

**CONSTRUCTIVE EXPERTISE: A CRITICAL, ECOLOGICAL AND MICRO-
DEVELOPMENTAL PERSPECTIVE ON DEVELOPING TALENT**

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ABSTRACT

A multitude of performance domains pursue the goal of understanding how we develop talent and expertise. Therefore, the main objective of the present work was to embrace this pursuit whilst operating in a sporting context. The work initially adopted an exploratory, critical and investigative approach to the problem with the remaining series of studies emerging from these initial findings. Study 1 utilised ethnographic enquiry over an eighteen month period whilst working in collaboration with the Rugby Football Union Elite Referee Unit. The study found shifts in existing perspectives of expertise and talent development including a) the movement from a descriptive and phase-staged approach to one which is dynamic and non-linear, b) non-normative as well as normative influences, c) recognition of an 'expert self' as intrapersonal, interpersonal, group and social, d) expertise development existing at micro-, meso- and macro-development levels, e) an integrative, contextualised and multiplicative nature of expertise, f) emergent as well as planned development, g) identification of a 'nested' and ecological outlook of expertise acknowledging the necessity of a positive 'talent development environment'. Additionally, mechanisms of expertise expanded on the existing theory of deliberate practice to include 'deliberate experience' and 'transfer of skills'. In sum- study 1 encountered an approach to expertise which embraced complexity and paradox, was equally psycho-social dynamic than intrapersonal and fostered the necessity for a creation of contexts from which elite performance can morph. From these findings, and alternative studies and readings, a period of reflection occurred where models of 'non-linear and dynamical systems', 'talent development environments', 'adaptive expertise', 'fractal models' and the promotion of adaptive expertise, self-regulation and meta-cognitive skills required to negotiate the complex pathway associated

with eminent performance was explored before a final sense-making notion of 'expertise as constructivism' was embraced. The remainder of the work embraced this constructivist approach of expertise and talent development which was then researched in collaboration with the Scottish Small-Bore Shooting team over a two year period. The period of work embraced 'constructivism as action research'. Study 2 utilised an 'ecological task analysis' of the Scottish Small Bore Shooting team and its members to identify constraints and affordances of excellence. It also served as a benchmark of existing levels of expertise which were evaluated at the end of the action research. Study 3 served as the primary research study and assessed the overall efficacy of the constructivist developmental approach inclusive of major transition processes over the two year period as served by the constructivist design. The program was deemed successful in relation to performance outcomes at the 2006 Melbourne Commonwealth Games. Study 4 focused on the importance of creating constructivist 'talent development environments' in comparison to an existing work of literature. Findings suggest a constructivist talent development environment which attends to both the planned and emergent nature of expertise requires fostering. Finally, a theoretical model of constructivist expertise and talent development is offered encompassing the overall findings of the work.

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I declare that this is entirely my own work and that it has not been submitted in any form for another degree or qualification.

2-9-03

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CHAPTER 1. INTRODUCTION

There are many reasons why this thesis and associated research ideology are overdue. The predominant nature of 'performance' and sport psychology research is to seek and clarify common characteristics, norms and centrals. However, it is generally accepted how elite individuals and their peak performances are more 'unique' and 'eminent', produced through a coming together of chance and opportunity, propped with focused engagement and fortitude. Elite and eminent individuals seem to do, think about and approach their specialism with authenticity, novelty and uniqueness. This is what is required to achieve the attainment of genius, -the pinnacle of peak performance and expertise. Groups of 'engineered' individuals regarded as highly competent and with considerable levels of expertise probably share characteristics reflecting their developmental process. However, the individuals who consistently stand out are characteristically *different* from and *surpass* norms and centrals inclusive of offered characteristics of excellence.

Many consider existing expertise research, especially within sport, as predominated by the 'general theory of expertise' (Ericsson, 1996) and its associated framework of deliberate practice (Ericsson, Krampe & Tesch-Romer, 1993). Within this theory, an operational framework for the study of expertise is offered where expert performance can be reproduced and studied under laboratory conditions. This desire to identify expert performance as positivist and as an empirical phenomenon (Ericsson, 1996) seems reflective of sport science and performance psychology's desire for credence as a 'hard' science. While researching the contextual interference effect in consideration of levels of expertise and task difficulty (Ollis, Button & Fairweather, 2005), as well as alternative studies such as biomechanical analysis of novice and expert Nordic (tele-mark) skiers (Ollis, 2001), I did

indeed adopt this empirical and positivist perspective. While of scientific interest and pertinent to the phenomenon of expertise, task difficulty and contextual interference, the weakness found in this approach was that the study was effectively looking at difference between competence and novice behavior. In other terms, I was looking at 'relative' rather than 'absolute' or 'transcendent' levels of expertise. Finding 'how the elite individuals became more expert' was out-with the controlled capabilities of the studies. Understanding what was required to become elite was effectively too complex.

Expertise and Performance

The development of talent, competence and expertise has become a predominant area of research, application and interest in the 21st century world. Individuals, teams, groups, organizations, governmental agencies and nation states invest serious time, finance and commitment to understanding how to enhance performance to varying levels of expertise. The theme 'pursuit of excellence' is common to various domains and fields including educational, business, military, scientific, medical, political and sporting worlds. Indeed, it is not since the Hellenistic era that this apparent striving of excellence has been pursued with such vigour by society as a whole.

The ultimate aims of national and political interest in performance enhancement may be perceived as either adaptive and productive or maladaptive and manipulative. Indeed, Hellenistic concepts such as 'arete' and 'virtue', seem to have been replaced by 'spin', 'drugs', 'superficiality' and 'impression management'. Critical theorists portray the pursuit of excellence as 'hijacked'. For example, this includes Gramsci's red cyclists, Hitler's 1936 Olympics, ideological associations of sport with the Cold War, Cuban boxing, Max Schmeling v Joe Louis and present perspectives of China's (and other far eastern nations)

recent involvement in sport as well as publicized approaches to talent development (various social psychology texts). Even Scotland's success at the recent Melbourne 2006 Commonwealth Games can be interpreted as a political vehicle associated with that as a nation, we are getting things right and thus fostering the 'feel good' factor. The eternal recurrence of the same draws us back to Ancient Greece however, where we are aware that 'states' recognized how the portrayal of excellence was highly beneficial whether in architecture, sport, education, politics or war. It can be interpreted how the act of pursuing excellence in sport can be inauthentic and only serve as a vehicle for power, controlled by those desiring hegemony, political and financial gain. The counter-interpretation that the act of pursuing excellence is the highest attainment of a society, meeting adversity with vigour and overcoming an array of challenges in pursuit of an honorable goal. While of obvious concern, the present thesis will look beyond good and evil leaving others to argue for the ethical justifications and offer the future exploration to those with authentic intent.

If the ultimate essence of humanity is indeed this fulfilling of an 'Odyssean quest' (Pasternak, 2003) or the 'will to power' (Nietzsche, 1878) then expertise development deserves a pivotal place in psychology research. Society's choice to focus on 'sickness', especially when we consider the field of psychology, opposes the Hellenistic view that virtue, happiness and ethics should fill a 'human's mind'. Fortunately, a recent upsurge in positive psychology (Snyder & Lopez, 2002; Linley & Joseph, 2004) has authenticated more proactive and growth orientated perspectives of understanding the human species. It is within this context that expertise and enhancement of performance may prosper.

Statement of Problem

As previously suggested, predominance in expertise research is with the empirical cognitive framework of deliberate practice and 'general theory of expertise' (Ericsson, Krampe & Tesch-Romer, 1993). This seems reflective of psychology's apparent desire to gain recognition as a 'hard' science governed with the necessity for norms and central tendency. What should concern researchers however is if the balance of methodologies utilized in psychology is reflective of the needs, opportunities and problems of society and its individuals we serve. Accordingly, to understand *how* an expert constructs elite-level performance, we have to consider if the design of more precise laboratory tasks alone can afford the 'general' aim of understanding how we can develop excellence, talent and expertise. We only have to turn to Jung and James for wisdom when they state:

'When, then we talk of 'psychology as a natural science' we must not assume that means a sort of psychology that stands at last on solid ground. It means just the reverse; it means a psychology particularly fragile, and into which the waters of metaphysical criticism leak at every joint....A string of raw facts, a little gossip and wrangle about opinions, a little classification and generalization on the mere descriptive level; a strong prejudice that we have states of minds, and that our brain conditions them...The Galileo and the Lavoisier of psychology will be famous men indeed when they come, as come they some day surely will.'

William James 1892

'Complex psychology means the psychology of 'complexities' i.e of complex psychical systems in contradistinction from relatively elementary factors'

Jung, 1954

'The treatment of psychology should in general be characterised by the principle of universality. No special theory or special subject should be propounded, but psychology should be taught in its biological, ethnological, medical, philosophical, cultural-historic and religious aspects.' *'The aim is to free the teaching of the human soul from the 'constriction of compartments'.*

Jung, 1934

'Our psychological experience is still too young and too little extended to enable general theories. For the time being, the researcher still needs a quantity of facts which would illuminate the essence of the soul, before we could also even think about putting up universally valid propositions'

Jung, 1951

It is with awareness of such advice and ideological position that the thesis evolves. Even Ericsson and Smith's (1991) 'general theory of expertise' three-stage framework, acknowledges the necessity for *in situ* observation, and thus descriptive account of expert performance requiring attendance at the preliminary stage. This is then followed by more analytical and controlled search for processes underlying the expert advantage via laboratory tasks and established investigative methodologies (stage2) followed by drawing links to the quantity and quality of practice (stage3) served by the notion of deliberate practice.

Consideration that an alternative perspective to 'deliberate practice' may exist suggests that a re-evaluation of expert performance *in situ* is merited. Equally, consideration that development and learning may occur out-with a 'positivist' or 'cognitive' approach is warranted. While the operational framework of the general theory of expertise has many positive attributes, especially for the explanation of the cognitive domain, it has some

significant shortcomings requiring consideration and investigation. Topical research themes in developmental psychology suggesting the integration of cultural, biological and environmental with cognitive influences, seem apparently missed by those laying allegiance to the theory of deliberate practice. The present thesis proposes that research into such inclusive theories is necessary if we are to understand *how* expertise and elite performance evolves. Before this can occur, an alternative or altered perspective of deliberate practice is required.

The present thesis will examine alternative ideas, evidence, models, perspectives and theories of expertise, learning and development in an attempt to explore the subject matter as a complex, multi-level iterative process that unfolds over extended periods of time. While the thesis will adopt the realms of positivism and normative science, it will also move beyond positivism and statistics and into the realms of interpretive studies, critical theory and complex adaptive systems. The aim is therefore to demonstrate a variety of alternative perspectives, but with applicability to a topic of interest in performance and sport psychology. Particular attention will be paid to the dominant general theory of expertise (Ericsson & Smith, 1991), deliberate practice (Ericsson, Krampe & Tesch-Romer, 1993) and the dominance of 'phase stage' (Bloom, 1985; Côté, 1999; Ericsson, 1996) approaches to expertise development. A shift to more ecological, inclusive and dynamical perspectives on this subject will then be investigated.

Research Question

The purpose of this thesis is to investigate the feasibility of an alternative theory of expertise to that of deliberate practice. The thesis intends to examine existing literature and working practice within an appropriate performance setting in order to understand and draw

conclusions on existing debates within expertise research. The thesis then intends to utilize these conclusions in the construction of an alternative expertise paradigm. This paradigm will be studied in order to identify further principles which in turn will be evaluated and may result in knowledge which may give basis for a future alternative theory.

Aims

To engage with the research question it will be necessary:

- To contribute a greater understanding of the complexities which integrate to construct an expert as well as expert levels of performance, by examining and describing existing domains, groups and individuals who have attained or are pursuing the attainment of expertise.
- To utilise novel methodologies and a means of examining the characteristics of expertise and related theories with an acceptance and embracement for pluralism.
- To construct a critical perspective that challenges or scaffolds the ‘general theory of expertise’ and ‘deliberate practice’.
- To explore the subject matter as a complex, multi-level iterative process that unfolds over extended periods of time and establish an iterative, meta-level process of expertise development which replicates the more dynamic and emergent theories alluded to.
- To examine the effectiveness of regulated development, constructivism and psycho-social dynamic principles within a developmental domain.

Objectives

To engage with research aims it will be necessary:

- To review the literature extending to alternative performance, learning and development fields, in order to identify weaknesses in the existing theories of expertise and gain support for an alternative model of expertise.
- To engage with ethnographic enquiry and explore the process of talent and expertise development over a longitudinal period with a suitable group.
- Describe, scaffold, integrate and expand alternative models of expertise, utilizing suitable and alternative development paradigms.
- Evaluate the effectiveness of an alternative constructivist and non-linear model of expertise with a suitable performance orientated group.
- Explore, compare and contrast existing models and overall findings with emergent paradigms.

Design features

The design features of the thesis, especially with recognition of time-frame and unforeseen constraints, required both planned and emergent characteristics. Aims and research questions were constructed to give scope and direction to the overall thesis program. Due to the exploratory nature of the thesis however, each study, external constraints and subsequent findings gave change to future scope and renewed direction for the following studies. Therefore, to assist in the 'story' of the thesis, a brief explanation of the flow of studies is offered with justification of purpose, progression and objective.

Firstly, a comprehensive, extensive and forward thinking review of the expertise literature and associated topics was offered. Adoption of a strong critical philosophy was inherited to reflect the *reality, difficulty and complexity* of constructing expertise. The literature review gave substance, guidance and boundaries to the remainder of the thesis. It has to be established, however, that the review of literature was considered *previous, during* and *after* the 18-month ethnography (study1) and is constructed to assist in sense-making of the overall thesis.

Study 1 utilised an ethnographic framework to understand how elite rugby union referees develop expertise. The research was exploratory in nature, utilizing the general aims, research questions, and existing department research as benchmarks. In accordance with the emergenic nature of ethnographic practice, further direction and scope of research flourished as the study progressed. The main tenets of the study focused on the inability to accurately identify talent as offered by Abbott, et al. (2001a, 2001b, 2001c), embrace the overall protocol offered by the University of Edinburgh Talent Identification (TID) team at the time and my initial remit for position as the talent identification officer for the Rugby Referee Union Elite Referee Unit. Accordingly a movement from assessment and identification, and subsequent shift towards talent development and expertise transpired.

Chapters 4, 5, 6, 7 and 8 utilised the ethnography findings to initiate a constructivist approach to expertise development. Following the emergenic nature of the thesis, and under the adage that as one door closes, another opens, fortune brought a requirement to support the 'Scottish small-bore shooting team' while support to the refereeing group came to an unforeseen end. However, and governed by an aim to understand 'expertise' rather than 'refereeing expertise', the opportunity to work with a higher level athlete with future

attendance at a major sporting event gave evolution to the research process. Understanding if the ethnographic findings be suitably applied to a different sport and context would give greater validity and reliability to the proposed model. The shooting program evolved into 200 days of support over a two-year period inclusive of attendance at the Melbourne 2006 Commonwealth Games. Action research was adopted as the appropriate research design. It was deemed important to adopt an ecological task analysis of the organization, team and members before initiating the constructivist development program as well as adopt principles of dynamic assessment over the two year period.

The thesis concluded with not only a general discussion of expertise development, but also the proposal of a working model. Finally, a summary inclusive of implications, recommendations, future research and final conclusions merited closure to the thesis.

CHAPTER 2. REVIEW OF LITERATURE

This literature review initially examines existing ideas, evidence, models and theories of expertise and development in an attempt to explore the subject matter as a complex, multi-level iterative process that unfolds over extended periods of time. Particular attention will be paid to the dominant 'general theory of expertise', 'deliberate practice' and 'phase stage' approach to expertise development. A shift to more ecological and dynamical perspectives on this subject will then be considered. Deemed as suitable ecological and dynamical perspectives, a proposed psycho-social dynamic process and constructivist approach to the development of an 'expert self' will then support a meta-level model of regulated development which endorses a more holistic and emergenic characterisation of expertise development.

Expertise is a subject which has expanded considerably within psychology research in latter years. Ericsson (1996) suggested "the establishment of the study of expertise and expert performance as an important field is directly linked to the theoretical proposal of de Groot (1946/ 1978) and Chase & Simon (1973) of a general mechanism of underlying expert performance across many different domains" (p.14). Since then, studies have extended in various domains including chess (Charness, Tuffiash, Krampe, Reingold & Vasyukova, 2005), sport (Starkes & Ericsson, 2003), occupational (Allen, McGeorge, Pearson & Milne, 2004), music (Ericsson, Krampe & Tesch-Romer, 1993; Hallam, 2001), dance (Warburton, 2002), medicine (Rikers, Schmidt & Mouleart, 2005), nursing (Benner, Tanner & Chesla, 1996), emergency service (Crundall, Chapman, France, Underwood & Phelps, 2005; Ollis, Button & Fairweather, 2005) and education (Gobet, 2005 ; Dunphy & Williamson, 2004).

Defining Expertise

Research in expertise gives host to a plethora of definitions guided by philosophy and epistemological assumptions. For example, within the domain of sport, Starkes (1993) defines expertise as the consistent superior athletic performance *over an extended period*. Ceci, Barnett & Kanaya (2003) define expertise as a very high degree of competence, with the term competence referring to adult attainments that are the result of gene-environment interactions and correlations as well as main effects. Richman, Gobet, Staszewski & Simon (1996) meanwhile define an expert in a very pragmatic way as someone who performs at the level of an experienced professional. Along with recognition that the study of expertise “examines the entire range of mastery from beginners to world-class performers” (Ericsson, 2005, p.233), it seems appropriate to critique the various perspectives of defining expertise before suggesting how it may be developed. Moran (2004) had previously picked up on this evaluation as illustrated by expertise being “applied in a rather cavalier fashion to such heterogeneous groups such as inter-varsity level athletes, provincial team members, professional performers and members of national squads- without any recourse to the ten year criterion. Therefore, greater precision and consistency are required in the operational definition of the term expert.” (p.190)

Simonton (1996) distinguished two levels of experts which included firstly those who represent state of the art practice, and secondly, those recognised as the disciplines creators, continually changing the discipline by contributing new knowledge, theories and techniques. These separate understandings reflected a recent stratification of what the ‘ultimate’ and ‘transcendent’ levels of expertise allude to. For example, the ‘state of the art practice’ is reflective of those who believe that ‘perfectionism’ is the driving nature of expertise (Durrand-Bush, 2000; Abbott, Button, Pepping & Collins, 2005). Conversely, ‘the creative

and changing perspective' is reflective of those who believe that 'eminence' (Ericsson, 1996) and 'adaptivity' (Ollis, Button & Fairweather, 2005; Smith, Ford & Kozlowski, 1999) are the true nature of expertise.

Whether attracted to the reasoning of either 'perfectionism' or 'eminence' as the highest plateau of expertise, it should be recognised that expertise behaves not as a static entity, but lies along a continuum and is deemed task specific. This indeed supports why those who perform at a level of an experienced professional deserve to be merited as beholding an element of expertise. However, Ollis, Button & Fairweather (2005) were quick to differentiate between those who had gained a level of expertise to those who were truly expert in a study of training efficiency during fire service training. Within this study, it was recognised that the fire-fighters utilised as *expert* participants, whom according to Richman, Gobet, Staszewski & Simon (1996) as experienced professionals should have been defined as expert, were indeed not. Results identified that though the fire-fighters had a higher level of expertise than the novice participants, a highly evident learning effect in the knot-tying task conducted within the experiment indicated they were still developing. When we understand that fire-service training is a 'competence based' vocation, and their training is structured as such, then this finding should come as no surprise. As such, they could only be defined as reaching a higher level of expertise, but not that of an expert. Mirroring this assumption, what is suggested is that expertise should be able to differentiate those who are 'truly' expert, to those who are 'highly competent', and those 'competent'. What is proposed is the understanding of expertise as a continuum where an individual moves from competent, to highly competent, to expert, but with a shared understanding that they are all in the process of *potentially* developing expertise. Thus, the present understanding of defining expertise development shares a common understanding with the Dreyfus & Dreyfus (1988) model of

the human learning process. The model operates within five levels in the learning of skills inclusive of novice, advanced beginner, competent performer, proficient performer and expert.

Deliberate Practice: The General Theory of Expertise

Studies in expertise have been dominated by Ericsson, Krampe & Tesch-Romer's (1993) theory of deliberate practice which suggests that individuals have to partake in 10,000 hours of practice which engage activities specifically designed to improve one's current performance. The theory of deliberate practice is a 'nurturist' approach which advocates expertise is attributable to an appropriate quantity of quality training rather than innate talent alone. Whilst the theory emerged from studies on the practice habits of eminent musicians (Ericsson *et al.*, 1993), findings that support deliberate practice have been validated when applied to further domains including sport (Helsen, Starkes & Hodges, 1998; Hodge & Deakin, 1998; Hodges & Starkes, 1996; Starkes, 2000; Young & Salmela, 2002), dance (Urena, 2004), education (Dunn & Schriener, 1999), chess (Charness, Tuffiash, Krampe, Reingold, & Vasyukova, 2005) and medical (Ericsson, 2004) domains.

Deliberate practice research has engaged with a methodology where, traditionally, retrospective accounts and diary methods have been utilised to determine a reliable account of hours an individual engages with 'specific, solitary, high quality, progressive training which requires full concentration and attention to be beneficial'. Ericsson, Krampe & Tesch-Romer (1993) adopted the use of diaries to assess the reliability of retrospective estimates in the music domain, and like many of the more recent studies, high correlations have been observed. Recently, Ward, Hodges, Williams & Starkes (2004) identified three further methods for increasing the reliability of these estimates and include first, the adoption of

longitudinal and quasi-longitudinal data at the time of practice. Second, to improve reliability of practice, estimates based on the assumption that estimates closer to the current year should be adopted, and third, to gain access to training log journals as they provide a wealth of longitudinal practice data. Urena (2004) recently constructed a questionnaire to assess deliberate practice in the ballet domain which was then triangulated against interviews. However, retrospective estimates of the frequency and duration of engagement in a variety of task-related activities are being maintained as the dominant approach for establishing hours engaged in deliberate practice (Charness, Tuffiash, Krampe, Reingold & Vasyukova, 2005).

According to Ericsson *et al* (1993), there exist four criteria of deliberate practice. The first is that deliberate practice targets specific skills at an appropriate difficulty level which will optimise performance. Therefore, a quality analysis which recognises the appropriate leverage factors is a pertinent skill. Second, is that it requires effortful and hard work to engage with such demanding practice structure. Thus, both physical and mental resilience are necessities for deliberate practice. Third, Ericsson believes that deliberate practice activities are not inherently rewarding (1996) or intrinsically rewarding- at the time. Fourth, is that it provides informative quality feedback which is normally acquired from a specialist coach or instructor. Thus, provision of room to make and correct errors is required.

Furthermore, Ericsson (2003) discussed three general characteristics of distinguishing expert (as opposed to competent) performance. These include the ability to select superior actions, the ability to generate rapid reactions, and the ability to control movement production. From these three characteristics, shared with the four criteria previously discussed, it becomes evident that those who desire expertise require a level of motivation close to obsession, and that it is this motivation, and not innate talent or ability which will

predict levels of performance. Within the long term development plan, it will be an ability to deal with set-backs, challenge, monotony, errors, risk, confrontation with the self and disappointments which requires possession of resilience and mental toughness. While deliberate practice is an effective learning strategy, and the underpinning rationale should provide no surprises, it remains difficult to perform and even harder to maintain due to the varying demands requiring full concentration and effort.

The present review also proposes the need to understand not only differences between experts and novices, but focus on effective ways of turning a novice, advanced beginner, competent performer and proficient performer into an expert. Indeed, the review would also wish to take expansion and direction towards understanding *the* peak performance and *transcendent behaviour* which occurs beyond the proficient performer and even *within* the upper levels of those deemed experts. For example the present review deems it appropriate to understand not what makes a good professional or amateur boxer, but how one transcends to be a Muhammad Ali; ...not what makes a professional footballer, but how one transcends to be a Maradona; ... not what makes a professional soldier, but how one transcends to be a seasoned member of the special forces; ...not what makes a Buddhist, but how one transcends to be a Bodhisattva; ...not what makes a good researcher, but how one transcends to be a great scientist and Noble Prize winner.

While studies in deliberate practice have traditionally reported the frequency of task-related activities in their own domains through retrospective account, alternative approaches to studying expertise contrast and compare novice-expert skills and characteristics within selected groups to predict what characteristics are required to develop an expert. For example, in a recent special edition of expertise, topics where novice and experts were

contrasted and compared included the eye movement and concurrent verbal protocol data in trouble shooting performance (Gog, Paas & Merrienboer, 2005); biomedical knowledge in clinical case representations (Rikers, Schmidt & Mouleart, 2005); transfer of pattern recall in sports (Abernethy, Baker & Cote, 2005); and attentional attraction during police pursuit driving (Crundall, Chapman, France, Underwood & Phelps, 2005). However, while these studies can assist in identifying ‘who has become an expert?’ or ‘who we predict to become an expert?’ through the measuring of hours in deliberate practice, they fail to identify ‘who has the true potential to become an expert within a specific domain?’ and more importantly ‘how does one become an expert?’

As mentioned, a critique of Ericsson’s notion that practice requires to be deliberate across the full spectrum of development with optimal acquisition at all stages is that it may be leading us to mediocrity and mere competence rather than expertise itself. To help explain, studies in contextual interference by Ollis, Button & Fairweather (2005) indicated that quality practice and learning need not be synonymous. Findings suggested that “a unilaterally determined level of contextual interference (i.e. based on deliberate practice) or a linear approach to understanding the influence of task complexity and level of expertise in a real world setting is inappropriate” (p.241). Indeed, previous findings in the contextual interference literature (see Brady, 1998 for a review) recognised that blocked practice which is more deliberate (i.e. less variable and more focussed) may produce high acquisition results, but are detrimental to retention and transfer of skills. In contrast, more variable practice, which is less deliberate, may produce low acquisition results, but enhance retention and transfer capability. Therefore, contextual interference findings would suggest that quality task and individual analysis based on retention and transfer distality has to be accorded before an appropriately monitored and controlled training program is given effect. As a

consequence, practice does not necessarily have to be purposeful and deliberate, but periodised and synchronised to long, medium and short-term goals. Accordingly, it has been recognised that 'indirect learning' may be beneficial to the optimisation of performance in many settings.

In this review, 'indirect learning' also encapsulates other terms and styles of learning such as implicit learning (Masters & Maxwell, 2004), non-conscious learning as conducted at the University of Tulsa (Lewicki, Hill & Czyzewska, 1992), tacit understanding, intuition (Myers, 2004), transfer of learning (Ollis & Fairweather, in review) or incidental learning (Abernethy, Farrow & Berry, 2003; Kelly, Burton, Kato & Akamatsu, 2001). In relation to the work of Curtner-Smith, Todorovich, McCaughtry & Lacon (2001), these indirect styles have been labelled as guided discovery, divergent and going beyond styles and refer to the acquisition of skills and characteristics of excellence without necessarily having an absolute defined outcome, or knowing they belong in one's 'arsenal'. The indirect instructional style can be identified with a more contemporary strategy of instructing and developing through both a problem-based and exploratory-based focus where the participant is guided towards finding their own solution. An indirect style that has been researched recently is Vickers, Livingston, Umheris-Bohnert & Holden's (1999) 'decision-training' approach to motor skill instruction. The research focused on comparing traditional (direct) training against an indirect 'decision training' schedule that focused on the use of complex holistic training, random-variable practice and delayed-reduced feedback. Though the results were not fully conclusive and the appropriateness of the task (baseball) seemed fallible, the findings did indicate that direct training enhanced false confidence. This is associated with the findings that blocked practice enhances acquisition results, but fails to enhance retention and transfer results (Brady, 1998). The decision training (and therefore indirect style) was more

conducive to the development of self-reliance and increased transfer of skills which are both quintessential to long-term development. The conclusion of the experiment identified the strategies that allow individuals to improve their ability to learn a task through self-regulation which compensated and integrated explicit and implicit learning.

Jackson & Farrow (2005) examined the conceptual, methodological and practical issues of whether skills can or should indeed be trained implicitly. Defined as the 'non-intentional automatic acquisition of knowledge about structural relations between objects or events' (Frensch, 1998, p.76), the potential advantages of implicitly learned skills relating to task complexity and robustness under stress were discussed and supported. The approaches used in perceptual training studies followed six types of training. These included the adoption of (1) implicit training, while the implicit training types included (2) guided discovery, (3) discovery learning, (4) implicit learning via use of concurrent secondary tasks, (5) implicit learning via incidental learning and (6) implicit learning via distraction tasks. Support of various implicit approaches including Williams, Ward, Knowles & Smeeton's (2002) adoption of discovery training in recreational tennis; the adoption of analogy training in table tennis by Liao & Masters (2001), and; the improvement of 'how' and 'what' decisions of elite table tennis players (Raab, Masters & Maxwell, 2005) has been accepted. What the present review may add to Jackson & Farrow's (2005) well presented argument is the need for greater implementation of implicit learning protocols as expertise moves towards the latter stages associated with the Dreyfus & Dreyfus (1986) model of expertise.

What indirect learning and the other associated terms and styles seemingly share is an acceptance that if we desire to understand *how* to develop expertise, there will be a requirement to integrate 'indirect' and therefore 'non-deliberate' practice with that of

‘directed’ or ‘deliberate’ practice. Indeed, Dreyfus & Dreyfus (1986) have already recognised that experts no longer rely on rules, guidelines and maxims, and have an intuitive grasp of situations based on deep tacit understanding, so re-emphasising Goethe’s recognition that “everything has been thought of before”. Accordingly, the present review would suggest that implicit learning has to be a fundamental protocol of training if ‘reflective automaticity’, eminence, and adaptivity are indeed characteristic of ‘transcendent expertise’.

Further issues in Ericsson’s criteria for deliberate practice that emerge from existing literature include Baker & Horton’s (2004) review of factors affecting the development of expertise. Within this review, it is recognised that deliberate practice along with genetic and psychological factors are primary influences. However, secondary influences inclusive of socio-cultural, familial support and contextual elements are also required to ensure the manifestation of high levels of performance. Therefore, deliberate practice would afford only partial influence on how we nurture and potentialise expertise, leaving the argument for the theory of deliberate practice, as the general theory of expertise, considerably weakened.

In summary, what has become evident in expertise literature is the multitude of new evidence that discusses varying structures of expertise, questions on how we attain expertise, and a plethora of methods and directions for future studies. For example, Ericsson’s (2005) article on ‘Recent advances in expertise research: A commentary on the contributions to the special issue’ shares an acceptance with the present review for the need to embrace and accept complexity as an inherent feature of the expert. In further support of the paradox inherent to expertise findings, Abernethy, Farrow & Berry (2003) give debate to the constraints and issues in the development of a general theory of expert perceptual-motor performance, while Williams & Hodges (2004) front an excellent series of reviews on the

expertise approach in skill acquisition and the adoption of non-linear and ecological/dynamical system approaches. In conclusion, what the present review suggests is that while existing studies provide evidence to support the argument that deliberate practice plays a critical role in the development of expertise, it appears to be only one dimension of a more complex and pluralistic entity.

Moving Towards an Acceptance of Complexity

Complexity appears endemic in expertise research as theories, models and explanations acknowledge various multi-component and multi-level led systems. For example, writing about the search for general abilities and basic capacities, Ericsson (2003) attenuates to the 'complexity of the mechanisms mediating the superior performance of experts' (p.105) and how 'the performance of experts is mediated by increasingly complex control processes' (p.107). Within sport, Moran further postulates that "it challenges us to understand the complex interplay that occurs between talent, motivation, practice habits, quality of coaching and family support (see Durand-Bush & Salmela, 2002) in shaping expertise" (p.162).

This reflection of complexity has also been recognised in more general models of human development. Gallahue & Ozmun (1998) review the conceptual approaches to the study of human development in recognition that the theoretical frameworks have evolved. While it is important to acknowledge Gallahue & Ozmun's concept that "no one theory is complete or totally accurate in describing or explaining human development and, as a result, all break down at some point" (p.26), the evolution of the models of development do seemingly embrace a notion of recurring complexity. The four conceptual models of development are classified by Gallahue & Ozmun as (1) phase-stage, (2) developmental task,

(3) developmental milestone, and (4) ecological and dynamical theories of human development. In relation to expertise research, what is recognised is the dominance of phase-stage, developmental task and developmental milestone approaches to understanding the development of expertise. What has to be established is whether the ecological and dynamical theories which exist at present are pertinent to further understanding the complexities existent in the development of expertise?

Existing dominance of a phase stage approach

Existing models of expertise gravitate to a 'phase-stage' approach which highlights generalised tasks and milestones requiring to be accomplished before transition to the next stage occurs (Bloom, 1985; Côté, 1999; and Dreyfus & Dreyfus, 1988). We will therefore discuss the most cited phase stage models utilised in expertise research which is Bloom's three-stage model of development (see Fig.1.1) that remains the primary model of development within expertise research. Bloom's model accurately portrayed the development process across different individuals and different sports/ activities in relation to interviews conducted with athletes, coaches and parents. This three stage model, which suggests that the careers of exceptionally talented individuals in disparate performance fields followed remarkably similar processes, provides a powerful conceptual tool for the analysis of talent development. It was emphasised that each stage was not determined by chronological age or some pre-determined time-dependent cut-off point, but was characterised by certain tasks being completed, relationships, attitudes developed or learning being achieved.

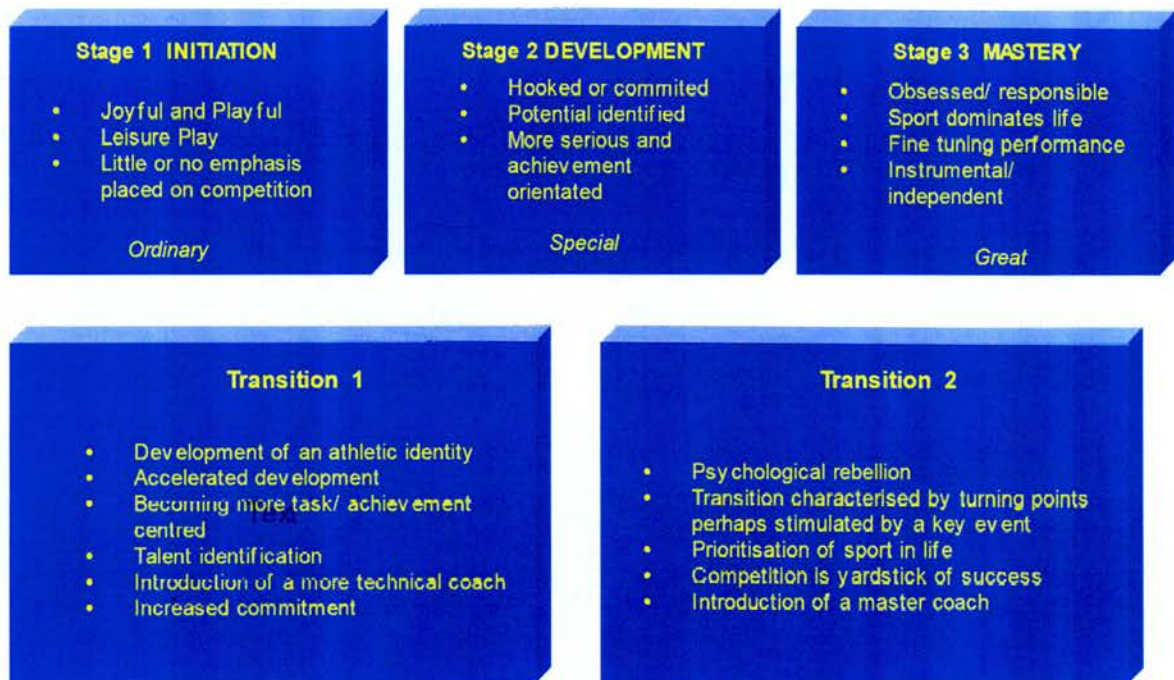


Figure 1.1. Bloom's three-stage model of development.

Perhaps the most important aspect of Bloom's model was the emphasis placed on movement between the stages (a necessary movement for the developing performer), termed phase-stage transitions. These transitions reflect the tasks and milestones required for the maintenance of development as identified in Gallahue & Ozmun's conceptual models of human development. The first transition was identified between individuals moving from the 'initiation' phase to the 'development' phase where the emphasis upon commitment is highlighted, along with the acceptance that the individual is no longer 'a person who participates at a sport', but a 'performer'. The second transition of Bloom's model is identified with the activity being the absolute central core construct to that individual's identity. Indeed, Bloom identifies the transition into this phase as 'obsessive' and the

prioritisation of the sport (or activity/ career) within the individual's life structure. The reasons 'why' are characterised by psychological rebellion, critical turning points, the prioritisation of the performance domain in their life, or the introduction of a master coach. Also, Bloom discusses how the transition into the mastery phase highlights the need for socio-environmental features to increase along with commitment. Other phase stage approaches to talent and expertise development also exist and include Balyi's models of long-term athlete development (Balyi, 1998a; Balyi, 1998b; Balyi & Hamilton, 1999) and Côté's 'stages of sport participation' (1999) which is an alternative model of talent development that also illustrates this point by emphasising the psychosocial element of 'support mechanisms' (primarily family).

The adoption of a phase-stage approach to expertise brings recognition to three main critiques. The first critique is recognition of stages as a hypothetical construction/part of a continuum. For example, recent development models (Fischer & Yan, 2002) believe that "descriptions of 'stages' provide a good starting point but did not adequately capture the organisation in the many examples (of development) that we examined" (p.284). Furthermore, they infer that it is more appropriate to discuss skill levels which are more idiographic and do not show the ladder like changes from one stage to the next, as proposed to date. Second, it is widely accepted that stages describe *generally* what might happen rather than should. Indeed, what has been found in careful longitudinal and micro-developmental observation of developing activities (Fischer & Yan, 2002) is that skills develop continuously through many small steps rather than instantaneous jumps between two or three stages. Third, stages don't explain the process of learning nor how people learn, especially in relation to the variation existent within real-life human development. The reason suggested by the present review is that to understand how we move through levels, it would

be required to focus on the micro-development, short-term patterns which indicate both the dynamic nature of the processes of change and specifics of growth and transition. From these critiques, it can be suggested that if the process of development is accepted as complex, dynamic, discontinuous, non-linear, multi-layered and influenced by many factors, then perhaps it is appropriate to adopt a conceptual understanding of expertise which migrates towards the ecological and dynamical-conceptual models of human development.

Ecological Perspective

One causal explanation of the complexity in understanding expertise lies with the powerful influence of the environment and significant others. The tendency of research to focus on expert-novice differences within specific individual characteristics, physiological, technical and psychological abilities highlights the belief that expertise emerges from the personal self and individualist perspective whilst ignoring socio-cultural influences and constraints. A recent awareness of the importance of socio-cultural influences and constraints, and thus an ecological orientation towards expertise studies, has been highlighted by Baker, Côté & Abernethy (2003) and Baker, Horton, Robertson-Wilson & Wall (2003). While already ventured upon earlier in the review, it would therefore be appropriate to expand Baker's suggestion of secondary influences. The secondary influences valued by Baker in the development of sport expertise include the socio-cultural factors of cultural importance, instructional resources and familial support; along with the contextual factors including sport maturity and depth of competition. Baker correctly identifies that the prediction of expert performance will always be limited by uncertainty due to the complex and dynamic relationships between primary and secondary influences. However, it is the principles of the ecological and dynamical systems inclusive of chaos theory, along with the fundamentals of pluralism which would negate Baker's statement that "the behaviour of

complex systems is only completely predictable when the components are known to an infinite degree of accuracy” (p.233).

The ecological orientation towards human development can be associated with the work of Bronfenbrenner (1979) who offered a theoretical perspective “in its conception of the developing person, of the environment, and especially of the evolving interaction between the two” (p.3). Bronfenbrenner (2005) conceives the ecological environment as a set of nested structures (see Fig 1.2), each inside the next, and as Bronfenbrenner illustrates, like a set of Russian dolls. These nested structures were termed as the micro-system, meso-system, exo-system, macro-system and chrono-system. The micro-system is the immediate setting containing the developing person and includes settings such as family, school, work, peers and home. The meso-system looks beyond the immediate setting and focuses on the relations between them and where it is proposed the interaction among various settings within the micro-system and the interconnections between them are decisive for development. The exo-system extends further a-field to the social settings in which the individual does not play an active role but is affected by socially set decisions. The macro-system alludes to the culture in which one exists and finally the chrono-system attends to the socio-historical events of one’s lifetime (Bronfenbrenner, 1979; Gallahue & Ozmun, 1998).

It has to be recognised however that while traditional concepts of development emphasise the psychological processes of perception, motivation, thinking and learning, Bronfenbrenner’s model attenuates to the functional processes both within and between settings. The principles of understanding development as an ecological niche in which immediate relationships are nested within the complexity of sub-cultural and cultural processes (Bronfenbrenner, 1979) are shared with Vygotskian principles. Vygotsky’s key

idea was that the ability we have to develop is the outcome of a fundamentally social process with a central principle attending to collaborative forms of behaviour lying at the very root of human development. It should also be recognised that Vygotsky's research did indeed span micro-system awareness, through to the chrono-system awareness and even offered disclosures of human psychological function as a socio-historical process which appropriately leads the review towards Vygotsky's zone of proximal development (ZPD).

Vygotsky's ZPD is a four stage model where it is recognised that assistance is necessary for optimal performance. The first stage is where performance is assisted by more capable others, whether these are parents, teachers, coaches, instructors, mentors or peers. During this stage there is a decline plane of supportive responsibility, and a 'handover principle' (Bruner, 1983, p.60) occurs where the individual enhances self-regulation. This terminates on the initiation of stage two where performance is assisted by itself with no assistance from others. Stage three transpires when the performance is developed and automatised. Indeed, it has been suggested that not only is assistance not required, but there is suggestion that even self-regulation has vanished and consequently both assistance and self-consciousness may be detrimental to the smooth integration of all task components. Stage four is a lead in to a recursive process as this is where de-automatisation occurs. To ensure further development occurs, the individual has to be aware of the symbiosis of self-collective regulation, self-individual regulation, automaticity and self-organisation to ensure 'arrested development' does not occur. This therefore suggests that automaticity is not the final stage of expertise as suggested in many expertise readings (e.g. Anderson, 1983; Fitts & Posner, 1967), but that this is superseded by a stage of 'reflective automaticity' where the integration of automaticity with existing, but complex representations of self-individual, self-collective, environment and task occur.

Dunphy & Williamson (2004) adopt the ZPD in an educational model for expertise development. Expanding upon the Dreyfus & Dreyfus model (1986), they not only recognise Fitts & Posner's three stage psychomotor skill acquisition model, but also incorporate the four stages of the ZPD to understand the pursuit of expertise. Within the review, they state of the three models (Dreyfus & Dreyfus; Fitts & Posner; Vygotsky) "the ZPD contains the best integration of phases of learning within teaching expertise (in the nursing, surgical and education domains) and concepts of teacher-learner interaction(s) (including the hand-over principle, and social and organisational approaches to learning)" (p.121) However, Dunphy & Williamson also state that the "literature on the ZPD does not outline specifically how a learner transits from phase three (autonomous performance) to expertise, nor clearly outlines concepts of expertise." (p.121)

Dunphy & Dunphy (2003) utilise assisted performance and the zone of proximal development as a potential framework for providing further knowledge about surgical skill acquisition. Within this research, attention focussed on the fourth stage of development due to an apparent gap in medical terminology for training in this stage. While skill training and the early curve were terms identified for surgical development in stages one and two; and competence based training was deemed an appropriate term for stage three, no routinely used medical terminology was recognised for stage four of the ZPD. While Dunphy & Dunphy (2003) recognised "This is a significant concern, as important educational needs for established specialists may not have been identified" (p.54) for the surgical domain, it can be postulated that this concern may be shared between the majority of performance domains that pursue expertise and excellence. While Vygotsky's ZPD has been endorsed and validated primarily within child development (John-Steiner & Mahn, 1996) and educational psychology (Jones, Rua & Carter, 1998; Kozulin, Gindis, Agayev & Miller, 2003), it has

been further incorporated in studies of performance development, such as basic surgical techniques (Qayumi, Cheifetz, Forward, Baird, Litherland & Koetting 1999), and playing the violin (Gholson, 1998).

Dynamical Systems

Dynamical systems theory and chaos theory (Fogel & Thelen, 1987; Gleik, 1987; Lewis, 1995; Thelen & Smith, 1994) adopt a non-linear and micro-constructive perspective to science and development. Guastello (2002) and Thelen & Smith (1994) highlighted principles of dynamical systems which the present review would suggest as appropriate reading. Together, both sets of principles highlight a need for a shift from planned, uni-dimensional and phase-stage approaches to expertise development towards more holistic, multi-dimensional, multi-component and emergenic perspectives where levels of development exist on ‘*a thousand*’ plateaus. Indeed, where development is highly idiographic rather than the generalised three or four distinct stages offered in expertise and talent development literature to date. Consequently, the area of greatest development exists along the full continuum of development at the ‘edge of chaos’ where order and chaos bridge the ability to be predictable or unpredictable. Chaos models “are predicated on the insight that development is dynamic, with small inputs accumulating in non-linear ways” while “dynamical system modelers approach this from a slightly different perspective, that of general mathematical modelling, but nevertheless arrive at some interesting conclusions”. Basically, if a model includes non-linearity and feedback looks at the changes in a system over time, the model can show *sensitive dependence on initial conditions*. The hallmark of chaos models.” (Ceci, Barnett & Kanaya, 2003, p.77-78).

Sensitive dependence on initial conditions has been termed the butterfly effect after Edward Lorenz discussed the question of whether the flapping of a butterfly's wing in Brazil could create a storm in America (Gleick, 1987). Therefore, what has to be understood is that as indicated in Guastello's second principle, while a massive input may have no effect on an output, paradoxically, a minute input could quickly have an overwhelming effect in output. For example, in understanding Paula Radcliffe's Olympic 'disengagement' within the marathon event during the 2004 Athen's Olympics, the answer to such a perceived catastrophic response was maybe a single 'micro-process' at that moment in time, integrated with both micro- 'historical influences' and 'long-term goals', rather than a grandiose explanation and requirement to blame, as pursued by the press. What was apparently catastrophic at the time may be exactly that essence which makes Paula so successful. For example she may be so highly attuned to winning, that coming second and third at such a relatively early period of the race would initiate a self-organising disengagement process, which although perceived as self-destructive to others, serves a stronger purpose now being addressed in existing positive psychology research.

What is further recognised is that many of these critical transitions and 'developmental turning points' (Elder, 1998) are what can be termed as 'non-normative' influences. Baltes, Reese & Lipsitt (1980) initially distinguished three forms of developmental shifts: normative age-graded (maturational and environmental) ones, historical ones, and non-normative influences on development. However, Hendry & Kloep (2002) believed these categories to be as insufficient to explain fully lifespan changes and adopted their own. These included (1) maturational shifts caused by normal biological changes and experienced in much-or-less the same age range by all human beings; (2) normative social shifts prescribed by law for a well-defined group or society; (3) quasi-normative shifts are

common in a certain well-defined group, and although not well defined by law, are normally expected and are governed by certain social pressures and ‘psychological contracts’; and (4) non-normative shifts “experienced in a particular way or at a specific time by relatively few people, and can take different forms” (Hendry & Kloep, 2002, p.42).

The different forms of non-normative influences include (1) off-time shifts which are non-normative, not because of their quality, but because of their timing such as teenage pregnancy, early death of parents or late marriage; (2) historical shifts which are due to historical events that occur to everyone in a particular group such as war, famine or inventions; (3) self-instigated shifts which do not happen automatically to people, but that have to be actively initiated such as divorce, career change or emigration; (4) idiosyncratic shifts that happen unexpectedly to only a few people including handicap or serious illness, winning the lottery or being tortured; and (5) non-events which are maturational, normative or quasi-normative events that form a challenge in an individual’s life by not happening, although expected. Examples include an unwanted childlessness, unemployment or winning events and achieving success in your particular performance domain.

As exemplified in the Lance Armstrong testimony, the non-normative shifts are not only more identifiable ‘developmental turning-points’, yet “present a greater challenge to the individual than the rather more predictive normative ones, but- as a consequence- also offer a greater potential for growth” (Hendry & Kloep, 2002, p.45). This conclusion has been granted further support through research in the recently emerging positive psychology (or old existentialism) field. This includes studies in post-traumatic growth (Tedeschi & Calhoun, 1995, 1996) which is defined as ‘a positive psychological change experienced as a result of the struggle with highly challenging life circumstances’, in the concept of benefit finding

where individuals facing adversity frequently report benefits in their negative experiences (Affleck & Tennen, 1996), existential growth (Sodergren, Hyland, Crawford & Partridge, 2004), hardiness (Klag & Bradley, 2004; Kobosa, Maddi & Kahn, 1982) and in studies of resilience which refers to a class of phenomena characterised by patterns of positive adaptation in the context of significant adversity or risk. The studies in resilience have had substantial impact on developmental outcomes and models (for a review see Masten & Reed, 2002) where early periods of maladaptive development are recognised in fostering enhanced zones of development in later life, and accordingly what were once challenges leading to greater turmoil, and emerge into positive and multiplicative transitions.

What is shared in the understanding of developmental turning points, whether normative or non-normative, is a need for the challenge of each transition to be either (1) met, addressed and to be utilised adaptively, or (2) disengaged with, at an appropriate and timely period if expertise is to be attained. Potentially, both positive and negative life events can lead to either adaptive or maladaptive transformation, and emerge into a critical transition. Thus, the complexity of development is truly met, and the understanding of Csikszentmihalyi's (1990) process of 'cheating chaos', recognised as a process of continuous challenge, demanding both planned and emergent-intuitive strategies.

The fundamental concept of dynamical systems and self-organisation suggests that the behaviour of a complex system would be assembled in an emergent fashion dependent on the situational constraints that surround it. In relation to the development of expertise, it would therefore be appropriate to highlight that it is already suggested in motor learning studies that it is the dynamic between environmental, task and individual constraints, which together impinge upon performance levels and ability to make adaptive transitions.

Complexity and Pluralism

In a recent review of a non-linear perspective of talent identification in sport, Abbott et al (2005) advocate that “continual monitoring and development of *all* components that may influence the fulfilment of an individual’s talent” (p.83) is required to develop talent. However, if this acceptance is true to expertise development, then what is advocated is that *everything* would require to include “talent, motivation, practice habits, quality of coaching and family support (see Durand-Bush & Salmela, 2002) in shaping expertise” along with environmental conditions . Furthermore, if ‘sensitive dependence on initial conditions’, ‘self-organisation’ and ‘interconnectedness’ are as important as claimed by the aforementioned, then to measure *everything* is unfortunately folly. Even that ‘butterfly’s wing in Brazil’!! However, where it can be agreed is that expertise development is indeed multi-faceted and complex. From these understandings, what can be suggested is a need for a pluralistic approach which understands that *everything potentially* matters has to be merited a place in the development of expertise, but which also endorses a capability to identify the pertinent ‘leverage’ factors which integrate to achieve expertise. Pluralism is one means of making sense of the diversity and complexity evident in expertise research.

The breadth and plurality of methodology and overall approach to expertise leaves one asking “What is the relationship between these perspectives, theories and methods?” Mitchell (2003, 2004) looked at complexity and argued for integrative pluralism within the field of biological studies. What Mitchell (2003) advocated was the need to recognise that “the pragmatic virtue of simplicity is most frequently bought at the cost of realism in explanation” as “causal models only describe what would be expected in idealised circumstances”. In reality “multiple causes are more likely to be present and interact” and require to be understood and managed if we desire to transcend levels of performance to

become more expert, proficient or competent. Hence, it is proposed that only through optimising the integrative nature of the multiple and interacting forces which exist at “different scales within variable temporal orders operating in diverse combinations in different particular situations”, can this aim be achieved.

While the theory of deliberate practice is regarded as the general theory of expertise, as recognised earlier, there has emerged recognition that a myriad of external influences may impinge on performance. Furthermore, the identification of findings within various domains (inclusive of task and social influences) leaves us considering if an expert requires more than a quantity of ‘deliberate practice’ alone. Therefore, how can we attempt to integrate these perspectives? What Mitchell (2003) contests is the existing “first... isolationist stance (reductionism) that partitions scientific questions into discrete levels of questions and their corresponding answers in a way that precludes the satisfactory investigation of any of the levels. The second, being an uncritical anarchism which endorses any and all propositions” (p.218). Like Mitchell in the biological domain, this leaves us pending upon how we can integrate the abundance of expertise research findings, components and domains!

Psycho-social dynamic system

The integration of the dynamical systems perspective with the ecological model can be deemed as two of the multiple levels of a psycho-social dynamic system. As a dimension of self, expertise can equally be recognised and afforded as “a system which functions at multiple levels and subsumes a number of subsystems that operate concurrently and in parallel” (Mischel & Morf, 2003). These levels and subsystems include not only the dynamical systems perspective with the ecological model, personal domains of expertise, motivational and self-individual systems with an environmental and cultural situe as reflected

in the self-collective and self-communal, but also the complexities, paradoxes and conflicting nuances which exist in real-world settings. While the studies of Bloom, Côté and Durand-Bush allude to the processing dynamics of the inter-personal as well as intra-personal during the development of talent, with a social-cognitive flavour, it is felt they compartmentalise findings too readily without addressing 'how' the individual progresses. For example, very prescriptive accounts of how a coach and family should provide and act are offered to progress to the next stage.

A psycho-social dynamic processing model of the self (which can be extended to 'self as expert') is offered by Mischel & Morf (2003) to engage with the "complexities and seeming inconsistencies surrounding the construction of self. That is, (1) the self as an organised dynamic cognitive-affective-action system, and (2) the self as an interpersonal self-construction system" (p.23). Where the self is both orderly and disorderly, controlled and controlling, logical and complex, emergent and planned, determined and willed. Mischel & Morf give a view of the self as a system, which is highly interactive and operating at multiple levels concurrently, and "suggest that the self may be usefully conceptualised not simply as a collection of attributes...but rather as a coherent organisation of mental-emotional (cognitive-affective) representations" (p.23). This conveys to an understanding of the self where to capture what expertise is, one needs to understand the individual as a social entity who is not passive, but rather as a motivated, goal directed, self-regulatory system that is both proactive *and* agentic (i.e. exerting control). Consequently, support for the importance of meta-level skills such as planning, monitoring, controlling, reflecting, regulating and goal-setting which exist in the expertise literature therefore becomes understandable. What the psycho-social dynamic perspective would further suggest is the requirement to *integrate* these meta-level skills at multiple levels of functioning. However, understanding what these multiple levels of

functioning and sub-systems may be is critical for the ability to develop and understand what makes both levels of expertise and the transcendental expert.

In summary, adopting an understanding of 'expert as self' through a psycho-social dynamic processing system ensures that the path to excellence is both a construct and a system which functions at multiple levels and is both pro-active and agentic. This reflects recent developments in constructivism and micro-development within human and child development studies, and which could offer alternative means of understanding expertise.

Micro-development

Micro-development is a process-orientated perspective for studying development and learning, and consequentially, seems appropriate for the study of expertise when adopting a psycho-social dynamic perspective. Indeed, while Moran's (2004) review of expertise summarises that much of the work in the sporting context is "generally supportive of Ericsson's claim that deliberate practice is crucial to athletic success" (p.188), it alludes to the need for additional research on the micro-structure of athletic practice being required. What is suggested at present is that this micro-structure could be attributed to micro-development which studies changes in abilities, knowledge and understanding during short time spans, focusing on the 'how' of development and learning (Granott & Parziale, 2002).

The two main approaches to studying micro-development are through the micro-genetic method (Granott, 1998; Parziale, 2002; Siegler & Crowley, 1991) and the dynamic systems approach. Siegler & Crowley (1991) define the micro-genetic method by three main attributes: (1) It spans a period from the beginning of a process of change until a stable state, (2) the density of observations is highly relative to the period of change, and (3) intensive



trial-by-trial analysis focuses on inferring processes that triggered quantitative or qualitative change. Both approaches utilise dynamic testing of change, and share the principle of recognising a dynamic between stability and instability existing at a micro-level. Furthermore, they share four main themes for understanding development and learning as offered by Granott & Parziale (2002) which are: (1) the nature of variability in development and learning, (2) mechanisms that create higher levels of knowledge in both processes, (3) interrelations between changes in the short time scale of development and the longer, life-long scale of macro-development, and (4) the crucial effect of context in micro-development.

Within micro-development studies, there has been a commitment to the integration of neo-Vygotskian and neo-Piagetian schools of thought. This integration suggest that while an individual's development (like deliberate practice) is to some degree individualistic and solitary in nature, an individual's development also occurs due to the dynamics between the social influences and contexts within which the individual nests. This commitment to the sharing of neo-Vygotskian and neo-Piagetan perspectives has been termed a constructivist approach.

Constructivism

“Constructivism is the philosophical and scientific position that knowledge arises through a process of active construction” (Mascolo & Fischer, 2005, p.49). Grounded in Piaget's theory of cognitive development, constructivism has evolved into a neo-Piagetian structure which progresses from the individualism inherent in Piaget's approach. While a full analysis is beyond the scope of the present review, attention is drawn to the existence of many varieties of constructivism including ‘personal construct psychology’, ‘radical constructivism’ and ‘social constructionism’. However, what the present review attends to is

the commonality of constructivism which focuses on ways in which societies and individuals create rather than discover (Raskin, 2002), especially in relation to development. Dynamic skill theory (Fischer, 1980; Fischer & Bidell, 1998) is proclaimed as a re-invention of Piaget's constructivist theory. The theory embraces Piaget's notion that an individual's own actions are the primary movers of development, but also engages with the sociocultural challenges to the primacy of individual action (Mascolo & Fischer, 2005).

Through the adoption of a Vygotskian perspective, dynamic skill theory introduces the principles of the ZPD where it is hypothesised a child's level of functioning will be enhanced when working with a more accomplished adult than when working alone. This is expanded to the principles of developing skill where dynamic system theory proposes that an individual will operate at a functional level (i.e. competent) with no social support, yet at an optimal level (i.e. expert) under conditions of high social support. In a scaffolded context when direct assistance by another is offered through direct participation, it is proposed that performance will surpass even that of an individual's optimal level.

The main principle of a constructivist approach to expertise lies in the theory of learning from performance feedback, integrated with an ability to identify future and emergent task/ environment constraints, coupled with an ability to recognise that the world exists beyond good and evil, strengths and weaknesses, opportunities and threats. Everything is an opportunity, even if you have to wait and suffer in the meanwhile. Additionally, as we have defended the need for an ecological model of development, learning from the performance feedback requires monitoring of team, coaching staff, organisation, cultural influences and individual alike while ensuring that change is both beneficial and appropriate. While never identified as constructivism, this process of development is readily identified in

many 'special' people.

Jose Mourinho is a coach who develops constantly. His ideas, training, methodology and concept of play are systematically analysed and studied, and are continuously evolving. He has progressed in such a way that he clearly states that he is not the same coach today as he was at practices two years ago. The end of every season is a landmark, and he invariably spends the holidays studying and preparing for the future. No matter how good the previous season there are always changes to be made for the next one- nothing stays the same.

(Lourenco, 2004, p.181)

Constructivism has also been advocated in studies concerning the concept of self and identity where Mahoney (2002) endorses "human beings as actively complex, socially-embedded and developmentally dynamic self-organising systems" (p.747). It could be suggested from the review to date that expertise reflects constructivism's quest to achieve a delicate balance between ordering and disordering processes. Furthermore, the prominence of Mahoney's five themes of constructivism (activity, order/disorder, multiple identity, social-symbolic processes, and dynamic & dialectical development) may serve as a vehicle for further research and understanding of expertise. Along with suggestions that the 'self as expert' may benefit from being investigated as a psycho-social dynamical system and as a micro-developmental entity, constructivism would therefore have to understand meta-level skills and how the expert both monitors and controls the complex, enduring and challenging journey to excellence. Therefore, all three approaches share that as a complex and dynamical system, the importance of recognising that information regulates action (Gibson, 1979; Kelso, 1995). Consequently, meta-level skills and self-regulation becomes an important, if not

critical, feature of the expert's repertoire, especially if it is accepted that deficiencies on certain components of performance may be addressed by strengths on others (Williams & Ericsson, 2005).

Self Regulation in Expertise

The concept of self-regulation and expertise has evolved as a popular research activity of sport (Crews, Lochbaum & Karoly, 2001; Vealey, 2001), chess (de Bruin, Rikers & Schmidt, 2005), music (Hallam, 2001) and education (Dunphy & Williamson, 2004; Thiede, 1994; Thiede & Dunlosky, 1999; Zimmerman, 2002; Zimmerman, Bonner & Kovach, 2002) in latter years. In order to excel within an activity or domain, the individual has to promote adaptable and refined self-regulatory skills during short-term and long-term development. This allows 'performers' to make decisions, change and adapt to the challenges of their chosen activity along with their own specific contextual and environmental demands. As offered by de Bruin, Rikers & Schmidt (2005), support for meta-cognitive and self-regulatory strategies by experts is gained as "only by deliberately reflecting on the practice session will they be able to further develop the quality of their performance" (p.168).

Studies in the development of expertise of young musicians (Hallam, 2001) acknowledge the strategy use, knowledge and individual diversity existent within development. Furthermore, Hallam indicates "why multi-dimensional rather than single dimensional explanations of levels of attainment and quality of performance would seem to be required" (p.7) due to the complexity of factors that affect progress and the outcomes of learning to play a musical instrument. This finding is also reflective of the role of multiple representations in education (Gobet, 2005) and utilised as one of many learning devices.

“Self-regulation refers to the many processes by which the human psyche exercises control over its functions, states and inner processes” (Vohs & Baumeister, 2004, p.1). More specifically self-regulation is a goal directed adaptive process in which action is controlled. To control action a number of sub-processes are utilized: self-monitoring, self-motivational beliefs, goal setting, and planning. Once action has been executed the self modifies behaviour through the use of feedback loops, which are both reactive and proactive. Theoretically, research in self-regulation has been influenced through various approaches including cognitive and motivational processes; cybernetic (Carver & Scheier, 1998), goal-setting (Locke & Latham, 1990) and problem-solving (Zimmerman & Campillo, 2003) perspectives; and discussions on whether self-regulation is a deliberate or automatic process (Fitzsimons & Bargh, 2004) which leaves many researchers interchanging and debating differences between the terms ‘self-regulation’ and ‘self-control’ (Vohs & Baumeister, 2004). Therefore, it is understandable why many believe the terms associated with self-regulation in the existing literature are both complex (Behnke, 2004) and not very clear (Crews, Lochbaum & Karoly, 2001).

While existing studies of ‘self-regulation’ focus on ‘here and now’ activities, the ability to ‘self-regulate’ long-term development has not gone undetected and indeed has been identified as a recent advancement in expertise research (De Bruin, Rikers & Schmidt, 2005). Within learning to play a chess endgame, novices were investigated for self-regulative and meta-cognitive control strategies where the more refined use of such strategies by the expert group were supported. As noted by Rikers & Pass (2005), this “is in line with Ericsson and colleagues’ view (1993) that practice should include deliberate or meta-cognitive elements in order to assure performance improvement” (p.147).

It is of interest that Heckhausen (1999), in relation to studies of regulated development concludes and believes “a promising area for future research would be the study of developmental regulation in individuals who lead exceptional lives. Non-normative successful life courses have to be realised without, and often in opposition to, the scaffolding of socio-structural and age-normative opportunities and constraints. These exceptional individuals have to rely almost entirely on individual regulation and resources to attain successful development” (p.195). Therefore, while not reported as such, the importance of regulated development as a powerful approach to expertise has not only been constructed from existing literature within expertise, but when we read studies in regulated development itself, the reciprocal benefits to both fields is highlighted.

What the present review surmises is that regulated development, and more specifically self-regulation, is the key mediator between genetic predisposition, environmental & cultural situe, past experiences and eventual levels of expertise. Through the espousal of constructivist, pluralistic and dynamical systems principles, the present view of expertise would suggest an endorsement of a psycho-social complex-dynamic system which has the ability to monitor and control primary and secondary influences (Baker, 2004) through both implicit and explicit regulation of the environmental situe and self-awareness. Accordingly, existing methodologies would have to adapt and new directions in expertise research would be required as we shift from the dominant cognitive perspective to a more complex-ecological model. This would require a conceptualisation of expertise which has an ability to embrace paradox, anarchic pluralism, non-normative influences, indirect learning, chaos and uncertainty.

Existing Methodologies and New Directions In Expertise Research

Ericsson & Smith (1991) proposed a descriptive and inductive three-stage framework for the study of expertise which they referred to as the expert performance approach. The framework has recently been re-evaluated as suitable for perceptual-cognitive expertise in sport (Williams & Ericsson, 2005) and illustrates the three stages inclusive of 'capturing expert performance', 'identifying underlying mechanisms' and 'examining how expertise is developed' embracing some of the measures and methods that can be used at each stage. The framework proposed that expertise research requires the study of individuals' superior performance in their various domains which is initially captured in the laboratory using representative tasks that identify reliably superior performance. Furthermore, Ericsson & Smith (1991) argued that the study of expert and exceptional performance must then be restricted to individuals with reliably superior performance characteristics which, once identified, should be reproduced in the laboratory. While control is an obvious strength of this approach, a weakness may be the apparent lack of attention to the ecological influences already shown to affect expertise development (Baker et al., 2003). If a psycho-social, dynamic, pluralistic and constructivist approach to understanding expertise is deemed appropriate, then it is important to identify new methodologies which can contend with the requirement to embrace complexity and paradox.

The question that dominates is if "expert performance does not rely on principles or rules to connect the understanding of the situation to an appropriate action...and they may be unaware of invoking skills as they proceed" (Dunphy & Williamson, 2004, p.108), and indeed intuition is a critical component of expertise, then ecological field studies will be complex. If "the self system functions at multiple levels and subsumes a number of sub-systems that operate concurrently and in parallel" (Mischel & Morf, 2003, p.26) and if self-

regulation is indeed a psycho-social dynamic processing system, suitable methodologies have to reflect the dynamics of such a system in ecological settings. This mirrors the assumptions of Karoly, Boekaerts & Maes (2005) who not only recognised self-regulation as a complex, multi-level iterative process, but also that “research ends up trading the practical exportability of self-regulatory models and methods for tight experimental control” (p.307). Accordingly, the use of multi measurements to assess regulated development and the construction of expertise to produce a complex insight into self-regulatory processes, showing that processes exist, are dynamic, emergent, operate at micro and macro timescales and interconnected are required.

The present review gives suggestion that studies and research in expertise neglect empirical work which adopts alternative epistemological positions such as critical theory, existentialism or constructionism. For example, qualitative research paradigms such as ethnography, interviews, focus groups, action research and case studies afford analytical techniques allowing researcher’s alternative, yet arguably richer, deeper, emergent and more holistic perspectives or frameworks for understanding a complex phenomenon such as expertise. This is in full agreement within Camic, Rhodes & Yardley’s (2003) analysis that qualitative research is ideally suited for holistic analysis of complex, dynamical and exceptional phenomena. Therefore, the present review does not wish to falsely inflame the situation by claiming the existing literature in expertise and self-regulation is either incomplete, inadequate or in-commensurate (Golden-Biddle & Locke, 1997). Indeed, it is appropriate to recognise our belief that no complete and fully adequate approach to understanding expertise exists, but that epistemologies should shift and alter, so together giving a fuller and richer understanding of the phenomenon. Accordingly, we do wish to expand the notion of integrated pluralism (Mitchell, 2004) to understand complex and

difficult phenomenon such as the self, and give justification to the present research.

Summary and Conclusions: Adaptive Expertise

Expertise is generally associated with the theory of deliberate practice and offered as a phase-stage model of development. Ericsson & Smith (1991) therefore stipulate that to study expertise, it can only be determined by the examination of stable performance attained by experts; requires more analytical and controlled search for the processes underlying the expert advantage via laboratory tasks and investigative methodologies; and requires an ability to draw links and generalise the putative mechanisms underpinning expert performance. However, it is suggested that a psycho-social dynamic, pluralistic and constructivist model of development, which has means of analysing the unique, emergent and complex multiplicities that unite to be an expert, may also be required.

As well as aiming to understand the complexities which make an expert through adoption of a critical approach, there is also a need to examine the benefits of such an approach in a suitable setting where expertise is desired. Although fragmented support for the usefulness of the various dynamic, regulated and constructivist approaches have been described in isolation, there has been a failure to challenge the dominance of 'deliberate practice' as the dominant theory of expertise. Thus, advocacy that more longitudinal field studies are required in expertise research to determine if there is a need to investigate if a constructivist, regulated developmental, dynamic psycho-social processing systems approach is either appropriate or beneficial.

CHAPTER 3. STUDY 1: EXPERTISE AND TALENT DEVELOPMENT IN RUGBY REFEREEING: A CRITICAL, EXPLORATORY AND ETHNOGRAPHIC ENQUIRY

This study explores how expertise is obtained in the domain of rugby refereeing. The research data are qualitative and are drawn from an eighteen-month period working in collaboration with the Rugby Football Union Elite Referee Unit. Adopting an ethnographic mode of enquiry, the study combined long-term participant-observation with in-depth interviewing, indirect observations and collecting artefacts inclusive of existing protocol, coach feedback forms and strategic reports. The diversity of methodology allowed the research to understand how expertise is developed across various domains of analysis inclusive of the intrapersonal, interpersonal, group and social perspectives. Building on expertise studies in 'deliberate practice', further pre-requisites for expertise, at least in this domain and with these participants, incorporated 'deliberate experience' and 'transfer of skills'. Additionally, a key issue in the findings concerns a shift from 'descriptive' towards a 'non-linear processes' oriented model of development. The researchers conclude by identifying opportunities and limitations associated with the adoption of ethnography as a method for studying expertise.

