ACTION SPORTS IN TRANSITION: OPTIMIZING PERFORMANCE

by

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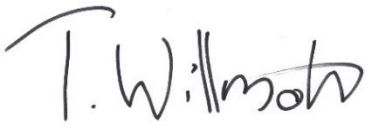
Signature of Candidate 

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Abstract

Within the past two decades, the snowboard and freeski disciplines of halfpipe, slopestyle and big air (collectively Park & Pipe) have progressed dramatically in objective performance levels while transitioning into Olympic sports. This thesis investigates the nature and impact of this transition, with a focus on athlete performance and coaching. A general overview of the sport from a biopsychosocial perspective is followed by a more specific investigation into skill acquisition and the role of the coach in Park and Pipe as an action sport. A retrospective analysis of trick progression amongst eight elite performers at the 2014 Sochi Winter Olympics is complemented by interviews with ten current elite Park and Pipe coaches and an athlete survey to achieve triangulated perspectives exploring approaches to training and associated coaching methods. The inherent risk of injury in action sports is considered throughout, along with approaches to managing this risk at an athlete, coach and systemic level. A suite of both formal and informal tools is presented including the application and use of professional judgment and decision making (PJDM, Collins & Collins, 2014).

This thesis provides insight for the action sports athlete, coach, high performance support team and management, exploring theory and application, examining change, success, failure, and providing a number of solutions to the optimal performance challenge. By establishing what current Park and Pipe best coaching practice looks like and comparing this to athlete preference, this research provides a picture of where the sport is currently at, proposes direction for the future, and highlights potential transfer to other action sports. Specific areas of focus and contribution to existing knowledge include sport progression modelling, holistic long-term athlete development, the use of motor imagery in skill acquisition, risk management, decision-making, and the periodisation of risk.

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Acknowledgments

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Abbreviations

BMX	Bicycle motocross
CDM	Classical Decision-making
CGS	Centimetres, Grams or Seconds - Refers to sports measured in distance, weight or time
D	Development
ESPN	Entertainment and Sports Programming Network
E	Elite
EST	Estonia
F	Female
FIN	Finland
FIS	International Ski Federation
FIS ISS	International Ski Federation Injury Surveillance System
FKHP	Freeski Halfpipe
FKSS	Freeski Slopestyle
FSA	Finnish Snowboard Association
HPSNZ	High Performance Sport New Zealand, the crown entity that funds high-performance sport in New Zealand.
IOC	International Olympic Committee
JPN	Japan
M	Male
MT	Mental Toughness
NDM	Naturalistic Decision-making
NZ or NZL	New Zealand
P&P	Park and Pipe
PBL	Problem Based Learning
PJDM	Professional Judgment and Decision Making

PY2018	PyeongChang 2018 Winter Olympics.
RDT	Resource Depletion Theory
REBT	Rational Emotive Behaviour Therapy
SBHP	Snowboard Halfpipe
SBSS	Snowboard Slopestyle
SMMs	Shared Mental Models
SPSS	Statistical Package for Social Sciences
SR	Self-regulation
SSNZ	Snowsports New Zealand, the National Sporting Organisation (NSO) for all snow sports in New Zealand.
SUI	Switzerland
US or USA	United States of America
UUPS	Unexplained Underperformance Syndrome

List of publications arisen from the thesis

Peer reviewed publications

Collins, D., Collins, L. & Willmott, T. (2016). Over egging the pudding? Comments on Ojala and Thorpe. *International Sport Coaching Journal*

Willmott, T. & Collins, D. (2015). Challenges in the transition to mainstream: promoting progress and minimizing injury in freeskiing and snowboarding. *Sport in Society* DOI: 10.1080/17430437.2015.1031530

Willmott, T. & Collins, D. (2017). A retrospective analysis of trick progression in elite freeskiing and snowboarding. *International Sport Coaching Journal*

Glossary

Aerials	A freestyle skiing discipline in which an athlete is judged on the difficulty and technique of a jump including multiple flips and spins.
Air & Style	An annual series of originally snowboard big air combined with music events, more recently incorporating freeskiing.
Airbag	Large (e.g., 20x20x4.5 metre) air bags that freeski and snowboard athletes can land into from snow takeoffs reducing injury risk in training.
Average rotation index	The total amount of cumulative rotation in a competition run divided by the number of tricks performed in the run.
Big Air	A competitive snowboard and freeski discipline where athletes are judged on their performance on one jump
Carded	A term used to describe an athlete's status as part of New Zealand's high-performance support system.
Dew Tour	An annual action sports series of events that includes Park and Pipe disciplines at the Winter stop of the tour in Breckenridge, Colorado in December.
Double Cork	A trick or manoeuvre where the athlete's head passes below their centre of mass two times.
Foam pit	A large pit full of foam blocks that an athlete can jump into and crash land with minimal injury risk. These have been used in indoor trampoline, acrobatic facilities and Hollywood stunts for many years. Shaun White pioneered the use of a foam pit on-snow, this setup later evolved into the air-bag which has great practicalities.
Freeski	A modern form of skiing that evolved from freestyle skiing and snowboarding. Freeskiing includes the competitive disciplines of halfpipe, slopestyle and big air.
Grab	An important part of execution of a trick where the athlete holds onto their board or skis to demonstrate control over the manoeuvre. Grabs originated in skateboarding where the skater needs to hold onto the board as they do not have bindings holding their feet to the board.
Halfpipe	A competitive snowboard and freeski discipline where athletes are judged on the performance of their run, riding from one side of the halfpipe to the other from top to bottom achieving four-seven 'hits'

High Performance Development (HPD)	The third level of five in Snowsports New Zealand's athlete pathway, and the first level where athletes receive direct high-performance investment
Moguls	A freestyle skiing discipline where athletes are judged on form and time as they ski down a series of bumps and perform jumps.
Parallel Giant Slalom	A racing discipline on a snowboard, where two athletes compete head-to-head side-by-side on a giant slalom course turning one way and then the other through gates.
Quad Plan	A performance plan overview for an athlete that stretches four years into the future.
Rocketship Skills Profile	A skills profiling tool specific to the Park & Pipe disciplines.
Rotation Index	The total amount of cumulative rotation in a competition run.
Skiercross	A ski racing discipline where four athletes race at the same time on a course including banked turns, jumps, rollers and other features.
Slopestyle	A competitive snowboard and freeski discipline where athletes are judged on the performance of their run, riding through a course of 'features' that include jumps, rails and transition modules
Snowboardcross	A snowboarding version of motocross where four or six athletes race at the same time on a course including banked turns, jumps, rollers and other features.
Sochi 2014	The 2014 Winter Olympics held in Sochi, Russia.
Sportification	To view, organize or regulate a non-sport activity in such a way that it resembles a sport and allows a fair, pleasurable and safe environment for individuals to compete and cooperate
Triple Cork	A trick or manoeuvre where the athlete's head passes below their centre of mass three times
X-Games	An annual (summer and winter versions) week-long action sports event hosted, produced and broadcasted by television network ESPN.

CHAPTER 1

INTRODUCTION AND OUTLINE OF THE THESIS

1.1 Context of the Work

1.1.1 My Own Status and Interests

I started this programme of doctoral study as a well-established National Head Coach of Snowsports New Zealand's Park & Pipe High Performance Programme targeting success at the 2018 Winter Olympics in PyeongChang and beyond. As such, part of the study was initially planned to identify potential interventions to improve skill acquisition in terms of enhancing the augmented feedback of the athletes that I work with. As I started along this path of study, however, it became clear that, in order to have the most impact on success for New Zealand in 2018 and in future Olympic cycles, it would be more fruitful to target a coaching enhancement focus. Indeed, the scope of the benefits this could bring were clearly wide ranging, covering my own coaching practice, that of my colleagues and system wide considerations. Consequently, this broader focus ultimately emerged as the best for accomplishing my primary purpose.

I work with the 'new kids on the block' of the Winter Olympic disciplines, namely, freeskiing and snowboarding. Both have emerged as distinct sports from the shadow of the alpine and nordic skiing disciplines, with their origins located within the world of extreme/action/adventure sports. As such, early performers were characterised as 'lifestyle' participants, or took part in very specific events such as the X-Games. As snowboarding emerged, the first competitive disciplines involved racing, basically snowboarding versions of the alpine skiing events. The equipment caught on, bringing new participants to the slopes. Reflective, perhaps, of this youth focus, along with influences from skateboarding, it wasn't long until the freestyle disciplines of halfpipe, slopestyle and big air stole the limelight. Taking things full circle, skiers were attracted

to the terrain parks and halfpipes built originally for the snowboarders: freeskiing was the logical extension to these innovations, leading to where we are today.

1.1.2 Terminology – A Guide to Key Ideas and Concepts

As with any new sport, there is a whole vocabulary which has developed. I hope that the use of a Glossary at the front of the thesis, together with clear explanations of terms as they appear will help the reader to stay with the thread. Before these specialist terms are considered, however, there is a more overarching distinction which needs to be clarified; namely, the categorisation of these sports in the taxonomy of sport. So, reflecting this as the first of many necessary clarifications, I will attempt to explain the synergies and differences of extreme sports, adventure sports and action sports; interchangeable and overlapping terms that have all been used to categorise snowboarding and more recently freeskiing (e.g., Gomez & Rao 2016; Jones & Greer, 2012; Willmott & Collins, 2015).

The terms identify collective similarities, uniqueness and differences to other, or 'mainstream' sports. 'Extreme' sport is a term that can be traced to the early 1970s "when rock climbing and marathon running – then considered extreme gained popularity" (Williamson, n. d.). It is used to describe the perceived high degree of risk associated with a range of sports performed in different environments: earth (urban e.g., skateboarding, parkour; mountain e.g., rock-climbing, mountaineering), water (e.g., surfing, wakeboarding, kayaking), snow and ice (e.g., snowboarding, skiing, ice-climbing), and air (e.g., BASE jumping, skydiving, paragliding). Common aspects of these sports are that they are usually individual rather than team-based (there are some outliers such as white-water rafting and adventure racing, also climbing or mountaineering is usually performed in pairs) and have a focus on "testing oneself and meeting personal challenges usually through close engagement with the natural environment" (Schrader, 2013, p. 1). "These activities often involve speed, height, a

high level of physical exertion, and highly specialized gear" (Extreme Sport, 2017). Of course, extreme is a perception; many of these sports can be performed on a spectrum of risk to the performer (for example rock-climbing can be performed in a relatively safe environment with a top-rope in place to ensure minimal risk of injury in the event of a fall, versus free soloing where climbers do not use any form of protection and expose themselves to the risk of certain injury or death if a fall was to occur).

Certainly extreme at one end of the spectrum, an alternative and perhaps overlapping or more encompassing term is 'adventure' sports. Whilst widely used but rarely defined (Tomlinson, 2016), this includes more moderate forms of the same sports or disciplines, together with forms at the lower end of the risk perception perspective (activities such as hiking, scuba-diving and skiing for example). For an overview on the history of extreme and adventure sports in New Zealand see Schrader, (2013).

'Action' sport is a third descriptor, coined in the 1990s (Wheaton & Thorpe, 2013) and used to describe a plethora of similar sports and disciplines that emerged as competitive disciplines. Some of these being included in an annual television network (ESPN) event called the X-Games. While initially covering summer action sports (including skateboarding and BMX), the inaugural Winter X-Games included snowboarding and snowmobiling and took place in 1997 at Big Bear, California. For more on the 'sportification' of action sports see Wheaton and Thorpe (2013). Some commentators use the term 'action and adventure' sports to ensure inclusivity (e.g., Kotler, 2014; Ellmer & Rynne, 2016). As you will see in Chapters 5 and 6, athletes are often actively engaged in multiple action and adventure sports: participants find them fun, and there is often also a degree of transfer in terms of motoric, kinaesthetic and cognitive effects.

To briefly mention further classifications while we are on the subject of categorisation, snowboarding has also been identified as a 'board' sport, a grouping

including skateboarding, surfing, wakeboarding, mountain-boarding, windsurfing, and skysurfing; all performed on a board and in a similar sideways stance. Both snowboarding and freeskiing have been identified as 'alternative' and 'lifestyle' sports described as "lacking regulation and control, expressing fun, creativity and performance" (Tomlinson, 2016). For more on the sociology of action/lifestyle sports and the lamented shift from 'alternative' to 'mainstream' refer to Wheaton (2013).

Many action and adventure sports have formal competition (outside of the already mentioned X-Games), although few have attained Olympic status. Since the late 1990s, a range of new Winter Olympic sports and disciplines in the action sports genre have been introduced, including snowboarding's parallel giant slalom and halfpipe in 1998, snowboardcross in 2006, skiercross in 2010, freeski slopestyle, snowboard slopestyle and freeski halfpipe in 2014. Snowboard big air will debut in 2018, and a proposal to FIS council has been drafted for the IOC to consider freeski big air for 2022. A recent strategy from the International Olympic Committee (IOC) to continue to appeal to youth (IOC, 2016) will see additions to the programme of the 2020 Summer Olympics in Tokyo with the introduction of surfing, skateboarding (park and street events), and climbing (including ranking the best overall climber in sport-climbing, speed-climbing and bouldering disciplines).

In 2016, the International Ski Federation (FIS) commenced a re-structure of its discipline committees (previously 'Snowboard' responsible for parallel giant slalom, snowboardcross, halfpipe, slopestyle and big air; and 'Freestyle' responsible for the old-school freestyle disciplines of aerials, moguls, and skiercross, and the new-school disciplines of halfpipe, slopestyle and big air) to better recognize disciplines taking place on similar terrain and with similar cultures. 'Freeskiing', including the disciplines of halfpipe, slopestyle and big air, was formally recognized as a sub-category of disciplines and as being different to 'Freestyle'. 'Park and Pipe' was identified with a

new sub-committee responsible for the organization and management of snowboarding and freeskiing's, halfpipe, slopestyle and big air disciplines. The decision by FIS was a natural evolution, as collaboration between Freestyle and Snowboard committees had been happening for some time with shared events, personnel and expertise ('Q&A with FIS council member Dean Gosper', 2016). Many independent events including the X-Games, Dew Tour and Air & Style had already been operating joint events including both freeskiing and snowboarding. Many National teams had also already recognized these similarities around the time of the introduction of freeskiing disciplines to the Olympic programme in Sochi 2014, and were operating high performance and development programmes under the same *Park and Pipe* classification including New Zealand, Great Britain and the US (British Ski & Snowboard, 2017; Snowsports NZ, 2017).

The Park and Pipe disciplines are examples of aerial action sports in that they involve athletes jumping into the air from constructed features performing a series of acrobatic manoeuvres called 'tricks' (one trick in the case of big air). The judging criteria involves recognition for progression, amplitude, variety, execution and difficulty (further detail on the judging criteria in Chapter 2; for more information see Association of Freeskiing Professionals, 2015). Athletes are typically scored out of 100 by averaging the scores from a panel of five-six judges. Various competition formats exist; however, recent standardization across different event organisers means that, normally, there is a two-run qualifying round where the top 10-16 men, and top six-eight women, advance to a finals round, where the best one of either two or three judged runs counts. A core value of Park and Pipe consistent across other competitive aerial action sports (such as mountain-bike slopestyle, skateboard park and wakeboard) is the 'free' nature of run planning and compilation. A subtle, although important point of difference with other subjectively judged aerial sports, (such as gymnastics,

trampolining, diving and freestyle skiing aerials) is that the run to be performed is not required to be presented to the judges beforehand so no 'tariff of difficulty' is explicitly calculated nor applied. In fact, apart from viewing the training and making inferences, the judges (and other competitors) do not know what runs and tricks the aerial action sport athletes are going to perform; modifications can be made on the fly. The judges are responsible for scoring what they see and using this score to help provide a final ranking and outcome for the event.

In light of the semantics indicated, this thesis uses the term 'Park and Pipe' (hereafter P&P) to refer to athletes and coaches engaged in one or more of the collective freeskiing and snowboarding disciplines of halfpipe, slopestyle and big air. As intimated, arguably *extreme-*, *adventure-* and *action-* (sport) are interchangeable, however, the term *action sport* has been selected as the most representative category of sport that the P&P disciplines feature within: generalisations from P&P to other similar and competitive action sports are made where indicated and summarised in Chapter 9.

1.1.3 An Overview of Attention in the Academic Literature

In the academic literature to date, research has focused on participant profiles of those engaged in risk-taking activities, following the advent of Zuckerman's sensation seeking scale (1971). More recently, the scope of investigation has broadened considerably. For example, Kerr & Mackenzie (2012) highlighted broader motives for participation in adventure sports beyond excitement and thrill-seeking, including goal achievement, risk taking, social motivation, escape from boredom, pushing personal boundaries, overcoming fear, connecting with the environment and pleasurable kinaesthetic bodily sensations from moving in water or air (in the current case no doubt this applies to snow). The occurrence of the flow state amongst action and adventure sport participants has also seen particular attention due to the perception of these activities as a ripe environment for the experience of deep or intense flow (e.g., Kotler,

2014; Mackenzie, Hodge & Boyes, 2013). Sociological perspectives on action sports have been presented (e.g., Wheaton & Thorpe, 2013; Wheaton, 2015); and recent work on the learning process in action sports have been insightful (e.g., Ellmer & Rynne, 2016; Jones, 2011). With respect to coaching, the role of adventure sports coaches in risk management and decision-making has also received recent in-depth attention (e.g., Collins, & Collins, 2012, 2013, 2014, 2015, 2016; Collins, Carson & Collins, 2016).

Research specific to coaching competitive action sports has received some attention: (e.g., Ojala & Thorpe, 2015). As a relatively new arena for the professional coach, however, further and detailed attention is required, especially with the current and projected future growth in this context of human performance. The primary focus of this thesis is therefore to add to the existing body of work, to provide an overview of the current action sports coaching landscape drilling down into specific areas of focus and interest in order to enhance future coaching practice and in doing so positively impact athlete performance.

1.1.4 The Cultural Focus Within Park and Pipe

Cultural agendas are implicit within this area, extending from pan-national to youth-based sub-cultures. There is certainly a western and English-speaking focus within this thesis which must be acknowledged. Consideration of eastern cultures are included in Chapter 6; however, for the most part, findings can be generalised to western cultures where the sports originally emanated from. There are, of course, likely significant differences in eastern cultures where P&P have been gaining in popularity (Pells, 2017) but this would represent at least one additional doctoral dissertation!

Historically, the emergence of action sports from alternative, anti-establishment hedonistic and carefree philosophies (see Wheaton & Thorpe, 2013), has influenced both their reality and the perception of their reality. Chapter 2 presents more detail on the history and changes experienced in recent years that have impacted P&P, which

currently involves a merger of sub-cultures in terms of snowboarders and freeskiers spending more time together both in training and competition, and a hybrid sub-culture of the modern P&P athlete replacing historical stereotypes. The thesis content should be contextualised against several factors, but the academic and cultural elements overviewed in Section 1.1.3 and 1.1.4 are worthy of particular attention.

1.2 My Approach to the Topic - The Pragmatic Philosophy

As a practitioner in a specific context: specific geographically (New Zealand), specific in domain (action sport), specific in performance level (elite), specific in sport (Park & Pipe); I am motivated to pursue pragmatic research that will deliver particular findings for particular people (specifically NZL P&P coaches, athletes and support). Rather than researching *through* or *of* sport, my intent was to research *for* sport (cf. Collins & Kamin, 2012). Reflecting the pragmatic approach, I was keen to draw on both theory and empirical research (my own and others') in driving forward my own coaching practice and impact on success (winning) for New Zealand athletes at major events, including the Winter Olympics. As such, a full literature review; perhaps traditional in a research degree thesis, was not seen as appropriate. This position notwithstanding, however, I have attempted to critically consider many different elements of research that I have considered across the journey.

Following from these aspirations, a general investigation and description of the 'what' of P&P, was followed by a 'how' and 'why' focus in order to meet the stated goals. Reflecting a local bias, while some of the findings of this thesis have been published with a goal of overtly sharing knowledge, contributing to the existing literature and stimulating discussion, there has simultaneously been a covert agenda. Most importantly, this course of research has delivered innovations and changes to my practice, and has impacted my work with athletes, coaches and support team members, along with systems and structures to promote performance. Targeted as offering New

Zealand P&P athletes a competitive advantage, a detailed review of these specific applications including a case-study is included in Chapter 9.

