this stage of rehabilitation had only just become injured and would not have had any experience on which to base their opinions. As such, it was unlikely that their attitudes to injury and rehabilitation had been formed at that stage, and that psychological measures would have been misleading, unreliable or subject to change.

Pain in recovery from injury and return to mainstream training was studied using a tightly controlled sample of injured Royal Marine recruits. On presenting at the medical centre, injured recruits' injuries are objectively confirmed by the medical staff using strict diagnosis protocols. Furthermore, their progress through rehabilitation is equally well controlled and progress checks and outcome measures are objective and standardised. The sample comprised a homogeneous group in so far as they were all male, their ages ranged from 16 to a maximum of 32, they ate the similar food, slept in largely the same conditions and receive controlled, prescribed rehabilitation from a dedicated remedial training team of physicians, physiotherapists and military training instructors.

### *8.4.6 Conclusions*

In conclusion, the application of the extended model of protection motivation theory, commitment, marine identity and fear-avoidance has offered some explanation as to why some injured Royal Marine recruits successfully complete their rehabilitation and why some do not. In particular, self-efficacy was identified as a predictive psychological variable. The results also suggest that the recovery time taken by recruits who successfully completed their rehabilitation programme and returned to training is less related to the psychological factors measured and that a lengthened recovery time is most likely due to physical predictors such as age and the severity of the injury in question. The opportunistic exploratory study of pain revealed the importance of change in pain over time as well as a recruit's concurrent experience of pain as being important in the formation of his attitude towards pain, injury and rehabilitation more so pain experienced at the onset of injury.

# Chapter 9
# General Discussion

## *9.1 Preface*

The military training undertaken by Royal Marine recruits is physically and mentally arduous and inevitably results in a high incidence of physical injuries. Serious physical injury usually results in the recruit being removed from the troop and training team with whom he has bonded. He is then transferred to a separate rehabilitation unit where he must undergo rigorous remedial training with the aim of eventually rejoining mainstream training. If and when this occurs, it will be with a different troop and a different training team. This reintegration can be stressful, proving too much for some recruits, who do not complete their rehabilitation and leave the Royal Marines' training course prematurely. Similarly, some recruits take much longer to recover from their injury than anticipated by Commando Training Centre medical staff.

The reasons why certain individuals take longer than others to recover from injury, and why some individuals do not complete their rehabilitation whereas others do, have remained unclear. It was speculated by remedial staff at Commando Training Centre that the answer may not be wholly physical, and that psychological factors might also contribute to a recruit's failed rehabilitation. As such, this research programme had two primary aims: first, to identify psychological factors that differentiated recruits who successfully completed rehabilitation from physical injury from recruits who did not; and second, to identify psychological characteristics of recruits who experienced an unnecessarily lengthened recovery time. A secondary aim was to develop and test bespoke implicit measures of commitment and fear-avoidance in order to reduce the potential confounding effects of social desirability bias.

To address these aims, statistical baseline data on injury and rehabilitation in Royal Marines' training was initially established. In addition, an in-depth review of the available literature and potential measurement methods was conducted. This was followed by a series of five studies through which a new measurement approach was developed and evaluated, and the proposed extended model of protection motivation theory was tested as a whole.

This chapter begins with an outline of the thesis as a whole, and guides the reader through the research programme chapter by chapter. The chapter then progresses to discuss the success of the selected model in explaining variance in rehabilitation outcome. Specifically, the model is described and the individual components comprising the model are reviewed. This is followed by an evaluation of the application of the model in the current military context and the population to whom it was applied is discussed. Finally, the contribution the model has made is outlined and considered. The next section of this chapter reviews the development and testing of the bespoke implicit measures. They are first described and their application within a military population is discussed, followed by a summary of their contribution to the research programme. The chapter then proceeds to consider the relative strengths and limitations of this programme of research. In particular, the strengths of the model, the implicit measures and the population are focused upon. The limitations of the research programme are discussed with reference to the measures, possible alternative approaches and specific measures that may have contributed to further variance in outcome being explained, but were not used on this occasion. The chapter then indicates future research possibilities. The final section of this chapter outlines and emphasises the unique theoretical and applied contribution this research programme has made to the study of health psychology in the context of rehabilitation from physical injury, and overall conclusions are drawn.

## *9.2 Thesis Outline*

### *9.2.1 Background*

Following an initial introductory chapter (chapter 1), chapter 2 reported the findings of a study of the available baseline data on physical injury and rehabilitation in Royal Marine recruit training at Commando Training Centre. A flow model of the throughput of rehabilitating recruits was presented, which indicated that approximately one in six recruits become physically injured seriously enough to warrant transfer to Hunter Company. Analysis of the data also revealed predicted recovery times (based on medical estimates) were unrelated to actual recovery times. Only age was related to recovery time, and other physical and educational data routinely collected by Commando Training Centre were unrelated to a recruit's ability to recover from an injury and return to training. The absence of any physical explanation for the lack of relationship between predicted and actual recovery times, coupled with observations of recruit behaviour by the principal investigator, remedial training team, physiotherapists and medical staff, indicated the possibility that psychological factors may have an influential role in recovery times. For example, differences in recruits' attitudes and approach to rehabilitation were observed; some attitudes were considered to be theoretically adaptive and others more maladaptive. Similarly, it was postulated that non-return to training or 'failed' rehabilitation could also in part be due to psychological influences. Again, recruits' attitudes toward injury, rehabilitation and potential return to training seemed to vary according to whether they completed rehabilitation or not.

Chapter 3 reviewed the relevant psychological literature, and identified psychological constructs that were potentially influential on a physically injured Royal Marine recruit's attitude toward the military and recruit training. Theories of commitment, athletic identity and theories on burnout were reviewed. Organisational commitment and athletic identity were identified as being empirically well-tested theories and measures that could contribute to a model to determine why some recruits progress better through rehabilitation than others. In chapter 4, the literature review focused on theoretical models developed to explain differences in injured individuals' interpretation, and adopted coping strategy, when facing injury and rehabilitation. The chapter focused upon attitude to injury and illness, attitude to rehabilitation, and attitudes to both injury and rehabilitation. In each section, attention was paid particularly to both reliable and valid generic models. Their strengths and weaknesses for use in the current context were discussed and their potential applications were evaluated.

The attitude to illness and injury section included a review of the literature investigating the common sense model of illness representations (Leventhal, Meyer & Nerenz, 1980) as well as other models specifically designed to explain outcome from illness and injury. It was concluded that the common sense model of illness representations could be limited in its ability to explain outcome of rehabilitation or recovery times given its focus only on the individual's interpretation of the injury and not on attitudes to rehabilitation. Although highly relevant to the difficulties faced by injured Royal Marine recruits, the models specifically relating to sports injuries described and reviewed had not been scientifically rigorously tested. Therefore, the reliability and validity of these models had not been established, meaning they could not be applied with confidence. Chapter 4 continued with a review of models and theories related to attitudes to rehabilitation. It was argued that although Ajzen and Fishbein's (1980) and Ajzen's (1985) theory of reasoned action and the theory of planned behaviour could be useful in explaining Royal Marines' attitudes to rehabilitation, the components comprising the model did not assess attitude to injury. Empirical support for Maehr and Braskamp's (1986) personal investment theory was comparatively lacking, and the main components of Ryan and Deci's (2000) self-determination theory were already encompassed in the extended model of protection motivation theory. Merit for the inclusion of Bandura's (2003) social cognitive theory was outlined; self-efficacy is a fundamental component of protection motivation theory.

Finally, the third section of chapter 4 detailed two theories that focus not only on an individual's attitudes toward injury and illness, but also to rehabilitation. Namely, Rogers' (1983) protection motivation theory and fear-avoidance theory (Lethem, Slade, Troup & Bentley, 1983) were discussed, and evidence in support of the theories was presented. Protection motivation theory was selected as an overarching, guiding framework for this programme of work, and within this context, the constructs of commitment, athletic identity, self-efficacy, fear-avoidance and pain were incorporated in an extension of this model.

*9.2.2 Methodology and measure development*

In chapter 5, the applicability of implicit measures for measuring constructs useful in explaining outcome of rehabilitation in the context of military training was considered. It was argued that indirect measures of attitude, such as implicit testing techniques, could counteract the confounding effects of social desirability bias. For example, the autocratic nature of military training could lead to some individuals being reluctant to voice their true beliefs regarding their injury and thoughts on rehabilitation, for fear of retribution from their peers or authority figures. As such, they might feel obliged to respond to questions in a certain way, and in contrast to their true beliefs. Measurement techniques developed in social psychology measure individuals' subliminal associations between target-stimuli and associated attributes by recording their latent response times and error rates during computer administered binary classification tasks. It can be inferred that the stronger the association between target-stimuli and associated attribute indicates an individual's implicit preference or dislike of the stimuli. In this research programme, it was proposed that two implicit association tests (IATs) using photographic images of Royal Marines and Royal Marines' training (one based on positive images and the other based on negative images) could be developed as an implicit measure of commitment or marine identity. Similarly, it was proposed that the method known as the TARA (timed antagonistic response alethiometer) could be adapted to measure fear-avoidance in injured recruits, by using short true or false statements addressing injury and rehabilitation. Explicit measures (Likert scale-based questionnaires) for the remaining components of the extended model of protection motivation theory (self-efficacy, treatment efficacy, rehabilitation value, perceived severity, susceptibility to future difficulty, pain, fear-avoidance, marine identity and organisational commitment) were also identified and discussed.

Chapter 6 reported the findings of three discrete studies aimed at empirically selecting the stimuli for the commitment IAT and the fear-avoidance TARA. The first study involved injured Royal Marine recruits rating 100 photographic images of Royal Marines' training and images depicting civilian life as positive, negative or neutral (50 images of the Royal Marines and 50 of civilian life). The majority of recruits rated six photographs that depicted images of the Royal Marines and Royal Marines' training as positive, and twelve photographs depicting images of civilian life as neutral. The study did not result in the participants rating six photographs as depicting negative images of the Royal Marines and Royal Marines' training, and so a second study was required. The second study included some new images captured by the Royal Marines photographic unit specifically for this study. The second study sample also included a group of recruits who had chosen to leave training of their own volition (opt-outs) as well as an injured recruit group. It was hypothesised that opt-outs' views on training differ to injured recruits. To ensure the implicit measure developed based on the results of these studies was as powerful as possible in differentiating successful and unsuccessful recruits, a range of recruits was required to increase the heterogeneity of the sample, hence the inclusion of injured and opt-out groups. Participants were presented once again with the images rated as positive from the first trial, along with the new bespoke negative images. The second study resulted in a majority of participants rating six Royal Marine images as positive and six Royal Marine images as negative. These images, combined with the twelve neutral images depicting civilian life that were identified in the first study, formed the target-stimuli for the positive image and negative image IATs.

Chapter 6 continued by reporting a third study in which injured participants were required to rate statements relating to their injury and rehabilitation on a Likert scale in accordance with whether they agreed or disagreed with the statements. Eight fear-avoidance based opposing pairs of statements were developed for this study, and six pairs of statements opposite in meaning according to the recruits' ratings were identified. These six pairs of statements formed the stimuli for the fear-avoidance TARA.

Chapter 7 reported the findings of a cross-sectional study that evaluated the ability of the commitment IATs to differentiate between two known groups of recruit participants, as well as investigating the psychometric properties of the tests. The sample (comprising two groups) was administered the bespoke positive image and negative image IATs, along with explicit measures of commitment and athletic identity (adapted to measure marine identity). The King's Squad group consisted of recruits who had successfully completed Royal Marines' training. In contrast, the opt-outs group consisted of recruits who had chosen not to complete Royal Marines' training of their own volition and had decided to leave Commando Training Centre. Optimised and simple indices were calculated for the IATs; both the positive and negative image IATs successfully differentiated between the two groups. Indeed, the optimised positive image IAT accounted for 35% of the variance in group identity. Furthermore, when combined with the explicit measure of commitment, the optimised positive image IAT index accounted for 69% of the variance in outcome group. The explicit measure of commitment accounted for 65% of the variance, which indicates that the implicit measure of commitment accounted for variance that was unexplained by the explicit measure.

In this cross-sectional study there were *a priori* reasons to expect King's Squad recruits would be more committed to Royal Marines' training than opt-out recruits, due to the fact they had succeeded in completing training. Therefore, the high correlations between implicit and explicit measures, and the high proportion of the variance explained by the explicit measure of commitment, may have resulted from low social desirability bias arising from a lack of pressure on individuals who had already passed Royal Marines' training or had made the choice to prematurely leave training. Thus implicit measures may explain a greater proportion of variance in outcome, relative to explicit measures, if administered *during* training when, it is hypothesised, the social pressures are high and recruits want to *appear* to be highly committed.

### *9.2.3 Effectiveness of the extended model of protection motivation theory*

A prospective study was undertaken to investigate outcome of rehabilitation in terms of success/failure, and relative recovery time, applying the extended model of protection motivation theory encompassing commitment, marine identity, fear-avoidance and pain as a guiding theoretical framework (chapter 8). At the start of rehabilitation, injured Royal Marine recruit participants completed the Sports Injury Rehabilitation Beliefs Survey (SIRBS). The SIRBS measures the principal components of protection motivation theory; perceived severity of the injury, perceived susceptibility to future difficulty, self-efficacy, treatment efficacy and a single item on rehabilitation value. The Three Component Model of commitment questionnaire (TCM) and the Athletic Identity Measurement Scale (AIMS; modified to measure marine identity) were also completed. The fear-avoidance TARA and the positive image and negative image commitment IATs were administered with the explicit measures. A bespoke explicit measure of fear-avoidance was also developed and administered as part of the TARA. A baseline measure of pain was administered when the participant initially became injured (Brief Pain Inventory, BPI), and again on commencement of rehabilitation, following a period of rest and recuperation. Outcome data in terms of whether or not each individual completed their rehabilitation was recorded, and the relative recovery time for those who successfully returned to training was calculated. Relative recovery time was calculated by subtracting the median recovery time for each injury calculated from 5 years of Hunter Company injury data.