As noted in the previous section of the thesis, understanding the collective integration of mechanisms and processes which underpin the development of elite performance remains a complex challenge for the sport scientist. The somewhat complicated affair of expertise development involves integrating attributes that studies endorse as necessary for elite performance. For example, sporting experts are characterised by their superior abilities in physiological, perceptual, decision-making and psychological attributes (Ericsson & Lehmann, 1996; Tenenbaum, 1999; Williams, 2002). While these attributes have been

acknowledged as *personal* 'domains of expertise' (Janelle & Hillman, 2003), a recent review article by Baker, Horton, Robertson-Wilson & Wall (2003) suggested that the development of expertise in sport also requires a successful interaction between *environmental* factors inclusive of biological, psychological and sociological constraints. This proposition also reflected studies in emotional development (Lewis, 1995, 2000; Lewis & Granic, 2000), physical health development (Schuldberg, 2002) and lifespan development (Pulkinen & Caspi, 2002) where further domains of analysis and the perplexity of time scales are deemed as determinants of 'performance'. Examination of these further domains would involve a shift from the existing studies of performer competencies, to an environmental awareness where inter-personal, group, organisational, societal and cultural factors have an effect on a performer's development. In short, expertise research requires the adoption of an all embracing and comprehensive analysis considering data for both personal and environmental factors.

Rugby Football Union Refereeing

In addition to a more comprehensive analysis, the researchers adopt Starkes, Helsen & Jack's (2001) recommendation that future researchers in expertise should use more longitudinal research designs and more field studies than have been employed to date. As such, the study engaged in an eighteen-month collaboration with the Rugby Football Union Elite Referee Unit and Regional Development Squads. The study emerged out of a line of enquiry which reflected the Elite Referee Unit's strategy for allowing referees to 'operate proficiently to a world class standard in an elite environment' with the aim of being 'the premier unit of elite officials in world rugby' (High, 2001). To fulfil this strategic goal, the Elite Referee Unit had to examine the central question of "How does one become an expert referee?"

A high level of proficiency is required for good officiating, where referees have to process information accurately and quickly before reacting with appropriate decisions (Weinberg & Richardson, 1990). In addition, referees have to deal with several sources of stress such as managing confrontations with coaches and players, media scrutiny, performance concerns and the presence of an assessor at each game. Consequently, the quality referee has to develop his or her own levels of expertise in perceptual, decision-making, emotional regulation and communication/social skills if they wish to officiate at the highest level. These dimensions make refereeing an appropriate topic for consideration, since expertise must be developed in several distinct but interacting areas if performance is to improve. Serendipitously, research in refereeing is a topical sport science subject with studies (Burke, Joyner, Pim & Czech, 2000; Oudejans, Verheijer, Bakker, Gerrits, Steinbruckner & Beek, 2000; Plessner & Betsch, 2001; Ste-Marie, 2000; Ste-Marie & Lee, 1991) and conferences (British Psychological Society, 2002) aimed at developing officialdom's performance. In light of earlier comments, there is still a need to justify using a case study of referees as an appropriate focus for investigation of expertise, as opposed to say, mere competence.

Ericsson (2003) discusses three general characteristics of distinguishing expert (as opposed to competent) performance. These include the ability to select superior actions, the ability to generate rapid reactions, and the ability to control movement production. The ability to select superior actions is central to refereeing performance. Making judgements in high pressure games, with thirty individuals on the field of play is a very demanding skill which requires referees to utilise both intuition and decision making skills. This requirement is amplified in the professional and international standard games where "playing the referee" is seen as a central component of international rugby (Kinton, 2004). The ability to generate

rapid reactions is reflected in the referee's ability of making decisions in such a fast moving and demanding situation. However, as refereeing is predominantly a cognitive skill, it does not extend to other factors apparent in other areas of sport such as movement control. Thus, although referees should maintain a high level of fitness to both keep up with play and maintain cognitive functioning, the needs for expertise are required in the perceptual, emotional regulative and decision-making skills.

The expanding role of expertise

Studies in expertise have been dominated by Ericsson, Krampe & Tesch-Romer's (1993) theory of deliberate practice which suggests that individuals have to partake in 10,000 hours of practice which engage activities specifically designed to improve one's current performance. The theory of deliberate practice is a 'nurturist' approach which advocates expertise is attributable to an appropriate quantity of quality training rather than innate talent alone. Whilst the theory emerged from studies on the practice habits of eminent musicians (Ericsson, Krampe & Tesch-Romer, 1993), findings have been validated when applied to the domain of sport (Helsen, Starkes & Hodges, 1998; Hodge & Deakin, 1998; Hodges & Starkes, 1996; Starkes, 2000; Young & Salmela, 2002). Ericsson & Smith (1991) propose that research of expertise requires the study of individuals' superior performance in their various domains. Furthermore, they argued that the study of expert and exceptional performance must be restricted to individuals with reliably superior performance characteristics which, once identified, should be captured and reproduced in the laboratory. While control is an obvious strength of this approach, a weakness may be the apparent lack of attention to the ecological influences already shown to affect expertise development (Baker, Horton, Robertson-Wilson & Wall, 2003). Accordingly, we propose that determining the appropriate quality and quantity of training required to master a skill should not be the sole

aim of expertise research. There also exists a parallel requirement for determining the motivational, environmental and cultural situe which is conducive to the emergence of expertise. As such, the purpose of this paper is to address Baker, Horton, Robertson-Wilson & Wall's (2003) suggestion that further examinations of the resources that constrain the development of expertise are essential inclusive of environmental factors and cultural influences. This will include examination of the 'integration' of domains of analysis and how they affect one another.

Investigations have already considered some environmental influences of expertise development. For example, previous studies have looked at the social influences throughout the development of expert athletes inclusive of family support (Côté, 1999; Soberlak & Côté, 2003), coach support (Côté, Salmela, Trudel, Baria & Russell, 1995) and peer support (Weiss, Smith & Theeboom, 1996). However, while these studies promote the understanding that psychosocial factors impinge on expertise development, they fail to engage with the full array of psychosocial factors, nor compare the potential multiplicative interaction of personal and environmental factors. To determine this full array of psychosocial factors, further analysis would have to include interpersonal, intrapersonal, group, social and cultural perspectives. The volume and depth of such a task could prove demanding and difficult. However, a failure to address all aspects of this complexity would inevitably yield an incomplete picture.

Analysing the complexity through ethnography

Such complexity appears endemic in expertise research as theories, models and explanations acknowledge various multi-component and multi-level evolved systems. For

example, writing about the search for general abilities and basic capacities, Ericsson (2003) attenuated to the 'complexity of the mechanisms mediating the superior performance of experts' (p.105) and how 'the performance of experts is mediated by increasingly complex control processes' (p.107). One causal explanation of this complexity lies with the powerful influence of the environment and significant others. The tendency of research to focus on the individual characteristics, physiological, technical and psychological abilities highlights how we believe that expertise emerges from the personal self. What has been argued in social psychology is that self (and as such, expertise) emerges and reflects our cultures, societies and groups which we participate and inter-relate within (Andersen, Chen & Miranda, 2002; Kashima, Kashima, Farsides, Kim, Strack, Werth & Yuki, 2004; Hardie, Kaskima & Pridmore, 2005).

As discussed earlier, Starkes, Helsen & Jack (2001) recommend that future research in expertise should use more longitudinal research designs and more field studies than have been employed to date. Ethnographic inquiry is a means of qualitative and exploratory investigation within a cultural group which allows a researcher to engage with the complexities of macro- and micro-analysis. This holistic approach allows the macro-analysis of biological, psychological and sociological interaction to be observed, while identified key factors can then be scrutinised in detail. As qualitative research is being accepted increasingly within the sport psychology literature (McKenna & Mutrie, 2003), it seems appropriate that research should utilise the benefits of such methodology. Therefore, the role of the present paper is not to fully engage in the validity of ethnographic study as method, yet it does acknowledge that the approach does provide us with a rare- possibly unique- opportunity to observe the complex interaction of 'developing experts' within their own environment.

Methods

The fieldwork, inclusive of analysis, was guided by the ethnographic methodology endorsed by Elliott, Fischer & Rennie (1999); May (2002) and Miller, Hengst & Wang (2003). Furthermore, the research was contextualized by McKenna & Mutrie's (2003) emphasis on quality in sport psychology qualitative papers. However, it is important to stress that ethnographic modes of enquiry do not constitute a single, unified perspective or set of methods (Miller, Hengst & Wang, 2003). Wolcott (1995) adopts a 'purist' and traditional, discipline-orientated viewpoint that notes it is possible for researchers to use ethnographic techniques (i.e. interview and conversation) but still not be doing ethnography. Meanwhile, Holt & Sparkes (2001) recognised a contrasting perspective where the term ethnography has been subject to controversy and highlight how ethnography designates a method that one uses as and when appropriate. It is therefore important that the present research stipulates and justifies credence for the present ethnographic approach.

The Rugby Football Union Refereeing Unit represent an institution which fits Schein's (1992) definition of organisational culture as encapsulating 'the deeper level of basic assumptions and beliefs that are shared by members of an organisation, that operate unconsciously and define in a basic "taken for granted" fashion an organisation's view of itself and environment' (p.6). Thus, as in any organisational culture, the referee group shared a deep sense of identity as referees, 'shared language used, behaviour patterns in the form of rites, rituals, stories, myths and legends, a style of leadership, degree of tolerance of conflict, type of reward systems and tolerance of risk' (Senior, 2003, p.358). Accordingly, the present research adopts an 'institutional ethnography' approach where 'ethnography does not here mean, as it sometimes does in sociology, restriction to methods of observation and

interviewing. It means rather a commitment to an investigation and explanation of how it actually works, of actual practices and relations' and where the focus of investigation is directed towards an 'aim to create *for*, rather than *of* people' (Smith, 2002, p.19). In the present context, this creation *for* is guided by how does one become an expert referee? A personal quest maintained by membership of a particular social group.

As suggested, many definitions of what ethnography and a culture constitute are very difficult to distinguish (Bryman, 2004). The present fieldwork adopts a research method in which the researcher was immersed in a social setting (organisational culture) for an extended period of time; made regular observations of the behaviours in that setting; listened to and engaged in conversations; interviewed informants on issues that are not directly amenable to observation or that the ethnographer is unclear about; and developed an understanding of the culture of the group and people's behaviour within the context of that culture (Bryman, 2004). However, it can be argued that the present case study fails to strictly encapsulate the notion of ethnography as the term ethnography not only denotes a method of research as adopted, but *also* requires strict adherence to the written product of ethnographic research. Therefore, it should be noted that while the researchers opted to direct the narrative form towards themes and assertions associated with the development of expertise to fulfil research aims, the same approach has also been adopted by others including Holt & Sparkes (2001).

A strength associated with an ethnographic methodology is the opportunity for employing various data collection techniques dependent on both planned and emergent needs. This reflects the present endorsement of a multiple perspective approach to the fieldwork where collection techniques had an opportunity to compete, co-exist, mutate and evolve during the eighteen months. Initially, the research was guided by Ericsson's theory of

deliberate practice and a model of talent identification suggested by Abbott, Collins, Martindale & Sowerby (2002). For example, in relation to support for the talent identification model, the research role was to identify critical transitions within a phase-stage model based on the work of Bloom (1985). Further remit was governed by a three-dimensional model for talent identification that encompassed performance, anthropometric and psychological features. However, as the research developed, the reflexive nature of the work and findings from the present cultural group gave an alternative perspective to these initial guidance elements. It is this feature of both similarities and differences in existing expertise and talent development research that the researcher deems appropriate for the present readers. What is offered therefore is a macro-account of the findings which are gathered from the reflexive and dynamic features associated within the ethnography. Therefore, the researcher emphasises the reflexivity required in the present study which existed at both macro and micro-levels. For example, at a macro-level, it soon became aware that deliberate practice did not appear as the only development mechanism, and as such a shift towards analysis of motivational, environmental and cultural situe, along with 'deliberate experience' and 'transfer of skills' occurred. Meanwhile, at a micro-level, the primary researcher had to adopt reflexivity at all times. For example, while interviews were semi-structured and formulated to identify 'developmental influences and mechanisms', deep conversations emerged from comments made in passing, or even within observations, and which opened emergent perspectives on how expertise was attained. An appropriate example is when one focus group *emerged* from a presentation on 'deliberate practice' due to the strong interaction and strong counter-argument from the group. In summary, while the primary researcher planned in great detail with the adoption of interview guides and observation checklists, the reflexivity at both macro- and micro-levels of the study determined the richness and quality of feedback and data.

Participants

Participants were referees, assessors, coaches and management (all male) who were involved with the Elite Referee Unit and Regional Development Squads at the time of the research. Over 116 individuals were involved with the study in an analytical context. Due to the nature of ethnographic study, it should be understood that some of these participants played a more significant role than others. Thus contributions to the study were defined as primary and secondary contributions. Participants utilised for in-depth interviews, deep conversations, focus-groups, video-analysis and whom direct-observation was accounted in a direct and focussed context were termed primary contributions. For example, structured observation was adopted during training sessions for a micro-analysis of 'deliberate practice' in accordance with existing characteristics of deliberate practice. Meanwhile those participants, who contributed information in casual conversations or unstructured observations while in attendance at rugby games, social events and meetings, were defined as secondary contributions. While it is easier to determine contribution of the primary contributors, it was more difficult to attain strict acknowledgement of secondary contributors. However, it should be recognised that in relation to the accumulation of the various information collecting sources, the sum was greater than the accumulation of all the parts, and that in many instances secondary contributions played an equal if not greater significance than primary contributions. The study conformed to the British Psychological Society's (2000) ethical principles for conducting research with human participants. Ethical approval was obtained from the Rugby Football Union Development Unit and the University of Edinburgh Postgraduate Research Committee. Due to the desire for naturalistic observation within a dynamic and fluid ethnography, ethical dilemmas required a degree of reflexivity. However, ethical awareness was continually discussed and integrated within the research validation process ensuring the British Psychological Society's ethical guidelines were

scrupulously followed.

It is of importance that we acknowledge the two primary participant sources as the 38 members of the Elite Referee Unit and the 25 members of the North Development Group. The Elite Referee Unit consists of 38 members, of whom 15 were referees, 10 touch judge's, 10 assessor/coaches and 3 management. Out of the fifteen referees, 5 were employed full-time. Ten of the 15 referees were officiating at Zurich Premiership level (with the other 10 having potential to do so), 7 had European experience, 3 had international experience and 2 were officiating at International Rugby Board levels and officiated at the 2004 World Cup. The North Development Group (one of three regional development groups) had 25 members and the composition included 'fast-track' referees, management, assessors and coaches.

Due to the nature of the participant-observation role, it is required to give a brief analysis of the researchers' contribution within the study. While two researchers were members of the Elite Referee Unit Psychology Support Team, only one researcher, being myself, was utilized in the full ethnographic process. The role adopted for the study was of researcher-participant (Bryman, 2004) as though participating in the process of referee development, was only semi-involved and was still functioning fully as a researcher in the course of the situation. This researcher had no experience of rugby nor rugby refereeing and was given the role of 'talent development and talent identification' officer within the psychology support team. The second of these researchers who also functioned as psychology support within the team adopted a 'peer clarification' role which will be discussed later in the 'analysis of data' section. No conflicts of interest or difficulties arose between the two researchers, with the role of the second research primarily providing a reflective capability productive bringing quality assurance ethnographic methodology.

Data

While the two hallmarks of modern ethnography (Erikson, 1986) combine long-term participant-observation (18 months was used) with in-depth semi-structured interviewing (we used 9 individuals), the present study also utilised alternative data sources such as detailed descriptions of officiating/ coaching/ assessor/ management routines (53 descriptions) and deep conversation (22), casual conversation (142), access to coach report forms (50), assessment report forms (50), attendance at training events (8), rugby matches (10), video's of games (22), attendance at Elite Referee Unit managerial meetings (12), focus groups (6), regional (1) and national (1) conferences, newspaper accounts (32), officiating protocol (21) and strategy documents (2). All data, whether direct quotes, full transcriptions of semi-structured interviews, or notes taken at appropriate periods such as after casual conversations, were recorded and classified as 'meaning units' (Tesch, 1990). As a 'working program', many of the focus groups and conversations emerged within workshops or conferences and were not taped or transcribed, although summaries and critical points clarified into a 'data' format. These data were then collected, typed/transcribed, reflected upon and interpreted. A room with appropriate storage and manoeuvrability was made available for the data and from the interpretation and dynamic process of the ethnographic inquiry procedure, revised and reconstructed on a continual basis.

The diversity of collection techniques employed governed a multiple perspective approach to the research (coined a pluralistic data collection). This pluralistic approach allowed the researcher to unify divergent views not only on changing perspectives as novel data emerged, but also on the diversity that exists within a holistic perspective, and as such within expertise research. Smith (2002) recognises that 'institutional ethnography is, in principle, never completed in a single study. Exploring an institutional regime is best done

from more than one perspective. Inquiry is conceived overall as opening different windows based on how people are positioned in the institutional regime, each giving a different view of the terrain' (p.30). Thus, it is accepted that the present research, while accommodating the results of ontology, is a phenomenological account which describes, interprets and analyses the referees' experience of expertise development. Accordingly, the accumulation of 'meaning units' becomes "one" actual entity formed by concrescence out of the "many" actual entities and forms. It is important when adopting such diversity of data collection techniques the researcher ensures chaos does not ensue. As such, order was maintained through adoption of a four-stage procedure with which to frame the ethnography within.

Procedure

The phases of ethnographic research adopted in the present study were endorsed by Miller, Hengst & Wang (2003), who also promoted a four stage procedure. First, there was a need to develop questions and gain access to the refereeing group. Due to the co-operative inquiry and needs of the Elite Referee Unit in requesting psychological support, the ethnographer was allowed appropriate access into the functioning of the group. Thus, whilst the researcher could not be afforded the participant role of 'referee', it was accepted that the participant role was that of 'developer of talent' within the unit. This early acceptance and access allowed the researcher to continually generate and negotiate the questions that primarily the Elite Referee Unit requested over an initial preliminary analysis. The second stage required the collection and management of data, which by the end of the eighteen month period was vast. The preliminary approach to the research aim required the researcher to assess deliberate practice in accordance with existing research. Therefore, this period of study adopted retrospective accounts of training including data indicated through interview, casual conversation, focus groups and observation of training diaries and periodization

programs when available (as adopted in the studies of Hodges & Starkes, 1996; van Rossum, 2000). Focus of analysis was not only on *how much* training referees participated in, but also whether referees could be distinguished into stages of development (e.g. Bloom, 1985) and motivational, environmental and cultural situe. Further analysis adopted a micro-analytic approach to measuring deliberate practice and training structure via observational analysis of training events and training sessions within conferences. This 'micro-analysis' focussed on *how* and *what* a referee trained upon during a training session as well as situational influences. The observation criteria were based on the four criteria of such practice (Ericsson, Krampe & Tesch-Romer, 1993) which includes that (1) deliberate practice targets specific skills that can improve performance, (2) that it requires hard work and intense concentration on the part of the learner, (3) that deliberate practices are not intrinsically rewarding, and (4) that it requires specialist feedback from a specialist coach or instructor.

Throughout the second stage, observations and informal conversations had to be written as frequently and as detailed as possible. This included accounts of match preparation, interpretation of officiating behaviour in either matches or during video analysis, interpretations of presentations delivered at conferences, casual conversations or behaviour within the training environment. Furthermore, interviews were transcribed and artefacts such as documentation and protocol dissected, and relevant material accumulated in appropriate categories. The third stage required the interpretation and analysis of data. The adoption of the 'room' and 'paper trail' reflected the researcher's preference in ensuring that the evolving complexity and dynamic characteristics of ethnographic enquiry were manageable. All data were recorded and categorized into appropriate groupings reflective of the researcher's interpretation of the development of expertise. Accordingly, while some categories were filled with greater depth as the study progressed, others emerged later in the study after

'insightful' observations, readings or discussions. Alternatively, earlier categories were discarded and data merged with other appropriate categories. In all, this required a project management that was not only well planned, but flexible and adaptable. For this reason, having the room, and space to manoeuvre became invaluable and it can be documented that the researcher's computer skill's could not have coped with such volume of change in data, interpretation of categories, or changes within the study group itself. The fourth and final stage is the writing process itself which Miller, Hengst & Wang (2003) acknowledge as requiring 'write early, write often'. This process allowed the researcher to construct focus groups or lines of inquiry at various milestones throughout the study, supported by the participatory nature of the Elite Referee Unit and Development Squad members.

While the four stage procedure existed at a macro-level in the study as reported, the same model was also utilised into a series of micro-level procedures to reflect the understanding that ethnography is never completed in a single study. Examples of these micro-stages included the focus on: identifying deliberate practice; identifying if the model of talent identification was relevant to the present group; periods where focus was on working with the Elite Referee Unit; working with the Regional Development Squads; where access to coach report forms and assessment report forms were granted; and when awareness of factors such as domains of analysis became evident. This continual and cyclical process of the four stages bestowed the reflexivity normally associated with ethnography, whilst scaffolding the overall macro findings.

Data Analysis

A key concern of a qualitative approach, especially when a pluralistic method is adopted, is the need to maintain quality within the research. Therefore, three accounts of

'quality' were adopted within the study. Denzin & Lincoln's (1994) evaluative criteria of ethnographic quality include trustworthiness, credibility and confirmability. Additionally, Yardley (2000) also offers principles for qualitative and interpretive research which includes (1) sensitivity to context, (2) commitment, rigour, transparency and coherence, and (3) impact and importance, and these were also adopted.

Accordingly, to overcome the deficiencies and biases that may stem from work without the appropriate principles and evaluative criteria, data and methodological triangulation processes were adopted. The data triangulation required clarification from at least two sources. This clarification came from the various sources of data which included interviews and observations of referees, assessors/coaches and management, plus the various artefacts and literature. The methodological triangulation involved the ability to investigate existing literature, attendance at Elite Referee Unit meetings and conferences, exploratory discussion and formal interviews. For example, whilst the participation-observer role allowed enhanced insight into the Rugby Football Union refereeing process, the adoption of in-depth interviewing served as a means of validating hypothetical constructions. Included in the methodological triangulation, respondent validation was constructed through clarification focus groups (Strauss & Corbin, 1998) designed to refine the research findings with the research participants. This analytical step adopted a presentation/ discussion group which allowed individuals to both support, question or extend the delivered data. The aim of the respondent validation was to check that participants recognized the interpretations in the final report as well as clarifying the overall findings and enhance the credibility of the data (Côté, 1999). In addition, researchers discussed overall findings with participant-collaborators, who were in charge of the Rugby Football Union Talent Development Program, where both contesting and supportive responses were sought.

The adoption of an internal audit was used to ensure that data was valid, trustworthy, genuine and coherent, whilst ensuring that ethical guidelines and procedures were fulfilled due to the emergent nature of ethnographic enquiry. A 'peer-clarification' process was conducted regularly throughout the case study. This was the primary role of the second researcher who also worked within the Elite Referee Unit Psychology Support Team. Finally, a primary and secondary 'independent audit' (Yin, 1998) to confirm that others could follow the trail of the data to the same conclusion was conducted periodically, although less frequently. In addition, a 'Rugby Football Union development manager' and an 'independent sport psychologist' were asked to ensure *meaning unit* (Tesch, 1990) themes were appropriately *categorized* as the primary audit. Finally, a staff colleague with experience of the ethnographic approach was given the data themes and final report to determine if the trail of data did reflect the final presentation of the research findings. As such, the study process faithfully reflected the recommendations of Denzin & Lincoln (1994), Miller, Henst & Wang (2003) and Yardley (2000).

Finally, before presentation of the data, it is appropriate to clarify that all meaning units and categories included in the findings went through this process of multiple triangulation. The authors would wish to highlight that the italicized comments embedded in the text are not *only* perceptions of the primary author, but were outcomes of this full and rigorous process. Therefore, when 'meaning units' are encountered in the findings, the reader is reminded that these reflect observed behaviour, comments, interviews, protocol and documented evidence.

Analysis

For clarity in presentation, findings are organized through the following emergent themes; (1) personal analysis; (2) interpersonal analysis; (3) group analysis; and (4) organisational analysis. The themes characterise how individual and environmental determinants account for a more 'holistic' and complex understanding of expertise. Within this analysis, a reflection against the existing theory of expertise also emerged due to the finding of alternative mechanisms of expert development. It will be argued how the identification of these mechanisms (deliberate experience and transfer of skills) nested within various domains of social and cultural milieu.

The Changing Context

The Elite Referee Unit were in a phase of 'professionalisation' as the group were only formed in 1997 and a stable management structure was in the early stages of expansion. In the eighteen month period, the Elite Referee Unit team was continually growing, with aims to have 18 full-time and 62 part-time members by 2007. Change and transition of rules, protocol, support mechanisms and working practice were fast-paced and constant throughout the research. Fitness and medical assessments were introduced, assessment tools increased, media scrutiny and coaching intensified. Indeed, the rate of growth and development was a constant concern of the Psychology Support Team due to the stressful nature associated with 'change' and consequently individual psychological support was provided to all members of the Elite Referee Unit.

The elements for change in the organisation included not only the organisation system, but also procedures, expectations, financial resources and management. This had a

direct impact on the beliefs and attitudes of the individuals that formed the organisational culture. Individuals were well aware that expectations were much greater, and thus the organisation had to ensure that appropriate support mechanisms and processes were available to all. Aspects such as training for impression management and media relations were recognised within the group, and the organisation reacted appropriately.

Change in context was not only experienced by the organisation, management, support staff and referees: The changing context was also experienced by myself as the primary researcher through the emergence of deliberate experience, transfer of skills and lack of stages as postulated in existing and expected theories of expertise. Thus the dual role of researcher and talent development officer took radical shifts as expected and planned interventions had to be adapted to these new findings.

Theme 1: Personal development

Two key features of personal development emerged from the data and illustrate what goes on within an individual referee and the personal action of the referee. The first feature involved the integration of deliberate experience and transfer of skills with deliberate practice as direct functions of expertise development. The second feature acknowledged the referee's non-linear development determined by both normative and non-normative influences.

Participant observation, interviews, training diaries, training logs and conversation alluded too "*a lack of training and practice within refereeing at present*". Retrospective accounts indicated that referee's trained from 0 to 5 hours per week, with the vast majority of this training time applied to physical conditioning. Aside from personal fitness training, the only permanent and structured training apparent was conducted on squad training nights (12

per annum) and conference syndicates (1 per annum). Observation of these training and conference meetings identified that individuals engaged in watching and talking rugby issues, yet few engaged in what could be termed *traditional* deliberate practice. However, as a cognitive skill, participants and data acknowledged that discussion and reflection drawn from weekend matches and issues raised at conference meetings does address contemporary issues, dilemmas and potential problems within refereeing. The majority of meetings utilised video of a refereeing decision, followed by discussion. For example, during the micro-analytical study on deliberate practice, one discussion within an Elite Referee Unit meeting/ training night (26 individuals attended) centred on the appropriateness of touch-judge feedback and possible means of 'try clarification'. The discussion was initiated by an incident where a touch-judge awarded a try, but the referee did not see the try being scored. As such, debate ensued on communication between referees and touch-judges and protocol to ensure such incidents did not occur. This discussion lasted for 1 hour and 22 minutes with a 'framework for protocol' still requiring full clarification. Most individuals seemed to enjoy the process of debate, but clarification of whether each individual participated in the problem-solving process is difficult to merit. Therefore, if problem-solving and reflection of dilemmas is a suitable means of refereeing training, then these discussions *could* merit 'deliberate practice'. Even still, these nights were infrequent and determination of the process as deliberate practice for all individuals, cannot be determined.

Further personal discussion and conversation with individuals during training nights highlighted how attitudes between individuals differed in that some individuals desired more training, whilst others believed that "*you learn your trade on the field and these meetings just ensure we're singing from the same song-sheet*". It appeared that the participants were trying to convey that it was not training and practice alone which made one an expert referee.

Referees' and touch-judges' officiated approximately forty games per annum. The five full-time referees officiated approximately the same number of games although standards, inclusive of status (European, International, etc.) and criticality of matches was deemed higher. While accepting training was important, primary and secondary contributors continually expressed that the only place where you could develop *"into an elite referee"* was on the rugby field. For example, one manager (and ex-International standard referee) expressed *"to be a good International standard referee, you have to referee International games. It's the same for the guys who want to move up to Zurich. The games are totally different and you are constantly learning"*. Furthermore, not only did the participants believe that practice and game experience were direct functions to expertise development, but also what *"you brought and keep on bringing to refereeing"*. One focus group highlighted how *'experiences in playing rugby', 'knowing how a rugby player thinks', 'how well you looked after yourself (fitness)', 'skills learnt at work such as management and assertiveness training', 'personality', 'confidence' and 'intelligence'* impinge on how well you could referee. For many of the participants, belief was that much of these issues are learnt and developed during earlier playing experiences, *"upbringing"*, and in occupational roles. However, it was the ability to transfer the appropriate skills and understandings that was crucial. The group also stressed that this transfer of skill was not just a starting point from which refereeing development begins, but that these skill transfers are being renewed constantly as you develop in your workplace or as a person.

Throughout the study, during individual interviews and group meetings, participants were asked to draw a diagram of their own personal development as felt pertinent to themselves. As illustrated in Fig. 1a, the majority of individuals (94%) utilized a non-linear wave-like diagram to express their own perspective of development. Furthermore, each

participant's pattern of development was distinct, with the non-linear wave patterns following different pathways. No two referees followed the same path, and indeed interpretations of both facilitators (upward transitions) and debilitators (downward transitions) of performance varied considerably. The reasons for change in direction of development paths (routes) were determined by a plethora of factors. What became apparent was that each individual identified these specific occurrences, as governed by their own personal interactions with refereeing. These in turn were influenced by socio-cultural and historical milieu. These occurrences were discussed as specific critical moments that had a large effect on each individual's career. Such moments included '*well refereed games*', '*important games*', '*highly assessed games*', '*games which were poorly refereed*', '*games in which 'big lessons' were learnt*'; social impacts such as '*moving house*'; family relationships such as '*commitment*' or '*having a baby*', '*the weather*', '*luck*', '*financial difficulties*', '*lack of motivation or desire*', '*injuries*', '*change in personnel*', '*change in organizational structure*'; relationship issues, such as '*not getting on with management, peers, coaches and assessors*', '*events at the workplace*'; or indeed '*when promoted within the Rugby Football Union structure*'. It is important to recognize that positive development included not only examples of well-refereed games, but also those that were deemed as 'poor':

"I made such a pig's ear of it. It was my biggest opportunity to date, and it turned into a total nightmare. Though I came close to leaving refereeing because of this game, it ironically ended up being my saving grace. I saw how my biggest problem was that you aren't out there to be liked. You're a referee. Taking that to my game, I then began to fly. But without that wake up call, I don't think I would have progressed as far as I had done."

The most enlightening feature of the non-linear wave-diagrams occurred when an attempt to *find* 'elements of deliberate practice' was operationalised. Referees were asked to take a more recent period of the original diagram (Fig. 3.1a) (which represented six to twelve years) and interpret their progression during a one-year or six-month period. What became evident was that this period also followed a non-linear pattern with no similarity to the equivalent period in the long-term diagram (see Fig. 3.1b). As with the first diagrams, these also did not permit the *finding* of deliberate practice mechanisms due to the transition factors not alluding to specific training or development elements. Accordingly, the participants were asked to repeat the process again, zooming in to present a diagram relating to a one week / one month period. These diagrams displayed yet another non-linear pattern, but with greater amplitude and frequency. Results also indicated an increase in the frequency of negative transitions and normative influences, so-called 'micro-transitions' (Fig. 3.1c). In addition, when questioned as to why this occurred, many referees believed, "*it's attention to detail that matters*", "*that only during refereeing do you actually develop*", "*and only through assessment and coaching analysis of your weaknesses do you progress.*" As a final stage, the referees were asked to construct a diagram of a recent game where they could indicate development within a match day. Results showed further support for a non-linear model, with high variance in amplitude and frequency which identified some specific development issues as follows: '*game preparation*', rule awareness such as '*controlling contact area and offside lines*' or '*the engagement sequence*', '*sticking to one warning*', '*using preventative measures*', '*game/ event/ management awareness*', '*positioning*', '*impression management*', '*luck*', '*quality of equipment*', '*assessor/ coach presence/ input*', '*an awareness of how everything changes dependent on time, game situation, preceding incidents*', '*the score*', '*pitch condition*', '*quality of play*' and their '*own gut feelings towards the situation/ incident*'. Figure 1c illustrates the non-linear patterns (and further micro-transitions) which the referee's

afforded to their personal development during each game.

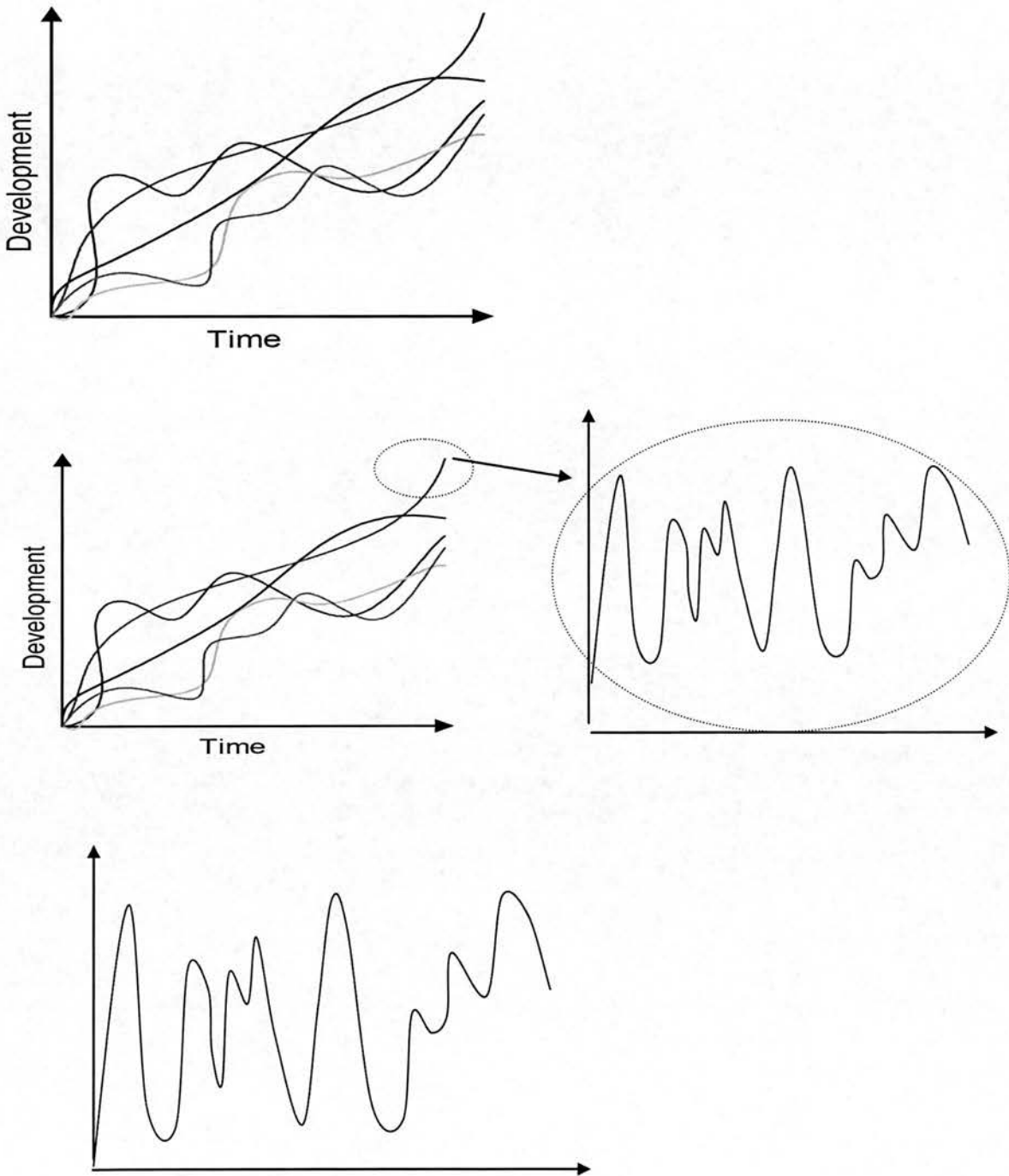


Figure 3.1 (a) Interpretation of referees' macro-development. (b) Interpretation of non-equivalent time period drawn from macro-development. (c) Interpretation of referees' micro-development diagram.

Theme 2: Interpersonal analysis

This domain focused upon the key interpersonal interaction of referees and the network of significant others who affect their refereeing development. Frequent interaction that referees deemed as critical and significant was conducted with peers, coaches, assessors, development officers, managers, rugby club officials, players and media, while it has also to be recognised that for the majority of participants, family and work relationships were also decisive. Although referees expressed the need for greater self-regulation as their careers developed, they equally expressed the importance of an exchange network providing material, technical and emotional assistance. Further support included medical assessment, physiotherapy, psychology, fitness, video-work and nutritional support, as well as flexibility and understanding within family and working relationships. Inter-personal factors were recognised as largely positive although some negative nuances were expressed during interview and conversation. Positive factors included *'having people who knew what you were all about to give advice or a second perspective'*, *'people to rely on'* or *'someone to go to your problems with'*, whilst negative factors included comments, such as *'I don't know why he's in the position he is, but you've just got to work round it'*, and some requests not to have interactions with certain individuals: Overall, the function of inter-personal relationships balanced performance and socialising needs. However, when we take participant accounts of communication skills, social skills, trust, persona and personality as key determinants of 'expert refereeing', then it may be suitably hypothesised that the 'social' factor may play a greater role in refereeing performance and not just represent socialising per se. For example, the more experienced referees highlighted that as relationships with clubs, players, coaches and assessors progressed through time, healthier communication, refereeing decisions and authority were more readily accepted. It seems that with refereeing, as so many other fields, group monitoring is a beneficial mechanism that can accelerate

developmental progress.

Theme 3: Group analysis

“While people feel we are loner’s, you should know that officials should and do work as a team. First of all, it takes two touch-judges and a referee to officiate a match effectively. There is also the team behind that, inclusive of the coach and support staff, the friends I have in refereeing and then I’m part of the Elite Referee Unit and I’m proud to say, Rugby Football Union.”

The importance of the group for referees was a surprising feature of the research. Participants were identified and acknowledged that the strongest group bonds were with ‘refereeing peers’, officiating teams that were structured for each match, the Elite Referee Unit, regional development groups, the Rugby Football Union refereeing group and Rugby as a whole. Referees, coaches, assessors and management continually cited the importance of the various groups towards their development. Individuals not only had to function under set rules, protocol and unwritten expectancies, but in order to develop they had to function and adapt within these constraints effectively, with group integration providing the support and mechanism to do so. The essential criteria of elite referees requiring individuals to *‘follow party line at all times, is supportive of colleagues and adheres to team ethos’*.

“I know I’ll only be measured as good as the Rugby Football Union or the Elite Referee Unit are measured. When we turn up for European matches, the guys expect me to officiate well, because I referee at Premiership level week in and week out. At the same time they’ll also complain that I won’t allow the game to flow, as much as they feel that is a feature of English referees. In ways it’s maybe true as we like to

apply the rules, but it's something that the Elite Referee Unit now discuss and work on and I think we're getting better at."

Smaller and semi-structured/ semi-formal groups were initiated through peer, management and coach persuasion. Groups of two to four individuals would form 'buddy-buddy' or 'self-monitoring' systems where communication was maintained through phone and personal contact. Sharing of knowledge, experiences, re-assurance and socialisation were the main topics of these group discussions, and individuals who partook in such ventures highlighted how this was one of the most productive actions towards their own development. *"I can phone A about a recent game he's had with the team I'm going to referee on Saturday and he can tell me the key players, who to watch out for, the subtle illegal plays that they try, if to expect abuse from the crowd or coaching staff and how they will try wind me up."*

Theme 4: Organisational analysis

The organisations that were identified as existing within refereeing development included the Rugby Football Union, International Rugby Board, Rugby Football Union, the media and rugby as a holistic entity. Referees highlighted how match protocol, rules, selection, expectancies, and what can be deemed the 'shadow' side of an organization, is critical to potential success. Discussion and observation acknowledged how decisions made at organisational levels did and could directly impinge, shape or constrain refereeing behaviour. For example, this would include the structure of development groups at national and regional level, the Elite Referee Unit and refereeing management strategies, availability of technical or individual support. As would be expected, financial implications at organisational level result in the ability or lack of ability to conduct training seminars, employ specialists, employ

full-time referees and management, provide quality communication equipment, have necessary logistical/ secretarial support which together creates a facilitative environment in which individual referees can develop. 'Politics' within and between organisations (and especially the key individuals!) was also acknowledged as having a top-down effect. Indeed, while many enjoyed this new 'professional culture', others expressed that the increased scrutiny was detrimental to performance. Whilst the participants felt they had better support mechanisms, they also felt that more was now expected from them. Furthermore, they also discussed how they come under very close scrutiny in the media, and from organisational management. Many referees openly discussed how for many, there was a *'fear of making the mistake which could freeze your career'* which was created at an organisational level.

Discussion

The main purpose of the paper was to further examine the resources that constrain the development of expertise. A number of processes were identified that affect the referee's ability to develop expertise. First, the analysis indicates that 'transfer of skills' and 'deliberate experience' are additional determinants of expertise along with 'deliberate practice'. Second, the nurturing of expertise is influenced by the various domains of analysis and their interactions. Third, a shift from 'descriptive' and traditional 'phase-stage' approaches towards a 'non-linear model', which accounts for macro-, meso- and micro-time scales is deemed necessary.

The dominance of 'deliberate experience', as the key constituent with regard to the development of expertise in refereeing, should be of little surprise as "it is difficult to imagine how anyone can acquire the self-regulatory capabilities to deal with the wide array of internal

(emotional/ cognitive) and external distractions that arguably cannot be experienced outside of the competitive arena” (Janelle & Hillman, 2003, p.40). What did seem critical was this ability to ‘adapt’ and develop after each refereeing experience, understand the ‘game’ of career development and address the ‘evaluation criteria’ at various ‘promotion transitions’. This focus on the criticality of exposure and competition reflected the findings of Baker, Côté & Abernethy (2003), Cleary & Zimmerman (2001), Durand-Bush & Salmela (2001) and Gould, Greenleaf, Chung & Guinan (2002) whose results advocate the importance of ‘deliberate experience’. It would therefore seem that the ability to learn new meta-cognitive and emotional regulative skills in a competitive setting would be the critical factors to further development of expertise in refereeing. Furthermore, this finding is not only reflective of sport, but is also accepted in organisational and occupational research (e.g. Summers, Williamson & Read, 2004) which expresses how expertise development requires both experience and education/ training. Furthermore, due to the comparatively late age at which referees enter their chosen role, the effect of ‘transfer of skills’ could be deemed as relatively more significant. Referee’s knowledge structure of the rules, expected behaviours of players, personality, man-management skills and fitness are predominantly stable and developed before coming into refereeing. The key contingencies for these transferred skills included senior school/university/club rugby participation and occupational roles.

According to Bandura (1997) “in social cognitive theory, human agency operates within an interdependent causal structure involving triadic reciprocal causation” (p.6). As such, behaviour (e.g. the gaining of expertise); the internal personal factors in the form of cognitive, affective and biological events; and the external environment interact and influence one another bi-directionally. When taken to the sporting context, this would suggest that expertise research requires to further extend the accounts of the social influences (Côté, 1999;

Côté, Salmela, Trudel, Baria & Russell, 1995; Salmela, 1994 and Soberlak & Côté, 2003) throughout the development of expert athletes. This would further and broaden inquiry that incorporates the collective agency of both personal and socio-structural theories. For example, ‘nesting’ is an ecological approach (Gibson, 1979) which emphasizes the direct interaction of individual (in our case the referee and his/her ability to attain expertise) and his/her habitat (see fig.3.2). What was recognized in the present study was this nesting of each individual’s performance within the intra-personal, personal, inter-personal, group, organizational, cultural and social processes. According to the present case study, inclusive of the clarification group meetings, each of the domains and their interaction created a climate, culture and protocol that dominated and constructed the referee’s development process.

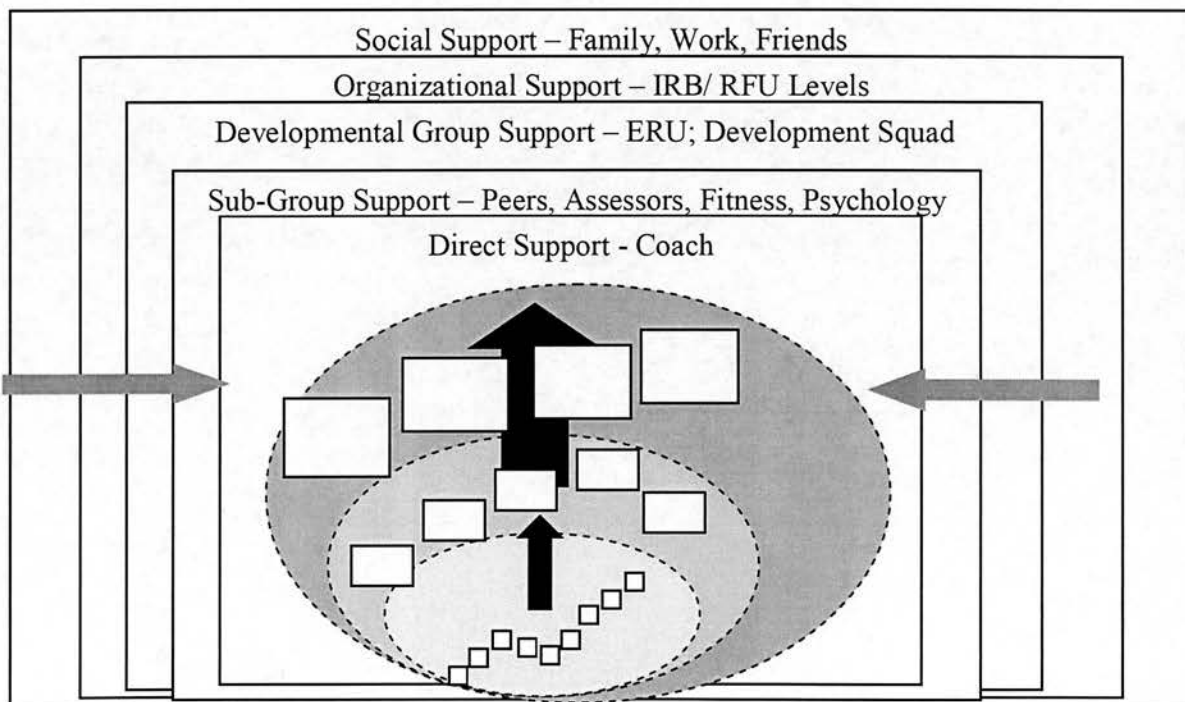


Figure 3.2. Nested model of expertise

In keeping with an ecological approach towards expertise, the 'holistic' analysis of the referees' development was interpreted as a discontinuous, self-organizing, transactional process among the task, individual and environment throughout life (Bernstein, 1967; Kugler, Kelso & Turvey, 1982). Referees attributed change in their developmental progress to factors that could be deemed as task, individual and environmental constraints (Newell, 1986; McDonald, Olivier & Newell, 1995). These included the task constraints of refereeing itself; individual constraints - including personality, communication skills, fitness and rugby knowledge; and the importance of environmental constraints in the form of media, fans, players, coaches, weather and location as well as the groups and relationships which dictate the developmental climate.

It is important to acknowledge that these constraints reflected a complexity in analysis due to the idiographic nature of refereeing development. Subsequently, what was debilitating for one referee could be facilitative for another and vice versa. Within these constraints, it is crucial to note that referees ascribed non-normative influences with the same value that they gave to normative influences (Ryff & Heidrich, 1997; Ryff, Singer & Seltzer, 2002). Normative-influences are the socially sanctioned, frequently prescribed transitions that individuals expect to encounter as they progress through their referee careers. These would be seen as action points, normal training days and learning material prescribed by themselves, peer or coach. Non-normative influences are those experiences and challenges that come unexpectedly, which are generally construed as upheavals and accidents that have adverse influences on refereeing performance. However, there is growing interest as to how certain individuals are able to thrive in the face of adversity and even benefit from it (Ickovicks & Park, 1998; Linley & Joseph, 2002). Support is derived from earlier findings where individuals discussed how *'certain poor and dreadful games were their own turning*

point within development'. A positive dimension of non-normative influences is also 'luck', i.e. the *'importance of good fortune and luck'* as well as *'being at the right place at the right time'*, which referees deemed as necessary to progress in (or hinder) their careers.

While existing models of expertise postulate a 'phase-stage' approach (Bloom, 1985; Dreyfus & Dreyfus, 1988; and Côté, 1999), the present referee interpretations of expertise development did not. Referees do not succumb to the traditional 'early' or 'middle' years stages due perhaps to the age at which they enter refereeing, although it may be expected that they would conform to an equivalent model which focussed on experience rather than age. While the referees did go through the stages of 'promotion' such as refereeing schools, amateur, four National Leagues, Zurich Premiership, European, International, World Cup, it did little to demonstrate 'how' the individuals developed. When you integrate that referees felt that their development was encapsulated by understanding that they developed at macro-, meso- and micro-timescales, that non-normative influences as well as normative influenced their development, that luck did matter, and that perspectives of coaches, assessors, groups and organisations also affected their development, then it is easy to identify exactly why a 'non-linear' development model of expertise was found. Indeed, the diagrams that individuals drew of their own development were classical non-linear patterns (Fig. 1a and 1c). These models encapsulate why referees feel you cannot fully predict who is and isn't going to make it. Some who were very good couldn't cope with small nuances or had strong work/ family commitments, whilst others who were deemed as *'very average- played the game, kept their nose clean and stayed the course'*. *'You really just can't tell, however, you can create the right environment for those with potential and desire to be the best they can be'*.

In summary, the study found shifts in existing perspectives of expertise and talent development including a) the movement from a descriptive and phase-staged approach to one which is non-linear and dynamic, b) non-normative as well as normative influences, c) recognition of an 'expert self' as intrapersonal, interpersonal, group and social, d) expertise development existing at micro-, meso- and macro-development levels, e) an integrative, contextualised and multiplicative nature of expertise, f) emergent as well as planned development, g) identification of a 'nested' and ecological outlook of expertise acknowledging the necessity of a positive 'talent development environment'. Additionally, mechanisms of expertise expanded on the existing theory of deliberate practice to include 'deliberate experience' and 'transfer of skills'. In sum, the present findings encountered an approach to expertise which embraced complexity and paradox, was equally psycho-social dynamic than intrapersonal and fostered the necessity for a creation of contexts from which elite performance can morph. From these findings, and alternative studies and readings emerging from associated readings and offered within the literature review, a period of reflection occurred where models of 'non-linear and dynamical systems', 'talent development environments', 'adaptive expertise', 'fractal models' and the promotion of adaptive expertise, self-regulation and meta-cognitive skills required to negotiate the complex pathway associated with eminent performance, was explored before a final sense-making notion of 'expertise as constructivism' was embraced. Accordingly, the remainder of the thesis will embrace this constructivist approach of expertise and talent development and investigate as appropriate.

Finally, the present study illustrates how the adoption of an ethnographic methodology gave a depth of analysis which could be difficult to replicate using another scientific form of methodological analysis. Ethnography allowed the researchers to engage

with the complex mechanisms and processes that determine expertise development from a multiple perspective approach. Due to the researcher's involvement in the change process that existed within the Rugby Football Union/ Elite Referee Unit domain during the eighteen-month research period, it was possible to multi-triangulate various sources of material which ensured a symbiotic development process. As a result, the synergy of the multi-perspective and pluralistic approach allowed the research questions to emerge and develop whilst solving the theoretical and empirical puzzles associated with research in expertise. Embracing Starkes, Helsen & Jack's (2001) recommendations of longitudinal research designs and more field studies, the present research would advocate the ethnographic approach as a suitable means of analysis in alternative expertise settings. Finally, readers may wish to reflect on the quality of the methodology, both in general and as used in the present study. Limitations of the methodology are related to the need for evaluative criteria of ethnographic quality including trustworthiness, credibility and confirmability (Denzin & Lincoln, 1994); the need for sensitivity to context, commitment, rigour, transparency and coherence; impact and importance (Yardley, 2000). It is hoped that these factors are both considered and adequately addressed in this paper.

Conclusion

Nietzsche's (1995) aphorism "This is my way; where is yours? - thus I answered those who asked me 'the way'. For the way- that does not exist." accounts well to the present study. The complexities that integrate from the various domains of analysis (personal and environmental), various domains of expertise (physiological, technical, tactical, psychological), fields of study (sport, occupational, art, music) and various time-scales (macro-, meso- and micro-) are expressed. Nietzsche would indicate that although a meta-

cognitive/ theoretical law could explain *how* expertise develops, no single path or stages of development can exist for all individuals, never mind all the sports or performance domains (fields of study). Expertise evolves from a complex interaction of time, task, individual and environment that deems it is more important for institutions and organisations (and subsequently the researchers they employ) to create a context from which elite performance can morph. Future expertise research will therefore require understanding that 'deliberate practice', integrated with 'deliberate experience' and 'transfer of skills' along with awareness of motivational, environmental and cultural situe are pertinent. The principles of constructivism afford an appropriate research philosophy from which to initiate future research and applied investigations.

CHAPTER 4. REFLECTIONS ON COMPLEXITY, CHANGE AND TRANSITIONS

The literature review and Study 1 examined existing ideas, evidence, models and theories of expertise in an attempt to explore the subject matter as a complex, multi-level iterative process that unfolds over extended periods of time. Particular attention was paid to the dominant and general theory of expertise, namely deliberate practice and the dominance of 'phase stage' approaches to expertise development. A shift to more ecological and dynamical perspectives on this subject was then discussed. Deemed as suitable ecological and dynamical perspectives, a proposed psycho-social dynamic and constructivist perspective to the development of an 'expert self' was then explained. The nature of these approaches was directed to support a cyclical and iterative meta-level model of regulated development which endorses an emergenic characterisation of expertise development.

Embracing longitudinal research set within an ecologically valid setting, Study 1 demonstrated that there was indeed support for an ecological and dynamic perspective of expertise. Existing within the ethnography, and contributing to a master's thesis (Ollis, 2002), a series of interviews and focus groups adopting Interpretative Phenomenological Analysis (IPA) were utilised as a micro-ethnography. Findings attenuated to a proposed 'multi-iterative process that unfolds over extended periods of time' emerging from the interpretive phenomenological themes. This model was termed 'IAE³' (I-A-triple E) and details of which will be discussed subsequently. The model spanned the multiple layers and domains of expertise research, whilst integrating the full range of macro-, meso- and micro-timescales as well as the full zone of proximal development including intra-personal, inter-personal, group, organisational, cultural and environmental situe.

Progressing from the literature review, findings afforded by the ethnography (Study 1) and the further micro-ethnography (Ollis, 2002), the purpose of the current study is, through provision of a reflective chapter, give a theoretical account of a model suitable to the aims of the present research. In such, it is hoped to achieve further progression in all five main research aims as defined on p.23. While the present study expands upon the theoretical account of the Ollis (2002) findings, it is important to clarify that they are fully separate studies as where the original study identified a cyclical and iterative process termed IAE³, the present study evolves the findings into a theoretically supported model with constructivist tenets and suitable to govern future research aims. The present study's objective is therefore to establish the methodological vehicle deemed necessary for future research. The micro-ethnography (Ollis, 2002) recognised the appropriateness of IPA, as with many other qualitative approaches, in assisting the construction of 'theory' and 'paradigm'. As a phenomenological account however, it is deemed necessary to give additional theoretical support to the IAE³ model and identify if a meta-level model of expertise is appropriate for further research. Accordingly, after brief description of the micro-ethnography findings, the study wishes to adopt existing theoretical and working models of 'transition and change' to assist in the final construction of the IAE³ model, recognise the appropriateness of the model as central to a meta-level development model, recognise implications of the model and give direction for future studies.

Micro-ethnography and Background

Ethnographic inquiry beholds a characteristic for both microscopic and holistic analysis (Miller, Hengst & Wang, 2003). While Study 1 can be expressed as the holistic analysis of expertise development, the micro-ethnography engaged in a microscopic analysis, or what Geertz (1973) termed "thick description". "Ethnographers often use the interpretive

strategy of lifting out an example for micro-level analysis as a way of deepening their understanding of the phenomenon in question” (Miller, Hengst & Wang, 2003, p. 230). As such, the aim of the micro-ethnography (Ollis, 2002) study was to provide thick description of the ‘transitions in the development of expertise’ from a refereeing perspective which would (in hindsight) take account of the transitions (micro-, meso-, macro-) required during an idiosyncratic quest for performance excellence. A secondary aim was to ‘generalise’ the model for any expert in any performance field. Hence, the micro-ethnography was contributing to a greater understanding of the complexities which integrate to construct an expert as well as expert levels of performance through the adoption of a ‘richer, more progressive and in-depth’ analysis.

The purpose of the micro-ethnography (Ollis, 2002) was to explore the theme of ‘transition and change in the development of expertise’ in both personal and environmental domains which mirrored a non-linear dynamical perspective as recognised in the holistic ethnography (Study 1). Participants were members of the Rugby Football Union (RFU) refereeing group and micro-analytical data were drawn from phenomenological in-depth interviews (n=9) and two focus groups (n= 4 and 8/ 22 respectively). Individuals from managerial, coaching and refereeing perspectives expressed ‘the management of both planned and emergent change’ as a meta-theme throughout the developmental process. Furthermore, five sub-themes emerged from the data inclusive of identify; act (as in action); establish; evaluate; and empower. These five themes formed a meta-level model of expertise development which integrated the ‘domains of analysis’, ‘domains of expertise’ and ‘macro and micro’ time scales. The meta-cognitive expertise model was appropriately termed ‘I-A-triple E’ (IAE³) and acknowledged a continual need for de-stabilisation and re-stabilisation of performance to occur throughout the expert development process (see Fig.4.1).

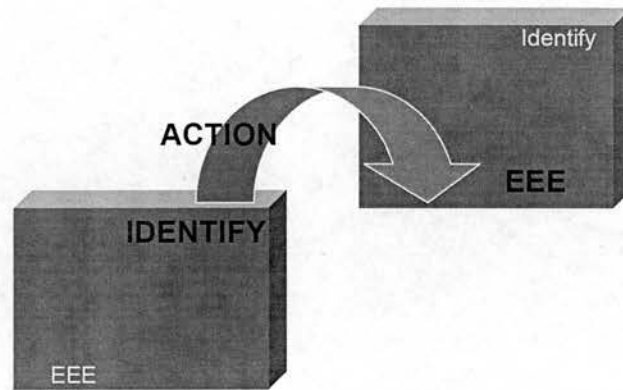


Figure.4.1. IAE³ meta-level model of talent and expertise development.

IAE³

Within the micro-ethnography a general explanation of the IAE³ model (Fig.4.1) was offered. The study expanded upon findings of previous research to gain some theoretical support for a micro-development model of expertise. Findings postulated a meta-level model of expertise from the themes identify; action; establish; evaluate; and empower which spans ‘domains of analysis’, ‘domains of expertise’ and ‘macro and micro-level time scales’. This concept of a meta-level model encapsulated the rich pattern of interconnection that existed between the component elements of the expert system. Studies with cellular automata and fractals (Guastello, 2002) indicate that quite simple rules when applied again and again can lead to complex behaviour. Therefore, when the five themes are integrated into the iterative IAE³ model, a complex adaptive process can occur freely as it continues to interconnect with other domains whilst feeding back and building on themselves. For example, not only could a simple perturbation of a technical component using the IAE³ process during training impinge on an emotional regulative component, but the simple perturbation of an individual’s behaviour could potentially impinge on the culture of the whole group. Quite simply, all the parts of a system which are developing expertise are continually interacting with each other

and shaping each others behaviour. Whilst this may appear slow and gradual, athletes, musicians, dancers and various other performers recognise how critical transitions specific to promotion and recognition, can occur suddenly through apparent discontinuous changes.

The meta-level model encapsulates the iterative process of IAE³ which allows the organisation, coach and individual to pursue optimal change and transition within a holistic ethos. In light of the interconnection with the social and cultural environment, the model offers the challenge that coaches and organisations have to develop and change within their own realms, *only* to ensure that an environment where athletes can engage with a pursuit of excellence is created. It is therefore the nested, dynamic and co-constructive concept of expertise offered in the present study which affords capability to perform optimally. Anecdotally, this is shared with the philosophy of the England rugby coach in his appraisal of the World Cup success (Woodward, 2004) where the pursuit of excellence in every aspect of the RFU organisation was acknowledged as transpiring towards the team's success. The IAE³ process gives rise to this cycle of iteration in which the pursuit of excellence, defined by the constraints of task, individual and environment is repeated over and over again.

Kaufmann (1995) observed that system behaviour located not far from the transition to chaos (also expressed as the 'edge of chaos') is the optimal site for complex adaptive systems to perform, so that dynamic patterns are both robust and flexibly responsive to the context. To develop refereeing expertise, participants are required to be in constant change and flux throughout their careers, at the same time maintaining order and a need to stabilise performance in the alternative domains of expertise. The creation of an 'excitable medium' (Goodwin, 1994), which has the capacity to generate developmental transition, would therefore ensure 'arrested development' (Ericsson, 2003) and would be less likely to occur.

This arrested development is explained by when there is too much stability in any system, change is unlikely. The IAE³ therefore offers the balance of chaos and order, where optimal development can occur through deep engagement with the goal of expertise.

Athletes, coaches and sporting organizations/ bodies are in a continual process of de-stabilisation (through identification and action) followed by a process of re-stabilisation (establish, evaluate and empower) which reflects the dominant trend in meta-cognition research to search for relations between monitoring and control (Nelson, 1996; Perfect & Schwartz, 2002) of action (expertise development). This balance between chaos and order also reflects existing meta-cognitive strategies adopted within sport, which utilise the role of self-regulatory learning strategies (Anshel, 1995; Anshel & Porter, 1995, 1996; Cleary & Zimmerman, 2001; Crews, Lochbaum & Karoly, 2001 and Kreiner-Philips & Orlick, 1992) where a proposed awareness of how sport science skills (inclusive of periodisation, planning, goal-setting and performance evaluation) can assist in the meta-cognitive requirement for monitoring and control of developmental change. The importance of training for adaptive capability through the use of self-regulatory and meta-cognitive concepts, supported with constructive principles is therefore re-emphasised. Equally, ensuring the monitoring and controlling of expertise development is done at both holistic and compartmentalized levels are necessary to ensure an embracement with the co-constructive features occurs. While the IAE³ model emerges through the understanding of the rich interconnection between change in the smallest (micro-development which can include a decision) to the largest (culture) detail, there is a requirement to understand why IAE³ would seem a more appropriate model of change than others previously offered. Therefore, and for ease of explanation, the remainder of the discussion will illustrate how each theme of change integrates to provide a proposed meta-level model of expertise rather than mere competence.

The first two themes (identify and action) illustrates how the participants, groups and the organisation did engage with a planned and deliberate process for the construction of expertise. Therefore support is not only given to the necessity of 'deliberate practice' (Ericsson, Krampe & Tesch-Romer, 1993) during the quest for expertise, but also the requirement for deliberate experiences, deliberate communications, deliberate reflections and so forth. This includes support for a learning athlete, team, coach, support staff member, organization and governing body. From an individual perspective, while Guadagnoli & Lee (2004) discuss the need for identifying appropriate 'challenge points' from (1) a motor-learning perspective; Bompa (1999) and Siff & Verkhoshansky (1999) discuss the need of periodisation programs that integrate the dominant (2) physiological needs with (3) technical skills; and Balague (2000) expresses the need for periodised (4) psychological skill training programs. The present study advocates a need for training programs that integrate and entrain destabilisation as well as an 'excitable medium' across all four domains of expertise, due to the apparent integrative and multiplicative effects expressed by the referees. Once again, utilizing the ecological model of development and its 'nested' principles, including the development of all aspects of the co-constructive elements as well as the capability to integrate, is of critical importance. A commitment to analyse strengths and weaknesses as well as opportunities and threats across the various domains of expertise is an integral feature of *identifying* both training needs and competition strategy within the holistic performance. As well as the basic problem-analysis, solutions also have to be identified and operationalised before action can occur. For an individual, this requires support and collaboration between athletes, coaches and organizations in providing quality analytical tools (e.g. video cameras, analysis programs) and quality support in appropriate domains (e.g. perceptual training, physiotherapy, motor learning specialists, elite coaches, elite managers).

The initial identification of training needs and competition strategy, inclusive of problems and solutions, has to be replicated into appropriate goals and action points. This integrates the first two themes of identification and action which suggests the process of de-stabilisation is fundamental to deliberate practice (Ericsson, 2003), deliberate experience or deliberate engagement with reflection or problem solving activities . Furthermore, both the findings of the first two themes and this de-stabilisation process are supported by action-control theory and goal-setting theory (Locke & Latham, 1985). In the organisational setting, Gollwitzer & Brandstatter, (1997); Orbell & Sheeran (2000); and Dieffendorff & Lord (2003) have all identified the volitional benefits of planning on task performance, where volition refers to the activities involved in maintaining and controlling action while striving for goal attainment. Support of performance enhancement in the sporting context is also identified with planning (Nevett & French, 1997; McPherson, 2000; Cleary & Zimmerman, 2001), periodisation (Bompa, 1999; Siff & Verkhoshansky, 1999) and goal-setting (for review see Burton, Naylor & Holliday, 2002). However, if the first two themes of *identification* and *action* offer a period of de-stabilisation, there is a need for newly formed patterns of behaviour or cognition to re-stabilise before optimal performance can be achieved. Once again, meta-cognitive research would indicate this is achieved through self-regulatory strategies which incorporate appropriate monitoring and control systems (Nelson, 1996; Perfect & Schwartz, 2002).

The third, fourth and fifth themes (establish, evaluate and empower) will be discussed together due to their co-existence within what has been described as a re-stabilisation period. Once again, while we pay particular focus to the athlete, the reader is reminded of the importance of the process to coach, team and organization alike. Before monitoring and control can occur, there is a requirement to decrease excessive variance in performance and

establish skills which have been simulated, fractioned, simplified and segmented on the practice ground, by allowing them to morph within the 'competitive arena'. Furthermore, due to the adaptive characteristic of expertise (Simonton, 1999, 2000; Study 1), the ability to retain and transfer skills becomes critical. As such, only after skills are established as well retained and transferable, can monitoring and control occur through accurate *evaluation*, preferably in the performance arena. This can be achieved through introspective awareness, coach analysis, performance and behavioural analysis, or through many of the technical (biological, chemical, mechanical or computer) apparatus available to the sport scientist or other specialists. The *empower* feature provides the important 'self-regulatory' and 'self-determination' role that ensures expertise can be achieved via ownership of developmental issues. To achieve these states of regulation, determination and ownership, there is a requirement for both 'situational' and 'psychological' empowerment (Leach, 2003). Therefore, athletes require increased participative knowledge, development and decision-making authority (situational), with a focus on the enhancement of self-efficacy and self-belief (psychological) in order to augment and optimise responsiveness and openness to challenges as expertise increases. This theme of empowerment reflected the dimension of stabilisation that managers, coaches and referee's alluded to being a characteristic of more developed individuals and was considered as an important factor in developing 'emotional regulation' skills and 'mental toughness'. Indeed, a shift from autocratic coaching and management to one of individual empowerment is hypothesised as a necessity of expertise. If individuals partake in a task which is complex adaptive, there is a need to make a shift from 'high levels of competence' to 'expertise' through an ability to adapt to the challenges on the training ground or sporting arena intrinsically and with immediacy. As such empowerment should not only be viewed as an effective strategy for promoting expertise (Hardy & Leiba-O'Sullivan, 1998; Leach, *et al*, 2001; Leach *et al*, 2004), but as an essential

process dimension at micro, meso and macro-developmental levels.

The micro-ethnographic research (Ollis, 2002) provided a cyclical and iterative meta-level model of expertise constructed from five themes reflecting change in the referee's pursuit of excellence. This has been expanded to embrace further principles of constructivism, meta-cognition, self-regulation, and a nested perspective of expertise. Similarities between the presented IAE³ model and the micro-development and meta-level models of change, which are to be discussed, are acknowledged, with concepts such as bridging (Granott, Fischer & Parziale, 2002) giving insight to appropriate developmental principles of a non-linear model of expertise. However, the present research focus primarily relates to the construction of theory from the IPA methodology adopted in the previous research. As such, the five themes reflected the constant change and flux, which occur at a micro-developmental level, emerging into meso- and macro-development issues, as we travel along the time-scale, and reflecting the more 'critical transitions' (hard transitions) on the pathway to excellence. As demonstrated in Study 1, these critical transitions, at least in the present refereeing context, were non-representative of existing models of expertise (e.g. Bloom, 1985) and reflected the day to day factors that integrate and multiply to construct the expert performer. Furthermore, it can also be expressed that for many of the participants, macro-transitions *were* micro-transitions, supporting the strong idiographic nature of expertise development.