1.3 Limitations, Delimitations and Assumptions

Limitations acting on this research centre on my role as the Head Coach of the New Zealand Freeski and Snowboard Team. Majorly, these include the risks of researcher bias, sample sizes and recruitment techniques in Chapters 5, 6 and 7; and the qualitative nature of data collection as potential methodological limitations. Chapter 6 was based on interviews with coaches, some of whom I work with, and others that I work in direct competition against. There may have been more of a reluctance to divulge 'trade secrets' to a potential opponent than an independent researcher for example; although notably there was very little evidence of bias or restriction in either direction. Generalisations to the P&P community are inferred based on the investigative findings of Chapters 5, 6 and 7, with sample sizes of eight athletes, ten coaches, and eighty-five athletes respectively. Here again, there are potential limitations, both in the idea of generalising from qualitative investigation and based on small numbers. I have tempered my interpretations accordingly: in my defence, however, I would suggest that the sample size, when considered against the elite 'target population' from which it is drawn, is fairly respectable and typical in such work.

Measures were taken at each juncture to minimize these limitations, including being upfront with research participants about the potential for bias and objectives of the research and stating the tentative nature of generalisability where appropriate. If I were to repeat the investigations again, I would modify the athlete survey used in Chapter 7, to include biographical data at the start rather than at the end of the questionnaire in order to capture more usable information from those that did not complete the entire survey. This would also have allowed me to chase up those

participants encouraging them to complete and would likely have achieved more completed responses.

With a professional focus on winning Olympic medals and a key performance indicator of my role being elite athlete progression, I chose to focus on P&P athletes competing at the elite level along with their coaches. In order to compare relevant factors and gain a better understanding of the progression pathway of an athlete from development to elite, the survey in Chapter 7 included participants competing at a development level.

It is assumed that all participants in the studies responded truthfully and painted an accurate picture of their progression, or perspective. To encourage this, anonymity and confidentiality was communicated with participants at each stage of the research, and the voluntary nature of participation in the research was stressed.

1.4 Research Objectives

Research specific to coaching competitive action sports has received some attention: (e.g., Ojala & Thorpe, 2015). As a relatively new arena for the professional coach, however, further and detailed attention is required, especially with the current and projected future growth in this context of human performance. The primary aim of this thesis is therefore to add to the existing body of work, to provide an overview of the current action sports coaching landscape drilling down into specific areas of focus and interest in order to enhance future coaching practice and in doing so positively impact athlete performance. This aim is realised through the following objectives:

1. To situate and critically consider the challenge of the performance focus to the existing/original social milieu of action sports.
2. To examine trick progression, methods used and challenges encountered in a sample of elite P&P athletes.

3. To investigate perspectives, challenges and methods employed by a sample of elite P&P coaches.
4. To test the genericity of athlete and coach issues across a larger sample of P&P athletes.

As a consequence of meeting these objectives, together with associated discussion and relationship to extant literature, the thesis is designed to make a significant contribution to the knowledge base within the sport.

1.5 Outline Structure of Study Progression

Reflecting these objectives, the thesis is constructed in 9 chapters. Following this first introduction chapter, the next section comprises Chapters 2 and 3, focusing on understanding the setting: the social milieu, the nuances of P&P, the transition from lifestyle to Olympic sport and the role of the coach. Chapter 4 outlines the methods used in section 2 comprising of three empirical studies - Chapters 5, 6 and 7. Chapter 5 examines the skill acquisition process, focusing on the progression pathway and skill evolution in P&P within an Olympic quadrennial. This is followed by an examination of the learning and coaching process from both the coach's (Chapter 6), then athlete's (Chapter 7) perspectives. Studying skill acquisition and examining optimal coaching methodologies and techniques from the eye of the athlete and the coach, using both qualitative and quantitative research techniques, was a deliberate tactic which aimed to provide both a balanced and rich understanding. The third section, Chapter 8, presents the essential personal characteristic required to achieve the essential balancing act in high risk sport – namely, self-regulation. The final section, Chapter 9, ties all of the messages emerging from the thesis together – the 'So What' of the thesis summarises both theoretical underpinnings and practical applications.

CHAPTER 2

CHALLENGES IN THE TRANSITION TO MAINSTREAM – PARAMETERIZING THE CULTURAL CHALLENGE

2.1 Introduction to THE SECTION (Chapters 2 & 3)

As intimated in Chapter 1, P&P has its own peculiarities of culture, and sub-cultures within. As with any other sport, indeed any other human activity, working within this culture requires an awareness and capacity to fit. Accordingly, in this first section of the thesis, I take time to achieve objective 1, to examine the cultural milieu of P&P, including early influences, the changes made by accession to Olympic status, and possible 'backlashes' from what might be regarded as the old guard.

2.2 Old and New: The Psychosocial Milieu of these Action Sports

The freeski and snowboard disciplines of halfpipe, slopestyle and big air (collectively referred to as P&P) are *action sports* (activities perceived as having a high level of inherent danger; Extreme sport, 2014) synonymous with progression and pushing the limits of physical endeavour: athletes entertain the crowds and their peers with breath-taking displays of audacity, aerial control, and style. These sports have recently been thrust into the mainstream since the proliferation of their Olympic inclusion. Olympic inclusion legitimizes sports, exposing them to a far wider audience once every four years. Scratching beneath the surface, however, the cultural tenets of these sports, their ethos, mores, and values share some similarities but also evidence unique differences to other more traditional Olympic sports (Thorpe & Wheaton, 2011). The subjectively judged and artistic nature lends participants to reflect supportive and performance focused qualities rather than an overtly outcome or win-at-all costs focus. Camaraderie exists amongst exponents of the sports and across disciplines as they work together to progress as individuals and push the sports to new levels.

Furthermore, the sports involve additional risks to mere ego damage. As action sports, in this example performed in the mountain environment, there is a fine line between success and failure; the elite within the sports are masters of finding that balance between maximizing performance progression and avoiding the antithesis of progression: injury. As with many other individual skill-based action sports, the consequences can be high when mistakes are made, and injuries can be career and even life ending. This chapter highlights that fine line between success and failure for these newcomer sports, outlines some of the psychosocial challenges which they face, and highlights the steps which performers, coaches, and support staff can take to accentuate the positives while avoiding the negatives. As such, these sports offer an important case study of both cultural change and optimized training, together with the sport-specific contribution to these recent arrivals on the Olympic scene.

The framework for investigating the issues surrounding performance progression and injury is a biopsychosocial approach (see Bailey, Collins, Ford, MacNamara, Toms, & Pearce, 2010, for a review of this approach in sport) that acknowledges the interaction between the multiple factors that play a significant role in human functioning (Engel, 1977). By including multiple angles and perspectives, a well-rounded approach to the issues and holistic recommendations can be generated which hold salience in the high-performance sport setting while also recognizing and fitting with the cultural tenets of the individuals and groups involved.

2.3 Examining Park and Pipe through Bio-Psycho-Social lenses

2.3.1 The Bio-Psycho: Physical Challenges and Risks

Challenges

At the elite level, slopestyle athletes perform aerial manoeuvres on a series of features including rails and jumps travelling at speeds of up to 90 km per hour, jumping up to 30 m in distance, and up to 7 m high (see X Games, 2017). Very challenging

manoeuvres are performed in a competition run such as a *triple-cork 16* for example, where the athlete's head passes under the centre of mass three times while in the air and includes 1620 degrees of rotation therefore landing backwards (see Ufberg, 2015). In similar fashion, halfpipe athletes perform a sequence of manoeuvres in a run as they negotiate the 22 feet (6.5 m) high walls of the halfpipe which transition from the (so-called) flat-bottom to around 84 degrees (close to vertical) at the top. Average amplitude per hit in a five-hit men's freeski halfpipe gold medal winning run at the 2014 Winter X Games was measured at 17.1 feet above the lip (see Xgamesaction, 2014). In a manoeuvre now considered standard –a *backside double-cork 1080*–Sage Kotsenburg, Sochi Olympic gold medallist in men's snowboard slopestyle, has been measured as experiencing acceleration of 4.6 times gravity, and exerting a torque of around 600 degrees per second (Brenkus, 2011). With forwards and backwards variations on take-off and landing, athletes are expected to be able to spin in all four directions. Competitions are occasionally postponed or cancelled due to severe weather conditions, but athletes are mostly expected to perform at times in gusty winds, heavy snow, whiteout conditions, and on an icy or slushy surface depending on ambient temperature. As a result of these challenges, the psychomotor demands, plus the physical and mental load (acute in competition and chronic in training), all require significant coping mechanisms in order for an athlete to experience sustained success.

Risks

Clearly, against such levels of challenge, the risks are significant. Indeed, this was highlighted in comments made by orthopaedic surgeon and head of the International Olympic Committee's scientific activities–Lars Engebretsen–shortly after the Sochi Games; points which appeared to question the desirability of the event's ongoing inclusion (Clarey, 2014). To put things into perspective, Florenes, Bjorneboe, Andersen, Heir, and Bahr, (2011) concluded that the injury risk amongst world cup

skiers and snowboarders is high, but only half that of elite Norwegian football players. In short, things are far from simple!

In other popular high-performance sports such as rowing and cycling, elite competition success is achieved by carefully training as hard and as smart as possible to get maximum adaptation in the system to a training load while avoiding burnout and overuse injury. Performance is limited by physiological and psychological capability. In P&P by contrast, where the limits of performance are still to be tested, progression is about exploring the current boundaries of performance for the individual and for the sport in an environment that punishes mistakes hard, which can rupture an athlete's anterior cruciate ligament, and put them out of action for 12 months in an instant of miscalculation or, worse yet, result in death.

Recent tragic training accidents have highlighted the real and severe risk of injury in the P&P disciplines: Sarah Burke was a pioneer of the sport, blazing a trail for women in freeskiing's elite, mixing it up with her male counterparts and inspiring many to do the same. She was a four-time Winter X-Games gold medallist, world champion, founding member of the Association of Freeskiing Professionals, and lobbied hard for the inclusion of freeskiing halfpipe and slopestyle in the Olympic Games. In January 2011, Burke's fairy-tale life as the queen of freeskiing came to an abrupt halt when she died in a training accident in the halfpipe at Park City Mountain Resort in Utah. Coincidentally, the ongoing tide of feeling at her death (her name to this day adorns participants' equipment) is further evidence of the tight social structure which characterizes P&P.

Other recent high-profile accidents in the P&P domain include Kevin Pearce and more recently Luke Mitrani. A traumatic brain injury sustained by Kevin Pearce in December 2009, arguably Shaun White's biggest threat to the 2010 Vancouver Olympic halfpipe gold medal, left him in an induced coma for 27 days and with permanent brain

damage. Pearce suffered his injury pushing for a new (at the time) and progressive double-cork move in the halfpipe to vie for Olympic glory. Mitrani suffered spinal cord damage and subsequently had to undergo surgery to fuse three vertebrae while training in 2013 prior to an Olympic qualifying event at Cardrona Alpine Resort in New Zealand. This ended Mitrani's chances of qualifying for the US team for Sochi 2014.

While the risk of serious injury in the P&P disciplines is significant and carries with it an ethical debate, Russell (2005) defends the value of dangerous sports, suggesting that individuals participate in such sports for self-affirmation and to challenge and extend ordinary boundaries. The intense feelings of satisfaction and pure fun in combination with competing and ultimately winning that can be routinely achieved in these sports attract an interesting fragment of society.

With such a high level of injuries sustained, and the very real threat of actual death, it is no surprise that a high level of anxiety exists in the sport; aside from competitive anxiety! Indeed, during the normal course of training sessions, athletes are spending significant amounts of time having their sympathetic nervous system stressed.

Fatigue

The combined effects of these risks clearly generate a significant cognitive and emotional load on the athlete, whatever his or her motivations. Add these stressors, both acute and chronic, to the physical challenges of the motor tasks and the mountain environment, and the incidence and impact of fatigue are significant. Physical monitoring can address the physical component of this challenge, as shown by the historic work on overtraining syndrome and its related conditions (Budgett et al., 2000; Meeusen, Duclos, Gleeson, Rietjen, Steinacker, & Urhause, 2013). There is, however, far less data about the impacts of emotional stress on fatigue and how these co-act, both in the short and longer term, to deplete the athlete's resources. To date, research has been dominated by animal models (Ravinder, Burghardt, Brodsky, Bauer, & Chattarji,

2013) or by consideration of fear impacts on coping with or recovery from chronic injury (Vlaeyen & Linton, 2000). Certainly, perceptions of stress and how well the individual thinks he or she can cope with it are already a part of the overtraining or unexplained underperformance syndrome (UUPS) puzzle (Gustafsson & Skoog, 2012). Nonetheless, gaining a detailed understanding on the impact and mediation of emotionally induced fatigue is another important area for examination in the development of optimum support for P&P, enabling us to develop guidelines similar to those emerging for military contexts (e.g., Murphy, 2002). I will return to this topic in Chapter 8.

Statistics and Epidemiology of Injuries

While many epidemiological studies on the general population of snowboarders have highlighted the upper extremity, especially wrist and head injuries, Wijdicks et al. (2014), in a review of literature pertaining to elite and recreational snowboarders, identified increased lower extremity injuries amongst elite performers. Injury is a topic which has seen a plethora of academic research specific to snow sports (e.g., Defroda, Gil & Owens, 2016; Moore, 2000). Injury rates in competition and official training have been tracked by the International Ski Federation (FIS) with the advent of their Injury Surveillance System (FIS ISS) since 2006. In P&P, the recent inclusion of freeskiing has meant that studies to date have focused on snowboarding. Major, Steenstrup, Bere, Bahr, and Nordsletten (2014) used the FIS ISS to compare the disciplines of elite snowboarding and found that knee injuries were the most common type of injury accounting for 17.8% followed by shoulder injuries (13.4%) and head injuries (13.2%). Injury rates were 6.3 injuries requiring medical attention per 1000 competition runs in halfpipe snowboarding. No difference in injury rates were detected between male and female snowboarders. So, as the new disciplines bed in at an Olympic level, and with *big air* to be added as an additional discipline in 2018, a keen

eye on studies specific to these disciplines in freeski *and* snowboard will be necessary to assist in focusing injury prevention efforts into the appropriate epidemiological areas.

2.3.2 The Pycho-Social: X-Games, Olympic Inclusion, Impacts on Progression

Tracking objectively measurable performance progression in the men's freeski halfpipe disciplines between 2006 and 2014 demonstrates that the sports have been steadily evolving (see Appendix A). Indeed, performances at the 2014 Sochi Winter Olympics, particularly in the men's freeski and snowboard slopestyle events, were widely heralded as the highest displays of performance ever (Gibson, 2014; Kennedy, 2014a)

Before Olympic inclusion, however, the sports were more naturally evolving and impacted by progression in other action sports such as BMX, Freestyle moto-cross, and Skateboarding. Since 1995 for the summer X-Games and 1997 for the Winter X-Games, the best athletes in the world in these sports were gathered annually to compete against each other and show off the latest moves, skills, and progression. "The X-Games have become the ultimate forum for setting records and performing ever more technical and creative manoeuvres for international audiences" (Thorpe & Wheaton, 2011, p. 833). In an event made for American television that is broadcasted worldwide, ESPN has cornered the action sports market, selling advertising space and marketing brands aligned with the spirit of adventure, physical challenge, and one-upmanship displayed in these sports.

> Snowboarding, I don't think, wouldn't be anything like it is today without the X Games being there. It helps push the level of progression every year, like the Olympics does every fourth year with halfpipe.
>
> (Torstein Horgmo, cited in Kennedy, 2010, para. 35).

Then, of course, the Olympics actually came along; first with halfpipe snowboarding, and progressively, more national sports federations were getting involved and providing support for their athletes. Action sports athletes from

nations recognizing the medal potential in these new disciplines were now exposed to coaches, physiologists, biomechanists, nutritionists, psychologists, performance analysts, and a raft of other 'ologists' (cf. Collins, 2008) all intent on helping them achieve podium success. This imposition has had a mixed impact however. In fact, I contend that this has added another layer of pressure which is, unfortunately, only partially mitigated (or indeed capable of mitigation) by the additional support generated. I return to how this support may best be deployed later in this chapter.

2.3.3 The Social: Sport Culture and 'Progression versus Style'

Within the sports, this rapid but recent development has generated clear splits in the social fabric. Pockets of the sport shun continuous performance progression and the acrobatic or forced nature of tricks with a high difficulty level performed at the expense of a smooth style; a facet in which some exponents of the disciplines are deeply entrenched (Cavanagh, 2013). The recent introduction and impact of the triple-cork (a jump manoeuvre where the athlete's head passes below the centre of mass three times) for example, was lauded as the 'death of snowboarding' by some members of the community. Interestingly history appears to be repeating itself as apparently, back in the 1980s, it was the advent of the 720 (two full rotations in the air) that was seen as taking the sport into the realm of acrobatics and away from its roots.

Ex US Head Coach and former Burton pro Bud Keene recalls that in the late 1980s, when people were first spinning 720's, the general reception was: "Oh my God. Snowboarding's going to hell. What a bunch of ballerinas. (Cavanagh, 2013, para. 7). Like it or not, the sports will continue to progress in technical difficulty and amplitude: The performance levels that will be required to win gold in Beijing 2022 have not yet been realized.

2.3.4 Psychomotor Demands

P&P clearly share some common psychomotor challenges with other more established sports. The need for high levels of kinesthesis suggests straight transfers from diving, gymnastics, and trampolining. Indeed, the third is used almost universally as a training aid for P&P competitive athletes and lifestyle performers alike. The psychomotor demands however, although similar in some respects, show some significant and important differences as well. Specifically, these relate to the much more complex and open environments, and hence degrees of freedom, involved in the learning, development, and competitive execution of skills. Gymnasts, divers, and trampolinists don't compete in windy conditions and the apparatus from which they perform are strictly regulated. As such, levels of consistency are higher; indeed a key factor in the performer's training schedule and competitive execution.

As a direct consequence, the levels of challenge and patterns of skill evolution in P&P are deserving of further and special study. There is a strong and cogent argument that, on the basis of control dynamics alone, these newcomer sports are likely to require special and different support processes. This variability also carries important implications for injury - both the incidence and the level of threat - making this another important factor for coaching and support in P&P.

Adaptation in variable environments is a critical skill for the P&P athlete when honing their skills and performing in competition. While variability in the mountain environment is implicit, P&P athletes are also famous for their off-snow training approach: Two-time Olympic gold medallist in snowboard halfpipe Shaun White is also a summer X Games gold medallist in *vert skateboarding*. It does not appear to be a coincidence that 2014 snowboard halfpipe Olympic gold medallist Iouri Podlatchikov (SUI) and silver medallist Ayumu Hirano (JPN) also have a strong skateboarding background. Sensorimotor transfers from similar moving platform sports have intuitive

benefit. There are also clear social milieu transfers, and specific timing, balance, and co-ordination similarity. The impact of skateboarding on snowboarding has received some interest in the literature (e.g., Kunzell & Lukas, 2011) via the process of structured learning (Braun, Mehring & Wolpert, 2010).

Structured learning theory, based on the findings of motor control studies (e.g., Braun et al., 2010) posits that similarity between tasks is necessary for transfer, and that variability during practice facilitates both transfer and retention. This learning to learn mechanism provides support for the efficacy of skateboarding as a cross-training tool for snowboarders and freeskiers, providing an opportunity for skill acquisition off snow. The psychomotor link, coupled with the psychological benefit from a change of training environment and stimulus, means we will continue to see athletes excelling in P&P that dedicate time to other moving platform sports.

The average age that the top 20 in Sochi achieved their first international event podium was 17.5 years suggesting an early specialization nature for P&P. Indeed, there is a raft of stars of the sport barely into their teenage years including Chloe Kim (USA) who achieved an X Games silver medal at age 13 (and gold at age 15) and qualified second for the US team for Sochi 2014 but was too young to compete at the Olympics. On the Freeski side, Kelly Sildaru (EST) at age 12 was also ineligible to compete at FIS events based on age, but achieved a win at the 2014 NZ Freeski Open with three different 900 degree spins in her run on the jumps, demonstrating a rotation index[1] higher than the Olympic gold medal winning run in Sochi (and has since achieved X-Games gold in 2016). Many of today's elite athletes were yesterday's child prodigies (e.g., Kennedy, 2014c; Olympictalk, 2017) and all have amassed significant time on snow at a relatively young age. Their development profile potentially challenges recent work (Kiely & Liefeith, 2014) highlighting the importance of general rather than

[1] The total amount of cumulative rotation in a competition run

specific training (more on this in the implications section) although, as I will show later, the current age profile for Olympic medallists is broader. Furthermore, as I will also discuss later, such general training may have more of a prophylactic than a performance enhancement contribution. Once again, the picture for this new sport is complex and clear policy directions are to be avoided rather than incorrect directions taken, or assumptions made!