The extended model of protection motivation theory successfully explained variance in outcome of rehabilitation of injured Royal Marine recruits. Specifically, the main components of protection motivation theory (i.e. perceived severity, perceived susceptibility to future difficulty, self-efficacy and treatment efficacy) all differentiated between recruits who successfully completed rehabilitation and returned to training from those who did not complete rehabilitation and left Royal Marines' training. Explicit commitment, marine identity and explicit fear-avoidance were also found to predict rehabilitation outcome. Multivariate logistic regression revealed self-efficacy and perceived severity together as accounting for 16% of the variance in rehabilitation outcome. Analysis of the interaction between perceived severity and self-efficacy supported the model as additive rather than interactional; self-efficacy did not appear to moderate the role of perceived severity, as might have been expected. Perceived severity was the only psychological factor that predicted relative recovery time (10% of the variance was accounted for when combined with age). It was concluded that psychological factors are influential in whether or not a recruit completes his rehabilitation and returns to training, or does not and opts to leave Commando Training Centre. Within the successfully rehabilitated recruits, psychological factors may not be as influential as physical factors, such as severity, in explaining the time it takes to recover.

The extended model of protection motivation theory also encompassed commitment, marine identity, fear-avoidance and pain. Fear-avoidance, commitment and marine identity all differentiated between successful and failed rehabilitation cases; although the regression and structural equation modelling analyses suggested that their relationship with outcome may be mediated by self-efficacy and severity. Thus these additional components appear to add to the theoretical explanation of why some recruits complete their rehabilitation and others do not. Athletic identity was known to be influential in competitive and training performance, but its relationship with rehabilitation however has been ambiguous in the literature. Some research suggests that higher levels of athletic identity facilitate recovery from injury, whereas other researchers have suggested athletic identity has an indirect effect on approaches to rehabilitation. The results reported in this thesis support the latter hypothesis in terms of its role as a mediator, with indirect effects on outcome of rehabilitation (chapter 8).

The extended model tested in this thesis contributed to the explanation of variance in whether or not an injured Royal Marine recruit was psychologically robust enough to successfully complete rehabilitation (chapter 8). The meta-analysis undertaken by Floyd, Prentice-Dunn and Rogers (2000) revealed a stronger relationship between coping variables and remedial behaviour than preventive behaviour and concluded that protection motivation components may be useful for individual and community interventions (discussed in chapter 4). Indeed, Webb and Sheeran's meta analysis (2006) found protection motivation theory combined with motivational interventions explained a larger proportion of the variance in health-related behavioural outcome than any other model reviewed. Motivational interventions, aimed at modifying individuals' attitudinal constructs comprised in protection motivation theory resulted in actual behavioural change, which suggests that components of protection motivation theory may be predictive of behaviour, rather than just associated with it.

Given the modifiability of the protection motivation components, the findings of the study reported in chapter 8 support the model's practical applicability in the improvement of the rehabilitation environment at Commando Training Centre. For example, efficacy interventions to improve individuals' self-efficacy in terms of their perceived capability to conduct remedial exercises and recover, or educational interventions to reduce perceived severity and perceived susceptibility to future difficulty, could be readily implemented in the Royal Marines' training environment.

Exploratory analysis of the role of pain experienced at the beginning of the rest and recuperation stage of rehabilitation and pain experienced at the beginning of the more physically demanding stage of rehabilitation was also conducted. The intensity and impact of pain at Time 2 and the trajectory of pain from Time 1 to Time 2 were related to the components of protection motivation theory and explicit fear-avoidance. This suggests that the change in pain over time and pain experience concurrently are more influential in the formation of attitudes and beliefs than pain experienced at the onset of the injury. The unexpected findings of the exploratory study of pain add to the existing body of knowledge on pain and, more importantly, interpretation of pain.

*9.2.4 The effectiveness of the implicit measures*

This research programme represents one of the first health psychology applications of implicit measures. The capacity of the bespoke implicit association tests to differentiate between the King's Squad and opt-out recruits was testament to the appropriate selection of stimuli. However, although the cross-sectional study (chapter 7) reported the excellent potential for the commitment IATs, the tests failed to relate to recovery times or rehabilitation outcome in the final study (chapter 8). It was not the case that participants were not taking the test seriously or indeed attempting to falsify the results, as the construct validity data provided evidence that the tests still related to marine identity and commitment. Furthermore, the data cleaning procedures ensured all data were as accurate as possible, such that individuals who were not paying appropriate attention to the tests were readily identified. Given that the participants knew they were taking part in a psychological study and were not being 'tested' (as they are routinely throughout the training course), it could be assumed that social desirability bias was unlikely to have confounded the results of the explicit tests administered in the prospective study (chapter 8). Nevertheless, it is possible that recruits were being less truthful in the prospective study, as they were still in training at the time, and they may have had concerns regarding confidentiality and negative repercussions. Recruits who participated in the cross-sectional study had already either passed, or opted-out, of training (chapter 7). In contrast to the cross-sectional study sample, the prospective study participants may have been 'undecided' about their future, and their ambivalence might have exhibited itself as less pronounced and clear-cut IAT scores and therefore less clear discrimination of those with less positive attitudes. It is possible that the reduced discriminatory capacity of the IATs in the final study would explain why they did not differentiate between recruits who successfully completed their rehabilitation and those who did not.

The TARA was found to be unrelated to rehabilitation outcome and any of the psychological measures (chapter 8, section 8.4.3). This was most likely due to a lesser capacity to predict than the IATs, caused by its indices' lack of control for idiosyncratic variance and the recruits' response heuristics. The IATs' indices were calculated by comparing individuals' response times in compatible and incompatible conditions. This comparison controlled for baseline reaction times, as it was the difference in response times between conditions, and not the actual response times within the conditions. The TARA indices were based solely on one block, and therefore on an individual's overall response times to alternating stimuli rather than a comparison across two conditions. Alternative response heuristics adopted by recruits may have confounded the results of the TARA (section 8.4.3), and it is possible that the TARA was an easier task to complete, as long as the recruit was consistent in how they rated the statement explicitly in the beginning. For example, a recruit who rated all the positive statements as positive and all the negative statements as negative could easily replicate responses during the actual binary classification task. Likewise, a recruit who rated all of the positive statements as negative and all of the negative statements as positive could also easily replicate responses during the actual task. The main difference between the IAT and the TARA is that the TARA relies on the ability of the individual to alternate their response strategy, whereas the IAT relies on the difference in difficulty of two conditions. It is therefore argued that, in the case of this research, the TARA is easier to 'fake' than the IAT. However, this would only be the case where the statements were rated consistently in the beginning. Further limitations of the implicit measures are considered in the following section.

## *9.3 Strengths, Limitations and Future Directions*

The strengths and limitations of this research are considered in four distinct areas. The first section considers the theoretical strengths and limitations of the extended model of protection motivation theory. Subsequently, the methodological strengths and limitations of its application are discussed. Second, the theoretical and methodological strengths and limitations of the application of implicit attitude measurement are considered. Next, a third subsection contemplates the general methodological and practical implications of the outcome measures used in the studies reported in chapters 2 and 8, and the population to which the framework was applied is discussed. The last section comprises suggestions for the future theoretical and applied development of the extended model and implicit attitude measures.

### *9.3.1 Strengths and limitations of extended model of protection motivation theory*

The components comprising protection motivation theory coupled with the other psychological measures comprising the extended model were specifically selected as they were well-validated, empirically tested measures and theories. A strength of this research programme was the previous empirical testing of protection motivation theory in an athletic injury context, a population that was 'as similar' to Royal Marine recruits in training as was possible from the literature. The reasons the athletic injury literature was considered similar to Royal Marines' training were twofold. First, like competitive athletes, Royal Marines' training is physically and mentally demanding. Second, Royal Marines are highly motivated individuals who, like athletes, are usually keen to return to training as soon as possible following a setback like injury. The three component model of commitment is also a very well-researched theory which has been generalised across a variety of different occupational settings, and equally generalised well to military training commitment. Athletic identity also added a new dimension to the model and discussion on the role of identity has added to existing academic debate in terms of its apparent indirect relationship with outcome of training. The exploratory study of pain addressed a gap in the research literature in terms of the relationship of early, concurrent and trajectory of pain in attitude formation, rather than the relationship of attitudes to pain levels as has been investigated more extensively in the literature.

In more general terms, this research has bridged a gap in the literature. The model combined the most important aspects of some well-validated predictive health behaviour models parsimoniously, whilst remaining specific to the context in which it was applied. Moreover, a strength of the extended model was the inclusion of marine identity and organisational commitment. Organisational commitment is an extensively empirically researched construct in business environments, but far less so in athletic or military environments. This new application of such a validated measure has proven worthwhile, in that its applicability in the prediction of outcome of rehabilitation in a military training environment was significant. Many studies of commitment have focused on its relationship with turnover intentions. Yet the results of this study demonstrated a real, behavioural association, in that commitment was related to rehabilitation outcome, thus completing the existing literature and supporting its application as a construct predictive of subsequent behaviour. Similarly, athletic identity is a construct well-researched in the prediction of athletic performance. Its application in predicting psychological response to injury has been speculated, yet research into the relationship between athletic injury and actual behavioural outcome in rehabilitation is in its infancy. Some new assertions have been made about the mediating role of athletic identity in injury recovery, which has added to the current dearth of empirical research available from the literature.

Despite the support of relevant literature for the chosen approach, it is recognised that alternative theories were available and it is recognised that other psychological constructs not measured in any of the empirical studies reported in this thesis may have contributed to the further explanation of variance in rehabilitation outcome. A potentially influential factor not accounted for in this thesis, and therefore a limitation of the model applied, is the influence of psychological factors external to the individual's interpretation of pain, injury and rehabilitation. For example, group cohesion (Spink & Carron, 1994) has previously been identified as important in successful troop dynamics in a military context (Hardy, Shariff, Jones & Allsopp, 2001), as well as in a sports team context (Prapavessis & Carron, 1996). It is possible that the loss of cohesion a recruit experiences when being removed from his troop because of an injury may impact on his motivation to remain at the Commando Training Centre. Likewise, cohesion with his peers in the new, rehabilitative environment may also impact on his motivation to succeed in his rehabilitation.

Social support, or lack of social support, might influence an injured recruit's attitude toward injury and rehabilitation (Green & Weinberg, 2001). Smith, Smoll and Ptacek (1990) found greater perceived social support was related to adaptive coping skills in adolescents recovering from sports injuries. Other influential factors such as socioeconomic status and unemployment rates of the recruit's home town (Jackson, Stafford, Banks & Warr, 1983) may equally impact on a recruit's prospects outside of the Royal Marines' training environment, and may therefore affect how he views his ability to complete rehabilitation. Although socioeconomic status was not measured in this programme of work, educational factors were measured in relation to rehabilitation outcome and were not found to be significant (chapter 2). Although alternative theories and other constructs not considered in the current programme of work might have contributed to the additional explanation of variance in outcome of rehabilitation, the logistics of running such a complex research programme were complicated and the resulting studies would have lacked the focused approach of the studies reported in this thesis. Therefore a measured approach was taken to ensure the most important, most likely, well-validated and most modifiable psychological constructs were measured in relation to an overarching framework. In hindsight, the focused approach adopted successfully satisfied the aims of this research programme.

The prospective design of the main study was a methodological strength. This is because causal inferences can be made with more confidence. Cross-sectional design studies only allow for associations to be explored whereas, although longitudinal observational designs do not permit causal inference, it is more plausible that associations between predictor variables and outcome may be causal when the predictor precedes the outcome in time. That said, intervention implementation and testing allows the most robust testing of causality, as direct relationships between variables manipulated by the intervention and outcome can be established. As such, the prospective design of the final study reported in this thesis is advantageous in comparison to cross-sectional studies, but is limited when compared to interventional studies.

*9.3.2 Strengths and limitations of implicit measures of attitude*

The main theoretical strength of the implicit association tests measuring commitment/marine identity remains the method's resistance to the unwanted effects of social desirability bias. A further strength is in how difficult it is to falsify results. Because of this, information provided to participants can be completely honest as to the purpose, without affecting the demand characteristics of the task. Another strength is their bespoke design; the IATs were specifically designed for the Royal Marines, and the stimuli were selected through empirical studies with Royal Marine recruit participants, which gives the test a high face validity and the researcher confidence in its application and interpretation. As a testing technique, the method is highly adaptable and could be modified and refined for use with other populations. A final strength is its administrative simplicity. Time is scarce for military trainees and the demanding training regime affords little spare capacity. Training teams are equally busy, so tests that can be administered by computer at a convenient time, that collate the data, and that can be analysed using computer-run algorithms are advantageous to the participants and training team, as well as the researcher, in such a logistically complex environment. A strength of the way in which these methods have been tested in the current context is, again, in the approach taken. The IATs were first tested cross-sectionally, followed by prospectively. The cross-sectional study findings revealed that the IATs concurrent and construct validity were good, thus warranting the prospective study. Without the cross-sectional testing of the IATs in chapter 7, the lack of significant findings from the main, prospective study could have been misinterpreted that the IATs simply had not worked. In fact, it is more likely that the implicit methods did not work in the prospective study due to the contextual and practical reasons outlined in the discussion in chapter 8, and because only a weak association between identity and outcome was observed. Alternatively, it could be the case that the IATs did work, indicating no association between implicit attitude and outcome.