The IAE³ model reflects the need for talent development and expertise research to focus on the concepts of transition and change at a meta-level, which incorporates the various domains of analysis (intra-personal, inter-personal, group, cultural), various domains of expertise (physical, technical, tactical, mental) and various time-scales (macro-, meso-,

micro-). Accordingly, the IAE³ model is primarily absorbed by a neo-Piagetan account of constructivist development, with a continual process of developmental succession. Levels of expertise are actively constructed through assimilation, accommodation and equilibration as the athletes makes appropriate change and transition towards excellence. Understanding IAE³ as a cyclical, continual and multi-level process reflects the non-linear dynamical principles of a discontinuous, self-organising and transactional process, leading to an understanding of change which is accomplished at emergenic micro-levels. However, as previously mentioned, this requires theoretical support, before future testing.

Change and Transition Processes

It has been affirmed that expertise is indeed a multi-layered and dynamic process which requires to be understood as the chaotic, emergenic, adaptive and complex system to which it is. Pathways to excellence are indeed complex and require a regulation of self (inclusive of his/her environment) which can identify, optimise and act upon leverage points and opportunities, as well as protect and defend the self against maladaptive effects during long-term development. Thus, it can be inferred that there exists a need to adopt a methodological approach and model which understands and reflects this chaotic and complex system and which also has the potential to eventually unfurl into a seemingly orderly peak performance. Not a model or methodological approach which negates the dominant reductionist and controlled approach to understanding expertise development, but one which is complementary and offers balance to what can be perceived as an existing bias. Accordingly, the present model aims to integrate reductionist and pluralistic perspectives. As such, the model advocates that (1) expertise is always under construction, (2) expertise development is regulated both implicitly or explicitly, (3) expertise depends on collaborative interaction of multiple afferent and efferent domains, (4) expertise development nests within

the intra-individual, inter-individual, group, social and cultural situe, (5) expertise development requires a meta-level perspective which integrates the temporal dynamics of both micro- and macro-development, (6) expertise has to afford ‘plasticity and adaptability’ and (7) expertise has to integrate both planned and emergenic properties.

As a complex adaptive system, it was suggested how important an iterative process is to long-term stability. Thus, we wish to expand upon this notion through various fields already identified in the literature. To accomplish this objective, micro-development models, constructivist systems, dynamical field theory, regulated development (goal-setting and attentional skills training), change management, periodization and action research are considered. Together with the IPA study, it is desirable to find some coherence within what can be described as shared principle of ‘optimal’ change and transition.

Models of Change and Transition

Micro-development models

“Micro-development is the process of recovering and re-organising skills when confronting novel problems in order to construct new skills that are needed to meet the demands of the new problem. Micro-development is learning structured in the short term in ways similar to development over a lifetime” (Schwartz & Fischer, 2004). What is emphasised in this quote is a shift from understanding development in relation to stages of development, which can expand for years towards an understanding of the process of development and change in abilities, knowledge and understanding during short-term spans. Instead of characterising abilities at different periods of a performer’s career, researchers

investigate processes of development and learning that evolve through time, and explain what enables progress in them. What is suggested is that this account of development may be more appropriate for understanding *how* expertise is nurtured.

Micro-development research examines the processes within specific task contexts focussing upon how people learn, adapt to new circumstances and environments, change their behaviour, discover new strategies, solve unfamiliar problems, create new understanding, and develop new abilities. Findings to date have suggested that variability is the most consistent attributes of developmental processes, and that there is a strong inter-relation between changes in the long-term (LT), short-term (ST) and the crucial effect of context. Furthermore, micro-development is more appropriate in identifying the mechanisms that create transitions showing that attribute of development are similar to those expected from learning processes and vice-versa (Granott & Parziale, 2002).

To understand the benefits of micro-development to the development of talent and expertise, it is maybe appropriate to look at the workings of existing models. Therefore, we progress to the understanding of two exemplar models, namely 'Kuhn's meta-level process' (Kuhn & Pearsall, 1998; Kuhn, 2002), the 'bridging' process of development (Granott, Fischer & Parziale, 2002). The first model is Kuhn's (2002) 'meta-level process', which proposes the importance of adopting a system where an individual engages in self-directed activity with the purpose of acquiring knowledge within some domain (e.g. sport). Kuhn (2002) claims that strategies cannot exist in a void, exercised for their own sake. Rather, they function in relation to a goal, defined by a task that the individual has accepted and engaged in. Therefore, to connect tasks to strategies, there is what Kuhn describes as a 'meta-level of operation' occurrence where individuals "*select* strategies to apply, in relation to task goals,

and *manage* and *monitor* their application” (p. 116). Anecdotally, these three phases reflect the understanding of effective and efficient development within the sport, supported with Ericsson’s (2003) argument that “there is compelling evidence that expert performance is mediated by complex mechanisms that *anticipate, prepare, monitor, and evaluate* its execution of actions” (p.119).

The second model, bridging, is defined as a “transition mechanism allowing individuals to direct their own learning and development towards achieving a goal” (Granott, Fischer & Parziale, 2002, p.131). The process of bridging operates as an attractor in the dynamic systems and pulls development towards a more advanced, relatively stable state. Bridging has been utilized in various micro-development studies as a scaffolding system where new ideas, learning and development can be categorized and observed, and therefore seems an appropriate concept that reflects the needs of coaches, athletes and sporting institutions. Although research into the transition process during short-time spans has been found to have broad applicability to most change situations (Granott & Parziale, 2002), further studies of ‘change dynamics’ (Burnes, 1996, 1998, 2000; Guastello, 2002; Hodgkinson, 2003) do exist and merit evaluation.

Micro-development principles are also evident as ‘the micro-genetic method’ (Flynn, Pine & Lewis, 2006; Granott & Parziale, 2002), where they have received support in various developmental domains including memory and organisational skills (Schlagmuller & Schneider, 2002), attentional strategies (Miller & Aloise-Young, 1996), understanding of science (Pine, Lufkin & Messer, 2004), inhibitory control (Flynn, O’Malley & Wood, 2004) and the stability and continuity evident in mind development (Flynn, in press). Flynn, Pine & Lewis (2006) conceive how “microgenetic methods have much to offer to the understanding

of the cornerstone of psychological research- change” (p.155) allowing us to understand (a) paths of change, (b) the rate of change, (c) the breadth of change, (d) the variability of change, and (e) the source of change (Siegler, 2006). While Flynn, Pine & Lewis (2006) identify micro-genetics and micro-development research as a crucial next step in a variety of applied settings (e.g. teaching) where generic stages and processes have already been developed, it is important that the appropriateness of this methodology in expertise research is highly pertinent.

Constructivist systems and dynamical field theory

The adoption of non-linear dynamics to the study of development has grown dramatically in the last decade (Thelen & Smith, 1994). Thus, developmental disciplines have begun to focus on the non-linear, emergent, dynamical and self-organisational processes inherent to this approach. Within this philosophical approach to the study of human development many researchers (Granott & Parziale, 2002; Mascolo & Fischer, 2005) advocate micro-development studies as a constructionist system.

Dynamical skill theory is a constructivist model of development which “maintains that transformations in psychological structures are tied to specific tasks, domains and social contexts. While retaining the principle that individual action functions as a central organiser of cognitive change, the new constructivism more fully embraces the joining of biological, psychological and socio-cultural processes as co-acting causes of cognitive change” (Mascolo & Fischer, 2005, p.62). The theory offers a “dynamic framework for describing, assessing, analysing, and explaining how person and world function together in human development, building on the tools of dynamic systems theory” (Fischer & Yan, 2002, p.280).

While chaos and variation are general principles of dynamical systems, it has also been recognised that this complexity involves fractals (Guastello, 2002). Fractals are “seemingly random shapes which can be generated by relatively simple equations that characterise fractal structures” (p.11). From an expertise perspective, it can therefore be proposed that as fractal structures are self-repeating over space, levels of magnitude, or more generally scale, that the IAE³ may be proposed as a qualitative fractal structure. While research in fractals has to date focussed on the geometric structures (see www.sprott.physics.wisc.edu), what is proposed is that the ‘concept of fractal’ iteration can be recognised as a key principle in how we pursue the development of expertise. While expertise is assumed as a complex dynamical process, which on the surface can appear as complicated, it may in essence morph from an inherent and cyclical feature of human development.

Fischer & Rose (1998) have already proposed a recurring growth cycle in behaviour and the brain which can have important implications for educational practice and policy. Within the review, recognition was given to discoveries about brain functioning leading to the first evidence of recurring growth cycles, and the consequential parallels with cognitive developmental cycles (Somsen, van’t Klooster, van der Molen, van Leeuwen & Licht, 1997). Fischer and Yan (2002) also recognise that while levels of development can be identified in shared contexts, a further structure could also be identified within the series- a cycle of levels which they called tiers (p.286). Akin to the proposed IAE³ model of expertise, the cycle of levels and tiers are an iterative and cyclical process, which on completion begins over again, thus producing evidence of the growth cycle and optimisation of performance. As a constructivist model of development, the ability to regulate development across all domains is therefore a critical component of such a growth cycle.

Regulated development

Within the constructivist approach to development, not only does developmental change occur as a creation of relations between biological, psychological and socio-cultural productions, but development is also recognised as a multidirectional web where different skills develop along different trajectories for different tasks, domains, persons, contexts and cultures (Mascolo & Fischer, 2005). Hence, regulated development is deemed a critical component for the adaptive self-control and self-monitoring of the diverging and converging pathways associated with dynamic development. Expertise development, like the basic requirements of human functioning, will therefore require to fulfil the management of selectivity and the compensation of failure experiences (Heckhausen & Schulz, 1998) if optimisation is to occur. Self-regulatory skills can therefore be considered as distinct and fundamental processes of expertise where individuals must adapt to affordances and constraints offered by the multidirectional web. Krampe & Baltes (2003) recognise that becoming an expert is a long distance race requiring developmental negotiation of both internal and external influences. Additionally, they espouse their view with the theory of deliberate practice by assuming “expert individuals face a continuous quest for methods to overcome and push beyond limitations and weaknesses in their performance” and that “attaining expert-level performance requires the mastery of an existing repertoire and skills and the individual can rely on known training methods and role models in this context” (p.36). This indeed reflects Ericsson, Krampe & Tesch-Romer’s (1993) and Ericsson & Lehmann’s (1996) acknowledgement of expertise development amounting to a long-term process resulting in maximum adaptation (and thus regulation) to specific task constraints.

Zimmerman & Kitsantas (2005) state that “research on academic and athletic self-regulation reveals that an individual’s development of optimal competence requires more

than basic talent and high quality instruction; it involves self-regulatory skill and accompanying self-motivational beliefs” (p.523). Therefore, individuals who achieve excellence are deemed to optimise the self-regulatory process which Zimmerman & Campillo (2003) distinguish as three cyclical self-regulatory phases: forethought, performance and self-reflection (see figure 4.2)

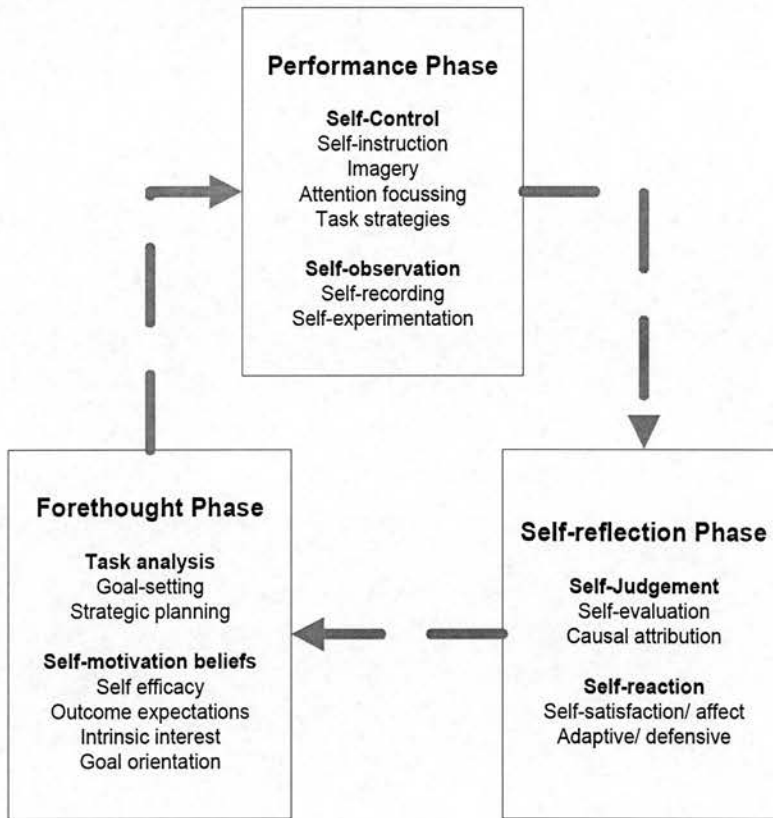


Figure 4.2. Zimmerman & Campillo’s (2003) cyclical model of self-regulation.

Once again, there is support for the adoption of a micro-analytic and cyclical model of ‘regulated development’ which affords recognition in psycho-social dynamic and constructivist principles. Ericsson (2003) derives “the principle challenge for attaining expert performance is that further improvements require continuously increased challenges that raise

the performance beyond its current level” (p.116). Attaining expertise requires an ongoing and cyclical process which endorses attentive, focussed and effective regulation of one’s development. Indeed, Ericsson further conceives of “expert performance as mediated by complex integrated systems of representations for the execution, monitoring, planning and analyses of performance” (p.116): In sum, self-regulation.

An essential aspect of self-regulation is the adoption of an effective goal-setting process. Goal-setting and goal orientation are recognised within the ‘forethought phase’ of Zimmerman & Campillo’s (2003) model of self-regulation and are considered representative of any effective performance enhancement program. Attention is a key concept in both goal-setting and self-regulation. Fitzsimons & Bargh (2004) recognise “Selective attention is, without a doubt, a strategic self-regulatory process: Individuals focus attention on what is important (the current goal) and are thereby vigilant for goal-relevant information in the environment” (p.153). One of the dominant theories in the development of expertise, and one which is used extensively in the motor-learning domain, is the Fitts & Posner (1967) model of development. The model is a three-stage model where individuals shift from cognitive, to associative, to an automatic dominance as competence and expertise is developed. While this has been associated with a long-term development model, which will be defined as macro-development, Gray (2004) has perceived the model alternatively, and more in alignment with the tenets of the existing research. While conducting the development of attentional expertise in baseball batting, Gray concluded with research findings indicating that the stages of cognition-association-automaticity (Fitts & Posner, 1967) are a cyclical and iterative process, and thus more akin to that of a micro-development model.

Change management

As a nested principle of expertise, capability of understanding human development as a process of change allows us to draw from the co-constructive properties of the IAE³ model. Accordingly, while the processes of change evident in a team and organization are understood as impinging upon individual development, it seems appropriate to draw upon research in the process of organization change to give support and direction for the development of the IAE³ model itself. There has been a recent appreciation of the importance of organisational development in the occupational sector creating a field of research and theoretical accounts. This process of organisational development has a common feature of change and is accordingly termed change management (Burnes, 2000; Ivancevich & Matteson, 2002).

In order to succeed in uncertainty and continual change, organizations, coaches and the more self-regulated athletes have to create new perspectives and learn from the chaos within which they operate. Research in change dynamics therefore focuses on how we make transitions and the process involved. For example, Lewin (1947) developed a three-step model of change which is an iterative, cyclical process involving diagnosis, action and evaluation, and further action and evaluation. Lewin identified how successful change involves three steps recognized as unfreezing the present level, moving to the new level, and refreezing the new level.

As well as structural, techno-structural, strategic management and performance management interventions, human process interventions have featured on change of interpersonal, group, organisational, cultural and environmental processes. Once again, this is highly reflective of the psycho-social dynamic process, which the present review advocates

as necessary for understanding how expertise may be developed. Even more appropriately, the adoption of non-linear dynamic system principles has been frequented in change management and organisational development to negotiate the challenge of complexity within the field (Stacey, 2000).

Existing organisational meta-change model

Bullock & Batten (1985) are two of many writers who have expanded Lewin's work; in their case, into a four-stage model of change based on a review and synthesis of over 30 models of planned change. The four-stage model reflects not only in the need to identify change phases, but also incorporates attendant change processes:

- Exploration phase - a period where explorations and decisions to change are formulated involving processes of being aware of need to change, support identification and definition of responsibilities.
- Planning phase - a period where understanding problems and concerns occur involving processes of quality diagnosis, goal-setting and gaining support of key decision makers.
- Action phase - this is where change is derived from the planning involving processes establishing appropriate arrangements and evaluation.
- Integration phase - a period where changes have been successfully implemented involving processes of consolidation and stabilization through feedback, reward systems and support.

This model has been found to have broad applicability to most change situations, although it fails to address the changing nature of organization development including the

move away from autocratic organizations, and displays an inability to incorporate radical and transformational change. Addressing these shortcomings has seen the evolution of what has been termed the 'emergent approach to change' (Burnes, 2002), an approach which, reflecting the research findings on talent development, emphasizes firstly the interconnectedness of change over time, secondly how the context of change shapes and is shaped by action and finally the multi-causal and non-linear nature of change.

However, the proponents of emergent change, although united by their skepticism regarding planned change, do not have an agreed alternative. They do have some agreements regarding the main tenets of emergent change however, including two main issues (Burnes, 2002). The first is that organizational change is a continuous process of experiment and adaptation aimed at matching an organization's capabilities to the needs and dictates of a dynamic and uncertain environment. Secondly, this is best achieved through a multitude of (mainly) small to medium scale incremental changes, which over time can lead to a major re-configuration and transformation of an organization. This indeed reflects the nature of talent and expertise development as expressed in the IPA study (Ollis, 2002), and also addresses unresolved issues that exist due to the limitations of previously adopted conceptual models. Indeed, if no model of development can address the 'process and transition problem', then how can we resolve the issues of understanding change?

The present paper advocates the case for an emergent approach to change based on the assumption that sporting organizations, coaches and athletes operate in a turbulent, dynamic and unpredictable environment. This has to be balanced against avocation, much like Bloom's (1985), that a dimension of predictability exists that can be planned for. By understanding and identifying the controllable factors that exist within the individual,

management, organizational and environmental symbiosis of the sporting environment, along with the meta-level operation of change, we can operate in a turbulent, dynamic and unpredictable environment – an approach somewhat simplistically applied by sport psychologists as “control the controllables”! Although ‘change dynamics’ has been found to have broad applicability to most change situations, further research into the transition process during short-time spans does exist (Granott & Parziale, 2002). To date however, it is Lewin’s (1947) three-step model of change which has been used extensively in organisational development evaluation.

Action Research

Lewin’s (1947) three step model of change is also recognised as the principle cyclical process in action research design. The iterative cycle of research and action is not only recognised at the organisational level however. Action research recognises that the development of change in action expands into considerable collaboration and reciprocity between individuals, teams, groups, organisations, global settings and cultures.

While the origins of action research nest within organisational development, a recent shift has seen the methodology being adopted for change and development in educational settings. The improvement of educational practice, while at all times being social, incorporates both individual experiences and group dynamics. Thus action research has the potential to support the psycho-social dynamic principles and constructive approach to expertise development afforded earlier where we understand expertise as a concept of ‘self’, which is individual, relational and collective.

Action research accounts for this approach to self as three broad pathways of research. The pathways are termed first person, second person and third person types of research. First person research is reflective of the individual self which addresses “the ability of the researcher to foster an inquiring approach to his or her own life” (Reason & Bradbury, 2006, p.xxv) and “enhances awareness of incongruities among our intent, our strategies, our actual performance and our effects” (Torbert, 2006, p.207). Second person research is reflective of the relational self by “encouraging mutual inquiry and mutual influence” (Torbert, 2006, p.207) which may include groups, communities and learning organisations. Meanwhile, third person action research is reflective of the collective self where inquiry focuses upon the collective future and transformation of strategies, practice and procedures.

Periodisation

Periodisation is a sport specific management of talent development, designing of sports training programs and peaking of performance at pre-determined times. Much like any development, the ability to peak for a specific performance is a complex matter. Periodisation has been researched as a sequential, cumulative process which utilises the iteration of stages, cycles and plans indicating that a transitions approach flexible over varying time-scales is necessary. Bompa accords training cycles as both micro- and macro-cycles which are re-iterated over daily, weekly, and 4-weekly periods. The accumulation of macro-cycles afford an annual or seasonal training program, which in turn morph into long-term planning and talent development programs covering 4-yearly (quadrennial) and ‘full career’ (10- 15- 20 yearly development programs dependent on sports).

Research in periodization has been predominated with the physiological components of strength, power, bio-motor abilities and endurance development. By controlling variables

of training (volume, intensity, density and complexity) and monitoring acquisition, performance and specific energy levels (including lactic acid tolerance, maximum oxygen consumption, anaerobic threshold, phosphate system and aerobic threshold- see Bompa), the ability to peak in performance can be enhanced.

Summary of transition models

The critical feature which the present research espouses as necessary for any talent development program is an effective transition (micro, meso, macro) process which optimizes the development of talent and expertise in both earlier and latter stages of involvement. This transition process requires to be considered as a meta-cognitive approach spanning the psycho-social dynamic, multi-dimensional, regulative, progressive, and can account for macro-, meso- and micro-time-scales of development. While the IAE³ model cultivates from a qualitative and phenomenological (IPA) account of development in refereeing, it is proposed that an accumulation of features of the 'transition models' reviewed in the present study offer strength, support and direction to the potential of a psycho-social dynamic, constructive and regulated development understanding of expertise. Furthermore, the generalization of the model to encompass a holistic account of various performance fields inclusive of sport, music, art, occupational and educational domains is pertinent to the present work.

Each of the reviewed transition models were considered iterative and shared features of identification- action- establish- evaluate- and empower. While some may be pre-dominated with individual transition (e.g. self-regulation), others featured upon collective transition (e.g. change management and action research). Additionally, while change management, along with existing models of talent development testify to the macro-development features of

'stage' orientated development, the recent adoption of micro-development models and dynamic field theory recognize the importance of emphasis on smaller-scale development studies which allow the idiosyncratic nature of development to be further understood and emergent qualities of development to be compensated and function optimally. Together, each of the transition models and strategies reviewed brought support and synergy to the appropriateness of the IAE³ model as a mechanism for understanding, constructing and researching how expertise develops.

Constructing Theory

'Deliberate practice' has been recognised as the existing 'general' theory of expertise. Both the review of literature, Study 1 and alternative expertise research (Critien & Ollis, 2006; Ollis, Button & Fairweather, 2005) have considered that there is a need for more than deliberate practice alone to construct and assist in the development of an expert. The adoption of psycho-social dynamic systems, constructivism and regulated development as the main tenets of a future theory, and the initial IAE³ model through IPA provides a model which *may* offer a future theory of expertise. The review of research and models of 'transition', 'regulation' and 'development', although ill-featured in the performance or expertise development domain, afford potential for such a venture. What has to be considered however, are if these existing findings merit consideration as a theory of expertise. Raftopoulos & Constantinou (2004) recognise that any theory of cognitive (or meta-representation) change needs to satisfy four requirements. These are:

1. to be able to account for change, a theory must be able to specify what is changing. Accordingly, the present thesis will acknowledge the variables of change pertinent to expertise development from a psycho-social dynamic and constructivist perspective.

2. it should also specify a theory of developmental sequences and functions which illustrates what is generated by the change. For the existing thesis, this accounts for the development of expertise itself and alludes to 'stages of development and learning' existing at present.

3. it requires a theory about types of change at all levels of description, and a theory of the mechanisms indicating how change occurs. This could include the adoption of Demetriou & Raftopoulos's (1999) mechanisms of change. The five mechanisms of change are considered from Demetriou & Raftopoulos's (1999) cognitive mechanisms of change which are identified as 'bridging', 'interweaving', 'fusion', 'differentiation' and 'refinement'. Each of the mechanisms represented various types of change that are observed in development and learning and attempt to show how change and transition occurs within and across systems, stages and levels. The purpose of the present review is not to consider the details of the five mechanisms, but highlight their existence in developmental research at present. Readers are advised to source the primary reading for further details of the mechanisms. While these five types of conceptual mechanisms were previously identified at the cognitive level, Raftopoulos & Constantinou (2004) recognise that the types of change also require to be considered meta-representational. Accordingly, inclusion of an environment-orientated domain-specific, as well as a self-orientated and organisation of mind perspective of 'cognitive' change is accounted for. As such, what is offered is that mind is situated within an integration of environment, individual and task, so adopting a constraints

led-perspective of learning. Mind and cognition cannot fulfil the development of expertise due to the tight connection between agent and the world, and the synchronisation required between task, individual and environment existing beyond brain representations. Furthermore, they also recognise the importance of dynamical systems theory, and therefore offer self-organisation as an additional model of change congruent with their dynamical connectionist account.

4. it finally requires a theory of developmental causes including specification of what makes progression along the sequences possible. In other words, it needs to specify why change occurs. If we adopted the existing theory of expertise, the 'why change occurs' would reflect engagement with deliberate practice. However, both the review and first study allude to additional developmental causes including deliberate experience and transfer of skills. Further investigation of developmental causes is required due to suggestion of 'mindfulness' and 'implicit learning' as meaningful to a theory of developmental causes

It is believed that further research has to be considered before these present findings merit consideration as a theory of expertise. However, a directive of research for the construction of a future theory based on the IAE³ seems feasible. This remains out-with the aims and objectives of the present thesis, but which gives future scope towards positivist research design.

Concluding Remarks, Implications and Future Research

The primary purpose of this paper has been to expand upon the findings of an IPA study in the refereeing context (Ollis, 2002), and along with the findings and suggestions

from both the literature and full ethnography (Study 1) which identified a multi-iterative process that unfolds over extended periods of time. The findings focused upon a model termed IAE³ which spanned multiple layers and domains of expertise; integrated micro-, meso- and macro- time spans and integrated the full individual, relational and collective field. The progression was endorsed by identification of further studies, research and models of development in the field of 'change and transition' supporting a meta-level model of regulated development which endorses an emergenic characterisation of expertise development.

The present chapter advocates a principle where expertise is situated and contextualized. Accordingly, maintaining motivation and persistence required to ensure pursuit of expertise is maintained endorses the meta-level model of expertise. The adoption of IAE³ critiques prior conceptions of expertise as a sequence of phase-stage development, but rather one of a recurring micro-developmental cycle integrating task, individual and environmental constraints. It can be proposed that within many contexts, similarities can be afforded to cycles evident over longer time-scales (meso- and macro-development recognised as 'stages'), but it is the micro-development process which affords an ability to better understand *how* we develop expertise.

The development of expertise is in consequence an eminent framework of evolving and hierarchical skills which are developed through the properties of meta-level transition and change. As a model which adheres to psycho-social dynamical principles and constructivist principles, the ability to enhance expertise is therefore endorsed as a personal creation that is contextually, socially and historically mediated. More importantly however, it is the same meta-level structure which is evident at all levels of development.

Practical implications from the adoption of the present findings are considerable. This spans from an emphasis of expertise, which is understood as both collective and individual, and with the consideration that chance, chaos and unpredictability are predominant features of talent development, and maybe more critically, talent identification. Thus, adoption at the model would be pertinent to individual performers, coaches, peers, families, group dynamics, sports development agencies, their associative development programs and governmental agencies who make fundamental decisions in ability to provide facilities and funding for competition and training, as well as the 'stipulations' for many merit consideration for funding. It also shifts emphasis towards the multi-dimensional, integrative and pluralistic accounts, which emphasise greater consideration of motivational and regulative characteristics in the pursuit of expertise. Finally, it has substantial implications for the role of psychology (as well as other support agencies) in supporting the individual, coach and team. For example, the 'periodisation' of psychological skills are fully integrated and co-constructive to other training and competition affects and experiences. Thus, psychological periodization has to have greater flexibility and 'emergenic' qualities than the other domains of expertise.

The implications for future research in the adoption of IAE³, and the psycho-social dynamic and co-constructive tenets are also considerable. For example, studies may reflect on the co-constructive nature of expertise as an empirical account, inclusive of specific analysis on psycho-physiological, behavioral, cognitive, relational, cultural and collective dynamics. However, a decision to test the efficacy of the constructivist approach and IAE³ as a working model of development has been afforded through both constraint and opportunity.

CHAPTER 5. STUDY 2: AN ECOLOGICAL ASSESSMENT OF EXPERTISE IN A NATIONAL SHOOTING TEAM

Before, the constructivist principles and working model of IAE³ can be tested and evaluated, an appropriate and accurate assessment of the environment in which the 'research in action' will be conducted should be delivered. The thesis of this article is that the development of talent and expertise cannot be understood by focusing on individuals alone. Explanations of expertise are to be found integrative with cultural climates, organizational influences, group dynamics, relationships, and with how they are incorporated into a construct of self. The present study explores the efficacy of a more multifaceted and ecological evaluation of expertise and compares the results with existing research. The analysis of expertise is conducted within a squad of international air and small-bore shooters. The levels of analysis are considered as primary, secondary and tertiary and together suggest that there is a need to view expertise as a more holistic entity. Discussions of the findings ascribe the development of talent as psycho-social dynamic and co-constructive.

Evaluating expertise in Scottish air and small-bore shooting

In relation to the thesis aims and objectives, it was considered that it would be necessary to take theoretical nuance from observational studies (study 1) and operationalise them. The formulation of a micro-developmental model (which can exist at a meso- and macro-level as well) in IAE³ (chapter 4) allows us to explore the subject matter as a complex, multi-iterative process that unfolds over time and potentially establish IAE³ as an iterative meta-level process of expertise. Before the effectiveness of this model can be tested as 'research in action', it is necessary to evaluate the levels of expertise within the working domain to allow future analysis of progress and development to be accounted.

What determines a person's level of expertise? Historically, this has been achieved through measurements of abilities and was at one period believed synonymous with an individual's intelligence quotient (IQ), 'heredity' body composition and innate disposition. A shift towards a nurturist and domain specific approach occurred with the adoption of Ericsson, Krampe & Tesch-Romer's (1993) theory of deliberate practice which assumes that performance levels are a result of time spent in task specific practice activities. However, and guided by the findings of Study 1, expertise has been recognized as a complex phenomenon requiring a multifaceted approach to understand the intricacies required to develop optimal levels of performance (Simonton, 1999, 2000). While the theory of deliberate practice still remains the dominant theory of expertise, a series of studies recognize the substantial influence of both environmental constraints and individual qualities when optimizing performance. Accordingly, evaluating expertise through more holistic and multifaceted perspectives may give greater indication of an individual's expertise and greater indication of 'potential talent'. The aim of the present study is therefore to report the efficacy of a more multifaceted evaluation of expertise and compare the results with existing research.

Measuring Expertise

Studies examining expert performance have recently been dominated with the monotonic relationship between the number of hours undertaken and performance levels achieved during an individual's sporting career. Retrospective interviews have been utilized since Ericsson, Krampe & Tesch-Romer (1993) measured the volume of deliberate practice amongst violin students and piano experts. Within the research estimates of musical and everyday activities during their developmental path, the most recent 'typical' week and the previous day were considered as pertinent to overall expertise levels. The interview findings were then triangulated against diary sheets divided into 15-minute intervals over a full 7-day

week in relation to the volume of 'deliberate practice', leisure time and sleep.

Manipulations of this approach to measuring expertise were also conducted by Baker, Côté & Deakin (2005) who, during the analysis of 28 male ultra-endurance athletes, utilized not only retrospective interviews, but also training structure information and standardized training time based upon training time, effort and intensity calculations. This was accomplished by calculating 'training units' from a training time and intensity based on perceived heart rates. Training diaries were utilized for validity establishment. Due to the high physiological nature of triathlon, the capability to associate deliberate practice with 'physiological intensity' is appropriate, but fails to transfer to many other sports, where the capability and necessity to engage with deliberate practice would be afforded through cognitive load and alternative constraint. For example, physiological load would be ineffective as a marker for the shooting domain, although cognitive load *could* be suitable.

What emerged from reflection on how to measure the specifics and accuracy of deliberateness within 'deliberate practice' in a non-physiological domain (such as shooting) was the 'phenomenological' and 'subjective' nature of deliberate practice in shooting. For example, what may be demanding during a single training or competition context may be routine in another. Equally, what may be a deliberate practice period with high mental load for one individual may be routine practice for another. Additionally, the level of engagement with a task could only be inferred through an integration of self-evaluation, retrospective interviews, observational analysis (by coach and support staff), performance/outcome evaluation and psycho-physiological markers. The capability for coach to induce 'training load' was effectively more complex than for many alternative sports. Self-responsibility for task engagement indicated that the ability for a coach to increase training load had to be

'sanctioned' psychologically by the individual athlete.

This retrospective interview and diary approach has been utilized in various domains inclusive of the studies by Hodges & Starkes (1996) in wrestling expertise and Hodge & Deakin (1998) in martial arts. More recently, Baker, Côté & Abernethy (2003) have utilised a structured interview protocol for expertise development in various sporting activities based on that developed for gymnasts (Beamer, Côté & Ericsson, 1999). This has been extended to incorporate not only the practice activities undertaken during the duration of their careers, but more recently, to incorporate environmental influences. Côté, Ericsson & Law (2005) however failed to utilize such aspects within their generalized procedure for reporting information on development of athletes. The content of the interviews looked at levels of performance, domain related activities, limiting factors, height and weight, quality of training resources and health/injury. The present study felt these were overly constrained due to the overt adoption of the theoretical framework of deliberate practice to construct developmental attributes.

The premise of the existing study is that previous expertise and talent evaluations, such as Côté, Ericsson & Law's (2005) generalized retrospective interview method, fails to acknowledge the co-constructive and nested nature of expertise. More importantly, the inability to acknowledge that the theory of deliberate practice only indicates 'correlation' rather than causality or 'how' expertise is constructed is a major failing. It is proposed that a more holistic and causal pluralism has to be adopted in evaluation of expertise and talent development. Therefore an ecological evaluation of expertise which is holistic, nested and flexible is proposed.

Primary and Secondary Influences on Sport Expertise

Evaluation of expertise is approached through a multi-methodological perspective which not only analyses primary expertise (individual), but also analyses secondary expertise (environment). Baker & Horton (2004) acknowledge “primary influences on expertise as genetic, training and psychological factors while secondary influences include socio-cultural and contextual elements” (p.211). The utilization of Study 1 findings indicates that while the evaluation of expertise causality may require to be expanded, and the anarchic, as well as integrated nature of pluralism accounted for, that Baker & Horton have at least initiated awareness of the psycho-social and contextual influences pertinent to causality.

Study 1 indicates that plurality in the causality of expertise and peak performance has to be embraced by applied practitioners- athletes, coaches, support staff, organizations and governing bodies, if targeted achievements of excellence (e.g. Sport 21, 2004) are to be fulfilled. These achievements may be personal, organizational (e.g. long-term player development policies of governing bodies) or national policy (e.g. Sport 21, 2004; Player Improvement, 2005).

Aims of the Present Study

The main purpose of the present study was to examine both the primary and secondary influences underlying levels of expertise within a sport specific group. This can be termed an ecological task analysis. The study extends previous research through the adoption of an environmentally aware, holistic and integrated analysis which attends to current hypothesis suggested within expertise literature. The secondary purpose of the present study

is therefore to report the efficacy a more multifaceted, dynamic and ecological evaluation of expertise and compare the results with existing research and reports. While the present research was compiled in relation to benchmark levels of expertise which exist with the Scottish small-bore shooting team, it also served as a template for conducting future ecological task analysis as well as examining expertise and *how* expertise is developed.

Method

Participants

The participants formed the Scottish Target Shooting Federation (STSF) Scottish Small-bore Rifle Association (SSRA) and were recognized as the Scottish 'A' squad as existing in 2003. The squad consisted of 14 International standard shooters and two coaches. All participants have represented their nation at either junior or senior level between 3 to 20 years. The participants can be described as a 'convenience' sample due to the researcher's capacity as support for the squad in a 'sport science, performance and psychology' role. At the time of research, the experts sampled had a mean age of 32.7 years (± 12.2 ; range 19-51; 8-male and 6-female).

It is important to recognize the role of the researcher as a 'sport science, performance and psychology' support officer and that the research investigation served a primary tool for the 'preliminary investigation' of the squad, the organization, the coaches and member athletes. As well as the request from the STSF to conduct the research and consequent support activity, all participants were requested to and provided informed consent during preliminary interviews. Additionally, ethical approval was obtained from the University of Edinburgh Ethical Research Committee and the study conformed to the British Association of Sport and Exercise Sciences (BASES) and the British Psychological Society's (BPS) ethical

principles for conducting research and support with human participants.

Procedures

To reflect the philosophical assumptions of a 'nested' and complex expertise process, a multi-methodological approach was adopted in the study to ascertain both an individual and ecological assessment (inclusive of environment, support, task) of how this particular group, and the individuals involved, attained their specific levels of expertise. The research investigation was conducted over a three-month period and served as preliminary analysis of the SSRA and its members for future sport science, performance and psychology support, inclusive of short, medium and long-term development strategies.

An integration of qualitative and quantitative assessment was utilized through the data gathering process. Analysis procedures were conducted primarily at 'training camp' and 'competition' attendance. All individuals were requested to fill in an 'expertise questionnaire' (appendix 1) and 'shooting survey' (appendix 2) which were both then scrutinized and utilized for further semi-structured interviews, background/on-site discussion and observational analysis. Training logs, performance plans (individual and team) and training diaries were also analysed during the preliminary analysis. Both structured and semi-structured observational analysis was considered in this period, while secondary analysis of web-based materials, training session plans, team and individual periodization, academic research, shooting literature and organizational performance plans were conducted as desk research. While this was predominantly conducted chronologically as described, overlap of the phases of analysis did occur in consideration of athlete availability, emergence of analysis themes and the dynamic nature of evaluation looking at elements of change.

The researcher ensured that focus on the preliminary analysis was concerned with evaluation of the talent development as an ecological task analysis, with acceptance that a multi-causal, multi-organisational and multi-agent complexity was required to accurately reflect and promote expertise and talent development capability.

Measures

Survey Questionnaires

Two general survey questionnaires were adopted in the present study. The first was an 'expertise questionnaire' (appendix 1) focusing on demographics, long and short-term development goals, typical training behavior, involvement in shooting, specifics of training activities, specifics of a training activity, support networks, psychological skills, coach relationships and specifics of the athletes' pre-competition, pre-performance, in-performance and post-performance routine. The second was a 'shooting survey questionnaire' (appendix 2) focusing on evaluation of peak performance, poor performance, good training sessions, bad training sessions, distractions and competition preparation. Each athlete also constructed various performance profiles (appendix 3) to evaluate perceived developmental influences and self-ratings of performance.

Interviews

All athletes and coaches participated in a 60-90 minute interview which focused on elements recognized as 'deliberate practice', 'deliberate experience', 'mindful engagement' and 'transfer of skills'. Further attendance to environmental influences including team dynamics, lifestyle issues, familial support, sport science and technical support, work and educational support, cultural perspectives and existing goals were also accounted for. Interviews were recorded using a Sony DPC VOR digital recorder and downloaded to laptop

computer for further analysis. Less formal interviews and background/on-site discussions were also attributed as a suitable and valuable data source and notes taken and recorded at a suitable convenience.

Published Data Analysis

Research of results database (appendix 4a, b, c), existing reports, competition attendance, training attendance as well as performance and training logs (goals and objectives- see appendix 5) were collected. This included adoption of data from SportScotland, STSF, SSRA, and Commonwealth Games. Data offered from the lead coach was also integrated with this official data source (appendix 6). Analysis was constructed from both raw data or presented as existing data drawn from reports. For example, shooting medal success at Commonwealth games utilized raw data from both Commonwealth games and SSRA websites, while Scottish Commonwealth game medal success and 'sporting value' were derived from existing published figures and protocol.

Observational Analysis

Observational analysis was utilized at training and competition events with formal observational analysis considered activities, measured in 5 minute periods, over a full series of training weekends. Training activities, rest periods, coach contact and team meeting/discussions/discussions were coded against 5 minute time intervals against every athlete for two full days and two half days (appendix 7). These 5 minute intervals were extended to 15 and 30 minute intervals in later training camp analysis as training activities became more structured and compliance to organized activities increased. Training activities were considered against the domains of expertise including physical, technical, cognitive-tactical, cognitive-perceptual and emotional-psychological regulative skills. An additional

code of 'simulated competition' was also afforded for the training activities. Alternative formal observation analysis included an in-depth analysis of competition shooting including pre-performance routine and preparation, in-performance routine (time and accuracy of shot), post-performance routine and any other activities observed during this activity (i.e. distractions, weather, shooting constraints, weapon/ammunition/target failure, videoed, coach observed). These observations were concluded with a brief discussion of events to clarify observations at convenience of the athlete. While recorded quantitatively, the 'phenomenological' account of deliberateness was deemed most important as the researcher, coach and athlete made sense of the raw data.

Informal analysis was adopted through note-taking, 'daily reviews', 'weekend reviews' and 'episode reviews' (appendix 8). This sometimes afforded a more general review of training activities against the group and individuals, while on other periods this afforded a greater detail of analysis in relation to pre-established codes. The digital recorder, computer generated scripts and 'note-taking' were all utilized in this process dependent on environmental constraints, accessibility and opportunity.

Reliability and validity

Reliability and validity of the preliminary observational analysis was achieved through a series of opportunities. The primary tool was achieved through individual discussion centred on a 'preliminary analysis feedback report' given to individual athletes, coaches, team and organizational manager. Within these meetings raw data sources were utilized to confirm statements, observed data or recommendations. Additionally, management and coach meetings were conducted on an on-going basis to clarify findings and future on-going analysis. Thus, a collaborative approach to the ongoing ecological task

analysis was afforded. Finally, a focus group with all athletes attending a weekend training session was utilized to clarify and validate more holistic findings, observer perspectives and future suggestions.

Accuracy of interdependent analysis of interviews and observation analysis was deemed inappropriate and overly time consuming in relation to the specific aims and objectives. For example, video analysis of a performance routine could have been evaluated against in-situ observer analysis. However, absolute accuracy (e.g. a couple of seconds between a few shots) was deemed ineffectual to overall analysis.

Analysis

Deliberate Practice

According to data from the questionnaires, training plans and interviews as presented in Table 5.1, the volume of deliberate practice among the squad, as measured against the traditional 4 hours per day for 10 years, is at best only a moderate amount dependent upon individual and stage of development. The mean and standard deviation for estimated engagement with deliberate practice at a training weekend was 10.86 (± 1.51) hours. The mean and standard deviation for approximate times of observed periods (rounded up conservatively to the highest hour) in deliberate practice over the same period was 5.64 (± 1.08) hours. Therefore, estimations were approximately twice the amount of actual deliberate practice. It has to be recorded that these weekend training events fulfill a large percentage of the overall training time. Discussions with athletes about planned versus actual time in training practice also revealed decrease by approximately 25-40%. Distribution of practice is also stratified randomly throughout the year, with large volumes of training occurring at training weekends and periods of disengagement with shooting activity

seemingly evident. The time spent in preparation or attending to technical elements such as fitting equipment, sights, barrels or ammunition tests were not judged as measurements of deliberate practice. Qualitatively however, some athletes, dependent on context, deemed this period “*as a critical component of being an expert shooter*”.

Table 5.1. Comparison of estimated and observed engagement with deliberate practice conducted over a training weekend.

Athlete	Estimated Weekend Deliberate Practice	Observed Weekend Deliberate Practice
A	14	7
B	12	6
C	10	5
D	11	4
E	12	5
F	10	6
G	9	6
H	11	4
I	10	6
J	8	5
K	12	7
L	11	7
M	12	5
N	10	6

Overall, a large discrepancy between time in and estimations of ‘*deliberate*’ practice was reported. However, it could be considered that observational analysis occurred in a period where motivation was low. Indeed, this three month analysis was conducted initially during the winter period during cold weather conditions and before the competitive season was established. However, estimations of time in deliberate practice could have been compensated by athletes during the interviews and survey questionnaires.

Observational analysis and interviews also allowed the research to establish the considerable period of preparation and travel required to commit to deliberate practice. In a typical session of training, the participants required almost 4-7 hours of travel and preparation (dependent on proximity of range) for any form of engagement with deliberate practice. Furthermore, while a 'full and busy' weekend session would require 48 hours away from home, the time spent in actual deliberate practice was recorded in the observational analysis as 5-6 hours. This included 'simulated competition', but not what has been recognized as deliberate mindfulness. Other activities included discussion groups, assisting peers, physiotherapy attendance and management meetings as well as previously discussed time required for preparation and technical adjustment. These weekends were deemed as the largest contribution to quality practice time.

Observational analysis also allowed *quality and deliberateness* of practice to be highlighted. For the present group, it was desired that training had to be more individualised and challenging due to the contextualized perception of training needs. Individuals were predominantly "*going through the motions*" during training sessions without any real purpose. Large periods of time were "*trying out new equipment*", "*changing barrels*", "*playing with different ammunition or sights*" or "*just doing what the coach has told us to do*". However, it has to be recognized that these are also features of a shooter's 'deliberate practice'. Coaches felt that they were either focusing on long-term periodization and planning or attenuating to individual problems such as fitting of equipment and clothing in the here and now. The phenomenological account of deliberate practice was afforded to the shooter's engagement with task as an individual.

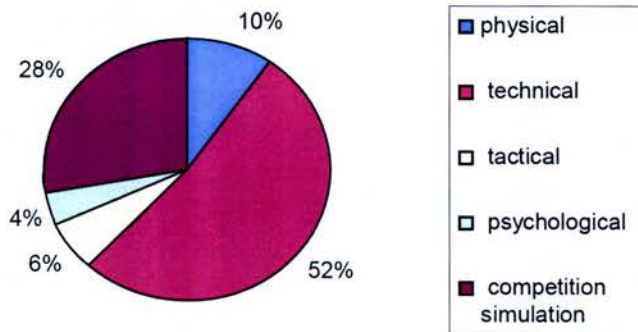


Figure 5.2. Percentage of time allocated to specific training activities

Training Activities

The cumulative hours spent in training activities as assessed through interviews, observational analysis, training log analysis and discussions were calculated both in volume and detail before being offered as an overall percentage (Figure 5.1) for weekly engagement over the three month period. It is therefore considered that both small-bore and air-rifle shooting are highly technical sports with almost 52% of training time spent on specific technical activities during this period. Physical activity was moderate at 10% but much of this was accorded to general health and fitness rather than specific shooting drills. Competition simulation was utilized as training activities due to its prominent use in training sessions. It should be recorded that observer evaluation, supported with confirmatory analysis by the team coach, that many of the training activities displaying an integrative feature where elements such as psychological skills and tactical development were features of either competition simulation or technical drills. Once again, the athletes' stage of development and periodization cycles have to be considered within this evaluation as technical nuances, requiring attention at the beginning of the season, would decrease. However, evaluation of annual training plans also reflected maintenance of this apparent

technical dominance.

As a group, physiological preparation was ill-attended to with many of the individuals utilizing personal fitness and health activities as the only contributor to physical conditioning. The demands of the sport are very different to other sporting activities however, where the aim of shooting is to remain as still and able as possible. Additionally, any form of muscle activation during shooting is detrimental to performance. However, the beneficial effects of physical conditioning has positive effects on postural and structural fitness, the capability to partake in lengthy training and competitive events, the psychological benefits of fitness (e.g. coping, mental functioning, self-efficacy, self-esteem) and general well-being and health (MacAuley, 1999). Structural fitness was addressed by an affiliated physiotherapist who attended weekend training events. The physiotherapist also conducted class activities, including the design of a general pre-performance stretching program with workshop.

Out-with attention to technical features, the predominant approach to practice during the present phase of analysis was the adoption of 60-shot match simulations, with attention to various action points for each individual. This could include 'breaking in a new jacket', 'building a new position', 'testing ammo' or 'shooting endurance' (remembering this was effectively pre-season training). The coaches would periodically attend to athletes with focus on a specific issue. This could include the shooting position corrections, placement of accessories such as telescope, stand and ammunition tray or shooting execution. Technical support was provided with performance feedback via equipment such as SCATT and NOPTTELL (computer aided training systems attached to rifle and target), which allowed specifics such as 'hold', 'zero', 'shot release' and 'follow through' to be inferred.

Deliberate Experience

Shooters attended between fifteen and thirty-five shooting national/international competitions each year. The volume was dependent on individuals shooting only prone or 3P, air or small-bore, or if they participated in them all. Additionally, shooters competed in local, university and club competitions on an approximately weekly basis, including the need to fulfill completion of 'score cards'. Each competition lasts between 90 minutes (prone and air) and 150 minutes (3-positions) but this includes time for match preparation and transitions. For example, international matches would require individuals to be in attendance for periods of one week to thirty days (Commonwealth Games). Therefore, actual preparation and time at the range increases considerably. Furthermore, competitions may require individuals to shoot in a qualifier and a 'final', which consists of the top 8 shooters conducting a further 10 shots. Accordingly, large periods of time were allocated for competition travel, attendance and preparation.

Coach and athlete discussed annually the importance attributed to the season's events, utilizing a 5 point priority scale (see appendix 5). Attendance during this season (2004) was focused on national (Scottish and UK events) and selection for future Commonwealth championship squads. The most important shooting event of the year was given to the CSF(ED) to be held at the end of the season (September, 2004) at the Isle of Man. Although not a 'huge' match on an international scale, it would give management and the team indication of team and individual development during an international event.

Deliberate Mindfulness

Deliberate mindfulness was considered as watching shooting, discussing shooting with peers or support staff (including coach), utilizing imagery as a psychological training

activity, reading about the sport, talking about the sport and reviewing video or computer generated data with a 'critical and engaged' perspective. Deliberate mindfulness was reported by athletes and coaches alike, as a pre-performance variable, a within-performance variable and as a post-performance variable including a shot, string, match, competition or long-term development reflection (appendix 4, appendix 7). It was impossible to ascertain a quantifiable account of deliberate mindfulness due to the athlete and coach reporting of the emergent nature of topic engagement within the group. For example athletes discussed on a good day they would *"have nothing but shooting on their minds"*, whilst at other periods they could go weeks without any form of mindful engagement. Individuals were attributed as more or less 'mindfully engaged' than others with consistency of evaluations stable. However, it should be noted that many of the athletes accounted *"mindfulness as a double-edged sword as sometimes it is important not to think. If you look as what Gavin was doing with us...it was about training for trust and not mental engaging....just being in the zone"*. What is important to recognize is the large volume of deliberate mindfulness recorded in relation to deliberate practice and deliberate experience. Once again, capability to afford accuracy of deliberateness is complex due to the contextual nature of the subject matter, with individuals and groups noting how thinking about a matter on one day is the right thing to do, but can be disastrous on another day. While not in accordance with the definitions of deliberate practice, the group believed that deliberate mindfulness could frequently be a form of deliberate practice or indeed, critical to deliberate experience, due to its potential for reflective properties.

The reason for a high account of deliberate mindfulness in the shooting environment was accounted towards 'cost of shooting', 'travel and preparation to shoot', 'necessity to reflect' and the perceived importance of the 'mind' in shooting. The approach to deliberate

mindfulness was recognized as important, but little formal or strategic structure to the issue was recognized or offered by any individual during interviews or in-situe discussions at either competition or training.

Transfer of Skills

These were merited highly by the group. Two primary examples include experiences of competing at dance competitions as creating great coping skills, while others included work experiences which were transferable, such as person-management skills, physical activities enhancing general levels of fitness and skills, such as computer/technical expertise, which benefited both the team and individuals.

Sporting Success

Sporting success was evaluated against medal success at Commonwealth Games, as the team featured little at Olympic, World or European levels. Figure 5.3 presents a time series analysis of medals won of any hue (i.e. gold, silver or bronze); medal points (i.e. gold=3, silver=2 and bronze =1) and points derived from top 8 finishes which correlates with attendance in 'shooting finals' (i.e. 1st=8, 2nd=7, etc.) since the 1966 Jamaican Games.

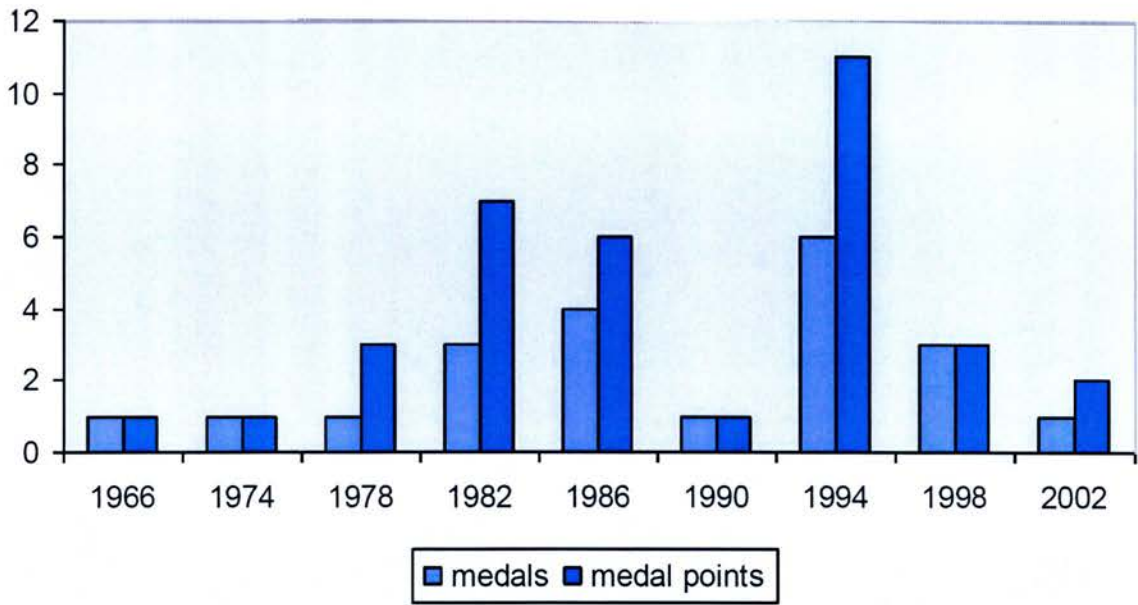


Figure 5.3 Time series analysis of number of winning medals

While 1982 and 1986 provided considerable success for both medal wins and medal point performance, the 1990 Games held in Auckland, New Zealand sees a relatively disappointing performance with only one bronze medal acquired. However, the following 1994 Games held in Victoria, Canada resulted in the highest medal accumulation with 6 medals including one gold, three silver and two bronze. Subsequent Games in Malaysia 1998 and England 2002 have resulted in a drop in overall performance, especially in consideration of a 'relative home' advantage in 2002 with the Games held in Bisley.

The mean and standard deviation for overall medal counts at all Games is 2.22 (± 1.81) and medal point count as 3.89 (± 3.25). Overall, the trend in medals is decreasing over the last few games in accordance with the increases in both nation attendance and the number of athletes taking part in the Commonwealth Games. For example, while the 1994 Games had only 1557 athletes taking part, the numbers doubled in the next Games to 3636.

Additionally, while only 26 nations participated in the 1986 Edinburgh games due to a boycott, these have risen to 70 and 72 nations respectively at the more recent games in Malaysia and England. The number of small bore and air rifle events contested at recent Games has remained stable with 12 events including an equal gender split.

The number of nations winning a gold medal or any known medal has increased considerably in recent years. Therefore, competition defined by the number of nations capable of winning medals, has increased substantially since the mid 80's, and also doubling in total. Using the conversion of medals into points where gold = 3, silver = 2 and bronze = 1, it can be recognized that Scotland's points have decreased rapidly from 1982 (48 points) and 1986 (51 points) to a low of just 20 points in 1998. This trend is also reflective of Scotland's market share of medal points. 2002 did prove to be a relatively successful Games, although 155 more medals were being contested and the home nation's (England) adoption of Judo as a Games event did see Scotland perform particularly well with ten, of its overall thirty medals coming from this sport. Within small-bore and air rifle shooting, Scotland enjoyed a particularly productive period from 1982-1994 (excluding 1990) winning at least 3 medals at each Games. However, the previous two Games indicate that Scotland's standing is depleting as competition has increased, reflecting Scotland's overall trend in all sports.

Instructional Resources

Coaching Quality

The coaching quality was evaluated through interviews with both athletes and coaches, through 'coaching and training evaluation of weekend effectiveness' forms (appendix 9) and through observational analysis. The 'coach and training evaluation' forms (appendix 10) looked at overall value of the weekend; clarity of objectives; learning and

development atmosphere; organization; feedback; support; facilities; coaching input; coach enthusiasm; capability to address issues, and evaluation of specific goals for each of the weekends (e.g. physiotherapy support, psychology workshops, planning and periodization workshops). Additional comments were also requested from athletes in case the selected topics did not fulfil the athletes perspective of developmental concern or focus of attention.

It is important to recognize that the SSRA were in a transition period with coach-x being recently appointed. The two coaches were generally viewed as coach-x being planning, management, general preparation and periodization orientated, and coach-y being technically orientated. The group perceived an appropriate balance of skills being offered by both coaches, but the athlete-coach relationship between coach-x and some of the senior shooters required attention. Allocation of personal instruction at training weekends was always of concern with shooters. Due to the period of development (technical focus and construction of position) some individuals would receive large volumes of attendance (3-4 hours), where others received none. The evaluation forms failed to be conducted with consistency or necessary volume to be utilized in the study, although details were utilized to identify and probe issues. Along with discussions, a clear progression of satisfaction with the overall coaching process in a short period of time was evident.

Initial observations of the first two training weekends indicated that the sessions were not only athlete-centred, but equally athlete-led. This was discussed with both coaches and the seemingly 'first come- first served' observations were confirmed. Observational analysis could see the coaches spend three to four hours with one athlete in one day, while others received no attention over a full weekend. Meanwhile, from proactive discussions with coach and senior team representatives, coaching expertise, athlete expertise, perceived ratings

of 'problem', coach-shooter relationships, and episodes of development for each individual, inclusive of contextual time demands/ responsibilities, seemingly determined the allocation of coaching time. However, the observational analysis recognized that the coaching quality progressed rapidly even within the three month period. Structured and individual training plans were distributed prior to weekends, support was distributed across all team members, training plans were adhered too, long-term, medium term and short-term development goals were constructed between athletes and coaches, and training goals were considered across all domains of expertise. Improvements in coaching quality were recognized, commented upon and appreciated by all athletes during the three months. To assist in coaching availability, programs were planned and published via the web in advance of training sessions (appendix 11); communication channels (phone) were initiated to support/monitor/control/enhance/reinforce additional training; shooters were kept busy the whole time, challenge points increased; shooting and training self-responsibility promoted, and evaluation of training weekends conducted between coaches and support staff (utilizing observations and athlete feedback).

Environment & Equipment

The expertise in coaching does not on its own incorporate instructional resources. The environment in which the athlete develops also incorporates quality of technical equipment, shooting range quality, facilities, infrastructure, communications within the group, the group culture, quality of competition, both within and between the group, and philosophical influences, which includes the role of intent for the shooting team and shooting community.

Scotland has no official national centre for shooting, although Denwood, Aberdeen, is recognized as the national training centre for the team. Indeed, it is probably the only adequate shooting range in Scotland in relation to hosting 'small' international (UK) based competitions. Denwood has a small 10m indoor range (10 shooters), a 25m outdoor range (20 shooters), and a second range utilized predominantly by the local shooting club. A small kitchen, change facilities, sitting area, office and storage areas are offered. Denwood approximates 2 to 3 hour drives for the majority of the athletes and teams, with 4 national team members living relatively local at the initiation of the investigation.

Further smaller ranges were fragmented around the country such as Glenrothes (10m indoor), Watson's (10m indoor), and some alternative outdoor shooting ranges also included Alloa, which is effectively a small field. In summary, facilities are seriously depleted and fail to reflect even minimum standards for an aspiring high performance shooting nation.

The quality of technical equipment was fair, although the desire for an electronic scoring system was consistently voiced. This drastically increases time available for deliberate 'training/development' and replicates the competition feedback experienced at international events since 1989 (see appendix 4). SCATT and NOPTTELL systems were available periodically (appendix 12). Coaches utilized digital cameras and recorders for structural/behavioral analysis. Observational analysis and verbal feedback indicated that personal systems could enhance productivity and quality of feedback exponentially. However, coach reliance and dependency was evident.

The team utilised the web and e-mail as a strong communication network among athletes, coaching and support staff. Frequent communications, both top-down and bottom-

up, were conducted with a team representative voted by the group. Group communications were rich, assisted by the small-group dynamic. Equally, the small-group dynamic also intensified detrimental communications, as historical events impinged on existing relationships.

Familial Support

Familial support was considerably strong in the present group. Indeed, two sets of participants were married to one another, while others had fathers, mothers, and daughters who also competed in the sport, as well as a brother and sister in the existing group of sixteen. Others discussed how important their family support was within their shooting development and how family members were required for financial, emotional and motivational sustenance.

Sport Science, Health and Lifestyle Support

The team had previous sport psychology support, although perspectives on value were mixed. Physiotherapy support was available for the full squad, and two individuals merited further individual support from the SIS. At the period of evaluation, no direct use of this affordance was utilized except from financial support. Constraints identified by coach and athlete discussions included a lack of funding for what the team believed was required to raise standards of excellence appropriately.

Cultural Importance-Global

Global depth of competition is evaluated against popularity of shooting in a global sense. Buhlmann, Reinkemeier & Echhardt (2002) accounted how 75 million shooters and 154 national member federations worldwide were represented by the International shooting

Sport Federation (ISSF). 20 million target shooters participate in the United States alone (www.usashooting.com) and 1.5 million in Germany (Buhlmann, Reinkemeier & Echhardt, 2002). Military shooting is not recognized within this group, but it is recognized that national and international shooting competitions exist on a vast and sporting scale. Predictions associated with recent Indian and Chinese performances and further strategic development of shooting in other far eastern nations (e.g. Singapore and Malaysia) identifies the growth in popularity with shooting on a global scale.

Shooting is an Olympic sport with 462 shooters participating in the 1996 Atlanta games and, 390 athletes from 106 nations in the 2004 Athens games. Both these games had 17 events. As for the program for Beijing 2008, the number of events have been reduced to 15 (5 from each of the sub-disciplines of rifle, pistol and shotgun) with 390 quota places established. Additionally, a world championship is conducted on a four year cycle and an annual world cup competition which requires attendance at various world cup events around the globe.

Cultural Importance- Scotland

Cultural importance will be considered in relation to four sub-themes inclusive of sport value, politics, educational experiences and financial investment.

Sport Value

The importance that a society places on a particular sport can have a significant influence on any success achieved (Baker & Horton, 2004). Sporting value will be considered from a Scottish perspective utilizing the Scottish Institute of Sport's meriting of support and funding. Scotland's national strategy for sport (Sport21 2003-2007) is co-

ordinated through the adoption of three teams. These are the 'widening opportunities', 'developing potential' and 'achieving excellence' teams. To ensure expertise development and 'medal success', investment is required at all three levels. Investment priorities are considered in relation to (1) athlete support to develop comprehensive training and competition programs; (2) national performance staffing structures to deliver, co-ordinate, support and develop long-term performance development; (3) institute network to deliver and enhance performance programs; and (4) national facilities to develop world class facilities for both training and competition. To assist in the co-ordination of funding, SportsScotland deem it necessary to identify the sports most likely to deliver 'medal success'. Along with the benchmark criteria of (a) 'success', which evaluates with likeliness that the sport can deliver Scots medals and (b) 'impact', which evaluates if investment can have a significant impact on the sport in helping deliver 'medal success', an additional criteria (c) 'value' is also considered, which evaluates if the sport is valued by the Scottish public.

Sports are then selected for quantity and quality of support through evaluation and divided into core, network and targeted groupings depending on the kind of investment they are eligible for. Nine sports are selected as network sports that receive area institute, coaching, athlete support and institute individual athlete support. Finally, 19 sports are selected as targeted sports which are eligible for athlete support and institute individual athlete support.

Measuring success is evaluated by performance at key events including Olympic, Commonwealth Games, Paralympic, European and World Championship. Surprisingly, while shooting is one of only five sports (the others being athletics, swimming, cycling and table tennis) considered for all key events, and that shooting is Scotland's 4th overall best

performer at the Commonwealth Games (1950-2006), it fails to be merited as a core or network sport. At the period of analysis, three shooters were eligible for athlete support funding due to medaling at previous Commonwealth Games. Accordingly, sporting value must be considered extremely low within the Institute's evaluation of shooting, based upon the additional criteria having little effect on overall funding.

Politics

Political evaluation of shooting is unfortunately embroiled with the Dunblane tragedy of 1996, where 15 children lost their lives. From discussions with all team members and support staff, the sport of shooting has in psychological terms, lived under a shadow since this occasion. Public perception and political ostracism has seen the sport decline rapidly, and indeed probably merits as the variable pertinent to its low sporting value. Evidence has been considered from press reports, public policy and observational analysis.

It can be concluded however that the cultural impact of the Dunblane massacre has had a negative effect on sports shooting within the whole of the UK. A report by Calum Macdonald (6th July 2002, Daily Record), titled 'Dunblane is killing my sport', highlighted the death of grassroots shooting and the retraction of political and financial support required to create elite athletes. Indeed, within the article, comments, such as "I'm delighted shooting as a sport is dying out", "People are beginning to see what a futile sport it is. I support the ban...", "shooting should never have been a sport, it is too dangerous" and "Because we let people hold guns for sport, children were massacred in Dunblane", highlight how the sport was directly attributed to the incident. It is not in the remit or desire of the present study to offer any perspectives on this issue.

Indeed, as of March 19th 2006 (Jim McBeth, The Sunday Times) an article titled ‘Glasgow’s Commonwealth games bid hits snag over shooters’, indicated, and re-inforced original beliefs about the lack of political and financial support for shooting, inferring that the Glasgow event could hold the shooting event in Bisley, England [discussions during Melbourne, 2006 indicated the Isle of Man as a suitable host for shooting as well]. Commitment to build a national shooting centre, which would be a legacy of the Games for small bore, air and shotgun events, is seen as a non-option even though the Melbourne games were propped handsomely with shooting success.

Educational Experiences

While the ability to create grassroots opportunities has been reported as negatively affected by the Dunblane massacre, many ‘private’ schools and universities maintained a level of commitment to sport shooting activities. However, many schools retracted shooting activities due to the event.

Financial Investment

Sportscotland awarded the STSF £42,500 in grant aid in 2003-04 with £44,000 received in 2004-05 (Sportscotland shooting policy, November, 2004). Individual athletes received lottery funding (2003) in the small-bore and air group including Sheena Sharp (£8,160), Susan Jackson (£8, 013), David Rattray (£3,000), Donald McIntosh (£3,000) and Martin Sinclair (£3,000). Individual support and alternative fundings were also available although specifics are unknown.

Group Culture

The observational analysis recognized that, at present, there was a lack of ‘high

performance culture' within the group. Indeed, discussions with management, coaches and athletes brought agreement that at present, the group could be classified as highly competent and proficient (Dreyfus & Dreyfus, 1988) amateurs. While seriously constrained by developmental resources, funding, geography and politics, the volumes of deliberate practice indicated that the team was not world class, nor had they professional status. Thus, based on amateur status, they would be classified in the development stage of Blooms (1985) and Ericsson's (1996) model of expertise.

Many of the individuals displayed periods of behavior associated with high-level performance culture with regular frequency. The constraints of preparation requirement, facilities, access to coaching, work & family responsibilities, world standard competitive opportunities, attitudes towards shooting and support services deemed the volume of effort required to sustain the identified level as commendable. However, the team lacked the awareness of requirement to become an elite shooting nation and world-class success. No performance plan was offered to evaluate the long-term goals and vision of the STSF although requested. The UK pathway to excellence, which many of the Scottish team members were qualified for, was not in operation at this period, or competent to proficient, as already mentioned within the Dreyfus & Dreyfus (1988) model.

Within the early training and competition observations, a positive atmosphere was noted. However, much of this was highly social. It should be noted however, that the team were re-forming after their winter break and weather (0°C) would have affected the desire to train. Please note that the activity of shooting requires an individual to lie on the ground between 90-120 minutes with no movement at all. A vast difference was observed from the early sessions at Denwood in comparison to a team training session in Wigan during the latter

stages of the analysis. Family and peer support was highly evident at both competition and training events. For many, but not all, the group seemed happy with the status quo, and effort required to make a transition to a culture of professionalism and excellence appeared distal.

The senior coach, and a couple of the athletes, had a strong desire for the team to make a transition from the present status to a team which portrayed a culture of excellence. It was observed, however, that this would require a series of progressive transitions over a longer term period than the proposed 'vast jump'. Effectively, the gulf was too great for a singular transition approach, and much more support required to be implemented. Motivating the shooters to engage with what is required to become an elite athlete, and the creation of an appropriate talent development environment became the agreed focus of vision. The Melbourne Games 2006 were identified as the appropriate transitional 'springboard'.

Depth of Competition

Club and community development included many social shooters who we will classify as 'serious leisure' participants. The passion was with club shooting and serious leisure activity rather than supporting 'elite performance'. The depth of competition within the squad for each of the shooting events was diverse. The greatest depth of competition was offered by the male prone shooters (6), with many of the other events having 3 competitors vying for 2 squad places at the international events. External depth of competition was offered from the UK circuit, although it was evident how the 'world class' UK athletes negated attendance at many of the events. Identification of the necessity of 'deliberate experience' and quality competition was noted.

Tertiary Influences

Qualitative analysis highlighted further factors beyond the primary and secondary influences. These additional factors are divided into variables that will be proposed as having a *tertiary* influence. Interviews and observational analysis recognized that seemingly evasive, obscure and indirect influences in everyday life could affect both short term performance and long-term development.

Athletes and coaches discussed how words, music, movies and both proximal and distal individuals or news can have a critical influence on development. These become especially evident during a critical incident or critical transition periods of long-term development. These influences seemingly create, or exist within, highly reflective moments and often give perspective, not only on their shooting experiences, but life-span development in general. This may be more pertinent to the present group due to their amateur status and high degree of family responsibility compared to alternative sports. These findings reflected study 1 which acknowledged the power of non-normative influences (experiences and challenges that come unexpectedly that normally arise in periods of transition to influence decision-making).