2.4 Addressing these Challenges: Other Considerations

The complex picture described above demonstrates the challenge for this sport, the coaches and policy makers, and its athletes, all of which can be seen to be in a state of transition. Adding further to this complexity, the sport can be seen as a 100m sprint along a tight-rope; the fine but hopefully optimum balance between physicality, skill progression, and injury. Of course, I do not suggest that similar challenges don't exist in other sports. It is just that the juxtaposition of the various issues makes for a more complex than most mix, open to be addressed if the sport is to bed down into its new existence as a fully-fledged, very popular, and high participation Olympic sport. As such, the sport also offers a useful case study for practitioners and policy makers, as well as those directly involved (cf. Grix, 2010a).

Against the objectives of broadening involvement which is used as an increasingly common (though arguably flawed; Bailey, 2005; Grix, 2010b) argument for government support of elite sport, such a profile would appear almost perfect. So how can the sport and performer transitions be managed with minimum damage to either? I next consider the component factors before turning attention to the implications of these challenges.

2.4.1 The Current 'Athlete' Profile

If elite achievement in sport *does* lead to greater participation, then P&P has a lot of potential to engage new participants. Medallists in Sochi across the four P&P

disciplines and both genders ranged in age from 15 to 33 (cf. our earlier comments on early specialization) and were from nine nations. Furthermore, and in contrast to alpine disciplines for example, participants had come to the sport from a wide variety of origins including (importantly for the no or low snow nations) indoor snow domes and outdoor dry slopes (e.g., UK competitor James Woods, who started the sport on his local dry slope; Bell, 2014). In short, these sports can be genuinely pursued at least at a developmental level without the necessity of alpine environments or even, to some extent, expensive and rare training and technical support.

This 'low-tech' and 'open to all' nature is, arguably, an important underpinning factor in the sense of community which pervades the sport. I mentioned earlier that many competitors still sport the Sarah Burke badge in some form, while one performer's success at a new trick is routinely greeted by applause and shouts of delight from his or her fellow competitors; a contrast to the 'mind games' and overt competitiveness which typifies many other Olympic sports. As alluded to earlier, this has led many performers to question, or even deride, the term athlete; as such, the sport's perception of itself offers a particular challenge and setting for coaches, support staff, and administrators. Even for those who do embrace the new regime, there are clear and apparent tensions which, for the moment at least, can act to inhibit the impact of the new coaching and sport science approaches.

2.4.2 Nuances that make Injury Prevention Different in Action sports

Overuse injuries are a threat as they are in many sports, but it is the acute trauma from crashing out when pushing the limits too far that is a distinguishing element of the injury prevention dynamic within action sports. These injuries are not a result of anyone else's actions, as in a high tackle in rugby for example, and, as such, are down to the control or lack thereof of the participant. Many factors will combine to influence and predispose an athlete to injury including internal factors (e.g., physical and

psychological) and external (e.g., social, environment, and weather). Certainly, recent research has shown that there is no one personality type which typifies action sports participants (e.g., Barlow, Woodman, & Hardy, 2013; Woodman, Hardy, Barlow, & Le Scanff, 2010) so the complexity of this issue alone is quite substantial.

Certain personality types including low conscientiousness combined with high extraversion and/or high neuroticism have been found to have higher self-report risk taking levels in high-risk sports and also a higher number of accidents (Castanier, Scanff, & Woodman, 2010). Kupciw and Macregor (2012, p. 29) state "it is clear that sports regulators may need to consider the psychological antecedents of risky behaviour in adventure sports (e.g., low conscientiousness) in order to ensure appropriate safety and accident prevention measures are in place." They suggest that "danger per se does not necessarily lead to accidents; it is when danger is accompanied by a lack of precaution that danger translates into accidents." (op cit, p. 29). Precautionary behaviours have been recommended to mitigate injury risk in P&P but the exact impact and optimum employment of these has yet to be clarified. I next consider these issues as a clear and important consideration in the health *and* performance progression of performers in this sport.

2.4.3 Social Influences on Progression

It was historically down to the athlete encouraged by his or her peers to decide to take the next risk and push for that next trick. Helms (1984) has labelled the phenomenon of increased risk taking amongst a group compared to risks taken by an individual as the 'risky shift', which would appear to be one of the elements in effect amongst the action sport community that impacts the progression of the sports and also injury rates. With the influence of innovation through social media platforms and YouTube, the action sport community is now global and communicating in terms of the latest trends or progression in the sport almost instantly; when a 16 year-old lands a

smooth triple cork at a training camp in New Zealand, within hours the video has been viewed 44,000 times across the globe. The peer group has increased in magnitude from a group of friends riding at the local ski resort to including a web-based international community of 'friends' and 'followers' (see Jones, 2011; Woermann 2012). Crucially, the impact of this wider audience seems to have exerted significant effects on both athlete and lifestyle performers alike (Ellmer & Rynne, 2016); in short, has *risky shift* (Kogan & Wallach, 1967) been magnified?

2.5 The Brave New World

2.5.1 Enter the Coach

With increasing financial support and national team structures there are now often even more people 'in the mix' from a decision-making perspective; not least the coach. In the controlled environment of the gymnasium, the coach can aid progression of the athlete when attempting new moves with manual guidance to increase confidence (Heinen, Pizzera, & Cottyn, 2010). On the mountain, however, this luxury is not afforded: The P&P coach is limited to verbal and visual tools. Accordingly, an even greater trust dynamic between coach and athlete is crucial in order for the coach to offer support with decision making, particularly in terms of the planning and execution of new and challenging moves (more on this in Chapter 6). The following excerpt from an interview with Toby Miller, 13 year-old US snowboarding prodigy, identifies the impact and influence of the coach:

> Bud Keene is recognized as the best coach in the business, he is the Chuck Norris of snowboarding . . . The biggest tip Bud Keene has given me is "I would not let you try this trick unless I know you can do this trick" which always makes you feel comfortable because that just tells you that he believes in you and that he knows you are ready to try these big tricks. (ESPN, 2014).

No matter where the power lies as influenced by unique dynamics of the coach-athlete relationship, the coach has prodigious responsibility for ensuring the safety of

the athletes he or she works with. In fact providing a safe training environment is the foundation for the facilitation of optimal progression.

2.5.2 Elite Training Facilities

Historically, athletes would use soft snow conditions present in the spring or soft powder snow conditions in the winter to progress their trick repertoire and attempt new moves which had a greater difficulty and, as a result, greater injury risk. Skip to the present and training facilities have improved. Additionally, increased financial resource for individuals and national teams can now pay for things like private training camps, foam pits, and huge airbags on snow (see Appendix B) in which athletes can build towards mastery of a trick without as much consequence if things go wrong. Even with the best facilities money can buy, however, there is still that critical and challenging moment when it is time to take a new trick to snow for the first time. Furthermore, significant subsequent rehearsal is required before a new trick will be dependable in any condition in a pressure competition situation.

2.5.3 Nature of Performance Progression and Competition Pathways

In some disciplines, for example women's freeski halfpipe or slopestyle, the elite field currently lacks depth of quality at the top end, and therefore it is possible to qualify for major events such as the Winter Olympics and World Championships with a skill set far lower than male counterparts for whom courses have been designed. This means that some athletes are being exposed to risks in competition and official competition training that they are not necessarily prepared for and therefore are putting themselves in greater danger of injury.

The ethos of the sport is about pushing boundaries, and those that subjectively judge the sport and provide the scores which will define an athlete's position in the competition have often been recognized as the gatekeepers of the sport's future (e.g., Kennedy, 2014b). Progression is rewarded in the overall impression judging criteria

which also takes into consideration risk taking and difficulty (FIS, 2013). Execution's strong position in the pecking order of the judging criteria tempers the reward for pushing things beyond reasonable limits: The judges aim to help athletes avoid injury risk by requiring manoeuvres to be well-rehearsed and performed with finesse rather than out of control and dangerous. Nevertheless, the cultural clash between the traditions and the new competitive status of the sport, added to the inherent pressures of greater media attention and potential rewards, are yet another factor which must be catered for in the next few years of crucial development.

2.6 Implications

To conclude this overview, I explain the implications of the various conundrums which this chapter has identified. I also offer some initial suggested guidelines for practice and highlight areas for further research. As I suggested earlier, the sport can make a significant contribution to all aspects of the Olympic ideal, encouraging involvement from wider audiences, both as spectators and as participants. To fulfil its destiny, however, the sport needs to be supported and carefully handled by its international sporting bodies as it continues to transition through this vulnerable stage in its growth. As a further and perhaps more immediate agenda, there is a need to direct the different components to ensure optimum development of impressive *but safe* performance. Finally, as coaches, support scientists, and (hopefully) humanitarians, there is a need to ensure optimum care for the athletes. Subsequent commentary considers the various aspects of this genuinely interdisciplinary process.

2.6.1 Mitigating High Injury Risk

It is clear that the complex and multidisciplinary nature of P&P performance requires an interdisciplinary approach for best effect where the support team work as a collective to provide holistic solutions to the challenges faced by the sport and the athletes.

Conditioning

Identifying any predispositions to injuries via musculoskeletal and movement competency screening provide the proactive physiotherapy and prehabilitation team with an opportunity to deal to these predispositions in advance through a suitable neuromuscular control and conditioning programme. Based on current evidence, I would suggest that movement conditioning rather than strength and conditioning per se has a higher priority within the athlete's skill profile. There is no doubt that a minimum general condition, fitness level, and musculoskeletal balance will reduce an athlete's injury risk and impact their ability to progress. However, higher order and arguably more influential variables with respect to performance will include their agility, adaptability, and rate of learning impacted by their movement vocabulary (cf. Leifeith et al., 2014). In short, injury mitigation can best be achieved by equipping athletes with a broad base of movement vocabulary at early stages of their growth and development, and extending that vocabulary during sport specialization to align with trick progression. For example, learning how to crash safely is a crucial skill generally learnt intuitively during the various minor and major crashes which are part and parcel of training for the sport. Explicit approaches including gymnastics, tumbling work, martial arts, and other contact sports can be used to bolster this skill.

Long-Term Development

Some long-term athlete development models (e.g., Balyi & Hamilton, 2003) identify windows of opportunity for developing certain skills; for example, suggesting that building the aerobic base and strength training have a window of accelerated adaptation between the ages of 12 to 16 in males and 11 to 15 in females. There is a considerable body of work dedicated to promoting a general approach to skill development in the early years and avoidance of early-specialization (see Jayanthi, Pinkham, Dugas, Patrick, & LaBella, 2013, for a review). While the general conclusion

is that early specialization at the exclusion of other sports is not recommended for most sports, an optimal long term development model aimed at elite performance specific to P&P has not yet been thoroughly researched. It is also unclear if an athlete who has missed an optimal window of fundamental skill development, if indeed such windows exist (cf. Baker, 2003; Collins, Bailey, Ford, MacNamara, Toms, & Pearce, 2011), can still progress in a specific performance component. Is the adage that 'you can't teach an old dog new tricks' actually true in relation to P&P skill progression?

While the debate over the perils of early specialization continues, recent work on movement agility (Leifeith et al., 2014) promotes a twin track approach whereby athletes combine both generic and specific agility training into their schedule. This appears to be a useful approach in P&P to achieve both an increase in base movement vocabulary, which in turn equips the performer with more options for finding movement solutions (especially when crashing!), and also skill transfer from related and more sport-specific movement tasks.

Mental Skills

It has already been highlighted that a key component of cutting edge performance in P&P includes operating close to the progression-injury threshold. An athlete may be operating at or close to their personal limit of risk for multiple days in a row as they attempt to acquire new skills (a deeper discussion of this notion is provided in Chapter 8). It is inherent therefore that strong mental skills, self-awareness, and coping mechanisms are in place to ensure the athlete can safely navigate these dangerous waters finding the route to progression and success and avoiding the multiple terrain traps in their path. This implies that a strong psychology knowledge base is available to the elite performer and that developing athletes incorporate mental skills education and training into their programme.

(P)Rehabilitation

With the high incidence of significant injuries, there is an element of when rather than if an injury will occur for an elite P&P athlete. The physical and psychological impact of the injury and the quality of the physical and psychological rehabilitation are therefore crucial aspects of a nurturing approach to athlete support. Medical teams often include team physiotherapists and team doctors, but it is perhaps the inclusion of the sport psychologist and coach for a truly interdisciplinary approach to rehabilitation and, indeed, prehabilitation that could be the vital components to ensure return to sport is not hampered or restricted by a lack of psychological readiness.

Hardware and Equipment

Prevention is better than cure: minimizing injury severity and occurrence through use of suitable equipment is common sense. The advantages of wearing helmets amongst the general population in snow sports appear unequivocal: Based on a literature review of 45 articles, Cusimano and Kwok (2010) conclude that there is strong evidence to support the benefits of wearing helmets to reduce head injuries in skiing and snowboarding. McIntosh et al. (2011) in their meta-analysis of various studies on snowboarders and skiers including data from the 2010 Winter Olympics identify snow sports along with equestrianism as sports with high risk of severe traumatic brain injury and credit helmets for reducing moderate to severe head injuries. However, the appropriateness of standards for recreational helmets was questioned when transferred to elite competitors where impact forces can be far greater. There has been a wave of attention lately on the long-term debilitating effects of concussion in American football, prompting research which has found significant differences in concussion rates with different models of helmet (Rowson et al., 2014). Further investigation and innovation in helmet design is warranted to decrease head injuries including traumatic brain injuries specific to P&P.

While the risk of orofacial injuries are clearly reduced by using a mouth guard (Knapik et al., 2007), links between mouth guard use and a reduced severity in concussion are tenuous at best (Benson, Hamilton, Meeuwise, McRory, & Dvorak, 2009). Novel approaches to injury prevention equipment include the advent of wearable airbags. Developed recently in the snow sports industry to help avoid burial and protect the head from trauma when in an avalanche, the latest innovation in airbag technology has been transferred to snow sports from Italian motorcycling equipment maker Dainese. A partnership with the International Ski Federation's injury surveillance system (FIS-ISS) has seen the research and design of a product which uses accelerometers and a gyroscope to deploy when it senses a skier has experienced forces that resemble a high-speed crash. Significant modifications to the prototype were made throughout testing regarding the deployment algorithm, pneumatic components, ergonomics, inherent safety, and aerodynamics. Unfortunately, while an exciting prospect for injury mitigation in alpine ski racing, the algorithm designed specifically for downhill is likely to deploy the bag for the majority of P&P tricks at this stage according to Vittorio Cafaggi, corporate marketing manager at Dainese (personal communication, July 11th, 2014).

Athlete Autonomy, Monitoring and Self-Awareness

As discussed, a key component in the decision making and risk management process are the athlete themselves; a factor which must be an explicit focus for any coach in high risk sports (cf. Collins & Collins, 2012). It is crucial, therefore, that they are highly aware of their inner state including levels of physical, mental, neural, and emotional fatigue. Overt monitoring practices including both quantitative load measurement and qualitative self-report psychometrics in the form of a training diary can increase the quality of information available and inform the decision making and risk management process (more on this in Chapter 9). This information can also help

identify to athletes and their support team when they are moving into the danger zone of injury risk or have sufficiently recovered from a training or competition stress allowing a more sophisticated manipulation of the training load.

Fostering an athlete-led programme to ensure autonomous and competent skills in terms of risk management and decision making will further support this agenda. Certainly, the application of principles from self-determination theory (e.g., Deci & Ryan, 2008), used with young people to such good effect in activity focused interventions (e.g., Chatzisarantis & Hagger, 2009), will enhance the efficacy of any such performance programme. The interactive focus on role ('what do I need to do?'), autonomy ('I know how to achieve this') and efficacy ('and I know I can do it') is a very positive and powerful combination in any performance environment, let alone one as individually dependent as this.

The Support Practitioner Approach

The P&P athlete will benefit from developing in an environment conducive to long term development gaining interdisciplinary support from both specialists and generalists with an individualized programme that fits into wider team structures. Opportunities to show off should be encouraged, creative flair and autonomy should be promoted. An interdisciplinary approach to service provision is crucial for sound prioritization and impact of support and investment.

2.7 Concluding Comments

The P&P disciplines involve unique characteristics, challenges, and risks that an interdisciplinary support team must continue to critically evaluate as athletes and the sport evolve. Focusing on the athlete's individual needs and wellbeing at the centre of the performance puzzle while having an acute awareness of the past, present, and future of the sport are both key to successful application of relevant theory.

This chapter should also offer a useful overview for readers of this thesis, showing the complexity of interacting factors, which must be addressed when planning and deploying support packages to new sports; they are *not* all the same! Clearly, this chapter suggests the need for various intertwined actions; in sport policy, sports science approaches, and coaching. As the P&P disciplines continue to transition into the mainstream, maximizing performance progression while minimizing injury will remain an ongoing challenge.

CHAPTER 3

ADDRESSING CHALLENGES TO THE NEW CULTURAL MILIEU

3.1 What Sorts of Challenges Exist to This New Direction?

In Chapter 2, I provided an overview of P&P in its new guise as an Olympic sport. As part of this overview, I identified the challenges this new status brings and highlighted those challenges that P&P continue to face as the sport evolves. I also intimated that the traditions of the sport may generate a backlash in an attempt to maintain many of the features, both positive and negative, of its old status. For example, Ojala and Thorpe (2015) argue against the effectiveness of coaching and highlight the challenges among a small group of Finnish elite snowboarders. Furthermore, they propose Problem Based Learning (hereafter PBL - Savery & Duffy, 1995) as being better suited to the ethos of P&P as an action sport. This interesting development encouraged me to take a second look at the social milieu and implications highlighted in Chapter 2. Accordingly, in this chapter I describe the challenges raised by Ojala and Thorpe (2015), together with counters to the specific points raised.

3.2 The (Finnish-Snowboarding) World of Action Sports According to Ojala and Thorpe

Ojala and Thorpe (2015) contend that in recent years, as action sports have become more institutionalized and competitive, coaches have become more commonplace. Ojala and Thorpe (2015) report that 28 Finnish snowboarders concluded that "Coaches are ineffective for elite snowboarders" (p. 66). The authors cite perceived top-down hierarchical power-relations in the coach-athlete relationship as a pre-cursor to resistance to coaching by members of their sample. Ojala and Thorpe (2015) further report that the majority of coaches are only useful for development level athletes and female snowboarders. Of the roles performed by the coach, management and logistical support was seen as a positive contribution, however technical skill

development was suggested to be better suited to peers and mentors. Ojala and Thorpe (2015) also report that the 'athletes' interviewed suggested that in order for the coach to have credibility he or she needs to have performed the skill they are teaching. Digging deeper, it appears that this perspective is not unique to the Finnish snowboarding scene. In Mark McMorris' (2014 Olympic bronze medallist) biography on the Canada Snowboard website, it states: "McMorris usually trains without a coach since, from his point of view, there is no coach capable of doing what he can do on a snowboard" ("Mark McMorris Rider Bio," n.d.).

Additionally, the coach is encouraged to respect the cultural values within the sport and take time to respect the individual goals of the athletes rather than "assuming traditional sporting values and coaching practices" (p. 66). Furthermore, Ojala and Thorpe (2015) unequivocally present PBL as an effective coaching tool for action sports coaches due to its promotion of control for the learner, self-directed learning and respect for individual goals and values.

3.3 Confirmation, Confusions and Counters – My Response

As discussed in Chapter 2, I concur with Ojala and Thorpe's (2015) statement on the "unique value systems" which athletes may hold and also that "not all action sport athletes pursue careers via competition" (op cit., p. 65). Indeed, this was a crucial part of my own argument in examining the important influences of social milieu and culture in the support approaches used with performers (Willmott & Collins, 2015). It is essential that the social and cultural context of any sport is carefully considered when developing appropriate support structures. Indeed, the structures and systems around coaching are themselves a social and cultural setting; a consideration when deciding on the optimum pathway for coach development, methodology and deployment (Stoszkowski & Collins, 2014).

However, Ojala and Thorpe (2015) go further and present a limited picture of performer perceptions. They also seem to lack balance in their presentation of PBL. Their absolutist stance seems contrary to the position that good coaching is a decision-making game (cf. Abraham & Collins, 1998, 2011; Collins & Collins, 2016), and is holistic and inclusive in its methodology; in short, a single method of coaching is almost inevitably flawed and the fundamental of good practice is the ability to select the right tool, at the right place and the right time to develop an individual performer. Accordingly, I present a short treatment of my counter position, including consideration of Ojala and Thorpe's (2016) comments on our original response paper (Collins, Collins, & Wilmott, 2016).