### *9.3.3 Implications of outcome measures and population*

A limitation of the outcome variable relative recovery time was the range of injuries. Although some injuries are more common and predictable than other Royal Marines' training injuries, not all recruits suffer from these, more common injuries. The range of injuries and therefore the associated increase in range of severity may have reduced the sensitivity and specificity of the prospective study results. For example, a neck of femur stress fracture is considerably more serious, and has a longer median recovery time, than a stress fracture of the metatarsal. The median recovery time for a neck of femur stress fracture was 34.5 weeks, whereas stress fracture of the metatarsal was less than half that at 14.9 weeks (chapter 2). The more serious the injury, the smaller the sample and the greater potential for complications such as secondary injuries and lengthened recovery time due to severity. An ideal resolution to this problem would have been to only recruit participants with common, easily diagnosable, reliably predictable (in terms of prognosis) conditions such as metatarsal stress fractures. However, this was practically not possible due to limitations of time and uncertainty about the required sample size being realistic and achievable. Severity within each injury was also a confounding factor of relative recovery time. As discussed extensively in chapter 2, it was not possible to account for differences in severity within each injury group. It was not logistically possible for the Commando Training Centre physician to rate each individual's injury as they presented at the medical centre. Further, a severity rating decided upon by the physician would have been arbitrary and there would be no guarantee that the measure would be reliable between patients with similar conditions.

The confounders discussed might explain why only perceived severity was found to relate to relative recovery time. If it were possible to comprehensively control for injury type and injury severity in order that all injuries were identical in nature and severity, psychological factors might have been revealed as explaining some of the variance in recovery time. It is concluded that relative recovery time was too crude a measure as to be sensitive enough for psychological measures to have been drawn out statistically as being influential on outcome. Given that psychological variables were found to have influenced overall outcome of recovery, it could be speculated that they are likely also to play a role in relative recovery time.

The population to which the model was applied also requires some discussion. The advantage of the research participants being Royal Marine recruits is that they operate in a highly controlled environment. As such, many of the extraneous variables potential as confounders in other studies of physical injury and rehabilitation are minimised in this research programme. For example, all Royal Marine recruits, whether in mainstream training, injured and residing in Hunter Company, or awaiting their opt-out date, live at the Commando Training Centre, eat similar meals in the same dining hall, wear the same clothing and are subject to compliance with the same rules and regulations. As such, the environment is well placed for experimental psychological research, where it is preferable to have as few confounders as possible. The disadvantage to Royal Marine recruit participants is that they are somewhat range limited in terms of age and physical factors, as well as being range limited in terms of their psychological characteristics.

Stringent selection criteria and demanding military training exercises reduce the range of psychological characteristics found within any given training troop. As recruits opt-out or become discharged, the range continues to narrow. By the time recruits have been in training for a number of weeks, it can be assumed that there are more similarities between them, particularly in the case of motivation, than the average sample usually recruited for this type of research. For example, it can be assumed that a recruit who has made it part-way through mainstream training, who then becomes injured but remains in Hunter Company long enough to transfer to 2 troop, is probably fairly well-motivated. Despite the proportion of recruits not completing rehabilitation, it is speculated that the majority of the sample who participated in the prospective study were more motivated to recover than some non-military populations. This notion is supported by the skew and the lack of range in the datasets of the explicit measures employed in the prospective study. The main concern and therefore limitation with such a controlled, range limited sample, is that the measures employed in the prospective study were developed on norm groups with a larger range of psychological characteristics, and as such, may not be as sensitive in the context of military training as they are with non-military populations; because there is limited variation in attitudes, attitude measures are less able to predict outcome. Despite the limits in range of data, the results obtained in the cross-sectional and prospective studies were statistically robust, and made theoretical and logical sense.

### *9.3.4 Future directions*

The implications of this work programme direct future research in a number of suitable ways. The finding that psychological factors account for some of the variance in rehabilitation outcome of military trainees clearly has theoretical as well as applied implications. It is now known that perceived severity and self-efficacy account for most of the variance explained by the psychological factors measured. The extended model of protection motivation theory could be further developed and refined specifically for the current population; the specific roles of social support and socioeconomic status outside of training in determining approach to rehabilitation could be investigated for example. Alternatively, the extended model could be applied to new populations experiencing similar difficulties in terms of the high prevalence of physical injury. For example, basic Army training also has a high injury and opt-out rate. The model and methods applied in this programme of work could be extrapolated to other groups of military personnel, such as those returning from operations with an acquired injury, or to investigate the high prevalence of low back pain in trained Armed Forces personnel and other non-marines populations.

The applied implications and future possibilities are equally extensive. The results indicate that an intervention based on protection motivation theory could be of benefit to some injured Royal Marine recruits to assist with rehabilitation and successful return to training. The model could be applied to individuals at the beginning of rehabilitation in order to identify those who may struggle with their rehabilitation, thereby allowing appropriate intervention to be applied at an early stage of recovery.

There are also a number of implications and options for future development of implicit measures. The implicit association tests of commitment worked very well as a test of commitment/marine identity. This finding could be built upon by expanding the cross-sectional study to be prospective in design. This research programme is currently underway; a protocol has been submitted and approved by the MoD ethics committee and Time 1 data collection is now complete. Should the commitment implicit association test be found to be predictive of opt-out from training or success in training, its implementation as a part of the selection procedure could be considered. At present, the selection system for potential Royal Marine recruits only includes physical data, and no systematic psychological information is collected or recorded. Therefore, it seems plausible that a large proportion of the variance in opt-out is not currently being addressed. If the commitment implicit association tests coupled with appropriate explicit measures could account for some of the variance in outcome of training, they could be included in the statistical risk zone model currently used to calculate the probability of a recruit's likelihood of passing the course. Their theoretical robustness coupled with their ease of administration and interpretation allows for further studies to be conducted and for their implementation into the training/selection system to be further explored. Finally, the method could be developed to measure other constructs that might be considered important in health psychology and military training.

### *9.4 The Unique Contribution of this Thesis*

This is the first time protection motivation theory has been extended and applied using the theories of fear-avoidance, commitment and athletic identity, and the additional measure of pain. The additional elements both complemented the overall framework, and enabled more comprehensive analyses and findings than if protection motivation theory had been applied in isolation. The finding that self-efficacy and perceived severity of the injury predict rehabilitation outcome is a key finding, as their influential importance has never been recognised by remedial training staff or by the Royal Marines prior to the research programme reported in this thesis. The findings of the present programme of work are of theoretical importance given the paucity of good quality empirical research into the psychological aspects of injury rehabilitation.

The study also allowed for an exploratory study of pain. The relationship of the trajectory of the intensity and impact of pain from Time 1 to Time 2 to attitudinal predictors of outcome has proven interesting both theoretically and practically. Although this study was not on pain patients, but injured recruits, the findings have potential implications for understanding the transition from acute to chronic pain. The environment and sample was better controlled than in many published articles on the effects of pain, reducing extraneous influences on this process that can confound findings in studies of pain patients in civilian life.

The population to which the extended model was applied is unusually homogeneous and well-controlled unlike most previous empirical work conducted in the field. Whilst psychology plays a significant role in the health literature and is gradually developing as a key discipline in the sporting arena, the role of health psychology in a military context is in its infancy and has made little impact in the UK Armed Forces until now. The physical requirements of Royal Marines' training has long been well-recognised, and the mental demands of training are widely acknowledged, yet whilst physiological and medical research abounds, systematic, scientific psychological research simply has not materialised up to this point.

This is also the first time implicit methods have been developed in the areas of fear-avoidance and commitment, as well as being the first time they have been applied to the Royal Marines and military training. This thesis included three unique studies that identified the stimuli for the implicit measures. Normative data are usually used by researchers developing implicit measures for social psychological research, and a review of the literature revealed that empirical studies with the implicit measures' intended audience in order to select the stimuli for inclusion in the final measure have never been conducted before. This development process may have contributed to the outstanding performance of the IATs reported in chapter 7.

This thesis not only contributes theoretically; the practical contribution must also be noted. The application of the extended protection motivation theory model could be used by management to assess each individual's probable approach to his injury and rehabilitation, and appropriate bespoke interventions could be developed and targeted. The implementation of interventions could result in a decrease in the number of recruits leaving Royal Marines' training, a saving that is not just of personal gain to the individual, but training and financial gains to Commando Training Centre. Similarly, the implementation of implicit tests of commitment as part of the selection system could also result in a more accurate recruitment process, saving the Ministry of Defence time, money and furthering their gains to trained strength.

## Appendix A: Modified Explicit Measures Applied in the Studies Reported in Chapters 7 and 8

*The Sports Injury Rehabilitation Beliefs Survey (SIRBS)*

Note: Subscales of the SIRBS are as follows:

Items 1-5: Perceived susceptibility

Items 6-9: Treatment efficacy

Items 10-13: Self-efficacy

Item 14: Rehabilitation value

Items 15-19: Perceived severity

The words 'rehabilitation programme' should be read to mean any advice that a recruit is given in order to assist the rehabilitation of his injury. Participants responded using the scale shown below:

| Very strongly disagree | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree | Very strongly agree |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

1. My recovery from injury may be hindered if I do not complete the rehabilitation programme.
2. In order to prevent a recurrence of this injury, my rehabilitation programme is essential.
3. The way to prevent my injury from worsening will be to follow my rehabilitation programme.
4. A successful and lasting recovery may not be possible if I do not complete my rehabilitation programme.
5. I am making it more likely that I will be re-injured by not doing what my rehabilitation programme involves.
6. The rehabilitation programme designed for me will ensure my complete recovery from this injury.
7. Completion of my rehabilitation programme will guarantee that I recover from my injury.

8. Following the advice that I have been given will have a very large impact upon how quickly I recover from this injury.
9. I have absolute faith in the effectiveness of my rehabilitation programme.
10. I am very capable of successfully completing all aspects of my rehabilitation programme, even if it involves being less active or something which may by discomforting.
11. I consider myself able to stick to my rehabilitation programme even though it may include activities which I do not enjoy.
12. I will have no serious difficulty in following the instructions of my rehabilitation programme.
13. I believe that I will stick with my rehabilitation programme despite any difficulties I may encounter.
14. Being fully recovered from injury is extremely important to me.
15. As injuries go, mine is serious.
16. I see this injury as a serious threat to my RM training involvement.
17. I fear that this injury will affect my long-term involvement in recruit training.
18. This injury is too serious to not follow medical advice.

    Injuries like this are minor interruptions to my involvement in recruit training.

Appendix A continued: Modified Explicit Measures Applied in the Studies Reported in Chapters 7 and 8

*The Three Component Model of Commitment Questionnaire (TCM)*

Note: (R) = to be reverse scored.

Subscales of the SIRBS are as follows:

(A) = Affective commitment scale

(C) = Continuance commitment scale

(N) = Normative commitment scale.

The word organisation has been changed to Royal Marines. Participants responded using the scale shown below:

| Very strongly disagree | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree | Very strongly agree |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

1. I would be very happy to spend the rest of my career in the Royal Marines. (A)
2. Right now, staying in the Royal Marines is a matter of necessity as much as desire. (C)
3. I do not feel any obligation to remain in the Royal Marines. (R) (N)
4. I really feel as if the Royal Marines' problems are my own. (A)
5. It would be very hard for me to leave the Royal Marines right now, even if I wanted to. (C)
6. Even if it were to my advantage, I do not feel it would be right to leave the Royal Marines now. (N)
7. I do not feel a strong sense of "belonging" to the Royal Marines. (R) (A)
8. Too much in my life would be disrupted if I decided I wanted to leave the Royal Marines now. (C)
9. I would feel guilty if I left the Royal Marines now. (N)
10. I do not feel "emotionally attached" to the Royal Marines. (R) (A)
11. I feel that I have too few options to consider leaving the Royal Marines. (C)
12. The Royal Marines deserves my loyalty. (N)

13. I do not feel like "part of the family", in the Royal Marines. (R) (A)
14. If I had not already put so much of myself into the Royal Marines, I might consider working elsewhere. (C)
15. I would not leave the Royal Marines right now because I have a sense of obligation to the people in it. (N)
16. The Royal Marines has a great deal of personal meaning for me. (A)
17. One of the negative consequences of leaving the Royal Marines would be the lack of alternatives. (C)
18. I owe a great deal to the Royal Marines. (N)

Appendix A continued: Modified Explicit Measures Applied in the Studies Reported in Chapters 7 and 8

*Athletic Identity Measurement Scale (AIMS)*

Note: The word athlete has been changed to Royal Marine recruit. The word sport has been changed to recruit training. Participants responded using the scale shown below:

| Very strongly disagree | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree | Very strongly agree |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

1. I consider myself to be a Royal Marine recruit.
2. I have many goals related to recruit training.
3. Most of my friends are Royal Marine recruits.
4. Recruit training is the most important part of my life.
5. I spend more time thinking about recruit training than anything else.
6. I need to do recruit training to feel good about myself.
7. Other people see me mainly as a Royal Marine recruit.
8. I feel bad about myself when I do badly in recruit training.
9. Recruit training is the only important thing in my life.
10. I would be very depressed if I could not continue with recruit training.