Discussion

The main purpose of the present study was to expand on the 'individual' assessment of expertise, and examine both the primary and secondary influences underlying levels of expertise within a sport specific group. This reflects the findings of study 1 which suggested the need for a more ecological model of expertise integrating intra-personal, inter-personal, group, organizational, and cultural dynamics. The present study adopted a multi-

methodological account of expertise which was found to be highly integrative. Indeed, at periods, the pluralism associated with evaluating expertise could bridge the integrative and anarchic perspectives of pluralism. Together, this gives strong support for both a psychosocial dynamic and co-constructive perspective of expertise

Deliberate practice is considered as the dominant theory of expertise. However, within the present group, constraints within each participant's ecological nest ill-afforded the capability to engage with high volumes of 'deliberate practice'. The primary constraints included costs, work/university commitments, family responsibilities, lack of financial support, geography, range facilities and accessibility to technical equipment and support. Four hours of deliberate practice is suggested as necessary for the development of expertise. While this amount of time was achieved at 'hothouse training camps', the daily amount calculated throughout the year was only between 1 and 1.5 hours per day for the squad members- dependent on what constituted deliberacy of practice. In contrast to those who fully endorse the theory of deliberate practice in understanding *how* we develop expertise, the present study suggests that alternative and additional approaches to the theory of deliberate practice exist.

Deliberate experience, deliberate mindfulness and transfer of skills were also considered by the group as essential within their own construction of performance. These are seemingly additional and alternative means to be considered for understanding *how* we develop expertise. Periods in deliberate experience were calculated as approximately 40-50% of time spent in deliberate practice for each athlete. It has to be recognized that the level of engagement and reflection upon the actual competitions is indicative of the *deliberacy* of experience and could be supported through peer evaluation and mentoring, reflective sessions

with the coach, video analysis or decision to attenuate more readily in competition. Indeed, the decision to attenuate to an element of shooting within competition can be considered as more developmental than performance orientated as it would be expected that additional cognitive effort is detrimental to shooting performance. The perspective of requirement of deliberate experience being critical to *how* we develop expertise was also shared by coaches who motivated and supported individual endeavors to engage with high level competition as frequently as possible. This has also been a recent and emergent strategy for many sporting governing bodies who advocate the necessity of funding for high quality competition attendance.

Baker & Horton (2004) divided the factors which influence the acquisition and manifestation of high levels of performance, in terms of primary and secondary influence. The variables acknowledged as primary influence included genetic, training and psychological factors. The training element focused upon the theory of deliberate practice and the progression of motor skills. It would have been appropriate for the model to have acknowledged the full spectrum of domains of expertise (Janelle & Hillman, 2003) inclusive of physiological, technical, cognitive (tactical/strategic; perceptual/decision making) and emotional (regulation/ coping; psychological) within the training element. Equally, differentiation between training, learning, maturation and development could have served as appropriate especially in consideration of the effect on intellect, creativity, inter-personal communication skills and sensori-motor capability.

Baker & Horton (2004) distinguished the variables that have a secondary influence inclusive of socio-cultural and contextual elements. These included cultural importance, instructional resources, familial support, contextual factors, sport maturity and depth of

competition. Within Baker & Horton's evaluation, cultural importance was framed within a national significance. While national culture (along with historical, western, capitalist, and European perspectives) are acknowledged as influential, it was important to acknowledge how the culture of excellence necessary to drive elite performance requires to be understood within a nested and multifaceted phenomena. For example, the culture included national influences, but more importantly reflected the culture of the national team, its behaviors, visions, processes, structures, norms, artifacts, legends, history, climate and values. This was problem driven from what seemed as an exclusion from the overwhelming perceptions of shooting as a sport, and even within sport, what an elite athlete should look like, especially within physiological consideration. Thus, the cultural nest includes global, sporting, national, regional, social grouping, national facility (and placement), national team, work, home and contextual influence. The cultural effect was seemingly a dynamic and multifaceted factor with the ability to change at any one moment in time.

Further secondary influences include the role of education and school PE, inclusive of school and sport club links, and the need for facilities. Most importantly, the lack of an elite national facility, catered for the whole of the shooting fraternity from which to create an identity of excellence, was noted. Within the secondary influences, serious attention to philosophy, strategy and focus required to be established. As many of the individuals were working, studying at University and/or married with young children, secondary influences were more influential upon the long-term development of the existing group than many other professional and elite sporting activities. However, it proved beneficial to identify how family, friends, peers, teachers, mentors could impinge on long-term development and how a powerful group culture is required to maintain the behaviors and attitudes required to accomplish elite athlete status.

Tertiary influences were also recognized as critical to the long-term development of expertise, especially during critical transitions or critical events surrounding important decision making. While Baker & Horton (2004) afforded contextual factors as sport maturity and depth of competition, the present analysis utilised a more dynamic and integrated definition of contextual and tertiary influences that are associated with every day and immediate living. The effect of tertiary influences was especially noted in the context of critical transition periods (both at macro- and micro-levels). Thus, a conversation, a movie, a program on tv, a book, a series of comments, the weather, travel, eating and accommodation arrangements, dynamic of a group changing in an instant with a single comment or silence, and even absolute chance had a major impact on developmental decision making. This included decision-making at an individual, relational or collective level. Additionally, decisions made at home, work, alternative social activities or university had a consequential effect on shooting. This was related to the concept of normative and non-normative influences of Study 1 and the understanding of how 'sensitive dependence on initial conditions' and 'sensitive dependence on existing micro-contextual conditions' can have a powerful effect on long-term development.

Thus, what the present study affords is the capability to identify agents and processes of change which can affect the pathway to excellence. The addition of tertiary influences, and suggestions of expansion in Baker & Horton's (2004) primary and secondary influences may seem appropriate. Alternatively, an understanding of expertise as a concept of self (Study 1) may be more appropriate to varying practitioners. The secondary purpose of the present study was to report the efficacy a more multifaceted evaluation of expertise and compare the results with existing research and reports which it is hoped has been achieved. Discussions of findings with the present group gave support for the multifaceted approach in

expertise evaluation. The emergence of *tertiary* influences was insightful to the present study. This finding probably occurred due to the depth of engagement with the researcher over an extended period of time.

The complexities associated with an enhanced number of variables within expertise research are amplified when one considers the complexities of pluralism, whether considered integrated or anarchic. If the construction of expertise is indeed anarchic, then requirement for a methodology or strategy to overcome the ‘chaos’ of long-term development is necessary.

The researcher feels the study succeeded in its overall purposes of examining both the primary and secondary influences underlying levels of expertise within a sport specific group and of reporting the efficacy of a more multifaceted and ecological evaluation of expertise and of comparing the results with existing research and reports. The identification of further variables within Baker & Horton’s (2004) primary and secondary influences, as well as the recognition of *tertiary* variables, gives scope for understanding *how* expertise may be developed. The present study highlighted the vastness, complexity, integration and anarchism associated with expertise and long-term development and gives stronger support for the adoption of non-linear and complex adaptive research philosophies. The multi-methodological approach served the present research well, although generalizations from the present research are limited. However, this approach and its findings further support the ‘constructivist’ and ‘psycho-social dynamic’ principles of expertise development.

Implications

Adoption of an ecological, psycho-social dynamic and co-constructive perspective of expertise development has considerable implications. The first implication is that *how* we develop expertise is an integrative and anarchic pluralist entity. Accordingly, change in one dimension of the ecological nest that surrounds the expert can have powerful and multiplicative effects on another dimension of expertise. This not only includes the within and between the primary and secondary influences, but potentially includes a tertiary influence as well. Alternatively, a direct linear cause and effect, which has been statistically supported in research, may have either no effect, or could indeed have a maladaptive effect to long-term development. This gives support for the need of a highly regulative approach to development where expertise is monitored and controlled with awareness that the variables exist within a dynamical system.

As a dynamical entity, the emergent variables associated with expertise development are also brought to the fore. This requires a supporting and motivational climate to both self-overcome and attend with a non-linear journey, which should find itself at both sides of the 'edge of chaos', and where individuals will have to overcome *both* order and disorder.

The importance of attending to excellence across the full ecological spectrum, including both primary and secondary influences, is necessary. Indeed, it would even suggest that the development of expertise is a 'way of being' requiring authentic engagement and optimal regulation, not only of the athlete, but of those who are influential to the individual's journey within the nest.

The need to train for transfer and adaptivity is also acknowledged. If agents and processes of change are deemed as influential on expertise development, then self-regulative and meta-cognitive skills require enrichment. Note that self-regulation concept absorbed in the present study has the understanding of an integrated personal, relational and collective self.

The role of the 'constructivist' sport psychology approach has to be considerate to more expansive and dynamic perspectives of support. Indeed, the role of the psychologist has to focus as much on appropriate challenge as support and coping. For example, utilizing the findings of the present study, the role of the psychologist expands to include lifestyle management, detailed and technically supported performance evaluation, role of a coach and athlete development officer, coaching skills supported with specific, psychological principles (e.g. challenge points training) and skill acquisition which for many is recognized as a dimension of psychology anyway. Furthermore, rather than working on the development of individual psychological skills training, an awareness of group dynamics, group structure, cultural change and further environmental influences has to be strongly considered.

CHAPTER 6. STUDY 3: CONSTRUCTIVE COACHING AND EXPERTISE DEVELOPMENT AS ACTION RESEARCH

This case study assessed the efficacy of a constructivist development approach and subsequent action research methodology during sport-science support to an international shooting team (n=14) over a two-year period. Specific analysis focused on the benefits of a coach-focussed program to integrate the pluralism associated with the development of sporting expertise. The broadest possible range of methods and tools were utilised to ensure a multi-level awareness of change was provided. This required monitoring and controlling change in organisational, team, relational and individual behaviour. Findings revealed that an emergent, iterative, ecological and meta-level process of coaching and sport-science support was conducive to the needs of this particular squad due to the nesting and multi-dimensional issues related to performance behaviours within intra-personal, inter-personal, group and social domains, and the rich-interconnectedness associated with the relevant domains of expertise. Furthermore, the constructivist coach-focussed program within the project was endorsed.

One of the major aims and objectives of the present study was to utilize the findings and theoretical position emerging from the critical review and adopt the findings in a working model which could be tested in a real-world environment.

Coaches and sport scientists are becoming increasingly aware that expertise represents more than just a collection of individualized attributes that are developed in the training environment. Recent theoretical perspectives on talent and expertise development recognize that a multidimensional, psycho-social construct of development may exist which adopts

complex and emergent characteristics (Simonton, 1999; Simonton, 2000; Study 1). Furthermore, current perspectives on the structure and content of expertise also recognize the contextual and environmental constraints that may impinge on performance potential and actuality (Baker, Horton, Robertson-Wilson & Wall, 2003; Study 1). Therefore, the self-regulative and meta-cognitive skills of self-monitoring and self-control should be considered fundamental to optimizing both short term and long term performance (Zimmerman, 2006). Schempp, McCullick, Busch, Webster & Mason (2006) identified that during the development of expertise, expert sport instructors often turn to themselves for self-monitoring. Embracing this approach, but with an understanding of additional perspectives of expertise (Study 1), the present study would consider that the concept of self has to a) expand towards an individual, relational and collective perspective of self; and b) capitalize on the interconnectedness of athlete, coach, team members, support staff and organization in order to develop expertise and to enhance performance due to the co-constructive relationship within and between elements of this 'expertise nest'.

Engaging with the relational and collective interpretation of expertise requires an understanding of the pluralism, complexity and interrelatedness incidental with the athlete-coach-environment dynamic. Therefore, how can coaches and practitioners maintain and augment control and systematic order? "In order to deal with complex practical situations, it is insufficient for practitioners to learn a theory and simply apply it to practice. Instead practitioners need to draw an integrated knowledge-in-action approach, much of which is spontaneous and tacit" (Schön, 1987, p.25). This suggests the adoption of a suitable development strategy and longitudinal research method where the engagement with the coach and athlete's real-world can be monitored, controlled and evaluated. Accordingly, the present case study assessed the efficacy of a constructivist development program and

subsequent action research methodology during sport-science support to an international shooting team (n=14).

Constructivism is a principle 'where learners construct their own knowledge' with emphasis on a quality supporting environment, reliance upon scaffolding, necessity for self-organization and promotion of deeper learning (Mahoney, 2002; Mascolo & Fischer, 2005; Sawyer, 2006). A constructivist model of coaching is therefore difficult to serve, is idiographic and requires a high volume of connectivity. It is ecological and therefore, emphasises optimisation of the zone of proximal development (Kozulin, Gindis, Ageyev & Miller, 2003) as well as the importance of relations and connectivity; embraces paradox within development; accepts the emergenic nature of development and emphasises the need to function with both interactive and anarchic pluralism as well as balance both chaos and order (Mahoney, 2002). To endorse this approach, emphasis on the coach's ability to understand and utilize research in regulated development, complex-adaptive and non-linear systems and micro-development, is necessary.

Within constructivism, principles of change, transition and micro-development (Mascolo & Fischer, 2005) are highlighted, and thus the project adopted an action research methodology reflective of the overarching principles of constructivist development. By using an action research format, the capability to monitor, control and research coaching, athlete and team development, whilst endorsing reconstruction and transformation over a sustained and longitudinal period, was also afforded. Action research, although not easily defined, "seeks to bring together action and reflection, theory and practice, in participation with others, in pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and their communities" (Reason & Bradbury,

2001, p.1). Lewin (1947) coined the term action research to describe a situation where the researcher and the people being researched participate jointly. As such, action research is a means of gathering data about a project, and reflecting on the material across different levels of participation in the project (McKie, 2002). The overall aim of action research is to generate knowledge and, on the basis of this, to adapt or change the project on an ongoing basis (Hart & Bond, 1995). Therefore, feedback from all parties concerned with an athlete's progress and development are required in a collaborative and participatory nature. In a sport context this includes the athlete, coach, family, team manager, organization manager, and support which can potentially extend to governing bodies and institutes of sport.

The present intervention adopted the IAE³ iterative model of expertise development (Abbott, Button, Pepping & Collins, 2005; Abbott & Collins, 2004; Chapter 4, Ollis, 2003) established during an Interpretative Phenomenological Analysis with rugby union referees. The model was considered by the participants in the refereeing study as more appropriate to expertise development due to the emphasis upon micro-development rather than the traditional phase-stage perspective, and consists of five stages of change: identify, action, establish, evaluate and empower -hence IAE³. Not only does the model address the iterative qualities of a complex process, but also incorporates further psychological mechanisms which are termed as important to the emergenic principles associated with change in the development of expertise. These include the ability to challenge, de-stabilize, re-stabilize, self-regulate, set goals, initiate action according to the principles of deliberate practice, reflect and focus development on the retention and transfer of skills, and all within a meta-theoretical level that spans macro- and micro-transitions (Study 1, chapter 4) and varying time-scales. The efficacy for adoption of the model is also considered with the IAE³ process of development extending towards an individual (e.g. athlete), related (e.g. athlete-coach) and

collective (e.g. team or organization) process. Utilising action research as a co-constructive process, where the development of the collective and individual (including coach, management and support), is recognized as a potentially powerful systematic intervention.

As a case study utilizing action research methodology, it was deemed appropriate to identify and describe the emergence of macro-transitions and episodes, within the sport science and coaching program, emerging from a constructivist perspective. From here, the discussion will then address the main purpose of the present investigation which was the efficacy of the constructivist program and action research methodology.

Methods

Participants

The participants were two male coaches (age=41.3 \pm 7.3) and 12 International standard shooters (age=32.7 \pm 12.2; range 19-51; 6-male and 6-female) who together form the Scottish small-bore shooting team. Of the two coaches, one also adopted the role of team manager periodically within the collaboration. All participants, inclusive of both coaches, have represented their nation at either senior or junior level and competed in their sport from 5 to 25 years. However, no participants had competed at World Cup or European Games consistently (during the period of research only two athletes competed at a European or World Cup standard) and none attended the Olympic Games. As such, whilst reaching expert levels within their sporting domains, and utilising World Cup and Olympic success as a true measurement of shooting standard, consideration of the group as achieving a high level of expertise is appropriate, but none would be termed World Class.

The sport science/ shooting team collaboration was initiated with the national shooting coach attending an MSc program in 'Performance Psychology'. The lecturer (future sport scientist) was requested by the shooting coach to provide sport science support for the shooting team (initially 20 days over the year). It was agreed that the sport scientist could adopt his own model of support, and thus a constructivist model of development, utilising an individual, relational and collective perspective of self-regulation, was endorsed after a few training and competition attendances.

Study Design

The study adopted the action research IAE³ model as previously discussed. The model reflects Reason & Bradbury's (2001) argument that a transformational science, in the form of action research, requires integrating first-, second- and third-person voices if validity is to be enhanced. Reason and Bradbury define that:

“first-person research/practice addresses the ability of a person to foster an enquiring approach to his or her own life; second-person research/practice engages a face-to-face group in collaborative inquiry; and third-person research/practice asks how we can establish enquiring communities which reach beyond the immediate group to engage with whole organisations, communities and countries” (p.xxv).

We believe that the present research/practice, due to the nesting of change within individual (athletes, coaches, managers, support staff), group (e.g. small-bore team) and organisation (i.e. national shooting team) development mirrors Reason & Bradbury's desire for integration and collective participation and thus provides desired validity.

The process of analysis made no primary assumptions consistent with a constructivist program and action research methodology being adopted. Agreement between the shooting performance manager, practitioners and coaches allowed all aspects of the 'expertise nest' (Bronfenbrenner, 1979, 2005; Critien & Ollis, 2006; Study 1) to be explored and developed in accordance with initial findings. Communications of progress, findings and development were continually shared with all parties inclusive of individual athletes, coaches and management throughout the intervention. Within each period of analysis 'perceived critical transitions' and 'leverage points' were sought, and, when these were achieved, they in turn endorsed future action points, strategies and plans. Action points included individual, relational and collective goals adopted by athletes, coaches, managers, and support staff alike inclusive of the sport scientist.

Data Gathering

The sport scientist gathered data and analysed various transition processes over the two year period (Fig 6.1). Approximately 200 days of support were conducted including competition analysis (58 days inclusive of the Games), training analysis (59 days) and individual analysis which included athlete, coach and management meetings (32 days). The remaining 48 days incorporated administrative duties, report writing and data analysis, analysis of organisational, training and competition protocol, along with appropriate background reading.

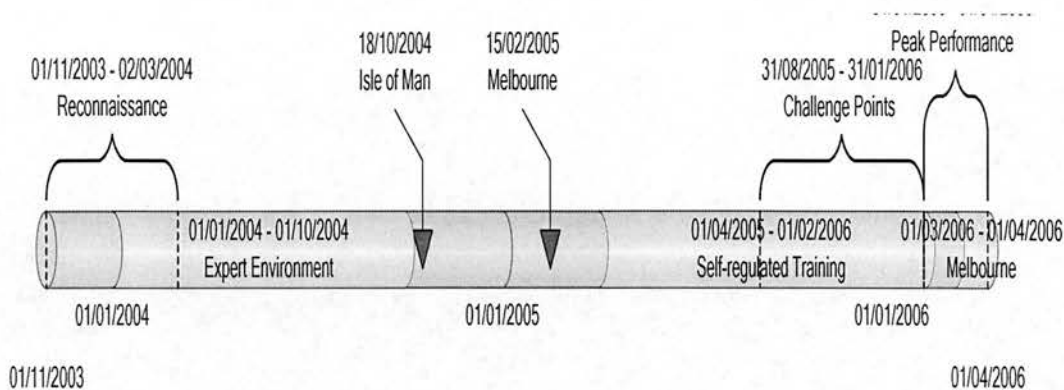


Figure.6.1. Time-line presentation of 2 year program.

The present research combines quantitative and qualitative data analyses at individual, relational and collective levels. This integrated qualitative and quantitative approach incorporated interview, questionnaire (appendix 1, appendix 2), behaviour checklists (appendix 7, appendix 10), existing protocol, heart rate (appendix 16), video, technological support, performance scores (appendix 4), training logs (appendix 5), periodization programs (appendix 5), communication systems (e.g. website), communication patterns (e.g. modes and volume of communication), observation and video analysis of pre-performance routines, performance routines, feedback mechanisms, planning, focus groups, observational analysis of ‘time spent training’; ‘time spent competing’; ‘quality of training’; ‘time to shoot’; ‘shooting tempo and rhythm’; ‘practice manipulation’, ‘training camp evaluation’, and more specific shooting performance markers such as ‘stability of hold’, and ‘zero point’ (appendix 7). Further qualitative data were gathered during formal and informal discussion/interview allowing the researcher to understand and enhance the richness of interaction and relationships between organisation, team and individual members. Finally, it should be recognised that the findings offered are not merely an accumulation of data, but as an action research study, the analyses of processes of transition and change. The findings will therefore incorporate how they interrelate and where, why and how they occurred.

In consideration of quality analyses, the present study adopts Yardley's (2000) principles for qualitative and interpretive research, which includes (1) sensitivity to context, (2) commitment, rigour, transparency and coherence, and (3) impact and importance, for establishing validity within the study.

Findings

The transition processes and macro-level episodes that were identified during the two year action research (see Fig.6.1) emerged from individual and micro-scaled development, morphing into collectively agreed, individually structured (athlete-coach-management) and macro-scaled development goals. For example, the self-regulation program (appendix 13) was a holistic program designed for the whole team, but functioned for varying individual needs inclusive of enhancing expertise, time management, enhancing confidence, attentional skills training, enhancing self-efficacy, goal-setting, enhancing motivation, problem-solving and self-reflection. Equally, an imagery program (appendix 14) was conducted for the whole team, but morphed from individual needs inclusive of rest and recovery, challenge-points training (appendix 15), problem-solving, technical problems and managing performance stress. Thus, the IAE³ process gave periodic, manageable, authentic and strategic direction to individuals and team alike. Action research, being both planned and emergent, utilised the formation of the macro-scaled development episodes and authentic strategic direction to configure systematic and planned processes such as goal-setting, general preparation, strategic choice and periodized training programs. Shared between both mechanisms of change was the continual use and identification of the IAE³ model to monitor and promote micro-, meso- and macro-development across collective, relational and individual elements of development. While the real-world overlapped, and was slightly 'messier' than these

sections would indicate, they did afford a planned structure to the intervention. Seven main episodes (see Fig.6.1) were accorded to the 'teams' intervention and are as follows: (1) reconnaissance, (2) creating an expertise conducive environment, (3) Isle of Man, (4) self-regulated development and adaptive expertise, (5) challenge points, (6) peak performance...shared mental models and trust, and (7) Melbourne.

Reconnaissance

The initial reconnaissance phase was conducted over a three-month period incorporating 'identification' of pertinent development elements. These elements spanned intra-individual, inter-individual, group, organisational and cultural constraints. All domains of expertise inclusive of physiological, technical, tactical, perceptual, decision-making and emotional-regulative skills were also investigated in detail. The methods adopted included interviews, observational analysis (appendix 7, appendix 10), questionnaires (appendix 2, appendix 3), diary analyses and training log analysis (appendix 4, appendix 5). The reconnaissance phase concluded with the construction of documented feedback across individual, relational and collective elements (appendix 8). This included individual athlete feedback, coaching feedback, group dynamic feedback and organisational feedback which incorporated 'culture' analysis.

Findings indicated that a series of 'issues' required addressing. Deliberate practice was measured and triangulated via questionnaires, interviews, observational analysis of training weekends and 'informal discussions'. Shooters experienced between 15 and 30 competitions a year, with the vast majority in the United Kingdom. Engagement with training was highly variable and volumes of work varied on seasonal, monthly, weekly and daily levels. For example, some shooters had 'disengaged' with shooting for long-term

periods due to issues such as work, education or family commitments. Other shooters found that some days they did not want to shoot as structured 'training plans' due to influences such as social activities, work, family, tiredness or laziness and indeed recognised that shooting was a highly 'self-motivated' activity, allowing procrastination to frequently occur. For most of the season however, shooters attended regular evening shooting sessions and periodic weekend training meetings. From deliberate practice questionnaires and interviews, the shooters believed they trained approximately 8 hours per week, and competed most weekends in the shooting season. Weekly training included approximately 2 hours physical training and 6 hours in technical practice. Questionnaires and interview data suggested that the majority of 'deliberate practice' was conducted at the periodic (monthly) weekend training meetings.

Structured observational analysis was conducted during the reconnaissance phase and focussed on the quality of coaching and attendance in deliberate practice. Findings were contrasted as 'perceived' time versus 'observed' time in 'deliberate practice'. Coaching support was reactive rather than proactive, and coaching practice had little structure. Indeed, the coaches accepted that on many occasions they attended training weekends with no program, no integration with long-term goals and simply assisted the athletes as required by immediate needs. Physiotherapy was available to the full squad at monthly meetings, and expanded from sport specific warm-up instruction to individual physiotherapy consultation. Eight of the squad members also attended 'British' training, but at the time of study, this too was in a period of flux and transition with appointments imminent.

Creating an Expertise Conducive Environment

From the primary reconnaissance, it was deemed by the researcher through

collaboration that a series of goals would be required to focus on enhancing individual expertise. It was critical to ensure that an environment, conducive to expertise development, could be fostered, but which also integrated individual learning programs. Accordingly, the adoption of a 'coaching process' (Cross & Lyle, 1999) was utilised as a 'critical leverage point' for the initial phase of intervention. The aim of this phase was to expand on the initial coaching process tenets and;

- Create an environment conducive to expertise development;
- Formulate a flexible, but strategic and systematic development program;
- Enhance interpersonal communication patterns;
- Increase volume and quality of deliberate practice;
- Increase volume and quality of deliberate experience;
- Enhance personal responsibility and reflective skills;
- Foster a culture of excellence within the group;
- Adopt and enhance mechanisms to regulate, monitor and control at individual,

coach and team levels.

The coach provided periodization, goal setting plans, structured and detailed weekend training programs (appendix 5, appendix 11) and was guided with a shared vision of 'excellence and professionalism' which transpired from early group sessions. Reflective practice and communications were enhanced and feedback forms measuring effectiveness of training weekends and competition support were collated. Frequent focus groups and coach-athlete dialogue were also promoted (appendix 9). Thus, coach created a culture where high levels of challenge, systematic training plans, rich communication channels, refinement of performance analysis (using video/ heart rate (HR) monitors/ retrospective recall and diary/training log analysis), high levels of support and adoption of principles which included

manipulation of feedback/ competition simulation and focused attention. Thus the coaches, athletes and support members frequently discussed how best to construct an environment that would both challenge and support the athlete. Feedback from athletes, coaches and management, triangulated with observational analysis, highlighted a high degree of success in addressing these aims. However, as agreed with the parties at an initial focus group, since shooting is results dominated, the success of the program would be considered when measured against a suitable high stake competition.

Isle of Man

At the end of the initial contract, it was critical to measure the effectiveness of the twelve month constructivist program. Deliberate practice, measured through observational analysis, questionnaires, feedback forms, diary/ training log analysis and interview methods, was seen to increase by approximately 200% in all categories. Motivation measured through direction, intensity and duration of shooting behaviour and recorded in training and competition feedback forms as well as observational analysis and group perceptions was very high and the coaching process was deemed to have been improved considerably through athlete, coach and organisational feedback. Deliberate experience and deliberate mindfulness had also been incorporated in the development program, and team, individual and coach 'self'-monitoring proved very effective. However, as constructivist principles promote retention, transfer and adaptivity, it was considered that performance at the Commonwealth Shooting Federation (European Division) Championships held in the Isle of Man (2004), should become the main performance marker. Held on the last week of the first year, the team recorded the highest medal tally the nation had ever received in this competition and included 17 gold, 4 silver and 10 bronze medals. Feedback from the event also alluded to the effectiveness of preparation routines, enriched communication patterns between coach-

athlete-practitioner and group, shared mental models being developed, and the benefits of psychology support.

The collaboration ceased in October 2004 and the team then went to Melbourne for a 'mock' Commonwealth Games (Commonwealth Championships) in February 2005. Performance at this competition was diagnosed through athlete, staff and coaching reports as 'underachieving' and 'poor', with varying justifications for the weak performance. This included the resignation of a coach due to social and non-shooting influences, a break in the athlete-coach-sport science support dynamic, time of season, new experience for some, expectancy, and finally, "*it just didn't happen*". What did emerge from the event however, was a re-establishment with the sport-science-coach-athlete collaboration process.

Self-Regulated Development... and adaptive expertise

The constructivist program as action-research was re-instated from July 2005 onwards, with the explicit goal of Melbourne Commonwealth Games 2006 medal performance. Whilst maintaining development of the coaching process, it was agreed that a shift in strategy towards coaching support of the individuals was required. Thus, whilst the first year focused on 'creating an environment conducive to expertise development', the second year focused on creating a peak performance at the Games. Therefore, an enhancement of focus towards the individuals ensued, although directed using a constructivist coaching process.

To reflect a constructivist program, it was critical that the individuals constructed their own scaffolding framework and that the scaffold was integrative and appropriately periodized for a peak performance in what was normally out of season (i.e. self regulation

program- appendix 13). Team and individual meetings were conducted, and well considered plans constructed. These plans followed principles of self-regulation and training for adaptivity which affirmed intra-personal, inter-personal, group and cultural affordances and constraints. Feedback and reports from athletes, coaches and managers highlighted that insufficient preparation for the 2005 Commonwealth Championships had been conducted in the months beforehand, and therefore, full periodized programs aimed to move beyond physiological and technical conditioning. This new program focused on the psychology of performance including monitoring and controlling of self-regulation, resilience, mental toughness and adaptive expertise. What was now apparent to the coach was the necessity to not only monitor and control these elements, but also to 'raise the game'. Accordingly, a 'challenge points' program (appendix 15), expanding from works such as Egan (2002), Guadagnoli & Lee (2004) and Hendry & Kloep (2002), was constructed which utilised deliberate practice, deliberate experience and deliberate mindfulness, as well as recognition that implicit learning was a critical component for the construction of an expert shooter.

Challenge Points

Within the coaching program, and contrary to recent models of development which endorse the highest levels of expertise as 'training for perfection' (Abbott, Button, Pepping & Collins, 2005; Abbott & Collins, 2004), emphasis was placed on the training for transfer, eminence and adaptivity. The transfer was essentially to perform in a major championship event held every four years, on the other side of the world, in a potential hot and sunny climate, and in a period deemed 'out of season'. Therefore, it was recognised that the need to make use of varying constraints at task, environment and individual levels would be required.

The challenge points program was a specifically constructed training program which

utilised competition, competition simulation, feedback manipulation (occlusion, delayed feedback, restricted feedback, random feedback, summary feedback, split-screen feedback, performance or outcome feedback, intermittent reinforcement), rhythm manipulation and visualisation techniques to induce physiological, cognitive, behavioural and emotional load (see appendix 14 for examples). An eight week visualisation program with a two day imagery workshop was also constructed to support the challenge points program (appendix 15). The challenge points program was engaged in by whomever possible including the sport scientist, the individual athlete, groups of athletes and the coach. Psycho-physiological feedback in the form of HR (appendix 16) was adopted in conjunction with performance scores, verbal and non-verbal feedback to infer, monitor and control the varying loads impinging on the athletes. At training camps, emotional regulation was monitored and discussed between coach and support staff to indicate training load, and thus effect changes to training programs. These regulatory features included physiological change, fatigue, mood states, health status, shooting performance, communications and sleep patterns. The biofeedback also gave awareness of 'implicit' reactions to constraints which would have been previously unobserved. For example, the degree of early fatigue caused by altitude was recognised early due to the effect on HR. Also, the effects of heat during competition on shot release HR, which is a relatively stable benchmark, was identified for many of the group as rising from 60bpm to 130 bpm, without the individuals being aware (appendix 16). Cognitive and emotional load could also be inferred from integration with verbal and non-verbal observations during this period, and discussed in reflective practice. The HR profile also provided information on rhythm states during shooting due to the increase then lowering of HR till shot release. The core of this 'challenge point' program was held at a winter training program (January 2006) in South Africa and proved critical to the effectiveness of the overall intervention. As well as allowing a concentrated 10-day challenge points training

program, it also allowed grounding for shared mental models, relational issues and a basis for 'containment' to be appropriately executed.

In South Africa, the support network of self, coach and physiotherapist was well received in the group and a powerful group dynamic was observed. Some constraints which were critical to transfer of training included the similarity of constraints in cognitive, emotional and physiological load. This included the effects of long-haul travel, living as a team, central food habits, climatic similarities expected in Melbourne (e.g. intensity of heat, mirage and sunlight), associated effects on the shooting tasks, equipment changes, and effects on competition ammunition. Altitude (1800m) augmented fatigue, as did a daily program of 'warm-ups' and 'warm-downs' controlled by the physiotherapist which initiated and closed each day. Other affordances inclusive of nutrition and hydration awareness, communicating and living as a team, and rest management in an 'unfamiliar and unique' environment were soft skills beneficial in long-term development (the team even tussled with elephants and wrestled with lions and cheetahs- real mental toughness training!).

Peak Performance...shared-mental models and trust

A period of 6 weeks ensued from the end of the training program in South Africa to when the team embarked for Melbourne. This period was utilised for various ends. Shooters managed the recovery of performance from the high intensity work utilised in South Africa and the previous two-months, administration, equipment control, maintaining competition state and ensuring family/work/university needs were attended pre-departure. Construction of shared mental models and promotion of 'containment' management values were embraced through dialogue between all members of the Commonwealth team. These dialogues occurred as a team, small groups, or pairs and provided venues where needs, expectancies,

challenges, opportunities and threats were discussed, evaluated and appropriate plans considered.

Shared mental models and relational processes were enriched and connected to ensure peak performance. Implicitly and explicitly, cognitive and emotional connections were formed, with the athlete needs and personal construction central to all conversation. This included an awareness of lifestyle effects, personal relationships with others, personal nuances, pre-performance and performance routines, ability to manage, physiological concerns such as minor aches and pains, and where and when they would expect the coach or sport scientist to be available. Discussion groups, personal discussions (coach-athlete-sport scientist triad), personal reflection and imagery were utilised to support this episode.

Melbourne...containment and self

The strategy for Melbourne was to adopt the principles of 'containment' to allow athletes to compete with belief, confidence and trust. Thus, while previous challenge points were designed to provoke and destabilise, the containment period may be metaphorically characterized as stabilising and mothering (McClure, 2005). The coaching role was to ensure the Melbourne 'home' (for four weeks) allowed the athlete to emerge with a "strong coherent sense of self and an innate ability for self-regulation" (McClure, 2005, p.113). Thus the coach, with assistance from other members of the support team inclusive of the sport psychologist, managed the uncertainties of high level competition and 'village' life. This required the coach and support staff to absorb emotional tensions, contain anxieties, make time management highly individualised, ensure disengagement with the competition pressures could occur periodically (psychologically periodized) and *surrender* their own selves for the athletes for the period of competition.

Communication channels and forms were established as the group and individuals desired, shared mental models and pre-performance routines were polished in relation to the unique context, and constraints well identified, shared and overcome. Physical space and provision of some home comforts inclusive of room allocation, games, television, information boards, drinks, and snacks were attended to, and support staff frequently communicated and remained vigilant.

Determining the overall success of the program was established through perceived and measurable improvements in the coaching process, deliberate practice, deliberate experience and deliberate mindfulness. However, the truest and most conclusive indicator was the Melbourne Games' medal count. A profile of previous years as well as Melbourne is offered (Fig.6.2).

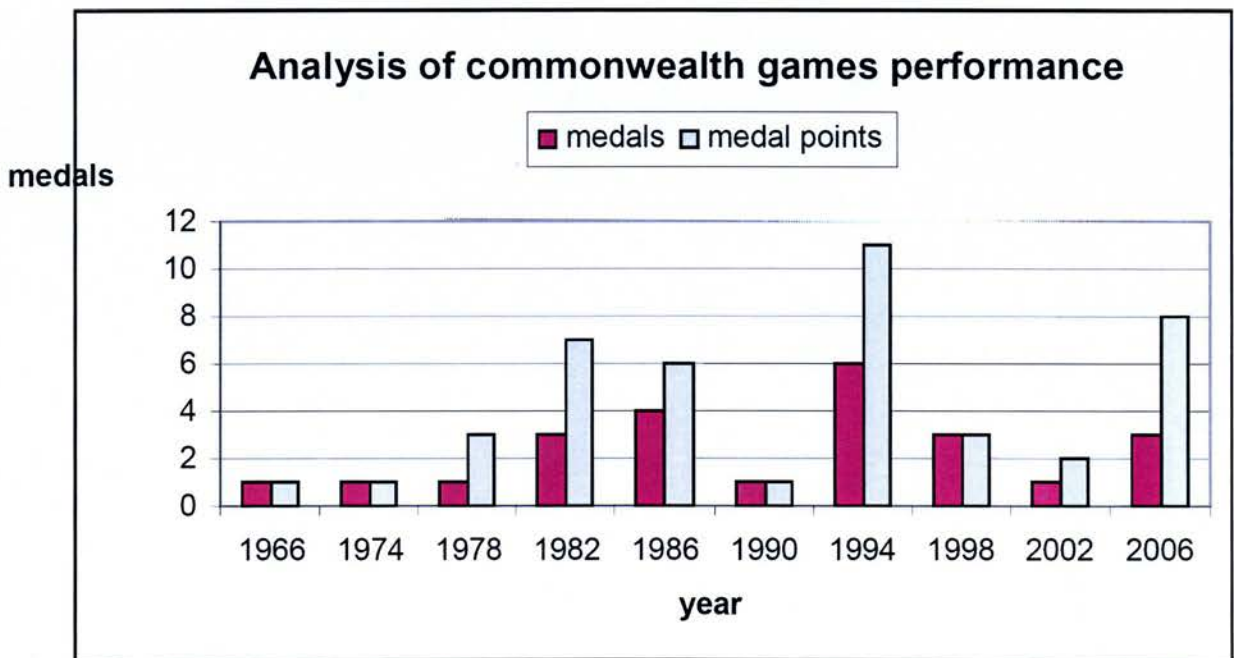


Figure. 6.2. Time series analysis of commonwealth games performance.

The mean and standard deviation for overall medal counts at all Commonwealth Games is 2.2 (± 1.8) and medal point count 3.9 (± 3.3). Overall, the trend in medals decreased over the last few Commonwealth Games in accordance with the increases in both nation attendance and the number of athletes taking part. The number of nations winning a medal has increased considerably in recent years. Therefore, competition defined by the number of nations capable of winning medals, has increased substantially since the mid 80's, and also doubled in total. In relation to small-bore shooting and using the conversion of medals into points, where gold = 3, silver = 2 and bronze = 1, it can be seen that the nation's points have decreased rapidly since 1994. This trend is also reflective of the market share of total medal points. In summary, the previous two Games indicate that the team's standing has declined as competition has increased (i.e. more nations, more competitors, same no. of events, higher quality of competitor), reflecting the nations overall trend in all sports, as well as the emergence of strong shooting nations such as India.

The program's success may be measured by the outcomes of the Commonwealth Games which indicate the reversal of a downward trend in medal success. Records showed two gold (the first for twelve years) and one silver medal; medal point success (eight); three competitors being placed fourth; three national records; and the second most successful Games record. Apart from the medals, a highly positive national team, coach, organization and athlete feedback; along with the performance indicators inclusive of enhanced engagement with deliberate practice, deliberate experience and deliberate mindfulness, measured throughout the two years, also gave credence to a constructivist coaching program.

Discussion

Findings revealed that an emergent, iterative, ecological and meta-level process of coaching and sport-science support was conducive to the needs of this particular squad due to the nesting and rich interconnectedness of performance behaviours within intra-personal, inter-personal, group and social domains, and the rich-interconnectedness associated with the relevant domains of expertise. While the main purpose of the case study was to assess the efficacy of the constructivist program as action research, the accumulation of findings in this research were vast, complex, informative and also contribute to (a) our understanding of the development of expertise, (b) the utilisation of action research as a methodology for change and development and (c) the adoption of constructivism, psycho-social dynamics and self-regulation as highly appropriate in sport science and coaching studies.

The adoption of an adaptive and complex action-research methodology allowed the researchers (1) to acknowledge both the planned and emergent properties of expertise development, (2) identify the rich interconnections between multiple layers across the full individual-socio-environmental spectrum, (3) identify the general principle of 'change' which endorsed both macro- and micro-transitions, (4) recognise limitations of the reductionist paradigm endorsed by many contemporary science studies, (5) embrace fluctuations, variability and instability as a necessity for long-term development, (6) appreciate the importance of challenge in development and (7) merge micro-development and individual development into manageable macro-development (episodic) and collective goals, thus allowing the ability to plan and control to be enhanced. In summary, all these features recognise expertise, coaching practice and sport-science support as a complex-adaptive system. Together, they give practical guidance as to how we can create an environment

conducive to expertise enhancement.

If the capability of extending our understanding of *how* we develop expertise is deemed necessary, then the present research acknowledged the emergence of, 'deliberate experience' and 'deliberate mindfulness' in addition to 'deliberate practice' as a suitable and holistic coaching and expertise theory. Indeed, it will be the capability of the coach and athlete to integrate these three elements (along with the feasibility of 'transfer' as acknowledged in the development of refereeing expertise- see Study 1; Ollis, Button & Fairweather, 2005) which should provide feasibility for future performance enhancement and supplemental research. Re-emphasis on the need to enhance the individual, relational and collective nature of self-regulation within these three elements is also offered. This reflects Reason & Bradbury's (2001) account of first, second and third person action research practice. Action research is not only designed to foster a collective systematic intervention (third-person), but is also designed to empower an individual (first-person) to inquire and self-regulate their own development in pursuit of excellence. Acknowledgement of the co-constructive and inter-related nature of these voices was endorsed in the present project.

In collating the findings, the case-study found that action-research allowed us to generate knowledge, and on the basis of this, to adapt or change the project, coaching, training environment and athlete behavior on an ongoing basis. Due to the rich-interconnectedness within the team, and impact that the coach had on creating an environment conducive to the development of expertise, it was recognized that the volume and quality of 'deliberate practice', 'deliberate experience' and 'deliberate mindfulness' could be enhanced with no 'direct' intervention on the athletes themselves. The shooting team, as an organization, adopted what was perceived as a 'dynamic capability' where the

individuals, through the coach, integrated, built and reconfigured internal and external capabilities to address constantly changing environments. Zollo & Grinter (2002) define dynamic capability as “a learned pattern of collective activity through which the organization systematically generates and modifies its operational routines in pursuit of improved effectiveness” (p.13). This definition was apparent in the organization’s (once again through the coach) constant pursuit of funding, support (e.g. physiotherapy and sport psychology), attracting potential and promising shooters, constructing coaching strategies, maintaining relations with various shooting and sporting bodies, sharing knowledge, and getting ideas to enhance a conducive training environment. Due to the small size of the shooting team, the ability for the organization to remain flexible, responsive and adaptable to both internal and external changes was enhanced through strong and potentially direct communication channels.

The coach has to play a key role in “defining adaptive functioning with reference to biological, behavioural and social systems characterised by dynamics, non-linearity and coupled modular processes” (Guastello, 2002). An action research model should not only provide a means of initiating change, but also a means of monitoring, correcting and assessing the developmental process. Providing challenge and a solution-based model, which embraces self-organisational processes, is a powerful developmental and performance enhancing tool. The IAE³ provides the framework for such a process. What cannot be offered is a ‘path’ to expertise due to the non-linear and complex-adaptive nature of expertise development.

The adoption of action research means the ability to fully predict and control is surrendered. However, what was recognised in the present research was that some degree of

predictability, control and planning can be utilised in the short to medium-term; that the generality of the principle of change does exist; and that the need to develop an environment conducive to expertise should be the ultimate goal of any organisation and management team. Action research becomes a potential tool for coaches, athletes and practitioners alike to identify, establish, evaluate and empower their personal and collective skills, especially in consideration of the emergent nature of expertise development.

Conclusion

Lewin challenged the artificial borders separating theory, research and action, insisting “No action without research, no research without action” (Fine, Torre, Boudin, Bowen, Clark, Hylton, Martinez, Missy, Roberts, Smart & Upegui 2003, p.174). If the development of athlete and coaching expertise is indeed perceived as obeying complex laws; if the development of expertise is an iterative process which extends across macro-, meso- and micro-timescales; if the development of expertise is induced by the rich interconnections and integration of macro-, meso- and micro-systems; then the adoption of a constructivist model as action research is deemed a suitable research and practice tool.

The findings revealed that an ecological and constructive model of coaching and support was conducive to the needs of this particular squad due to the nesting of performance behaviours within individual, group, team and organisational domains. Constructivism in coaching is tied to the development of expertise and talent development environments in the sport setting. Athletes, coaches, sports scientists, teams and organisations can develop optimally only if they effectively map new information onto previous experience. Thus one coaching approach does not fit every learning situation. Further research is required to assess

the efficacy of an ecological model in alternative sport settings, and suggestions that micro-analysis of 'creating an environment', 'regulated development', 'challenge points for adaptivity' and 'containment' are merited.

CHAPTER 7. STUDY 4: A MICRO-ANALYTIC AND COMPARATIVE ANALYSIS OF A TALENT DEVELOPMENT ENVIRONMENT

Understanding the co-constructive, integrative and multi-level qualities required to attain high levels of expertise was concluded from both Study 1 and Study 3. This constructivist and ecological approach to expertise expresses the critical importance and need for construction of an environment conducive to talent and expertise development. Within this expertise and talent development environment, the capability to integrate organizational, relational, coach and individual athlete learning programs was considered critical. Utilising the context of an elite shooting squad, and supported by the suggestions of study 1 of focusing on talent development in rugby refereeing, study 3 identified that the coaching process was a critical element and leverage point of this goal. While study 3 discusses the importance of an expertise conducive program in consideration of a 'holistic' program focusing on talent development policy, it was deemed appropriate that the situated action research experience be utilised in existing literature based on talent development environments (Martindale, Collins & Daubney, 2005) and alternative literature discussing 'rich learning environments' in a situated development setting.

From TID to TiD

Emerging from the Study 1 conclusion, a series of lectures and a preliminary position paper concerning Talent Development Environments (TDE), an initial empirical study was initiated between Ollis, Martindale & Collins (2003) whereby IAE³ was utilized as a transitional framework governing the construction of the supportive TDE. This collaboration was based on the negation of capability to identify talent as proposed by Abbott, Collins, Martindale & Sowerby (2002a, 2002b) through the Study 1 ethnography.

My initial role as talent identification officer for the RFU elite referee support group was to confirm capability of the proposed department TID model, and specifically that 'potential' could be identified through the 'characteristics of excellence' (McAffrey & Orlick, 1989) and perfectionism was the major contributing factor. The operational remit for my role as TD officer was to substantiate a three-dimensional model of TID based on the integration of anthropometrical, physiological and most importantly, the psycho-behavioral (characteristics of excellence- McAffrey & Orlick, 1989) profile of an individual (Abbott, Collins, Martindale & Sowerby, 2002a, 2002b; Mascarenhas, 2002). Unfortunately, this TID philosophy was negated at an early stage within the referee officers' evaluation due to the recognition of characteristics of excellence being even less stable as physiological and anthropometrical markers, and adoption of the more ecological, micro-developmental and dynamic systems approaches as expressed in Study 1. A shift to a more regulated and meta-cognitive approach (rather than the specific characteristics of excellence), guided by a dynamic systems and constructivist philosophy to expertise and talent development unfolded. Therefore, to clarify, while Abbott, Collins, Martindale & Sowerby (2002a, 2002b) claimed that talent could be identified generally inclusive of a time period approximating 11-13 years old, the initial investigations of the RFU referee elite referee unit and subsequential studies, theoretical accounts of development and introspective evidence drawn from alternative performance domains negated this proposal.

The referees' characteristics of excellence were identified as highly variant during critical transitions across the life-span development continuum, as well as between individuals. These characteristics were highly prone to reversals and influenced by both normative and non-normative influences both in the short and long-term. Further investigation of the appropriateness of a psychological TID model as offered by Abbott,

Collins, Martindale & Sowerby (2002a, 2002b), was given greater depth of investigation by Ollis in his role as TID officer over the initial investigative period and indeed, the concept of psychological TID was recognized as something not as novel or eminent as believed. Indeed, Durand-Bush & Salmela (2001) recorded a host of talent detection models in sport (Bar-Or, 1975; Geron, 1978; Gimbel, 1976; Jones & Watson, 1977; Montpetit & Cazorla, 1982) which utilized psychological assessment with inconclusive effect. Indeed, it should be noted how many of the models negated the capability to identify talent long-term, but focused on the feasibility of talent 'selection' on a short-term basis.

Readings giving support for inability to predict and identify talent over a long-term period were also reflected in alternative performance domains. This was surmised in the works of Feldhusen & Jarwan (2000); Kanevsky (2000); Perleth, Schatz & Monks (2000); Trost (2000); Gardner (1999); Sternberg (1999); and Simonton (1999, 2000) who collectively portray a theoretical perspective of talent which is multi-dimensional, systemic, context-situated, and indeed moving into the realms of complexity theory where self-organisation, context-sensitivity, unpredictable and dynamical systems are dominant. Accordingly, within the evolution of a constructivist perspective, stress was placed upon the effect of the social and environmental context during expertise development. It was this theoretical stance and the IAE³ philosophy which gave credence to the principles of a TDE in sport.

The principles of non-linear development, dynamical systems theory, chaos theory, psycho-social dynamics, ecological development and complexity theory brought understanding of the incapability to identify talent with any long-term accuracy. Equally, a series of psycho-biographies of eminent achievers and teams were adopted which gave further support for the fragility of psycho-behavioral skills of individuals and teams. From

these investigations, the RFU TID report (2002-03) highlighted the inability and difficulties to identify and predict talent accurately. This was especially so at early stages of selection with proposals for the need to focus attention to the enhancement of the development program, based on self-regulation and meta-cognition, thus allowing talent to more readily emerge. It is from this stance that the Edinburgh University Talent Identification Team shifted from a TID model to one which adopted a dynamic, multifaceted and multidimensional TD philosophy and was expressed as 'T- small -I -D' (TiD).

A preliminary position paper, and working practice adopted in the referee development program, was initiated by Ollis with further collaboration utilising interviews with coaches that at the outset looked at Martindale's study of 'reflective practice' in coaching. This project was initiated previous to commencement of the shooting project (Study 3) and after completion of the initial ethnography (Study 1) which indeed concluded how "expertise evolves from a complex interaction of time, task, individual and environment that deems it is more important for institutions and organisations (and subsequently the researchers they employ) to create a context from which elite performance can morph". Utilising the principles of IAE³, and further findings highlighted in the IPA study (Ollis 2003; Ollis & Collins, 2003) it was proposed that the adoption of an ecological model of expertise could be adopted and utilised to influence the needs of a talent development environment based on the principles of the ecological, pluralistic, lifespan orientated, transitions orientated and micro-development model.

Collins (2004) continued to lecture on the subject matter as part of the Performance Psychology Course (MSc program- University of Edinburgh, October, 2004- referred to as Martindale & Collins, 2004). This was followed with a position paper authored by

Martindale, Collins & Daubney (2005). Additionally, a follow up study on the TDEs is also ready for publication (Martindale, Collins & Abrahams, in press). It should be important to note, in consideration for 'original thought' in PhD preparation, how the attention to the talent development environments was also afforded as a proposed manuscript by Ollis, Davidson & MacIntosh (2004) based on the first year experiences of support provision to the shooting team, prior to the publication of Martindale, Collins & Daubney, (2005).

The present study evolves from these investigations and primarily utilises the position paper of Martindale, Collins & Daubney (2005) to compare the initial findings of the action research experiences of the 'expert conducive environment' period. While comparative case studies traditionally evaluate data of one case against another (Stake, 2005), the present comparative case study evaluates the data of one case against the key generic themes identified by the position paper. To achieve this aim, the key themes offered from literature in Martindale, Collins & Daubney's (2005) TDEs will be reviewed before qualitative comparisons are made in relation to the action research experiences of the appropriate stage in study 4. Finally, these comparisons will be utilized into principles conducive to constructivist learning environments and design.

Talent Development Environment

The Martindale, Collins & Daubney (2005) paper defines and qualifies the TDE as the coaching environment. It should be recognized however that the TDE, in the original construction of the original TDE (Ollis, 2003; Ollis, Martindale & Collins, 2003; Ollis, Davidson & Macintosh, 2004), is a more expansive and encompassing concept of what the 'environment' is. Indeed, the focus for creating a talent development environment includes awareness of cultural and social situe, as well as recognition of supporting organizations,

political influence, institutions and individuals and the actual organisation and sporting body itself. Therefore, the original talent development environments perspective adopted the principles of Bronfenbrenner's model of 'ecological' development. This account recognizes, that even though coaching is a critical leverage point in many sporting groups, that the coaching environment does not incorporate all the possible environmental influences of change which impinge across the lifespan. As a comparative analysis of TDEs, it is appropriate to integrate alternative readings at present, but focus on the key themes associated with a TDE as offered by Martindale, Collins & Daubney (2005).

The key themes apparent in the literature that have relevance to the effective development of talent are offered directly from the Martindale, Collins & Daubney (2005) paper. The five key generic themes that are believed to emerge consistently include; long-term aims and methods; wide ranging coherent messages and support; emphasis on appropriate development rather than early selection; individualized and ongoing development; and finally, integrated, holistic and systematic development.

Long-term aims and methods is the first generic theme and focus's on the necessity to adopt a long-term vision, purpose and identity with an associated process focused on systematic planning and implementation. Attention is afforded to the notion that capability to predict and identify talent based on early years performance levels is not appropriately valid, and therefore the need to rush the production of young star performers is unnecessary. Literature, highlighting the high rate of early drop-out and wasted talent when early specialization and goal of winning at all age groups, was offered. Utilising principles such as the benefits of 'deliberate experiences' (Study 1) the generic theme then attenuated to the appropriateness of systematic planning and implementation in achieving long term

requirements as well as cruciality of early specialization for long term development. The first generic theme then continues to highlight that a systematically long-term vision requires to be reinforced at a number of levels. For example, they describe how reward systems can be adopted (Ashforth & Mael, 1996) to reinforce aspects inclusive of performance standards. Reinforcement of the need to focus on long-term player development rather than focus too much on performance is maintained.

The second generic theme is the necessity for wide ranging coherent support and messages. This included the need to a) provide coherent philosophies, aims and methods at a variety of levels both within (and outwith) the 'coaching environment' (TDE); b) educate parents, schools, peers, coaches and important others (and encourage positive contributions); c) utilize role models at a number of levels; d) open communication patterns between the influential support networks; and e) set up a variety of support networks focusing on sport-specific problems.

The third generic theme addresses the need for emphasis on appropriate development NOT early selection. Recognition, that performance is different from potential with the need to move away from a focus of early selection, is presented. The theme then further addresses the characteristics required for appropriate development, inclusive of the provision of stage-specific integrated experiences and teaching which draws from the principles highlighting the individual, dynamic and unpredictable development process (Abbott, Button, Pepping & Collins, 2005; Ollis, Macpherson & Collins 2006). Recognition is given to how these characteristics require fundamental mental and fundamental physical skill, as well as the importance of sport specific skills and their integration and balance. The focus on self-responsibility, autonomy, personal commitment and intrinsic motivation and self-

determination is emphasized.

The fourth and final generic theme attenuates to the necessity for individualized, ongoing and systematic development to also be integrated and holistic. The theme is carried by recommendation to provide opportunities and fundamentals to as many youngsters as possible which, in turn, require provision for flexible systems to allow for performance and physical development variation to necessitate such a goal. The study then alludes to how a transitions approach to development, utilising a three stage approach which includes identifying, preparing and supporting individuals, may be appropriate, along with provision of regular individual goal setting, review processes and systematic reinforcement contingencies.

In summary, the approach to creation of a suitable TDE lies in the necessity for an integrated and dynamic model which recognises the incapability to identify talent at a young age with the Martindale, Collins & Daubney (2005) statement that “we hope this review can provide the foundation on which research can move away from attempting to identify performance correlates of potential and focus more explicitly on the need to explore the individual and environmental factors that are causative of effective development and future success” (p.367).

Methods

A comparative research design “entails the comparison of two or more cases (in this particular case a study and theoretical position) in order to illuminate existing theory or generate theoretical insights as a result of contrasting findings uncovered through the

comparison” (Bryman, 2004, p.538). The present study primarily compares the action-research and ongoing findings of study 4’s ‘creating an expertise conducive environment’ against existing literature in ‘talent development environments’ as provided by Martindale, Collins & Daubney (2005).

The case orientated comparative analysis, as adopted in the present work, is qualitative and utilises a semi-reflective approach to the problem. The adoption of reflective comparison is based upon the literature being written in 2005, one year after the TDE program adopted within study 3 was completed. It is important to acknowledge that as action research, the creative expertise conducive environment was being researched and coded as an ongoing case study: The provision of the Martindale, Collins & Daubney (2005) paper allowed a systematic comparison to be afforded.

Traditionally, a comparative analysis would compare two ongoing cases studies to identify both similarities and contrasts. For example, Hay & Barab (2001) compare and contrast two different summer camps which adopted alternative philosophical assumptions. One summer camp based its assumptions with constructionism, while the other summer camp based its assumptions on the principles of apprenticeship. Data collection methods were based on naturalistic research methods. This involved collaboration of three researchers, video’s, discussions, questionnaires, field notes and interviews as primary data source utilised to gain a holistic vision. The camps were analysed in terms of theoretical assumptions, community and groups, participant roles, practices and other evidence of learning with various similarities and distinctions offered. Comparing and contrasting the two camps was conducted through data analysis, supported with dialogue between the two lead researchers.

The present study fails to compare and contrast two alternative case studies, but adopts the 'salient issues' and 'generic themes' of the TDE position paper to be compared and contrasted against the practices of the Scottish Small Bore Shooting Team. While the focus of study featured on the epoch of 'constructing an expertise conducive environment', comparison was also conducted against on-going practice up until the project closed. It should be noted that Hay & Barab (2001) utilized not only empirical analysis of the two camps, but adopted a literature analysis focusing on issues that were fundamental to constructionist and apprenticeship learning environments.

The present case study utilises the same participants and setting as offered in Study 2 and Study 3. Specific focus was attended to the talent development appropriated by the coaching process. Rich analysis was feasible due to the unique position and dynamic afforded by the 'coach' (who was also manager and husband of *team director*) and which therefore afforded capability to address all these issues, with the coach as leverage point. It should be recognized however, that, theoretically the TDE can be influenced and therefore investigated at a more expansive level. It therefore may be more appropriate to recognize the 'coaching process' as a 'development and learning process', due to the identification of additional agents of change and influence.

The present work is deemed a micro-analysis of whole action research study, as presented in Study 3. The micro-analysis reflects studies in ethnography allowing greater scrutiny to an issue which the researcher merits as deserving of thicker and more detailed investigation. Within ethnography research, this approach to detailed focus of an issue is defined as a micro-ethnography. Thus, while the participants and situe are the same as study 3, more detailed consideration is given to the TDE issue. Consideration is given to not only

depth of analysis within the existing work, but also the emergence of the Martindale, Collins & Daubney (2005) work, which afforded comparative potential.

Findings

The overall findings are offered in table 7.1. Within this table, the themes of Martindale, Collins & Daubney (2005) are provided, with similarities and differences identified in the present case study offered. Sources of evidence for the similarities and evidence are offered in the final column.

Table 7.1. Comparison and contrast of learning environments.

Martindale, Collins & Daubney (2005) generic themes	Similarities	Contrasts	Evidence
THEME 1			
Long-term vision	<ul style="list-style-type: none"> ▪ Long term vision utilized 	<ul style="list-style-type: none"> ▪ Medium term vision utilised ▪ Short term vision utilized ▪ Negation of Bloom's (1985) phase stage progression ▪ Adaptation of long-term vision. 	<ul style="list-style-type: none"> ▪ Organisation goals, objectives and aims - literature ▪ Coach goals, objectives and aims – interviews, discussions, intervention. ▪ Athlete goals, objectives and aims – questionnaires, interviews, discussions, intervention. ▪ Training camp objectives – training program literature. ▪ Competition objectives – pre performance literature, team discussions, interventions. ▪ Non-linear progression profiles inclusive of shot to shot, match to match, competition and long-

			<p>term athlete profile-observation analysis, performance analysis, electronic scoring results, development analysis, questionnaires, interviews.</p> <ul style="list-style-type: none"> ▪ Evident and discussed critical transition paradigms being micro-developmental
Inability to predict	<ul style="list-style-type: none"> ▪ Poor long-term predictive capability 	<ul style="list-style-type: none"> ▪ Relative to poor short-term and medium term accuracy in predictions ▪ Meta-predictive capability observed 	<ul style="list-style-type: none"> ▪ Shot to shot predictions – supported with observational analysis, electronic score systems. ▪ Match predictions – coach and athlete interventions. ▪ Competition predictions ▪ Final (match) predictions ▪ Squad, team and event selection ▪ Long-term development predictions ▪ Capability to identify ‘general’ shooting capability outwith specific results [i.e. accurate predictions impossible, but general medium term capable in consideration of specific characteristics]. ▪ Capability to identify ‘clusters’ of shooting capability (teams, groups of individuals, overall annual performance- e.g. India will win many medals in shooting)
Systematic planning	<ul style="list-style-type: none"> ▪ Systematic planning evident 	<ul style="list-style-type: none"> ▪ Non-systematic practice evident ▪ Emergent and planned skills evident ▪ Systemic rather than systematic ▪ Many feasible systems- capability 	<ul style="list-style-type: none"> ▪ Annual development profiles ▪ Periodisation profiles ▪ Training schedules ▪ Problem based skills-athlete, coach, support, organization ▪ Complex-adaptive and nested effects

		<p>to adapt system to long-term goal.</p> <ul style="list-style-type: none"> Constructive- rather than instructivist 	<p>observed and discussed.</p> <ul style="list-style-type: none"> Importance of holistic analysis- wholeness matters in all coaching and psychological interventions Team and organizational behavior and goals relating to systemic practice. Coach-athlete discussions and coach- team goals.
Re-inforcement	<ul style="list-style-type: none"> Importance of culture Negation of early selection policies Focus on development 	<ul style="list-style-type: none"> Catch up identified Accepts paradox between long-term and medium/short-term visions Accept development and performance are two-sides of same coin Mastery & performance goals utilized in coaching and support process. 	<ul style="list-style-type: none"> Sheena – ‘press release’ as ‘super-granny’. Time-outs in shooting. Identified short-term gains and accelerated development with short-term programs. Long-term predictions of ‘collective’ talent identified. Training ‘mastery’ and ‘performance’ orientated- integrated. Coach and athlete discussions.
THEME 2			
Wide ranging & coherent support & messages	<ul style="list-style-type: none"> Fractal but expansive process in shooting context. Nested principle. Co-constructive principle 	<ul style="list-style-type: none"> Co-constructive and nested principle allows ‘focus’ on leverage to be utilized. Emergent principles and development ‘for’ peak performance can be utilized. 	<ul style="list-style-type: none"> Adoption of constructivism Adoption of IAE³ All domains of expertise utilized Psycho-social dynamic utilized Integrated influence- e.g. loco’s physiotherapy.
Provide coherent philosophies, aims & methods	<ul style="list-style-type: none"> Coherent messages Epochs of coherence Risk of saturation of messages. 	<ul style="list-style-type: none"> Incoherent messages Complexity Paradox Coherence was identified in non-linear and paradox being embraced Epochs of strong coherence Acceptance of 	<ul style="list-style-type: none"> Organisation, team and individual goals. Balance of family, work, university, alternative passions. Time out Mastery & performance goals NO team philosophy initially. Individual

		pluralism	<p>philosophies difficult to locate.</p> <ul style="list-style-type: none"> ▪ Periods of focus and coherence set by goals. ▪ Many paths- many methods. ▪ Adaptive capability dependent on context and transitions. ▪ Need for stability (coherence) in some dimensions allowing incoherence and paradox to be utilized for optimal gain.
Internal & external focus	<ul style="list-style-type: none"> ▪ Integration and unification of self and organization. 		<ul style="list-style-type: none"> ▪ Co-constructive processes inclusive of self being personal, relational and collective.
Educate parents, schools, peers, coaches & important others.	<ul style="list-style-type: none"> ▪ Learning has to occur. ▪ Support has to be identified in the nested process. ▪ Most parents, schools, peers and coaches clearly <i>educated</i>. 	<ul style="list-style-type: none"> ▪ Systematic education ill-requirement ▪ Most understand and are aware- however, it is making actionable that is the issue. ▪ Athletes paradoxically developed psychologically by overcoming so called 'desirable characteristics'. ▪ Construction of self-dependency fostered by independence. ▪ Support more culturally determined than direct individuals. ▪ Dynamic of overall nest more critical than individual collective. 	<ul style="list-style-type: none"> ▪ Interviews and psychology support issues- family, university, work, peers ▪ Family discussions ▪ Family dynamic of team- many individuals related and married. ▪ Indication of fathers living through siblings? ▪ Discussions of positive long-term gains emerging from short-term adversities. ▪ Transitions of ownership, self-responsibility and psychological maturation evident.
Role models at number of levels	<ul style="list-style-type: none"> ▪ Senior team members utilized as suitable role models ▪ Competitive team members in next 'level' identified as suitable role models ▪ Teachers, schools, peers. 	<ul style="list-style-type: none"> ▪ Moral reasoning/ attitudes developed through negation. De-struction of senior members. ▪ Danger of failure to rise to next level if moral and philosophical assumptions of role models are overly 	<ul style="list-style-type: none"> ▪ Mentoring systems utilized ▪ Interviews/ discussions on individual difference ▪ Dominance of 'philosophy' by senior members. Sometimes positive- sometimes negative. ▪ Unique pathways and

		<p>absorbed.</p> <ul style="list-style-type: none"> Construction of independent selves. Individuals read about, etc. also influential. Songs, music, movies, books, quotes, events utilized as highly influential as well. Maybe more powerfully 	<p>philosophies evident.</p> <ul style="list-style-type: none"> Discussions on the others and influences on philosophical, moral, attitude and behavioral development Respect of various opposition-discussions.
Open communication patterns	<ul style="list-style-type: none"> Open communication patterns positive Need for open communication system to exist. 	<ul style="list-style-type: none"> Open communication patterns negative Closure of communication paths periodically productive Once again a dynamic quality- open and closed dependent on context. Communication system requires to be adaptable. 	<ul style="list-style-type: none"> Well informed communications systems- web based, written and verbal. Time addressing 'open communications' absorbed 'limited time'- complaints to management, self and coach. Time away from DP and DE. Athletes enjoyed their 'own' thing which was deemed an escapism.
Variety of support networks focusing on sport specific problems	<ul style="list-style-type: none"> Variety of support extremely useful Physiotherapy, physiological, lifestyle, coaching, team management, psychology, technical expertise evident. 	<ul style="list-style-type: none"> Saturation of support and aims. Cognitive/ physiological overload Periodically, overly reductive and deviate from holistic goal. Addition of support networks identified as a critical 'multiplier effect'. 	<ul style="list-style-type: none"> Physiotherapy utilized as a psychological/ technical co-constructive dynamic. Quality and variety of support appreciated. Coherence of episodic and long-term messages challenged Coach required to maintain grasp of 'holistic' aims. Complaints of short-term support liaisons. Necessity for 'engagement, commitment & respect' from support members- become 'team members'. Utilising support network as elite athletes identified as a multiplier effect- thus if overly

			<p>abundant at 'early development', risks individuals to LEARN about own psychology, technical, physiological capability through 'problem solving'.</p> <ul style="list-style-type: none"> ▪ Detrimental to 'team dynamic' when a team role is challenged by a 'generic expert'.
THEME 3			
Appropriate development & not selection	<ul style="list-style-type: none"> ▪ Negation of early selection ▪ Importance of training 	<ul style="list-style-type: none"> ▪ Negation of middle and late selection where possible. ▪ Accept financial, social, selective transitions exist. 	<ul style="list-style-type: none"> ▪ Accuracy of performance difficult to determine. ▪ Emergence of excellent scores based on non-selection and vice-versa. ▪ Career, family and personal interests had enormous effect on capability to shoot.
Performance v potential	<ul style="list-style-type: none"> ▪ Potential requires to be accounted for and fostered 	<ul style="list-style-type: none"> ▪ Balancing performance and potential capability. Potential capability is appropriately identified in performance especially when biases are accounted and compensated for. ▪ Acceptance of role of genetic, physiological and anthropometrical ceiling and boundary effects. ▪ Could not define a holistic and fully encompassing 'highly able child'. 	<ul style="list-style-type: none"> ▪ Coach and organization created balance between mastery and performance goals. ▪ Performance and dynamic assessment of performance profile is highly indicative of shooting potential. ▪ Requires sustained engagement with sport for an epoch. ▪ Performance is definitive marker of potential- inclusive of competition scores and dynamic assessment.
Stage specific integrated experiences	<ul style="list-style-type: none"> ▪ 'episodes' of development identified and utilized as 'projects'. ▪ Individual, dynamic and unpredictable development process identified. 	<ul style="list-style-type: none"> ▪ Stages negate Bloom, Abbott et al model of macro-stages. ▪ Elements by-passed and others determined more critical. ▪ Stages created (e.g. see study 3) were 	<ul style="list-style-type: none"> ▪ Study 3 episodes. ▪ According to Bloom, these individuals would have been identified as members of second stage (amateur). ▪ Behaviours and observations

		<p>shared and collective, as well as individual.</p> <ul style="list-style-type: none"> ▪ Episodes emerged from existing constructions, context and future goals/ needs. ▪ Stages require to promote context of collective, relational and personal worlds rather than a single generic model. 	<p>identified transitions exemplifying all transitional periods.</p> <ul style="list-style-type: none"> ▪ Behaved as novice, intermediate and expert in varying contexts, environments and tasks. ▪ Constructivist development profile as micro-developmental.
Dynamic & unpredictable process			<ul style="list-style-type: none"> ▪ Much of the observations, actions, coaching and psychology support was highly emergent. ▪ See study 3 for emergent episodes and supporting evidence.
Fundamental physical	<ul style="list-style-type: none"> ▪ Fundamental physical capability required. ▪ Conditioning program initiated. ▪ Focus on general health and fitness in program. 	<ul style="list-style-type: none"> ▪ Some fundamental physical attributes of a generic disposition negates shooting capability. ▪ No specific body shape/size identified for various shooting positions or events. ▪ Fundamental skills exist at varying layers and important to shooting e.g. health, stamina, endurance, structural fitness, tendon/ligament, joints, capability to train for elongated period (20 years), self-identity and travel to varying environments physical issues. ▪ Some excellent shooters (and generally of shooters) not physically attuned specimens 	<ul style="list-style-type: none"> ▪ Muscle mass negates capability to utilize structural fitness as a scaffold. ▪ Loco's shoulder physiotherapy. ▪ Susan's general health and general conditioning (did it have an effect?) ▪ Self-awareness and self-identity at Games! ▪ Physiological profile of eminent achievers (or could they have been better?).
Fundamental mental	<ul style="list-style-type: none"> ▪ Importance of psychological factors. ▪ Psychological factors can be developed. ▪ Learning autonomy- 	<ul style="list-style-type: none"> ▪ "young athlete putting in many hours of deliberate practice" negates ethos of Martindale philosophy?? 	<ul style="list-style-type: none"> ▪ Adoption of constructivist principles. ▪ Adoption of emergent principles. ▪ Focus of program on

	self-regulation and meta-cognitive key elements.	<p>Deliberate practice highly specific practice.</p> <ul style="list-style-type: none"> ▪ Self-regulation and meta-cognition constructed and supported <i>for</i> rather than instructed. ▪ Negate importance of 'characteristics of excellence' at early stages of development. ▪ Negate existing approaches for developing psychological skills. 	<p>enhancing self-regulative and meta-cognitive skills.</p> <ul style="list-style-type: none"> ▪ Characteristics of excellence elite athlete orientated at final stage and overly one dimensional. ▪ Initial McAffrey and Orlick (1989) characteristics of excellence outdated.
Lifestyle management	<ul style="list-style-type: none"> ▪ Critical to existing group 		<ul style="list-style-type: none"> ▪ Fathers, mothers, high-profile professional, university students.
Sport specific skills	<ul style="list-style-type: none"> ▪ Co-constructive nature of expertise 	<ul style="list-style-type: none"> ▪ Impossible to specifically identify necessary 'future' skills. 	<ul style="list-style-type: none"> ▪ Focus on adaptive expertise training. ▪ Focus of challenge points program on retention and transfer capability. ▪ Integrated and 'holistic' training focusing on high pressure match simulation.
Habits beneficial at later stages	<ul style="list-style-type: none"> ▪ Co-constructive nature of expertise 	<ul style="list-style-type: none"> ▪ Dynamic and unpredictable 	<ul style="list-style-type: none"> ▪ Episodic and medium term focus. I.e. training for Melbourne Games. Present goals- Delhi 2010 and London 2012. ▪ Politics and games councils will select shooting events based on gun laws and public opinion. ▪ Sensitive dependence to initial conditions were highly contextual and open to chance and context.
Concept of balance	<ul style="list-style-type: none"> ▪ Complex adaptive system. ▪ Dynamic capability 	<ul style="list-style-type: none"> ▪ Overcoming periods of imbalance created potential for multiplier effects. 	<ul style="list-style-type: none"> ▪ Holistic feature of program. ▪ Constructivist principles guiding. ▪ De-selection reactions, periods of

			<p>stress being learnt from.</p> <ul style="list-style-type: none"> ▪ Indication that short term gains and transitions were optimized by periods of imbalance in life, work, relationship, shooting and actual performance
Responsibility & autonomy	<ul style="list-style-type: none"> ▪ Self-regulation and meta-cognition focus 	<ul style="list-style-type: none"> ▪ Collaborative and relational dynamic ▪ Collective dynamic 	<ul style="list-style-type: none"> ▪ Self as personal, relational and collective utilized. ▪ Mentoring programs. ▪ Team culture. ▪ Reciprocal relationships of support. ▪ Travel, accommodation and attending shooting range issues. ▪ Shooting evaluation.
Intrinsic motivation & personal commitment	<ul style="list-style-type: none"> ▪ Focus of empowerment ▪ Attitudes, integrated skills and mental skills influenced more informally. 	<ul style="list-style-type: none"> ▪ Recognition of relational and collective commitment. ▪ Extrinsic motivation evident and identified as performance enhancing. ▪ Most potent form of athlete learning (integration and mental skills) being informal is NOT due to lack of systematic and instructivist sport psychology training program. 	<ul style="list-style-type: none"> ▪ Necessity of individual to optimize self. ▪ Understanding that optimizing Scotland team and overall dynamic was critical to individual success. ▪ The environment IS collective. ▪ Require expert athletes, managers, organizers, coaches, support staff and equipment/resources nest to enhance personal commitment. ▪ Extrinsic motivation of wanting to be seen as a winner fuelled many medalists. ▪ Athletes and coaches balanced attributes of motivation to intrinsic and extrinsic sources. It is understanding how and when to utilize the extrinsic motivators. ▪ Greatest psychological gains self-fulfilled by constructivist principles and

			personal overcoming and engagement with problems/issues/challenges.
THEME 4			
Individualised, systematic & ongoing development	<ul style="list-style-type: none"> ▪ Individualised program important. 	<ul style="list-style-type: none"> ▪ Quality collective programs and community focused programs equally critical. ▪ Individualised approach can create gulfs between select squads and individual behaviours/attitudes. ▪ More systemic than systematic. ▪ Focus on individual, relational and collective variables. 	<ul style="list-style-type: none"> ▪ Community of practice collaborated and shared gives capability to function more appropriately in elite squads. ▪ Philosophy and visions shared. ▪ Philosophy and visions <i>should</i> be different at various stages, but progressive. ▪ IAE³ model
Provide opportunities & fundamentals to as many youngsters as possible	<ul style="list-style-type: none"> ▪ Pyramid approach to talent development acknowledged. 	<ul style="list-style-type: none"> ▪ Focus equal attention to 'middle stages' where physical activity and engagement with sports decrease. ▪ Transitions approach has to focus on key leverage issues. ▪ Increase capability to re-engage with shooting. 	<ul style="list-style-type: none"> ▪ Critical transitions more important at periods of university/career/family commitments than 'opportunity' stage. ▪ IAE³ model
Provide flexible systems allowing performance and physical development variation	<ul style="list-style-type: none"> ▪ Performance and physical development variation very important. ▪ Flexibility and adaptivity key elements to success. 	<ul style="list-style-type: none"> ▪ Psycho-social dynamic effect on developmental variation greater in present culture. ▪ Performance and physical development variation lower effect in shooting. ▪ Financial implications 	<ul style="list-style-type: none"> ▪ IAE³ model ▪ Work, family, study, lifestyle issues frequently attended too at various periods. ▪ Coach attends to psycho-social dynamic.
Identify, prepare & support through key transitions	<ul style="list-style-type: none"> ▪ Transitions approach effective 	<ul style="list-style-type: none"> ▪ Relational and collective transitions equally important 	<ul style="list-style-type: none"> ▪ IAE³ model ▪ Relational and collective elements of support. ▪ Relational and collective aspects of managerial and coaching process.