Counterpoint 1: Role of Coaching and Coaches in Action Sports

In a response to the concerns raised in this article (Ojala & Thorpe, 2016), the authors provided clarification of the sample in their original paper (Ojala & Thorpe, 2015). Participants (n=15) were interviewed regarding the role of the coach. Of these participants, eight were competition-oriented, five were film-oriented, while two were equally film and competition oriented. This presents a juxtaposition of competitive focused *and* media focused athletes within its sample. These sub-categories, despite having an overlap, are understandably at opposite ends of the spectrum with respect to perspectives on the role of the coach. Interestingly Ojala (2014, p. 64) herself highlights that "snowboarders perceive competitions and filming or photo shoots as two different subfields in which different institutional elements are emphasized". Methodologically, if the sample was known to include two sub-groups of participants, then a split in the data and subsequent inferences should have been made to ensure validity. It is clear that some athletes will successfully transition from a competitive-focused to a media-focused career, and some are able to maintain elements of both at the same time. However, the evolution of the sport and progression of performance

levels has seen a natural shift for the professional from generalization across all elements of the sport (both across competitive disciplines *and* performing for cameras outside of the competition arena) to increased specialization due to the sheer amount of time and focus required to remain competitive and relevant at the elite level in the discipline of choice (The Specialisation of Snowboarding, 2012).

The position presented is certainly at odds with my own experience of action sports participants (in practice and during this research) and suggests that the sample may be biased. To my knowledge, most of the current top Finnish competitive snowboarders passed through the Vuokatti-Ruka Sports Academy coached by Pekka Koskela and Antti Koskinen, including Olympic silver medallists Peetu Piiroinen and Enni Rukajarvi, "…and have had plenty of coaching and structure present in both their formative and elite years" (P. Koskela, personal communication, April 7th, 2015). Interestingly, Ojala and Thorpe (2015, p. 65) cite Rukajärvi as stating that she "… might pass on the next Olympics"[2] because she prefers styles of snowboarding which have more "soul". This is clearly supportive of multiple cultures within the sport, which my own work inherently acknowledges, but surely *not* indicative of an anti-coaching stance. This may suggest a need for a skill akin to cultural intelligence on the part of the coach (Peterson & Brooks, 2004). Finally, Ojala and Thorpe (2015) state categorically that "many of the most internationally recognized Finnish professional snowboarders have no affiliation with the FSA" (p. 66) the national governing body which provides coaching, science and funding support for performance. The absence of any data to support this contention, either qualitative or quantitative, is a clear weakness and would seem at odds with both the facts and perceptions reported above.

[2] skip to the first FIS points list of 2018 and following a foray into filming in the backcountry Enni Rukajarvi is back on the competition scene ranked 1st for Slopestyle, 3rd for Big Air (FIS, 2017) and has qualified for the PyeongChang 2018 Winter Olympics in both disciplines. She actively works with current Finnish National Head Coach Antti Koskinen.

Ojala and Thorpe (2015) also appear to present a rather narrow and dated view of what coaching is. Directly developing high end technical skills by telling/showing an athlete how to do a trick is a small facet of coaching (Willmott & Collins, 2015). I would argue that while definitions of coaching struggle with a lack of clarity (Collins & Collins, 2012) this view is dated at best and illustrative of ineffective coaching at worst, hence Ojala and Thorpe's (2015) findings. Shaping and driving the essential feedback-rich training environment is by far the more impactful role for most coaches. This differs from the "traditional, authoritarian" style which Ojala and Thorpe (2015) appear to be discussing (p. 66). Based on my experience it simply wouldn't be tolerated and certainly would not be effective.

I was also interested to note that "if the coach is to be taken seriously with respect to enhancing snowboarding skills, he or she must have personally experienced and successfully performed the skills they are teaching" (p. 66). My experiences of working with Bud Keene (former coach to Shaun White, double Olympic and multiple X-Games gold medallist) and Hamish McKnight (coach to Billy Morgan, executor of the world's first quad-cork) would suggest otherwise. Indeed, any sport is going to be very limited in its progress if this perception of only teach what you can do were in any way universal. Surely, the point of any elite coach in any activity is to enable performers to exceed their own achievement. Any sport at the elite level relies on coaches who can develop levels of skill higher than their own!

Counterpoint 2: The Uncritical and Sole Promotion of PBL

An effective coach will make use of a wide variety of coaching styles, using Professional Judgement and Decision Making skills (PJDM – Abraham & Collins, 2011; Collins & Collins, 2014, 2016) to select the optimum tools for each specific context. As such, meaningful consideration of any potential coaching methodology (by implication from any source) should reflect a balanced, pros and cons approach.

Medicine and education have a long engagement with PBL and provide an informed perspective on PBL's value. So where are the pitfalls and potential weaknesses of PBL?

Tan (2004), Wood (2003) and Morgan, Jones, Gilbourne and Llewellyn (2013) all highlight that inexperienced learners experience insecurities, stress and overload until they are familiar with the PBL process. While stresses and pressures need not be avoided, and are arguably an essential part of deep learning (cf. Bjork 1994) and the development of an expert performance (Collins & MacNamara, 2012), this does suggest three points; (a) that students at different stages of learning may require different teaching approaches; (b) that epistemological and ontological differences may present challenges (c) cultural perceptions of effective coaching are an important factor. The provision of declarative knowledge, at least in problem solving, will surely be required prior to its use (Tan 2004). The 'take home' being that, in fact, PBL does not meet everyone's needs all of the time.

More importantly, the question of efficacy of PBL as a pedagogy also has to be considered. PBL potentially falls into the trap of being a fashion despite its 50-year history. I feel that this is an unwelcome tendency in coaching and education. Notably, Newman (2003) reduces these criticisms to a lack of high quality evidence, doubtful experimental design and the nuances of PBL in its application. The lack of empirical evidence necessitates greater research rather than assumptions on its validity in regard to PBL and its relevance and value in action sports coaching. The nuances associated in its application demonstrates a need for judgement and decision and supports my contention earlier that action sport coaching, in fact all coaching, is a PJDM based activity.

Interestingly, Butler, Inman and Lobb (2005) identify that PBL does not necessarily develop understanding. This may be an experimental design or application issue, but does raise the potential that PBL may not fit within the notions of

constructivism despite its alignment with those philosophies. This appears to be supported by research that identifies that PBL does not foster application or integration of knowledge, build on existing learning, develop forward reasoning or cognitive abilities (Morrison, 2004; Walsh, 2005). Admittedly, these views are challenged (cf. Albanese & Michell, 1993; Norman & Schmidt, 2000; Vernon & Blake, 1993) but the jury is definitely out in this respect. At best, Morrison, (2004), Moust et al, (2005), Morgan, Jones, Gilbourne and Llewellyn (2013) and Newman, (2003) highlight that more research is needed, and that findings for the efficacy of PBL are inconclusive (I echo this position).

Finally, Norman and Schmidt (2000), and Colliver (2000) comment that PBL has been 'over sold' by its advocates and identify that "any study that treats PBL as a single intervention and examines the usual cognitive and clinical outcomes will arrive at a conclusion of minimal difference" (Norman & Schmidt, 2000. p. 727): against such critique, its use has to clearly be more carefully considered and investigated. Consequently, and in the present context, I would question the positive picture of PBL which Ojala and Thorpe (2015) provide and encourage, two further considerations (1) a more pragmatic approach to its application based on evidence and further research and (2) consideration of PBL alongside other pedagogies.

3.4 In Conclusion

Action sports present the coach and research with a new array of challenges. Developing a body of knowledge that relates to action sports is a common goal of both mine and Ojala and Thorpe's (2015) investigations: within this emerging culture a healthy academic debate is essential. I contend that Ojala and Thorpe's (2015) engagement with a single (albeit nonhomogeneous) group prevents understanding of broader trends, and different ways of knowing. I observe that, based on the two issues I have raised, such limitations are apparent in the perspectives provided. As an example

of the limitations, they cite Hmelo-Silver and Eberbach (2012) on the goals of PBL as being to develop (a) flexible knowledge, (b) effective problem-solving skills, (c) effective self-directed learning skills, (d) effective collaboration skills, and (e) intrinsic motivation. I would have to observe that, far from being the sole preserve of PBL, this summarises all good coaching.

3.5 Section Summary

As set out at the start of Chapter 2, the purpose of the two chapters in this section was to provide a baseline picture of the social milieu surrounding P&P. Unsurprisingly perhaps, P&P has its peculiarities and special considerations as with any other human activity. Reflecting the challenges raised by Ojala and Thorpe (2015), I feel that the position and status of coaching is rather different to the picture that they paint at least with regard to the elite end of the sport which is my major focus. Importantly, however, checking issues of both culture and acceptance of coaching represents an important issue to be addressed later in the thesis.

Finally, *if* coaching is important then teasing out best practice principles and methodology will represent a big step towards addressing the questions posed for this thesis.

Accordingly, and on the basis of the work so far, I suggest that:

- culture is an important factor in coaching *any* sport, not just action sports.
- Action sports athletes may be far more accepting, indeed desirous, of *good* coaching than Ojala and Thorpe (2015) suggest.
- PBL is one technique of many. The decision to use the right tool in the right place at the right time with the right person being the pivotal factors in good coaching.

CHAPTER 4

METHODOLOGY

4.1 Introduction to THE SECTION (Chapter 4, 5, 6 & 7)

Chapters 2 and 3 highlighted some of the tensions inherent in P&P as a new Olympic discipline as it transitions towards mainstream sport. Specifically, the training challenges of athlete health balance was considered: a usual issue for most sports but a particular one for these high-risk disciplines. Moving to my own empirical examination of relevant issues (cf. Chapter 1), the next section considers the impact and operation of coaching in P&P from different perspectives in three chapters (5, 6 & 7). Based on a pragmatic research philosophy, as discussed in Chapter 1, a mixed methods approach was used including triangulation within and between chapters, incorporating, both qualitative and quantitative methodologies. The combination of athlete interviews in Chapter 5, coach interviews in Chapter 6, an athlete survey in Chapter 7, along with personal observations throughout, are outlined in this chapter.

4.2 Chapter 5 Methods – Athlete Interview

4.2.1 Athlete Interview - Participants

Eight elite athletes (M_{age} = 22.5 years, *SD* = 3.42) from New Zealand and the United Kingdom along with their respective nationally appointed coaches, (N=5; M_{age} = 38.8 years, *SD* = 10.83) were purposively selected into a stratified sample, with at least both one male and one female athlete engaged in each of the three new Olympic P&P disciplines: freeski halfpipe, freeski slopestyle, and snowboard slopestyle. All athletes represented their country at the Sochi 2014 Winter Olympics, where six achieved top-10 results, the two remaining athletes were injured at Sochi, but have since achieved major event podium results. To maintain participant confidentiality, athletes' demographics are kept deliberately brief (Table 4.1). Athletes were recruited by contacting their coaches and national sports organisations and requesting their involvement in the study.

Coaches were invited to assist their athletes in recalling their progression over the past four years. Informed consent was obtained *a priori*, detailing the purpose, voluntary and anonymous nature of the study.

4.2.2 Athlete Interview Design

A semi-structured interview lasting approximately one to one-and-a-half hours was completed (see Table 4.2), recorded, and transcribed verbatim. Questions were developed through consultation, against the need to elicit participants' experience of trick progression. Pilot testing was completed with an independent athlete-coach dyad. Each question was open-ended, thus yielding a variety of responses pertinent to each athlete and resulting in 22 typed pages of transcripts. Probes and prompts were used for clarification and elaboration of key points, and to obtain consistency in the depth of responses (Patton, 2002).

As a first step, and in order to aid recall of detail with respect to objective 2.1, participants were asked to provide a timeline sketch of their own progress against key tricks over the course of the past quadrennial (see Figure 4.1 for an example). This approach has been previously shown to increase the accuracy and veracity of recall (e.g., Drasch & Matthes, 2013; Ollis, MacPherson, & Collins, 2006). To specifically address objective 2.2, athletes and coaches were asked to weight training modalities and level of effort by completing an excel spreadsheet calculating % of time spent performing each modality (see Table 5.1), and identifying effort invested on a scale of zero (zero effort) to 10 (maximal effort) to establish averages and variance across this sample (see Table 5.2).

4.2.3 Athlete Interview - Data Analysis and Trustworthiness

Content analysis of the interview transcripts was completed as a categorical breakdown: grouping responses that matched themes of the various elements of investigation. Trustworthiness was established through three means. Firstly, the

involvement of the athlete and his/her coach increased reliability as athletes and coaches could confer or correct each other to aid in recall of the details of progression over the previous 4 years. In all bar one of the interviews (coach unavailable), athlete and coach were interviewed together. Secondly, member checking was conducted whereby full transcripts plus selected quotes for each athlete were dispatched to athlete and respective coach, and approved. This resulted in no modifications or requests for change. Thirdly, a copy of the draft paper was approved by all participants (athletes and coaches), both with respect to the accuracy of the quotations used and also the veracity of the interpretations made.

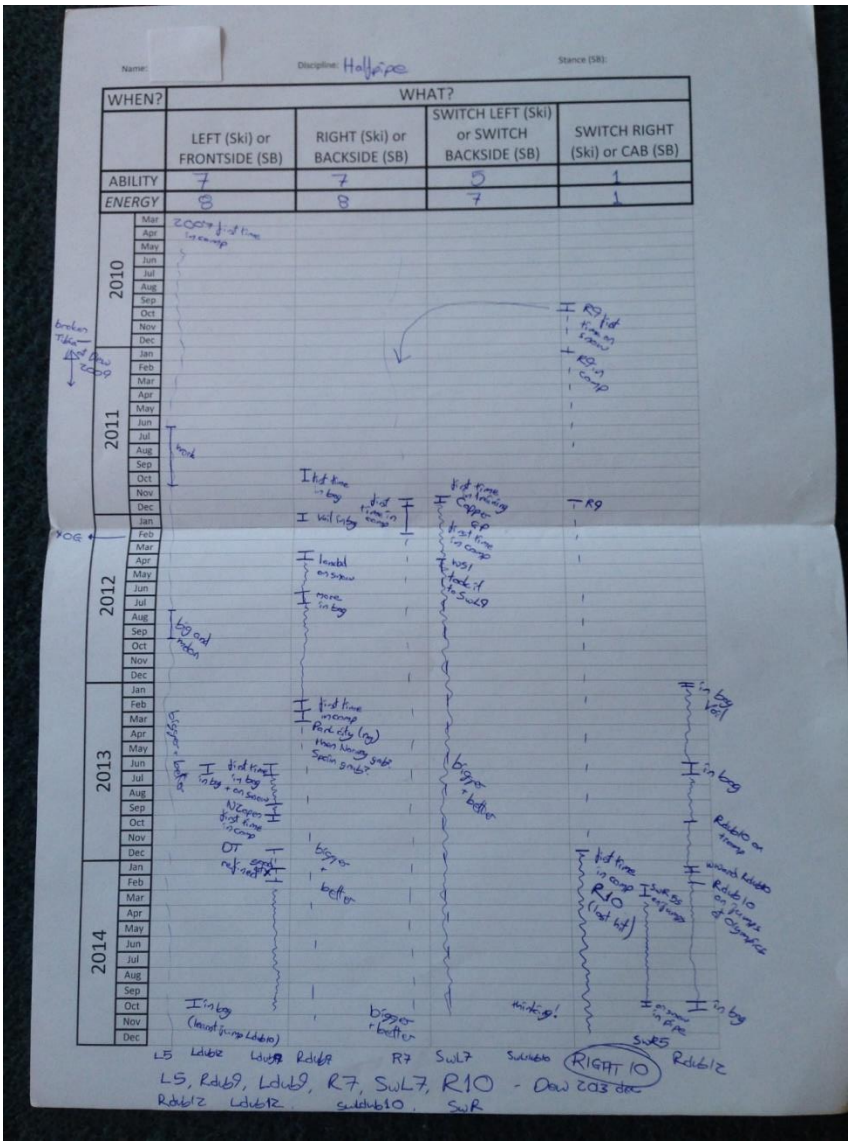

Figure 4.1 Exemplar Data Collection Sheet

Label	Gender	Freeski/Snowboard	Discipline
P1	Male	FS	Halfpipe
P2	Male	FS	Slopestyle
P3	Male	SB	Slopestyle
P4	Male	FS	Halfpipe
P5	Female	FS	Slopestyle
P6	Male	FS	Halfpipe
P7	Female	FS	Halfpipe
P8	Female	SB	Slopestyle

Table 4.1 Athlete Interview - Participant Profiles

Question	Probes	Stimuli	Purpose	
1. What is your current hardest trick? *a) in competition* *b) in training*	• What makes them the hardest?	• Overall difficulty • Gnarly-ness • Personal progression – I have found this sort of stuff difficult	• Establishes current performance level • Starts to probe progression rates and methods	**10**
	• What is the difference between the training and comp trick? • Why	• How long will it take to move the trick from single, training reps to a place in your comp routine? • What sorts of progressions/methods will you use?		
2. Considering single tricks, take me through your progression over the last four years?	• Where did you start?	• Think back to where you were performance-wise • Against major competitors??	• Looks at progression – both rate and line of advance • Planning process – is there one and who is involved? • Look for possible sticking points, lack of linearity, preferences for side/direction, etc.	**20**
	• Any waymarks or critical dates along the way (e.g., major comps, change in coach, etc.)?	• It MAY help to draw a timeline then work from that		
	• Was this done to a specified plan	• How and when was the plan drawn up? • How far in advance do you look? • If no plan, who and how have progression decisions been made?		
3. How does this match the progression of your routine?	• When and why do you move a trick into your routine?	• How well does this work? • Has it ever gone wrong?	• As above	**10**
	• Is the evolution of routine based on how well/quickly you develop a new trick?	• What are the underpinning principles, if any, of how your routine progresses?		

Question	Probes	Stimuli	Purpose	
4. What are your favourite/usual/most effective methods for development?	• Bag/water jump • Trampoline/gymnastics work • Coach input and discussion • Training camps with others • Solo sessions • Imagery • Other (please specify)	• Relative weighting in frequency of use and importance • How these are combined together • Where/who did this come from?	Varied use of training methods	**15**
5. How much is your progression impacted/influenced by that of your competitors	• Watch them at comps • Watch them at camps • Listen to gossip/media • On my own path	• Social influences in the sport. • Has this changed over the last four years/as the Olympic push has come in?	• Solo versus group focussed orientation	**5**

Table 4.2 Athlete Interview Guide

4.3 Chapter 6 Methods – Coach Interview

4.3.1 Coach Interview - Participants

A purposive sampling approach was employed to ensure both a geographic and discipline spread. Coaches were selected based on involvement across the spectrum of coaching levels from regional development programmes to elite levels, whilst all were actively currently coaching athletes at an elite level. Coaches where contacted by email and asked for their willingness to be involved in the research project. In the invitation email, an information sheet on the nature of the research project and an informed consent form was provided identifying opportunity to withdraw from the research. Ten coaches participated with a mean age of 39.6 years (SD=8.32), and a combined 105 years coaching at the elite level. Nine of the coaches were male and one was female. All had worked with athletes who had achieved multiple major event podiums, six of the coaches had coached athletes to Olympic podiums. From five different nations, participants were currently in National Head Coach (n=4), National Coach (n=3), Regional Programme Director (n=1), Private Programme Director (n=1) and Private Coach (n=1) roles, working with athletes representing eight different national teams across four continents. Brief demographics are presented in Table 4.3. No incentive was offered and as with my earlier work, specific demographic information has been withheld to protect anonymity.

4.3.2 Coach Interview Design

Questions were developed through consultation, against the four areas of research interest identified in the introduction. Probes and stimuli were used for clarification and elaboration of key points, and to obtain consistency in the depth of responses (Patton, 2002, see Table 4.2). Pilot testing was completed through one coach interview, leading to the movement of one probe from one area to a more appropriate research area, three slight modifications in the wording of stimuli, and one new stimuli

question added to the end of the interview in response to asking the participant what had not been asked (as recommended by Levitt, 2015). Apart from these modifications, the pilot process suggested the interview schedule to be sound. Each question was open-ended, thus yielding a variety of responses pertinent to each coach and resulting in 163 single-spaced, size 11 font-typed pages of transcripts.