Appendix A continued: Modified Explicit Measures Applied in the Studies Reported in Chapters 7 and 8

*The Brief Pain Inventory (Short Form)*

Note: Subscales of the BPI are as follows:

Items 1-4: Pain intensity

Item 5 A-H: Pain impact

Participants responded using the scale shown below each subscale:

1. Please rate your pain by circling the one number that describes your pain at its *worst* in the last 24 hours.
2. Please rate your pain by circling the one number that best describes your pain at its *least* in the last 24 hours.
3. Please rate your pain by circling the one number that best describes your pain on the *average*.
4. Please rate your pain by circling the one number that tells how much pain you have *right now*.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| No Pain | | | | | | | Pain as bad as you can imagine |

5. Circle the one number that describes how, during the past 24 hours, pain has interfered with your:

A. General activity

B. Mood

C. Walking ability

D. Normal training

E. Relations with other people

F. Sleep

G. Enjoyment of life

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Does not interfere | | | | | | | Completely interferes |

Appendix A continued: Modified Explicit Measures Applied in the Studies Reported in Chapters 7 and 8

*The Brief Pain Inventory (Short Form): Authority from author to use measure*

150/093 please

Page 1 of

NEW PAPER 58

**Munnoch Kathy**

**From:** ccleeland@mdanderson.org
**Sent:** 23 March 2006 14:32
**To:** Munnoch Kathy
**Cc:** tmendoza@mdanderson.org; APSanchez@mdanderson.org
**Subject:** Re: Brief Pain Inventory permission

You have my permission to use. Good luck with your study.

Charles S. Cleeland
Chair, Department of Symptom Research
McCullough Professor of Cancer Research
U.T. M.D. Anderson Cancer Center, Houston

**"Munnoch Kathy" <hsohf2@inm.mod.uk>**
03/23/2006 04:33 AM

To: <ccleeland@mdanderson.org>
cc:
Subject: Brief Pain Inventory permission

Dear Dr Cleeland,

I am a Chartered Health Psychologist working for the Institute of Naval Medicine in the United Kingdom. I am also studying for my PhD with the University of Southampton. I am writing to you to request permission for me to include yo Brief Pain Inventory as a baseline pain measure and also outcome measure in a study I am conducting with injured Royal Marine recruits.

Please contact me if you need any details or have any queries.

Thank you very much,

Kathy

Miss K Munnoch (HSOHF2),
Chartered Health Psychologist,
Environmental Medicine Unit,
Institute of Naval Medicine,
Crescent Road, Alverstoke,
PO12 2DL
(BT) 02392 768 056 / (Mil)9380 68056
E Mail: hsohf2@inm.mod.uk

CENTRAL REGISTRY
24 MAR 2006
I N M

Appendix B: Information for Photographic Image Selection Study

(Study 1, Chapter 6)

*Civilian images obtained from freefoto.com: Authority to use photographs in studies*

150/093

Page 1 of 2

NEW PAPER

**Munnoch Kathy**

**From:** Kathy Munnoch [kathy@munnoch.fsworld.co.uk]
**Sent:** 27 November 2004 10:15
**To:** Munnoch Kathy
**Cc:** kathy@soton.ac.uk
**Subject:** Fw: Authority to use photos

----- Original Message -----
**From:** Ian Britton - FreeFoto.com
**To:** Kathy@munnoch.fsworld.co.uk
**Sent:** Friday, November 26, 2004 12:28 PM
**Subject:** RE: Authority to use photos

Hi

Thanks for taking the time to write to us.

We are happy to accept your proposals outline below

Please provide a credit to FreeFoto.com, mark the images as (c) Ian Britton - FreeFoto.com.

Rgds Ian Britton ian@freefoto.com

FreeFoto.com Ltd Company No 3973268 VAT No 747 2310 43

9 Oaktree Grove, Stockton on Tees, TS18 5NG
Phone +44 (0)870 240 6430 Fax +44 (0)20 7691 9529 Mobile +44 (0)7974 394621

FreeFoto.com Inc, 17 Pheasant Lane, Lexington, MA 02421, USA
Phone +1 781 240 3076 Fax +1 781 240 3076

-----Original Message-----
**From:** Munnoch Kathy [mailto:hsohf2@inm.mod.uk]
**Sent:** 26 November 2004 12:15
**To:** sales@freefoto.com
**Subject:** Authority to use photos

Hi,

Re our telephone conversation just now....please find below my original e mail. Please send the reply to my home e mail address which is Kathy@munnoch.fsworld.co.uk. Or failing that Kathy@soton.ac.uk. Both of those should work with a bit of luck! Apologies for this e mail address blocking your original reply. I hope I haven't caused you too many problems.

Thanks very much for your assistance,

Kathy

150093
CENTRAL REGISTRY
30 NOV 2004
I N M

-----Original Message-----
**From:** Munnoch Kathy
**Sent:** 25 October 2004 15:15
**To:** 'sales@freefoto.com'
**Subject:** internet-authorised: Authority to use photos

29/11/2004

Appendix B continued: Information for Photographic Image Selection Study

(Study 1, Chapter 6)

*Civilian images obtained from freefoto.com: Authority to use photographs in studies*

*Good afternoon,*

*I have been browsing your website and whilst I believe I am working within the rules you have laid out, I wanted to check with you personally before I use any of your photographs.*
*I am a health psychologist and I work for the Institute of Naval Medicine. I am carrying out some research looking into the attitudes and beliefs held by people . Part of this involves a comparison of people's reactions to 'military life' versus 'civilian life'. The military life photos have been easy to get hold of as we hold a CD directory here. However, the civilian photos Gust everyday things -people washing the car/going shopping etc) have been nearly impossible for me to find without running into issues of copyright (if I were to use the photos of others) or consent (if I were to take them myself) or hefty payment.*

*A friend of mine who is a graphic designer then pointed me in your direction.*
*What I would like to know is whether it is within the rules if I use some of your photos for the purpose of research (I am doing my PhD with Southampton University Psychology department) and I guarantee that the photos will only be used for research purposes. I will also credit the freephoto website in any write-up I produce. I will only use small versions of the photos, as I cannot add a hyperlink in a psychological test! But I can assure you, they will be used with the best of intentions and will be used by me only.*

*I hope you don't mind me contacting you, as I wanted to make sure I was doing the right thing before it's too late!! Please feel free to contact me anytime on any of the contact details below if you have any comments, queries/concerns etc.*

*Thank you for taking the time to read this mail and I look forward to hearing from you,*
*Kathy*

Appendix B continued: Information for Photographic Image Selection Study
(Study 1, Chapter 6)

*Participant information sheet*

Institute of Naval Medicine Study:

DEVELOPMENT OF IMPLICIT ATTITUDE MEASURES FOR USE WITH INJURED ROYAL MARINE RECRUITS

Involvement in this study is voluntary and you are free to withdraw at any time. Please read this information sheet before taking part in the study.

What is this task?

The task you are being asked to complete is designed to gain a better understanding of factors influencing commitment to the Royal Marines. It asks you to view photographs of civilian and military life and decide whether they are positive, negative or neutral in terms of how you feel about those aspects. This is NOT a test. There are no right or wrong answers. There are no good or bad answers. We want to know your personal views on the content of the pictures.

You may feel that some of the photographs are very similar. This is because we are interested in how you view different Royal Marines and civilian lifestyles and how you respond to those pictures.

Please give your most honest response as this will give us a fuller picture of how you view civilian and military life.

Who will see my answers?

The information you give is totally anonymous. There will be no attempt to identify you. Only researchers at the Institute of Naval Medicine will have access to questionnaires completed by individuals. All information you provide will be treated in accordance with the Data Protection Act 1998.

Once you have completed the questionnaire, please place it in the envelope provided and hand it to the administration team.

How long will it take?

There is no set time limit but this task should take about 30 minutes to complete.

How do I complete this task?

You will be shown 100 colour photographs depicting military or civilian life. The photographs will be numbered from 1-100. Please view each photograph carefully. For each photograph you are asked to mark on the answer sheet whether you feel the picture is positive, negative or neutral depending on how YOU feel about it (NOT how you think others would view it). Respond according to your first reaction. Do not spend too long on one question.

What do I do if I have any questions?

You may contact the Project Officer, Miss Kathy Munnoch (02392 768 056) at any time if you have any queries or concerns regarding this study. Please keep this information sheet for the Project Officer's contact details.

Appendix B continued: Information for Photographic Image Selection Study (Study 1, Chapter 6)

*Volunteer Consent Form*

DEVELOPMENT OF IMPLICIT ATTITUDE MEASURES FOR USE WITH INJURED ROYAL MARINE RECRUITS

1. I have read the information sheet, which provides full details of this study, and have had the opportunity to raise and discuss my questions with the Project Officer and the Independent Medical Officer, with regard to the general nature, object, potential risks and duration of the study, and understand what is expected of me.

2. I understand that in the event of my sustaining injury, illness or death as a result of participating as a volunteer in INM research, I or my dependents may enter a claim with the Ministry of Defence for compensation under the provisions of the no-fault compensation scheme, details of which are attached. Such a scheme does not require me or my dependents to establish negligence on the part of the Ministry of Defence or its employees. I also understand that should such injury, illness or death have been caused by the negligence of the Ministry of Defence or its employees either I or my dependents may have a claim in law.

3. I understand that the aim of the study is for me to rate each of 100 colour photographs on a scale according to whether I think they depict military or civilian life as positive, negative or neutral. I understand that the purpose of this task is to contribute toward the INM's development of a scale to measure injured Royal Marine recruits' attitudes toward training and the Corps in the future.

4. I agree to volunteer as a subject for the study described in the information sheet. I give my full consent to my participation in this study.

5. This consent is specific to the particular test described in the information sheet attached, and shall not be taken to imply my consent to participate in any subsequent experiment or deviation from that detailed here.

6. I reserve the right to withdraw from this experiment at any time; I also understand that I may be withdrawn at any time, and will suffer no penalty as a result.

Project Officer: Miss K Munnoch

Independent Medical Officer: Surg Cdr R Thomson

Signed ________________

Name ________________ Date _________________

Witnessed ________________

Name ________________ Date _________________

Appendix B continued: Information for Photographic Image Selection Study (Study 1, Chapter 6)

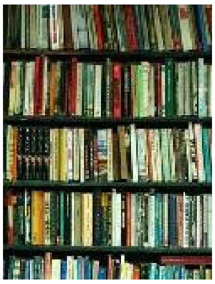
*Photo selection study response sheet*

Week of training at time of injury: Age:

No weeks spent in Hunter Company so far:

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 1.  | -1 | 0 | +1 |
| 2.  | -1 | 0 | +1 |
| 3.  | -1 | 0 | +1 |
| 4.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 5.  | -1 | 0 | +1 |
| 6.  | -1 | 0 | +1 |
| 7.  | -1 | 0 | +1 |
| 8.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 9.  | -1 | 0 | +1 |
| 10.  | -1 | 0 | +1 |
| 11.  | -1 | 0 | +1 |
| 12.  | -1 | 0 | +1 |
| 13.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 14.  | -1 | 0 | +1 |
| 15.  | -1 | 0 | +1 |
| 16.  | -1 | 0 | +1 |
| 17.  | -1 | 0 | +1 |
| 18.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 19.  | -1 | 0 | +1 |
| 20.  | -1 | 0 | +1 |
| 21.  | -1 | 0 | +1 |
| 22.  | -1 | 0 | +1 |
| 23.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 24.  | -1 | 0 | +1 |
| 25.  | -1 | 0 | +1 |
| 26.  | -1 | 0 | +1 |
| 27.  | -1 | 0 | +1 |
| 28.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 29.  | -1 | 0 | +1 |
| 30.  | -1 | 0 | +1 |
| 31.  | -1 | 0 | +1 |
| 32.  | -1 | 0 | +1 |
| 33.  | -1 | 0 | +1 |
| 34.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 35.  | -1 | 0 | +1 |
| 36.   | -1 | 0 | +1 |
| 37.  | -1 | 0 | +1 |
| 38.  | -1 | 0 | +1 |
| 39.  | -1 | 0 | +1 |
| 40.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 41.  | -1 | 0 | +1 |
| 42.  | -1 | 0 | +1 |
| 43.  | -1 | 0 | +1 |
| 44.  | -1 | 0 | +1 |
| 45.  | -1 | 0 | +1 |
| 46.  | -1 | 0 | +1 |

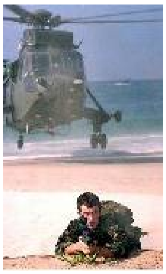
| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 47.  | -1 | 0 | +1 |
| 48.  | -1 | 0 | +1 |
| 49.  | -1 | 0 | +1 |
| 50.  | -1 | 0 | +1 |
| 51.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 52.  | -1 | 0 | +1 |
| 53.  | -1 | 0 | +1 |
| 54.  | -1 | 0 | +1 |
| 55.  | -1 | 0 | +1 |
| 56.  | -1 | 0 | +1 |
| 57.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 58.  | -1 | 0 | +1 |
| 59.  | -1 | 0 | +1 |
| 60.  | -1 | 0 | +1 |
| 61.  | -1 | 0 | +1 |
| 62.  | -1 | 0 | +1 |

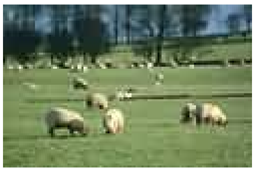
| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 63.  | -1 | 0 | +1 |
| 64.  | -1 | 0 | +1 |
| 65.  | -1 | 0 | +1 |
| 66.  | -1 | 0 | +1 |
| 67.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 68.  | -1 | 0 | +1 |
| 69.  | -1 | 0 | +1 |
| 70.  | -1 | 0 | +1 |
| 71.  | -1 | 0 | +1 |
| 72.  | -1 | 0 | +1 |
| 73.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 74.  | -1 | 0 | +1 |
| 75.  | -1 | 0 | +1 |
| 76.  | -1 | 0 | +1 |
| 77.  | -1 | 0 | +1 |
| 78.  | -1 | 0 | +1 |
| 79.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 80.  | -1 | 0 | +1 |
| 81.  | -1 | 0 | +1 |
| 82.  | -1 | 0 | +1 |
| 83.  | -1 | 0 | +1 |
| 84.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 85.  | -1 | 0 | +1 |
| 86.  | -1 | 0 | +1 |
| 87.  | -1 | 0 | +1 |
| 88.  | -1 | 0 | +1 |
| 89.  | -1 | 0 | +1 |
| 90.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 91.  | -1 | 0 | +1 |
| 92.  | -1 | 0 | +1 |
| 93.  | -1 | 0 | +1 |
| 94.  | -1 | 0 | +1 |
| 95.  | -1 | 0 | +1 |
| 96.  | -1 | 0 | +1 |

| Photo Number: | Negative | Neutral | Positive |
|---|---|---|---|
| 97.  | -1 | 0 | +1 |
| 98.   | -1 | 0 | +1 |
| 99.  | -1 | 0 | +1 |
| 100.  | -1 | 0 | +1 |

Appendix C: Information for Photographic Image Selection Study
(Study 2, Chapter 6)

*Photographic image selection study response sheet*

Age:

Injured/Opt Out / Discharged Recruits (please delete as appropriate):

Week of training at time of injury:

Week of training at time of opt-out decision:

Please rate each photograph presented below according to how *positive, negative or neutral* you think it depicts the Royal Marines and training.
Please use the scale -1 to +1.