Provide individual goal setting & review processes	<ul style="list-style-type: none"> ▪ IAE³ individual 	<ul style="list-style-type: none"> ▪ IAE³ relational ▪ IAE³ collective 	<ul style="list-style-type: none"> ▪ IAE³ model ▪ Relational elements of coaching and support program. ▪ Collective elements of coaching and support program.
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Both similarities and contrasts were found in the comparative analysis. While much of the Martindale, Collins & Daubney (2005) position paper is appropriate, a major failing emerged due to the focus on policy and strategic representation rather than a ‘coaching orientated TDE’ as initially stated. The Martindale, Collins & Daubney (2005) paper attenuated to the construction of long-term development pathways and links between various development stages, rather than a specific coaching talent development environment. Csikszentmihalyi (1996) suitably recognizes a distinction between the “macro-environment, the social, cultural and institutional context in which a person lives and the micro-environment, the immediate setting in which a person works” (p.139). This macro and micro understanding of TDE is reflective of the ‘nested and dynamic’ principle of a TDE which the present findings allude to. Therefore, the study would seem to afford principles for construction of a generalized long-term individually tailored strategy for a program, rather than describe the environmental variables conducive to the construction of excellence in a situated community and coaching or teaching environment. An athlete’s environment is formed from through accumulation of various TDEs inclusive of the national framework, regional support, club and school TDEs. It was assumed that a ‘coaching TDE’ would have focused on the specifics of such school or club TDEs. Indeed the distinction of dynamics between a school of excellence and transcendence (expert) against a school of development and fundamentals (novice and developer) would equally require attention.

Additionally, the study was overly individualized and ‘instructivist’ indicating that a modular system exists, which seems to oppose the benefits of a TDE (which for the present reader indicates an interaction of the personal, relational and collective self). The Martindale, Daubney & Collins (2005) study failed to embrace the guiding philosophy that development pathways are dynamic, unpredictable and ever-adapting against internal and external influences, whilst evaluating systems, policies, human and state needs. This includes the reactionary effect of a talent development environment within a coaching context. A healthy talent development environment requires to balance an overly instructivist paradigm with notions such as emergent change, which would in turn allude to neo-Vygotskian principles such as communities of practice, apprenticeship, situated learning theory and activity theories. More recent papers such as Cassidy & Rossi (2006) reflect the Study 3 principles by highlighting how TDEs are primarily designed *for* development. Within this position paper, Cassidy & Rossi discuss the merits of situated learning theory and the associated concept of communities of practice within coach education. Therefore, a movement towards a constructivist TDE may be optimal to expert performance development, as well as fostering well-being and a mastery orientated motivational climate. Carol Dweck (Dweck, 2000; Elliott & Dweck, 2005) recognised that an achievement goal could be conceptualised as a ‘performance’ or a ‘mastery’ goal. Performance goals are drawn by a purpose to demonstrate one’s competence (or avoid demonstrating incompetence) while mastery goals focus on ability to improve one’s competence or learning. As performance goals are drawn to ‘looking smart’ rather than being smart as well as foster a focus on failure and maladaptive motivation, it is clear that long-term development and pathways to expertise could be hindered with an overly performance orientated motivational climate. TDE’s should therefore be designed to create (especially in the early years) a dominance of mastery orientated goals and foster self-esteem, confidence, an incremental theory of intelligence

and self-belief.

The position paper did, however, highlight many of the pertinent issues, and address the individualized and instructivist issues, which the present study would declare as a component of the overall talent identification environment. The Martindale, Collins & Daubney (2005) paper was guided in principle by its focus on the micro-developmental and transitional approach to talent development which was confirmed with the presentation of Collins (2004) where the IAE³ model was proclaimed as the guiding model of the TDE. A sharing of the major principles, such as emphasis on appropriate development rather than early selection, was evident.

A constructivist learning environment is deemed to share characteristics which were only partially evident within the Martindale, Collins & Daubney (2005) position paper. As drawn from the evidence and contrasts of Table.1, a TDE has to be contextualized with the 'here and now', adaptive, complex, reflective, intentional, constructed as *for* development- i.e. planned and emergent, and embrace paradox. In sum, a TDE should necessitate not only individualized development, but also relational and collective principles which together are absorbed by a socio-cultural perspective of constructivism. The Martindale, Collins & Daubney (2005) study was overly reductive and modularly causal in approach to the problem. Before further discussion however, it may be appropriate to evaluate the key generic themes in light of alternative findings and more recent supporting evidence.

The first generic theme addressed long-term aims and methods. The action research study highlighted the importance of micro-, meso- and macro- integration. Therefore, in a temporal consideration, the need to highlight the importance of long-term aims, with

medium-term aims, short-term aims and the here and now is therefore critical. For example, during early development periods, mastery-orientated motivation training (Allen & Hodge, 2006) requires attendance to 'here and now' competences where the process of development and learning are considered primary aims. By focusing on the capability to gain personal competence and highlight continual improvement, long-term development should be served as the self-regulatory, meta-cognitive and motivational effect are strengthened. Therefore, there is no need to continually focus on 'performance' skills required in ten years. Enhancing the self-regulatory and meta-cognitive skills are the long-term gains.

The dangers attributed to an overly focused perspective to produce programs with long-term aims and methods are reflected in the historical dynamics of sport in any nation. While agreement that long-term visions and goals are a necessary feature of a suitable TDE, the advice for prioritization of 'long-term aims' requires to be balanced against the importance of living, achieving and performing in a 'here and now' climate. Critique of an over-emphasis on long-term prioritization is reflected in models of phase-staged development which are adopted in talent development programs to date. For example, the Player Improvement consultancy paper (Sportscotland, 2005) introduces a long-term player development program based on the principles of Balyi (1998b) and work of Abbott, Collins, Sowerby & Martindale (2002). Within these programs criteria to the infrastructure of Scottish sport and development programs are given and where "relevant knowledge and skills will help to maximize an individual's potential at all stages of development" are deemed as generic. However, drawn from the early work of Ollis (2002) the subsequent identification that a general stage approach does not reflect the pathway to excellence has been highlighted (Abbott, Button, Pepping & Collins, 2005; Martindale, Collins & Daubney, 2005) as it is indeed a more complex choreography than these phase-stage models would suggest.

The present case study acknowledged how the long-term development of Scottish shooting was important to all stakeholders. Acceptance that politics and perspectives of shooting out-with the sporting context will determine how shooting is perceived, was a given norm. What did matter in the shooting context was the 'here and now' and the construction of a 'medal potential' team. By focusing on the 'here and now', and training for adaptive capability, the ability to negotiate issues of tomorrow were enhanced. The medal count at the Melbourne Games gave the sport of shooting and its individuals another few years at least to change public opinion- as well as ensure it would be included in the proposed Glasgow Commonwealth Games -2014. Prioritisation was therefore given to getting the environment for which medal potential could emerge. The focus of all aims and methods was focused on Melbourne 2006 and the development of episodes of excellence which together would achieve that aim. To illustrate the emergent nature of 'long-term aims', it should be recognized how all periodization plans and organizational goals were focused at all levels on Melbourne 2006. Since the games, however, emergence of focus on London 2012 has seen a transition from a Scottish to British vision with seven of the Games team now partaking on the British Pathway. Thus, it is through success of priorities given to a 'here and now' which produced the capability to engage in future goals. This approach reflected constructivist and non-linear attenuation to medium and short term developments, with long-term aims accepted as relatively uncontrollable. The focus was given to doing the 'here and now' right. However, coach, manager, athletes and support staff alike felt the adoption of good and best practice in the 'here and now' would ostensibly have an effect on long-term aims, methods and practice.

Systematic focus was therefore more appropriately directed to emergent and ongoing needs rather than a planned, modular or phase-stage approach. Martindale, Collins &

Daubney (2005) therefore have to adopt a definition of TDE that is more inclusive of planned and emergent, individual and social processes. Political groups, national governing bodies and sport councils do require to embrace long-term visions and philosophies. However, with consideration of 'coaching environments' being defined as their interpretation of a TDE, the focus of a coaching TDE should, and, in relation to the shooting team, was on 'here and now', short term and medium term provision in the context of where the coaching occurs.

This highlights the importance of recognizing a TDE as a hierarchical and nested phenomenon which together feature a dynamic and changing focus on short-term, medium-term and long-term visions. As mentioned previously, many TDEs exist (national, regional, club/school) and are best identified as 'nested'. Thus, whilst Csikszentmihalyi (1996) addresses the macro- and micro- TDE domains, maybe a more appropriate and sport specific determination of the various TDEs which exist can be offered. Specific analysis of each layer of the nest requires accounting, and then integrated, if an efficient pathway to excellence is to be afforded.

Schempp (2003) offers an understanding of a teacher/coach perspective of a TDE where the creation of a learning environment draws upon the social and physical factors in and around the classroom. This includes understanding the social dynamic of a class to recognize the character of a community. To assist, attention to the motivational climate, equipment, facilities, teacher/coach knowledge of equipment, technological support, social climate, size of a class, collaborative and group task opportunities. Specific focus is given to the adoption of building relationships on humanistic principles; planning and organizing the appropriate learning environment to set appropriate levels of challenge and support; and the establishment of rules, procedures and philosophies which create a manageable environment.

This included focus on “building and sustaining a momentum in a class breathes life and excitement into a lesson, making it a dynamic, interesting, meaningful and successful experience for students and teacher alike” (Schemp, 2003p.91). It was this perspective of a TDE which as a ‘coaching TDE’, the present contrast expected to evaluate.

The second generic theme looked at the importance of wide ranging, coherent messages and support, and the overall philosophy was once again shared. Once again however, the main critique reflected the failure to address a ‘coaching talent development environment’ rather than a ‘governing body’ vision. Additionally, the adoption of a constructivist and systemic rather than instructivist, modular and systematic approach seemed a necessary advancement to the provision of coherent philosophies, aims and methods, especially when the importance of flexibility and adaptability is considered. Thus, how parents, schools, peers are educated (instructivist) is an important factor, as we fully understand no one way exists. The paradoxical effect of important influences, and effect of the dynamic system rather than any one individual element has to be acknowledged. Accordingly, understanding that every component of a support network is a double edged sword requires emphasizing.

The third generic theme highlighted the necessity for emphasis on appropriate development rather than early selection and many comparisons were identified. This is a considerable reversal from the proposal of the ‘initial’ Edinburgh TID team- Abbott, Collins, Martindale & Sowerby (2002a, 2002b) who proclaimed “The key criterion for determining whether a pre-adolescent child has the capacity to develop is psycho-behavioral” and from which they “developed a theoretically and empirically based TID system”, which they planned to “pilot, refine and evaluate the efficacy of the proposed TI system within a

Scottish/UK context". Indeed, contrary to the presented focus on *development* of potential and not current performance ability, the original position voiced the ability to *identify* potential through psycho-behavioral abilities rather than through anthropometrical and physiological based performance markers (Abbott, 2002). It therefore seems paradoxical that the present work now states "Ideally, such programs will deemphasize identification and selection and stress appropriate development" (Martindale, Collins & Daubney, 2005, p.361). However, it is deemed an appropriate and correct shift.

Inability to predict was also identified in medium and short-term periods as well as long-term development. For example, team selections based on performance and training profiles of the previous year, months and weeks were adopted by management and coaching staff. However, individuals who were not selected to represent Scotland, but still attended the competition, consistently outperformed the selected individuals. Indeed, in many high profile competitions, predicted scores and behaviors failed to emerge on many an occasion. The principle which seemed to emerge from the period of study seemed to reflect a need to select in relation to performance, with acceptance that every individual had equal opportunity. When equal scores were evident, then selection was calculated on score profiles (improving and decreasing), criticality of competition (and reaction to high competition stakes) and finally long-term benefits to the team and individual. This reflects the principles of Harre (1982) who believed that the only way to detect and select talent is to put as many children as possible through training and assess level of performance, rate of improvement (or decrease), stability and reaction to training and competition demands. Thus, whether selection and detection occurred in youth stages, or selection and detection in later stages of development, the principles remained the same. Performance was the critical factor- all other factors being equal. Periodising the year with the coach allowed insight into the

'priority' matches which allowed assessment of 'competition reaction' to be assessed. Thus, the coach and selectors would not look at only accumulative scores, but capability to perform in the appropriate arena. This gave insight into identifying differences between talent identification, talent detection, talent selection and more importantly, talent discrimination.

The comparative analysis highlighted that while the Martindale, Collins & Daubney (2005) TDE was addressing youth sport (seemingly at the end where transition from development to perfectionism/expertise would soon occur as according to the Bloom, 1985 and Abbott, Button, Pepping & Collins, 2005 model), the existing analysis was assessing the coaching TDE of a relative level of expertise, and one which was progressing in effectiveness over the two year period. Understanding that the analysis was addressing two different contexts brought awareness that TDE's are themselves dynamic and multidimensional entities which adapt and change in relation to context. For example, the Martindale, Collins & Daubney (2005) study seemed to promote TDE's as a generic, modular and stable environment, promoting a phase-stage approach which can be shared across all sports, whilst the shooting TDE was constantly evolving, paradoxical and dynamic, requiring a capacity to evolve and re-invent itself: A community of practice, which like the athlete was on its own pathway to excellence, and where the individuals, team, organization, and stakeholders had a synergetic effect on the coaching TDE itself.

It is interesting to recognize that within a stage of development e.g.- perfectionism (or in the present case- adaptivity), that micro-cycles of initiation, development and perfectionism could all be identified at a smaller level. In our own terminology, how IAE³ existed at a macro-cycle with meso- and micro-cycles existing within. For example, the elite athletes were consistently bringing something novel and unique to their shooting training

program, displaying characteristics of novice, intermediate and then expert, as a micro-cycle. This could be trying a new form of rhythmic shooting, a new shooting routine, construction of a new 'position', focus of attention, awareness of 'mirage' or shooting with a new type of rifle/sighting system. Each time, a de-construction before re-construction occurred, although accepted on varying scales and addressed with greater timeliness.

The fourth theme puts emphasis on a necessity for individualized and ongoing development as well as an agreement that individualized and ongoing development is critical. However, identification of success of an indirect and emergent nature of expertise and performance was evident. Collaborative, mentoring, relational, and collective (group, team, squad and organization) development were equally important for long-term capability in producing excellence. Additionally, in relation to the function of a TDE, while the Martindale, Collins & Daubney (2005) focus of analysis remained on individual and personal commitment of the athlete, the focus of the shooting TDE was more on the personal, relational and collective function of a TDE and the overall interaction.

In Gestalt therapy, this view of the human being, as an organism that is part of nature, the environment and the social, cultural and historical web, draws us towards the concept of *organismic self-regulation* and the *organism-environment field*. By adapting to an organism-environment field "human beings achieve the best possible adjustment in the context in which they live" (Woldt & Toman, 2005, p.85). This reflects well with the principles of the overall thesis as the Gestalt therapy theory of change shares the Lewinian principles of change which function within the IAE³ model as well as action research, and promote the principles of co-constructivism. This approach is also found in the principles of the 'constructivist' developmental systems theory (Ford & Lerner, 1992; Lerner, 2002). For the

first year of collaboration, the TDE for the shooting team primarily addressed the construction of a community of excellence rather than the design of a systematic and individual program. Only when an appropriate constructivist TDE was accomplished did focus towards a systemic and individual (although organismic) program flourish adequately. It was from this basis that the effective skills of 'situative awareness' and 'self regulation' could foster with the appropriate level challenge and support: Once again, reflective of Gestalt's promotion of 'here and now', existential dialogue, paradox, authenticity, field theory and holistic view of development. Maybe more appropriately, also reflective of the developmental systems theory (Ford & Lerner, 1992, Lerner, 2002) which promote the necessity of organismic, integrative, systemic and contextual models of human development, requiring understanding of the individual as an open self-regulating and self-constructing system.

Many of the interventions utilized during study 3's two-year collaboration were not only individualized, but also focused on the relational and collective components. Indeed, the aim of the reconnaissance period was to be drawn away from individualized interventions, and actually focus on high leverage relational and collective features required to allow the individual to prosper. To promote such capability, a systematic and modular process was discarded for the adoption of a systemic and dynamic process looking at the community of practice and situated learning principles. Once again, it should be noted how the development of a TDE functioned as a complex-adaptive system promoting situated cognition, or maybe termed more appropriately as situated mindfulness. Utilising and drawing from the co-constructive, ecological and integrative nature of a truly multidimensional model of expertise is necessary to achieve eminence and transcendence. Accordingly, bringing opportunity and challenge within a supportive environment is key to

the construction of a suitable TDE at all periods and stages of development.

Discussion

Creating an expertise development environment

Along with many similarities, some considerable variance and contradiction was evident between the Martindale, Collins & Daubney (2005) position paper and the findings of the shooting action research experiences of creating an expertise conducive environment. It is proposed that a primary influence for the volume of contrast lies in five main areas. The first is that the shooting TDE was contextualized to the latter stages of an expertise continuum while the Martindale, Collins & Daubney (2006) model focused on the latter stages of a youth development environment. Therefore, it can be proposed that a TDE has different functions (although some primary concepts may remain) as expertise levels are enhanced. However, the study would allude to the idiographic and contextual influences being important between TDE's in the same sports, at the same stage of development, in the same region bases and that this is certainly not the only influence. The second reason for the contrast lies in the Martindale, Collins & Daubney (2005) study claiming a focus on a TDE which looked at the coaching environment, while it indeed adopted reflection on what can be proposed as the full ecological hierarchy utilising a sport development program perspective such as the Player Improvement program (Sportscotland, 2005). The third reason for contrast lies in the focus of personal and individually orientated athlete programs, whilst the shooting TDE highlighted the individual, relational and collective aspects necessary for a high achieving TDE and community of practice. This explains why the fourth difference- a shift from a modular and systematic approach, to a more dynamic and systemic approach- emerged and requires attention. The fifth and most important influence is the adoption of an

instructivist and direct (planned) approach by the Martindale, Collins & Daubney (2005) paper, while the shooting study adopted more constructivist principles which shared both direct and indirect (emergent) methodologies.

Instructivism v Constructivism

A clear delineation within the comparative analysis can be identified within adoption of two contrasting TDEs- defined as either instructivist or constructivist. Martindale, Collins & Daubney (2005) adopt an instructivist approach with highly structured and systematic principles adopted. This includes not only 'teaching' and systematic instruction of the individual athletes, but also extends this principle to the instruction of parents, schools, coaches and organizations. Accordingly, the instructivist approach was directive and individualized. Weaknesses in this approach have been voiced by Gruber & Mandl (2000) who allude that "it has repeatedly been doubted that systematic presentation of information and systematic accumulation of knowledge is adequate for teaching complex skills" (p.387). Like the findings of earlier thesis studies, the concern for the development of expertise is that intensive practice, and therefore deliberate practice, is not sufficient. A necessity for situative and contextualized knowledge which utilises adaptive capability is necessary, and thus a constructivist approach to expertise development is necessary.

The principles, concepts and philosophies promoted within the shooting TDE meanwhile were recorded as constructivist. A situated-learning perspective was promoted where individual mental constructive (rather than receptive) activity and the social, cultural and historical embeddedness of learning was embraced. Thus, the TDE fostered the enhancement of a community of excellence where complex, authentic and challenging activity- deemed as existing at the edge of chaos was constantly constructed by the coach,

support staff and team members alike. As a constructivist learning environment, the TDE itself was constantly identified as evolving, active and adapting.

The principles of situated learning, cognitive apprenticeship, and communities of practice are embraced within a constructivist TDE which views the development of expertise and talent as a process of enculturation through engagement within authentic activity. The shooters utilised a principle which sequenced learning into increasingly complex and self-regulated activities, utilising the social aspect of the group as leverage, challenge, co-operation and support. Sharing a neo-Vygotskian constructivist principle which utilises Bronfenbrenner's (1979) ecological model of development, Côté (2006) "identifies the conceptual and operational knowledge of coaching and is developed around the following six components: (a) competition, (b) training, (c) organization, (d) coach's personal characteristics, (e) athletes' characteristics, and (f) contextual factors. Thus understanding that the development of expertise is both a formal and informal venture is expressed as how coaches learn in three main settings: (a) coach education programs, (b) learning experiences as an athlete, and (c) learning experiences as a coach. The study would also suggest that expert coaches draw from 'life experiences' whether experienced or perceived by themselves or their athletes, and transfer a learning experience from them. Therefore, expertise is indeed a rich interplay with anarchy and complexity, where creative capability and ability to adapt to context, and utilize it for advantage, is the highest level of capability. It seems only constructivism, with a tendency towards neo-Vygotskian principles, can afford this.

Systemic v Systematic

Martindale, Collins & Daubney (2005) promote the requirement for a systematic approach to development. A systematic approach alludes to a highly controlled and monitored program which adopts a constant and analytic process of step by step deduction. The defining of an ideal systematic approach is a highly rational and reductive process whereby the analytical process of accumulated and completed information will lead to an optimal result. The present findings suggest that an overly systematic (and mechanistic) system creates an environment where optimal performance cannot occur. As a complex-adaptive system, the present findings would suggest that an optimal talent development environment should be considered more readily as a more open, self-regulating, self-constructing system (although appropriately supported) which would indicate a more complex organization and concept of system. This will be defined as a systemic model of talent development.

A systemic approach concerns itself with more holistic views to problem solving. Complexity theories are adopted in systemic models of development and the dynamics and changing relations between component sub-units are identified as defining the collective and developing state, rather than simple cause and effect as afforded by a systematic approach. Accordingly, an appropriate TDE has to ensure systemic capability for its participants, as well as optimal systemic capability between TDEs: For example, as an individual moves from a junior to senior team, from club to national standard squads, and eventually to elite international competition.

The only identified consideration to systemic approaches in a sporting talent development context is attributed to Gréhaigne, Richard & Griffin (2005) who allude to a

systemic model of game play analysis in team sports and games. Within the systemic model (and in opposition to either analytical or structuralist models) “focus is on trying to explain the oppositional relationship to better understand the game” (p.9) with the adoption of complex and dynamic systems. “Within the systemic approach, movement replaces permanence, flexibility replaces inflexibility, and adaptability replaces stability...revealing the interdependence of phenomena and their gradual change” (Gréhaigne, Richard & Griffin, 2005, p.13). It is from this consideration that Gréhaigne, Richard & Griffin (2005) are drawn to a constructivist teaching-learning approach to games education in physical education. Alternative adoption of systemic models of talent development in alternative domains has also been considered in the educational development of giftedness. Monks & Mason (2000) utilize a perspective of development which incorporates the *zeitgeist*. “The systemic perspective includes interacting influences that affect a child’s life and development. Beyond the family, they might include the schools, political system, economic environment, social agencies, cultural practices, and related factors” (Monks & Mason, 2000, p.147). One which it is hoped the reader agrees reflects the principles, philosophy and aims of Study 2. Therefore, the importance which TDE research requires to focus on is the relational and collective effect of social, environmental, cultural and historical influence as determined by practice within a contextualized community.

Planned v Emergent

While an explicit and transitional approach to the development of expertise is considered as important, the present case study highlights the necessity for a TDE to establish a positive, affective and contextualised climate as an integral feature of it: One which has capability to foster challenge and support, create patterns of reactive activity and action, as well as planning and reflection. Accordingly, a high degree of situated awareness allowing

regulative capacity is required where the negotiation of uncertainty is promoted. This suggests an emphasis of philosophy, utilizing situated learning, communities of practice, adaptive expertise and constructivism is necessary.

A TDE cannot focus explicitly on a planned approach to talent development alone. Indeed, the role of the development of a constructivist TDE is the creation of balance between emergence and planning in an overly bureaucratic and systematic process. It should be acknowledged that the creation of rules, guidelines and criteria within an activity, where the highest levels achievement are defined by eminence, transcendence and creativity, are highly likely to create non-selectivity at various stages of development.

It is for this consideration that a challenge to many phase-stage programs associated with player improvement (Sportscotland, 2005) may require re-evaluation. Within the player improvement model, a planned approach which aims to focus on 'basic moves' and 'fundamental movement skills' is being promoted. The concern remains that a serious delimiting effect can be conditioned in a period of development which is more complex than basic. Thus, the educational setting at this period of development should embrace technical, tactical and regulative learning (early psychology) utilizing principles of situated learning theory as well as the ZPD. Accordingly, constructing challenging environments within the TDE of any age group is the guiding focus where the development of individual, relational and collective technical, regulative and tactical skills is fostered. These skills may be observed very differently along the developmental pathway, but conceptually remain the same. The concern for the existing and proposed model (basic moves) is first, the technical, tactical and regulative skills, which do exist, will remain unchallenged, as well as philosophically- NO basic move exists. Therefore, "the educational setting should not

oppose technical learning and tactical learning but rather should articulate them in a tactical matrix of technique” (Gréhaigne, Richard & Griffin, 2005, p.20). Embracing challenge within the whole complexity of the game (however perceived) is necessary and to forego elements of the expertise and talent development domain by focusing on movement alone is de-limiting. Indeed, to refer back to Martindale, Collins & Daubney (2005), it is important not to de-limit factors beneficial at later stages. It is for these concerns that a re-evaluation of their fundamental physical and fundamental mental is proposed. The importance of creating a culture of excellence and sporting activity as proposed by Coalter, Taylor & Jarvie (2006) becomes even more important.

Individual, relational and collective

A successful talent development environment requires to engage in the personal, social, environmental and cultural construction of knowledge. Concepts such as situated learning theory, activity theory, communities of practice, communities of excellence, zone of proximal development, socio-cultural development and constructivist learning environments all share one feature- the collective nature of development is greater than the sum of its parts. Coaching, physical education teaching and general ‘training’ literature would suggest that this development is one of the more recent and positive advancements within the appropriate fields of studies. For example, Salas & Cannon-Bowers (2001) suggest how “organizations have shifted their views about training from a separate, stand-alone event to a fully integrated, strategic component of the organization. New training related approaches, including action learning, just-in-time training, mentoring, organizational learning and managing skill portfolios are all being explored” (p.472). This would suggest that a psycho-socio-cultural perspective of the trainee is now prominent. Indeed, this is supported by views that a systems view of training is more concerned with context and demonstrations of how

organizational climate (e.g. situational cues, consequences) is the most appropriate predictor of expertise and competence being attained. Thus Salas & Canon-Bowers (2001) provide from a ten year review of training studies confirmation that integrative and contextualized theories of training, where systems are embedded in an organizational context, provide today's most effective working practice.

Findings of the present comparative analysis continually refer to Martindale, Collins & Daubney's (2005) failure to promote a shared vision of expertise as individual, relational and collective self. Therefore adopting the main findings of study 1, as well as the present finding, into a holistic and integrated TDE where the aim is to plan *for* an environment where levels of performance can excel is somewhat progressive. One where constructivism dictates social and environmental variables are equally, if not more important as individually tailored systematic models.

"Bartlett argued that human action is not caused by the execution of plans, rules, schemata or other kind of stored program that is retrieved from memory. Bartlett's theory of memory is based on active processes that are constructed constantly within action in an adaptive manner. Memory is thus constructive or reconstructive rather than reproductive, even with respect to perceptual-motor skills" (Jenkins, 2006, p.iv). Therefore, a shift towards implicit and indirect models of development, which are also regarded as more conducive to retention and transfer capability, is a suitable research venture. This is indeed why situated cognition, situated learning and neo-Vygotskian (whether under the flag of socio-constructivism or socio-cultural movements) principles may be regarded as appropriate research principles to test.

The neo-Vygotskian model of development (Karpov, 2005) is a theory that integrates cognitive, motivational and social aspects of expertise development with emphasis on the situated and engaged role of activity as mediated by influential others (especially the coach) in their life-span development. While the Martindale, Collins & Daubney (2005) themes reflect well the Piagetian principles of independent and individualized development, the present findings support necessity for an action theory promoting mediation taking place within specially organized activities (TDE's). The most important elements requiring promotion from a suitable TDE being the capability for bringing episodes of challenge, which plays a motivational role in sustaining long-term engagement with sport and physical activity. Once again, we cannot stress more the importance of self-regulation and meta-cognitive capability, especially in early youth.

Conclusion

Overall findings suggest that the Martindale, Collins & Daubney (2005) interpretation of TDE is only half the story. It is a story of Piagetian constructivism which characterizes expertise as an individual, directed, planned and systematic journey. The failing is the lack of a neo-Vygotskian notion of expertise development. A more appropriate TDE model should address planned and emergent change, relational and collective features of self, a systemic approach to change, as well as the higher levels of potential as a constructivist design. It is proposed that this will be served appropriately through the investigation of a contemporary constructivist TDE that is inclusive of awareness of the relational and collective self.

CHAPTER 8: A CONSTRUCTIVIST MODEL OF EXPERTISE

Critique of existing uni-dimensional accounts of expertise and talent development such as the theory of deliberate practice is becoming more prominent. Indeed, emergent research in this field has emphasised the need for a multi-dimensional and pluralistic account for optimizing performance. Utilising the findings and suggestions within these critical accounts, a constructivist model of expertise is offered. The model is structured around both a planned and emergent approach to expertise development which identifies the athlete as a personal, relational and collective self. Within this structure, deliberate practice is scaffolded with deliberate experience, deliberate mindfulness, transfer, non-deliberate practice, non-deliberate experience and non-deliberate mindfulness to give a more holistic account of expertise. The constructivist model is utilised to highlight the integrated, synergetic and co-constructive nature of talent development along with the importance of ecological and environmental influences. Suggestions for future research and application based on the constructivist approach are offered.

Embracing the collective integration of mechanisms and processes that underpin the development of elite performance remains a complex challenge for athlete, coach, sport scientist and governing bodies alike. The complexities that integrate long-term development culminating into an eventual peak performance emerge from the multitude of processes of change, agents of change, chance and situativity. One where the interconnectedness of individual, environment, task, time and context can produce either normative and typical profiles of development or, paradoxically yet more commonly for transcendent experts, elements of non-normative and non-typical development profiles. The challenge for those

who research expertise and talent development is making sense of this complexity, yet delivering a systematic, flexible, progressive and manageable program which reflects the life-world of the aspiring athlete complimentary to his or her supporting network and cultural situe. The aim of the present paper is to assist in such sense-making activity. While the theory of deliberate practice (Ericsson, Krampe & Tesch-Romer, 1993) has been a productive model of expertise, emerging research would suggest that the model now constrains our future understanding of expertise development as no simple solution or general theory to this multi-dimensional and complex problem of expertise exists. This has been supported with implicit identification of additional mechanisms of expertise development, as well as documented limitations with the deliberate practice model (Abernethy, Farrow & Berry, 2003; Gagné, 2000; Moran, 2004; Simonton, 2003a).

The present position emerges from a desire to bring conclusion from the studies and suggestions offered in the thesis to date. Within these studies, and as suggested by others, expertise and peak performance was deemed to evolve from a rich interplay of seemingly ‘endless’ variables and constraints and the multi-faceted nature of talent (peak performance variables). The ‘investigative’ research and review process required to support the present paper also ventured into alternative performance domains such as dance, music, military, fire service, medical, education and business and a variety of sporting domains such as football, squash, badminton, outdoor pursuits, athletics, tennis, and inclusive of general Talent Development (TD) and Talent Identification (TID) programs. Additionally, a full review and engagement with general expertise and talent development models, best practice methodologies, as well as emergent literature was incorporated within the development of the offered model over a five year period.

To clarify, the aim of the paper is to offer an alternative yet progressive model of expertise- one which moves beyond the monotonic and uni-dimensional theory of deliberate practice. It should be highlighted however, that many of the characteristics which evolve from the theory of deliberate practice should be maintained, but endorsed within a constructivist perspective. However, it is the identification of alternative variables and processes, apart from practice alone which give merit to the proposed model.

Constructivist Expertise

The requirement for a *philosophy, theory or perspective* of development and learning which assists, and reflects the long-term development to peak performance experienced by athletes is one which remains illusive. Approaches adopted to understand the learning and development of human ability seemingly reflect the general theories of child development. Accordingly, we have seen research shift from behavioural, to phase stage, to cognitive, to ecological, to dynamical systems assumptions. For example we have moved from Bloom's (1985) phase stage approach to Ericsson's (1991; 1993) cognitive perspective of expertise through deliberate practice. At present we now have an emergence of studies and position papers in sport psychology which advocate the importance of a multi-dimensional, non-linear and ecological outlook on expertise development (Abbott, et al, 2005; Abbott & Collins, 2004; Gagné, 2003; Ollis et al, 2006; Simonton, 1999, 2001). The present paper suggests that a constructivist approach, which embraces an ecological and micro-developmental outlook on development, yet addresses other nuances of expertise research (e.g. Abernethy, Farrow & Berry, 2003), may give insight into how we develop expertise and research such a phenomenon in the future.

The necessity to expand our understanding of a constructivist perspective evolves from recent awareness of varying 'types' and 'levels' of expertise. For example, Ollis, Button & Fairweather (2005) highlighted the insufficiency of performance with those considered 'expert' in a knot tying task by firefighters (experts) and students (novice). This reflected identification that many research studies focus on 'relative' rather than 'absolutist' expertise (Chi, 2006). While relative expertise studies compare 'levels' of expertise which affords generalization of 'characteristics', absolutist research recognizes exceptional levels of expertise replicate more of a unique, dynamic and non-normative odyssey. This leaves us asking if considerable difference exists in how we develop a relative rather than absolutist expert, and if peak performance capability occurs due to the type of expertise promoted. Absolutist expertise has equally been described as 'eminence' (Ericsson, 1996), 'mastery' (Hoffman, 1998; Dreyfus, 2006), 'wisdom' (Dreyfus, 2006) and 'transcendent' expertise (Starkes, Cullen & MacMahon, 2004). We suggest, absolute experts have apparent capability to function in complex environments, synergising and synchronising the rich interplay of variables, and identifying more readily the pertinent and leverage elements to focus upon, or disregard. A process appropriately described by Gagné (2003) as a 'complex choreography'. Eminent achievers create a capability to overcome and adapt to dynamic contextual nuances, therefore producing higher levels of performance. Thus we propose a need to differentiate between training for perfectionism (regular expertise focusing on high levels of automaticity) and adaptive expertise (transcendent and absolutist expertise). Constructivism is a means of development and learning that would seem to foster adaptive expertise, and therefore seems an appropriate venture for promoting adaptive and transfer capability.

Constructivism is a view that learners actively construct their own understandings of concepts, phenomena and ideas, balancing what they already know with what they discover.

Constructivists believe that “knowledge is dynamic rather than static, a process rather than a thing, a pattern of action rather than an object” (Gagnon & Collay, 2006, p.xv) and as such make a movement from ‘instructivism’ to ‘constructivism’. It is suggested that the complex choreography required to develop talent is best supported by constructivist design where acquiring knowledge is a highly engaged, authentic, contextualised, self-regulated and active process of constructing meaning and expertise, rather than a passive receipt of overly deliberate information and practice. Therefore constructivism is best understood as a process (if not slightly anarchic), rather than a bounded rational model of understanding, requiring active engagement in a rich and authentic learning environment. It has been suggested that there exist two paths (although parallel) to constructivism which reflect the neo-Piagetian with the neo-Vygotskian perspectives. The neo-Piagetian position attends to the mechanisms of change and development and proactive structure of mature thought by an individual (the outcome of adaptation), while the neo-Vygotskian position attends to the environmental, social and historical nuances which impinge on development. However, contemporary perspectives of constructivism have married the two parallel paths of cognitive and socio-cultural influences into a unified learning theory (e.g. dynamic skill theory, Mascolo & Fischer, 2005). Together they acknowledge that physiology, social and environmental domains are each highly structured dynamic systems, and that they are coupled with one another. Additionally, while we adopt a holistic perspective of constructivist learning, it is important to acknowledge that various perspectives of constructivism exist, inclusive of cognitive-, social-, developmental- and neuro-constructivism, dependent on research focus.

Adaptive expertise refers to maintaining a reflexive and flexible approach when presented with novel constraints. This contrasts from training, which focuses on acquisition capability focussed on perfectionism (Abbott, et al, 2005; Abbott & Collins, 2004) and

classed as routine expertise. The capability to be trained in adaptive expertise and transfer capability has been recognized from a motor skill perspective (e.g. Williams & Hodges, 2004) which requires the need to structure and construct an appropriate training and development environment. The present paper would advocate that transfer and adaptive capability expands across all domains of expertise (physical, technical, tactical, psychological- see Starkes et al, 2003). For example, alternative means of promoting adaptive expertise within a psychological domain include refinement of regulative and meta-cognitive skills (Kozlowski, 1995). For individuals to understand and perform efficiently, as opposed to simply and robotically perform, we suggest (guided by the principles of constructivism and adaptive expertise) that meta-cognitive ability and refined situation analysis should be developed. This approach would seem to increase individuals' contextual control and responsibility over their performance, enhancing the development of individual skills and cognitive strategies as well as the development of 'game play' strategies for example. This is important because we must not assume that meta-cognitive ability will develop to full potential automatically. Indeed, suggestion that meta-cognitive skills evolve into intuition (much like how many other skills develop into automaticity- Fitts & Posner, 1967) necessitates that an adaptive expert requires the complex capability of meta-cognitive and intuitive nuance. Accordingly, the primary focus, utilizing research in attentional skills training and situation awareness, should promote the capability to reflect on the immediate and long-term needs of a performance and development with focus on the synergy between individual, task and environment. This should then evolve to a 'beyond automaticity' skill (i.e. a progressive shift from meta-cognitive to intuition) as expertise levels are enhanced. While providing authentic, engaging and challenging training programs and periodizing engagement in specifically calculated competitions for psychological edge remains critical, recognition that adaptive capability can also occur at individual, team, organizational, social

and cultural levels is offered. Therefore the essential role of situativity, contextualism and temporality associated with an integrated, ecological and dynamic account of expertise is advocated at all levels.

Constructivist Model of Expertise

A constructivist model will have to attend to elements of development inclusive of (1) non-linear development; (2) meta-cognitive, self-regulatory and meta-level processes; (3) explicit (planned) and implicit (emergent) change; (4) paradox, context and situativity; (5) a personal, relational and collective self; (6) a multi-dimensional, pluralistic and holistic perspective of expertise and (7) an aim to construct adaptive expertise.

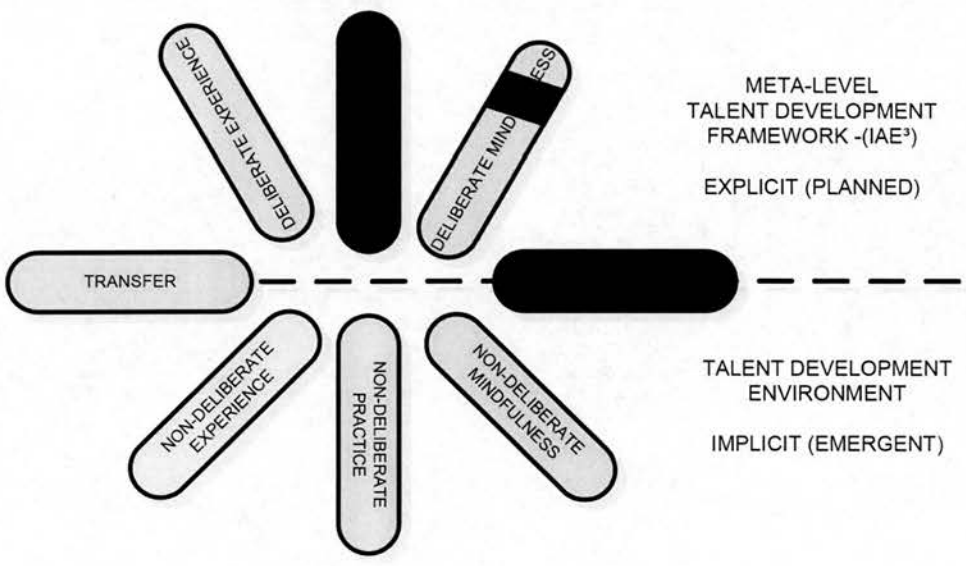


Figure.8.1. Constructivist model of expertise

To attend to these we will begin by addressing a (a) meta-level talent development framework (TDF) inclusive of the full array of variables and mechanisms required to develop an expert followed by (b) a constructivist talent development environment (TDE) as offered in Figure 8.1. This embraces a constructivism which promotes both neo-Piagetan and neo-

Vygotskian influences. The TDF requires a constructivist, micro-development model (IAE³- see Ollis & Sproule, 2007) to integrate the full array of variables existing within the framework and will be referred to later in the paper. The TDE adopts a more socio-cultural perspective of expertise which embraces theories, such as Bronfenbrenner's ecological model of development (1979, 2005), neo-Vygotskian development and other socio-cultural and community constructivist models, to develop an environment *for* expertise development. Together, the TDF and TDE balance both planned and emergent constructivism, as well as individual and socially orientated constructivism.

Figure 8.1 represents the constructivist model of expertise development inclusive of deliberate practice. Three additional mechanisms inclusive of deliberate change include 'deliberate experience', 'deliberate mindfulness' and elements of 'transfer'. As 'deliberate mechanisms' of change they are defined as both 'explicit' and 'planned' and can be monitored and controlled through a suitable talent development framework. For example, Ollis & Sproule (2007) utilized the systematic, iterative, micro-developmental, meta-level and transition orientated model termed IAE³ (identify, act, establish, evaluate, empower) to change personal, relational, group and cultural behaviors, cognitions, affect, and statements of intent, when working with a national sporting team with suitable effect. The remaining elements of the model incorporate recognition that much of the development of expertise is implicit and emergent. Accordingly, we introduce the terminology of non-deliberate practice, non-deliberate experience, non-deliberate mindfulness and the remaining non-deliberate elements of 'transfer'. Each mechanism of change existing within the framework will be discussed, with support from existing literature.

Deliberate Practice

“The core assumption of deliberate practice is that expert performance is acquired gradually and that effective improvement of performance requires the opportunity to find suitable training tasks that the performer can master sequentially” (Ericsson, 2006, p.692).

Acceptance that deliberate practice remains critical to the development of expertise is maintained within the present model (Figure 8.1). Indeed, the fellow constructivists amongst us may claim that the theory of deliberate practice is only being scaffolded and reconstructed! Therefore, the aim of the present study is not to discredit the importance of deliberate practice, but indeed progress the ideas with emergent research findings.

As well as identifying what deliberate practice is, it is equally important to focus on what deliberate practice is not. For example, deliberate practice is not something that is emergent, but is directly planned, it is not just thinking about a task but focuses solely upon active involvement, it negates the experiential and apprenticeship account of expertise, and it fails to account for implicit development and non-deliberateness. Equally, it fails to recognise the expert *fully* as a ‘psycho-social dynamic’ self giving account to neither the relational or collective self, that deliberate practice can (sometimes) be enjoyable and discards the phenomenological and interpretive account of expert as self required to promote affordance, creativity and eminence.

It is acknowledged at this point however, that a series of exemplars contributing to Ericsson’s defence of Abernethy, Farrow & Berry’s critique of the deliberate practice framework have evolved. However, Ericsson (2003) has also recently, and maybe inadvertently, acknowledged that the 10,000 hour rule for attaining expertise is inadequate with emphasis that mere *quantity* of practice is unlikely to result in expert performance, but *quality* of

practice is also required. The effect size of quality within deliberate practice would therefore have a strong effect on total hours and is critical to eventual levels of performance we would presume. Other recognitions by Ericsson of future developments required in the expertise literature are the recent acknowledgement to the influence of experience (Ericsson, 2006) and implicit learning (Ericsson, 2003).

The critique with deliberate practice as a monotonic function is failing to embrace the multiplicative, holistic, non-normative and paradoxical nature of expertise. Ericsson (2006) and Feltovich, Prietula & Ericsson (2006) postulate that experience is not sufficient for the development of expertise whilst maintaining allegiance to the uni-dimensional mechanism of 'deliberate practice' as the means of producing excellence. Ericsson's framework of deliberate practice therefore, and unfortunately, loses impact when expanding its well-founded principles and characteristics to progress into an interactionist and multi-causal model. Therefore, deliberate practice only partially supports skill acquisition which it is therefore proposed is equally as non-deliberate as it is deliberate; relational and collective as it is individual; emergent as it is planned; experiential as it is trained and finally non-linear. While the present paper embraces the notion that the volume of deliberate practice is highly correlated with levels of expertise, a suggestion that a myriad of alternative causal factors are pertinent to the *how* of expertise development is required.

Gagné (2000) accords many researchers as frequently resorting to an over simplification of talent development. Amongst these researchers, Gagné highlights "Ericsson's conviction that deliberate practice constitutes the most significant cause of talent emergence is a good example of such beliefs" (p.70). He further discusses deliberate practice as exemplary of a narrowed explanatory perspective signifying a 'pet' variable rather than an

ecological explanatory picture and as a blinkered interpretation of talent development. While it is supported a movement from an 'instructivist' to a 'constructivist' perspective which embraces Gagné's awareness of holism, integration, environmental situe and the complex choreography required to achieve excellence, it is acknowledged the importance of deliberate practice and its achievements in expertise research.

Deliberate Experience

Recognition that deliberate experience is critical to the development of expertise is not novel. Indeed, terms such as 'apprenticeship' and 'experiential learning' (see Cassidy & Rossi, 2006) give recognition that we are addressing an eternal recurrence of nuances associated with promoting achievements of excellence. Ollis et al (2006) highlighted the importance of deliberate experience within the refereeing domain quoting Janelle & Hillman (2003) with "it is difficult to imagine how anyone can acquire the self-regulatory capabilities to deal with the wide array of internal (emotional/ cognitive) and external distractions that arguably cannot be experienced outside of the competitive arena" (p.40). The referees required experience of challenging games and high-level competition at international level before acknowledging "if they have what it takes". The promotion of deliberate experience in sport has had additional support from MacMahon, Helsen, Starkes & Weston (2007) where "referees feel league games are relevant practice during which they acquire or refine skills" (p.76) and "officiating of league games was considered the activity most relevant to improving refereeing" (p.77). Finally, further consideration of deliberate experience from a top-down approach has been offered by Green & Houlihan (2005). Within their assessment of elite sport development policies they highlight the major importance of competition opportunities (deliberate experience) for elite sport development and the capability of elite athletes to prepare systematically for major international competitions.

The appropriateness of experience for optimal learning and achievements of excellence was recognised by individuals such as Nietzsche, William James, Lewin and Dewey. More contemporary theoretical recognition has been recognised in Kolb's (1984) work on the 'cycle of learning' where he explained "Learning is the process whereby knowledge is created through transformation of experience" (p.38). Dreyfus & Dreyfus (1986) also stated "no amount of rules and facts can capture the knowledge an expert has when (s)he has stored her/his experience of the actual outcomes of tens of thousands of situations" (p.108). Further evidence of deliberate experience has expanded to the work of Sternberg (1999) who acknowledges how developing the longitudinal, dynamic, uncertain and complex capability of capturing expertise requires an individual to learn from experience over one's lifetime.

Deliberate Mindfulness

Mindfulness is a means of paying attention in a particular way: on purpose, in the present moment and non-judgementally (Kabatt-Zinn, 2003). Langer (2000) defines mindfulness as a "flexible state of mind in which we are actively engaged in the present, noticing new things and sensitive in context" where "being mindful is the simple act of drawing new distinctions... leading us to greater sensitivity to context and perspective" (p.220). Alternatively, mindlessness occurs when our behaviour is prone to over-learning, when our behaviour is rule and routine governed, *overly*-automatic and comes about through either repetition or single exposure. We suggest a necessity for mindfulness and a generalised state of alertness to the activities one is engaged in and situational surroundings are required to construct an expert. While 4 hours of practice per day will provide regular expertise, transcendent and adaptive expertise requires mindful engagement to further training benefits and experiential sense-making. Indeed Ericsson himself (in Feltovich, Prietula & Ericsson,

2006) recognises that expertise involves reflection, monitoring, control and planning. The present model (Figure 8.1) incorporates this understanding.

While some research identifies mindfulness with meditation, the present perspective incorporated mindfulness as more congruent with meta-cognition. Equally, the here and now of mindfulness can occur not only within the performance domain, but also from a long-term and day-to-day consideration of ongoing development. For example, and akin to existing mindfulness research, 'performance mindfulness' is akin to a capability where non-judging present moment attention can be developed through "specific mindfulness, attentional training, and situational training refocusing exercises" (Gardner & Moore, 2006, p.104). Hauw & Durand (2007) utilise mindfulness in a situated analysis of trampolining which was also incorporated as an action research approach adopted by Ollis & Sproule (2007) in the shooting context. From the action research experience, it is wished to extend the present definition of mindfulness with acknowledgement of a developmental mindfulness where individuals promote mindful attention to their long-term, medium-term and day-to-day development, but still situated within a 'here and now' perspective. Both performance and developmental mindfulness require "directing attentional resources toward task-relevant, in the moment external contingencies and not toward self-judgement, threat-scanning and future-orientated cognitive activities" (Gardner & Moore, 2006, p.98).

The present constructivist model of expertise suggests deliberate mindfulness, and its capability to construct a meta-cognitive and reflective learner is of necessity to promote transcendent levels of expertise. A mindfulness that assists in accepting, and therefore removing negative thought intrusions and preservative self-focused processing, whilst promoting an overcoming and change process which focuses on the appropriate attentional

resources. An existential mindfulness that acknowledges pain and adversity goes with eminent performance.

Non-Deliberate Practice, Experience and Mindfulness

Non-deliberate practice, experience and mindfulness attends to the notion that many developmental gains occur indirectly. Terms encapsulating 'indirect learning' include implicit learning, non-conscious learning, tacit learning, intuition, decision training, transfer of learning and incidental learning. The indirect instructional style can be identified with a more contemporary strategy of instructing and developing through both a problem-based and exploratory-based focus. Jackson & Farrow (2005) examined the conceptual, methodological and practical issues whether skills can or should indeed be trained implicitly. Defined as the "non-intentional automatic acquisition of knowledge about structural relations between objects or events" (Frensch, 1998, p.76), the potential advantages of implicitly learned skills relating to task complexity and robustness under stress were discussed and supported. The approaches used in perceptual training studies followed six types of training. These included the adoption of (1) implicit training, while the implicit training types included (2) guided discovery, (3) discovery learning, (4) implicit learning via use of concurrent secondary tasks, (5) implicit learning via incidental learning and (6) implicit learning via distraction tasks. Support of various implicit approaches including Williams, Ward, Knowles & Smeeton's (2002) adoption of discovery training in recreational tennis; the adoption of analogy training in table tennis by Liao & Masters (2001), and the improvement of 'how' and 'what' decisions of elite table tennis players (Raab, Masters & Maxwell, 2005) has been accepted. What the present review may add to Jackson & Farrow's (2005) well presented and argued paper is the need for greater implementation of implicit learning protocols as expertise moves towards the latter stages associated with Dreyfus & Dreyfus (1986).

What indirect learning and the other associated terms and styles seemingly share is an acceptance that if we desire to understand how to develop expertise, there will be a requirement to integrate 'indirect' and therefore 'non-deliberate' practice, with that of 'directed' or 'deliberate' practice. Indeed, Dreyfus & Dreyfus (1986) have already recognised that experts no longer rely on rules, guidelines and maxims; and have intuitive grasp of situations based on deep tacit understanding. Accordingly, the present review would suggest that implicit learning has to be a fundamental protocol of training if 'reflective automaticity', eminence, and adaptivity are indeed characteristic of transcendent expertise.

Transfer

Adaptive expertise and transfer capability can occur within-task, between-task, within-trial, and between-trial. Equally transfer and learning effect can also be recognized as proximal or distal (Ollis, Button & Fairweather, 2005) which are also termed near or far. Transfer is deemed to occur where learning in one context enhances or undermines a related performance in an alternative context. Thus, the role of athlete and coach is to optimize transfer capability and one's general strengths so that overall development and peak performance may be optimised. Finally, it should be recognized, with promotion of a constructivism which is both individual and socio-cultural, that transfer capability extends from individual, to team (Canon-Bowers, Salas & Milham, 2003), to organizational (Holton & Baldwin, 2003) and to a cultural level.

Transfer is also recognized as occurring between training and competition, between sports participated in school or with peers, within a 'general skill' such as throwing, catching or moving and is pertinent to many, and between, stages of expertise or performance role

(such as athlete to referee or coach, between leagues such as Championship to Premiership in English football, moving from regional to local to international events and in consideration of promotion or captaincy). Ollis et al (2006) identified how transfer capability was utilized by many of the referees who exploited managerial roles, personality, fitness and rugby playing experiences to assist in the navigation of refereeing expertise. Equally, the focus of a challenge points training program in the shooting domain was constructed for transfer capability designed to emerge at the Commonwealth Games (Ollis & Sproule, 2007). Other sporting acknowledgement of transfer capability is recognized with modern athletes having to adapt to change within sport, inclusive of equipment, strategies, tactics, team dynamics, culture or rules.

Transfer occurs both implicitly and explicitly through mechanisms such as contextual interference and feedback manipulation, or recognizing that childhood and middle age conditioning impinge on existing performance. For example, many recognized traits can be argued as being transferable conditioning. It is the role of society, organizations, teams, coaches and athletes alike to utilize transfer capability optimally. Equally, transfer of training can be enhanced through the promotion of self-regulatory and meta-cognitive skills whereby decision-making and situational awareness are promoted.

Integration and Synergy

The causal factor of each element of change is dependent on a myriad of factors inclusive of specific demands of sport, expertise level, contextual factors, situativity, time (historical), strengths, weaknesses, resources, support network, opportunity, chance and luck (Simonton, 1999, 2001; Gagné, 2000, 2003). In accordance with constructivist principles, we propose that attaining transcendent expertise, the achievement of eminence within a chosen

domain, requires a capability of navigating both performance and development with situated awareness: A difficult and demanding journey where the complexity is approached through utilising available resources and support, as well refined meta-cognitive and self-regulatory skills.

Deliberate practice alone will not produce the highest levels of expertise, as neither will deliberate experience, deliberate mindfulness, non-deliberate mechanisms or transfer. While the elements are reduced as separate entities for presentation of the model, it has to be recognized that they are indeed a holistic phenomenon, and many developmental opportunities integrate many elements at the same time. For example, it can be expressed that intuition is indeed automatised 'meta-cognition', or that deliberate experience and elements of deliberate mindfulness (such as reflection in action) are complementary. Indeed, when we consider definitions of experience- "The fact of being consciously the subject of a state or condition;...and, knowledge resulting from actual observation or from what one has undergone" (Oxford Dictionary)- then we recognize action and mindfulness are not two discrete aspects of experience. This is surmised well with the difference in Schön's (1983) terms of reflection-on-action, which recognize the reflective and reflection-in-action which shifts towards deliberate experience.

The most important element which the model attests to, in relation to integration and synergy, is the non-linear relationship and complex trajectories of development and performance levels. Constructivism attests to concepts such as non-linear change, developmental contextualism and the person as an open, self-regulating, self-constructing system as his and her abilities evolve through their lifespan. Within this approach, the ecological and environmental influences, along with personal disposition are critical only

within a co-constructive basis.

Ecological and Environmental Influences

The present paper, as a constructivist approach, recognizes expertise morphs from a synergy between biological, psychological, social and cultural processes co-acting upon the individual who is the primary source of developmental change. It has already been suggested that adaptive expertise is co-constructed within an athlete, coach, team and organizational dynamic (Ollis & Sproule, 2007). Therefore, from a similar notion of ecological philosophy, it should be recognized that individuals have to enhance and optimise their personal, relational and collective capability and utilize their zone of proximal development (Karpov, 2007). They also optimize the zone of current development (ZCD) (Granott & Parziale, 2002) where the ZCD focuses on the range (variability) of performance in which a person operates in a given sequence, at a given period of time and context. This pursuit of excellence is required whether expertise is ventured by athlete, coach, psychologist, physiotherapist or manager. While this gives notion to the development of a 'culture of adaptive excellence', and one which the author attests to, present focus will remain on developing the adaptive skills required for the athlete as the primary source of developmental change. However, recognizing that the athlete, coach, team, organisation and culture co-constructively enhance expertise should be noted.

It is proposed that the emergent and self-organising nature of expertise development and absolutist peak performance requires attendance to the development of a constructivist learning environment. Ollis & Sproule (2007) identified the importance of creating an appropriate talent development environment during the first period of engagement with a

national shooting team. The environment created was one where collaboration, rich communications, high levels of challenge, motivational focus, frequent and episodic construction of authentic projects/tasks, which together optimised all the elements of expertise as offered in Figure 8.1, was necessary.

A constructivist learning environment would utilize principles such as situated learning theory (Lave & Wenger, 1991), communities of practice (Wenger, 1998), activity theory (Engestrom, Miettinen & Punamaki, 1999), problem-based learning environments (Barrows & Tamblyn, 1980) and discovery based learning to collectively design the environment *for* expertise development. This is in recognition that expertise cannot be systematically designed and planned as its own entity, but that it does indeed morph, emerge and self-organise from the appropriate environment, context and situativity.

Cassidy & Rossi (2006) and Cassidy, Potrac & Mckenzie (2006) not only give support for 'experience', 'transfer' and 'mindfulness' in the development of expertise with their adoption, apprenticeship and mentoring as a possible tool for developing professional expertise in coaching, but more importantly highlight the appropriateness of constructivist learning environment principles. They highlight how learning "cannot be designed" (Wenger, 1998, p.225) and how learning can only be designed *for*. This reflects well with the lower half of Figure 8.1 which promotes the need for a talent development which promotes implicit, emergent, self-organisational development. However, as advocated by the upper half of the model, we would like to highlight the importance of the talent development environment in creating the conditions for planned, controlled and therefore 'designed' expertise development (i.e. the IAE³ model). What is therefore advocated is the necessity for a suitable development program which has capability to foster both planned and emergent

change during the pathway to excellence: One in which constructivism is neural, biological, volitional, behavioral, cognitive, relational and socio-cultural, promoting a co-constructive ethos which can be utilized to enhance both development and performance multiplicatively.

Application and Future Research

Long-term development and peak performance models of expertise have to take into account all elements of constructivist expertise models. Each mechanism (deliberate practice, deliberate experience, deliberate mindfulness, non-deliberate practice, non-deliberate experience, non-deliberate mindfulness and transfer) can be developed and optimized through individual athlete, coach, team and organizational change. Equally, the importance of 'communities of practice' and 'situated learning theory' to balance both planned and emergent constructivism requires re-emphasis. In recognition that it is important for getting an environment conducive for transcendent and adaptive expertise, while it is important for elite athletes, it is of considerable importance in how we ensure the development of expertise in the next generation. The question being is the focus on a uni-dimensional perspective of 'fundamental skills' (such as training for basic moves) or creating 'communities of practice' (which address the integration of physiological, technical, tactical, decision making and psychological demands at an appropriate level) more effective? Indeed, under the principles of constructivism, we can ask if any 'generic motor skills' actually exist at such an early age? Other issues addressed by the adoption of constructivism can include the over-generalisation of phase stage models; limitations in capability to identify talent effectively; the promotion of absolutist expertise as necessary; if adaptive expertise should be the 'focus' of all long-term development programs; and address if there is need to utilize and endorse all mechanisms of expertise (especially decision making and meta-cognitive skills

such as situational awareness at a young age to enhance future transfer capability) throughout the life-span and especially in youth activities.

The principles of constructivism were attended to by a national shooting team to positive effect (Ollis & Sproule 2007). In an action research study, the emergent phases included focus on talent development environments, challenge points, self-regulated development, shared mental models and peak performance which all utilized an understanding of deliberate practice, deliberate mindfulness, deliberate experience, transfer, and recognition of non-deliberate development. Reviewing existing working models (for example see NZ *Linking Promise to the Podium* at www.ausport.gov.au/fulltext/2004/nz/Promise_Podium.pdf) we may consider if constructivism is a principle which gives sense-making to many of the unresolved nuances, and synergy to what is acknowledged to date (e.g. non-linear, idiographic, need for collaboration, focus on long-term development).

Future research which embraces the model can include refining understanding of elements of the model such as mindfulness or experience, or more importantly, its integrative nuances. From an applied perspective, longitudinal adoption of a constructivist program which would be monitored, controlled and evaluated would be merited. Other ideas include the investigation of transfer capability derived from situated learning environments and the importance of understanding the athlete as a personal, relational and collective self. However, it is more important to understand that the philosophical tenets of the model embrace an accepted complexity which is highly emergent and implicit. Those with the appropriate skills may therefore merit research which utilises 'dynamical systems perspectives' and adopt computer simulation. Equally, others will afford their own research

ideas from the model.

Conclusion

It is proposed that a shift from what can be termed 'instructivism' to one which embraces 'constructivism' is required in the expertise and talent development domain. The present model of constructivist expertise suggests that a rich interplay of chance, opportunity, practice, experience, mindfulness and transfer which are in turn situated within a myriad of a personal, relational and collective self is required. This dynamic requires optimized if we are to move from a theory of expertise featuring transcendent and absolutist understandings rather than regular and relative perspectives of expertise. Thus while it is credited that "it is unlikely that we will be able to fully understand and predict future innovations" (Ericsson, 2006, p.700), we may be able to better understand the needs and environmental nuances of emergent understanding required *for* such a goal. The appropriateness of this modern perspective of constructivism and learning, in progressing our understanding with its embracement of situativity, connectionism, emergence and self-organization in how we develop expertise, is therefore credited and deemed worthy of further investigation.

CHAPTER 9: GENERAL DISCUSSION

The aim of this section of the thesis is to synthesise and conclude the findings of the series of studies as a whole. While chapter 8 was adopted in partial fulfillment of this aim, it is necessary to bring closure and sense-making upon the existing work, before the next research journey begins. To assist in this process, the discussion chapter is divided into three parts. Firstly, the core themes that emerged in relation to the primary research question, aims and objectives will be expressed and evaluated. Then, contributions of the present thesis to expertise literature and application will be offered. Finally, recommendations will be made for future research.