Label	**Age**	**Years Coaching**	**Years Coaching Elite**	**Disciplines**
	M=39.6, SD=8.32	M=16.3, SD=5.31	M=10.5, SD=4.65	Total=5
C1	31	10	3	SB SS & BA
C2	47	20	12	SB HP
C3	43	16	5	FS HP
C4	56	27	17	SB & FS HP
C5	46	22	16	FS HP
C6	33	14	9	SB HP & SS
C7	32	11	8	SB SS & BA
C8	36	16	13	FS SS
C9	40	15	14	FS HP
C10	32	12	8	SB HP

Table 4.3 Coach Interview - Participant Profiles (representing 5 nationalities coaching athletes from 8 national teams)

Question	Probes	Stimuli	Purpose
1. What is the nature of the optimum coach-athlete relationship in action sports?	• On a continuum from direct instruction to guided discovery, where do you operate? When? Why?	• Do you change/vary how you are working? When and why? • When is it appropriate to operate differently? • How important is trust in the relationship?	• Clarifies and investigates degree to which a trusting coach-athlete relationship is required • Investigates coaching styles in action sports
	• Who is responsible for decision making? Athlete, Coach or both?	• Does this vary? • Differences – gender, stages of development, individual • Why and based on what?	
2. What training aids and coaching tools do you use?	• How do you manipulate the training environment?	• Do you target training camps in different seasons? Do you target soft-snow conditions? • What is your perception of the usefulness of airbags? • Do you purposefully vary the size of jumps/type of pipe your athletes train on	• Establishes common coaching tools and their pros and cons
	• Specialist Support	• What sport science/other specialists do you incorporate into your athlete's training	
	• Off-snow movement	• What off-snow training apparatus do you use with your athletes? • What are the elements of general and specific transfer that you are looking for? Please provide some examples? • Other types of training – moving platform?	
	• Physicality & Robustness	• How important is strength and conditioning? Which elements are the most crucial and why?	
	• Mental Skills • Skill Acquisition • Embedding Process	• Do you prompt your athlete to model off others? • Use Imagery? Consider the rhythm, of a trick? • Encourage and develop coping skills? i.e. self-talk, amp-up/relaxation before dropping in… • What sources of information (feedback) do your athletes have? Objective/subjective? Do you cue them on specific body parts?	

		What their equipment is doing? Do you break a trick down into components or focus on the trick as a whole? • What are you talking about the most with your athletes? • What is the role of video feedback? • Are there any other training aids or coaching tools that you use? • Once a trick has been acquired, what do you do to develop it further?	
	• How do you balance the use of these tools/support?	• On what criteria? • When, why, how? • How/where from do you innovate/get new tools? • Has formal coach education played a part?	
3. Planning/Adaptation. How far in advance do you plan with your athletes?	• Nested thinking versus Adapting on the fly • Constraints to planning? • Periodization (Macro/Meso/Micro)?	• Are your athletes involved in the planning? Is there a written plan? • Are the athletes aware of the long-term plan and why they are doing certain things at certain times? Why/why not? • Do you and your athletes change things and adapt on the fly? When and how does this happen? • Do you reflect on your coaching? When does this occur? • Who is responsible for decision-making around changes to the plan?	• Identifies how much nested planning is considered in FSSB • Establishes current perceptions of planning
4. How do you account for the risk inherent in the sport in your planning and coaching?	• Monitoring and adjusting? • How do you adapt to changing weather/snow conditions during a session/training camp • Pro-active skills development versus reactive support	• What role does risk play in your planning process? • Do you have any tools in place? Formal? Informal? • Do you review your thought processes during a session? • Do you systematically develop and enhance coping skills for dealing with risk? • What are the differences between action sports and conventional/other sports? Coach-athlete relationship? Culture?	• Examining the influence for the distinctiveness of action sports

Table 4.4 Coach Interview Guide

4.3.3 Coach Interview - Procedure

All participants were recruited directly. All agreed to take part and completed informed consent, the study having been approved through the University Ethics Committee. A semi-structured interview which varied in length (mean duration = 74 Minutes) was completed (see Table 4.4). All interviews were held at a location and time agreed with the participants, three of the interviews were conducted via Skype, which has been shown to be an acceptable method for this style of research (Deakin & Wakefield, 2014). Interviews were recorded on Iphone six Voice Memo software and transcribed using a commercial transcription service. To guarantee anonymity, the letter C for coach and the numbers 1–10 were used to identify each participant. Inductive content analyses were conducted for each participant: specifically, after reading and re-reading the transcription, qualitative analysis software (QSR NVIVO 11) was used to transform raw data units into thematic hierarchies by recursively engaging in tag creation, category creation and category organisation (Côté, Salmela, Baria & Russell, 1993), to provide tabulated data across the four research areas.

4.3.4 Coach Interview - Data Analysis and Trustworthiness

In the introduction to the interviews, I explained the potential for conflict of interest between coaches and systems, how this was to be avoided and the purpose of the research. The opportunity to refrain from answering specific questions was offered, however in no case was this taken up. Member checks were conducted with participants, involving emailing key quotes to check their associated meaning had been correctly construed (as recommended by Morrow, 2005). From this process no thematic categories were changed, eight quotes from one of the coaches received minor adjustments. To enhance the trustworthiness of the analytic process, the full table of derived themes, together with a 10% sample of raw data, were examined by an independent researcher. Furthermore, this individual was used as a

'critical friend' throughout the process, providing a sounding board for questions as they arose (Kember et al., 1997).

4.4 Chapter 7 Methods – Athlete Survey

4.4.1 Athlete Survey - Participants

The survey received a total of eighty-five responses, seventy-one of which were fully completed; a further fourteen were partially completed. One of the partially completed surveys was excluded from further analysis because the participant did not meet the minimum level of competition experience. Due to demographic data being included at the end of the survey, this information was missing in some of the cases of partially completed surveys. Otherwise, incomplete data sets were included in the analysis to maximise the picture

4.4.2 Athlete Survey - Questionnaire Design

A survey was created on the 'Survey Monkey' hosting website (see appendix C) including questions related to two recent tricks that had been acquired. In the first part of the survey, participants were instructed to consider a new trick that they had recently learnt. Participants were asked to identify if they had used a variety of training aids and tools and the extent that each of the 24 training aids and tools was useful on a 4-point likert scale: 1 = *Not at all useful,* 2 = *A little useful,* 3 = *Quite Useful,* 4 = *Very useful*. With respect to each of the tools, participants were then asked to rate the involvement of their coach: 1 = *Not at all,* 2 = *A little*, 3 = *Quite a lot,* to 4= *Completely*. The second part asked participants to re-address these same questions, but from the perspective of refining a well-established trick. The survey concluded with eight questions profiling the respondent's biographical information. A pilot version of the study was sent to two members of the New Zealand Freeski team who were asked to provide feedback on the content and duration of the survey, appropriateness and wording of the questions. Following this pilot, both participants reported complete

understanding of the questions (which I confirmed by post-hoc questioning) and satisfaction with survey duration. No changes were made to the survey.

4.4.3 Athlete Survey - Recruitment and Procedure

Three approaches were used to ensure a large response and to purposefully sample both elite and developing competitors in the park & pipe disciplines. Firstly, the head coaches of national teams were sent an email introducing the study (appendix D) and were asked to pass on the request to complete to their athletes. Secondly, a press release from the Association of Professional Freeskiers was posted on their website and emailed to their membership asking members to complete the survey. Thirdly, individual athletes were approached by the author at various training camps and competitions in the 2017 competition season and asked to complete the survey. A link was subsequently sent through to them by email.

4.4.4 Athlete Survey - Analyses

Data from the SurveyMonkey online platform were exported to Microsoft Excel in order to complete demographical analysis. The software Statistical Package for Social Sciences (SPSS)/24.0 was then used to complete statistical analyses. The first three purposes of the study were addressed by considering the mean and standard deviations of ordinal rankings provided by participants, measuring the proportion of the sample using each of the tools, then comparing these to the picture presented by the coaches presented in Chapter 6. Examination of the quantitative data was supplemented by use of open-ended question responses where appropriate. Finally, building on the issues around gender and level, a series of independent t-tests were run on ordinal rating data (Carifio & Perla, 2007). Given the large number of responses this approach seemed merited for these preliminary investigative examinations. Where analyses were completed to investigate the level of involvement of

coaches, participants (n=12) that indicated they did not have a coach were removed to avoid skewed data.

4.4.5 Athlete Survey - Limitations

Due to the design of the survey (asking for biographical data at the end of the survey), participants that only completed the first section on skill acquisition remained anonymous and with descriptors unknown. Therefore, they were excluded from some of the demographical analysis. Due to the selection methods which included contacting athletes via their coaches, participants may have been biased towards those with a coach. Finally, for many of the participants, English is a second language, therefore, there could be a concern that understanding of the questions was an issue.

CHAPTER 5

RETROSPECTIVE SURVEY OF SKILL PROGRESSION: INVESTIGATING PROGRESSION IN PARK & PIPE – PARAMETERIZING THE COACHING CHALLENGE

5.1 Nature of the Sport and Training Opportunities

Kotler (2014, p. vii) emphasizes the recent "unprecedented flowering of human potential" that has occurred over the past three decades in the action and adventure sport domain, and cites the recent and profound progression of competitive freeskiers and snowboarders amongst big-wave surfers, mountaineers, free divers and whitewater kayakers as extreme examples of the pursuit of ultimate human performance. The comparative 'youth' of these sports as Olympic and competitive disciplines, followed then by rapid growth associated with the move towards mainstream recognition, has resulted in an increased commitment from athletes; or at least a more complex commitment! In turn this transition has added to the need for insight into how coaching operates, how effective this is and whether the process can be enhanced. Furthermore, and specifically, a comparative dearth of investigation, together with this recent but powerful change, has effectively negated what little data were already available (e.g., Collins, Collins & Willmott, 2016). Such information is essential to the coach for effective planning, monitoring, and direction of athlete progression (cf. Plisk & Stone, 2003), so this lack is a significant issue. For example, and as just a few of many considerations, what are the levels of psycho-emotional loading which characterize elite athletes' development in this high-risk environment? How might differences in the developmental template across individuals inform and enhance practice? Accordingly, in order to inform coaches on the safe but optimum progression of athletes in these sports, a current and detailed picture is required.

Providing further complication, evolution in the sport has resulted in an increased variety of training approaches and modalities, combined in a number of permutations and schedules. These factors are complicated by the shear pace of change over the last decade or so. As a result, athletes and coaches have tended to either follow the anecdotal/biographical accounts of established elite athletes, or to be overly influenced by the waves of new but unspecific sport science support now available. In short, the field is characterised by a move towards an apparently well-structured but, so far, evidence-light schedule. Once again, the need for clear and concise data is clear.

Finally, and from a more theoretical perspective, the range of challenge inherent to the sport offers opportunity to examine the style of technical development across elements, thus supporting the picture in similar sports. For example, do athletes and coaches push ahead with technical difficulty in one direction or axis only, building on their inherent strengths and preferences at the expense of others? Or, in contrast, and especially based on a recent focus on variety in the judging criteria (Tuotolmin, n.d.), is a more holistic (left and right, upright, corked and flipped rotations, forwards and backwards approaches) developmental pathway more effective?

Based on these important but unanswered questions, the study in this chapter reflects the second of four overarching research objectives introduced in Chapter 1 (see 1.4 Research Objectives), 'to examine trick progression methods used and challenges encountered in a sample of elite P&P athletes'. Objective 2 was broken into two parts, the first step (objective 2.1) was to gain a retrospective and in-depth understanding of trick progression (technical skill acquisition and refinement) of a small sample of elite P&P athletes over the last Olympic quadrennial. I was particularly interested in the time course and number of repetitions involved during a tricks' development from initiation, through practice trials, to incorporation in high-level competition and the pace of development (including fast and slow

periods). The level of perceived challenge experienced when training through the various stages was a key and integral consideration. Additionally, I was interested in identifying factors that promoted progression: training aids, cognitive skills used and elements such as specific versus general transfer (for example developing a new trick based on pre-requisite manoeuvres versus general movement ability required to progress). Directionality (the variety of directions and axes that tricks can be performed in) was a further focus area, along with an investigation into the level of planning for progression, and the impact of the Olympics on planning and embedding a competition run (Carson & Collins, 2016).

Reflecting these considerations in a new and rapidly changing sport (in terms of the environment, the participants and the progression) and with limited attention in the literature to date, I identified a useful and important opportunity to inform a clear picture of an elite athlete's daily training environment. Given an understanding of the 'what' of trick progression in the first part of this chapter, the second part, (objective 2.2) was to increase understanding of the 'how' of trick progression. Determining the relative weighting (in terms of time and effort) which athletes placed on different training modalities, including on and off snow components provides information on the current balance of training, which in turn underpins coach's decision making in order to optimize their athlete's progression. Across both components of research objective 2, I aimed to provide preliminary practical implications and considerations for athletes, coaches, support staff, and high-performance programmes to help achieve their goals of athletic, major event, and Olympic success. Further general discussion and implications for practice are included in Chapter 9.

5.2 Athlete Interview Results and Discussion

To dig deeper and explore the elements of objective 2.1 in greater detail, and to discuss and assess the impact of objective 2.2, I now present my results and discussion drawing on other literature where appropriate, in order to contextualize or interpret the data.

I attempt to make meaning of my findings in a quest to gain a greater understanding of the complex nature of trick progression. Practical implications based on my findings are embedded within the commentary, with a concluding preliminary summary of implications for practice.

5.2.1 Objective 2.1 – Understanding Trick Progression

A halfpipe or slopestyle run involves the performer completing a series of discrete tricks. The judging criteria, measuring the quality of the performance of the series includes the following components: progression, amplitude, variety, execution, and difficulty (Association of Freeskiing Professionals, 2015). Thirty-three competitive tricks (halfpipe or slopestyle jumps) landed in competition runs, either at the Sochi 2014 Winter Olympics or at other major events that year, were tracked through use of the timeline approach. To ensure uniformity across all participants, rail tricks (which only feature in slopestyle, not half pipe) were deliberately excluded.

Of the 33 tricks, 14 (42.4%) were learned prior to 2010 and maintained or refined in the quadrennial leading into Sochi 2014, while 19 (57.6%) were developed within the quadrennial. Of these latter 19 tricks, nine were learned using an airbag (all nine by halfpipe athletes), seven on snow in training, and three were landed for the first time in competition. Thirteen of the 33 tricks were considered upright spins (where the head remains above the centre of mass throughout the rotation), seven involved a single cork/flip (where the head dips under the centre of mass during the rotation), 10 involved a double cork/flip, and three involved a triple cork/flip.

Of the nine tricks developed using an airbag, the total amount of time between first trials on an airbag and first landing the trick on snow averaged 13.4 months (SD = 4.9). Of all the tricks learned within the 2014 quadrennial, the total amount of time between first

landing the trick on snow and first landing the trick in competition averaged 7.4 months (*SD* = 9.1).

The developmental pathway for each trick was of particular interest. P4 identified the pathway for trick development from initially thinking about it, to general off-snow training, to more specific on-snow training, to trials on snow:

> Start with thought process and visualization and then move into airbags and other forms of trying the trick without having the full risk of hurting yourself (including trampolines and that sort of stuff) and once you have it on the airbag and have done it a bunch of times and landed onto your feet three or four times in a row then it's ready to go to snow.

With regard to supporting training modalities, athletes indicated using training methods including trampoline for general aerial awareness and air bags for specific preparation. Notably, however, the two modalities were carefully and explicitly differentiated:

> When I trampoline I try my best to not think about skiing and just enjoy the trampoline – because it is the spatial awareness that I am getting from it – it is too close and also too far away from skiing. When I was a grommet learning corked 7s yes I would learn them on the tramp, but now I try and make that separation really clear in my mind – there's not a trick I can learn on the tramp which means I am closer to doing it on snow, it is just the spatial awareness. (P2)

This differentiation was reflected in all participant responses and is also apparent within the 'received wisdom' of the sport. For example, Shaun White (double Olympic champion in 2006 and 2010) pioneered the use of the on-snow foam-pit in 2008 at his private training facility in Silverton, Colorado in preparation for the 2010 Winter Olympics. Subsequent innovation to address the challenges of building foam-pits in the alpine environment led to proliferation of the use of air-bags at training camps: a similar type of apparatus that can achieve the same training effect as the foam-pit and is more practical to set up. The latest innovation, gaining widespread support from various national teams in 2017, has been sloping 'landing bags' used to accurately re-create a jump landing (see appendix B for images of the different types of foam-pit and airbags in use). These facilities provide a highly specific lower-risk environment where mistakes can be made, kinaesthetic awareness can be

developed, and successful movement patterns can be honed prior to attempting the skill on snow:

> Sometimes if it's available and if it's going to help I use an airbag and then do it [on snow]. Most of my tricks I have learned I haven't used an airbag to learn them, it's only the last few that I have and that's because it has been available and easy. All my pipe doubles I've learned on a bag. (P1)

Reflecting this differentiation, however, athletes made varied use of training aids in the development of new tricks. As P5 stated "Trampolines, foam pits, airbags, it just depends what kind of trick it is, we normally start working on tricks in the summer and then you can learn it on soft snow".

As a further, but perhaps more naturally occurring aid, some athletes, particularly slopestyle, found that soft snow conditions at summer training camps and in the spring time were more conducive to landing tricks for the first time, although one halfpipe athlete noted the consistency in shape of features and speed in winter snow being advantageous to high-end skill development:

> I find that soft snow helps mentally more than anything, although in the halfpipe I would rather an icy pipe to try a trick in purely because it's not going to move on you, you pop and it is still there you can feel everything rather than in a soft pipe where it deteriorates throughout the day and you have a small window of opportunity and you might miss it by 5 minutes and you push into the snow and it gives way on you. A lot of people only like to try things in spring – on jumps it is way more mellow, icy jumps are scary, and icy pipes are scary but I like the whole staying the same, the consistency of the snow. (P4).

Pace of Development, Number of Repetitions, Level of Challenge

When a trick had been landed on snow, the next stage was to consolidate that trick – make it more robust and then prepare to land it in competition. Some participants remarked that a new trick could be transferred from training to competition after just a few repetitions:

> I would chuck it in comp pretty much as soon as I've landed it in training – as long as it's clean enough, I usually get tricks pretty quickly if I can grab it then I will do it in a comp…I always make sure I try a trick three times to make sure it wasn't just a fluke, but generally if I've got a trick that I have put a grab with straight away [an added element to gain an even higher score] then I would class that as competition ready. (P4)

P3 agreed "If you landed it the first three times you tried it in training, that's a pretty solid land ratio, so there's no reason why you couldn't use that". Others required slightly more repetition: As P7 observed "I feel that I have to land a trick consistently until I feel confident at least 10 times before putting it in a comp run."

Notably, however, some athletes took significantly longer to take certain tricks into competition:

> For the dub 12 it took ages – like 2 years – I did it at spring camp 2 years before…but then for a left dub 9 it happened the season after. I probably learned 9's in a comp, or the cab 10 at the Olympics I had done a couple at spring camp 2 or three years before, then I just decided to do it and did it perfect in training and then did it in the comp. (P1)

In fact, there was evidence for considerable variation (from a number of days to a number of months or even years) in the duration of trick development, both within and between participants:

> You can do two of that trick that you have been petrified of, and suddenly it's like I know I can do that trick next season and I have got it dialled. It can be really short…like 3 days of doing it – solid days – you might need 3 months to get those days, but 3 days' worth of doing it can be enough. I know it seems pretty daft and pretty short but it can take you all season to get that. (P2)

There was also evidence for an impact of mood-state on skill acquisition. When asked about the difference between harder training tricks versus tricks landed in competition one athlete answered:

> I think it's because so many aspects need to be right on the day for you to be able to do tricks like that. The jump for the [trick name] was made for it pretty much, the conditions were perfect and I was in my right frame of mind, with my friends and everything like that, and you need those things to be in place when you are learning and trying new tricks. (P3)

The bottom line from these different perspectives is that, at the present early stage of the sport's development, trick progression is extremely varied and idiosyncratic.

To provide a summary so far, my research provides two key findings. Firstly, trick progression is usually achieved intermittently, moving through different stages during the year subject to experiencing the right conditions, training facilities, balancing time for

progression with time for consolidation, competition periods, and rehabilitating from injuries. My second key finding related to results showing that there was high variance in the duration of trick progression between individuals and also high variance in the number of repetitions required in order to land a trick in competition.

Of the elements that thwarted the pace of development, pressure of the Olympics (more detail later in this chapter) and injury were highlighted across the sample. It is clear that aspirant elite podium athletes need to increase the level of difficulty of the discrete skills within their run on an ongoing basis in order to improve their ranking within the sport. Moving faster than the progression of the sport, to get to and then remain at the cutting edge, has an inherent high level of challenge however (see Kotler, 2014 for a commentary). This, in turn, has implications for: participant profiles of successful action sports athletes (e.g., high sensation seeking: Guszkowska & Boldak, 2010; risk-taking personality types: Castanier et al., 2010) and the incidence and mitigation of injury risk (e.g., Wijdicks, et al; 2014; Willmott & Collins, 2015) The epidemiology of injury in snow sports has received plenty of attention elsewhere, therefore further discussion is more sensibly focussed on methods to minimize injury risk through development stages.