Please then rate each photograph presented below according to how 'iconic' or *representative* of the Royal Marines and training it is *to you*.

1. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

2. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

3. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

4. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

5. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

6. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
| --- | --- | --- |
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
| --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 |

7. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
| --- | --- | --- |
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
| --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 |

8. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
| --- | --- | --- |
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
| --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 |

9. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
| --- | --- | --- |
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
| --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 |

10. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

11. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

12. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

13. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

14. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

15. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

16. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

17. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

18. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

19. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

20. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

21. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

22. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

23. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

24. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

25. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

26. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

27. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

28. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

29. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

30. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

31. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

32. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

33. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

34. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

35. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

36. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

37. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

38. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

39. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

40. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

41. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

42. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

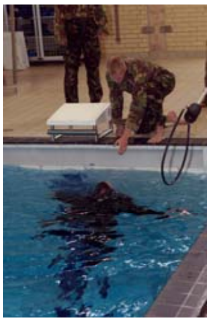
| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

43. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |



44. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

45. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

46. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

47. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

48. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

49. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

50. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

51. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

52. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

53. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

54. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

55. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

56. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

57. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

58. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

59. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

60. How do you think this image portrays the Royal Marines?

| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

61. How do you think this image portrays the Royal Marines?

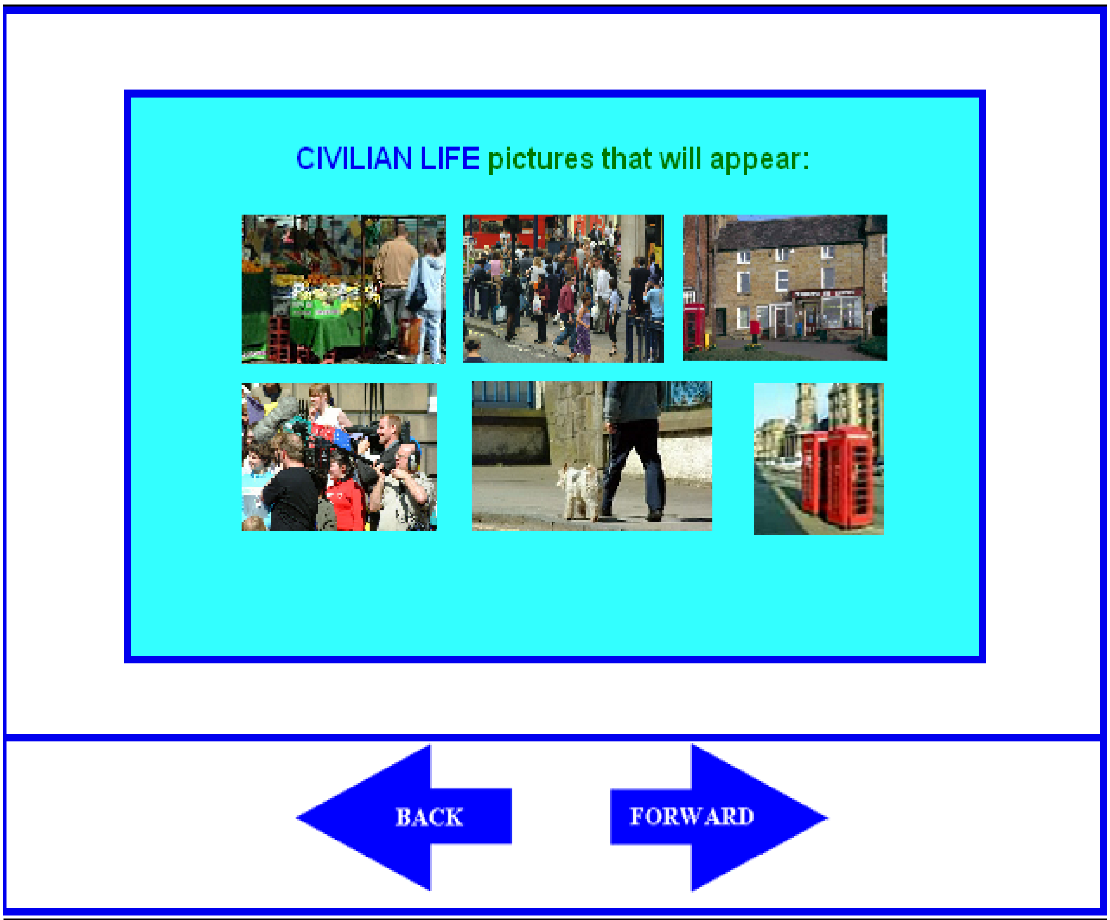
| Negative | Neutral | Positive |
|---|---|---|
| -1 | 0 | +1 |

How well do you think this picture represents the Royal Marines to you?

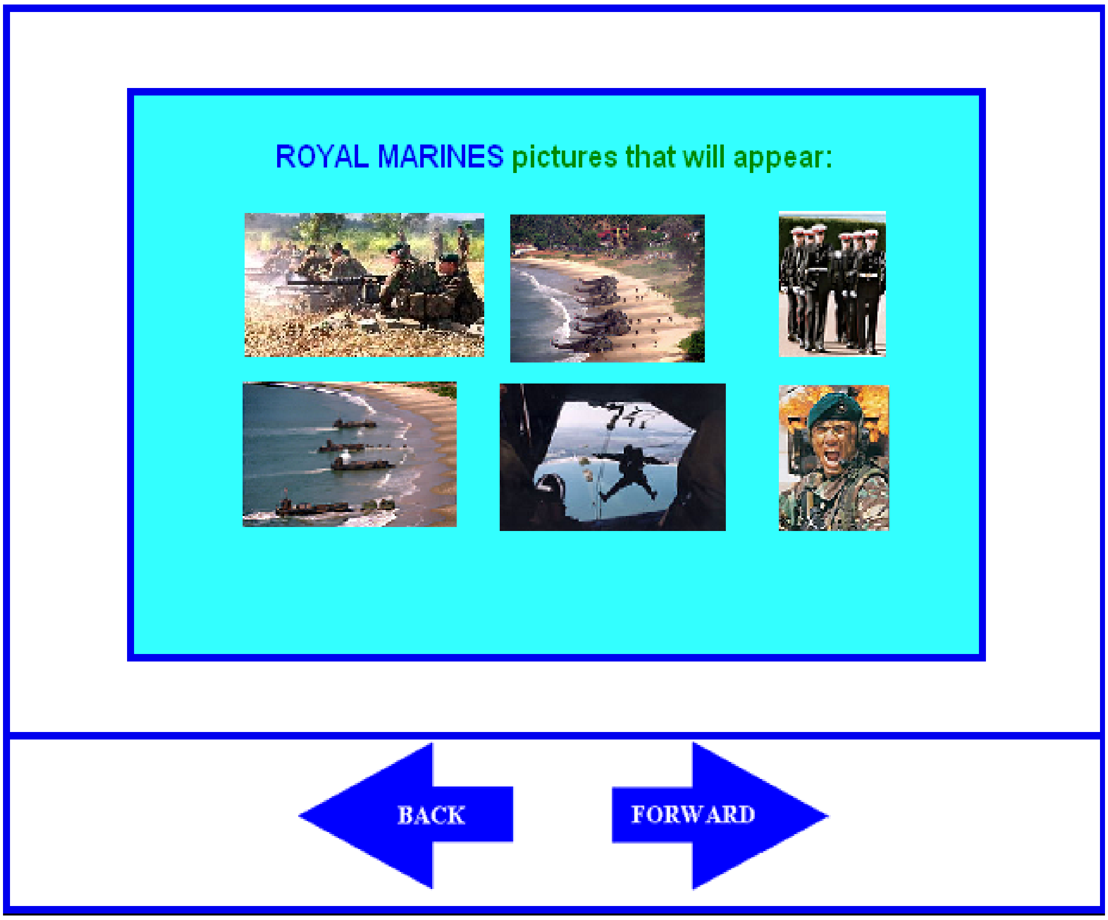
| Not at all | A little | Quite well | Very well | Extremely well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

Appendix D: Implicit Association Tests' Stimuli

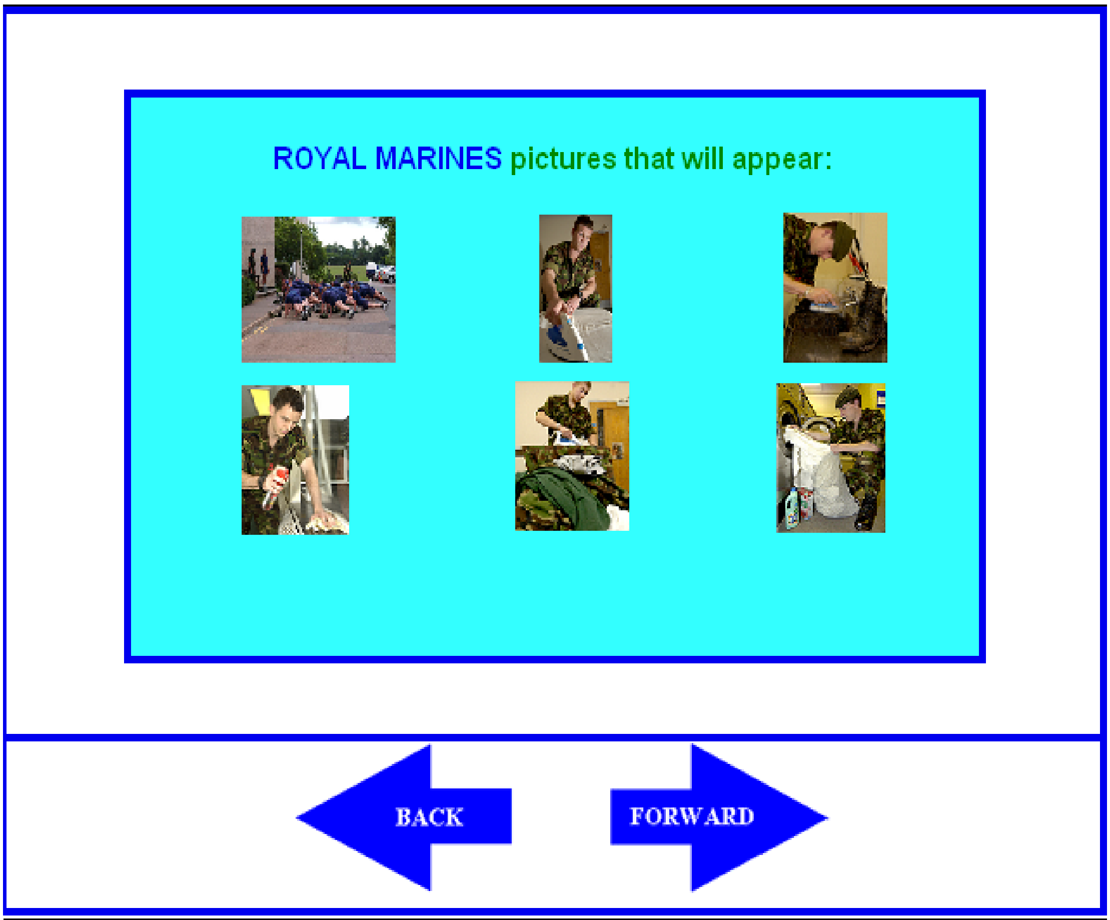
*Images of civilian life used in the IAT as target-stimuli*