Core themes

This series of studies has shown that alternative theory of expertise to that of the uni-dimensional deliberate practice exists. Core themes which gave theoretical proposition for alternative theories of expertise included: a) non-linear and dynamical systems perspectives of expertise; b) expertise as self-regulation and meta-cognition; c) adaptive expertise; d) ecological and psycho-social dynamic (nested) models of expertise; e) life-span development models of expertise; f) experiential expertise; g) expertise as mindfulness; h) expertise as self (personal, relational and collective) and j) implicit expertise. The thesis integrated these alternative models of expertise to offer a k) constructivist paradigm of expertise. The constructivist paradigm of expertise was adopted as a micro-developmental 'research in action' approach with a seemingly positive effect on performance. Additionally, a constructivist model of expertise was finally offered drawing from the experiences of the overall thesis and supporting literature and experiential engagement.

To return to the beginnings of this thesis, the aims of the present study included a desire:

- To contribute a greater understanding of the complexities which integrate to construct an expert as well as expert levels of performance, by examining and describing existing domains, groups and individuals who have attained or are pursuing the attainment of expertise;
- To utilise novel methodologies and means of examining the characteristics of expertise and related theories with an acceptance and embracement for pluralism;
- To construct a critical perspective that challenges or scaffolds the ‘general theory of expertise’ and ‘deliberate practice’;
- To explore the subject matter as a complex, multi-level iterative process that unfolds over extended periods of time and establish an iterative, meta-level process of expertise development which replicates the more dynamic and emergent theories alluded to;
- To examine the effectiveness of regulated development, constructivism and psychosocial dynamic principles within a developmental domain.

To engage with the research aims it was felt necessary:

- To review the literature, extending to alternative performance, learning and development fields, in order to identify weaknesses in the existing theories of expertise and gain support for an alternative model of expertise;
- To engage with ethnographic enquiry and explore the process of talent and expertise development over a longitudinal period with a suitable group;

- Describe, scaffold, integrate and expand alternative models of expertise, utilizing suitable and alternative development paradigms;
- Evaluate the effectiveness of an alternative constructivist and non-linear model of expertise with a suitable performance orientated group;
- Explore, compare and contrast existing models and overall findings with emergent paradigms.

It was deemed that all of these aims and objectives were achieved, although a series of suitable and empirical research ventures will be required to gain further support and credence for the constructivist perspective. Thus, the present series of studies would suggest that constructivist expertise and its associated principles merit further empirical investigation.

Study 1 provided findings which indicated expertise was indeed a multi-faceted phenomenon, requiring the co-construction of individual, task, social, ecological, cultural, contextual nuance and chance. This psycho-social dynamic and nested model of expertise was utilized to provide capability of ecological assessment of a sporting team, as given in Study 2, as well as assist in the development of a 'complex process' of expertise development (Study 3). As a non-linear, iterative, pluralistic and micro-development process, suggestion that expertise was indeed a complex choreography was realized as a consistent theme throughout all of the studies. Additionally, further causal mechanisms of experience, transfer, mindfulness and chance assisted in the critique of the uni-dimensional model of deliberate practice. Along with these findings, the expansion of the IAE³ model as a micro-developmental and iterative model of expertise development (Chapter 4), as well as the appropriateness of a constructivist model of expertise was offered.

Study 3 proved pivotal to the whole thesis, where all the aims were embraced over a two year engagement with the applied development of expertise. It is in this study where the principles of a co-constructivism were embraced and tested in the real-world context of an international sporting event. Thus, the studies together brought more and more clarification of the constructivist principles embraced in the thesis, and indeed, finally brought synthesis of the early explorations into a model of constructivist expertise.

Contributions

The most important contribution to scientific knowledge achieved by this series of studies was to negate uni-dimensional accounts of talent development and provide critical suggestion of the anarchic pluralism, co-constructive integration and plethora of causal relations which resides in human development, and especially within the development of expertise. Accordingly, practitioners and the researchers who serve these practitioners should address the complexities associated with causality whilst on the pathway to excellence. The success of identifying causality within 'closed and controlled research environments' is depleted when we understand that the integration of these causal claims are lost, reversed, restricted and sometimes ineffectual in real-world domains. More importantly, the co-constructive nature of development potentially instigates non-linear dynamics and paradox within the developmental profile of the individual across domains which have never previously been suggested as inter-linked. Constructivism seemingly allows us to understand the real-world effect, but more importantly giving scope for future research.

It must be acknowledged however, that reflecting the ebb and flow of tidal movement and transition from smooth sailing to stormy waters encountered in human development

(Harold, Colarossi & Mercier, 2007), that what the findings present are a capability to engage with more reductive research which replicates the co-constructive model (i.e. can we identify co-constructive relations between domains of expertise, or the self, relational and collective integration upon mental state or neural activity for example). Equally, the model of constructivism (Fig. 8.1) gives scope for much research, inclusive of investigations of integrative effect, effect of deliberate experience, or deliberate mindfulness as singular effect, but also correlation studies looking at deliberate experience and replicating the research methods as adopted in deliberate practice research. Thus, the human breath in research analogy gives sense-making on how more qualitative and alternative paradigms of research can be adopted as pathways of idea formulation conducted for the feasibility of future research.

Issues

It is recorded how many studies adopted in research, especially case-studies, which give holistic, in depth and real-world integrative accounts, are treated with disdain and accounted for as scientifically 'superficial' or even 'journalistic'. Thus, it should be made intimate that a shift from a predominantly positivist study of elite performance, to one which can embrace alternative world-views and paradigms may be timely. These paradigms can include perspectives of science which include interpretivism, critical theory and postmodernism, and may equally include further perspectives such as feminism, pragmatism or queer theory. With the appearance of novel findings in sporting expertise literature, emerging critical awareness of the theory of deliberate practice, as well as advances in alternative performance 'expertise' research, it seems progression is appropriate so advancing from an overly restrictive viewpoint and constrained approach to the topic. What paradigms

are deemed as more appropriate in recognition of the needs, aims and objectives of the sporting research community is one requiring further debate. Options include remaining with the status quo of positivist dominance, adopting of a further paradigm due to identified needs (e.g. interpretivism), integrating all the mentioned (or selected) paradigms with positivism, one which embraces an anarchic pluralistic account of science or finally one controlled by the philosophy of constructivism. The findings of the present research and construction of the model and co-constructive principles gives scope for an abundance of research opportunity.

Application

The adoption of a systemic and co-constructive approach to expertise and talent development is one which serves well for application in varying domains. For example, how we monitor, control and regulate the development of 'general' expertise is one which not only reflects the development of an athlete, but also the coach, team, organization and national development programs. Thus, for example, the development as a constructivist action research is one which would apply well to coach development or physical education courses, giving suggestion of how we construct programs, activities and evaluation. Equally, it serves well in the alternative performance domains for anyone who wishes to progress to high levels of expertise inclusive of dance, music and occupational roles for example.

Recommendations for future research

Research direction

As previously mentioned, the constructivist model of expertise (chapter 8) and IAE³ gives opportunity for a series of studies in both applied and controlled settings, as well as throughout the varying research paradigms and performance domains (dance, music,

education, outdoor pursuits, work).

A working example for instance would be research upon the instructor/coach/teacher relationship with the athlete/student. The present findings allude to the capability to investigate 'change processes in relationships' (Fogel, Garvey, Hsu & West-Stroming, 2006) utilising "a unique research method called relational-historical research based on advances in dynamic systems theory in developmental psychology, and qualitative methods in life history research" (Fogel, Garvey, Hsu & West-Stroming, 2006, p.ii). This approach was used 'in principle' with the evaluation of micro-development and constructive development of the shooters where a lack of precision is possible. However, the relational-historical research approach not only gives more positivist suggestion of constructivist evaluation, but also an indication of how the relational and collective aspects of development can be evaluated.

Personal preference would seek investigation of the co-constructive, socio-cultural and neo-Vygotskian influence upon long-term development and well-being. This requires an approach to expertise where the integrative nature of biological, individual-psychological and the socio-cultural and physical-ecological levels of development are married. The construction of suitable TDEs should be the aim of any society, sporting team, educational setting or workplace, whether focusing on performance or well-being (i.e. well-being associated with the development of a self-disciplined, mastery-orientated and empowered individual who transfers capability to regulate the self via physical education and sporting participation skills and experiences: The self aspect incorporating the refinement of personal, relational and collective spheres of participation). This could be monitored across various physiological, performance, behavioural or psychological gains. Real-world evaluation of neo-Vygotskian constructivist programs and real-world effect is of personal interest with

suggestions from research in positive youth development and outdoor pursuit studies giving scope and suggestion for future application.

Research methods

As mentioned, the findings of the present study give scope for the adoption of alternative research paradigms and epistemologies to be integrated with the existing positivist dominance. Ericsson (1996) considers the development of expertise to be best described as a positivist and cognitive phenomenon. His thesis is guided by the 'general theory of expertise' and the theory of 'deliberate practice' and serves as the predominant approach in sport science research. Recognition that both the general theory of expertise and theory of deliberate practice have many positive attributes is projected. However, it may be considered by some that in recognition of the multi-agent complexity, situativity and importance of context which characterize expertise and are identified within the present series of studies, alternative perspectives and paradigms with which to extend research in expertise may be timely. Accordingly, the thesis leaves us asking, does the sense of expertise we can discover depend upon the modes of access that we have to it? Consideration, that alternative paradigms of understanding *how* we develop expertise do exist and may have been neglected in sporting expertise research, is offered.

The present discussion suggests an exploration of the psychology research movement beyond positivism, normative studies and statistics which it can be argued create a predominance and overly prescriptive viewpoint of expertise development. For example, in sport psychology research, this overly prescriptive viewpoint and constrained practice can be viewed as the general theory of expertise and deliberate practice. Thus, while we are aware

that the theory of deliberate practice has only a correlational relationship with the level of expertise, and is indeed unfalsifiable (Moran, 2004), it remains the predominant means of understanding how we develop expertise even though causal capability is negated.

Without ability to conform to comparable research approaches (i.e. cognitive, positivist and within the structure of the general theory of expertise), it can be difficult to evaluate alternative perspectives without bias. What is therefore proposed is that alternative paradigms, with their alternative philosophical commitments and alternative methodologies may give further insight in understanding *how* we develop expertise. Others have comprehensively argued for a wider range of relevant research work, under consideration of adopting more 'qualitative research'. The present position is to not mean simply qualitative research, but to endorse alternative paradigms informed by other epistemological perspectives. Indeed, "qualitative researchers must resist conservative attempts to discredit qualitative inquiry by placing it back in the box of positivism" (Denzin & Lincoln, 2005, p.9). Recommending adoption of other epistemological positions within the term of 'qualitative' is therefore echoed.

In order to address and offer coherence to these concerns, a future research position can be organized as follows. To begin with, an indication of alternative and neglected perspectives within psychology research should be offered. Then, the paper should explain what expertise is, highlighting the predominance of positivism and cognitive theories in sport and its desire to generalize, characterize and centralize. To follow, the paper should engage with existing critical perspectives of both the general theory of expertise and deliberate practice. Within this argument, supporting research and alternative theoretical paradigms should be identified. The paper should attempt to make sense of the complexity and pluralism

associated with the development of expertise by outlining how alternative perspectives such as interpretivism, critical theory, constructivism, dialogicism and postmodernism may be suitable for future research. Additionally, the need for coherence to examine the significance of such an approach in relation to theory, methodology, future research and application, as well as its limitations would be required.

Arguments abound for reductionism being too strong a requirement on higher level sciences and social sciences. Symon & Cassell's (2006); McGrath & Johnson's (2003); Guba & Lincoln's (2005) and Cresswell & Clark's (2007) perspectives of alternative approaches are utilised to identify some of the existing alternative paradigms. While no conclusive approach to alternative paradigms is given, the perspectives have been divided generally as positivism (and post-positivism), interpretivism, critical, feminist and postmodern.

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APPENDICES

APPENDIX 1.

EXPERTISE DEVELOPMENT QUESTIONNAIRE

Background

Name: _____

Age & DOB: _____

Club/ Squad: _____

Coach: _____

Marital/ Family _____

Occupation/ Student: details: _____

PB (+where & when): _____

Future Goals: _____

Present Action Points: _____

Please conduct the questionnaire as honestly and authentically as possible. All questionnaires will be held under strictest confidentiality.



1. How long have you been involved with shooting (give age and year) and how would you describe your existing performance level?

2. What was your peak performance? Give details of event, year, level of competition and describe the quality of your training previous to the event.

3. How much planning do you attend too? Is it recorded? Do you have a log or training diary?

4. How often do you train at shooting per week? Give details of weekly sessions (location and hours actually training- not preparing!). [Do this before you conduct the following time log]

Monday

Tuesday

Wednesday

Thursday

Friday

Saturday

Sunday

5. Do you enjoy your training environment? What makes this so?

6. What positive differences would you make to existing shooting set-up? This includes culture, team ethos, number of individuals, coaches, support, competitions, training structure, web-sites, etc.

7. What elements would you not change in the existing shooting set up?

8. How many competition or training weekends/ weeks do you attend per year and with which squads? I.e. local/ national/ international.

9. How do you normally feel after a training event? Do you enjoy them? If so (or not), why?

10. How many competitions do you attend each year? Which ones are you attending this year (location and dates)?

11. How many matches do you attend each week? Do you enjoy them? (Hours/minutes?)

12. What are the biggest constraints which affect your ability to compete and train optimally?

13. Do you do physical training out-with shooting sessions? How much per week and what? Include organised strength and conditioning/ circuit sessions.

14. How much are you involved with long term planning and periodization of your training program? Do you have a personally constructed periodization program? If so, could you please attach.

15. Describe the perfect physical condition for an Olympic and world class shooter.

16. Describe the perfect mental condition for an Olympic and world class shooter.

17. How often do you think the world's elite train both physically and mentally?

18. From your understandings of the world's elite, how do you feel they train differently?

19. From your understandings of the world's elite, how do you feel they behave differently?

20. What further technical/ environmental support would enhance your shooting ability?

21. How would you describe your ability to control your on-range capability? How do you monitor, evaluate and control this?

22. Do you have any tactics or strategies that you feel are important to shoot optimally? What are your most common 'strategies' and 'game-plans'?

23. Do you conduct post-match analysis? How do you conduct this? What tools do you utilise? What do you look for?

24. Do you conduct frequent development analysis? How do you conduct this? What tools do you utilise? What do you look for?

25. What psychological skills have you used to date? These can be self-taught (and natural skills) or skills learnt from peers, coaches or previous psychology support.

26. Have you ever lost control of your emotions at a competition? What allowed this to occur? Did you regain composure? Did you learn anything from the event?

27. How often do you communicate with your coach? What do you discuss?

28. What could the support team (managers, coaches and support staff) do better/ more of to ensure you achieve your goals?

29. What could you do yourself to ensure you achieve your goals without coach or management support?

This questionnaire has been provided by Stewart Ollis who is bound to abide by the code of conduct of both the British Psychological Society and British Association of Sport and Exercise Sciences.

E-mail: Ollis@btinternet.com

APPENDIX 2.

SHOOTING SURVEY QUESTIONNAIRE

UNIVERSITY OF EDINBURGH
Department of Physical Education Sport and Leisure Studies

Pre-Competition and Competition Questionnaire

Name : Date: .../.../.....
Shooting Event : Coach.....
Present Goal :

Please answer the following questions truthfully. False or inaccurate answers may result in inappropriate advice being given. Please read each question carefully before answering.

1 a) Approximately when do you begin to prepare yourself **mentally** for a forthcoming, major competition? (weeks in advance? days? hours?)

b) How do you begin this type of preparation?

c) What do you **think** about most during this preparation stage? (performance? results? opponents? pleasing coach/ parents/ peers?)

2 a) Do you like people who are very close to you (parents, brothers, sisters, husband, wife) to be present at competitions

YES NO

b) If yes, please state who in particular and for what particular reasons?

c) Do any of these people ever offer you **incentives** to either win or set personal bests in competition?

Always Sometimes Never

d) If so, what kind of incentives and for what type of events?

3 What do you usually **look forward** to most?

a) in the days leading up to the competition?

b) in the competition itself?

c) about the time immediately following the competition?

4 What do you usually **dislike** the most?

b) in the five or six days leading up to the competition?

d) in the competition itself?

e) about the time immediately following the competition?

5 a) How long before you set off for a competition do you pack your shooting gear?

b) How do you pack your shooting gear? Do you have a set procedure/ checklist?

c) Have you ever failed to pack an essential item or gear before a serious competition? (Please specify and state how recently)

6 a) Do you have **favourite equipment** you use for certain events?

YES NO

b) If yes, please specify

7 a) What do you like most about the **24** hours immediately before a competition?

b) What do you like **dislike** most about this same period of time?

8 a) Do you have a **set procedure** for when you arrive at a competition venue to begin your preparation for a competition?

b) If so, what precisely is your set procedure? (indicate in order in which you carry this out)

9 a) Do you use any **special food** or **drink** on the day of the competition?

YES NO

b) If yes, please specify

c) How close to competing do you **eat** anything?

d) How close to competing do you **drink** anything and what is it?

10 a) What do you look for at the rifle range and it's surroundings that will be of relevance to you in competition?

11 a) What precisely do you do to **warm up** both in and out of the shooting range? (please indicate the order in which you do things)

b) When in relation to the beginning of competition do you begin to **warm up**?

c) What precisely are your main **objectives** in the warm up? (please indicate in order of priority)

d) What do you usually **think** about most during the warm-up?

12 a) How long before a competition do you like to be '**martialled**'?

b) How do you react to shooters when you are in the '**martialled/ preparation**' room/ area?

13 a) Do you always begin a competition with a clear **strategy** in mind (especially outdoor events)?

YES NO

b) Is it the same strategy for all shooting events?

YES NO

c) If not, then what kind of things make you change your strategy?

14 a) What do you think of precisely in the ===== phase?

b) What do you think of precisely in the ===== phase?

b) What do you think about when the martial initiates shooting?

d) What do you think about during:

(i) the first 5 shots? _____

(ii) the first 30 shots? _____

(iii) the second 30 shots? _____

(iv) the final ten shots? _____

(v) the final 3 shots? _____

15 a) What do you do in time between sixty shots and finals?

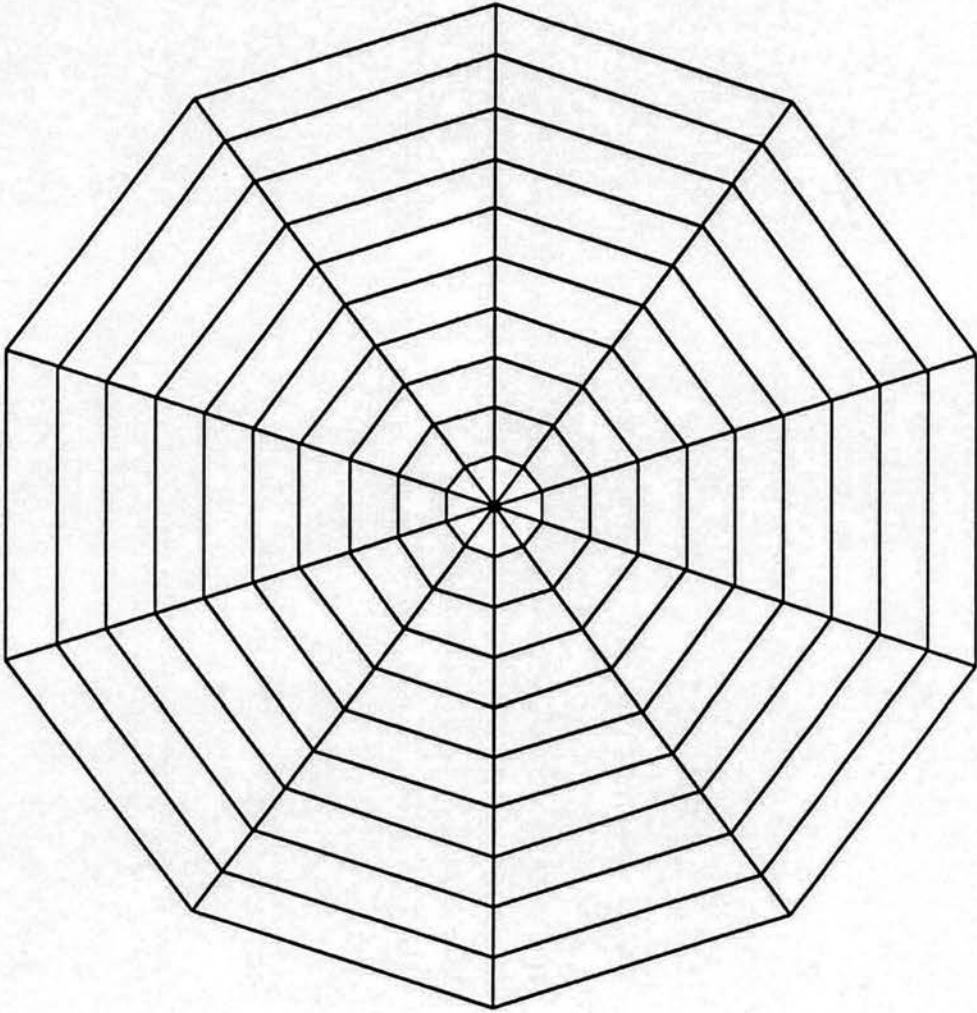
b) How do you think you could use these short periods of time more effectively?

c) Where do you sit during a competition meet and why?

d) Where would you like to sit during a shooting meet and why?

Thank you for taking the time to fill in this checklist.

Stewart Ollis
University of Edinburgh
January 2004



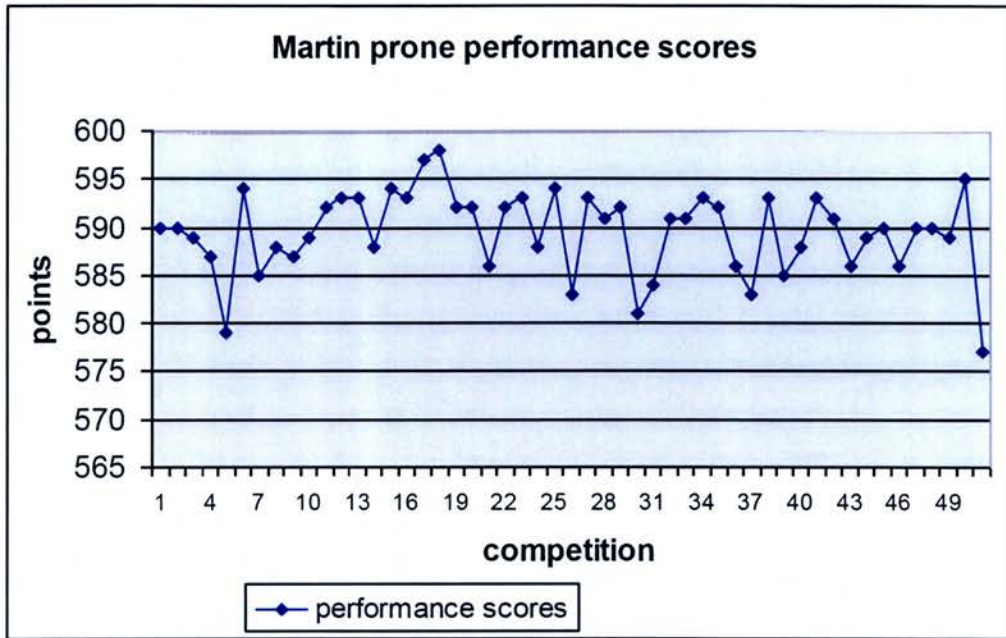
APPENDIX 4.

RESULTS DATABASE a, b and c.

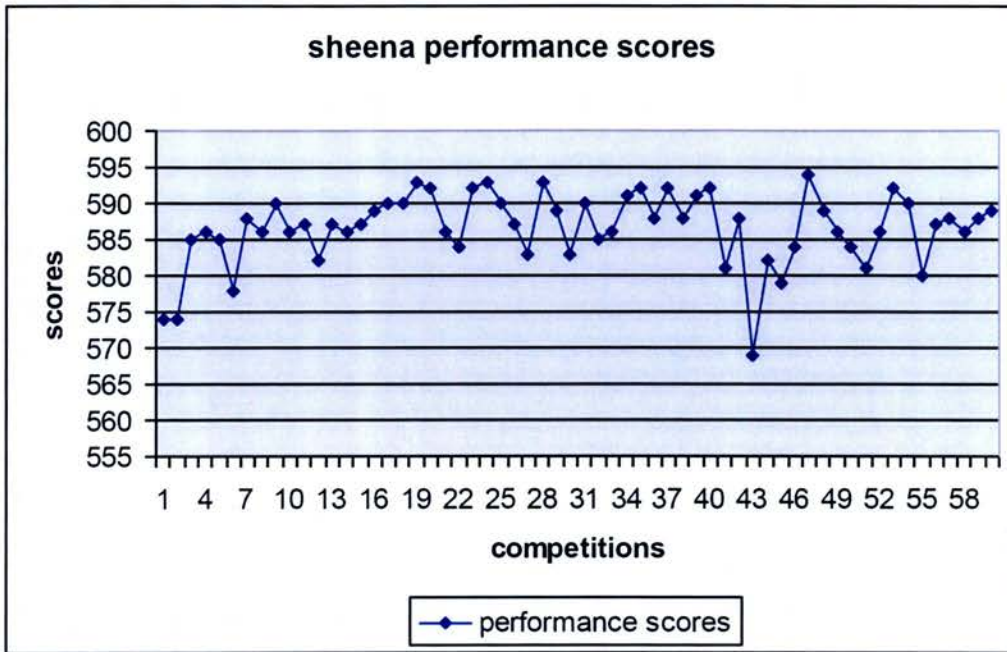
Database a

Results database were identified in various forms. Database a was constructed by self to show developmental profile and was conducted for all athletes. While the present profile considers the two years of collaboration, further life-span and specific event profiles (database c) were also available. This gave capability to identify macro- and micro-perspectives of development, as well as trends and backward transitions. Three separate profiles are offered to indicate how the development profile was utilized in relation to long-term development both individually and collectively. It should be recognized that no 'formal' competitions existed before Melbourne Games.

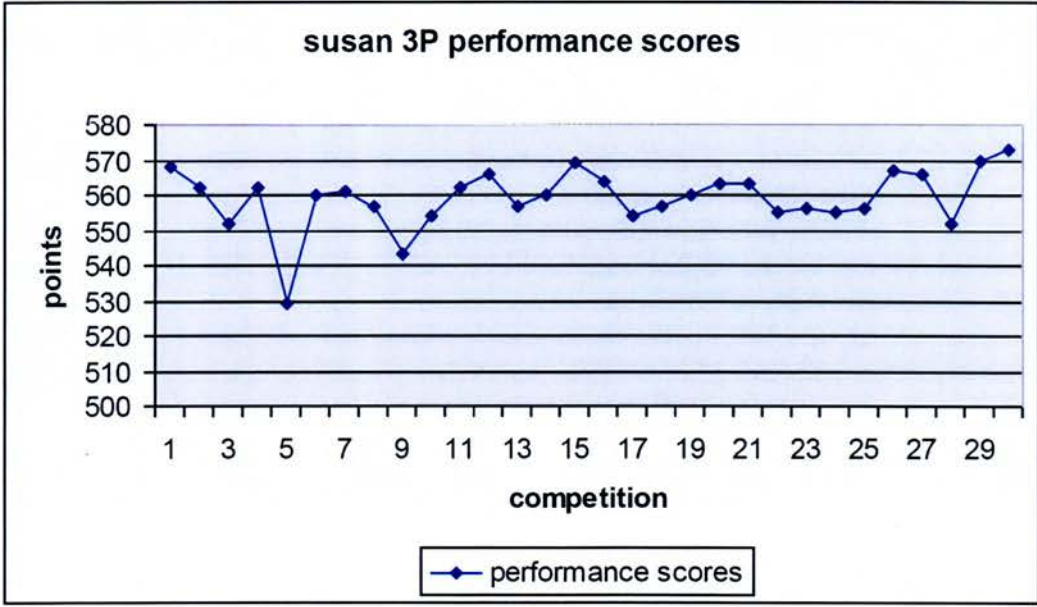
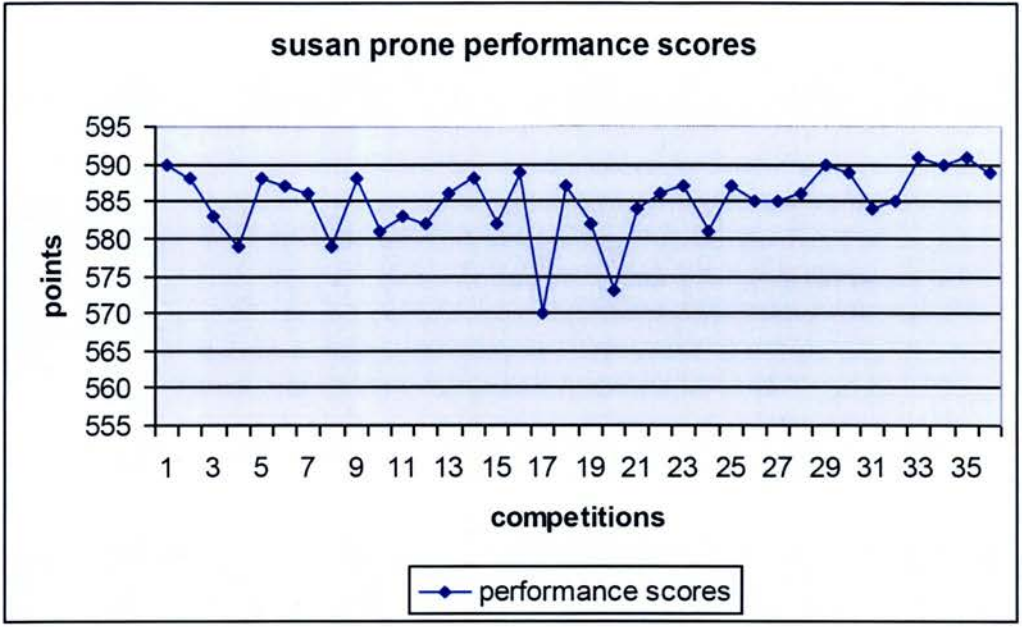
The first profile was indicative of a 'full-bore' male shooter who indicates how a reaction to the 'TDE' period (first progressive climb- comp 19) was powerful. Results became more variable for next period due to 'personal' choice of shooting manipulations. Family and work issues became an issue for next 12 months (and serious at latter stages- note effect), but identified capability to shoot in 'big' competitions- especially when not selected! This individual did eventually win silver medal in pairs event and finish fourth in individual event. The profile also suggested how a rhythm technique (adopted for various competitions- inclusive of his highest result was effective). Also discussed how failing of 'training for trust' and cognitive load was highly detrimental to performance. Note still shot well general, but many catastrophic results.



The second profile is of the individual who eventually won two gold medals at Melbourne. Once again the profile suggests powerful effect of the initial TDE program. Some of the variability also occurs not only of prioritization and testing of strategy in competition, but also of weather effect. What was examined was evaluation of competition scores against profile, and it was identified how weather conditions (mostly wind) affected some results- although the individual still won. Largest note was her Melbourne 2005 score- a catastrophic lowest and where it was deemed that psychology support which had been powerful asset was required. Also note, how return and 'personal' visit (595), followed by contractual issues had absolute effect.



The final profile is of the other 'pairs' gold medalist. Attention is drawn to the moderate effect of the TDE program (please note this individual also shoots another event and why competition is therefore smaller than other two). This individual also shot a catastrophic score in Melbourne 2005 (event 17) and directly contacted on return. More importantly, and during challenging weather conditions, the positive effect of the next twelve months and benefit of the 'challenge points' program is identified. This was also indicated by choice to shoot full-time for one year at this period. While unable to be identified in the graph, it was evident how this individually had adverse effects to the further 6-months program which was designed for non-full time members and also where pregnancy 3-months prior to Games had affect. We always say she would have had two-three golds if the Games were in November 2005. Added in her other event (3P) to identify same trend.



Database b

These results are indicative of a single event utilizing ‘basic’ electronic score-boards and indicate precise location of shot, time of shot and score for every individual. I.e. while only 60 shots are offered, almost 1800 shots were fired in this database. Modern electronic scoreboards display the target and data visually.

STNR	RP	10R	TIME	X	Y	ITS	PR	INSERT

1	1065	8.90	0 8.90	131829	16.29	0.36	1 13	0 0
2	1529	7.80	0 7.80	131830	25.49	-1.23	1 13	0 0
3	1067	0.00	1 0.00	131834	67.33	44.43	1 13	1 0
4	1504	8.60	0 8.60	131835	-18.16	3.65	1 13	0 0
5	1541	7.60	0 7.60	131838	18.91	18.71	1 13	0 0
6	1038	6.80	0 6.80	131839	5.64	32.93	1 13	0 0
7	1019	9.00	0 9.00	131840	5.91	-14.33	1 13	0 0
8	1529	7.70	0 7.70	131844	24.97	-5.95	1 13	0 0
9	1065	7.70	0 7.70	131845	24.73	6.72	1 13	0 0
10	1015	10.50	0 10.50	131843	0.87	3.34	1 13	0 0
11	1086	8.30	0 8.30	131848	-8.01	-19.24	1 13	0 0
12	1533	6.90	0 6.90	131850	31.41	6.43	1 13	0 0
13	1504	10.00	0 10.00	131854	-7.87	1.39	1 13	0 0
14	1067	7.00	1 7.00	131857	19.06	-25.15	1 13	1 0
15	1019	8.80	0 8.80	131858	-4.21	-16.44	1 13	0 0
16	1026	0.00	0 0.00	131858	29.27	79.06	1 13	0 0
17	1541	9.80	0 9.80	131859	7.73	-4.43	1 13	0 0
18	1517	8.60	0 8.60	131859	9.27	16.29	1 13	0 0
19	1099	9.40	0 9.40	131900	12.72	0.36	1 13	0 0
20	1529	10.20	0 10.20	131906	5.24	-3.39	1 13	0 0

21	1086	6.00	0	6.00	131909	0.72	-39.80	1	13	0	0
22	1015	9.30	0	9.30	131909	11.52	-6.58	1	13	0	0
23	1019	9.80	0	9.80	131911	0.87	-8.89	1	13	0	0
24	1065	9.90	0	9.90	131910	5.14	-6.16	1	13	0	0
25	1514	10.20	0	10.20	131910	4.88	-2.83	1	13	0	0
26	1038	9.30	0	9.30	131915	3.03	12.79	1	13	0	0
27	1533	8.20	0	8.20	131918	16.01	-14.98	1	13	0	0
28	1504	10.20	0	10.20	131920	-2.52	5.71	1	13	0	0
29	1512	9.90	0	9.90	131918	-0.26	8.48	1	13	0	0
30	1517	9.20	0	9.20	131922	10.51	-8.76	1	13	0	0
31	1541	9.50	0	9.50	131923	11.91	0.98	1	13	0	0
32	1018	7.40	0	7.40	131921	10.78	25.93	1	13	0	0
33	1019	10.70	0	10.70	131925	1.44	-0.72	1	13	0	0
34	1067	9.00	1	9.30	131926	10.69	8.22	1	13	1	0
35	1065	10.20	0	10.20	131928	4.62	3.39	1	13	0	0
36	1086	6.80	0	6.80	131930	-2.67	-33.38	1	13	0	0
37	1529	9.10	0	9.10	131933	10.57	-10.16	1	13	0	0
38	1038	9.40	0	9.40	131936	1.39	12.18	1	13	0	0
39	1015	8.80	0	8.80	131936	5.50	-16.41	1	13	0	0
40	1512	9.50	0	9.50	131936	-11.98	0.67	1	13	0	0
41	1019	10.00	0	10.00	131937	-1.49	-7.55	1	13	0	0
42	1013	9.30	0	9.30	131938	13.39	1.65	1	13	0	0
43	1065	9.60	0	9.60	131945	9.55	-4.62	1	13	0	0
44	1504	10.40	0	10.40	131945	-2.88	-3.70	1	13	0	0
45	1018	10.40	0	10.40	131946	-2.57	-3.29	1	13	0	0
46	1016	6.00	0	6.00	131945	-37.07	-12.89	1	13	0	0
47	1099	7.00	0	7.00	131948	-27.16	-16.93	1	13	0	0
48	1514	10.00	0	10.00	131951	7.92	0.72	1	13	0	0
49	1026	4.90	0	4.90	131952	41.49	25.62	1	13	0	0

50	1517	10.30	0	10.30	131953	0.52	5.36	1	13	0	0
51	1019	10.10	0	10.10	131954	-2.11	-6.11	1	13	0	0
52	1038	10.30	0	10.30	131955	3.65	3.96	1	13	0	0
53	1541	9.70	0	9.70	131954	-6.65	7.99	1	13	0	0
54	1529	9.70	0	9.70	131954	6.26	-7.29	1	13	0	0
55	1094	0.00	0	0.00	131954	-116.46	-5.40	1	13	0	0
56	1086	10.10	0	10.10	131957	4.99	-4.06	1	13	0	0
57	1512	9.30	0	9.30	131958	0.31	-13.06	1	13	0	0
58	1016	5.50	0	5.50	132001	-38.50	-19.74	1	13	0	0
59	1013	8.80	0	8.80	132002	15.56	-6.49	1	13	0	0
60	1015	10.30	0	10.30	132004	4.94	-0.21	1	13	0	0

Database c

Not all competitions afford electronic scoring and therefore manual application of scoring is required. Therefore, coach, support staff or non-competing shooters would record database as offered. These database could be utilized on own, or integrated with video-feedback or heart rate dependent upon focus of analysis. Utilising colleagues also as observers also offers capability to enhance 'collaborative' and 'relational' development.

Name: NEIL SUTTON		Event: 153F	Date: 12 4 06
Venue: BILLY		Round:	Time: 16:30
Weather:		Preparation Notes:	
Sighter Start Time:			
	Start time: 16:26	16:46	
	1 9.6	1 10.8	
	2 10.7	2 10.4	
	3 10.3	3 10.4	
	4 9.7	4 10.2	
	5 10.3	5 10.2	
	6 10.6	6 9.2	
	7 9.6	7 10.1	
	8 10.9	8 10.4	
	9 9.7	9 10.6	
	10 10.5	10 7.4	
Score: 96	96		
	Start time: 17:00	17:07	
	1 9.7	1 10.3	
	2 10.1	2 10.6	
	3 10.4	3 10.5	
	4 9.9	4 10.6	
	5 10.5	5 10.5	
	6 10.3	6 10.3	
	7 10.1	7 10.5	
	8 10.5	8 9.4	
	9 10.1	9 10.5	
	10 10.4	10 10.4	
Score: 95	99		
	Start time: 17:14	17:23	
	1 10.2	1 10.6	
	2 10.1	2 10.8	
	3 10.2	3 9.9	
	4 10.7	4 10.4	
	5 10.7	5 9.8	
	6 10.0	6 9.2	
	7 10.1	7 10.1	
	8 10.3	8 9.2	
	9 10.4	9 10.6	
	10 9.7	10 10.8	
Score: 97	96		
			End Time: 17:29
Observations:			

Other forms of database were offered and can be viewed as results on the SSRA website (www.ssra.co.uk) where domestic competitions, domestic results, international competitions and international results are readily available. Additionally, links to other sites can also be offered.

APPENDIX 5.

GOALS AND OBJECTIVES

SSRA Squad - Training Plan 2003/4			
Name:	Emma Cole-Hamilton	Prepared By:	Donald McIntosh
Date:	14 th January 2004		
Long Term Goals:			
TBD			
Goals for this year:			
Selection for 2004 CSF(ED) & 2005 CSF Championships Selection for European Junior Championships Selection for 2005 GB Junior Squad Increase Personal Bests to at least 390 (Air), 560 (3x20)			
Competition Plan:			
<u>Event</u>	<u>Date</u>	<u>Venue</u>	<u>Priority</u>
SSRA GP III	18 Jan	Glenrothes	4
Intershoot	5 – 7 Feb	The Hague	3
SSRA GP IV	22 Feb	Dumfries	5
British Airgun Champs	29 Feb – 2 Mar	Bisley	2
SSRA GP V	14 Mar	Glenrothes	4
Cumberland News Open	21 Mar	Carlisle	4
Scottish Airgun Champs	3 – 4 Apr	Largs	3
SSRA 3x20 GP I	1 May	Denwood	3
SSRA Prone GP I ¹	2 May	Denwood	4
Junior International	15 – 23 May	Oldenburg/Suhl	2
SSRA 3x20 GP II	5 Jun	Denwood	4
NSRA ISSF Meeting	12 – 13 Jun	Bisley	2
SSRA 3x20 GP III	11 Jul	Denwood	4
Junior Europeans	21 – 26 Jul	Munich	1
Scottish 50m Champs	7 – 8 Aug	Denwood	3
Junior International	9 – 13 Aug	Bisley	2
National Meeting (50m Events)	14 – 15 Aug	Bisley	4
SSRA 3x20 GP IV	28 Aug	Denwood	3
SSRA Prone GP IV ¹	29 Aug	Denwood	5
SSRA 3x20 GP V	4 Sep	Denwood	3
CSF(ED) Championships	17 – 19 Sep	Isle of Man	1
Periodisation Plan:			
<u>Dates</u>	<u>Air Theme</u>	<u>Cartridge Theme</u>	
12 Jan – 1 Feb	Hold	Hold	
2 Feb – 8 Feb	Intershoot	N/A	
9 Feb – 29 Feb	Aim	Hold	
1 Mar – 21 Mar	Release	Aim	
22 Mar – 18 Apr	Pre-Shot	Release	
19 Apr – 2 May	Performance	Pre-Shot	
3 May – 23 May	TBD	TBD	
24 May – 13 Jun	TBD	TBD	
14 Jun – 4 Jul	TBD	TBD	
5 Jul – 25 Jul	TBD	TBD	
26 Jul – 22 Aug	TBD	TBD	
23 Aug – 19 Sep	TBD	TBD	
20 Sep – 31 Oct	Rest	Rest	
Signed (shooter):	Date:	Signed (coach):	Date:

High Performance Monitoring – Internal Use Only

Name: DAVID RATTRAY	Event: SHOOTING	Funding Period: 1 February 2004 to 31 January 2005
DPM Officer:	DPM Comments and Signature:	

Date	Competition & Venue	Selection Required	Goal or Performance Indicator	Priority (1-5)
4-7-2004	INTERSHOOT - DEN HAAG, HOLLAND	YES	SHOOT ABOVE 580	2
18-1-04	SSRA G.P. - GUENROINES	NO	TO WIN - ABOVE 580	2
22-2-04	SSRA G.P. -	NO	TO WIN	1
12-3-04	SSRA G.P. -	NO	TO WIN - SHOOT ABOVE 580	1
21-3-04	ISLAND NEWS - CAKUSSE	NO	SHOOT AVERAGE SCORES OVER 580	1
11-5-04	ESSEX RISLEY	NO	FIRST/SECOND PLACE	1

UNDERTAKE 3.P. 22 MATCHES FOR SEASON IN COMING YEAR WITH INTENTION OF TRYING FOR CG GAMES MELBOURNE .

High Performance Monitoring – Internal Use Only

Name: DAVID RATTRAY	Event: SHOOTING	Funding Period: 1 February 2004 to 31 January 2005
DPM:	DPM Comments and Signature:	

Period/Dates	Phase	Typical Programme & Venues (per week)
	GENERAL PREP	FLUID TRAINING BASED ON SHIRT PATTERN AND AVAILABILITY
		3-4 HOURS WEEKLY CARDIOVASCULAR/ENDURANCE
		30 MINS RUN 3-4 TIMES WEEKLY
		20-40 MINS 2-3 TIMES WEEKLY STRENGTH/ENDURANCE/TRAINING
		SMART WORK - 6-10 HOURS WEEKLY BUILDING UP TO MAJOR MATCHES
		COACHING AS AND WHEN / TO BE ARRANGED WITH COACH
		LIVE FIRING POLICE RANGE EAST KILBRIDE .

High Performance Monitoring – Internal Use Only

Name: DAVID RATTRAY	Event: SHOOTING	Funding Period: 1 February 2004 to 31 January 2005
DPM:	DPM Comments and Signature:	

Period/Dates	Phase	Typical Programme & Venues (per week)
		PROGRAMME TO BE ARRANGED WITH COACH FOR OFF SEASON . 3P TRAINING TO COMMENCE .

High Performance Monitoring – Internal Use Only

Name: DAVID RATTRAY	Event: SHOOTING	Funding Period: 1 February 2004 to 31 January 2005
DPM:	DPM Comments and Signature:	

Date	Competition & Venue	Selection Required	Goal or Performance Indicator	Priority (1-5)
	ISFED ISLE OF MAN	YES	MEDAL PLACE .	

Sport Psychology - Annual Athlete Review Document

Name:

Date:

1.

Targets for 2004/05	Actual results achieved
(Include Key process goals, performance goals and outcome goals)	

For sections 2. to 8. please score each answer 1 – 10 [1 being terrible, couldn't be worse and 10 being excellent, couldn't be better], give a reason for this score, and give suggested ways to improve.

2. Personal review of Performance for current Year.

[What has been positive, and what could be improved by yourself & others]

3. Technical Performance

- Over the last year, what areas have you been aiming to improve? Have you managed to make these improvements, if not what have been the barriers?

- What is your current level, and what areas need to be improved upon?

4. Physical Preparation

- Over the last year, what areas have you been aiming to improve? Have you managed to make these improvements, if not what have been the barriers?

- What is your current level, and what areas need to be improved upon?

5. Psychological/ Mental Preparation

- Over the last year, what areas have you been aiming to improve? Have you managed to make these improvements, if not what have been the barriers?

- What areas are you aiming to improve on?

6. Training & Practice Facilities

Have you made good use of the practice facilities at your disposal or have they

held you back in any way?

- **Camps** [No. of camps attended, scheduling, relevance, etc]

- **Sessions on the camps and at home** [Structure & content of sessions]

- **Staffing, coaching & support staff** [Levels & relevance]

- **Personal organisation/ needs** [were you able to combine personal needs with the programme requirements?]

7. Coaching Support

- **Access to coaching**
- **On an individual basis**

- **On a group basis**

8. Support services [Have you had sufficient access to, and what has been the quality of provision?]

- **Strength & Conditioning**

- **Doctor**

- **Physiotherapy**

- **Massage**

- **Nutrition**

- **Psychology**

- **Performance Lifestyle (formerly A.C.E.)**
- **Sport Science**
- **Video Analysis**
- **Office support**
- **Travel/ accommodation/ logistics on trips**

9. Improvements for next year.

- What are the major issues that will help you improve next year, and what will YOU do to make them happen?

- What would have the biggest single impact on your performance next year?

- Have you discussed this with your coach?

11. Any other feedback?

Template based on SIS support mechanisms and annual feedback form- to ensure continuity of support environment and integrate STSF with SIS support services.

APPENDIX 6.

OFFICIAL DATA SOURCE- INDIVIDUAL

Personal Details					
Name:	Martin Sinclair	Place of Residence:	Eskbank, Midlothian	Occupation:	Software Engineer
		Date of Birth:	December 1966	Place of Birth:	Folkestone
Shooting Profile					
Discipline(s):	3x40 & Prone		Club(s):	E U Alumni	
Number of Scottish Caps:	18		First Scottish Cap:	CSF Championships, India, 1995	
Personal Bests:	3x40 - 1158 Prone - 598		Records Held:	Scottish Men's Prone - 598	
Major Games Attended:	CSF Championships 1995, 1997, 1999 & 2001 Commonwealth Games 1998 & 2002 European Championships 2003 ISSF World Cups Atlanta 2002, Munich 2003				
Major Medals & Championshi ps Won:	Scottish 3x40 Champion 1997, 1999, 2000, 2001 & 2002 Scottish Long Range Prone Champion (The Haig) 2001 Scottish Men's 50m Prone Champion 2002 & 2003 British ISSF Prone Champion 1997 & 2002 British ISSF 3x40 Champion 2000 & 2001 British NSRA 3x40 Champion 2000 & 2002 CSF 3x40 Pairs Gold 1999 & 2001				
Other Info:	Married to fellow squad member <u>Lynda Sinclair</u>				

APPENDIX 7.

OBSERVATIONAL ANALYSIS SHEET

Various observation analysis forms utilized inclusive of offered. For example, this includes the observational analysis utilized within the thesis based on 5 minute periods. This was also done manually on an A4 notebook when forms were unavailable- or activity deemed important was required for recording.

Adjustments to analysis criteria could be made readily as well as increases or decreases to the periods of time.

Additional observation analysis sheets were also constructed for elements such as focus groups or team meetings to make and assist the team in making them more productive.

Nature of Group :
 Nature of Activity :
 Name of Observer(s) :
 Date :

Group arrangement.....

	A	B	C	D	E	F
Taking initiative - e.g. attempted leadership, seeking suggestions, offering directions.						
Brainstorming - e.g. offering ideas or suggestions, however valid.						
Offering positive ideas - e.g. making helpful suggestions, attempting to problem-solve						
Drawing in others - e.g. Encouraging contributions, seeking ideas and opinions						
Being responsive to others - e.g. Giving encouragement and support, building on ideas.						
Harmonising - e.g. Acting as a peacemaker, calming things down, compromising.						
Challenging - e.g. Seeking justification, showing disagreement in a constructive way.						
Being obstructive - e.g. Criticising, putting others down, blocking contributions.						
Clarifying / summarising - e.g. Linking ideas, checking progress, clarifying objectives / proposals.						
Taking initiative - e.g. Spokesperson, recorder, time keeper, humorist.						
OTHER COMMENTS						

APPENDIX 8.

EPISODE REVIEW- Coach, Athlete and Organisation

The episode reviews were conducted at varying periods of collaboration inclusive of progress reports, initial three month report (reconnaissance), annual report, and episode report (see study 3).

As an ecological approach to development, episode reviews would look at organization, team, coach and athlete development. The offered review is one of 19 during the reconnaissance period- progress report; coach report; team report; 16 athlete reports. Reports utilized in latter sections were written as 'period' papers to bring conclusive analysis. Shared mental model reports were also conducted previous to Melbourne 2006.

Reviews were drawn from interviews, data assessment, observational analysis, organizational plans, team plans, focus groups, meetings, results, development profiles, agreed goals/objectives and field notes written at night (summative reports of each day/ training weekend/ training camp or competition) or any additional data believed appropriate. The reviews served as a suitable venture to monitor and control development of all aspects of the collaboration and especially served appropriate in the conductance of an action research study.

The offered report was conducted at the reconnaissance period after the initial three month primary analysis.

PRELIMINARY ASSESSMENT REPORT OF COACHING AND TRAINING



Practitioners Name: Stewart Ollis
Client Name: Donald McIntosh and Robert Nibbs
Date: March 2004

Progress Report Criteria

- The main aim of the report is to deliver the psychology support assessment of the coaching and training environment as conducted by the small-bore shooting team.
 - Subsequently, the report offers a four-fold process for future aims and objectives in relation to long, medium and short term action points to be structured.
-

Introduction

This report provides the conclusion of the initial assessment and analysis as conducted from January 1st to March 20th 2004. From this assessment and analysis report, a number of recommendations about areas we could work on with a view to increasing the consistency and quality of the shooting teams coaching and training will be offered. The assessment and analysis report alludes to coaching and training effectiveness analysis. However, you will quickly realise that there is a great deal of overlap between the recommendations, and indeed the individual and team assessment that all individuals will receive are nested within the existing report.

The psychology support will be conducted by Stewart Ollis and Amanda Davidson, both from the University of Edinburgh. Both psychologists have adopted an integrated role in the sense that they will be involved with all three shooting sections. It is envisaged that there will be a 70:30 split, with Stewart leading the small-bore team. The shooting team has allocated 50 days support which will be divided between organisational, team, coach and individual needs. It is fortunate that the small-bore team has been very pro-active throughout the management, coach and individual structure towards the psychology support.

The assessment and analysis will be conducted as an indirect and direct approach to enhancing coaching effectiveness and training excellence. The aim is that the coaches will utilise the analysis as a framework to self-regulate their personal coaching development in future times. The assessment utilises coaching effectiveness, psychology and motor learning principles and will hopefully prove fruitful in recognising future areas of personal coaching development that the psychology team can help supplement. Between the existing report, additional 'coach excellence tool' and four-fold process, it is envisioned that coaching development criteria can be determined to ensure we offer optimum support for the team.

As already alluded to in the initial progress report, the psychology team is adopting a holistic approach to the support package in that it envisages organisational development and change; coaching development and change; & individual development and change as being required to ensure optimum performance results. The holistic concept also relates to how the individuals environment, the shooting task and individual personality and abilities all combine to determine the penultimate shooting performance. As such, most of the support focus will be ensuring that 'good practice' and 'coach/organisational' empowerment flourish. This has been determined by the team needs as well as the strategic adoption of 'coach empowerment' as a central underpinning of the small bore psychology support strategic choice. The primary factor for the adopted strategy will see the integration of psychology and coaching to give the shooter optimum opportunity for development. The secondary factor alludes to the identification that both coaches have strong 'psychology' understanding, and indeed, one of the coaches is in the early stages of 'formal' sport psychology accreditation.

It is recognisable that 'coaching' is seen as a central concept to the ability for the shooting team to develop to their own capacity. Therefore, the ability to maintain and build upon the quality of support already provided is critical for the whole team's future development.

Assessment

The assessment has been completed by a variety of means including:

- Interviews
- Individual surveys and questionnaires
- Observation of training and competition
- Analysis of existing miscellaneous coaching tools
- Performance and planning schedules
- Coach perspectives
- Existing coaching, psychology and motor learning principles

The assessment offers an opportunity for the psychologist to ensure they have an understanding of the 'shooting environment' and clarification of the demands, strengths and opportunities associated with the discipline. It has to be re-emphasised that this 'assessment' provides suggestions and a process which should lead to direct 'operative recommendations'. In light of this, the report is an opportunity for the coaches to take stock and identify constraints that can be utilised effectively in the shooting team, coach and management development. I would therefore expect the present report findings to expand quite considerably.

Background

Shooting can be quite simply defined as a continuous and repetitive event which lasts from 1hr 15mins to 1hr 45mins dependent upon competition and event. It appears a difficult skill to master, with the need for individual dedication and commitment in time and effort, but also quality support from management, work and home. Indeed, able instructors and coaches are essential if individuals wish to make a transition to the elite level. However, it has to be reminded that this is only one of many constraints, beginning with the individual her or himself as expert rifle shooters are indeed self-regulated perfectionists. However, it is the qualities of a coach creating a suitable environment which will allow this to occur.

The shooting team consists of both air rifle and .22 small bore competitors. The shooters compete in either prone, standing or three-position (prone, standing and kneeling) events. The aim of competitive shooting is to accumulate as high as possible a score as possible. This ranges from totals of 400 for female one-position events, 600 for male (and some other female) one-position events, and 1200 for the three-position events. Each shot has the ability to score 10 points. Indeed, it requires sheer precision at the finest degree, accumulated via years of training and support, to hit the one-centimetre bulls-eye from 50m. As such, shooters have traditionally focused on the micro-elements of technical detail to allow this to occur.

Shooting is a sport which requires both individual and rifle (& supplementary equipment) to be in optimal condition. For the individual this includes both body and mind. To understand this symbiosis of rifle, body and mind, a task analysis of the shooting discipline is offered. This will also be required for individual and coaching assessments.

Task Analysis

In the task analysis, I have listed the five main areas according to existing expertise literature. This section allows you to critique my understanding of shooting, and ensure I focus on the appropriate factors that mirror your discipline. Traditionally, it appears that shooting coaching has focussed on the technical aspects, based upon technological advances and the sharing of technical abilities. Whilst such practice is undoubtedly well founded, it is probable that a holistic account of the problems and skills required will be required for current standards to make a transition towards world level.

The task analysis is also the framework against which I hope to construct training and post-competition performance briefs, and along with your feedback and future workshops, a performance evaluation form. I am hoping that the coaches ability to expand this section will be bountiful and it will serve purpose of training needs, assessment needs, coaching emphasis and aspects such as performance profiling.

Physical

Physiological aspects of expertise include factors such as endurance, speed, strength, power and flexibility. These are characterised by anaerobic power, aerobic capacity, muscle fibre type, body morphology, body segment size, height and general aesthetics (Wilmore & Costill, 1999). While the specific need for any of these factors is difficult to acknowledge as directly relevant for competitive shooting, we can identify correlations when we acknowledge the demands not only of competing, but also the ability to train as required.

The recognition of the importance of fitness training is acknowledged by many, but it has not been fully endorsed. Indeed, an assessment of the 'characteristics of excellence' and 'appreciation of fitness' was conducted via direct action. While many did participate in a very short run at Denwood (31/01/04), many did not, and indeed were keen to voice the 'fact' that fitness is not required to shoot. For those who did the run (approximately 2 miles), it did highlight the low levels of fitness within the group. It should be noted at this point however, a few did conduct themselves very well both in relation to fitness levels and attitude.

The shooting management, along with the institute of sport acknowledge the need to raise the fitness profile of the group. Many individuals are in physiotherapy, which considering many of the young ages, would indicate that general conditioning has been previously lacking. Research collaborated between the shooting team and the Scottish Institute of Sport is ongoing at present with 'core stability' being the research topic.

Enhancing a culture of 'fitness awareness' within the group is required. The initial focus should be on general fitness and conditioning, which will encourage 'preventative' attributes, and allow individuals to more readily accept the need for fitness levels. If required, skills to enhance the uptake of fitness by both the group and individuals can be offered.

A few of the direct benefits of higher fitness levels correlate directly with 'coping skills', 'relaxation skills', 'motivation', 'nutrition', 'health', 'core stability' 'shooting endurance', 'travelling', 'training' and 'general health'. Many more exist, but it should be acknowledged that the management, and the majority of individuals, are already aware of the benefits. Other obvious correlations with performance could be expected between positioning, proprioceptive awareness, balance, muscle tension, hold characteristics and breathing rhythm which includes volume, frequency and cycle.

Technical

Technical expertise normally refers to the degree of sensorimotor coordination from which refined, efficient and effective movement patterns emerge. In shooting however, there is a greater focus on the ability for movement patterns not to emerge, and indeed be controlled from emerging. This requires great technical awareness of both individual positioning and equipment. It should be easy to recognise why the technical aspects of shooting dominate the overall level of expertise.

Regarding the development of technical expertise, ample evidence exists to suggest that co-ordinated, refined and efficient movement patterns emerge largely as a function of years of extended and systematic training, or deliberate practice (e.g. Ericsson and Lehman, 1996; Starkes, 2000; Janelle and Hillman, 2003). What is less recognised in expertise literature is the need to understand that this is also constrained by coach, family and work. The take away message from this however is that time in training and competition correlates with success.

The technical aspects acknowledged by this assessment have included the amount of time required to get equipment, rifle and individual working optimally as one. This includes outer and inner positioning, hold & zero point, aiming, shot release, follow through, equipment (rifle, accessories, clothing and ammunition). It is important to acknowledge that this results in the greatest attention for coaching and training weekends. The purpose of this assessment is not to regurgitate what the coaches already know, but confirm that this component of expertise is what comprises the vast majority of the training weekends.

Cognitive/ Tactical

Tactical knowledge involves not only the ability to determine what strategy is most important in a given situation, but also whether the strategy can be successfully executed within the constraints of the required task (McPherson, 1994; Starkes, 1993). What constrains the shooters strategic options is related to conditioned behaviours, physiological and technical 'ceiling effects' and emotional regulation skills in the competitive environment.

It can be argued that the tactical domain in shooting is non-specific due to the 'individuality' and 'self-regulation' associated with the sport. However, choice of equipment, ammunition, rate of shooting, competition appraisal and shooting tactics (which is greater for the .22 small bore shooters due to their interaction with the environmental elements) indicates that 'tactics' have to be accounted and addressed.

Tactical awareness is also required to be acknowledged at the macro stage of planning and development. This will include choice of training, periodisation of training and competition selection. For example, there exists a good debate of whether you should seek 'competition' and 'exposure', against the ability to shoot quality scores in traditionally good environments.

Cognitive/ Perceptual

Regardless of whether one is shooting indoors in a self-paced air rifle discipline, or shooting outdoors in .22 small bore event where an interaction self-paced and environmentally determined, expert shooters are capable of attending to and extracting the most relevant cues in the shooting environment and can avoid attending to distracting or irrelevant cues.

These cues exist within the environment, the sighting and visual search system and within the shooter themselves. The timing of the shot, and therefore shooting rhythm, is regulated with the perceptual and proprioceptive skills which are based largely on the interpretive value of information gained by the shooter. Research identifies, to some degree, that the shift from visual, to self talk, to training for trust are important elements of performance. Furthermore, the ability to move from relatively broad to appropriately focussed is a skill which takes years to master.

The ability to provide training tasks that allow individuals to experiment with various perceptual attributes is a focussed area of attention and includes looking at stability, feedback, practice structure, practice distribution, think aloud procedures and slow-motion practice.

Emotional and Psychological Regulation

Psychological skills and the ability to monitor and exert some control over emotion are key elements to successful shooting. Outwith the obvious emotions associated with competing in high level competitions, individuals have to compete with the constant feedback received while they strive to constantly score 10's. Dropping points in major competitions can be serious disruptors to an individuals shooting rhythm, and indeed the inability to cope is a major hurdle. This ability to regulate emotions is magnified in the finals when decimal scoring is adopted and single shots affect the outcome of years of individual, family, coach and team commitment and dedication.

The psychological skills such as goal-setting, motivation, concentration, confidence building, performance routines are crucial not only on the shooting range, but more importantly with the individual's ability to train at a suitable intensity and volume. These skills should then be immersed in an individuals psyche and benefit in the 'competitive arena'. However, it should be noted that many psychological regulating skills morph within the arena alone, and so 'exposure' to competitive stressors should also be promoted, monitored, evaluated and controlled.

All the individuals have various strengths and weaknesses. While shared needs for psychological skills can be taught in educational slots within the training programme. However, the majority of psychological skills training requires individual attention.

.22 Small-Bore and Air Rifle Shooting Team

The team has ten members in the senior squad, and five members in the junior squad. The present focus for all is on the 2006 Melbourne Commonwealth Games, with the appropriate milestones of qualification and team selection dispersed through the two years. The team has not won a gold medal since 1994, and this therefore is the number one objective.

As one of four disciplines in the STSF, the small bore and air rifle team appear well organised, structured with coherent goals and objectives. The team performance co-ordination is managed by Shirley MacIntosh, with Robert Nibbs and Donald MacIntosh co-fronting the coaching role. Furthermore,

Donald has been recently appointed as 'shooting team manager', which gives increased responsibility. It is important to recognise the team is in a period of transition and reconstruction, with new processes, strategies and techniques being introduced to the group.

The ability of the individuals, coaching staff, team, and organisation to develop will be the principle of effective performance. The production a gold winning performance requires the integration and synergy of all these elements as identified in Figure 1 and Figure 2. As such communication will be a key element to coaching and performance success. The ability to motivate and re-focus training action points between squad training and competitive events is a key nature of management control.

This is not taking responsibility from the shooters themselves as a key characteristic of excellence is indeed the ability to self regulate basic activities of management to a certain degree. However, along with work and family constraints, paper chasing has been offered as a large area of time loss for key individuals, and as such requires greater support.

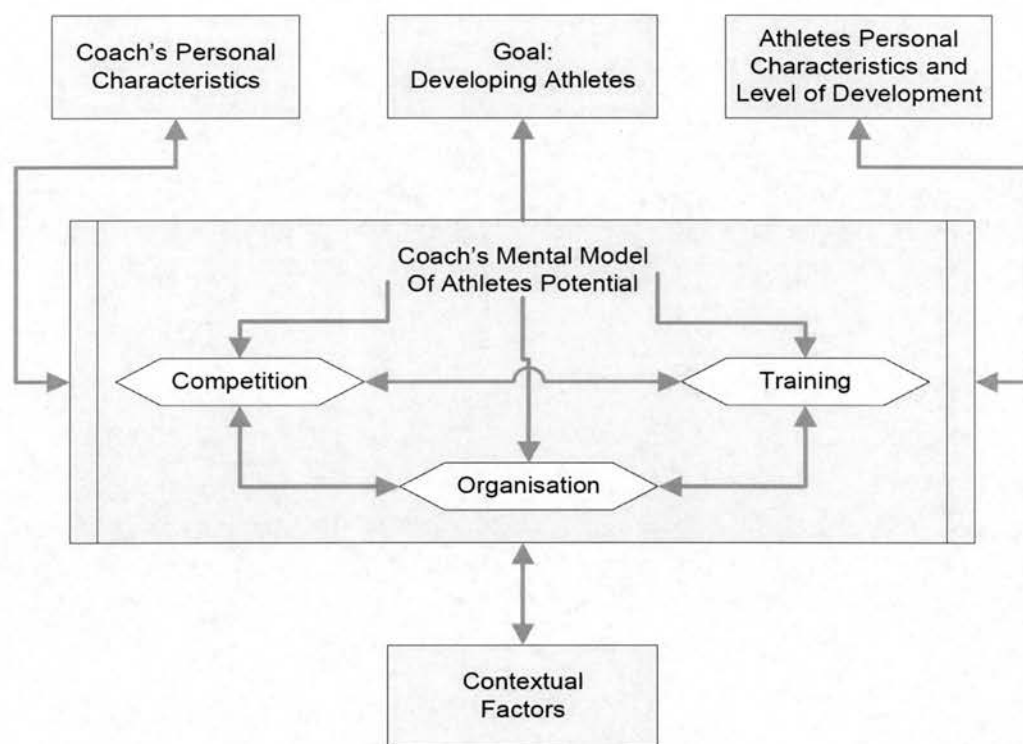


Figure 1. The coaching model

Coaches are the central leverage mechanism in the ability for a shooter to perform optimally. More and more emphasis on coach support roles dominates shooting as analysis and support tools evolve within the sport. It is important to identify the principle skills required in coaching, as well as task analysis. Between them both, the training environment can be understood with greater detail and specificity. The model (Figure 1) acknowledges that the three primary categories of coaches' knowledge are: organisation, training and competition. The model identifies how the coach and athlete's individual differences, along with contextual factors such as work, family, administration, travel, financial support, etc integrate with the coaches mental model (hopefully accurate???) to develop athletes through appropriate goal setting at long, medium and short term. It is the ability to analyse and help train the athlete at the three categories of competition, training and organisation that will primarily aid in constructing the appropriate mental model. These categories will serve as the primary domains of analysis, with recommendations being offered after each section.

Organisation

Defined as ‘the knowledge used by coaches to establish optimal training and competition conditions by structuring and co-ordinating various coaching tasks’, this category can be supported by Figure 2 as a suitable template. At present, you are both in a period of transition, with the new coaching team being developed. From my own perspective, it appears Donald takes lead role in the organisational responsibilities with Robert stronger in technical understanding. Focus on change within the coaching practice has been on planning schedules, training weekend structure, training weekends, training camps and communication links. However, greater attention will be alluded too these factors later.



Figure 2. The nature of management control and organisation

Planning has been a recent addition to the team (as I hear them complain of the paperwork!) in the present coaching format of the Don-Rob symbiosis. Based on periodisation principles, the planning looks at long and short term goals in relation to both training and competition. The sheets I have analysed (Mathews and Sheena’s) are suitably detailed and allude to seasonal goals and monthly training goals. Indeed, Mathews was very specific indeed to exact training schedule structure. What I do not recognise however is the consistency through time of planning, as well as the consistency of planning for all individuals.

The individuals receive training schedules for one month, but then there is little follow-up (reasons and constraints?). Furthermore, no ‘generic’ training plan can be seen with all individuals. Some do have the planning, others don’t. Recently, Donald has been constructing an e-mail to the whole team which re-emphasises the need for detailed and periodised planning schedules. What we have to ensure however is that the ‘periodised planning’ is adopted by all individuals in the Commonwealth Squad (with the 2 year plan towards Melbourne being recognised as the ‘motivational drive’ to accept the periodisation program). Furthermore, Sheena’s recent progress is a very suitable exemplar to show how effective the balance between ‘quality planning’ and ‘emergent awareness’ are characteristics of developmental excellence.

The recommendations in this section include the following:

- Full generic periodisation template based on 2-year, 1-year, 6-month, quarterly and 1-month (weekly detail) specifics.
- Full weekend goals and action points for training weekends for all individuals. This should include the ability to 'monitor' and 'assess' previous monthly goals, and springboard the next month goals (along with the emergent factors that arise at weekends).
- Integrate all domains of excellence i.e Should you set physical training programs? Should you both be involved with psychological training of individuals (based on my analysis-definitely!)
- Determine responsibility of planning and evaluate how you will integrate it within your life-schedule, how it will be monitored, how frequent should you make communications with individuals and what levels of training specificity is suitable for the individual.
- Review of performance profiling. Hopefully, individual support sheets will give more rounded awareness of performance needs (in explicit rather than implicit understanding).

The success of this planning phase will be conducive to control goal-setting. As such, the coach must be able to ensure that the individual shooter is central to the planning and goal setting process. However, your role will allow great control and responsibility to the final set program. Directing and controlling the individuals has to be addressed and with my initial observations, this may require delicate initiation. However, Melbourne is certainly the 'vehicle' too which the group will readily accept. So start – long term, and they will buy in. Once initiated, it is up to consistent communication, assurance that programs will be regular (no missed months!) and rewarding of completion hopefully in results (Sheena!!) that will ensure planning becomes the norm and automatic habit. The only word of caution comes in ensuring that the coach takes lead role at present. The shooters require 'deliberate practice', and will take time before self-regulatory transition of responsibility can occur.

The second element within the organisation role focuses on the administrative concerns. As previously alluded too, my initial analysis recognises both a resistance to paperwork and lack (or probably more appropriate- need of more) of deliberate practice within the team. As such, the 'coach and management team' have to share responsibilities for this domain. The recommendations given for administrative include discussions on:

- Administrative responsibility.
- How to initiate, maintain and 'change' perception of responsibility (to the shooter!).
- Appropriate generic templates and models.