Six of the eight athletes highlighted that repetition and volume was a key aspect in reducing the level of challenge of a trick:

> It's not even the difficulty of the trick it's more how many times I have done it. To a lot of people a rodeo 9 is way easier than a forwards dub 9, but I would rather do a forward dub 9 before a rodeo 9 because I haven't done rodeo 9's forever, so the thing for me is the more I have done something the easier it is and that's no matter what it is. (P1)

> I start on something small, something that I can under-commit to, say it's a rail trick, something low without stairs, so I can under-commit and be fine and then build from muscle memory – from the feel. Then I take it to something bigger, on a jump I start on something real small and I spend a lot of time in the building process, I've noticed compared to some other people – they will learn it on this jump and take it straight to another one, but I have noticed that I am usually more consistent than people that do that with their tricks. It's slow and steady. (P8)

The extent to which this repetition was necessary for emotional reasons (less nerves, greater confidence) rather than embedding the trick motorically (cf. Carson & Collins, 2016) is an important issue which awaits further investigation.

Factors That Promote Progression

In most cases, the level of challenge and risk of injury is deliberately reduced when developing a new trick. Methods identified involved off-snow facilities including general training on trampolines, more specific options such as ramps into foam-pits, and on-snow facilities including air-bag landings. New technologies are improving the quality of such training facilities. For example, 'super-tramps' have evolved which allow an athlete to bounce higher with less impact on their bodies and require less specific skill to recreate snow sports manoeuvres. As another recent evolution, artificial dry slope jumps into sloping air bags have emerged that have advantages both in the ease and quantity of access (they can be built close to high-density population areas, and have potential to be accessible year-round) and their higher level of specificity to an actual jump. In short, the challenges of learning new tricks are getting lower although they are still significant.

Of course, access to high-quality training facilities within a feedback-rich environment is essential to optimize the skill acquisition process, increasing the level of feedback in the environment, including activation of all senses, is perhaps an area which deserves further consideration. Transferring manoeuvres from artificial apparatus to on-snow training environments and competition relies on a successful transfer and maintenance process, and represents the enduring challenge inherent within the sport.

Notably, cognitive skills were commonly reported as key to overcoming this challenge. The use of imagery, both visual and kinaesthetic, was identified by most athletes as a crucial and necessary part of skill acquisition; the first stage in developing a new trick, and then used throughout the process. P1 stated "I do heaps of thinking about it, visualization

and imagery." P2 expressed similarly "I am quite psycho with my visualizing, I am really dialled, I will be in my room by myself and I can't lie flat, I will find my little space and I will visualize for ages." Imagery was widely used and universally supported by the sample, especially as a tandem approach with physical practice (cf. Toussaint & Blandin, 2010). Imagery was used within training sessions to aid skill acquisition, and also between the sporadic periods of facility access impacted by seasonal and financial constraints. Of course, imagery ability has been shown to enhance confidence (Williams & Cummings, 2012), and this was seen as key to successful performance, particularly in this sport with the high inherent injury risk.

Future use of imagery approaches for learning new skills would certainly merit further investigation. For example, the degree of functional equivalence of motor imagery to achieve complex motor actions that have not yet been performed has been questioned by Olsson and Nyberg, (2010), who suggest that you cannot effectively image a skill until you can perform it physically. O'Shea and Moran (2017), through pupillometric studies of expert pianists, found that easy movements and slow complex movements required similar levels of attentional effort, supporting functional equivalence between motor execution and motor imagery. In contrast, with respect to fast and complex movements, disrupted neurocognitive congruence between execution and imagination was observed which led the authors to conclude that the attentional mechanisms supporting motor imagery constrain its functioning. To use a snow sports example, it is unclear whether there is enough neural overlap between a frontside double cork 1080 and a frontside triple cork 1440 to allow an athlete who has already mastered the first to assist acquisition by effectively imaging the second. In simple terms, research which examines the 'projective scope' of imagery is urgently needed. For the moment, however, it would appear that the closer an athlete can get to replicating a novel manoeuver through effective imagery, the more neural overlap will exist. Certainly, the

sample found that a combination of such projective imagery, often combined with observational learning based on watching others performing the trick (cf. Ram, Riggs, Skaling, Landers, & McCullagh, 2007) was an extremely useful adjunct. The level of movement vocabulary possessed by a particular athlete would also seem to be important here, as a broader library plus experience of using it would make the generation of a more accurate 'picture' of a novel skill more likely.

Watching others perform a skill in person or via media is a facet embedded in the culture of snow sports (Ellmer & Rynne, 2016; Jones, 2011; Willmott & Collins, 2015; Woermann, 2012). Progress from one corner of the globe is immediately transmitted via social media, and so the opportunity for modelling the latest breakthroughs is readily available. As per imagery, modelling enhances confidence (Hall et al., 2009), and its effective use both in-training and intra-training sessions was reported by the sample. Modelling assists in the formation of cognitive representations (Ram et al, 2007), and it is the combination of modelling and imagery which will have the best effect in terms of acquisition and retention (e.g., Hall & Erffmeyer, 1983).

These advantages notwithstanding, physical practice was still seen by some of the sample as the real key to progression. In contrast, some athletes indicated that it was possible for a trick to be landed in training and then performed in competition after only a small number of repetitions, in fact only three of the thirty-three tricks tracked were landed for the first time in competition. The question of what discriminates between those athletes who can land tricks (and tricks that can be landed) from such short preparation remains unanswered.

Extrapolating from both my data and experience however, I suggest that athletes with a greater movement vocabulary (access to a broader base of motor programmes) are able to integrate new tricks into competition swiftly as they have greater neural overlap between existing movement patterns and desired movement patterns. If a new trick was in a preferred

spin direction for example (more on this later), and the athlete had a strong foundation of prerequisite skills, a new trick may have been landed for the first time within a short time frame. Adding 180 degrees of rotation to a previously mastered trick, for example taking a left triple cork 1440 to a left triple cork 1620 was achieved for the first time in a competition run by P3, 11 months after the 1440 variation had first been landed. It is suggested that the 11-month period of mastery was necessary in order for the athlete to focus on execution and attain the control required to add the additional 180 degrees. Further longitudinal research is required to gain a better understanding of exactly how many repetitions it takes (in this example within the 11-month period) in order to move a trick along the continuum from first landed to mastered. For the moment, this chapter offers a basis for practitioners to apply.

Of course, learning a skill is only part of the battle. While increasing progression and technical difficulty is a fundamental focus of action sports athletes, it is the execution (commonly referred to as 'style') element of the judging criteria (see FIS, 2015) which is a skill in itself and will ultimately separate those on the podium performing similar levels of difficulty. There is a desire from many athletes, and an ethos in the sport which is mirrored by judges, to ensure that style is not lost and the aesthetics of performance are accentuated (Thorpe, 2009). To separate from the rest of the field and to avoid robotic movements, a focus on individual subtle variations and style or execution factors is recommended. Other action sports (i.e., surfing; Wilson, 2012) are also caught up in the competing perspectives of technical progression at the expense of style, and it is clear that a keen focus on maximizing both elements will reap the greatest reward. Thus, research in support of performance in these sports must also allow for the aesthetics inherent in subjectively judged events, as well as the processes of skill acquisition.

Directionality

Freeskiers perform in a symmetrical stance and generally report a spin direction preference – spinning to the left or to the right is considered their 'natural' direction while spinning in the opposite direction is classed 'unnatural'. Snowboarders have different biomechanics involved in left or right spins depending on their stance (left foot forward = 'regular', right foot forward = 'goofy'). Both freeskiers and snowboarders complete tricks forwards and backwards (= 'switch') in each direction, meaning four possible spin directions.

Asked to rate their level of performance on a one–to-ten scale on the four spin variations, all the subjects purported a spin direction preference, and reported at least one out of the four directions being notably weaker than the others. Participants' perceptions on their balance of spin and direction capabilities were of particular interest in order to understanding the meaning of this data. As P4 observed "some spin better left or right, and I think it all comes down to time doing it." While others reported:

> I learned heaps of stuff to the left first and then I had to go back and learn it all to the right, the thing that made spinning right harder was that it was all new and felt harder – especially learning how to spin switch right side, looking over that shoulder was really weird and annoying and odd, the more I did it the more it became mellow. Still now, skiing switch right is like kind of weird. I can do my tricks that way, but bombing down the hill looking over that shoulder still feels real weird to me. (P1)

> Left side tricks – my unnatural way are definitely the harder ones…with switch it's not in the air, but it's takeoff and looking over the other shoulder which makes them hard… it's like trying to write with the other hand. (P5)

Variety in spin direction is a key part of the judging criteria (FIS, 2015). The gold medal X-Games winning run in men's freeski halfpipe has included tricks in all four directions since 2014, and jumps in all four directions in men's freeski slopestyle since 2013. The 2015 gold medal X-Games winning runs in both men's and women's snowboard halfpipe also featured tricks in all four directions. Is it a concern therefore that the elite athletes in this study all report a deficit in at least one direction? Furthermore, is such a concern grounded in the pragmatics of performance or the potential contribution to elite levels of physical literacy?

Many slopestyle courses, including the Sochi 2014 Winter Olympics only have three rail sections and three jump features. In these circumstances, a slopestyle athlete is not disadvantaged score-wise if one of their spin directions is considerably weaker since they can simply leave it out of their run, or complete the fourth direction within the rail features. Furthermore, the PyeongChang 2018 Winter Olympic slopestyle course will also have three rail sections and only three rather than four jumps (Chae, personal communication 23rd August, 2015).

The advantage may be more implicit to total development than explicit to the competitive challenge, however. For example, Heinen, Vinken, and Velentzas (2010) point out that, as the vestibular system is placed upside down when a gymnast is inverted, there is an inevitable misperception of turning direction. With the complexity of single, double, triple, and now quad cork manoeuvres, where the head may pass beneath the centre of mass multiple times, an elite P&P athlete, just like an elite gymnast, needs a well-tuned vestibular system that is comfortable spinning in all directions and in multiple axes. In the same way that gymnasts must master fundamental moves in specific directions in order to be able to perform more complex moves (Heinen et al., 2010); P&P athletes benefit future progression (and scoring potential) by developing fundamental skills in all four directions.

Also of interest and with previous attention in gymnastics, (Heinen, Vinken, & Velentzas, 2010) was the transfer of learning from one spin direction to the other. For example, P6 indicated that it took 16 months from first attempting a right double-cork trick variety into the airbag to landing it in competition, while 4 months later, the same double-cork trick to the left took just 3 months to transition into competition. This clearly reflects the impact of lateral transfer shown in other motoric challenges (cf. Collins, Morriss, & Trower, 1999). It has been demonstrated elsewhere (Smith, 2001) that learning a manoeuvre in both directions in the same session can increase both acquisition and retention. Athlete's

working on a left 540 for example may benefit from acquiring both tacit and declarative knowledge while learning a right 540, that helps them acquire the former trick.

The strong correlation between ability in the four directions with energy invested in that direction amongst athletes in this study, along with reports that an 'unnatural' spin direction can feel more 'natural' after significant repetition, suggests it is the responsibility of the athlete and/or coach and/or performance planner to ensure that energy is invested appropriately in order to achieve the required balance across the four spin directions.

Level of Planning for Progression

Given the relative youth of the disciplines as formal sports, and the free spiritedness of their origins (Ojala & Thorpe, 2015; Willmott & Collins, 2015) it is perhaps unsurprising that athlete planning was somewhat hap-hazard. That said, and also unsurprisingly, the planning approach varied between athletes. For example, P7 identified careful goal selection with their coach:

> I think we followed the Individual Performance Plan pretty good – we set out goals for every training period and we try to achieve those goals and keep chipping away at it. I have an overall goal and what I want my run to look like for 2018, but we work more specifically in 6-month chunks.

In contrast, another athlete identified the added pressure of externalizing goals and preferred to progress in keeping with the established social milieu by one-upping each other on a spontaneous basis:

> There might have been plans on paper, but my progression was always out of the blue, like 'it's time to do this', like my switch triple this year at X-games, I've planned to learn a triple, but then it was like the day before it I knew that it was the time to do it…some tricks work sometimes and sometimes they don't. (P1)

While development of a comprehensive and detailed planning habit may provide significant benefit for some athletes, trick progression is highly variable-dependent (i.e., weather, mood, facilities, etc.) so it would seem that some adaptability in planning is essential. Certainly, at

least for the moment and in keeping with existing advice in other sports, catering for individuality in planning approach would also seem to be key.

Impact of the Olympics on Planning and Embedding a Run

It was the first time at the Olympics for some of the sports and all of the athletes in this study. Most mentioned the fact that the Olympics provided a definitive timeframe by which trick progression needed to be completed. This was significantly different in nature to previously preparing tricks for competition because it was quadrennial rather an annual cycle (e.g., X-Games). As P4 observed "You have one shot and you need to be at the forefront of it…It seemed to put a ticking time bomb on it all", and supported by another participant:

> It did give a deadline, for the first time. You are always learning tricks to put them into the next contest, be it one of the 10 contests that you do in a season. But the Olympics wasn't like that, it was boom here's the date and you need your shit sorted by then which we have never had before… normally it doesn't matter because if it's not this contest it's the next. (P3)

In terms of preparing a run for the Olympics, P4 identified that planning was on a need-to basis, reacting to advancement of the field and breakthroughs by other competitors:

> Seeing people come out with stupid new tricks that you have to learn quickly – that was the hardest part, people doing new tricks closer and closer to the time [of the Olympics] and realizing you were going to need them and learn them quickly.

The media hype and increased support and focus from National Sporting Organisations was also credited with placing a special emphasis and brighter spotlight on the athletes than had previously been experienced. In this regard, it seemed that the concept of peaking was facilitative to some while debilitating to others:

> If I wanted to keep winning comps then I had to do these tricks – I never had a pressure of having to do tricks, then all of a sudden I had the pressure of doing them so then they became massive in my head…rather than figuring out how to get there – they became unattainable in my head. (P1)

> First-time ever, suddenly the countries give a shit about you and they are breathing down your neck, it was more a pressure rather than a 'let's do this', it's like 'I have responsibility greater than my own career. (P2)

Special impact of the Olympics notwithstanding, participants also acknowledged the more general development in profile which had already impacted on the sport:

> It gets so much more intense now especially in the Olympic year in the build-up…and I don't think it's just the Olympics, the whole industry has grown and there's so many more kids that want in. There used to be about four or five of us that could win a comp at any comp and it was just like rotating and now there's about 20 that can win the comp and they are all just as hungry. (P1)

The pressure of the Olympics and attention from National Sport Organisations (NSOs) was novel for this group. Debilitative elements of Olympic pressure presented with the associated impact of NSOs involvement may have exerted a greater pressure due to this novelty, and I would expect that subsequent generations would be more aware of, and better prepared for, such challenges. Whether the sports inclusion was opposed or embraced, however, the impact of the Winter Olympics certainly provided a whole new level of challenge, which was viewed as being facilitative for performance levels, albeit sometimes only in retrospect!

5.2.2 Objective 2.2 – Relative Weighting of Different Training Modalities

Athletes were asked to estimate the percentage of time spent across different training modalities over the course of the past four years (see Table 5.1). As shown, on-snow training including fundamental skills, freeriding, trick progression, consolidation, and competition accounted for a cumulative total of 60% of their time while time-spent training off-snow accounted for 40% with minor variations between athletes (ratios ranged from 70:30 to 54:46). Off-snow work included off-snow movement (trampoline, gymnastics and moving platform sports), physicality and robustness, mental skills, training approach (planning and reflection), and recovery. The largest variation across logged activity was in the percentage of time athletes spent learning new tricks which ranged from 10%–40% of their time. Importantly, the high variations apparent across athletes' self-reported activity support my earlier statements on the significant individualities within the sport. As P8 summarized:

> Trampolines are a new thing for me that I am starting to learn. [On snow], it has been quite a progressive week and that was in really slushy conditions and again that is a

> new thing. Basically learning is starting on the smallest feature in parks; that's where I learn the most…ground stuff including learning how to move my hips over my board. I also use a lot of video analysis – it is massive for me, I don't do as much imagery as I could…I used it a lot when I did the [name of trick] and it helped a lot. And I also do meditation which helps calming down with some of the harder tricks – learning how to quieten the mind.

In short, athletes use a wide variety of methods in a wide variety of ways.

A similar picture was apparent in the data on self-reported energy invested across the various tasks (see Table 5.2). Athletes collectively invested the most energy in competing and learning new tricks and the least in recovery and training approach. Variations were also apparent across the key components of competition and trick progression, with seven out of eight athletes interviewed rating competition maximally, and six out of eight rating trick progression at the same level. Within this variable picture, however, these snow athletes were clearly most committed to on-snow work. The average score for energy investiture across the on-snow training modalities was 7.88/10 while the average score across the off-snow training modalities was 5.8/10.

This balance between on and off snow components in both time and energy invested represents a stark contrast to Turnbull, Keogh, and Kilding's suggestion (referring to elite snowboard halfpipe athletes) that "as a consequence of the sporting culture and self-expression ethos of board sports, the athletes commonly have little inclination to do off-snow training" (2011, p. 7). Does this demonstrate a shift in culture over the period of the last quadrennial? Is this shift unique to those athletes now involved in Olympic disciplines? Whatever the reason, long gone are the days where action sports athletes just got better by doing their sport (cf. Ojala & Thorpe, 2015): although, unsurprisingly competing and trick progression received the highest levels of energy investment and effort.

Of course, getting the right balance of on and off-snow training is critical to achieving optimal progression in P&P as it is in other sports, with off-snow training focussed towards enhancing the quality and quantity of on-snow training (Kipp, 1998). Physicality and

robustness training ensures athletes have the strength, power, and endurance to be able to train to a sufficient level, and helps to protect them from inevitable impacts sustained while acquiring new skills. This injury prevention concept of off-snow training is clearly also applied through the off-snow movement skills described by participants, where an ability for cat-like fitness (always landing on your feet) was promoted. In parallel, performance enhancement was achieved through the development of specific movement patterns with a high volume of repetition easily achieved (i.e., trampolining). Importantly, however, further research is required to determine the best combination of traditional strength and conditioning versus movement conditioning approaches, both from an injury prevention and a performance enhancement perspective.

5.2.3 Limitations and Future Directions

Data gleaned from the athlete interviews provided an overview of performance improvement time-lines, however it clearly does not measure when and how the 'best' learning takes place: this can only be inferred. Furthermore, while I measured progression in terms of months from first trial to landing in competition, it is difficult to measure all of the general and specific training that took place within that period directed towards development and mastery of a trick. Clearly, further longitudinal research is required to achieve greater clarity in this regard. Methodological limitations of the current study include the small sample size (N=8) and self-report nature of the study. Only one form of data collection was used. A quantitative follow-up would be beneficial to investigate optimal strategies to maximize progression and identify the ideal coaching approach in this context. Further exploration of the potential for and limits to the rate of progression will also benefit the action sports community and coaches in particular increasing their awareness of what is possible, achieving the right balance of risk vs reward, most importantly reducing injury and informing their practice.

Training Modality	Mean % of Time Spent (SD)	Range
Off-snow movement skills (i.e., trampolining, skateboarding etc.)	6.25 (4.13)	1–12
Physicality and Robustness (i.e., gym work, prehab, conditioning etc.)	15.00 (7.87)	5–29
Mental Skills (i.e., imagery, self-talk, relaxation)	7.63 (5.76)	2–20
Training approach (i.e., planning & reflection)	5.00 (2.93)	1–10
Freeriding	8.88 (7.85)	1–20
On-snow movement skills (i.e., fundamental skiing/riding skills)	7.00 (4.24)	3–15
Technical skill development – Learning new tricks	16.88 (9.92)	10–40
Technical Skill Development – Amplitude, Execution, & Style	16.38 (6.41)	9–25
Tactical skills (competing)	10.63 (4.31)	5–15
Recovery	6.38 (4.41)	2–15

Table 5.1 Time spent working on different training elements

Training Modality	Mean Effort out of 10 (SD)	Range
Off-snow movement skills (i.e., trampolining, skateboarding etc.)	6.29 (2.98)	2–10
Physicality and Robustness (i.e., gym work, prehab, conditioning etc.)	8.14 (2.04)	4–10
Mental Skills (i.e., imagery, self-talk, relaxation)	5.00 (1.83)	3–8
Training approach (i.e., planning & reflection)	4.29 (2.69)	2–8
Freeriding	6.29 (3.25)	1–10
On-snow movement skills (i.e., fundamental skiing/riding skills)	5.00 (2.58)	1–8
Technical skill development – Learning new tricks	9.57 (0.79)	8–10
Technical Skill Development – Amplitude, Execution, & Style	8.71 (1.38)	7–10
Tactical skills (competing)	9.57 (1.13)	7–10
Recovery	3.43 (2.23)	1–6

Table 5.2 Summary of participant ratings for effort expended on different training modalities

5.3 Preliminary Conclusions and Implications

Prediction work suggests that the sports are continuing to progress: tricks will be landed in competition in 2022 that have not yet been witnessed. It is clear that currently high end skill development is a piecemeal approach and is not high volume, moving through different stages during the year subject to experiencing the right conditions, training facilities, balancing time for progression with time for consolidation, competition periods, and rehabilitating from injuries. Optimal use of training aids to reduce the level of challenge and

therefore injury-risk should be considered by coaches to help athletes progress swiftly and safely along the trick development pathway, taking into consideration their appropriate deployment from both a specific and a general transfer perspective. Novel approaches and further innovation in this space may well provide dividends.