*Royal Marine images used in the positive image IAT as target stimuli*

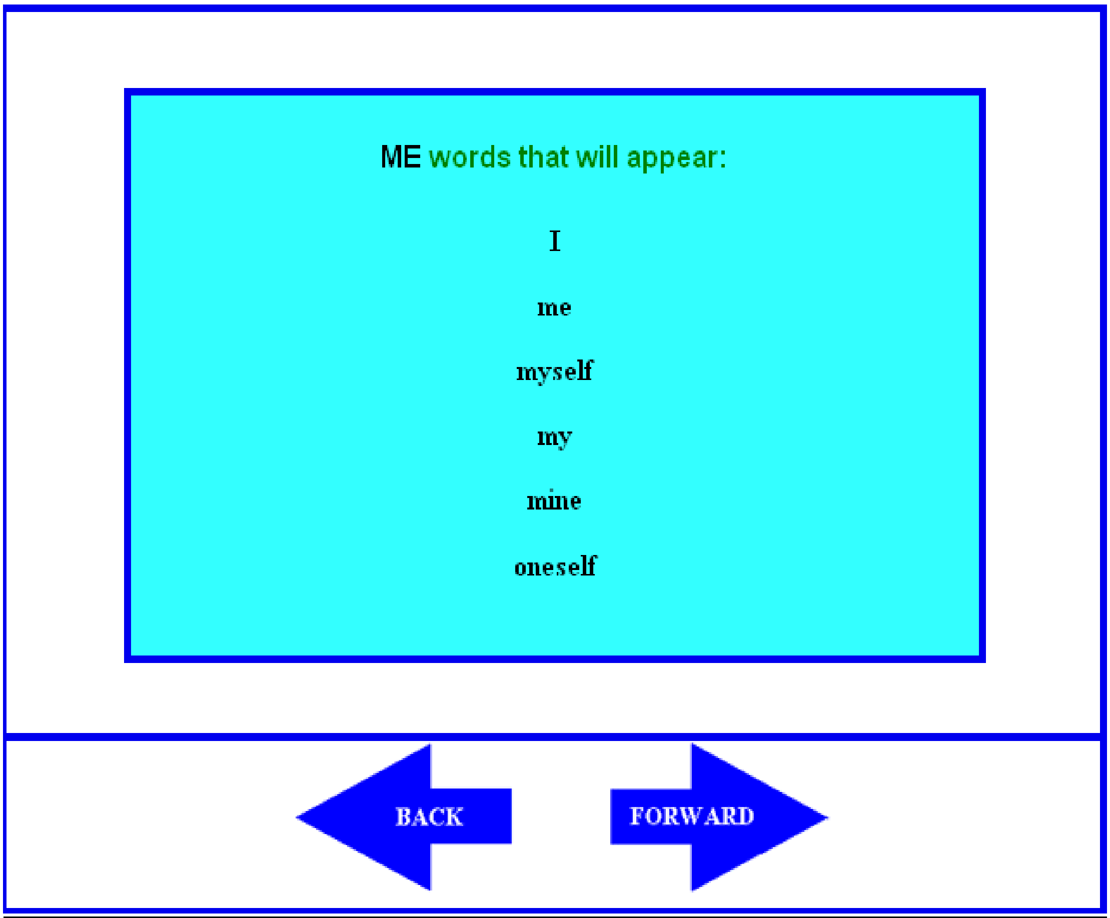


*Royal Marine images used in the negative image IAT as target stimuli*

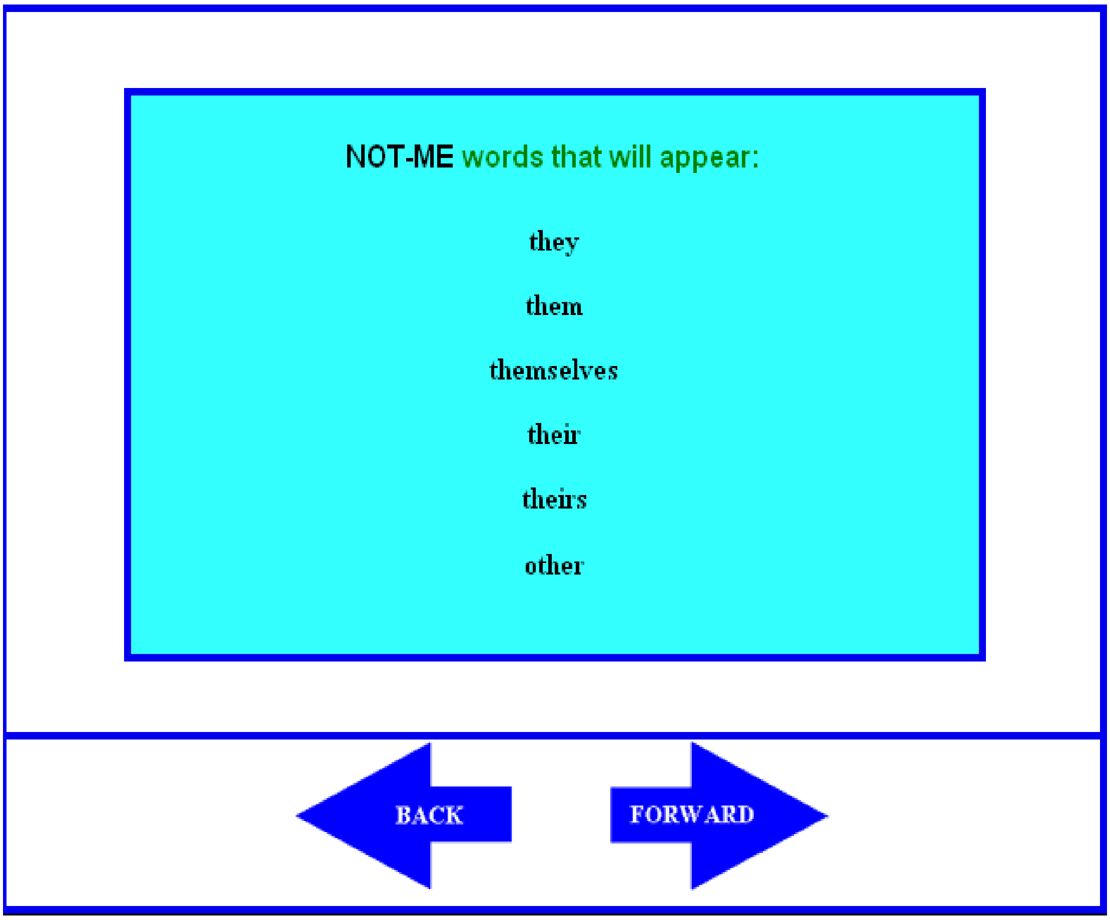


Appendix D continued: Implicit Association Tests' Stimuli

*Me words used in the IAT as associated attributes*



*Not me words used in the IAT as associated attributes*



## Appendix E: Statement Selection Study Information and Outcome (Study 3, Chapter 6)

*Participant information sheet*

Institute of Naval Medicine Task:
DEVELOPMENT OF IMPLICIT ATTITUDE MEASURES FOR USE WITH INJURED ROYAL MARINE RECRUITS

Involvement in this study is voluntary and you are free to withdraw at any time. Please read this information sheet before completing this questionnaire.

What is this questionnaire?
The questionnaire you are being asked to complete is designed to gain a better understanding of the factors influencing your recovery from injury. It asks you about aspects of rehabilitation, remedial exercises and pain. This is NOT a test. There are no right or wrong answers. There are no good or bad answers. We want to know your personal views on the issues raised in the questionnaire.

*You may feel that some of the questions are the same and repeating themselves. This is because we are interested in the way the statements are phrased and how you respond to those statements.*

Please take each item seriously as we value your responses. Give your most truthful response as this will give us a fuller picture of what you experience in Hunter Company.

Who will see my answers?
The information you give is totally anonymous. There will be no attempt to identify you. Only researchers at the Institute of Naval Medicine will have access to questionnaires completed by individuals. All information you provide will be treated in accordance with the Data Protection Act 1998.

Once you have completed the questionnaire, please place it in the envelope provided and hand it to the administration team.

How long will it take?

There is no set time limit but this questionnaire should take about 10 minutes to complete.

How do I fill in this questionnaire?

Information on how to complete the questionnaire is provided on the questionnaire itself.

What do I do if I have any questions?

You may contact the Project Officer, Miss Kathy Munnoch (02392 768 056) at any time if you have any queries or concerns regarding this study. Please keep this information sheet for the Project Officer's contact details.

Appendix E continued: Statement Selection Study Information and Outcome (Study 3, Chapter 6)

*Volunteer Consent Form*

DEVELOPMENT OF IMPLICIT ATTITUDE MEASURES FOR USE WITH INJURED ROYAL MARINE RECRUITS

1. I have read the information sheet, which provides full details of this study, and have had the opportunity to raise and discuss my questions with the Project Officer and the Independent Medical Officer, with regard to the general nature, object, potential risks and duration of the study, and understand what is expected of me.

2. I understand that in the event of my sustaining injury, illness or death as a result of participating as a volunteer in INM research, I or my dependents may enter a claim with the Ministry of Defence for compensation under the provisions of the no-fault compensation scheme, details of which are attached. Such a scheme does not require me or my dependents to establish negligence on the part of the Ministry of Defence or its employees. I also understand that should such injury, illness or death have been caused by the negligence of the Ministry of Defence or its employees either I or my dependents may have a claim in law.

3. I understand that the aim of the study is for me to rate each of 16 statements on a scale of 1 to 5, according to what I think best describes how I am feeling about my injury, pain and remedial exercises. I understand that the purpose of this task is to contribute toward the INM's development of a scale to measure the attitudes of injured Royal Marine recruits towards their injury and rehabilitation in the future.

4. I agree to volunteer as a subject for the study described in the information sheet. I give my full consent to my participation in this study.

5. This consent is specific to the particular test described in the information sheet attached, and shall not be taken to imply my consent to participate in any subsequent experiment or deviation from that detailed here.

6. I reserve the right to withdraw from this experiment at any time; I also understand that I may be withdrawn at any time, and will suffer no penalty as a result.

Project Officer: Miss K Munnoch
Independent Medical Officer: Surg Cdr R Thomson

Signed ________________

Name ________________ Date ________________

Witnessed ________________

Name ________________ Date ________________

Appendix E continued: Statement Selection Study Information and Outcome (Study 3, Chapter 6)

*Statement selection response sheet*

Week of training at time of injury: Age:

No of weeks spent in Hunter Company so far:

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 1. I'll never fully recover from my injury. | 1 | 2 | 3 | 4 | 5 |
| 2. If I go back to training, I'll get injured again. | 1 | 2 | 3 | 4 | 5 |
| 3. Remedial exercise makes my injury better. | 1 | 2 | 3 | 4 | 5 |
| 4. Remedial exercise does me good. | 1 | 2 | 3 | 4 | 5 |
| 5. I'm very willing to do remedial exercises. | 1 | 2 | 3 | 4 | 5 |
| 6. When I go back to training, I'll re-injure myself. | 1 | 2 | 3 | 4 | 5 |
| 7. I'm afraid of remedial exercise. | 1 | 2 | 3 | 4 | 5 |
| 8. If I go back to training, I won't re-injure myself. | 1 | 2 | 3 | 4 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| 9. I feel fine doing remedial exercises. | 1 | 2 | 3 | 4 | 5 |
| 10. I welcome remedial exercise. | 1 | 2 | 3 | 4 | 5 |
| 11. Remedial exercise is bad for me. | 1 | 2 | 3 | 4 | 5 |
| 12. I find remedial exercises very painful. | 1 | 2 | 3 | 4 | 5 |
| 13. Remedial exercise makes my injury worse. | 1 | 2 | 3 | 4 | 5 |
| 14. When I go back to training, I'll get injured again. | 1 | 2 | 3 | 4 | 5 |
| 15. I'm sure I'll make a complete recovery. | 1 | 2 | 3 | 4 | 5 |
| 16. I can't stand doing remedial exercises. | 1 | 2 | 3 | 4 | 5 |

Appendix E continued: Statement Selection Study Information and Outcome (Study 3, Chapter 6)

*Selected pairs of Fear-Avoidance Items for the TARA*

| |
|---|
| Remedial exercise makes my injury worse.<br>Remedial exercise makes my injury better. |
| If I go back to training, I'll get injured again.<br>When I go back to training, I'll stay injury free. |
| I'll never fully recover from my injury.<br>I'm sure I'll make a complete recovery. |
| I can't stand doing remedial exercises.<br>I'm very willing to do remedial exercises. |
| If I go back to training, I'll re-injure myself.<br>When I go back to training, I won't re-injure myself. |
| Remedial exercise does me good.<br>Remedial exercise is bad for me. |

Appendix E continued: Statement Selection Study Information and Outcome (Study 3, Chapter 6)

*Fear-Avoidance Beliefs Questionnaire (FABQ) for Patients with Back Pain*

*Instructions*

Here are some of the things which other patients have told us about their pain. For each statement please circle the number from 0 to 6 to say how much physical activities such as bending lifting walking or driving affect or would affect your back pain.

Statements:

(1) My pain is caused by physical activity.

(2) Physical activity makes my pain worse.

(3) Physical activity might harm my back.

(4) I should not do physical activities which (might) make my pain worse.

(5) I cannot do physical activities which (might) make my pain worse.

The following statements are about how your normal work affects or would affect you back pain:

(6) My pain was caused by my work or by an accident at work.

(7) My work aggravated my pain.

(8) I have a claim for compensation for my pain.

(9) My work is too heavy for me.

(10) My work makes or would make my pain worse.

(11) My work might harm my back.

(12) I should not do my normal work with my present pain.

(13) I cannot do my normal work with my present pain.

(14) I cannot do my normal work till my pain is treated.

(15) I do not think that I will be back to my normal work within 3 months.