The third element of organisation alludes too 'team rules'. I think there has to be an increase in training weekend impetus. I think one means of controlling and managing this aspect is through quality planning. For example, I know a few individuals get dejected when weekend goals are not completed. Yet when I look at these goals, I wonder if they were ever achievable, or are they 'best case scenario'? Others don't arrive with any goals. I also recognise that there is a strength of 'ownership' of decisions with the shooters and not with the coaches. It would be interesting to identify if this is due to a humanistic coaching philosophy, a matter of circumstance or something which you desire to be altered. The weekend

run at Denwood spoke more about attitude, commitment, planning and focus than anything else than anything physiological. Indeed, what was more surprising was seeing the individuals still sitting drinking coffee on return. They didn't even opt to conduct alternative training. Probably more akin to the overall message- you didn't make/ manage/ control them! One of the key characteristics of quality coaching is an ability to ensure all individuals are always busy during a training session. This means your ability to take control and not accept (from some) the strong social factor as the dominant force. At the same time however, this must never be lost as it is key to the strong dynamics of the team. Indeed, the Wigan weekend highlighted how self-regulated motivation can prove very useful. I don't think it is my responsibility to highlight exactly who requires carrots, sticks or left alone. However, a more structured and planned weekend program should allow for this. I.e set times for a 'competition shoot', lecture/ tutorial time, physical training (core stability, etc) and specific shooting and technical tasks in between.

- Weekend programs- detailed and adhered to.
- Consistent start time and finish time.
- Keep individuals busy at all times.
- Evaluation of weekends a must (gauge whether you are pushing too hard- or not enough).
- Can we create greater competition in the weekends with appropriate triads and dyads?
- Ensure communications (weekly/ fortnightly) at set times become a rule. I.e. 20 minute slots for individuals to phone (pre-determined). This will also allow the 'organiser/ planner/ administrator' to have a consistent and regular period where they can do 2-3 hours work over a day or two a week. This ensures they have their life too.

As you can see most of the recommendations are already coach and management aware. However, you do not display them consistently, do not give them the appropriate rigour (much like pre-performance routine material) and the re-visiting which they require and deserve. Overall, what I would like to see evolve is the ability for yourselves to 'control' and 'direct' the training activities of the team. I agree that for some of the older members, this will be very difficult, and that this must be an 'indirect' mechanism. The ability to construct individuals planning and goal-setting, along with monitoring and strong communication should see this as an appropriate vehicle. Warning: you cannot afford to get angry and frustrated when it does not work during the initial stages. This will develop through many troughs and peaks. As a coach, you are in a very powerful position in the individual's life. Accept the responsibility with appropriate respect and manage the increase in 'deliberate practice', and you must never lose your emotional control- UNLESS PLANNED!!

Training

I think you will both agree that this is the central tenet of your coaching role. It can even be suggested that it is your technical coaching which the team appreciate, require and identify your roles as. Due to the intricacies of your sport- this is probably very well justified. I enjoy and acknowledge the level of your expertise in this field, and commend your abilities to recognise faults through observation and solutions to what would seem to me as too complex to understand.

What I would like to see is a training process that evolves from quality planning and integrates the skills you gents already have. Do you know your own weaknesses? Do you work on them, or do you utilise your abilities as a future team? What CPD mechanisms do you have in place? What would you like to see

from the training weekends that does not exist at present (i.e. attitudes to training, commitment) and can I be of some help in trying to manage that situation?

From a 'motor learning perspective', I see that more rigour has to be focussed on follow-up and retention issues (which is directly correlated with quality planning and action point feedback loops). Also, I would like to see more focus on practice structure and feedback manipulation. Do you feel you hit appropriate challenge points for peak performance? I know from our discussions that you don't. Manipulating feedback and practice structure are two powerful mechanisms that do allow this (and sometimes without the individuals recognising!). I expect Donald's 'instructional issues' essay to be a template for applied coaching in shooting (so make sure it's good). We even had ideas for training manipulation 'designed' into a master's class. I do expect to see the best of these in your essay.

Some possible examples from myself include:

- Randomised training (air and small bore at same period to allow internal positioning)
- Randomised training (greater ability for doing all 3P's on one day)
- Randomised training (indoors and outdoors)
- Manipulation of shooting speed (rhythm)
- Simulation competitions (first thing of weekend i.e. time starts at 1000hrs- inclusive of pre-routine)
- Adapted and fun competitions to enhance motivation and skills transfer.
- Video feedback maintained and software increased. Donald has to 'get more' from Institute. I.e. we were already doing positional analysis via Robert (nothing new!) and I was already looking at performance routines and rhythm (nothing new!). So, from the institute- NOTHING. Manage the situation and ensure that you get something novel as they will have access to equipment and resources. I can think of a few means of measuring stability which I know the institute has not identified for different positions, and so would they if you manage the situation more appropriately.
- Feedback manipulation – occlusion, delayed feedback, restricted feedback, random feedback, summary feedback, split-screen feedback, performance or outcome feedback, intermittent reinforcement.
- Training weekend feedback –for all individuals. Action points and monthly training plans constructed. Learn to put a 'self-regulated' training class (or use support staff) at the end of the training weekend. This will ensure you can talk to all individuals for 20 minutes each. This requires good planning. Remember you can break someone's '60 shot match as a means of distraction control'. Have next months training already pre-prepared, but alter for emergent planning needs that arose from weekend. Use it as a tool too 'control' and 'manage'. Confirm communication times and gain feedback for the appropriateness of the weekends training.

Your coaching responsibilities also include physical and psychological training. I will give examples of training tools that should be focussed on the range at training weekends for groups of individuals. These can be incorporated into adapted competition or individual training. These will include attentional skills training (and attentional cueing which is another feedback manipulation), relaxation, distraction control, concentration techniques which I believe you should control rather than myself.

How do you feel you should manage and control physical training? What is appropriate for each individual? Can we do something at a group level to change the resistance to exercise? These require discussion as a coaching group, with individual assessment and analysis (probably at a semi-subjective and technically correlated level) and team culture as the appropriate headings. I.e. stability training can be measured on the range, aerobic training can be measured by ability to control heart rate and physiological control on the range and conditioning can be affected with decreases in aches and pains. I feel the ability to show directly where the benefits exist through facts are required. So, identify why they come off a 60 shot simulated competition and log. Show through 'modelling', how others don't.

In summary, I expect to see an increase in the creation of an instructional scenario which achieves:

- high challenge points,
- maintenance of existing and further utilisation of Institutional facilities in diagnosing the learning experience,
- increased planning and utilisation of feedback and training structure manipulations to improve the design of the learning experience,
- increased assessment of the learning experience from individual shooters and yourself with an eye on both how you will share this information and utilise the information for coaching development.
- Finally, we know that each manipulation can be facilitative AND debilitating. As such, there is a need to document the instructional strategy to ensure manipulations are controlled, measured, monitored and utilised in future planning. This can be achieved via mixed individual log books, coach training logs and communications about goal-setting/ planning tasks.

Competitions

As well as the training and practice situation, the other environment for performance development occurs within, and just after, an individual's exposure to competition. This is magnified when an individual has learnt the principle shooting skills and has never been exposed to a high standard competition where controlling your emotional regulation is central to outcome. This is where the coaches ability to provide the appropriate feedback at the appropriate time, with greatest focus on attentional cueing. It is important that this domain also includes the post and pre-competition phases. Therefore awareness of facilities and needs at the competition site inclusive of travel, accommodation, rest and recuperation areas, nutrition and hydration management, arousal and anxiety control is required. Recommendations for the competition include:

- Pre-competition – arousal and anxiety management awareness. This includes week before big competitions, the night before, the morning before, three hours before, the hour before and so forth. You should be fully monitoring all individuals at all of these periods, inclusive of knowing with whom and when to stay away. Know when to arouse, know when to relax and taper these so peak performance will occur. Get involved with imagery techniques, know when they would like to turn up at site, know if they want you to talk to them- for how long and what to say. Ensure you block distracters as appropriate so that the shooter maintains ability to shoot optimally.
- Competition- agree on approach to coaching during competition. At times is it appropriate to break the rules? I know you have appropriate examples. You should also have appropriate feedback forms to give to the individuals post-competition. Do you think video can be appropriate? It is now common practice with every other elite level sport.
- Post-competition- post game evaluation is important for motivational, developmental and future performance progression. For example when individuals shoot well, it should be attributed to

how well they trained and preparation, along with how they controlled anxiety and arousal- not just outcome. Pat yourself on the back later. You should be able to identify exactly where the individual performed poorly through both 'visual analyses' and 'post-match discussion'. These should then form major action points for future training plans (unless through your awareness of the situation that you deem it as circumstantial). However, you will require learning the skill of controlling the emotions and the natural tendency to correct any flaws and errors that you noticed during the game. Allow time for the individual to analyse themselves, see if both coach and individuals assessment are similar, and understand that the big de-brief should occur at the next training session (or suitably post- post-competition). What has to occur is the actual competition assessment however. Probably more so with the development squad and incorporating how 'training and preparation' are key.

Holistic Recommendations

Specific recommendations have already been conducted. What I propose is a four-fold mechanism for a holistic account of your needs and desires:

1. Look at the recommendations and offered questionnaire to assess how you may continually develop as a coach.
2. Triangulate feedback with group needs.
3. Have a coach meeting based on the offered material and subsequent findings. From this, discuss where you feel the important leverage points that will provide greatest benefit for the group and yourselves should be adopted. Decide if you require information on practice structure and feedback manipulation. Brainstorm training weekend structure and practice details. Brainstorm templates based on existing models.
4. Systematically detail action points of coach development and practice which we can monitor, evaluate and assess. These should be fully behavioural criteria.

Conclusion

The analysis of the coaching practice was very positive. Indeed it was found that you:

- You operate, more or less systematically, within a fairly detailed planning umbrella. You do send out weekend plans and have periodised templates constructed. *We can however enhance organisational factors as per recommendations inclusive of consistency of use.*
- Implement detailed exercise loadings as appropriate to your target sport. How much detail does shooting require in the planning of training for individuals. Should they have a program that all you require to do is monitor and evaluate. *You also balance this with an emergent understanding of individual needs that are restricted due to the nature of the sport and geography.*
- Play a central role in direct intervention, particularly at the training weekends. *Require to see you gaining more control through the planning and goal-setting mechanisms.*

- Make extensive use of mental models of day-to day expectations about athletes' performance in both competition and training. You seem to know your shooters strengths and weaknesses, needs and desires, opportunities and potential.
- Exercise intuitive decision making from which you utilise previous experience, skills, and cognitive abilities.
- Supplement subjective data gathering by objective testing and monitoring at selected times in the programme. This is very much the case at training weekends with the Silicon Coach, SCATT and NOPTTELL systems. *We need more tools accessed that can support this role!!*
- Use contingency planning as a normal and expected part of coaching practice. This is recognised both in competition and training where your flexibility is highly evident when injury, illness, work and family commitments occur. This is recognised in the fine-tuning of schedules such as at training weekends where your 'emergent' planning skills are strong.
- Operate a system of crisis thresholds, taking account fluctuations in performance, which occur due to the contextual factors that individuals in the time are constrained with.
- Solve short and long term problems such as recognised in competition and at training weekends where it is reflected in your contingency and emergent planning skills. The long term problems are recognised in your ability to pre-locate suitable training camps. *What kind of notice do you feel the team requires to ensure they get this period off?*

The analysis of training is probably our most important role, and will probably be the core of future discussion. Holistically, you are a very efficient team and work well within a pattern of professional short-cuts. What I recommend is to re-master the more detailed and controlled side of coaching so gain control of the individuals' ability to partake in deliberate practice. If we can increase deliberate practice by 20%, then I feel we can substantially improve medal winning prospects. At present I see a culture of 'un-deliberate practice' with some individuals shooting to no true 'challenges' along with a motivational impetus to get them shooting those extra few hours per week. I also believe the offered recommendations will go a long way to increasing the amount of practice we know to reach the top.

P.S. should Sheena be shooting at World Cup level?

Summary

The report carries the function of:

- Creating good practice at a coaching level.
- Creating an environment where individuals have greatest potential to develop.
- Ensuring the psychologist has strong awareness of the discipline and coach needs, and ensuring these are reflected within individual support.
- Promotion of 'coach empowerment'.
- Documentation of psychologist aims.
- Opportunity for change.

The recommendations outlined above represent the areas I think would be most beneficial for us to focus on at this stage. I would like to instigate meetings between Donald, Robert and myself with our

'coach' hats on when appropriate. There will be many aspects that we need to discuss and adapt, but I believe this is the perfect period to implement change within the team as a whole. Momentum is gathering within the full time and development squads as awareness of selection is prominent.

As the new partnership with Donald and Robert begins within their coaching and management roles, this is also the ideal time to introduce procedures that are most effective in increasing the speed with which the whole team as collective individuals develop.

Regards

Stewart

INDIVIDUAL ASSESSMENT REPORT



Practitioners Name: Stewart Ollis
Client Name: Shirley & Donald McIntosh
Date: March 2004

Progress Report Criteria

- The main aim of the report is to deliver the psychology support team individual assessment.
 - Subsequently, the report offers future aims and objectives in relation to long, medium and short term action points.
 - The report concludes with action points which should be integrated within their training program. The individuals desire to share information from the report is client determined.
-

Introduction

This report provides the conclusion of the initial assessment and analysis as conducted from January 1st to March 20th 2004. From this assessment and analysis report, I have made a number of recommendations about areas we could work on with a view to increasing the consistency and quality of your planning, training and performance. Within the report I have grouped the information under four broad areas;

- a. task analysis and you
- b. training performance
- c. competition performance
- d. analysis of strengths and weaknesses

From these four areas, recommendations are also divided into sections relating to specific areas for work. However you will quickly realise, as you read, that there is a great deal of overlap between some of the recommendations. Thus something you need to work on for use in competition has first to be used in training.

The report commences with a brief summary of relevant background information. As with all of the information gained in this report you need to confirm the accuracy, completeness and relevance. Indeed, at this point, it is important to highlight the need for feedback from yourself as to any of the support mechanisms at team, coach and individual support level. Anything that you feel has been missed or appears irrelevant will need to be reviewed jointly by us. Whilst the report provides the immediate focus for future work I hope it will also provide a stimulus for discussion and it should be considered as a working document that will inevitably adapt and change accordingly to your developmental progress and needs.

Assessment

The assessment has been completed by a variety of means including:

- Interviews
- Individual surveys and questionnaires
- Observation of training and competition
- Analysis of existing miscellaneous coaching tools
- Performance and planning schedules
- Coach perspectives

The assessment offers an opportunity for the psychologist to ensure they have an understanding of the 'shooting environment' and clarification of the demands, strengths and opportunities associated with the discipline. It is of important relevance that we acknowledge a shared understanding of your discipline and I am sure my analysis of the task will require constant amendment and which I rely on you to assist.

Background

Shooting can be quite simply defined as a continuous and repetitive event which lasts from 1hr 15mins to 1hr 45mins dependent upon competition and event. It appears a difficult skill to master, with the need for individual dedication and commitment in time and effort, but also quality support from management, work and home. Indeed, able instructors and coaches are essential if individuals wish to make a transition to the elite level. However, it has to be reminded that this is only one of many constraints, beginning with the individual her or himself as expert rifle shooters are indeed self-regulated perfectionists.

The shooting team consists of both air rifle and .22 small bore competitors. The shooters compete in either prone, standing or three-position (prone, standing and kneeling) events. The aim of competitive shooting is to accumulate as high as possible a score as possible. This ranges from totals of 400 for female one-position events, 600 for male (and some other female) one-position events, and 1200 for the three-position events. Each shot has the ability to score 10 points. Indeed, it requires sheer precision at the finest degree, accumulated via years of training and support, to hit the one-centimetre bulls-eye from 50m. As such, shooters have traditionally focused on the micro-elements of technical detail to allow this to occur.

Small bore rifle at 50m and air rifle at 10m are the constituents of the biggest international events, inclusive of the Commonwealth Games. There are five events in the Olympics with the men competing in 60 shots air rifle; 60 shots .22 prone; and 3x40 shots .22 three-position. The females compete in 40 shots air rifle and 3x20 shots .22 three-position. The Commonwealth Games incorporate more shooting events inclusive of:

- 60 shots air rifle standing – individual (male)
- 60 shots air rifle standing – team (male)
- 40 shots air rifle standing – individual (female)
- 40 shots air rifle standing – team (female)

- 60 shots air rifle prone – individual (male)
- 60 shots air rifle prone – team (male)
- 40 shots air rifle prone – individual (female)
- 40 shots air rifle prone – team (female)

- 3x40 shots air rifle three-position – individual (male)
- 3x40 shots air rifle three-position – team (male)
- 3x20 shots air rifle three-position – individual (female)
- 3x20 shots air rifle three-position – team (female)

- 60 shots .22 small bore prone – individual (male)
- 60 shots .22 small bore prone – team (male)
- 40 shots .22 small bore prone – individual (female)
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- 60 shots .22 small bore three-position – individual (male)
- 60 shots .22 small bore three-position – team (male)
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- 40 shots .22 small bore three-position – team (male)

Shooting is a sport which requires both individual and rifle (& supplementary equipment) to be in optimal condition. For the individual this includes both body and mind. To understand this symbiosis of rifle, body and mind, a task analysis of the shooting discipline is offered. This will also be required for individual and coaching assessments.

Task Analysis

In the task analysis, I have listed the five main areas according to existing expertise literature. Traditionally, it appears that shooting coaching has focussed on the technical aspects, based upon technological advances and the sharing of technical abilities. Whilst such practice is undoubtedly well founded, it is probable that a holistic account of the problems and skills required will be required for current standards to make a transition towards world level.

Physical

Physiological aspects of expertise include factors such as endurance, speed, strength, power and flexibility. These are characterised by anaerobic power, aerobic capacity, muscle fibre type, body morphology, body segment size, height and general aesthetics (Wilmore & Costill, 1999). While the specific need for any of these factors is difficult to acknowledge as directly relevant for competitive shooting, we can identify correlations when we acknowledge the demands not only of competing, but also the ability to train as required.

The recognition of the importance of fitness training is acknowledged by many, but it has not been fully endorsed. Indeed, an assessment of the 'characteristics of excellence' and 'appreciation of fitness' was conducted via direct action. While many did participate in a very short run at Denwood (31/01/04), many did not, and indeed were keen to voice the 'fact' that fitness is not required to shoot. For those who did the run (approximately 2 miles), it did highlight the low levels of fitness within the group. It should be noted at this point however, a few did conduct themselves very well both in relation to fitness levels and attitude.

The shooting management, along with the institute of sport acknowledge the need to raise the fitness profile of the group. Many individuals are in physiotherapy, which considering many of the young ages, would indicate that general conditioning has been previously lacking. Research collaborated between the shooting team and the Scottish Institute of Sport is ongoing at present with 'core stability' being the research topic.

Enhancing a culture of 'fitness awareness' within the group is required. The initial focus should be on general fitness and conditioning, which will encourage 'preventative' attributes, and allow individuals to more readily accept the need for fitness levels. If required, skills to enhance the uptake of fitness by both the group and individuals can be offered.

A few of the direct benefits of higher fitness levels correlate directly with 'coping skills', 'relaxation skills', 'motivation', 'nutrition', 'health', 'core stability' 'shooting endurance', 'travelling', 'training' and 'general health'. Many more exist, but it should be acknowledged that the management, and the majority of individuals, are already aware of the benefits. Other obvious correlations with performance could be expected between positioning, proprioceptive awareness, balance, muscle tension, hold characteristics and breathing rhythm which includes volume, frequency and cycle.

Technical

Technical expertise normally refers to the degree of sensorimotor coordination from which refined, efficient and effective movement patterns emerge. In shooting however, there is a greater focus on the ability for movement patterns not to emerge, and indeed be controlled from emerging. This requires great technical awareness of both individual positioning and equipment. It should be easy to recognise why the technical aspects of shooting dominate the overall level of expertise.

Regarding the development of technical expertise, ample evidence exists to suggest that co-ordinated, refined and efficient movement patterns emerge largely as a function of years of extended and systematic training, or deliberate practice (e.g. Ericsson and Lehman, 1996; Starkes, 2000; Janelle and Hillman, 2003). What is less recognised in expertise literature is the need to understand that this is also constrained by coach, family and work. The take away message from this however is that time in training and competition correlates with success.

The technical aspects acknowledged by this assessment have included the amount of time required to get equipment, rifle and individual working optimally as one. This includes outer and inner positioning, hold & zero point, aiming, shot release, follow through, equipment (rifle, accessories, clothing and ammunition). It is important to acknowledge that this results in the greatest attention for coaching and training weekends. The purpose of this assessment is not to regurgitate what the coaches already know, but confirm that this component of expertise is what comprises the vast majority of the training weekends.

Cognitive/ Tactical

Tactical knowledge involves not only the ability to determine what strategy is most important in a given situation, but also whether the strategy can be successfully executed within the constraints of the required task (McPherson, 1994; Starkes, 1993). What constrains the shooters strategic options is related to conditioned behaviours, physiological and technical 'ceiling effects' and emotional regulation skills in the competitive environment.

It can be argued that the tactical domain in shooting is non-specific due to the 'individuality' and 'self-regulation' associated with the sport. However, choice of equipment, ammunition, rate of shooting, competition appraisal and shooting tactics (which is greater for the .22 small bore shooters due to their interaction with the environmental elements) indicates that 'tactics' have to be accounted and addressed.

Tactical awareness is also required to be acknowledged at the macro stage of planning and development. This will include choice of training, periodisation of training and competition selection. For example, there exists a good debate of whether you should seek 'competition' and 'exposure', against the ability to shoot quality scores in traditionally good environments.

Cognitive/ Perceptual

Regardless of whether one is shooting indoors in a self-paced air rifle discipline, or shooting outdoors in .22 small bore event where an interaction self-paced and environmentally determined, expert shooters are capable of attending to and extracting the most relevant cues in the shooting environment and can avoid attending to distracting or irrelevant cues.

These cues exist within the environment, the sighting and visual search system and within the shooter themselves. The timing of the shot, and therefore shooting rhythm, is regulated with the perceptual and proprioceptive skills which are based largely on the interpretive value of information gained by the shooter. Research identifies, to some degree, that the shift from visual, to self talk, to training for trust are important elements of performance. Furthermore, the ability to move from relatively broad to appropriately focussed is a skill which takes years to master.

The ability to provide training tasks that allow individuals to experiment with various perceptual attributes is a focussed area of attention and includes looking at stability, feedback, practice structure, practice distribution, think aloud procedures and slow-motion practice.

Emotional and Psychological Regulation

Psychological skills and the ability to monitor and exert some control over emotion are key elements to successful shooting. Outwith the obvious emotions associated with competing in high level competitions, individuals have to compete with the constant feedback received while they strive to constantly score 10's. Dropping points in major competitions can be serious disruptors to an individuals shooting rhythm, and indeed the inability to cope is a major hurdle. This ability to regulate emotions is magnified in the finals when decimal scoring is adopted and single shots affect the outcome of years of individual, family, coach and team commitment and dedication.

The psychological skills such as goal-setting, motivation, concentration, confidence building, performance routines are crucial not only on the shooting range, but more importantly with the individual's ability to train at a suitable intensity and volume. These skills should then be immersed in an individuals psyche and benefit in the 'competitive arena'. However, it should be noted that many psychological regulating skills morph within the arena alone, and so 'exposure' to competitive stressors should also be promoted, monitored, evaluated and controlled.

All the individuals have various strengths and weaknesses. While shared needs for psychological skills can be taught in educational slots within the training programme. However, the majority of psychological skills training requires individual attention.

Recommendations

Whilst there are a number of ways in which to proceed and implement performance psychology at an organisational level, I believe that my role should be to bring awareness, and not manage and monitor organisational and team change as a formality.

I have identified what I believe are various recommendations associated with the group performance at present. There is a great opportunity for change, and also the team manger and coaches to create a new culture within the development squad.

Technical Training	<ul style="list-style-type: none"> • Strong coaching area where Donald and Robert's strengths marry very well. • Liase with alternative coaches or training teams (Euro). • Research emphasis has to be increased in applied areas. • Brainstorm of appropriate applied research topics between Shirley, Donald, Robert and team representatives.
Physical Training	<ul style="list-style-type: none"> • 'Team' weak area which requires culture shift. Too many injuries, aches and pains which can be alleviated with suitable programs. • Adopt 'enhancing physical exercise' program. • Increase strength and conditioning programs. • Establish stability research as a vehicle for change. • Establish physiotherapy as a vehicle for change. • Increased monitoring. • Scheduled into goal setting, planning & training camps.
Cognitive Training	<ul style="list-style-type: none"> • This should collate with the research emphasis on rhythm and stability of performance. • Construction of 'performance routine' profile. • Macro level – planning focus. • Micro level- performance routine focus. • Donald's research and supplementary research with availability of tools (EEG, kinematic analysis, etc.)
Psychological Training	<ul style="list-style-type: none"> • Main priority of 'individual support'. • Education classes on all training weekends. • Concentration skills is primary topic (feedback demand) • Individual consultations.
Integrated Training	<ul style="list-style-type: none"> • Coach empowerment adopted • Periodised and holistic planning. • Competition report form constructed • Training report form constructed • Medium & long term report form.
Planning	<ul style="list-style-type: none"> • Computer based periodisation and planning program. Framework from Donald's existing work. • Access to UK or Scottish planning materials. • Weekly contact with individuals. Team manager/ coach responsibility to conduct log. • Long term shift back to individual responsibility. • Competition assessment form. • Training assessment form. • Medium and Long term assessment form.

	<ul style="list-style-type: none"> • Commonwealth opposition and Melbourne analysis.
Organisational Development	<ul style="list-style-type: none"> • Implement Donald and Robert ideas ASAP (window of opportunity). • Motivational awareness of management, and controlled via planning and coaching mechanisms and processes. • Group awareness of performance needs conducted via performance profiles. • Shooter commitment supported at all periods. • Symbolism- team construct logo. • Long term goals integrated within all individual long term plans. • Media training (in house or institute?). • Lifestyle awareness.
Communications	<ul style="list-style-type: none"> • Web page with templates and team information available and up-dated. • Increase to weekly contact. • Feedback forms for planning, support, coaching and event organisation utilised. • Log book and diaries central to contacts.
Evaluation	<ul style="list-style-type: none"> • Monthly and 3 monthly reviews of 'organisational goals'. • Action points to be conducted for each meet. • E.g. web page, planning program, contingency training etc.

Summary

The report carries the function of:

- Creating good practice at an organisational level.
- Creating an environment where individuals have greatest potential to develop.
- Ensuring the psychologist has strong awareness of the discipline and organisational needs, and ensuring these are reflected within individual support.
- Promotion of 'coach empowerment'.
- Documentation of psychologist aims.
- Opportunity for change.

The recommendations outlined above represent the areas I think would be most beneficial for us to focus on at this stage. I would like to instigate meetings between Donald and myself with his 'team manger' hat, and meetings with Donald and Robert with their 'coach' hats on when appropriate. There will be many aspects that we need to discuss and adapt, but I believe this is the perfect period to implement change within the team as a whole. Momentum is gathering within the full time and development squads as awareness of selection is prominent.

As the new partnership with Donald and Robert begins within their coaching and management roles, this is also the ideal time to introduce procedures that are most effective in increasing the speed with which the whole team as collective individuals develop.

Regards

Stewart

This report has been compiled as part of the Sport Science Support provided by the University of Edinburgh.

Stewart Ollis is bound to abide by the code of conduct of both the British Psychological Society and British Association of Sport and Exercise Sciences.

If you desire to discuss either or both individuals conduct, contact: Hugh.Richards@education.ed.ac.uk ,
Dave.Collins@education.ed.ac.uk , BASES or BPS directly.

PRELIMINARY ASSESSMENT REPORT OF SMALL BORE SHOOTING TEAM



Practitioners Name: Stewart Ollis & Amanda Davidson
Client Name: Shirley & Donald McIntosh
Date: March 2004

Progress Report Criteria

- The main aim of the report is to deliver the psychology support team preliminary assessment.
 - Subsequently, the report offers future aims and objectives in relation to long, medium and short term action points.
 - The secondary aim is to clarify the psychologists understanding of the discipline demands and dynamics of the shooting team as a group.
 - The report is also indicative of the ongoing work being conducted by the psychology team.
 - The report is delivered in conjunction with the coach and individual assessments that will be delivered to each individual within the team.
-

Introduction

This report provides the conclusion of the initial assessment and analysis as conducted from January 1st to March 20th 2004. From this assessment and analysis report, a number of recommendations about areas we could work on with a view to increasing the consistency and quality of the shooting teams management planning, training and performance will be offered. The assessment and analysis report alludes to organisational, coaching and individual analysis. However, you will quickly realise that there is a great deal of overlap between the recommendations, and indeed the individual and coach assessment that all individuals will receive are nested within the existing report.

The psychology support will be conducted by Stewart Ollis and Amanda Davidson, both from the University of Edinburgh. Both psychologists have adopted an integrated role in the sense that they will be involved with all three shooting sections. It is envisaged that there will be a 70:30 split in their determined teams. Stewart will lead the small-bore team, Amanda will lead both clay and full-bore. However, in relation to the 'holistic' approach adopted, it is beneficial for individuals to have a grounded and rounded awareness of all three teams. This also serves a purpose towards both 'clarification' and 'analysis' audit processes. The shooting team has allocated 50 days support which will be divided between organisational, team, coach and individual needs.

The assessment and analysis process is the first of a 4 stage process of intervention. This will be followed by an education, practice and evaluation/ modification phase. The report includes analysis of organisational, coaching and individual factors. However, it should be noted that an educational element and subtle models of 'good practice' are being enforced.

The small-bore team has been given most attention from the psychology team to date due to the indoor training and competitions that the seasonal structure of shooting dictates. This has allowed Stewart and Amanda to attend both training and competition events in Bisley, Denwood, Edinburgh, Glenrothes and Wigan.

As already alluded to in the initial progress report, the psychology team is adopting a holistic approach to the support package in that it envisages organisational development and change; coaching development and change; & individual development and change as being required to ensure optimum performance results. The holistic concept also relates to how the individuals environment, the shooting task and individual personality and abilities all combine to determine the penultimate shooting performance. As such, most of the support focus will be ensuring that 'good practice' and 'coach/organisational' empowerment flourish. This has been determined by the team needs as well as the strategic adoption of 'coach empowerment' as a central underpinning of the small bore psychology support strategic choice. The primary factor for the adopted strategy will see the integration of psychology and coaching to give the shooter optimum opportunity for development. The secondary factor alludes to the identification that both coaches have strong 'psychology' understanding, and indeed, one of the coaches is in the early stages of 'formal' sport psychology accreditation.

Assessment

The assessment has been completed by a variety of means including:

- Interviews
- Individual surveys and questionnaires
- Observation of training and competition
- Analysis of existing miscellaneous coaching tools
- Performance and planning schedules
- Coach perspectives

The assessment offers an opportunity for the psychologist to ensure they have an understanding of the 'shooting environment' and clarification of the demands, strengths and opportunities associated with the discipline. It has to be re-emphasised that this 'assessment' are suggestions and not 'operative recommendations', and indeed this is an opportunity to identify constraints that can be utilised effectively in the shooting team, coach and management development.

Background

Shooting can be quite simply defined as a continuous and repetitive event which lasts from 1hr 15mins to 1hr 45mins dependent upon competition and event. It appears a difficult skill to master, with the need for individual dedication and commitment in time and effort, but also quality support from management, work and home. Indeed, able instructors and coaches are essential if individuals wish to make a transition to the elite level. However, it has to be reminded that this is only one of many constraints, beginning with the individual her or himself as expert rifle shooters are indeed self-regulated perfectionists.

The shooting team consists of both air rifle and .22 small bore competitors. The shooters compete in

either prone, standing or three-position (prone, standing and kneeling) events. The aim of competitive shooting is to accumulate as high as possible a score as possible. This ranges from totals of 400 for female one-position events, 600 for male (and some other female) one-position events, and 1200 for the three-position events. Each shot has the ability to score 10 points. Indeed, it requires sheer precision at the finest degree, accumulated via years of training and support, to hit the one-centimetre bulls-eye from 50m. As such, shooters have traditionally focused on the micro-elements of technical detail to allow this to occur.

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Shooting is a sport which requires both individual and rifle (& supplementary equipment) to be in optimal condition. For the individual this includes both body and mind. To understand this symbiosis of rifle, body and mind, a task analysis of the shooting discipline is offered. This will also be required for individual and coaching assessments.

Task Analysis

In the task analysis, I have listed the five main areas according to existing expertise literature. This section allows you to critique my understanding of shooting, and ensure I focus on the appropriate factors that mirror your discipline. Traditionally, it appears that shooting coaching has focussed on the technical

aspects, based upon technological advances and the sharing of technical abilities. Whilst such practice is undoubtedly well founded, it is probable that a holistic account of the problems and skills required will be required for current standards to make a transition towards world level.

The task analysis is also the framework against which I hope to construct training and post-competition performance briefs, and along with your feedback and future workshops, a performance evaluation form.

Physical

Physiological aspects of expertise include factors such as endurance, speed, strength, power and flexibility. These are characterised by anaerobic power, aerobic capacity, muscle fibre type, body morphology, body segment size, height and general aesthetics (Wilmore & Costill, 1999). While the specific need for any of these factors is difficult to acknowledge as directly relevant for competitive shooting, we can identify correlations when we acknowledge the demands not only of competing, but also the ability to train as required.

The recognition of the importance of fitness training is acknowledged by many, but it has not been fully endorsed. Indeed, an assessment of the 'characteristics of excellence' and 'appreciation of fitness' was conducted via direct action. While many did participate in a very short run at Denwood (31/01/04), many did not, and indeed were keen to voice the 'fact' that fitness is not required to shoot. For those who did the run (approximately 2 miles), it did highlight the low levels of fitness within the group. It should be noted at this point however, a few did conduct themselves very well both in relation to fitness levels and attitude.

The shooting management, along with the institute of sport acknowledge the need to raise the fitness profile of the group. Many individuals are in physiotherapy, which considering many of the young ages, would indicate that general conditioning has been previously lacking. Research collaborated between the shooting team and the Scottish Institute of Sport is ongoing at present with 'core stability' being the research topic.

Enhancing a culture of 'fitness awareness' within the group is required. The initial focus should be on general fitness and conditioning, which will encourage 'preventative' attributes, and allow individuals to more readily accept the need for fitness levels. If required, skills to enhance the uptake of fitness by both the group and individuals can be offered.

A few of the direct benefits of higher fitness levels correlate directly with 'coping skills', 'relaxation skills', 'motivation', 'nutrition', 'health', 'core stability' 'shooting endurance', 'travelling', 'training' and 'general health'. Many more exist, but it should be acknowledged that the management, and the majority of individuals, are already aware of the benefits. Other obvious correlations with performance could be expected between positioning, proprioceptive awareness, balance, muscle tension, hold characteristics and breathing rhythm which includes volume, frequency and cycle.

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Technical expertise normally refers to the degree of sensorimotor coordination from which refined, efficient and effective movement patterns emerge. In shooting however, there is a greater focus on the ability for movement patterns not to emerge, and indeed be controlled from emerging. This requires great technical awareness of both individual positioning and equipment. It should be easy to recognise why the technical aspects of shooting dominate the overall level of expertise.

Regarding the development of technical expertise, ample evidence exists to suggest that co-ordinated, refined and efficient movement patterns emerge largely as a function of years of extended and systematic training, or deliberate practice (e.g. Ericsson and Lehman, 1996; Starkes, 2000; Janelle and Hillman, 2003). What is less recognised in expertise literature is the need to understand that this is also constrained by coach, family and work. The take away message from this however is that time in training and

competition correlates with success.

The technical aspects acknowledged by this assessment have included the amount of time required to get equipment, rifle and individual working optimally as one. This includes outer and inner positioning, hold & zero point, aiming, shot release, follow through, equipment (rifle, accessories, clothing and ammunition). It is important to acknowledge that this results in the greatest attention for coaching and training weekends. The purpose of this assessment is not to regurgitate what the coaches already know, but confirm that this component of expertise is what comprises the vast majority of the training weekends.

Cognitive/ Tactical

Tactical knowledge involves not only the ability to determine what strategy is most important in a given situation, but also whether the strategy can be successfully executed within the constraints of the required task (McPherson, 1994; Starkes, 1993). What constrains the shooters strategic options is related to conditioned behaviours, physiological and technical 'ceiling effects' and emotional regulation skills in the competitive environment.

It can be argued that the tactical domain in shooting is non-specific due to the 'individuality' and 'self-regulation' associated with the sport. However, choice of equipment, ammunition, rate of shooting, competition appraisal and shooting tactics (which is greater for the .22 small bore shooters due to their interaction with the environmental elements) indicates that 'tactics' have to be accounted and addressed.

Tactical awareness is also required to be acknowledged at the macro stage of planning and development. This will include choice of training, periodisation of training and competition selection. For example, there exists a good debate of whether you should seek 'competition' and 'exposure', against the ability to shoot quality scores in traditionally good environments.

Cognitive/ Perceptual

Regardless of whether one is shooting indoors in a self-paced air rifle discipline, or shooting outdoors in .22 small bore event where an interaction self-paced and environmentally determined, expert shooters are capable of attending to and extracting the most relevant cues in the shooting environment and can avoid attending to distracting or irrelevant cues.

These cues exist within the environment, the sighting and visual search system and within the shooter themselves. The timing of the shot, and therefore shooting rhythm, is regulated with the perceptual and proprioceptive skills which are based largely on the interpretive value of information gained by the shooter. Research identifies, to some degree, that the shift from visual, to self talk, to training for trust are important elements of performance. Furthermore, the ability to move from relatively broad to appropriately focussed is a skill which takes years to master.

The ability to provide training tasks that allow individuals to experiment with various perceptual attributes is a focussed area of attention and includes looking at stability, feedback, practice structure, practice distribution, think aloud procedures and slow-motion practice.

Emotional and Psychological Regulation

Psychological skills and the ability to monitor and exert some control over emotion are key elements to successful shooting. Outwith the obvious emotions associated with competing in high level competitions, individuals have to compete with the constant feedback received while they strive to constantly score 10's. Dropping points in major competitions can be serious disruptors to an individuals shooting rhythm, and indeed the inability to cope is a major hurdle. This ability to regulate emotions is magnified in the finals when decimal scoring is adopted and single shots affect the outcome of years of individual, family,

coach and team commitment and dedication.

The psychological skills such as goal-setting, motivation, concentration, confidence building, performance routines are crucial not only on the shooting range, but more importantly with the individual's ability to train at a suitable intensity and volume. These skills should then be immersed in an individual's psyche and benefit in the 'competitive arena'. However, it should be noted that many psychological regulating skills morph within the arena alone, and so 'exposure' to competitive stressors should also be promoted, monitored, evaluated and controlled.

All the individuals have various strengths and weaknesses. While shared needs for psychological skills can be taught in educational slots within the training programme. However, the majority of psychological skills training requires individual attention.

.22 Small-Bore and Air Rifle Shooting Team

The team has ten members in the senior squad, and five members in the junior squad. The present focus for all is on the 2006 Melbourne Commonwealth Games, with the appropriate milestones of qualification and team selection dispersed through the two years. The team has not won a gold medal since 1994, and this therefore is the number one objective.

As one of four disciplines in the STSF, the small bore and air rifle team appear well organised, structured with coherent goals and objectives. The team performance co-ordination is managed by Shirley MacIntosh, with Robert Nibbs and Donald MacIntosh co-fronting the coaching role. Furthermore, Donald has been recently appointed as 'shooting team manager', which gives increased responsibility. It is important to recognise the team is in a period of transition and reconstruction, with new processes, strategies and techniques being introduced to the group.

The ability of the individuals, coaching staff, team, and organisation to develop will be the principle of effective performance. The production a gold winning performance requires the integration and synergy of all these elements as identified in Figure 1. As such communication will be a key element to coaching and performance success. The ability to motivate and re-focus training action points between squad training and competitive events is a key nature of management control.

This is not taking responsibility from the shooters themselves as a key characteristic of excellence is indeed the ability to self regulate basic activities of management to a certain degree. However, along with work and family constraints, paper chasing has been offered as a large area of time loss for key individuals, and as such requires greater support.

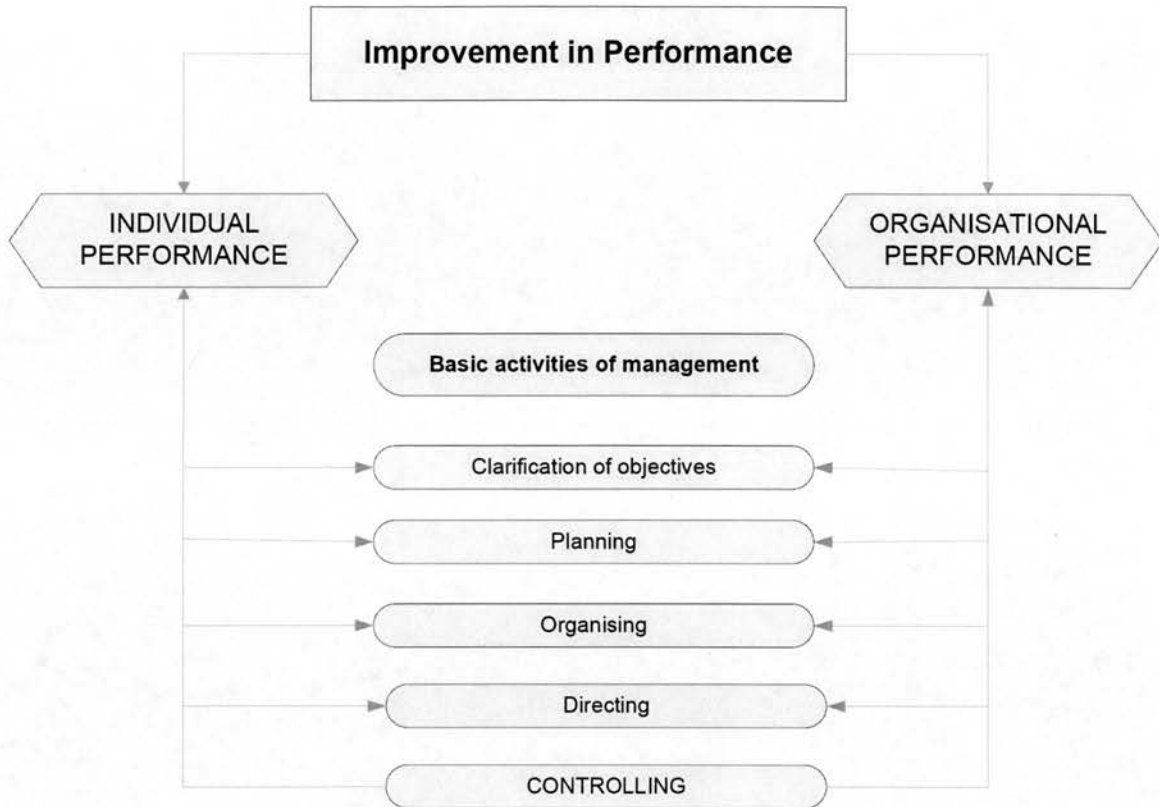


Figure 1. The nature of management control

It is positive how the management recognise an effective performance control system is required, especially in relation to fair team selection. While this will be governed and constrained by the Commonwealth committee and STSF, a translucent process which is controlled via appropriate adoption of planning objectives and targets, establishment of performance standards and appropriate monitoring of actual performance is required. As such this process must be:

- understood by all athletes
- conform with structure of the organisations involved in selection process
- deviations from initial set protocol has to be communicated
- drawing of attention to critical activities which are important to organisation
- flexible
- consistent with long term aims and objectives
- be subject to continual review

Management and Team Control

The shooting squad is not only a system of hierarchical structure, but also a system of social relationships, status and power. Power is a complex and dynamic concept and difficult to define. At a broad level, power can be interpreted in terms of control or influence over the behaviour of other people with or without their consent.

The three main forms of control identified in the squad have been:

- Direct control
- Control through standardisation
- Control through influencing the way people think what they should do

The balance between control and autonomy within the group has been effective to date. However, the ability of the shooting team to ensure it maintains its control of its own destiny has to be addressed. Political power has been positioned against the group, to which it must defend against, and indeed be ready to counter. Fortunately, the strong professional culture of the group has afforded the successful ability to do so to date. A promotional campaign with local MP's and councillors to show the dedication required to master this art is maybe a suitable strategy, especially as 'wind of the 2014 Commonwealth Games' begins to arise.

Resistance to control systems has to be acknowledged within this section. While the 'shooting performance team' recognise the importance of an integrated shooting expertise model incorporating physical, technical, cognitive and psychological regulation, this has been resisted within many of the group. Overcoming this 'culture' has to be conducted by understanding:

- Consultation and participation
- Motivation
- Groups and informal organisation
- Organisation structure
- Leadership style and systems of management.

What will be therefore of note is how the performance management team can increase the volume and intensity of competition and practice to the high levels of consistency required to fulfil organisation and team goals.

Organisational Development

In order to bring about effective change, organisational development makes use of a number of approaches – often referred as intervention strategies for organisational culture, climate, commitment, conflict and change. Areas of concern to the shooting organisation include:

- Motivational awareness
- Basic underlying assumptions of performance needs
- Power structures
- Symbolism
- Long term goals
- Shooter commitment
- Lifestyle awareness
- Media training

Change is originating from both within the group, such as changes in coaching and team management staff, and from external sources such as new rules on miscellaneous equipment that can and can't be worn. Integrated with this is the constant flux in performance and development of every individual within the team which occurs on a day to day basis. Utilising research in 'change management' is a

means for coaches and team managers to maintain control of change and ensure the team remains stabilised (yes, only to a degree Donald). Indeed, I am sure there are many changes which the organisational and team management hope to implement at a cultural level.

As team manager, there are seven skills involved in managing change (Crainer, 1998).

- Managing conflict
- Interpersonal skills
- Project management skills
- Leadership and flexibility
- Managing processes
- Managing strategy
- Managing their own development

Donald will have to learn rapidly the skill in managing 'overworked, overstressed, delicate' individuals who need to understand what gaining expertise involves. Contingency training with the seven skills as a frame-work may be an appropriate learning mechanism to simulate future demands. No, I don't think professional skills has got you fully prepared!!

I am very impressed with how discussion groups and training weekends have been conducted and progresses. However, a 'shadow side' in communications is quite easily identified within the group whose cause and emergence is not appropriate for me to discuss. This has to be capped to the same level of competence to date. Selection period however is going to be a delicate period, where Donald's role is to ensure that all needs, protocol, expectations and levels of required competence are fully informed well before the period. It would be appropriate that this is translated to all individual in the 6month goal records and suitably discussed.

A word of warning should be made apparent at present. Commonwealth results of the past are no great indicator of the Melbourne medal winning scores. Shooting is a non-linear performance sport where results vary dramatically, and some developing nations identify shooting as a discipline where medals can be picked up relatively easily. Therefore, increase the 'expectation levels' for selection for several reasons:

1. The expectation that 'average' scores could bring them results is a dangerous mind-set to culture. The individuals have to understand that training optimally from here in however will give them a strong opportunity for success. Can we access Commonwealth national shooting event results?
2. Having higher 'goals' and 'expectations', if achievable, are strong motivational mechanisms which will allow individuals to recognise that Melbourne begins now. Use expectations to ensure stagnation does not develop.
3. Development squad – aim for 'world class' and do not allow this 'Commonwealth' ceiling effect materialise. All talk and expectations are to 'world standards'. Do you think they have the potential?
4. Higher expectation levels will allow 'grievances' at selection period to be easily managed as they were fully informed throughout period of required standards. There seems an ability of individuals to remember scores of years gone by and imprint them as that of their 'performance level'. We require to put there performance level to which they will be getting selected in front of them now.
5. Performance charts- get them processed now. This can be conducted within the individual assessments I am formulating based on various performance sources. That

way we can show individuals where they are, how they are progressing, why they should select certain events, enhance communication, increase self-responsibility, and most importantly- increase motivation to get training.

6. The 'gut' feeling that performance levels are ready to make a non-linear upward transition.

The management has a responsibility for the underlying philosophy and attitudes of the organisation, for creating and sustaining a healthy climate, and establishing appropriate and supportive organisational processes. This is nested within the understanding that the individuals bear greatest responsibility of their own destiny (yes, we're back to the yellow brick road). Action points which may be appropriate however include:

- Weekly individual discussions with all individuals to ensure goals and training action points are being discussed. This will also serve as a mechanism for filling in training diaries, and managing change. Communication in the performance environment has to focus on quality feedback and recognise and communicate success for motivational and 'up-ing the stakes' needs.
- Computer based periodisation and planning program.
- 'Melbourne' planning link (based on the bobsleigh program Donald?) to get the long term goal set.
- This can be adapted for various 'international' shooting ranges for the development team (and to be sold on to the UK?)
- Team building weekends – also to give a 'physiology shift'. These should occur at every stage of the long term plan. (6 monthly blocks?).

The conclusion of this section alludes to ensure that the team management have an ideal opportunity to ensure they 'lead change', by the standards, processes, conduct, communication skills and behaviour that they emit at present. These will be easily identifiable in the team manager and coaches working tools. I.e. planning forms, feedback sheets, regular communication, etc.

Recommendations

Whilst there are a number of ways in which to proceed and implement performance psychology at an organisational level, I believe that my role should be to bring awareness, and not manage and monitor organisational and team change as a formality.

I have identified what I believe are various recommendations associated with the group performance at present. There is a great opportunity for change, and also the team manager and coaches to create a new culture within the development squad.

<p>Technical Training</p>	<ul style="list-style-type: none"> • Strong coaching area where Donald and Robert's strengths marry very well. • Liaise with alternative coaches or training teams (Euro). • Research emphasis has to be increased in applied areas. • Brainstorm of appropriate applied research topics between Shirley, Donald, Robert and team representatives.
<p>Physical Training</p>	<ul style="list-style-type: none"> • 'Team' weak area which requires culture shift. Too many injuries, aches and pains which can be alleviated with suitable programs. • Adopt 'enhancing physical exercise' program. • Increase strength and conditioning programs. • Establish stability research as a vehicle for change. • Establish physiotherapy as a vehicle for change. • Increased monitoring. • Scheduled into goal setting, planning & training camps.
<p>Cognitive Training</p>	<ul style="list-style-type: none"> • This should collate with the research emphasis on rhythm and stability of performance. • Construction of 'performance routine' profile. • Macro level – planning focus. • Micro level- performance routine focus. • Donald's research and supplementary research with availability of tools (EEG, kinematic analysis, etc.)
<p>Psychological Training</p>	<ul style="list-style-type: none"> • Main priority of 'individual support'. • Education classes on all training weekends. • Concentration skills is primary topic (feedback demand) • Individual consultations.

Integrated Training	<ul style="list-style-type: none"> • Coach empowerment adopted • Periodised and holistic planning. • Competition report form constructed • Training report form constructed • Medium & long term report form.
Planning	<ul style="list-style-type: none"> • Computer based periodisation and planning program. Framework from Donald's existing work. • Access to UK or Scottish planning materials. • Weekly contact with individuals. Team manager/ coach responsibility to conduct log. • Long term shift back to individual responsibility. • Competition assessment form. • Training assessment form. • Medium and Long term assessment form. • Commonwealth opposition and Melbourne analysis.
Organisational Development	<ul style="list-style-type: none"> • Implement Donald and Robert ideas ASAP (window of opportunity). • Motivational awareness of management, and controlled via planning and coaching mechanisms and processes. • Group awareness of performance needs conducted via performance profiles. • Shooter commitment supported at all periods. • Symbolism- team construct logo. • Long term goals integrated within all individual long term plans. • Media training (in house or institute?). • Lifestyle awareness.
Communications	<ul style="list-style-type: none"> • Web page with templates and team information available and up-dated. • Increase to weekly contact. • Feedback forms for planning, support, coaching and event organisation utilised. • Log book and diaries central to contacts.
Evaluation	<ul style="list-style-type: none"> • Monthly and 3 monthly reviews of 'organisational goals'. • Action points to be conducted for each meet. • E.g. web page, planning program, contingency training etc.

Summary

The report carries the function of:

- Creating good practice at an organisational level.
- Creating an environment where individuals have greatest potential to develop.
- Ensuring the psychologist has strong awareness of the discipline and organisational needs, and ensuring these are reflected within individual support.
- Promotion of 'coach empowerment'.
- Documentation of psychologist aims.
- Opportunity for change.

The recommendations outlined above represent the areas I think would be most beneficial for us to focus on at this stage. I would like to instigate meetings between Donald and myself with his 'team manager' hat, and meetings with Donald and Robert with their 'coach' hats on when appropriate. There will be many aspects that we need to discuss and adapt, but I believe this is the perfect period to implement change within the team as a whole. Momentum is gathering within the full time and development squads as awareness of selection is prominent.

As the new partnership with Donald and Robert begins within their coaching and management roles, this is also the ideal time to introduce procedures that are most effective in increasing the speed with which the whole team as collective individuals develop.

Regards

Stewart

This report has been compiled as part of the Sport Science Support provided by the University of Edinburgh.

APPENDIX 9.

EVALUATION OF WEEKEND EFFECTIVENESS

The offered form is an exemplar of the weekend and training camp effectiveness forms utilized in the two year program.

University of Edinburgh
Department of Physical Education Sport and Leisure Studies

(i) Shooting Weekend Effectiveness

Name : Date:/...../.....

Shooting Event : Coach.....

Experience (Competition) :

Peak Performance :

Present Goal :

NB. It is essential that you respond to each statement truthfully. Failure to do so will invalidate your responses and thereby render useless any course of action that may be suggested to help you. Read each statement carefully before circling the number that most accurately describes your feelings or reactions.

The numbers correspond to the following statements:

- 1. Excellent
- 2. Very Good
- 3. Good
- 4. Fair
- 5. Poor
- (b) 6. *Very Poor*

1. The weekend as a whole was
1 2 3 4 5 6

2. Clarity of weekend objective was
1 2 3 4 5 6

3. Amount you learned on the weekend (Action Points)
1 2 3 4 5 6

4. Relevance and usefulness of weekend content was
1 2 3 4 5 6

5. Interest level in the weekend was
1 2 3 4 5 6

6. Conduciveness of weekend atmosphere to learning was
1 2 3 4 5 6

7. Value for shooters who will attending future weekend training
1 2 3 4 5 6

8. Weekend organisation was
1 2 3 4 5 6

9. Explanations, discussions and support by coaches was
1 2 3 4 5 6

10. Quality of coaching input was
1 2 3 4 5 6

11. Coaches enthusiasm was
1 2 3 4 5 6

12. Coaches ability to address your questions/problems/needs were
1 2 3 4 5 6

13. Encouragement given to shooters to express themselves were
1 2 3 4 5 6

14. Your degree of motivation to apply what you learned on the training weekend

1 2 3 4 5 6

15. Expected value of training weekend for improving your shooting

1 2 3 4 5 6

16. Anticipated effect that the positive approach will have on your competition performance

1 2 3 4 5 6

a) To Provide Specific Evaluation, Rate Value of Each Component

17. Introduction and Administration

1 2 3 4 5 6

18. Performance Profiling

1 2 3 4 5 6

19. Free Training

1 2 3 4 5 6

20. Finals

1 2 3 4 5 6

21. Planning Workshop

1 2 3 4 5 6

22. Air Rifle Match (Competition Simulation)

1 2 3 4 5 6

23. Air Rifle Biathlon

1 2 3 4 5 6

24. Noptel System

1 2 3 4 5 6

25. SCATT System

1 2 3 4 5 6

26. Video and Digital Analysis

1 2 3 4 5 6

Could you provide any further comments on the weekend (overall and specific)

Thank you for taking the time to fill in this training evaluation.

Stewart Ollis
University of Edinburgh
January 2004

APPENDIX 10.

COACH AND TRAINING EVALUATION FORMS PERFORMANCE PSYCHOLOGY: COACHING EXCELLENCE

Name: _____

Date: _____

Criteria	Action Points
To plan and publish the programme in advance of each training session.	•
To start and end on time.	•
To keep shooters busy the whole time.	•
To include variety.	•
To include behaviours required in competition.	•
To involve each athlete in goal setting.	•
To generate 'appropriate' feedback to each and every individual.	•
To evaluate each training session as soon afterwards as possible.	•
To promote competition between friends.	•
To create a positive learning environment.	•
To increase self-awareness.	•

Adapted from 'Towards excellent coaching sessions'. Richard Cox (2000).

PERFORMANCE PSYCHOLOGY: INTERVENTION CRITERIA

Name: _____

Date: _____

ACTION POINT 1. _____

Criteria	Phys.	Tech.	Cog.	Psyc.	Int.	Plan	Comp	Comms	Date

ACTION POINT 2. _____

Criteria	Phys.	Tech.	Cog.	Psyc.	Int.	Plan	Comp	Comms	Date

INSTRUCTIONAL ISSUES



Practitioners Name: Stewart Ollis
Client Name: _____
Date: _____

Learning Experience Design Checklist

- The main aim of the checklist is to decide what types of assistance required prior to devising your own instructional strategy.
 - The diagnosis adopts a situational learning approach where the understanding of the individual, task and environment constraints are supported.
 - Adapted from Schmidt & Wrisberg (2000).
-

Practice Preparation

- Goal setting
 - a. outcome
 - b. performance
 - c. process
- Stage of learning
- Transfer of learning
- Target skills
- Target behaviour

- Target context
- Performance measures
 - a. outcome
 - b. process

Practice Structure

- Schema development
 - a. constant practice
 - b. varied practice
- Facilitating transfer
 - a. blocked practice
 - b. random practice
 - c. consistent and varied S-mapping

Practice Presentation

- Clarifying expectations
- Managing arousal
- Focussing attention
- Instructions
- Demonstrations
- Guidance

Physical rehearsal

- a. simulators
- b. part practice
- c. slow-motion practice
- d. error detection practice

Mental rehearsal

- a. procedures
- b. imagery

Practice Feedback

Intrinsic Feedback

Extrinsic feedback

Instructional decisions

Types of feedback

- a. program/ parameter
- b. visual/ verbal/ manual
- c. descriptive/ prescriptive

Amount of feedback

- a. average feedback
- b. summary feedback

Precision of feedback

Frequency of feedback

INSTRUCTIONAL ISSUES



Practitioners Name: Stewart Ollis
Client Name: _____
Date: _____

Learning Experience Diagnosis Checklist

- The main aim of the checklist is to diagnose the learning experience variables prior to devising your own instructional strategy.
 - The diagnosis adopts a situational learning approach where the analysis of the individual, task and environment are required.
 - Adapted from Schmidt & Wrisberg (2000).
-

Individual

- Age
- Previous experience
- Motivation
- Stage of Learning
- Abilities
- Attention
- Arousal

- Memory
- Information-processing capability

Goal(s) of Learning

- Program learning
- Parameter learning
- Error detection and correction
- Skill refinement
- Generalization

Task Characteristics

- Discrete/ Serial/ Continuous
- Motor/ Cognitive
- Closed/ Open
- Closed-loop control
 - a. Exteroceptive feedback
 - b. Proprioceptive feedback
- Open-loop control
 - c. Motor programs
 - d. Generalised mot programs
- Speed-accuracy trade-offs
 - a. Spatial accuracy
 - b. Temporal accuracy

- Object manipulation
- Information-processing demands
 - a. Stimulus identification
 - b. Response selection
 - c. Response programming
- Risk of injury

Target Context

- Recreational
- Competitive (athletic)
- Clinical
- Home
- Social Evaluation

APPENDIX 11.

TRAINING SESSION

Name:		Sheena Sharp	Prepared By:	Donald McIntosh	Date:	21 Nov 2003
Goals for this period:						
<ol style="list-style-type: none"> 1. Break in Monard jacket and establish position with it. 2. Develop zero point so eight-ring hold possible. 3. Improve quality of hold to 100% in 10.5 (SCATT Trace) 						
Competition Plan:						
None this period.						
Periodisation Plan (based on three session per week):						
All sessions, whether live or dry, should begin with 20 warm-up shots. These are a prequel to the exercises below. Every time you get down into the position the zero point must be carefully checked and adjusted.						
Session	Dry/Live	Number of Shots	Exercises	Goal		
1	D	20	Take aim, close eyes for five seconds, relax (no breathing), release shot.	10 shots inside 10 ring.		
		20	Take aim, close eyes, take two breaths, release shot.	20 shots inside 6 ring, 10 shots inside 8 ring.		
2	D	20 (each position)	Manipulate Sling Rotation so pulling from inside, centre and outside of arm.	Check quality of hold – identify optimum position.		
		20 (each position)	Manipulate Sling Height from highest possible down three notches on sling keeper.	Check quality of hold – identify optimum position.		
3	L	2x15	Take aim, close eyes for five seconds, relax (no breathing), release shot.	15 shots inside 10 ring.		
		4x20	10 shot groups, 20 shots at a time (i.e. without breaking position)	All groups of quality to be 99 – 100 if centred.		
4	D	20	Take aim, close eyes for five seconds, relax (no breathing), release shot.	13 shots inside 10 ring.		
		2x15	Take aim, close eyes, take two breaths, with attention completely on relaxing shoulders and left arm. Release shot.	15 shots with quality of hold equivalent 100% in 10.5 for last second		
		20 (each variation)	Manipulate length of butt slightly (max +/- 2cm)	Check quality of hold – identify optimum position.		
5	D	20 (each variation)	Manipulate strength of hold of pistol grip.	Check quality of hold – identify optimum strength.		
		20	Take aim, close eyes, take two breaths, release shot.	15 shots inside 7 ring, 8 shots inside 9 ring.		
6	L	2x20	Take aim, close eyes for five seconds, relax (no breathing), release shot.	25 shots inside 10 ring, remainder in 9 ring.		
		3x30	15 shot groups, 30 shots at a time	All groups of quality to be 148 – 150 if centred.		

APPENDIX 12.

SCATT TRACE

www.scatt.com

APPENDIX 13.

SELF-REGULATION PROGRAM

The self-regulation program was, as a constructivist program, constructed in collaboration. A more empirical and booklet form of the self-regulation program was to be constructed, but time and financial constraints denied this capability.

However, the present self-regulation afforded a foundation from which to initiate the self-regulation program conducted over the eight month period.



Commonwealth Games 2006

TRAINING MANUAL

INTRODUCTION

The purpose of this manual is to provide you with some guidance and support in planning, executing and reviewing your training over the next few months. It is primarily targeted at those selected for the 2006 Commonwealth Games, but the principles on which it is built are just as valid for the remaining squad members, albeit that the annual framework of training and competition will be considerably different.

This manual is by no means exhaustive – it will attempt to address all of the most significant components of a sensible training plan, but the differences that make you all distinct individuals mean that it is not possible to cover every single item that might be included in such a plan. It is intended to provide you with a reference that can be used to help in constructing your plan, and to help you decide what you should be doing and when you should be doing it. It cannot be a substitute for objective input from members of your support team, and should be used in conjunction with those other sources of information. The support team will assess how your training is progressing at various stages, and will intervene as much or as little as is deemed necessary based on those assessments. Obviously plans have to be flexible, and there is little point in planning too far ahead in great detail, but there is hopefully agreement that there is benefit in at least doing some outline planning for the medium term and more detailed planning for the short term.

Training camps obviously have a part to play in the training programme, and they will continue to consist of structured activities. However, the focus of attention at these camps will turn from the largely technical orientation of the last year to a more performance-orientated programme. This places a greater onus on you, the shooter, to make best use of your time to do the underlying training between the camps – on your own, with your teammates, and with the support team when available. It is certainly my intention to spend time on the range with every one of the CG team on a weekly basis, or as close to this objective as is practicable. Over the last 18 months or so we have discussed the issues surrounding planning and reporting in some detail, but unfortunately there remains little commitment – with one or two exceptions – to this essential aspect of your training.

Regular contact can mitigate the damage that this does, but it cannot solve the problem completely, so included in this manual is a very simple reporting structure which I would ask you all to adhere to.

We are obviously entering the Autumn and Winter months, and will be in Melbourne long before the sun returns to Scotland in earnest, and the weekly grind of training can become wearing over time, so it is essential to keep your objectives firmly in mind – all the hard work will be well worthwhile once you are standing on that podium with a medal around your neck!

EQUIPMENT

Hopefully you have all got the equipment you intend to use at the Commonwealth Games and/or next summer either already in place, or at least on order. If not, please get it done NOW! Certainly those going to Melbourne need to be training with the equipment that they are going to be taking with them as soon as possible – particularly items such as jackets, trousers, boots and kneeling rolls that have a significant impact on your positions.

If anyone has any concerns with their vision, please get it addressed as soon as possible – contact us if you need any support with this.

If your rifle is in any way suspect, please deal with it now. Getting barrels replaced, or new barrels & actions ordered up can take some time. Getting used to new stocks can take even longer, so if you are going to make any changes please do it now.

The only exception to this is ammunition. We are working on a solution for testing air rifles, perhaps making use of a test rig at Aldersley, and will pass on more information as soon as it becomes available. Smallbore ammunition is perhaps easier to deal with – particularly those who are going to be using Eley. Most of you will already have selected ammunition, however experience shows us that the EPS Tenex tends to “go off” within a few months, so I would recommend that you all get booked into Eley sometime in early February. This will give them time to deliver the ammunition to your local dealer, but will ensure that it is reasonably fresh. When you have a date booked with Bert, please let me know what it is.

OBJECTIVES

Before you can work out any details of what training you are going to do, you need to work out what your objectives for the forthcoming months are. This might just be through to the Commonwealth Games, perhaps through the rest of the spring and summer including the domestic smallbore season, perhaps you aspire to the World Championships, or perhaps you are looking beyond that to the 2008 or even 2012 Olympic Games? The current uncertainty about what is happening with the British squad, and the implications that this has on selections for World Cups etc certainly doesn't help some of you, but we just have to proceed as best we can for the moment.

As before, ideally you should be looking to peak at one or two matches next year. The Commonwealth Games is obviously top priority for those selected, but if you can see clearly beyond that then it is perhaps worthwhile trying to plan at least an annual programme – certainly if you are hoping to go to Zagreb for the World Championships in July. Don't worry if you don't want to plan beyond next March – this process can easily be repeated once you have recovered from that!

We have discussed before the various types of goals. The relevant ones when looking at medium term goals are normally:

- Outcome – in other words, where you want to be placed in relation to other people – this could be winning a medal at the Commonwealth Games, it could be winning a Quota Place for the Olympic Games, it could be getting selected for the World Championships and so on. In shooting you have no direct control over this, as you cannot influence what your competitors are going to do, but you can make an educated guess as to where you stand in relation to the remainder of the field, and it is often these kinds of goals that drive us on.
- Performance – in other words the score(s) you want to produce. Again, this is something you don't have total control over as environmental factors can have a considerable impact, particularly on smallbore events. However, it is normally safe to assume that you will encounter sufficiently good conditions during a competitive season, so setting an objective of increasing your personal best to at least a certain level in a given time period is not unreasonable.

Use the box below to write down your main objectives for either the next 6 or 12 months:

Performance or Outcome	Objective/Goal

PHYSICAL TRAINING

Hopefully most of you are on top of your physical training, and Sue has been keeping an eye on all of you over recent months. While you might think you are fit enough already, I'm sure you can all improve, and it will help your shooting. The better conditioned you are, the better able you are to cope with a heavy training load, and the better able you are to cope successfully with the stresses and strains of a major event like the Commonwealth Games.

Aerobic Training

Obviously the sport doesn't really require any aerobic conditioning, but general living does, and the greater your aerobic fitness the more likely you are to cope with physical reactions to stressful environment. Aerobic training can take any form you like – simple activities like running, swimming, cycling or using the machines in the gym are fine. More complex activities that require some degree of hand-eye coordination – like playing a racquet sport – are also a good option.

The important bit is to ensure that you keep your heart rate in an appropriate training range for your age, and for long enough for it to do you some good. Your maximum heart rate can be approximated by deducting your age from 220. You should then be aiming to train at 70 – 80% of this for at least 30 minutes, three times a week. So, for example, if you are 30 then your theoretical maximum is 190. 70% of 190 is 133, 80% is 152, so you should be aiming keep your heart rate in between those two values. This is a very basic approach, and a real minimum for healthy living, and you can of course make this more complicated if you want but it is a starting place.

Any serious work you need to do on your aerobic fitness should have been started at the end of the summer season, and should ideally be finished by the end of the year.

Core Stability

Anyone who doesn't know about this hasn't been listening to Sue! I imagine that all have some kind of core stability programme, and if not then please speak to Sue at the next session. This is a basic requirement for all the shooting positions – the shoulders for prone, along with the back and abdominals for standing and kneeling. If you don't have this in place then your positions are likely to be less stable than they could be, which means your hold won't be as good as it could be. For standing shooters in particular, you are increasing the risk of injury and longer-term damage.

Flexibility

Again, if you don't know about this then please speak to Sue. This is basic conditioning, and a requirement for the sport. If are not flexible enough then your positions may have to be compromised, and your risk of injury is higher.

Balance

A key element of all positions, but particularly the standing discipline. Some of this will come from sport specific training, but I'm sure every one of the 3P and Air Rifle shooters would benefit from some basic balance training. This is something that would be best scheduled for the remainder of this year, dropping out of your programme after the Christmas break. I have a basic balance training programme that Sue prepared for us some months ago, if anyone needs a copy please let me know.

Strength

Always a contentious topic in shooting! The chances are, an appropriate strength training programme would make a difference, but it is a bigger commitment than the other forms of physical training, and getting you the right input is probably difficult. If anyone would like to do something about this, or Sue feels that you would benefit substantially, then we will see if we can get some support in this area. Any work done here really needs to be done before Christmas, dropping into maintenance mode after that.