My results showed that there was high variance in the duration of trick progression between and within individuals and also high variance in the number of repetitions required in order to land a trick in competition. For elite athletes challenging for the podium, acquiring new tricks in the current quadrennial needs to be achieved bearing realistic timeframes in mind and in tandem with refining and finessing existing tricks from the previous quadrennial. A carefully planned approach is therefore recommended allowing for periods of learning and trick progression followed by periods of consolidation and execution with simultaneous maintenance of the existing trick repertoire.

Ways to speed up acquisition include manipulating the quantity and the quality of the currently limited training opportunities. Obtaining access to general and specific high-level training facilities for safe repetition will continue to be a challenge for the coach, optimizing the organisation of practice is an important part of maximizing the effect. While imagery and modelling are currently widely used, I have identified the potential to further tap these powerful tools. Invoking a broader range of senses and including the rhythm and relative timing of the skill to aid in acquisition are suggestions to enhance this aspect. As discussed earlier, the speed of acquisition will be impacted by the development profile and history of the athlete: those with a higher level of general movement ability and greater movement vocabulary will be pre-disposed to acquire new tricks faster.

Directionality emerged as a particularly fruitful area for immediate exploitation and future investigation. The athletes in this study suggested that the acquisition of skill in one particular direction is the result of time engaged in spinning in that direction, therefore for the

committed athlete willing to invest time into their weakness the rewards are inevitable. If a spin direction is overlooked during developmental years, it was reported that significant energy was required in order to catch up at a later stage. In order for an athlete to avoid a disparity in the strengths of their spin directions, and to benefit from the enhanced effects of lateral transfer, it is suggested that athletes spend equal amounts of time developing all four directions particularly during the formative stage of their career. Athletes and coaches should take directionality into consideration when planning their progression, ensuring all four directions are included and that prerequisite manoeuvres are included in an athlete's training repertoire at the right stage in order to facilitate the learning of more complex manoeuvres at a later stage of development.

It is clear that an individualized approach to off-snow training is required taking into consideration an athlete's stage of physical development and maturation, carefully manipulating their off-snow training load to complement their on-snow load dependent on the phase of the season. With a potential increase in the repetition of more complex and physically demanding manoeuvres, athlete's will inevitably be increasing their injury risk. There is therefore a need for enhanced physical conditioning to allow a higher number of repetitions to occur and likewise an increase in the quality of physical and mental recovery strategies.

Each of the athletes in this study were first time Olympians. Understandably the impact on their trick progression by this unique event was individual and varied. As the sport continues to evolve within the Olympic environment, success will be enhanced in those athletes that plan and prepare appropriately and embrace the positive elements of the Olympic spotlight while mitigating any negative elements. A key role in navigating these muddy waters, guiding an athlete safely to the top of the podium is the coach.

It is crucial for ultimate performance, that in the quest for progression in terms of difficulty (more spins and more flips), the very essence of the sport: ‘free’, ‘style’, is not lost. Athletes must be encouraged by their coaches to continue to retain and progress their individual style and expression which will ultimately separate the good from the great.

In conclusion, I have focused on the arrhythmic nature of progression within P&P at the elite level. The next steps are to focus on ways to optimally support and promote this progression by first interviewing coaches on their perspective (Chapter 6), and following up with an athlete survey (Chapter 7). An extension of these preliminary conclusions and implications will be completed in Chapter 9.

CHAPTER 6

COACH INTERVIEWS: 'GETTING THE BALANCE RIGHT – THE ART AND SCIENCE OF COACHING ACTION SPORTS'

6.1 Introduction – What Does the Coach Think?

As discussed in Chapters 2 & 5, the introduction of P&P events across recent Olympic cycles has generated a whole new set of challenges, taking this action sport into completely new areas (Willmott & Collins, 2015). Despite concerns about its older traditions and mores as a lifestyle activity, as outlined in Chapter 3, this additional novelty enables coaches to initiate new approaches based on an optimum juxtaposition of physio-mechanical, psychomotor and psycho-social factors to offer evidence-based guidelines which can then be distributed through the sports' well founded social milieu (Stoszkowski & Collins, 2014). Given the particular characteristics of the sport (extreme difficulty, high risk, reward for progression and creativity), the picture provided may also inform developments in other sports with some or all of these same challenges.

Chapter 5 identified some important elements of best coaching practice, ranging from basic and generic elements, such as common and contextual coaching tools through to more sport-specific elements such as arrhythmic progression patterns coupled with a highly variable gestation period. Add in the implications from physical and mental injury/burnout due to the high-risk nature of the sport, plus the wide diversity in the use of coaching which stems from its lifestyle roots, and P&P emerges as an excellent focus for coaching research. In short, considerable benefits may be gleaned from systematic study, both for the sport itself and for coaching science in general. The aim of this chapter was therefore to address research objective 3 (see 1.4 Research Objectives) 'to investigate perspectives, challenges and methods employed by a sample of elite P&P coaches.'

One big feature of action sports, which supports this research focus, is the inherent complexity. From the coaching perspective, work in other adventure/action sports has demonstrated the hyper-dynamic environments which, coupled with the high levels of consequence for decision making, place significant pressures and high cognitive load on the coach. This research has already highlighted the importance of informed Professional Judgement and Decision Making (PJDM – Collins & Collins, 2016) as a means to optimise the impact and safety of practice. As such, accurate information on what works is crucial, but the reasoning underpinning the decisions taken (or not) is of even more importance in providing us with the general *and* specific insights which may be obtained.

Accordingly, and reflecting those unique features demonstrated by previous research (e.g., Willmott & Collins, 2015; 2017), this chapter will focus on four broad areas of coaching practice in action sports. Firstly, on the nature, scope and variability/consistency of the coach-athlete relationship. Secondly, coach's perceptions of training aid and coaching tool efficacy from a motor learning perspective, basing these on what high level experienced coaches felt were the most useful environmental manipulations, physical training methods, mental techniques (imagery and observational learning), coping methods and sources of information (MacPherson, Collins & Morriss, 2008; MacPherson, Collins & Obhi, 2009) offered to support evolution of the athlete's trick repertoire. Thirdly, the concepts of nested planning, periodization, reflection and adaptation were considered to identify the structures used and foresightedness of action sports coaches operating in a dynamic and rapidly changing environment. Finally, an examination of the constraints and consequent actions taken to counter/cater for the high levels of risk inherent within the activity performed in a dynamic mountain environment. Questions and probes reflected the various approaches currently used in the sport but also drew on recent research-supported methods apparent in

other performance domains (e.g., Collins, Collins, & Carson, 2016; Collins, Carson, & Collins, 2016).

6.2 Results

6.2.1 Tabulated Results

This section will report the findings of the research with respect to the four purposes identified in the introduction. In all cases, data are tabulated to present the thematic structure together with, in brackets, the number of participants who mentioned that particular element (see Table 6.1). In cases where no number is shown (as for example in the case of most 2nd order themes), all participants referred to this element in their interviews.

3rd order theme	2nd order theme	1st order themes	Raw-data exemplar
Optimum coach-athlete relationship	Coach's Role		"You want the athlete to drive it and you the coach guide it. Put the lights out on the road and they drive it" (C1) "The coach is, in some respects, a more experienced, a more thought out view. A third eye." (C6)
	Coaching Style	Direct instruction (6), Guided discovery (8), Multi-style (9)	"I think my aim as a coach is to make my athlete self-sufficient, and I think guided discovery does that the best way, where they can self-correct and they can self-manage." (C2) "when the risk is high you are very cautious on your use of guided discovery as opposed to the instructional base." (C1)
	Decision Making	Athlete-led (9), Coach-led (9), Collaboration (9)	"100% the athlete is responsible for decision making. The coach can offer advice and offer insights. But at the end of the day, it is 100% on the athlete." (C8) "I think at the level I'm coaching at now - I call it partnership coaching." (C2) "Well, I think it should be a very deep cooperation, in a way where more of the responsibility is on the athlete for the decision-making" (C7)
	Trust	Knowing the athlete (3), Friendship (3), Risk factor (7)	"Perhaps it's even more important in action sports because of the danger factor, and not only will the person potentially fail or fail to achieve what they're trying to achieve, but they might actually get hurt doing it and so it's extremely important that there be a solid bond of trust between coach and athlete." (C4)
	Influences	Age and stage, Cultural (1), Gender (9), Individual (6)	"at an introductory level it'll be more direct instruction, whereas the higher end the athlete, it becomes more of a joint operation with discovery happening both on the part of the coach and the athlete in an effort to actually progress the sport." (C8) "I feel women in general - obviously, there's exceptions - but as a general rule, I find the women are a little more into a little more structure, a little more guidance and a little more, definitely in a technical sense, they like very specific technical detection, correction style stuff." (C5)

Training aids & coaching tools	Coach development (9)		"I feel like I get more from organic discussion and workshopping just directly with other athletes and coaches generally. It strikes more of a chord with me than structured coaching education things…" (C5)
	Environmental manipulation	Airbags, All conditions (4), Best environment (3), Comp condition simulation (3), Soft-snow (7), Varying feature size (8)	"I think [airbags] have their place, but I think they're over used." (C9) "I think airbags are awesome. A lot of people don't like to use them, but I think they're a really good tool for the athlete once they understand how to use them properly." (C3) "I usually base our summer riding around new trick acquisition so that you're getting a little bit of mileage on the new trick in soft conditions" (C10) "I feel like the most important thing is a well-built jump or a well-built feature and not so much the softness of it. Sometimes the softness, I feel, can be even a little bit risky or dangerous, to be honest." (C7)
	Individual tools (2)		"…in slopestyle and halfpipe you can build a miniature jump and then you can use your little figurine." (C3)
	Off-snow movement	Biking (2), Diving (4), Dryslope (1), Ice Skating (1), Rollerboards (1), Rollerblades (2), Russian Swing (1), Skateboarding (9), Slackline (1), Surfing (4), Swimming (1), Trampoline & acrobatics (9), Water ramps (2)	"…anything that's going to aid in balance, coordination… something that's also an action sport in its own right that gives you that element of…risk on its own so it's exciting." (C5) "I'm a big proponent of skating or rollerblading." (C9) "For trampolines, we're just getting that air awareness, maybe trying a new trick. But it's definitely very different than getting on-snow with the trampoline." (C10)
	Pedagogical considerations	Analogies (2), Coaches' confidence (1), External cues (1), General transfer (9), Imagery, Internal feedback (1), Modelling, Part-whole (9), Repetition (7), Simple-messaging (4), Skill refinement (7), Sources of information (7), Specific transfer (8), Video	"…as a coach, you've got to realize that there's really only about five or six problems athletes have in the halfpipe. And it's just a matter of how you communicate to the athlete to solve those issues that they're struggling with." (C3) "…we do model but we take elements…say take five other elite athletes and we take their strengths and we focus on putting them all together to create I guess it sounds funny but a super elite athlete" (C1) "To me the role of video feedback is massive. I can sit there and say a thousand times to do something, or they're not doing something, or that this is what they're doing, and this is what they need to do, but a picture speaks a thousand words." (C4)

Training aids & coaching tools (Cont.)	Physical considerations		"I really believe that strength training in a gym done improperly for an extended period of time…can make you not as agile. You can be slower, you can be more muscle-bound. In this sport, you need to be quick and agile at all times" (C9) "I was a believer in that the best way to get better was just being on snow, but…as our sport progresses and stuff gets bigger…we've got some work to do on the physical aspects of the athlete so that they if they land tricks low, that they have the strength and ability to recover, so that they can continue their run." (C3) "We do tend to work a fair amount on power training mostly because of how I feel that translates into, probably more than anything, taking a landing." (C5)
	Psychological considerations	Centring (1), Coping (8), Goalsetting (6), Pre-performance routines (3), Self-talk (3)	"…we have a whole mind performance staff, and I hardly use them. I guess that says kind of where I'm at with that." (C9) "…when I was working with younger riders, yeah. You have them develop triggers to get them in the zone. Get them out of just chilling, hanging out with their friends, to, "Okay, it's contest time." I'm in the zone." (C10)
	Specialist support	Acrobatic specialist (3), Assistant coach (4), Chiropractor (1), Doctor (2), Family (1), Logistics (1), Massage (2), Nutrition (2), Performance analyst (1), Physiotherapist (9), Sport psych, Strength & conditioning (9), Team-mates/peers (7), Translator (1), Videographer (3), Wax Tech (6)	"You could argue different things but it would be strength and conditioning, physio, then sports psych. And then chiropractor would be the last." (C6) "…sport psych, physio, acrobatic training specialist, strength and conditioning and nutritionist. I'd say those five in that order." (C4) "I would say toss up for priority between…S and C and sport psych …if their body isn't strong enough or capable enough to progress and learn a trick, it's pointless trying to teach it to them because they're just going to get hurt." (C8)
	Technical considerations	Body-part focus, Directionality (2), Equipment, Execution & grabs (2), Focal points (2), Fundamentals focus (4), Line in the pipe (2), Rhythm & timing (9), Stance & body position (4), Takeoff & landing (5)	"I refer to body parts almost every single time I'm talking to them." (C3) "…sometimes you que the body part, sometimes you que what the board is doing…" (C1)"Particularly now with the advent of double, triple, and even quad corks, the rhythm of the trick is extremely important, perhaps more important now than it ever was." (C4) "…our sport is about timing. If you're timing's off, then your trick's going to feel uncomfortable or sketchy." (C10)

Planning, periodization, reflection & adaptation	Adaptation		"I'm constantly adjusting my training plan" (C3) "…that is the most important thing…as a coach and an athlete – being able to adapt and change on the fly." (C1)
	Constraints (8)		"Budget." (C2) "Resources. I mean, I have to look at the budget. I have to figure out the balance where we're not using too much money and then making effective use of the money we have, basically. That's our biggest concern, I'd say. "Money, time, parents. Weather, but it is what it is." (C9)
	Periodisation (7)		"I guess we just prioritise….we've built a programme. And then in certain phases, certain things become a priority, and that's the priority for that phase." (C6) "We categorise certain periods throughout the yearly training calendar for progression versus results." (C2)
	Planning	Athlete involvement, Olympic quadrennial (9), Planning timeframes (9), Written plans (9)	"Some people need to know really far in advance, they need to know. Some people like to just live in the moment, and there's pluses and minuses to both personalities." (C9) "Most recently, the longest I've planned is four years." (C6) "we'll plan the 12-month period. The only exception I've found so far to that is around the Olympics where we took an 18-month training approach" (C8) "I'm seeing a lot more value in real short-term daily goal planning, goal setting." (C5)
	Reflection	Reflection-in-action, Reflection-on-action	"if…the rotation is taking a lot of time and I'm at the top by myself, then of course, I have time on my hands to figure out what I'm doing and reflect on what I'm doing sort of on the spot, and maybe change something if I feel like it." (C7) "I constantly reflect on my coaching. It happens every night whether I want it to or not." (C8) "I think I'm constantly asking myself 'Am I doing right by these guys? Is this what they need? Am I being too hard? Am I being too easy?'" (C3) "I reflect on my coaching all the time and it quite often occurs in a constructive way. It occurs because I think about what I'm trying to accomplish or what I'm trying to do to help an athlete to accomplish what they want to accomplish and I think long and hard and often about what the best way to go about that is" (C4)

Catering for inherent risk	Formal Risk Management Strategies	Injury debriefs (3), Periodisation of risk (9), Progression checklist (5)	"The most common occasion when I…reflect on risk management is…if there has been an injury…I think, whether or not the risks should have been managed more carefully, or what the different reasons were for the injury to happen in the first place." (C7) "Push it in the training environment, then when we get to events, you actually operate at a lower level than you are in training, because the environments are typically a lot more unpredictable and a lot more dangerous in the actual competition environments." (C8) "We have a system of checklists and a lot of communication back and forth between the athlete to process the decision." (C6)
	Informal Risk Management	Adapting to the weather (9), Coach testing facilities (2), Collaboration in decision-making (6)	"…we have to make changes on a regular basis. Not so much due to the planning not being correct, but more so the, the environment side of things – the field of play." (C1) "…the final decision is actually the athlete's because it's their body and their health they're putting on the line….So the discussion is both, but the final decision is the athlete." (C6)
	Safety Focus (6)		"I know it sounds basic, but I think safety's always the first thing and I think the second biggest thing is the mental wellbeing of the athlete" (C2) "Everything has to be perfect in my eyes, leading up into a new trick. If there's something off, there's something different, then…I'm going to not have my athlete do that new trick." (C10)
	Differences between FSSB & Conventional Sports		"Well, the main difference is that there's a lot more to lose." (C6) "Fear. That one's a huge part of everything. It's what I would do a research project on if I had to. No one's nailed it. No one's figured out how to crack the code of how one kid can and one kid can't manage fear." (C9) "The ability to take risks and believe that you're going to come through it, is kind of a hallmark of action sports that I think isn't as overt in other sports." (C4) "The huge difference for our sport too, and snowboarding went through it just like freeskiing is going through it now, is that all of a sudden overnight they went from being action sports to being Olympic sports." (C8)

Table 6.1 Tabulated summary of participant responses and themes identified

6.3 Detailed Reflection and Discussion on the Four Main Themes

Building from Table 6.1, I now provide more detail and consider discussion on the themes identified.

6.3.1 Theme 1 - The Nature of the Optimum Coach-Athlete Relationship in Action Sports

The nature of the sport and the cultural milieu as discussed in Chapters 2 and 3, impacted the role of the coach and the effectiveness of the coaching approach. Clearly, there has been a lot of research already on coach-athlete relationships in more conventional sport settings (e.g., Jowett & Cockerill, 2003). Accordingly, my purpose here was to highlight the differences which seemed to follow from the particularly challenging nature of P&P, the inherent risk and the reward for progression and creativity.

One clearly apparent difference to other sports was the level of importance placed on the role of the coach as guide and mentor when working with high end athletes. C7 stated:

> I don't feel like the…traditional authoritative coaching model works that well in snowboarding, so I feel like the athlete needs to have a pretty clear idea of what he or she wants to do with her snowboarding, and where she wants to take it. And then, the coach is more of a mentor, I believe.

C1 agreed: "the athlete will set the goal and the coach will guide the path towards that goal and the coach is responsible for that path being…I guess the most efficient or effective path". The evolution and maintenance of trust was a major factor in building this relationship. Reflecting this, and unsurprisingly given the risks involved, trust was cited by all coaches (n=10) as a critical component of the optimum coach-athlete relationship. This finding is in line with previous studies of the coach athlete relationship in university students (Zhang & Chelladurai, 2013) and research amongst summer Olympic medallists that identified a central role for trust in the athlete-coach relationship (Jowett & Cockerill, 2003). C8 commented:

> I'd say the nature of the optimum coach-athlete relationship is professional, but at the same time, trust-based. So there's a respect between the athlete and the coach as professionals, but they're both very clear in their jobs and their role clarity, but at the same time, there has to be a personal level of trust that goes beyond their professional relationship.

When probed on their reasoning, the risky nature of P&P was cited by the majority of coaches (n=7) as making trust a critical aspect of the coaching relationship. To quote C4:

> Perhaps it's even more important in action sports because of the danger factor, and not only will the person potentially fail or fail to achieve what they're trying to achieve, but they might actually get hurt doing it and so it's extremely important that there be a solid bond of trust between coach and athlete.

The importance placed on this by coaches matches work done in other adventure coaching environments that share similarities in terms of risk by Grey and Collins (2016).