(16) I do not think that I will ever be able to go back to that work.

| Response | Points |
|---|---|
| completely disagree | 0 |
| | 1 |
| | 2 |
| unsure | 3 |
| | 4 |
| | 5 |
| completely agree | 6 |

*Fear-avoidance beliefs about work (scale 1) =*

= (points for item 6) + (points for item 7) + (points for item 9) + (points for item 10) + (points for item 11) + (points for item 12) + (points for item 15)

*Fear-avoidance beliefs about physical activity (scale 2) =*

= (points for item 2) + (points for item 3) + (points for item 4) + (points for item 5)

*Items not in scale 1 or 2: 1 8 13 14 16*

*Interpretation*

• Minimal scale scores: 0 • maximum scale 1 score: 42 (7 items)

• Maximum scale 2 score: 24 (4 items)

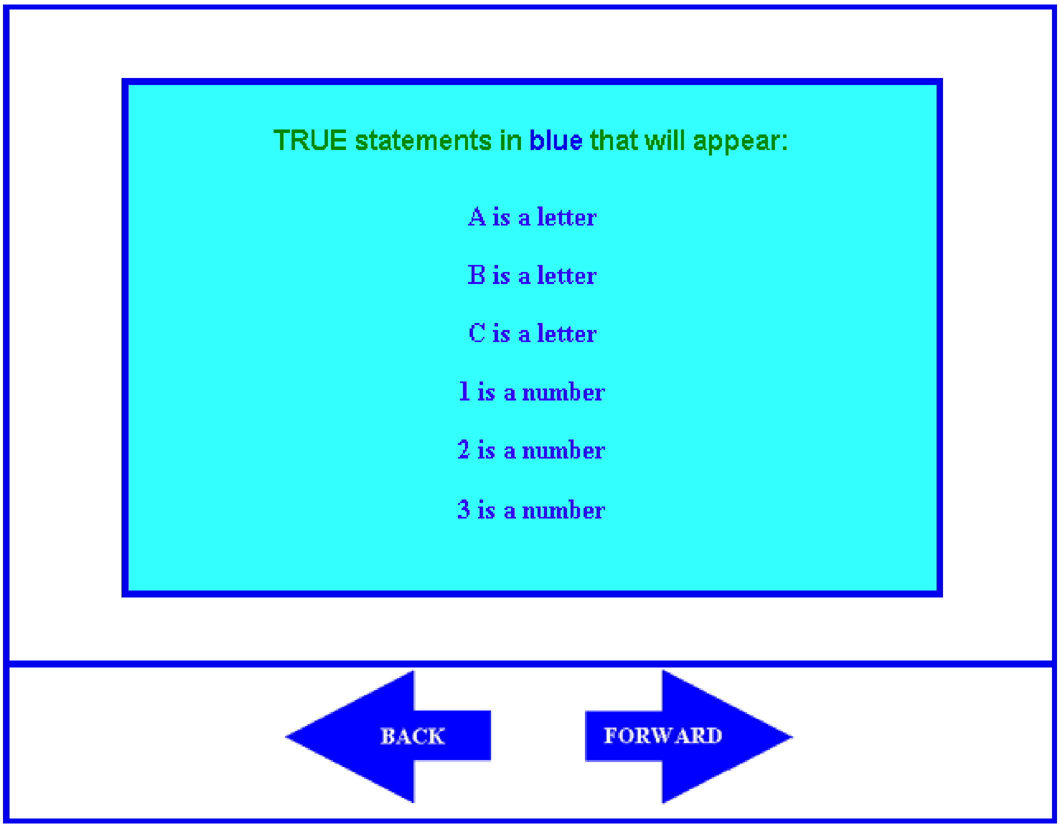
• The higher the scale scores the greater the degree of fear and avoidance beliefs shown by the patient.

*Performance*

• Internal consistency (alpha) .88 for scale 1 and .77 for scale 2.

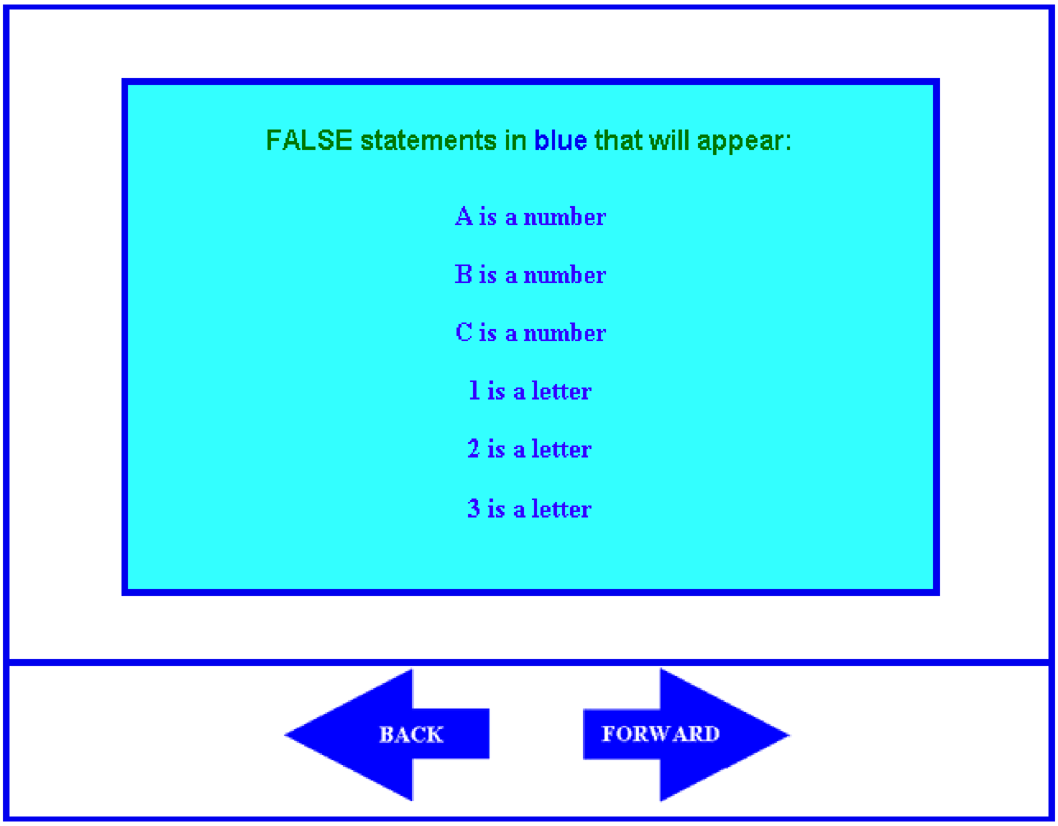
Appendix E continued: Statement Selection Study Information and Outcome (Study 3, Chapter 6)

*True irrelevant statements used in the TARA*



Appendix E continued: Statement Selection Study Information and Outcome (Study 3, Chapter 6)

*Appendix E: False irrelevant statements used in the TARA*



## Appendix F: Information for Implicit Association Test Validation Cross-sectional Study (Chapter 7)

*Participant information sheet*

Institute of Naval Medicine Task:

CONCURRENT AND CONSTRUCT VALIDATION OF THE IMPLICIT ASSOCIATION TEST OF ORGANISATIONAL COMMITMENT OF ROYAL MARINE KING'S SQUAD AND OPT-OUT RECRUITS

Involvement in this study is voluntary and you are free to withdraw at any time. Please read this information sheet before completing this questionnaire.

Welcome!

We would like to invite you to participate in this research project being undertaken by Miss Kathy Munnoch. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information.

What is this study?

We are looking at how your thoughts and feelings about RM training may effect whether you complete training or decide to opt out. This is with a view to improving the selection process and subsequent training received by RM recruits.

What does the study involve?

You will be asked to carry out some simple tasks such as categorising pictures on a computer screen. You will also be asked to answer various questions about aspects of RM training on a computer. This is NOT a test. There are no right or wrong answers. The task you are being asked to complete is designed to gain a better understanding of the factors influencing your attitudes, beliefs and performance in RM training. The study should take no longer than about 10 minutes.

How do I take part?

If you would like to take part, please attend the Adult Learning Centre and look for the 'INM study' signs. Log on to one of the computers and follow the instructions. Information on how to complete the task will be provided on the computer screen. You can log-on to the computer using your Service Number, surname and date of birth. This is only so we can link your answers with details of your age, body mass index, education and week of training at opt-out (where necessary). Once the data has been matched up, all identifiers will be removed so you cannot be identified by the information you have given.

If I have questions, who can I ask?

You can contact Miss Kathy Munnoch on mil 9380 68056 or civ 02392 768 056 anytime, she will be happy to answer any questions. An independent medical officer (Surg Cdr Roger Thomson, PMO, Sickbay) will also be available to answer any queries or concerns. His sole function is to act independently of the study team to ensure your safety and well-being. You may at any time withdraw from the experiment without giving a reason. If you ever require any further explanation, please do not hesitate to ask.

Who sees my results?

Any information obtained during this trial will remain confidential as to your identity and will be held at the Institute of Naval Medicine. No CTCRM staff will have access to your data. Other material, which cannot be identified with you, will be published or presented at meetings with the aim of benefiting others. You have a right to obtain copies of all papers, reports, transcripts, summaries and other material so published or presented on request to the Project Officer. All information will be subject to the current conditions of the Data Protection Act 1998. Experimental records, including paper records and computer files, will be held for a minimum of

100 years in conditions appropriate for the storage of personal information. You have right of access to your records at any time.

What if I experience adverse effects?

In the event of you suffering any adverse effects as a consequence of your participation in this study, you will be eligible to apply for compensation under the MoD's 'No Fault Compensation Scheme'.

Who's authorised this study?

A full scientific protocol for this research has been approved by the Ministry of Defence Research Ethics Committee. This study complies and at all times will comply with the Declaration of Helsinki[1] as adopted at the 52nd WMA General Assembly, Edinburgh, October 2000 and with the Additional Protocol to the Convention on Human Rights and Biomedicine, concerning Biomedical Research, (Strasbourg 25.1.2005). Ask the Project Officer if you would like further details of the approval or to see a copy of the full protocol.

Name and contact details of Independent Medical Officer (if appropriate):
Surg Cdr Roger Thomson 93785 4120

Name and contact details of Principal Investigator:
Miss Kathy Munnoch 9380 68056

[1] World Medical Association (2000) Declaration of Helsinki. Ethical principles for medical research involving human subjects. 52nd World Medical Association General Assembly, Edinburgh, Scotland October 2000.

Appendix F continued: Information for Implicit Association Test Validation Cross-sectional Study (Chapter 7)

*Volunteer Consent Form*

CONCURRENT AND CONSTRUCT VALIDATION OF THE IMPLICIT ASSOCIATION TEST OF ORGANISATIONAL COMMITMENT OF ROYAL MARINE KING'S SQUAD AND OPT-OUT RECRUITS

1. I have read the information sheet, which provides full details of this study, and have had the opportunity to raise and discuss my questions with the Project Officer and the Independent Medical Officer, with regard to the general nature, object, potential risks and duration of the study, and understand what is expected of me.

2. I understand that in the event of my sustaining injury, illness or death as a result of participating as a volunteer in INM research, I or my dependents may enter a claim with the Ministry of Defence for compensation under the provisions of the no-fault compensation scheme. Such a scheme does not require me or my dependents to establish negligence on the part of the Ministry of Defence or its employees. I also understand that should such injury, illness or death have been caused by the negligence of the Ministry of Defence or its employees either I or my dependents may have a claim in law.

3. I understand that the aim of the study is for me is to complete a task on the computer that will involve me answering questions about RM training. I understand that the purpose of this task is to contribute toward the INM's understanding of recruits' experiences in RM training, with a view to improving the selection and management of RM recruits in the future.

4. I agree to volunteer as a subject for the study described in the information sheet. I give my full consent to my participation in this study.

5. This consent is specific to the particular test described in the information sheet attached, and shall not be taken to imply my consent to participate in any subsequent experiment or deviation from that detailed here.

6. I reserve the right to withdraw from this experiment at any time, I also understand that I may be withdrawn at any time, even after I have completed the tasks, and will suffer no penalty as a result.

Project Officer: Miss K Munnoch
Independent Medical Officer: Surg Cdr R Thomson

Signed ________________

Name ________________ Date _________________

Witnessed ________________

Name ________________ Date _________________

Appendix G: Information for Prediction of Rehabilitation Outcome Prospective Study (Chapter 8)

*Participant information sheet, Time 1*

Institute of Naval Medicine Study:

PREDICTING REHABILITATION OUTCOME OF INJURED ROYAL MARINE RECRUITS

Welcome!

We would like to invite you to participate in this research project being undertaken by Miss Kathy Munnoch. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information.

What is this study?

We are looking at how your thoughts and feelings affect your stay in Hunter Company and how well you recover from your injury. This is with a view to improving services received by injured recruits residing in Hunter Company in the future.

What does the study involve?

*Time Point 1:* You will be asked to answer questions about aspects of pain on a computer. This is NOT a test. There are no right or wrong answers. The task you are being asked to complete is designed to gain a better understanding of the factors influencing your recovery from injury. This should take no longer than about 10 minutes.

*Time Point 2:* You will be asked to take part in the second part of the study when you join 2 troop. The second part of the study will involve you carrying out some simple tasks such as categorising statements and pictures on a computer screen. You will also be asked to answer various questions on a computer screen about RM training, injury, pain and rehabilitation. You will be reminded by the CSM or your physiotherapist when you transfer to 2 troop. Further information on the second task will be given to you then, or you can contact the Project Officer on the contact details below.

How do I take part?

If you would like to take part, please attend the Adult Learning Centre and look for the 'INM study' signs. Log on to one of the computers and follow the instructions. Information on how to complete the task will be provided on the computer screen. You can log-on to the computer using your Service Number, surname and date of birth. This is only so we can link your answers from this task to the next one, with details of your injury and outcome of rehabilitation, age, body mass index, education, week of training on entry to Hunter Company. Once the data has been matched up, all identifiers will be removed so you cannot be identified by the information you have given.