SPORT-SPECIFIC TRAINING

General fitness training is important, but sport-specific training is the meat of your training programme – without good skills it won't matter how physically fit or mentally tough you are. You all have good technical skills, but there aren't any European, World or Olympic Champions in the squad (yet), so I guess there is scope for improvement!

Training Sessions

Quality and quantity are, as with most things, crucial. Quantity on its own will not suffice – your training sessions need to be well planned and structured in order to provide the quality that is required to make progress. But, you cannot have quality without quantity. Shooting once or twice a week isn't going give you much chance to improve your skills. If you want to make technical progress then ideally you will be doing anything from three or four up to eight or ten technical sessions per week.

Technical sessions are probably best if they are about two to three hours long. In that time you can realistically work on one position, perhaps including a 30 minute session in a second position if you want. If you are training for 3P then it would make sense to roll through the positions in this sort of fashion, so the first session in a cycle would be primarily prone, with a little standing at the end, the second session would be primarily standing with a little kneeling and the third session would be primarily kneeling with a little prone. If you need to add air rifle into the equation, then treat it as a fourth position, perhaps after the kneeling, and then return to prone.

If you are going to do more than one session in a day, then you need to make sure that you leave a sufficient gap between sessions to allow some physical and mental recovery time – there is no point putting in six consecutive hours if you are too tired by the end of it to learn anything. In training camps we've used both the Finnish model of two three hour sessions with a two hour break between them, and our own variant of three two hour sessions with an hour between each one, and both seem to work. Bear in mind though, the two or three hours of a session does not include setup, changeover or packup time, so a one hour break disappears pretty quickly when you are changing position.

So, given this outline structure, one approach would be to work out approximately what training you are going to be able to do in between training camps. Don't try to plan too far ahead, work just to the next camp (Scottish, not British). Firstly work out when you can fit sessions in given the other constraints in your life (work, university, family, friends, shit happening, etc etc), and then plan which position(s) to work on at which time. Take into account when the competitions are also, so you can manipulate the schedule for the more important ones – for example you might want to add some additional air rifle sessions before one of the bigger championships.

(c) Training Load

There are many ways to manipulate the training load, and what works for the person next to you may not be what suits you best. Options include:

1. Maintaining a steady load over time.
2. Starting from a relatively low base, progressively increasing the training load up to the major competitions.
3. Starting from a relatively high base, progressively reducing the training load in the lead up to major competitions
4. Combining (2) and (3) above, so that the training load increases towards the major competition of the year, but is then tapered down in the period immediately before the competition.

It may be worth experimenting with different approaches over the next few months, using your performance at training camps as a measure of which proves to be the more effective for you. This should allow us to optimise your preparation in the last few weeks before the Games proper.

(d) Rest Periods

For a group of shooters who – in general – probably don't do enough training, the resistance to rest periods is quite amazing! Rest periods are essential in any properly periodised training programme, to give your body and mind time to recover and adapt following a concentrated period of work. As a guideline, I suggest that everyone has a break from shooting for a few days at least after every training camp, perhaps getting back into training over the following weekend. This should be a complete break from shooting, and does not mean that you should go shooting postal league cards instead! By all means continue to do some physical work, but preferably keep it reasonably light. All the spare time that this gives you is now available for planning your next few weeks training!

Analysing Your Shooting

OK, so you have an idea of how much training you will be able to do and when you will be able to do it. But, and this is the biggest question for most shooters, what should I be doing. Shooting loads of simulated matches? Firing lots of ammunition? Doing lots of dry firing? Well, that really depends on where your shooting is at. And to determine that you need to do some analysis. I realise most of you do some implicit analysis in your head as you go along, but I would like to make a case for a more considered and analytical approach.

If no structured, or at least semi-structured analysis of your shooting takes place then how do you know that all the training you are doing is going to be of any benefit? Are you dealing with the areas where you have the most to gain? Are you doing enough to maintain the bits that are working? What things have you tried to ignore because dealing with them is too hard? If you don't invest at least a little time on this analysis then there is a much higher risk that you won't reach your potential.

So, how do you go about analysing your shooting? You have various sources of information available to you, for example you can get hard data from:

- SCATT or Noptel
- Scores in competitions and training matches

That's not the whole picture though. You can also make subjective assessments about your own shooting, and you can receive feedback from your support team. None of these will give you the full picture on their own, you really need to draw an all of these sources, and perhaps others, to get a more complete picture.

(e) Doing the Analysis

You should already be aware of how to use Performance Profiling – although we really didn't make very good use of it. If that's an approach you would like to use then feel free. If you can't remember, or missed the session, then please speak to me about it.

In order to help you to do this, a couple of simple forms, one for training analysis and one for competition analysis have been created. You can find copies at the back of this document. These are quite simple, and you can write as much or little as you like. Hopefully they are relatively self-explanatory, but here's a quick summary just for future reference:

- Name – that's your name! Added so that when I get a copy, I know who you are!
- Date(s) – the range of dates covered by this sheet.
- Position(s) – which position or positions did you train in.
- No. of Sessions – how many training sessions this covers.
- Objective(s) – what your goals for the match(es) were.
- Your Score(s) – what you scores in the matches. Please provide ten-shot breakdowns, plus a final where appropriate.

- Technical – you should identify any areas of technique where you feel things require worked on, and any areas that you felt went well. This might include aspects of:
 - Outer Position
 - Inner Position
 - Hold
 - Aim
 - Zero Point
 - Trigger
 - Recoil

How consistent were you with these things?

- Decision Making – you should consider how well you made decisions on when to shoot. Things to consider might include:
 - Environmental Factors (wind, mirage, light)
 - Starting the Match
 - Taking Breaks
 - Shot Anticipation (was it going to be a good shot)
 - Shot Routine (where your attention on the right things)

- Tactics – while Decision Making is to do with “in the moment” decisions, tactics is more about your approach to the match/session as a whole. Again, consider the things that went well, and the areas where there is scope for improvement. Things to consider might be:
 - Pre-competition preparation (24 hours prior to start?)
 - Use of Preparation Time
 - Use of Sighting Time
 - Planned Breaks
 - Shooting Rhythm
 - Planned approach to environmental factors

- Emotional – how well did you manage yourself in the match/training situation. Things to consider might be:
 - Arousal level – too low; too high; just right
 - The start of the match
 - The end of the match

- The reaction to unsatisfactory shot(s)
- Physical – how did you feel physically before, during and after the match/session.
 - Did anything hurt?
 - Were you particularly fatigued? Anywhere in particular?
 - Were you experiencing muscle tremor anywhere?
- Action Points – you can only progress by training the trainables. By identifying three main action points, you can focus attention on developing the key aspects of your shooting that will bring the greatest improvements. By having only three main action points, it is easy to both remember and manage. Having more action points would leave you with too much to focus on. Therefore, from the previous identified sections, what are the three main areas that can improve your ability? These may stem from either the “to work on” (negative points) or the “good” (positive points), since as well as developing your weaknesses, it might be just as advantageous to focus on the positives in order to really excel in that area. Remember to make these action points specific and measurable. It should also be possible to re-evaluate them so that they are progressive.

In terms of making use of the Training Assessment form, the frequency is up to you. At one extreme, you could use the training assessment form as a diary page and try to complete one for every session, or every day. At the other extreme (assuming you use the form at all) you could complete one once a year and plan all of your training on the basis of that. Hopefully the latter is clearly not sensible! Given that initial reaction to this is no doubt going to be “more damned paperwork”, I suggest that you complete one as part of each Scottish training camp, covering the training sessions since the last one, using as many of the sources of information discussed previously as you can.

If you feel that you would rather complete it for each training session or day, then that is wonderful. However, there is a risk that by focussing on only one session at a time you become too narrowly focussed and miss the big picture. There is a solution to that, which requires a little more work, so if anyone would like to pursue that then please speak to me individually.

Hopefully it makes more sense to complete the Match Assessment form for each competition, or at least each group of competitions, that you go to (e.g. if you shoot 3P and Prone in the same weekend, the only complete one form).

(f) Change and Stabilisation

OK, so from here you have identified areas that require attention, and also areas that are going well. Or, phrasing it slightly differently, you have aspects of your shooting that require change in order to come up to a level you are happy with, and other aspects where you require to stabilise the existing level of performance in order to make sure these don't deteriorate while you are working on the changes.

Another couple of simple forms have been created to help you with this process – the Change Plan and Stabilisation Plan worksheets. Again, these have been kept very simple – the boxes should all be self-explanatory. It may be appropriate to work through these with a

member of the support team.

(g) Constructing a Session

So, hopefully by now you have a wonderful plan in place, with sessions scheduled between now and the next training camp, and a list of things you want to change and another list of things you want to stabilise. But, how do you construct a session? Well, turning once more the Finnish model, a training session could consist of the following steps:

1. Preparation
 - Light Physical Warm-up
 - Short Relaxation
 - Focus on the objectives
2. Easy Skills
 - Gentle introduction to techniques – hold, balance, dry fire, white target, etc.
3. Training a Technical Component
 - Trigger Control, Aiming Time, etc
 - Concentrate on one aspect at a time
4. Competition Simulation
 - Training Match, Competition Exercises, etc.
5. Analysis

Hopefully you all have physical and mental warm-ups sorted out – if not, then we can run a session on this at the next team camp.

The sort of drills that you use for steps 2, 3 & 4 should be familiar to you all by now. The emphasis between these phases will vary depending on what you are trying to achieve – but there it is likely that there will always be at least a short drill at each phase.

I've pulled all of the drills we have used so far, along with some new ones, into a spreadsheet. Rather than print it out here, I've put a copy on the squad area of the website:

<http://www.ssra.co.uk/a-squad/drills.xls>

If anyone can't access this, please let me know and I'll get a copy printed out. Remember, these aren't the only drills in the world – you may have your own, which you might care to share with the remainder of the squad – and I will hopefully be adding more to the spreadsheet over the next few weeks and months.

SCATT/Noptel

A few words about using opto-electronic trainers such as these:

- Firstly, they are great for diagnosing problems with technique.
- Secondly, they provide objective data about how well you are progressing. We

will be attempting to use them in a slightly more systematic fashion to ensure that ongoing data is gathered as your training progresses.

- However, they are not a substitute for training on a live range. You MUST be putting ammunition down the range on a regular basis in order to progress.

Having said that, there are people with difficulties accessing ranges often enough who make regular use of these perhaps more often than is ideal. If that applies to you, then here are some things to consider:

- Don't be seduced into believing the scores that the units produce – while they provide some kind of comparative statistic, it doesn't necessarily bear much relation to the scores you will produce when live firing.
- Be careful about how often you go to the PC seeking information. There are various strategies you can apply to restrict the frequency with which you access the information that the units provide:
 - Only look at the data every few shots – 5 or 10 say.
 - Only look at the data for a subset of the shots – say every 5th or every 10th shot.
 - Only look at the data when you feel a shot wasn't satisfactory.
 - Look at the data regularly at the beginning of a session, but less frequently as a session goes on.
 - Look at the data rarely at the beginning of the session and more frequently towards the end.
 - Allow someone else to control access to the feedback – they can provide it when the result of the shot (either score or some other aspect of the shot) drops below a certain threshold. The threshold can either be held static throughout a session, or can be tapered up or down as desired.
- Remember to analyse what you can feel and what you can see before looking for the feedback from the computer.

EVENT CALENDAR 2005-6

The most recent version of the squad calendar is attached to this document, but as you are all well aware, this document changes frequently. So, there is a live version of our programme on the SSRA website, in the private A/U25 Squad area. The username and password for this have been distributed to you all, if anyone can't remember them please get in touch... The link for the calendar is:

<http://www.ssra.co.uk/a-squad/calendar.xls>

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Change Plan Worksheet

Name:

Date:

The changes I want to continue to make (or continue making) are:
The reasons I want to make these changes are:
The steps I plan to take in changing are:
The way others can help me are:
The ways I can help myself are:
I will know if my plan is working if:
Some things that could interfere with my plan are:
What I will do if plan isn't working:

Stabilisation Plan Worksheet

Name:

Date:

The areas I want to stabilise are:

The reasons I want to stabilise these are:

The means I plan to take in stabilising these are:

The means to monitor these are:

The way others can help me are:

The ways I can help myself are:

I will know if my plan is working if:

Some things that could interfere with my plan are:

APPENDIX 14.

CHALLENGE POINTS PROGRAM

The challenge points program was designed with attention to increase 'performance load' utilizing emotional, cognitive, physiological, technical, tactical or task constraint. The principles came from 'stress exposure training' being suitable for 'adaptivity and transfer' capability, along with heavy principles of skill acquisition- contextual interference, feedback manipulation, practice structure. Indeed, it was subtlety of 'challenge points' afforded by the skill acquisition manipulations which the following examples indicate.

Other challenge points were applied through 'competitive' situations and specific goals/ aims constructed by coach and athlete.

PERFORMANCE PSYCHOLOGY



CHALLENGE POINT: PILOT SESSION A

Practitioners Name: Stewart Ollis
 Client Name: Susan Jackson
 Coach: Donald Macintosh
 Date: September 2005

Prone Position: Blocks of Five
 Bio-feedback (optional)

Instruct individual to maintain a normal and rhythmic training session. Instructions and details will be offered.

Action	Details
5 shots as per norm	Let them look at feedback as per norm. On final shot, take away feedback tools.
5 shots with massed feedback	Avg. of all 5 shots.
5 shots at 12 sec tempo	You will conduct 5 shots at 12 (?) secs apiece- 60 secs in all
5 shots delayed feedback- 10 secs	Ask to hold shot every time and give f-back before telling them to continue
10 shots (visualisation/ talk through with real fire- MELBOURNE)	Give no feedback, but ask them to 'rate' each shot both before and after within self-talk!!
5 shots with massed feedback	Avg. of all 5 shots
5 shots at 8 sec tempo	You will conduct 5 shots at 8 secs apiece- 40 Secs in all
5 shots delayed feedback- 10 secs	Ask to hold shot every time and give f-back before telling them to continue
5 shots as per norm	Return feedback tools at beginning. (observe what they attenuate too)

Full reflection. What worked- what never. Fill in required 'holes'. Give overall performance. Utilise Biofeedback and NOPTCELL, along with inner position to indicate cognitive load and challenge.

PERFORMANCE PSYCHOLOGY

CHALLENGE POINT: PILOT SESSION B



Practitioners Name: Stewart Ollis
Client Name: Susan Jackson
Coach: Donald Macintosh

Date: October 2005

Prone Position: Blocks of Five
Noptell and SCATT
Bio-feedback (optional)

Instruct individual to maintain a normal and rhythmic training session. Feedback will be issued at the end of every 5 shots. Request self-efficacy rating for each block of FORTHCOMING shots.

Always give result, then indication of performance.

Action	Details
5 shots	Hold
5 shots	Zero point
5 shots	Performance
5 shots	Rhythm in %
5 shots	Recoil
5 shots	Sway
5 shots	Performance
5 shots	NOTHING
5 shots	Hold
5 shots	Rhythm in %
5 shots	Give NOTHING; then ask for overall score!!

Full reflection. What worked- what never. Fill in required 'holes'. Give overall performance. Utilise Biofeedback and NOPTELL, along with inner position to indicate cognitive load and challenge.

PERFORMANCE PSYCHOLOGY

CHALLENGE POINT: PILOT SESSION D



Practitioners Name: Stewart Ollis
 Client Name: Susan Jackson
 Coach: Donald Macintosh
 Date: October 2005

Prone Position: Blocks of Five
 Bio-feedback and Noptell

Instruct individual to maintain a normal and rhythmic training session. Instructions and details will be offered.

Action	Details
5 shots as per norm	Let them look at feedback as per norm. On final shot, take away feedback tools.
5 shots closed eyes after 3 secs	Hold feedback offered (after 5 shots give both performance + indicator of hold)
5 shots with massed feedback	Feedback given on pertinent action point
5 shots on 'action point'	Feedback on 5 th shot.
5 shots delayed feedback	10 second delay
5 shots attenuate to x	Feedback on a, b, c and d.
5 shots closed eyes after 3 secs	Individual hold performance
5 shots delayed feedback- 10 secs	Ask to hold shot every time and give f-back on various issues before telling them to continue
10 shots as per norm	Self-efficacy on each shot

Full reflection. What worked- what never. Fill in required 'holes'. Give overall performance. Utilise Biofeedback and NOPTELL, along with inner position to indicate cognitive load and challenge.

APPENDIX 15.

IMAGERY PROGRAM

The imagery program was utilized to assist in the creation of a challenge points program.

It was also utilized in relation to alternative psychology support processes inclusive of relation, pre-performance routines, problem solving, decision making and coping.

PERFORMANCE PSYCHOLOGY



IMAGERY AND VISUALISATION WORKSHOP/ TRAINING

Stewart Ollis

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SPORT PSYCHOLOGY:

IMAGERY & VISUALISATION WORKSHOP/ TRAINING



Name: Stewart Ollis
Client: Melbourne STSF
Date: October 2005

Introduction

You must understand, I am not by nature a day-dreamer. I try to control those parts of my life that can be controlled, to plan everything that I want to happen down to the most insignificant detail. I traffic in a world in which fractions of a second separate success and failure, so I'd visualised the 1996 Olympics down to the millisecond. I'd crafted a decade of dreams into ambitions, refined ambitions into goals, and finally hammered goals into plans.

(Johnson, 1996, p.14)

Small-bore shooting shares this need and requirement for extraordinary attention to detail, where one micro-millimetre over a ninety-five minute period, during a once in a life time occasion will merit lifetime and self-held perceptions of success or failure. This micro-millimetre will be constrained by quality of equipment, quality of training, levels of expertise and long-term preparation. More importantly, the difference between many performances will exist by what goes on behind the eye's, how you feel and what you believe both before and during the event, as well as both before and during the release of that trigger. The main element contributing towards success will be diligent preparation and practice, which include psychological skills. Therefore, it is deemed appropriate to do an imagery workshop so giving yourself an additional psychological skill for your personal performance toolbox.

Imagery is simply 'practicing in your head'. It is not something made at a factory, nor grown in the field. It is a natural occurring phenomenon, which occurs within us all and many utilise in everyday life. The purpose of this workshop is to refine this phenomenon into a tool, not an answer, and certainly not magic dust, but something which has many benefits. It should also be identified that an imagery program has to fit the needs of an individual athlete, and not the group; it should be simple and concise and most importantly controlled and systematic. First of all however, I would like you to go through the following two exercises:

String and bolt

Each athlete should take a string approximately 14 to 16 inches long threaded through a heavy bolt (a neck chain and heavy ring will also work). Stabilizing the elbow, ideally on a table top, each athlete will lightly hold the two ends of the string between the thumb and forefinger with the weight suspended directly below. Focusing on the weight, imagine the weight moving right and left like the pendulum of a clock. Once most athletes have at least some movement right and left, then change the image so the weight swings directly away and from the body. Again, once successful, change the image so the weight moves in a clockwise circle and finally in a counter-clockwise circle. In discussing the exercise, you should find most athletes are absolutely amazed at how imagining the movement ultimately translates to the actual physical movement of the pendulum. [Take the opportunity to explain that subtle innervation in the arm and hand created by the imagery is responsible for the movement of the pendulum].

Arm as iron bar

Each athlete should pair up with a partner of similar height and strength. While directly facing each other, one partner extends his/her dominant right arm straight out, palm up, so the back of the wrist is resting on the partner's opposite shoulder. The other partner cups both of his/her hands above the bend in the partner's elbow. The person whose arm is extended then maximally tightens all the muscles in the arm, trying to make it as strong as possible. Then the partner tests for strength by pushing down at the elbow with both hands, trying to see how much strength it takes to bend the arm. Then switch roles and have the other person tested for strength. Afterward, resume the initial position with the original partner. This time, to create strength, the partner is to close everything out of his/her mind and imagine the arm is a thick steel bar. Not only is the arm a hard, steel bar but it extends out through the opposite wall. Once you have created the image of an unbendable, strong steel bar, indicate by raising one of the fingers on the opposite hand. This begins the partner again to test for strength. Again switch roles and have the opposite partner practice the image and be tested for strength.

What both tasks are designed to identify is the power of the mind, and the power of imagery. Body and mind are symbiotic. They are both one, and not one. Therefore each, and through practice together, have to be optimised for that peak performance.

Basic Imagery Training

Uses for imagery

Imagery can be utilised for three primary purposes. These include: (1) enhancing physical skills, (2) enhancing perceptual skills, and (3) enhancing psychological skills.

The enhancement of psychological skills include:

- Motivating athletes
- Modifying cognitions
- Regulating arousal and anxiety levels
- Goal setting
- Decision making
- Problem solving
- Self confidence
- Attentional focussing
- Attentional refocusing
- Increasing self-awareness
- Controlling physiological responses
- Improving self-regulation
- Interpersonal skills
- Psychological barriers in recovery

At this point I would like to show you a DVD clip of Dave Collins working with the javelin athlete - . While predominantly to assist in overcoming an inability to train due to injury, I hope you can identify that all three primary purposes overlap and are indeed reciprocal, something I hope you utilise in future imagery sessions we both share and which you refine on your own. I think for our own needs however- it is getting ready for Melbourne. Knowing what we should expect, how we will feel and getting our body and minds into the appropriate and optimal state.

Only by keeping our emotions under control can we win finals. We have to be true to ourselves always. We've come this far (as a team), and we must now play (as a team). We will have the capacity to excel, and three hours from now it will all be over, we'll get the cup and go home.

(Mourinho, 2004, p.166)

Melbourne

I have here a clip of the shooting range at Melbourne. I just want you to watch and try get back to being there. Know the range, the layout, prominent markers and attentional cues. What helps you gauge the wind, what was the weather like last February, what did it smell like, can you hear the prominent sounds, where would you like to prepare your equipment. Use this moment to accept you can be placed at any range. [I take a small fee for travel costs].

Now, I want you imagine what you will expect the Games 2006 to be like. More hustle (?), more apprehension (?), camera and media attention, Donald taking up smoking 200 Havana cigars per day, attached to a drip and he has paced up and down the range so much that he is now only 4ft "7. We now see 'wee mac', shootings

answer to Jimmy Kranky- isn't imagery fun!!

The aim is to have an acknowledgement that this is how it could feel. However, through imagery control, going through this process meticulously and 'visiting this place frequently', you will have it all understood, problems solved, hurdles overcome and indeed recognised that this is the arena for which you have trained your whole shooting career. This is going to be a, and possibly one of THE memorable moments for the rest of your life. Hopefully with a ribbon and treasured in a box!!

I want you to focus on the details of the Melbourne range. (PETTLEP- see p.9)

I know you will all have been to Melbourne, and we will return here in your mind soon. But first I want to help you recollect your own peak performance. This could include a full shooting event, routine, a series of strings or just that one perfect shot. However, what we want is for you to get a powerful imagery recollection from where to initiate our imagery training. Where we will be going to this will be Melbourne, but for the moment the national circuit, European circuit, previous Games, Glenrothes, Denwood, Alloa, Bisley, or even a training session at your local range will do. However, I want you to think of a vivid shot/ string/ event where you have vivid recollection of how well you felt, the power of control and suitable outcome.

Shooting

Vividness

routine

First of all, I want you to recollect being on the range at 'one of those perfect days' where everything functioned optimally. I want you to imagine that full routine, from shot to shot, the change of conditions, and how you mastered them. How did your kit feel- tight, snug, loose? How did your rifle feel, like the rock of Gibraltar, solid, steady and unshakable, or loose and easy to control. Did it feel feather light, or solid. Once again, take your time and recollect this feeling and allow it to return. Go through everything which constructs your inner and outer position. Now let us move to your 'self'. What mood were you in, how did you prepare, what was the weather like, any smells, noises, what did you say when talking to yourself and what did you think/ attenuate to (and not!) during all periods of the routine and each shot. Try to visualise the details of that day with great vividness and attention to detail: (PETTLEP)

I want you pay particular attention to the symbiosis between yourself, your rifle and the environment. As you feel good and in the flow state, the rifle feels stable, always wanting to pierce the inner-bull- 10. Whatever the conditions, wind, rain or sun, you cannot help being in total control. Your rhythm and shooting tempo are perfect for this particular occasion. Knowing when to delay, knowing when to apply the appropriate pressure to your trigger, knowing when to slow your shooting pace down, and knowing when to increase your tempo and attack. Even knowing when to lay your rifle down and move away from the range if required. Nothing can go wrong.

Now continue with a string of ten shots.

That 'One'-

Vividness

perfect shot.

Now I want you to recollect the one perfect shot. I want you to go into the fullest detail of your shooting routine. Once again I want us to go into the fullest details of 'the shot': (PETTLEP)

[END OF SESSION ONE]

Shooting*Controllability***routine**

I want you to return being on the range at 'one of those days' where everything went well. Try to visualise the details of that day as you did in the vividness exercise: (PETTLEP)

Now however, I want you to go to Melbourne. On this occasion I will pay all expenses, you do not require passports and gun control has been rescinded from all future competitions abroad!! So let's do focus on that peak performance.

Try to remember lying down on the range. Lets get back to Melbourne and get vivid details of lying on that range.

Once again visualise the details (PETTLEP) as done in session one. (10 minutes) Now let's transfer that peak performance to this moment. Those exact same thoughts, feelings, strategies, attentional focus, shooting rhythm, etc. – only this time in Melbourne.

Begin with a few shots. You can even include a small period where you 'settle' into your Melbourne range. The aim is to go through a full routine when you can and control the ability to take this peak performance to the Melbourne range. Go through the same process, and remember to be as vivid as possible with your imagery. The feel of your kit, the symbiosis with your rifle, how you feel great inside, you are detecting all the environmental cues and it is a great shooting experience.

[END OF SESSION TWO]

Shooting*Self-Awareness***routine**

The following exercises are adopted from Vealey and Greenleaf (2001)

Exercise 1:

Think back and choose a past performance in which you performed very well. Using all your senses, re-create the situation in your mind. See yourself as you were succeeding, hear the sounds involved, feel your body and how your equipment and rifle felt solid, note both your inner and outer position, and re-experience the positive emotions. Try to pick out the characteristics that made you perform so well (e.g. intense concentration, feelings of confidence, optimal arousal). After identifying these characteristics, try to think if you brought them to other successful events. Think about things you did in preparation for this particular event. What are some of the things that caused this great performance? Certainly, you can enjoy your greatest performances without overanalysing them, but it is often helpful to use imagery to re-create the enjoyment, satisfaction and confidence associated with peak performances and perhaps gain insights as to why things went so well in that particular situation.

Repeat this exercise, imagining a situation in which you performed very poorly. Make sure you are very relaxed before practicing this image, as your mind will subconsciously resist your imagery attempts to re-create unpleasant thoughts, images and feelings. Attempt to become more self-aware of how you reacted to different

stimuli (e.g. coaches, opponents, officials, fear of failure, high expectations, needing approval from others) and how these thoughts and feelings may have interfered with your performance.

The task is then to identify solutions, re-image the problem areas and evaluate the appropriateness of your solution. Is it a mood-word, self-talk, imagery itself, breathing technique, refocusing of cognitions, etc.

Exercise 2:

Think back to a shooting situation in which you experienced a great deal of anxiety. Re-create the situation in your head, seeing and hearing yourself. Especially, recreate the feeling of anxiety. Try to feel the physical responses of your body to the emotion and also try to recall the thoughts going through your mind that may have caused the anxiety. Now attempt to let go of the anxiety and relax your body. Breathe slowly and deeply and focus on your body as you exhale. Imagine all the tension being pulled into your lungs and exhaled from your body. Continue breathing slowly and exhaling tension until you are deeply relaxed. Now repeat this exercise imagining a situation in which you felt a great deal of anger, and then relax yourself using the breathing and exhalation technique. You can also choose one of these emotions- some more pertinent to individuals more than others

- Fear
- Panic
- Moodiness
- Over arousal
- Under arousal

Exercise 3:

The purpose of this exercise is to help you become more aware of things that happen during competition that bother you when you perform. Think about times when you perform. Think about times when your performance suddenly went from good to bad. Recreate several of these experiences in your mind. Try to pinpoint the specific factors that negatively influenced your performance (e.g. officials, team-mates, opponent's remarks, good results from others). After becoming aware of these factors that negatively affected your performance, take several minutes to recreate the situations, develop appropriate strategies to deal with the negative factors, and imagine the situations again; but this time imagine yourself using the strategies to keep the negative factors from interfering with your performance. Reinforce yourself by feeling proud and confident that you were able to control the negative factors and perform well.

[EACH ONE A SESSION]

Motivational specific

I want you to imagine yourself either winning, being congratulated or picking up a medal in relation to your 'realistic' performance capability. Focus on how you feel to have constructed your optimal performance on the day. Who is watching you, who are you smiling at, can you see the medal around your neck, does the air feel better, is it sunny, can you hear the national anthem?

[A SINGLE SESSION]

**PETTLEP
Model**

Type of mental practice	Description
Physical	Using mental simulation through the adoption of both movement with sporting implements. The aim to create the 'fire in the belly, and ice on the head' scenario.
Environmental	Ensuring the individuals see's (visual), feels (kinaesthetic), hears (aural), and smells (olfactory) the environment through the multisensory environmental cues. In relation to shooting, both the outer and inner position.
Task related	The content of practice should reflect the performance goals and action points identified in the analysis.
Timing	Attempts to develop a temporal rhythm reflecting real world performance.
Learning	Have to adapt program continually to clients needs which should adopt constructionist principles.
Emotion	Ensure that emotional states are engaged with
Perspective	Inner and outer perspective

The greater the specificity and ability to trigger any area of the PETTLEP model is indicative of quality in your imagery skills. However, do remember that there is no perfect answer to how to conduct or react to imagery. Therefore, do not overwork this task, but expect to develop in a slow progressive manner.

Summary

Self---Rifle-----Environment.

Please remember that you may have perceived you felt the force- but alas you, nor I are indeed Obie-One Kinobe or Darth Vader (even though I do pretty good sound effects!!).

The use of imagery is however a suitable psychological tool to add to your toolbox. When used appropriately, it is powerful and a beneficial psychological skill. At the same time, it should not be perceived as something extra, but instead an integral part of training and practice. Therefore, just as you periodise your shooting program (and physical training!!) at weekends and during the week, you should set up a regular period for your visualisation and imagery training. Hopefully the following program will assist us in initiating such a routine.

Imagery Handbook

Ensure you find an appropriate environment and period of time to conduct your imagery training. The greater the simulation reflects the actual competitive environment, the richer the quality of the training. Thus, try ensure you are wearing the appropriate equipment inclusive of clothing, mat and rifle.

Approximately 5-10 minutes before you begin training, you should lie in a comfortable position, close your eyes and relax for an appropriate period. Clear your mind of all thoughts. Try and breathe deep through your nose, filling your lungs, and breathe out through your mouth, pushing out with your abdomen.

You should then button up the remainder of your clothing, attach your rifle and get yourself in a comfortable position. You should try and mimic as many movements of your shooting routine as possible, unless injury makes this uncomfortable. It is recognised that you will not have access to your equipment on all occasions, and it will be indicative of your imagery skills to see if you can still attain powerful kinaesthetic feelings.

Background You will then begin your imagery routine according to your training program. You may individualise your program in accordance with your goals, aims and action points which emerge from ongoing reflection and analysis and follow five different functions (SIQ).

SIQ

Function	Sample Question
Cognitive- specific	When imagining doing a particular move, I can consistently perform it perfectly in my head.
Cognitive- general	I imagine executing entire routines/ sections, just the way I want them to happen in a competition.
Motivational- specific	I imagine the audience applauding my performance.
Motivational- general (arousal)	When I imagine a competition, I feel myself emotionally excited.
Motivational- general (mastery)	I can easily change my image of a move.

**When to
conduct
your**

To be systematic, daily imagery practice is advised. This may last only ten minutes, especially when you have refined your basic skills. At other periods you can indeed imagine doing a full competitive program. You may also do imagery practice before actual practice, after actual practice and during practice. Indeed, this also goes for before competition, after competition and during competition.

It may also be helpful for those to go through a pre-performance imagery routine before every contest. This could be a 'string of tens' or so the night before (remember

having your kit on is not always a necessity) and few shots before the actual contest assisting yourself to trigger the appropriate arousal and emotional state. You can even utilise imagery as part of your preparation phase of the competition, and maybe even before some 'critical shots' if required. At this point it should be recognised that as with any pre-performance routine, practice is necessary, and not something to be tried at the last moment.

Another appropriate time to do imagery is after competition. Using imagery at this time facilitates increased awareness of what actually happened during competition. Again, this should be an individual exercise, but coaches can monitor by having athletes complete *postcompetition evaluation sheets* based on their postperformance imagery. This can also be enhanced through the supplementation and addition of shooting scorecards, video analysis and a triangulation of perspectives (e.g. coach feedback).

To monitor imagery, and just as you should have a competition log, training log, and physical training log, you should also have a psychological skills/ imagery log to record imagery experiences. The log can contain different types of imagery exercises, evaluation forms and dates and times.

The imagery evaluation may attest to practicing alone, practicing with others, in a competition, or recalling a peak performance. The following are sport imagery evaluations that could be asked using the associated likert scale.

Sport	<ul style="list-style-type: none"> • How vividly you saw or visualised the image. • How clearly you heard the sounds. • How vividly you felt your body movements during the activity. • How clearly you were aware of your mood or felt your emotions. • Whether you could see the image from inside your body. • Whether you could see the image from outside your body. • How well you could control the image
Imagery	
Evaluation	

Associated Likert Scale

- | | |
|-------------------------------|------------------------|
| 1. no image present | / no control |
| 2. not clear or vivid | / very hard to control |
| 3. moderately clear and vivid | / moderate control |
| 4. clear and vivid | / good control |
| 5. extremely clear and vivid | / complete control |

**Sample Imagery Script for Competition Preparation.

**Sample Imagery Script for Relaxation

What is finally offered are 'indicative' templates for a 7 week workshop/ training package. This is not to be absolutely adhered to. Go as slowly as you desire, you may even see no purpose in imagery and disengage for all the correct reasons. You may wish to accelerate to 'self-awareness', or indeed do more than the recommended. However, what is likely is the utilisation of imagery by the coach, and thus the basics should be understood.

Practice Diary

Name: _____ 7 Week Course: _____

Week	Content	Feedback
1	Basic training: Introduction	
2	Basic training: Vividness	
3	Basic training: Controllability	
4	Basic training: Self awareness	
5	Mix	
6	Basic training: Self awareness	
7	Individualised program: Psych Skills	

How did your training go over the 7 weeks?

Practice Diary

Name: _____

Week 1: Basic Training: Introduction

Day	Content	Details & Feedback
1	Introduction 1	
2	Introduction 2	
3	Routine	
4	Melbourne	
5	Off	
6	Routine	
7	Off	

How did your training go this week?

Practice Diary

Name: _____ Week 2: Vividness

Day	Content	Details & Feedback
1	Routine:	
2	Off	
3	Routine:	
4	Off	
5	Melbourne Range:	
6	Routine:	
7	Off	

How did your training do this week?

Practice Diary

Name: _____ Week 3: Controllability

Week	Content	Details and Feedback
1	Melbourne Routine	
2	Off	
3	Melbourne Routine	
4	Off	
5	Melbourne Routine	
6	Melbourne Routine	
7	Off	

How did your training go this week?

Practice Diary

Name: _____

Week 4: Self Awareness

Week	Content	Details and Feedback
1	Exercise 1 positive	
2	Off	
3	Exercise 2	
4	Off	
5	Exercise 1 positive	
6	Exercise 1 poor	
7	Off	

How did your training go this week?

Practice Diary

Name: _____

Week 5: Mix

Week	Content	Details and Feedback
1	Vividness and control	
2	Off	
3	Vividness and control	
4	Off	
5	Self awareness	
6	Melbourne- realistic goal	
7	Off	

How did your training go this week?

Practice Diary

Name: _____

Week 6: Self Awareness

Week	Content	Details and Feedback
1	Exercise 1 positive	
2	Off	
3	Exercise 3	
4	Off	
5	Exercise 1 positive	
6	Exercise 1 poor	
7	Off	

How did your training go this week?

Practice Diary

Name: _____

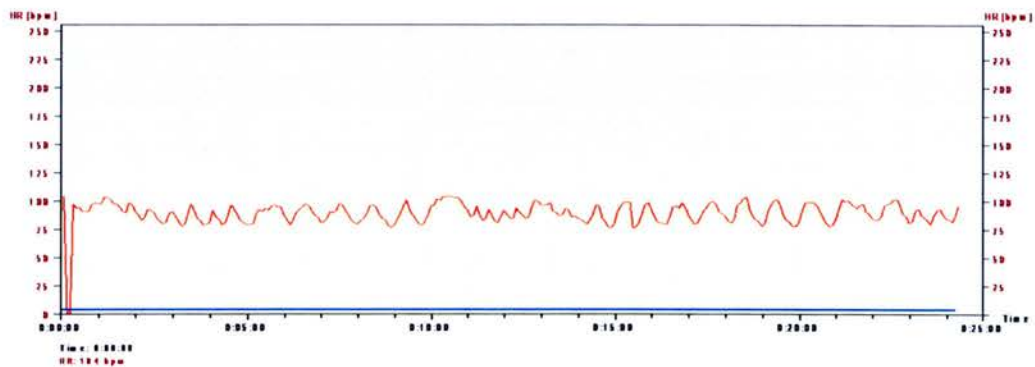
Week 7: Psychological Skills

Week	Content	Details and Feedback
1		
2		
3		
4		
5		
6		
7		

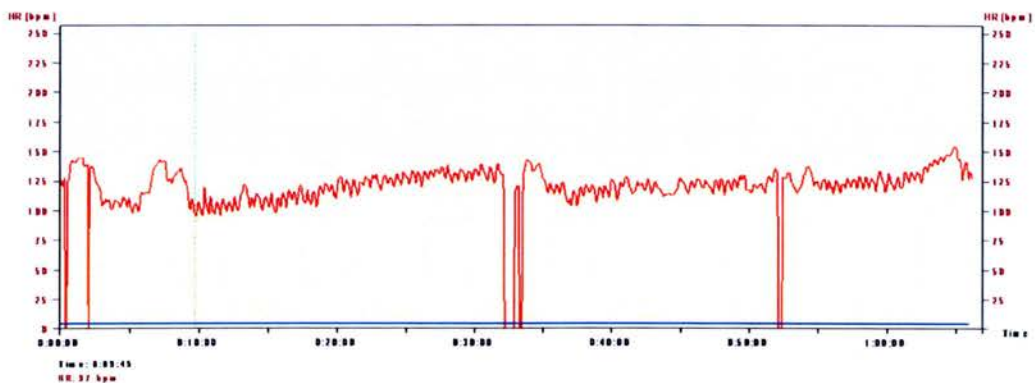
How did your training go this week?

APPENDIX 16.

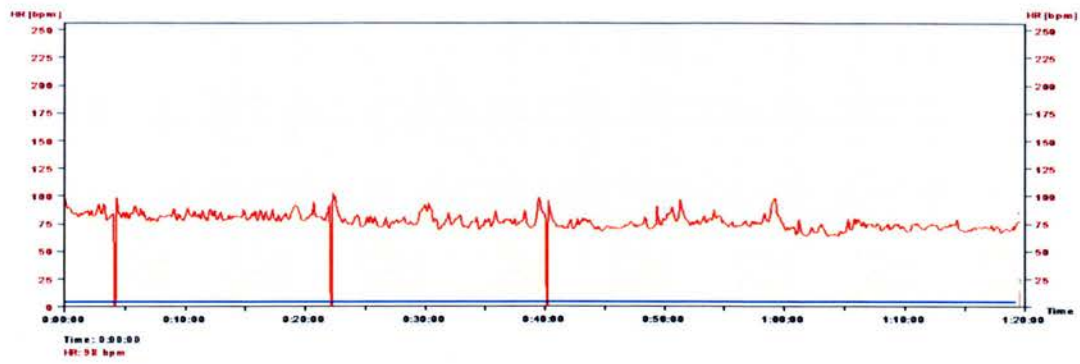
HEART RATE



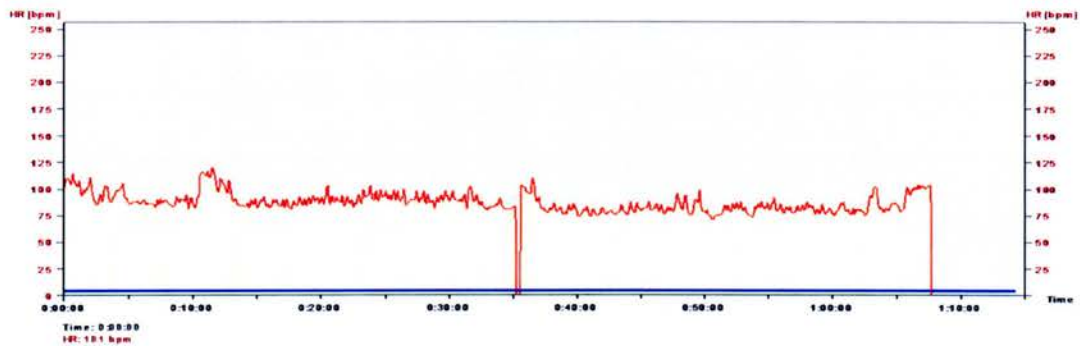
Person	suave_jackson	Date	12/02/2006	HeartRate	90-100		
Exercise	12/02/2006 12:02	Time	12:02:32	Max HR	100		
Span	Running	Duration	0:24:24.2	Distance			
Note	suave_jackson EBC						
				Selection	0:00:00 - 0:24:20 (0:24:20.0)		



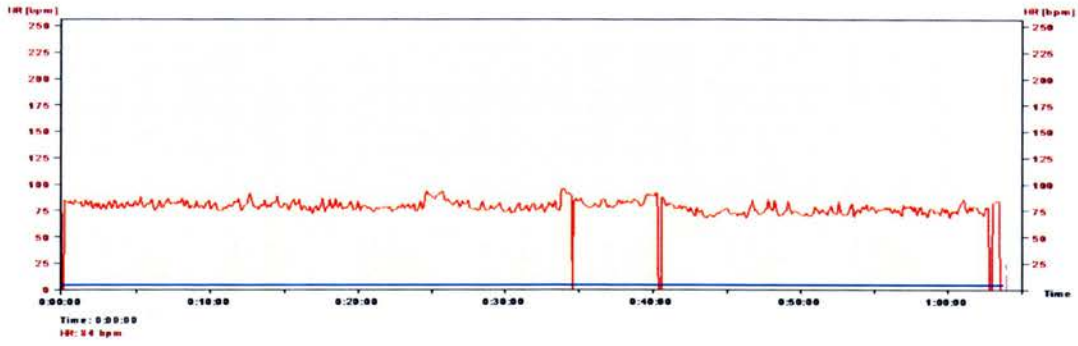
Person	suave_jackson	Date	12/02/2006	HeartRate	100-135		
Exercise	12/02/2006 02:17	Time	02:19:15	Max HR	100		
Span	Running	Duration	1:08:17.1	Distance			
Note	suave_jackson EBC						
				Selection	0:00:00 - 1:08:15 (1:08:15.0)		



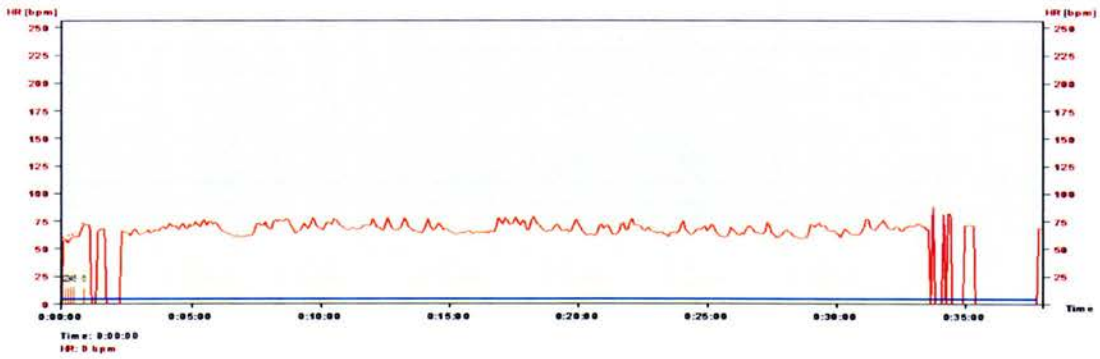
Person	sheena	Date	19.01.2000	Heart rate	77 - 100		
Exercise	19.01.2000 05:48	Time	05:48:43	Max HR	100		
Sport	shooting	Duration	1:19:39.0	Distance			
Note	challenge points prone thurs am 19m ea			Selection	0:00:00 - 1:19:35 - 1:19:39.0		



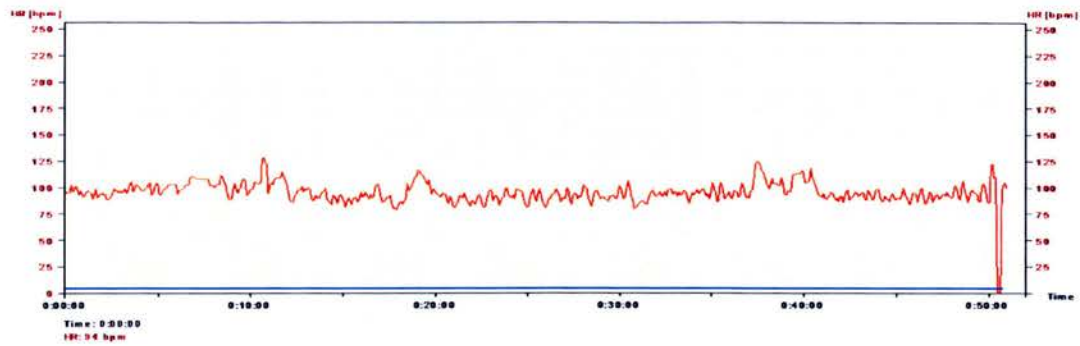
Person	sheena	Date	19.01.2000	Heart rate	87 - 120		
Exercise	19.01.2000 05:23	Time	05:23:31	Max HR	100		
Sport	shooting	Duration	1:14:35.1	Distance			
Note	interval comp. ea prone 50 15m jan thurs am			Selection	0:00:00 - 1:14:35 - 1:14:35.0		



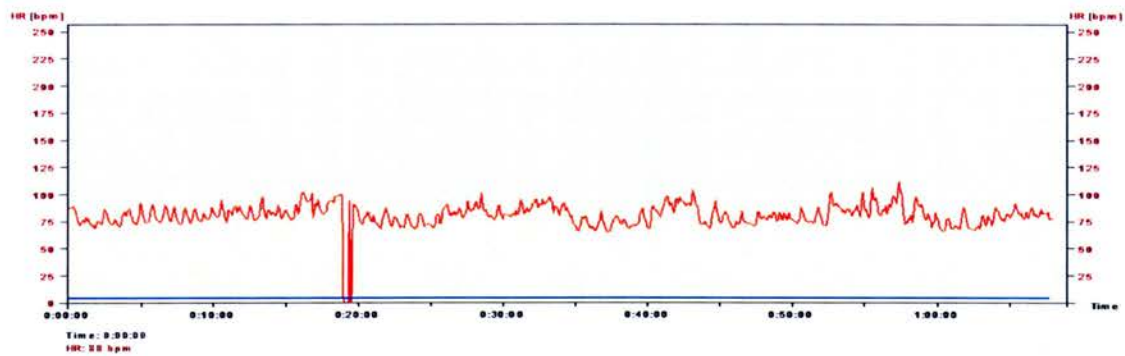
Person	sheena	Date	14.01.2008	Heart rate	73 - 82		
Exercise	14.01.2008 12:38	Time	12:08:45	Max HR	150		
Sport	shooting	Duration	1:04:01.1	Distance			
Note	23 day 1 afternoon	Selection	0:00:00 - 1:04:00 (1:04:00.0)				



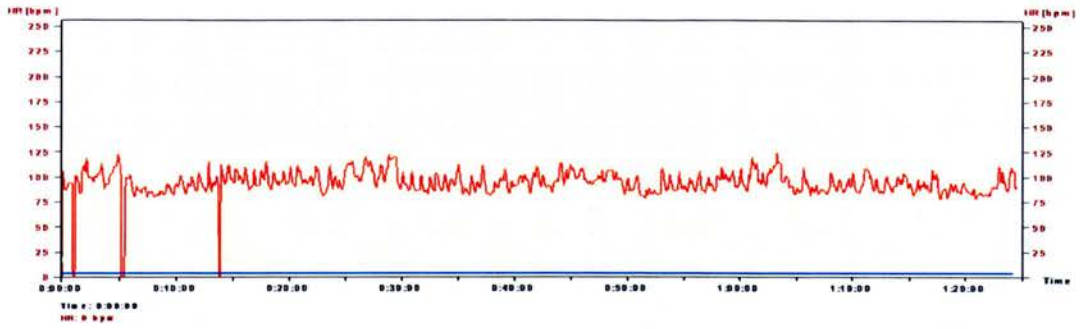
Person	sheena	Date	10.11.2008	Heart rate	83 - 99		
Exercise	10.11.2008 07:50	Time	07:59:41	Max HR	150		
Sport	shooting	Duration	0:37:59.1	Distance			
Note	Friday am 60 shot match 1a	Selection	0:00:00 - 0:37:59 (0:37:59.0)				



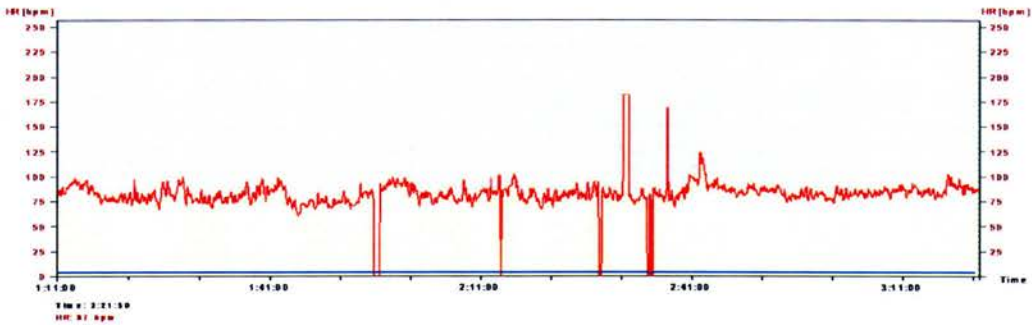
Person	neil	Date	17/01/2006	Heart rate	95 - 129		
Exercise	17/01/2006 05:17	Time	05:17:51	Max HR	150		
Spot	shooting prone	Duration	0:51:02.1	Distance			
Note	08:33 a.m 40 x hot match prone			Selection	0:00:00 - 0:51:00 (0:51:00.0)		



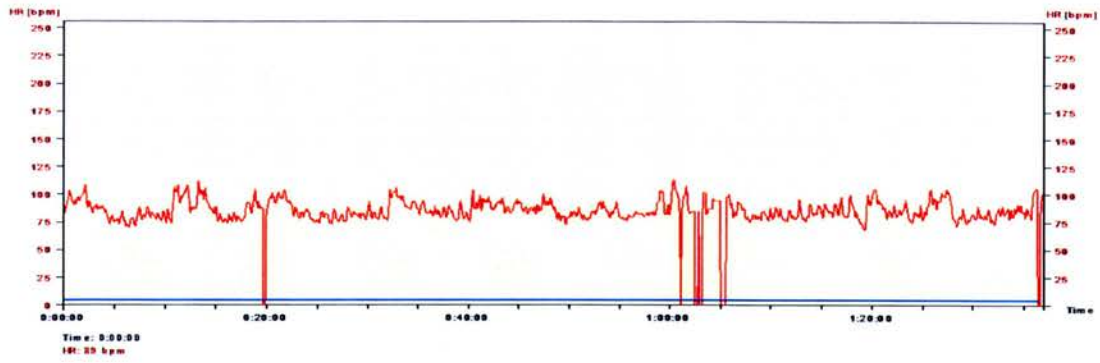
Person	neil	Date	18/01/2006	Heart rate	80 - 112		
Exercise	18/01/2006 07:23	Time	07:23:19	Max HR	150		
Spot	shooting prone	Duration	1:08:02.1	Distance			
Note	challenge count - wed 18th a.m			Selection	0:00:00 - 1:08:00 (1:08:00.0)		



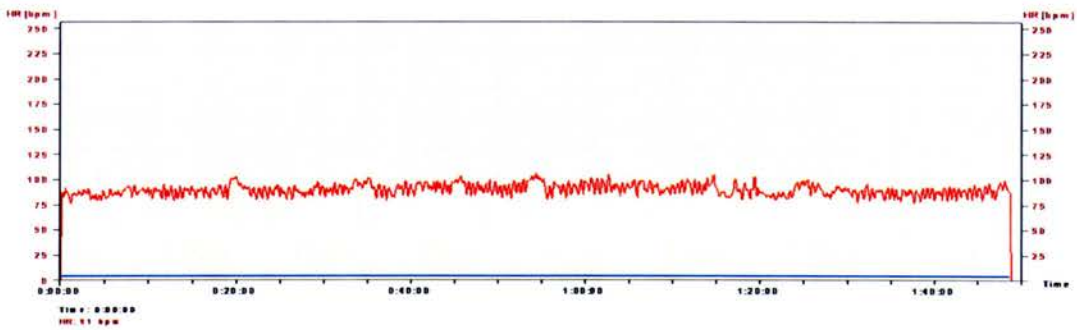
Person	na	Date	18-01-2008	Heart rate	81 - 125		
Exercise	18-01-2008-06:55	Time	00:55:30	Max HR	180		
Spot	shooting prone	Duration	1:24:30.0	Distance			
Note	Aerobically shoot 1500 muls am ax						



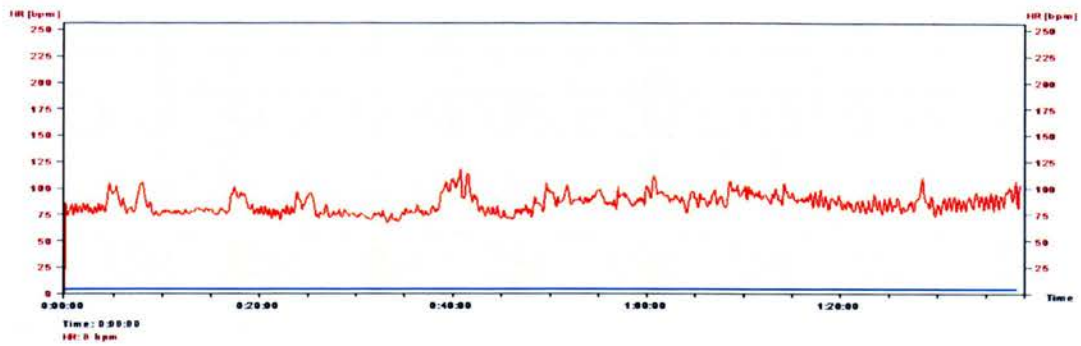
Person	na	Date	18-01-2008	Heart rate	81 - 180		
Exercise	18-01-2008-05:20	Time	05:20:45	Max HR	180		
Spot	shooting prone	Duration	3:21:52.1	Distance			
Note	ax day 2 avc-combitions						



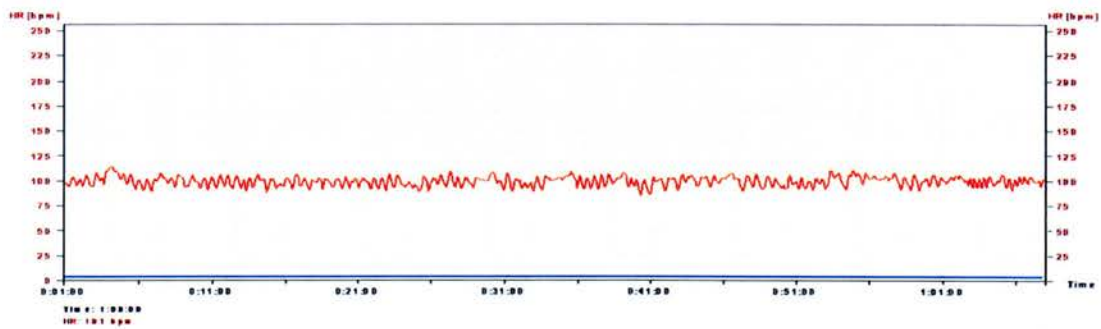
Person	xx	Date	15-01-2008	Heart rate	85 - 114		
Exercise	15-01-2008 07:21	Time	07:21:00	Max. HR	150		
Spot		Duration	1:35:00	Distance			
Note	xx-1st day			Selection	0:00:00 - 1:35:00 (1:35:00)		



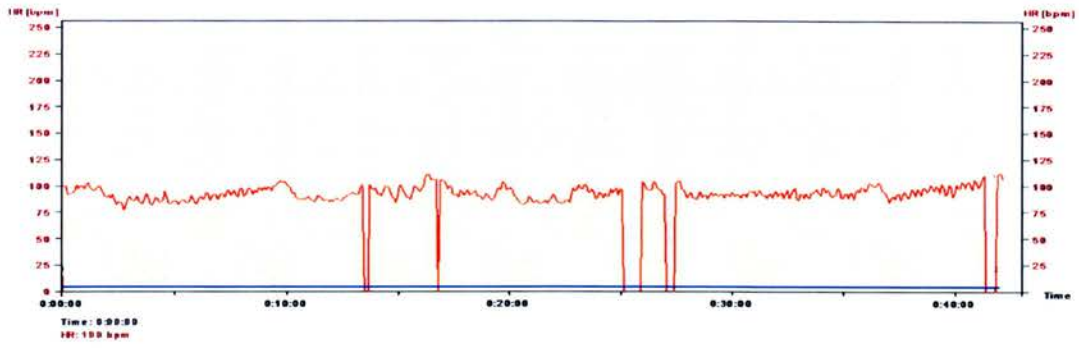
Person	xx	Date	15-01-2008	Heart rate	85 - 107		
Exercise	15-01-2008 10:38	Time	10:38:00	Max. HR	150		
Spot	xx-first day 2nd session	Duration	1:49:00	Distance			
Note	xx-first day 2nd session			Selection	0:00:00 - 1:49:00 (1:49:00)		



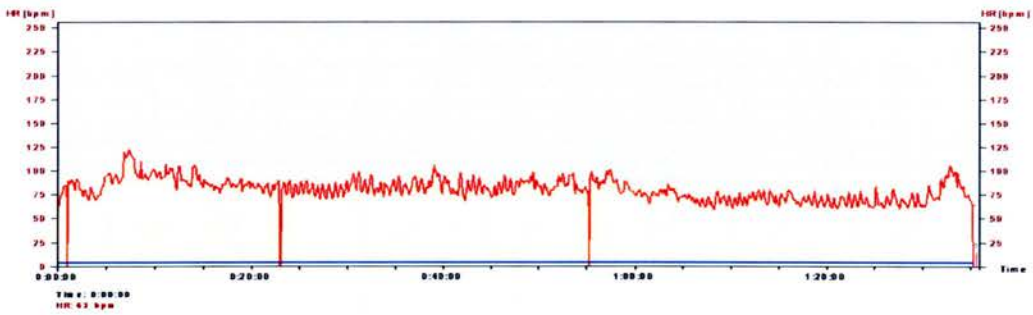
Person	martin	Date	18/01/2008	Heart rate	88 - 115		
Exercise	18/01/2008 11:51	Time	11:51:41	Max. HR	180		
Sport		Duration	1:38:38.0	Distance			
Note				Selection	0:00:00 - 1:38:35 (1:38:35.0)		



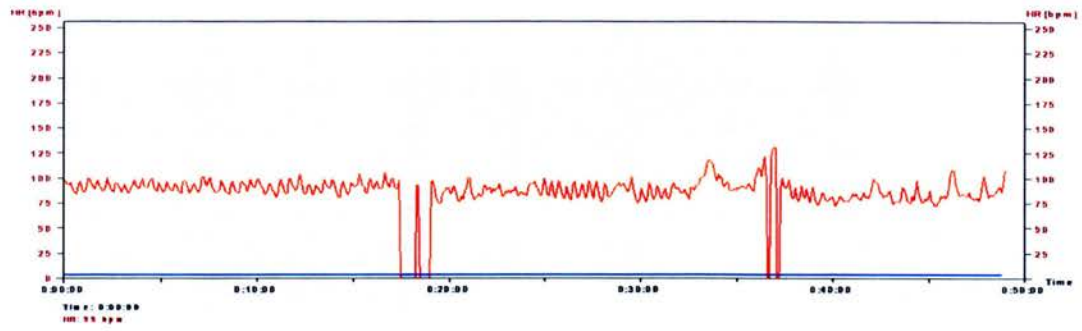
Person	martin	Date	18/01/2008	Heart rate	88 - 114		
Exercise	18/01/2008 11:50	Time	11:50:21	Max. HR	180		
Sport	shooting	Duration	2:29:37.1	Distance			
Note	challenge points starting 15M thursday eve			Selection	0:00:00 - 2:29:35 (2:29:35.0)		



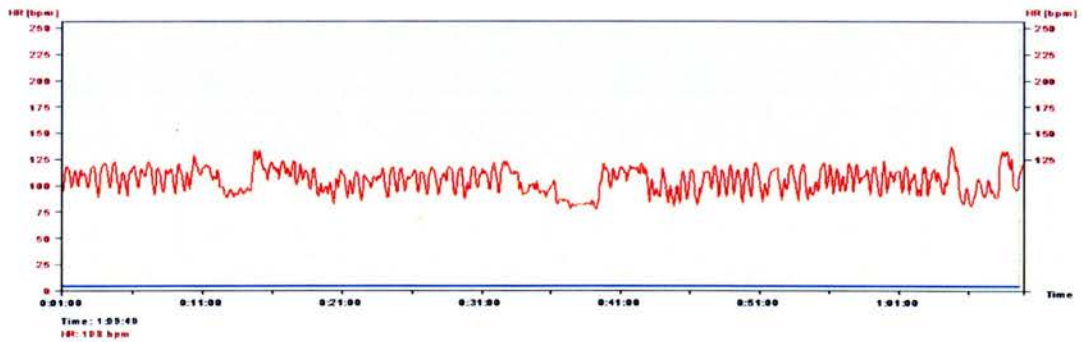
Person	martin	Date	19-01-2006	Heart rate	92 - 112		
Exercise	19-01-2006 07:00	Time	07:00:22	Max. HR	100		
Sport	shooting	Duration	0:42:13.1	Distance			
Note	international shoots & 50 prone 19th jan thurs am			Selection	0:00:00 - 0:42:10 - 0:42:10:0		



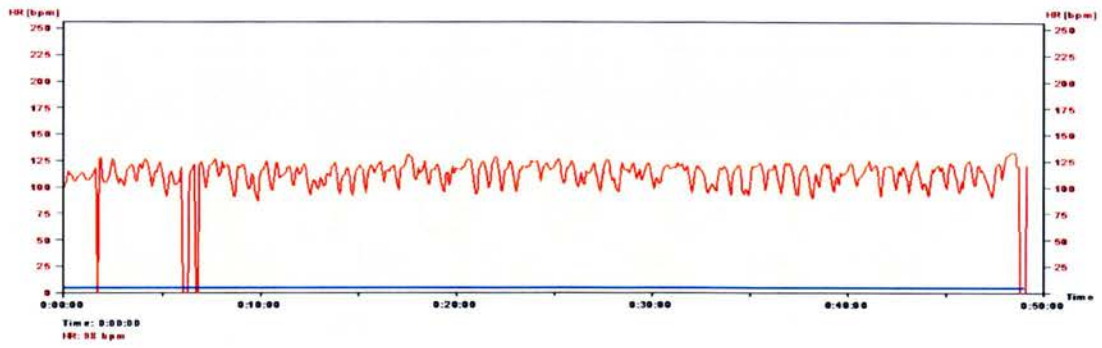
Person	martin	Date	11-02-2006	Heart rate	80 - 120		
Exercise	11-02-2006 09:04	Time	09:04:26	Max. HR	100		
Sport	shooting	Duration	1:15:44.2	Distance			
Note	dewford 3s			Selection	0:00:00 - 1:15:40 - 1:15:40:0		



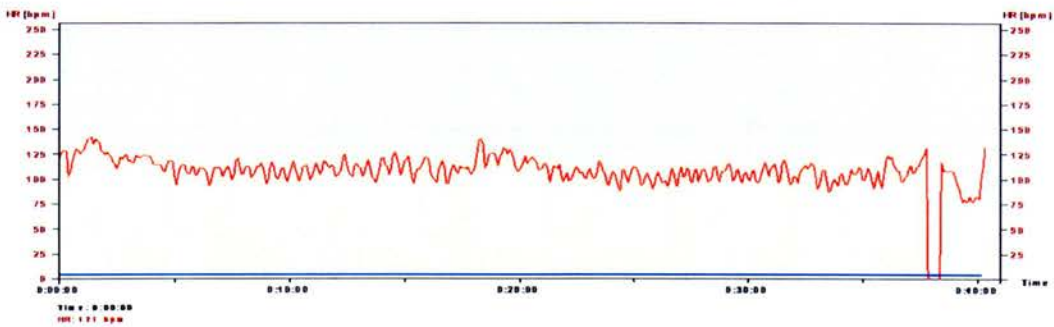
Person	emma	Date	20/01/2008	Heart rate	35 - 131		
Exercise	20/01/2008 04:30	Time	05:31:21	Max. HR	150		
Sport	shooting	Duration	0:45:02.1	Distance			
Note	challenge 2018 AM Hday stone			Selection	0:00:00 - 0:45:00 (0:45:00.0)		



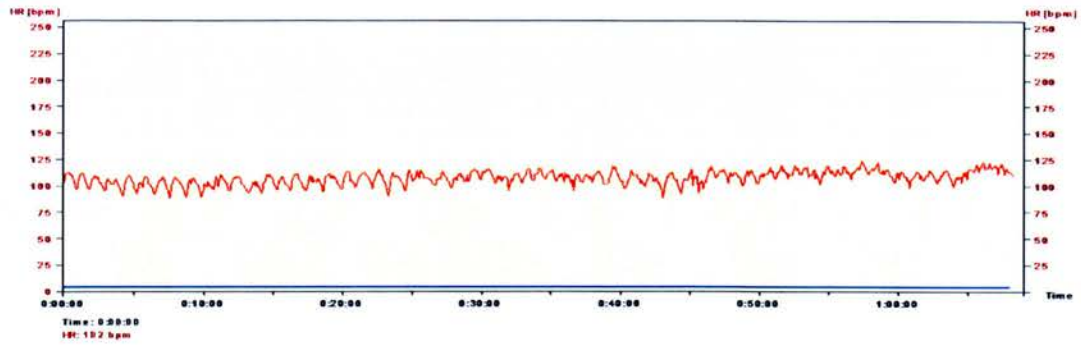
Person	emma	Date	16/01/2008	Heart rate	103 - 142		
Exercise	16/01/2008 12:00	Time	12:09:53	Max. HR	180		
Sport	shooting	Duration	2:23:49.1	Distance			
Note	sa office day 1 avc			Selection	0:00:00 - 2:23:45 (2:23:45.0)		



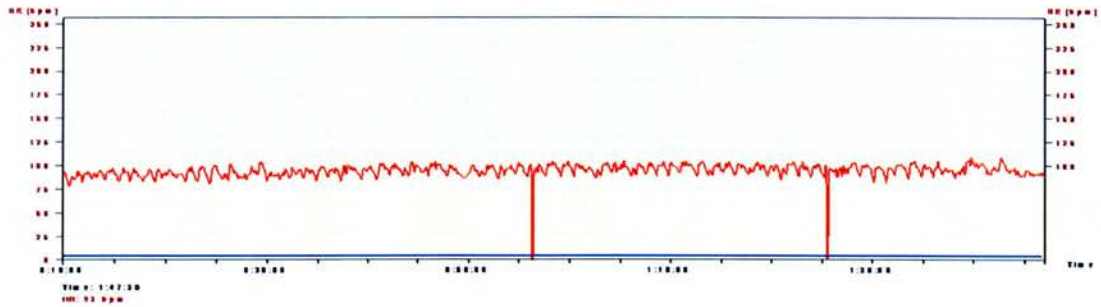
Person	emma	Date	16/01/2006	Heart rate	112 - 133		
Exercise	16/01/2006 13:10	Time	13:19:07	Max HR	130		
Sport		Duration	0:49:19.1	Distance			
Note	avod day 2 air match			Selection	0:00:00 - 0:49:10 (0:49:10.0)		



Person	emma	Date	17/01/2006	Heart rate	109 - 142		
Exercise	17/01/2006 05:38	Time	05:39:49	Max HR	130		
Sport	shooting	Duration	0:40:21.1	Distance			
Note	sa day 3 air match standing			Selection	0:00:00 - 0:40:20 (0:40:20.0)		



Person	robin	Date	10/01/2006	HeartRate	107 - 124		
Exercise	100m 2006 07 15	Time	07:16:35	Max HR	150		
Sport	shooting-air	Duration	1:08:13.1	Distance			
Note	day 2 challenge countaining us on words change and what change followed by good shot						
				Selection	0:00:00 - 1:08:15 (1:08:15:0)		



Person	robin	Date	10/01/2006	HeartRate	81 - 116		
Exercise	100m 2006 06 09	Time	06:39:10	Max HR	160		
Sport	shooting-air	Duration	8:14:41.1	Distance			
Note	day 2 challenge countaining us on words change and what change followed by good shot						
				Selection	0:00:00 - 0:14:42 (0:14:42:0)		