If I have questions, who can I ask?

You can contact Miss Kathy Munnoch on mil 9380 68056 or civ 02392 768 056 anytime, she will be happy to answer any questions. An independent medical officer (Surg Cdr Roger Thomson, PMO, Sickbay) will also be available to answer any queries or concerns. His sole function is to act independently of the study team to ensure your safety and well-being. You may at any time withdraw from the experiment without giving a reason. If you ever require any further explanation, please do not hesitate to ask.

Who sees my results?

Any information obtained during this trial will remain confidential as to your identity and will be held at the Institute of Naval Medicine. No CTCRM staff will have access to your data. Other material, which cannot be identified with you, will be published or presented at meetings with the aim of benefiting others. You have a right to obtain copies of all papers, reports, transcripts, summaries and other material so published or presented on request to the Project Officer. All information will be subject to the current conditions of the Data Protection Act 1998. Experimental records, including paper records and computer files, will be held for a minimum of 100 years in conditions appropriate for the storage of personal information. You have right of access to your records at any time.

<u>What if I experience adverse effects?</u>

In the event of you suffering any adverse effects as a consequence of your participation in this study, you will be eligible to apply for compensation under the MoD's 'No Fault Compensation Scheme'.

<u>Who's authorised this study?</u>

A full scientific protocol for this research has been approved by the Ministry of Defence Research Ethics Committee. This study complies and at all times will comply with the Declaration of Helsinki[2] as adopted at the 52nd WMA General Assembly, Edinburgh, October 2000 and with the Additional Protocol to the Convention on Human Rights and Biomedicine, concerning Biomedical Research, (Strasbourg 25.1.2005). Ask the Project Officer if you would like further details of the approval or to see a copy of the full protocol.

Name and contact details of Independent Medical Officer (if appropriate):
Surg Cdr Roger Thomson 93785 4120

Name and contact details of Principal Investigator:
Miss Kathy Munnoch 9380 68056

[2] World Medical Association (2000) Declaration of Helsinki. Ethical principles for medical research involving human subjects. 52nd World Medical Association General Assembly, Edinburgh, Scotland October 2000.

Appendix G continued: Information for Prediction of Rehabilitation Outcome Prospective Study (Chapter 8)

*Volunteer Consent Form, Time 1*

<u>PREDICTING REHABILITATION OUTCOME OF INJURED ROYAL MARINE RECRUITS</u>

1. I have read the information sheet, which provides full details of this study, and have had the opportunity to raise and discuss my questions with the Project Officer and the Independent Medical Officer, with regard to the general nature, object, potential risks and duration of the study, and understand what is expected of me.

2. I understand that in the event of my sustaining injury, illness or death as a result of participating as a volunteer in INM research, I or my dependents may enter a claim with the Ministry of Defence for compensation under the provisions of the no-fault compensation scheme. Such a scheme does not require me or my dependents to establish negligence on the part of the Ministry of Defence or its employees. I also understand that should such injury, illness or death have been caused by the negligence of the Ministry of Defence or its employees either I or my dependents may have a claim in law.

3. I understand that the aim of the study is for me is to complete a task on the computer that will involve me answering questions about pain. I understand that the project officer will access information on my injury and recovery from the sickbay and will link it with my answers to the tasks, my age, body mass index, education and week of training on entry to Hunter Company. I understand that the purpose of this task is to contribute toward the INM's prediction of outcome of rehabilitation using psychological information, with a view to improving the services available for injured RM recruits.

4. I agree to volunteer as a subject for the study described in the information sheet. I give my full consent to my participation in this study.

5. This consent is specific to the particular test described in the information sheet attached, and shall not be taken to imply my consent to participate in any subsequent experiment or deviation from that detailed here.

6. I reserve the right to withdraw from this experiment at any time, I also understand that I may be withdrawn at any time, even after I have completed the tasks, and will suffer no penalty as a result.

Project Officer: Miss K Munnoch
Independent Medical Officer: Surg Cdr R Thomson

Signed ________________

Name ________________ Date _________________

Witnessed ________________

Name ________________ Date _________________

Appendix G continued: Information for Prediction of Rehabilitation Outcome Prospective Study (Chapter 8)

*Participant information sheet, Time 2*

Institute of Naval Medicine Study:

PREDICTING REHABILITATION OUTCOME OF INJURED ROYAL MARINE RECRUITS

Welcome!

We would like to invite you to participate in this research project being undertaken by Miss Kathy Munnoch. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information.

What is this study?

We are looking at how your thoughts and feelings affect your stay in Hunter Company and how well you recover from your injury. This is with a view to improving services received by injured recruits residing in Hunter Company in the future.

What does the study involve?

*Time Point 2:* This time, you will be asked to take part in a number of computer-based tasks. Some tasks will ask you to answer questions about aspects of rehabilitation, remedial exercises, pain and RM recruit training. Other tasks will ask you to categorise statements or images according to what you think, as quickly as possible. The results of the tasks will give us a better understanding of how you are feeling about recruit training and injury. This is NOT a test. There are no right or wrong answers. We want to know your personal views on the issues involved in this task, so we can see how they relate to your rehabilitation progress.

How do I take part?

If you would like to take part, please attend the Adult Learning Centre and look for the 'INM study' signs. Log on to one of the computers and follow the instructions. Information on how to complete the task will be provided on the computer screen. You can log-on to the computer using your Service Number, surname and date of birth. This is only so we can link your answers from this task to the next one, with details of your injury and outcome of rehabilitation, age, body mass index, education, week of training on entry to Hunter Company. Once the data has been matched up, all identifiers will be removed so you cannot be identified by the information you have given.

If I have questions, who can I ask?

You can contact Miss Kathy Munnoch on mil 9380 68056 or civ 02392 768 056 anytime, she will be happy to answer any questions. An independent medical officer (Surg Cdr Roger Thomson, PMO, Sickbay) will also be available to answer any queries or concerns. His sole function is to act independently of the study team to ensure your safety and well-being. You may at any time withdraw from the experiment without giving a reason. If you ever require any further explanation, please do not hesitate to ask.

Who sees my results?

Any information obtained during this trial will remain confidential as to your identity and will be held at the Institute of Naval Medicine. No CTCRM staff will have access to your data. Other material, which cannot be identified with you, will be published or presented at meetings with the aim of benefiting others. You have a right to obtain copies of all papers, reports, transcripts, summaries and other material so published or presented on request to the Project Officer. All information will be subject to the current conditions of the Data Protection Act 1998. Experimental records, including paper records and computer files, will be held for a minimum of 100 years in conditions appropriate for the storage of personal information. You have right of access to your records at any time.

What if I experience adverse effects?

In the event of you suffering any adverse effects as a consequence of your participation in this study, you will be eligible to apply for compensation under the MoD's 'No Fault Compensation Scheme'.

Who's authorised this study?

A full scientific protocol for this research has been approved by the Ministry of Defence Research Ethics Committee. This study complies and at all times will comply with the Declaration of Helsinki[3] as adopted at the 52nd WMA General Assembly, Edinburgh, October 2000 and with the Additional Protocol to the Convention on Human Rights and Biomedicine, concerning Biomedical Research, (Strasbourg 25.1.2005). Ask the Project Officer if you would like further details of the approval or to see a copy of the full protocol.

Name and contact details of Independent Medical Officer (if appropriate):
Surg Cdr Roger Thomson 93785 4120

Name and contact details of Principal Investigator:
Miss Kathy Munnoch 9380 68056

[3] World Medical Association (2000) Declaration of Helsinki. Ethical principles for medical research involving human subjects. 52$^{nd}$ World Medical Association General Assembly, Edinburgh, Scotland October 2000.

Appendix G continued: Information for Prediction of Rehabilitation Outcome Prospective Study (Chapter 8)

*Volunteer Consent Form, Time 2*

PREDICTING REHABILITATION OUTCOME OF INJURED ROYAL MARINE RECRUITS

1. I have read the information sheet, which provides full details of this study, and have had the opportunity to raise and discuss my questions with the Project Officer and the Independent Medical Officer, with regard to the general nature, object, potential risks and duration of the study, and understand what is expected of me.

2. I understand that in the event of my sustaining injury, illness or death as a result of participating as a volunteer in INM research, I or my dependents may enter a claim with the Ministry of Defence for compensation under the provisions of the no-fault compensation scheme. Such a scheme does not require me or my dependents to establish negligence on the part of the Ministry of Defence or its employees. I also understand that should such injury, illness or death have been caused by the negligence of the Ministry of Defence or its employees either I or my dependents may have a claim in law.

3. I understand that the aim of the study is for me is to complete a series of tasks on the computer and that the instructions for each task will be provided on the computer screen. I understand that the purpose of this task is to contribute toward the INM's prediction of outcome of rehabilitation using psychological information, with a view to improving the services available for injured RM recruits.

4. I agree to volunteer as a subject for the study described in the information sheet. I give my full consent to my participation in this study.

5. This consent is specific to the particular test described in the information sheet attached, and shall not be taken to imply my consent to participate in any subsequent experiment or deviation from that detailed here.

6. I reserve the right to withdraw from this experiment at any time, I also understand that I may be withdrawn at any time, even after I have completed the tasks, and will suffer no penalty as a result.

Project Officer: Miss K Munnoch
Independent Medical Officer: Surg Cdr R Thomson

Signed ________________

Name ________________ Date _________________

Witnessed ________________

Name ________________ Date _________________

Appendix G continued: Information for Prediction of Rehabilitation Outcome Prospective Study (Chapter 8)

*Audit of injuries and recovery times conducted to calculate relative recovery times*

The injuries and associated recovery times for the sample of 885 injured recruits' data audited from the last four years of routinely collected injury data from Hunter Company (from 2004 to 2007 inclusive), are presented in Table 39.

Table 39

*Prevalence and recovery times for Hunter Company's audit sample*

| Injury | *N* | % of sample | *P25* | *Median* | *P75* |
|---|---|---|---|---|---|
| Stress fracture total | 146 | 16.6 | 10.7 | 13.5 | 17.0 |
| Unspecified stress fracture | 91 | 10.3 | 11.0 | 15.0 | 19.0 |
| Femur stress fracture | 2 | 0.2 | 7.0 | 10.5 | 14.0 |
| Foot stress fracture | 27 | 3.1 | 12.0 | 15.0 | 19.0 |
| Fibula stress fracture | 1 | 0.1 | 12.0 | 12.0 | 12.0 |
| Tibia stress fracture | 13 | 1.5 | 11.0 | 15.0 | 22.5 |
| Metatarsal stress fracture | 12 | 1.4 | 11.0 | 13.5 | 15.5 |
| Knee injury | 145 | 16.4 | 7.0 | 12.0 | 20.0 |
| Ankle injury | 83 | 9.4 | 6.0 | 10.0 | 16.0 |
| Back injury | 75 | 8.5 | 5.0 | 13.0 | 24.0 |
| Soft tissue injury | 73 | 8.3 | 5.0 | 12.0 | 22.5 |
| Tendon | 59 | 6.7 | 7.0 | 13.0 | 20.0 |
| Leg injury | 48 | 5.4 | 5.2 | 13.0 | 18.8 |
| Foot injury | 42 | 4.8 | 7.0 | 11.0 | 15.3 |
| Hip pain | 27 | 3.1 | 9.0 | 13.0 | 20.0 |
| Fracture (foot) | 22 | 2.5 | 10.0 | 14.0 | 16.5 |
| Respiratory | 21 | 2.4 | 3.0 | 8.0 | 13.0 |
| Shin splints | 20 | 2.3 | 7.0 | 11.0 | 19.0 |
| Shoulder injury | 18 | 2.0 | 7.5 | 14.5 | 33.5 |
| Heat/cold injury | 18 | 2.0 | 4.3 | 9.5 | 28.3 |

| | | | | | |
|---|---|---|---|---|---|
| Fracture (metatarsal) | 14 | 1.6 | 7.3 | 14.0 | 18.3 |
| Compartment syndrome | 12 | 1.4 | 3.0 | 7.5 | 16.0 |
| Hand/finger injury | 10 | 1.1 | 4.5 | 7.5 | 15.0 |
| Dislocated shoulder | 8 | 0.9 | 8.3 | 15.0 | 34.5 |
| Fracture (arm/elbow) | 6 | 0.7 | 9.5 | 15.0 | 43.5 |
| Fracture (tibia) | 6 | 0.7 | 16.0 | 28.0 | 47.8 |
| Fracture (leg) | 6 | 0.7 | 20.3 | 37.0 | 86.3 |
| Fracture (wrist) | 5 | 0.6 | 5.0 | 13.0 | 47.0 |
| Fracture (hand) | 5 | 0.6 | 5.0 | 9.0 | 11.5 |
| Fracture (finger) | 4 | 0.5 | 4.0 | 11.5 | 15.3 |
| Fracture (hip/pelvis) | 3 | 0.3 | 24.0 | 28.0 | 38.0 |
| Fracture (fibula) | 2 | 0.2 | 10.0 | 10.5 | 11.0 |
| Fracture (jaw) | 2 | 0.2 | 6.0 | 8.0 | 10.0 |
| Fracture (femur) | 2 | 0.2 | 33.0 | 62.0 | 91.0 |
| Fracture (ankle) | 1 | 0.1 | 92.0 | 92.0 | 92.0 |
| Fracture (ribs) | 1 | 0.1 | 2.0 | 2.0 | 2.0 |
| Fracture (skull) | 1 | 0.1 | 34.0 | 34.0 | 34.0 |
| Total | 885 | 100 | 12.0 | 17.5 | 27.3 |

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