Coaching Style

Whilst the trust element was universally seen as central to the coaching process, participants also acknowledged the benefits of a multi-style approach (cf. Collins & Collins, 2015). Following this lead, and to provide some structure for participants, I introduced the concept of a continuum from direct instruction to guided discovery (based on Mosston & Ashworth, 2002). Some coaches discussed sliding back and forth along the scale based on the age and stage of the athlete and the nature of the activity; C1 pointed out:

> …when the risk is high you are very cautious on your use of guided discovery as opposed to the instructional base…then when they make that move from a developing athlete into an elite athlete that scale can swing across to the athlete making more decisions on their own and keeping safe and making the right decisions more independently.

C8 concurred:

> I found that there's a direct correlation between direct instruction and guided discovery along the spectrum of the skill level, that at an introductory level it'll be more direct instruction, whereas the higher end the athlete, it becomes more of a joint operation with discovery happening both on the part of the coach and the athlete in an effort to actually progress the sport.

Direct instruction was sometimes a component of technical coaching and skill acquisition - C9 identified situations where direct instruction was particularly useful:

> …you can be more direct I think with professional athletes because you have already set up a dialogue for over a decade with some athletes. And you just need a few cue words, or one thing, one specific technical piece of information to give them and that sets them back on track or gets them to go where they need to go.

On the other hand, the importance of guided discovery techniques, particularly in action sports, were highlighted by C5:

> …much of the time it's just about trying to engineer the right environment for them and then if that's there, they're going to grow and thrive within it. And that kind of growth, especially in action sports, is usually almost the most productive growth because that's the core of action sport, is that creativity. And that's where it was born, was from people just doing the stuff on their own and feeling it out. That's where I think the gold standard of the development still is in many ways.

Up and down the levels of ability in which these coaches had previously and currently operated, generating an autonomy supportive coaching climate (see Mallett, 2005) was considered imperative. Following from this direction, decision-making was highlighted by the vast majority of coaches (n=9) as being the responsibility of both coach and athlete working in a partnership or collaborative relationship – again a product of the high-risk nature of the sport: “I say it's a discussion with both, but the final decision is actually the athlete's because it's their body and their health they're putting on the line” (C6).

In most cases, the coach provided a sounding board to the athletes, offering options and suggestions based on their observations, stepping in to offer potential solutions as required while encouraging learning and development. As in other sports (Weinberg & Gould, 2011), this contrasted with earlier stages of development, in which decision-making was more likely to be led by the coach. Indeed, some of the coaches (n=5) specifically promoted the power of the athlete even further in the decision-making context suggesting that the athlete should have greater responsibility for decision-making than the coach particularly with respect to risk-management. According to C8:

> 100% the athlete is responsible for decision making. The coach can offer advice and offer insights. But at the end of the day, it is 100% on the athlete. I feel like the coach is definitely responsible for laying out more of the plan and laying out schedules and providing opportunities, but at the end of the day, whatever the coach provides - the coach can provide everything, the coach can provide nothing, at the end of the day, it's the athlete that's going to be responsible and is going to be the one that definitely makes that decision.

C4 agreed and reported promoting the focus of the coach in planning and the long-term to allow the athlete to focus on the present:

> The final decisions about everything lie with the athlete. But perhaps a coach or an administrator might have more input to the athlete as far as the plans and changes that need to be made to the plan because that person is more of an administrator and a guider, is the one who's actually keeping track of the plan. The athletes tend to - and this is a good thing - tend to live more in the moment.

Influences on Coaching Style & Decision-Making

Six of the coaches stressed that the biggest influence on both their coaching style, and the responsibility for decision-making, was the personality of the individual athlete and the athlete's needs. As C4 put it: "There are athletes who crave coaching. There are athletes who reject coaching. And then there's everything in between." From a more generic perspective, the majority (n=6) of coaches suggested that female athletes tended to prefer a greater amount of structure and input than their male counterparts. C7 mentioned: "Generally, the female riders tend to come up and request more feedback, and more direct advice." C8 concurred: "…the more information the better, with girls. I've found with guys, for the most part, they want as little as possible. They'd rather just get it out of the way. Girls like to talk about it." Explanations for this phenomenon provided by the coaches included a feeling that females were generally more risk averse when compared with their male counterparts who were also likely to favour greater self-determination in their performance. C5 stated:

> I feel like for a lot of the men because they're just not as risk averse, they're a little more comfortable, "Ah, whatever, I'm going to try it anyway and see how it works," whereas the women would like someone to go, "I think you should try this. I'm pretty confident it's not going to screw you up.

It has been suggested that there are a number of evolutionary reasons that females are more risk averse than males including Darwinian analysis of parental investment, risk-taking of males to achieve greater resources and thereby attract more mates, and the "offspring risk hypothesis" (Harris et al., 2006, p. 60). Of course there is also evidence of a nurture explanation, indeed Morrongiello et al's (2010) results of mothers' and fathers' reactions to risk taking behaviours of sons and daughters, suggested that parents socialise boys and girls differently regarding risk taking. Interestingly, Mather and Lighthall (2012) found that stress amplifies gender differences and males take more risk and females take less risk under stress. It is a given that action sports involve stressful learning and performance environments, therefore it is perhaps not a surprise that some of the coaches identified this difference in their athletes. (For a review of action sport specific sociological research related to gender differences see Wheaton and Thorpe 2013). In contrast somewhat, Sundheim (2013) contends that the most successful risk-taking is a collaborative effort between men and women. In light of these differences, it would be interesting to evaluate the effectiveness of both a male and female in the coach athlete dyad in terms of the risk-management element of elite action sports compared with same gender coach-athlete dyads.

One of the coaches identified that pre-pubescent girls might have an easier time committing to higher-risk tricks and this was something he had experienced across other sports such as gymnastics and diving. As mentioned earlier, there was a common understanding that, at an earlier stage of an athlete's development, more of a direct-instruction coaching style and coach-led decision-making was more appropriate; this serving in transitioning to greater autonomy for the athlete as they progressed to the elite ranks. This was in line with work in other domains that has found differences in the needs and most appropriate support for learning as the learner progresses through levels of experience and performance (i.e. Benner, 2001; Dreyfus & Dreyfus, 1980).

Notably, however, while this growth/transition change generally goes hand-in-hand with the age of the athlete, one coach stressed that it is more about the training age of the athlete rather than chronological age.

The number of athletes each coach was responsible for varied, and this was another factor which influenced the way in which coaching style and decision making was applied. For example, C5 identified that sometimes decisions had to be made by the coach based on what is best for the team as a whole:

> …you're trying to give more direction in terms of say, planning, certainly with regards to something like say, planning a season, especially if you're the coach of a team. In that respect, then, yeah, you're giving pretty specific direction. 'Hey, here's what we need to do. We're going to define it. We're going to try and make everyone stick to it because that's what's happening as a team.'

In summarizing this section, and placing results against constructs identified earlier in the thesis, it is clear that, for these participants at least, coaching is well established within P&P. Once again, Ojala & Thorpe's (2015) contention that elite action sports athletes have historically rejected coaching due to a perception of top-down hierarchical power relations is not echoed in the present tense amongst this sample of elite coaches. As I stated earlier, this *may* demonstrate a rapid maturing of the sport, the culture and the athletes. Whether this is the case or not, unsurprisingly our sample of elite action sports coaches widely support an athlete-centred approach. Whilst this reflects findings from other more traditional coach-athlete relationships, the extra risk inherent in P&P appears to play a central and important role in determining coach behaviour, interactions and style. I return to this factor later in the fourth section of the results.

6.3.2 Theme 2 - Training Aid and Coaching Tool Use and Efficacy

The second and largest section of the interviews focused on the mechanics of coaching. Coaches were questioned on their perceptions of a variety of training aids and coaching tools to evaluate and gain a better understanding of the practice of elite

P&P coaches. I next present these perceptions, starting with practical considerations, moving to theoretical based approaches to skill acquisition, then finishing this section by considering coach's views on optimal specialist support.

Manipulation of the On-Snow Training Environment

A wide variety of approaches to training in terms of environmental manipulation were utilized as shown by the numbers of participants mentioning the various techniques shown in Table 6.1. As a general rule, tool-use was aimed at decreasing risk by seeking more forgiving training environments such as airbags, and soft-snow conditions for progression in line with the athlete interviews in Chapter 5. C1's statement was mirrored by many of the coaches (n=5): "At times, we target soft snow conditions purely because the safety goes up and the risk goes down therefore you can push the limit a bit higher". There were, however, some differences specific to the discipline – for example coaches working with halfpipe athletes favoured the use of airbags while coaches working with slopestyle athletes were less inclined to use them. Halfpipe coaches (n=4) in particular sought a soft halfpipe wall when athletes were taking new tricks to snow for the first time and through early repetitions. Notably, however, C7, a slopestyle and big air coach identified risks associated with soft snow conditions:

> I feel like the most important thing is a well-built jump or a well-built feature and not so much the softness of it. Sometimes the softness, I feel, can be even a little bit risky or dangerous, to be honest.

C9 agreed that "Sometimes too soft is a problem".

Some coaches (n=3) stressed the importance of finding the best quality environment and facilities for their athletes to train in. According to C5: "if you could have just a perfectly shaped pipe for a steady amount of time that would be the best thing ever"; while others (n=4) focussed on training in all conditions to prepare for the varying conditions experienced in competition. According to C3,

> I think one of the strongest tools that I actually use is the fact that I make my guys train in all the weather conditions. I don't care if it's snowing, I don't care if it's blowing sideways, we're still going to go out and train. Sochi [Winter Olympics 2014] being the number one example of this. The weather wasn't great and the conditions weren't good. You saw how the snowboard halfpipe competition went down. We've got to train in all conditions.

Indeed, some of the coaches (n=3) based their training locations specifically around the conditions likely to be experienced at upcoming competitions. C2 suggests: "Korea [Winter Olympics 2018] is going to be a little different. it's going to be pretty hard, pretty fast, pretty icy, so now we're going to target that." This seemed to reflect both a situational awareness and an anticipatory capacity.

Coaches (n=6) were also cognizant of varying the training environment in other ways, including the size of jumps their athletes train on, helping them to develop adaptable execution of tricks that could be transferred from one feature on a slopestyle course to the next. C8 stated:

> I think varying where athletes train, how they train, what time they train, the size of features, is one of the key components to slopestyle skiing just because the courses are constantly changing and the way that an athlete can stay on top in slopestyle is simply being able to adapt to different features, different conditions, as fast as possible.

Off-Snow Movement

The development of adaptability was also a major consideration in the off-snow diet. Coaches challenged their athletes by including a plethora of complementary activities including trampolining, skateboarding, surfing, acrobatics, diving, rollerblading to name but a few (see Table 6.1). Trampoline training, in line with the comments of athletes interviewed in Chapter 5, was selected by coaches to develop a general transfer of skills to snow in terms of agility and aerial awareness. C8 suggests: "Just introducing different ways to spin, different ways to flip, so [athletes] increase their air-awareness. They understand how the human body spins and flips, [which] kinaesthetically is incredibly beneficial." An added benefit of using trampolines was

the ability to achieve high volume repetition of specific movement patterns in a low-risk environment. C4 stated:

> …the trampolines, the diving boards, those things have a very specific application where athletes are able to practice a movement or a motion over and over and over and over and over again in a relatively safe environment. And get that movement or motion on lock where there's no real danger.

A tertiary utilization of trampolines was for the specific transfer of certain movement patterns and technical elements of performance such as takeoff-timing and projection as explained by C8:

> …a big piece we're trying to develop is patterning. The idea of getting off of the ground and then rotating. Whether you're doing it from a standing jump or doing it five metres off the ground on a super trampoline…And there is a lot of direct transference from that into slopestyle, halfpipe, big air, rails.

Complementary 'moving platform' sports such as skateboarding and surfing which are closely linked to snowboarding (Thorpe, 2009) were also highlighted by the vast majority of the coaches (n=9) as a supporting off-snow training activity. C1 identified general transfer: "…skateboarding will challenge more fine motor skills in the lower half of the body than snowboarding will or can, and things surfing can bring is the timing and how you distribute power from the body to the board." The similarity in the mental challenge of these complementary board-sports was also noted by C1 as a useful element:

> Throwing yourself into a new environment – so a snowboarder who hasn't been to the beach or has never really been to the beach in their life can go test out surfing and feel the fear and feel what it is like to not be in their element…they have to adapt fast and push through those barriers like fear and so on. They probably don't have as much control…and their skillset is not there so they have to adapt and they have got extra fears and extra things that come at them environment wise…that they don't really deal with in their natural or preferred environment.

This concept of utilizing other activities to expand an athlete's comfort zone or to enhance experience of the challenge-skill balance (a critical component in the experience of flow state, Jackson, 1995) was mirrored by C5:

> …anything that's going to aid in balance, coordination….something that's also an action sport in its own right that gives you that element of…a little bit of risk on

> its own so it's exciting. And you're challenging yourself through that. You've got…a little bit of a fear-based challenge which is one of the things unique to action sports compared to some other sports where it's not as much of a[n]…issue"

Theoretically Based Approaches to Skill Acquisition

Extending from these practical considerations, theoretically based approaches to skill acquisition included pedagogical, psychological and technical considerations. In referring to specific tools, the power of imagery emerged as a tool widely supported by eight out of 10 of the coaches supporting the comments of athletes in Chapter 5. According to C10:

> I think the more that you can do it in your head, the easier it's going to be. You can kind of condition your muscles to do it. I think it was like four years ago I heard about Marcus Kleveland. He would go out, visualise a trick for hours and hours and hours. Go out and try a trick, land it first try.

C3 mentioned utilizing imagery in order for the athlete to be able to manipulate time in the development of tricks: "I'm trying to slow down the learning process as slow as it can get so that they're really not forgetting - not leaving anything behind." C4 demonstrated cultural intelligence in his approach to introducing the use of imagery with his athletes:

> I present it all the time to my young athletes in particular as daydreaming about their sport because mental rehearsal or visualisation sounds clinical or boring and oftentimes closes their ears when I talk about it in those terms. But everybody daydreams about snowboarding or freeskiing, especially these kids. So, when I talk about it as daydreaming, it sounds like fun and it actually becomes something that they might do.

As a further adjunct, the use of modelling was widely, though albeit carefully, supported; C10 suggested:

> Especially for trying a new trick that's been done, and there's a rider there that's already got it. You kind of get them to start watching for that. But you don't want it too much, because otherwise they're going to be exactly similar. I want my athletes to have their own individual style.

C4 noticed the ease of targeting other people as examples to model from:

> There will typically be people in the pipe…doing things that you want them to do, so you can point those people out and have them watch. The other thing is in this day and age, you can YouTube any trick in the book and get 100 results. You can

> watch many, many people doing it, because everybody does things a little bit differently too, and you may see a particular way that you want to do it, by having access to all those different images.

Indeed, the use of video feedback was also widely supported by all of the coaches (in line with Woermann, 2012; and other action sports research e.g., Ellmer & Rynne, 2016; Jones, 2011), in some cases in combination with both imagery and modelling as a primary source of information for the athletes (this point is mirrored in athlete interviews in Chapter 5). C2 perhaps summed it up the best:

> …I probably won't show my guys bad stuff, and I'm not a real fan of waiting till the end of the day to sit down to have a session. I think we use it as a correction tool and as an enforcement tool of good tricks straightaway off the bat…And then we'll let the guys have the video themselves and go through it, and I think that's also part of building self-sustaining athletes, is that they can look at themselves and start seeing things themselves, as well, that may have been the cue for what one of the coaches gave them in a training session, where they go, "Oh, I get what coach is saying now." So that's how we use it. It's super important.

When asked about their approach to conceptualizing a new trick, many of the coaches (n=8) discussed breaking a trick down into components before focusing on the trick as a whole. C9 stated: "I'm definitely a component person, yeah, and then get to a whole. That just seems such a no-brainer." C10 agreed:

> …you break it down piece by piece and then you start making it a whole so that they can see it all as one trick after you've kind of gone through and worked through the basic parts of it. So, yeah, definitely a bit of both. Piece by piece and then the trick as a whole as you get into the repetition of it and start acquiring it.

C8 had a slightly different approach:

> I tend to focus more on a take-off than anything else in contrast to breaking it down into components because typically what I've found with working with athletes is that they can only process one concept at a time. So, if I talk to them about their grab they'll miss their take off. Or if I talk to them about their landing, they'll miss their grab. So, we'll talk about the grabs and the landings and those things at other times, but right before they do the trick I'll just focus on the take off.

In order to finesse and refine a new trick, repetition was highlighted as a critical element, as C6 stated:

> …the simple answer is just playing the numbers game, but trying to play the numbers game and respecting the fact that we want to build this trick correctly.

We want to build it safely, and we want to manage the risk.

More on managing risk later, but safe to say getting enough repetition (compare with athlete comments on repetition in Chapter 5), while avoiding excessive exposure to risk was a pivotal focus for many of the coaches. C9 identified confidence in a trick as a crucial component and repetition as a key technique in developing confidence: "I want to encourage them to believe that, yes, they do know how to do a certain thing, but it's still good to repeat that same trick and just get more and more confident about it." While an alternative strategy utilized at times was to put a trick on ice:

> …first learn it then put it in a run then compete it. And then maybe put it away for a little bit because your mind always wants to take the path of least resistance and you can become complacent with something or lacks its magic or if it's a really difficult trick, you might not respect it any more…your mind can play tricks on you. Sometimes put it away for a little while once it gets to a certain level.

To support the application of these different perspectives, sources of information available to the athlete were many and varied, including video, social media, team-mates, peers, coaches, assistant coaches and of course judges. C1 highlighted the role of the coach in supporting an inquisitive athlete

> I really think that as a coach you should promote learning off others…so rather than just being the… direct source of learning yourself you should enable the athlete to search for information off others around and see others...as information...you are trying to develop an information gatherer so to say.

Another key element of quality coaching in terms of feedback delivery intimated by a number of the coaches (n=4) was the criticality of simple messaging, especially at times of increased pressure. C6 highlighted:

> I just want to deliver one piece of information. Especially in the heat of the moment, because you can't expect an athlete to drop mid-40, 50 k's an hour going into a wall thinking about two or three things. It just doesn't work.

Talking of pressure, while some coaches mentioned the natural evolution of coping skills from exposure in the environment, and others deferred to the input of sport psychologists, six of the coaches expressed actively working with their athletes on how

to deal with pressure. C1 outlined his approach to developing coping skills with his athletes:

> …resilience is huge, how to be ready and how to adapt to the things that come at you. A big one is controlling what you can control, controlling the controllables – that helps with their coping and throughout training sessions you can increase fear or increase pressure or manage and adapt those things so they can be used to it and learn to be in that situation.

Pre-performance routines were identified by three of the coaches as an important part of getting ready to compete - C2 explained:

> I'll talk to my guys about how a good golfer will have the same setup - the same pre-game routine - for each shot. And we're trying to do that with our guys now, that they have the same pre-game routine…but we've been working on, like I said, those trigger words - those performance triggers. It can be as simple as putting a mouth guard in. Once the mouth guard goes in, it's game on - block everything out - so they're the type of things we concentrate on.

Other coping methods, either to deal with the anxiety associated with a new or difficult trick, or to prepare for competition included centring as explained by C6:

> We work on tactics to get [the athlete] back to being mentally centered before he drops for his next run. We've worked a lot on that over a long period of time because it's not easy...getting in a place you want to be before you're…doing something scary where you've got to be on. It's risky and you don't want to be clouded with emotions.

From a technical perspective, interestingly it was a focus on fundamental skills that was the most common response in terms of where a coach spends his or her most time engaging with an athlete even at the elite level. C5 found:

> Surprisingly, I talk a lot about very, very basic fundamental aspects and even with the best athletes, I probably put more time into a technical - basic fundamental reminders than really working through the high-end technical part of a skill.

Stance and body position, take-off and landing technique, grab-hold and execution, line in the pipe, focal points, rhythm and timing were all mentioned as examples of fundamental skills that were developed and continually referred to during on-snow training sessions. Other tools for skill development included an internal focus on the movements of specific body-parts, or alternatively an external focus on what the athlete's equipment was doing.

Specialist Support

In terms of specialist support, the coaches in the sample had a varying level of access to, budget for and utilization of additional personnel. From the head coach of a large and established national team, to the regional coach, to the private coach, the context was different. Many of the coaches interviewed performed multiple support-team roles themselves and the prioritization for additional personnel varied. However, there were certainly clear priorities at the top of the list. Sport psychologists, strength and conditioners and physiotherapists were the roles sought after by most of the coaches, due to the specialized nature of these roles. There was a moderate demand for roles that took pressure off the coach including assistant coach, wax technician, and videographer that could free up the coach to focus their time and energy on other areas of performance. Other specialist personnel that received mention included doctors, chiropractors, nutritionists, massage therapists and logistical support. The importance in the role of team-mates or peers in optimizing the training environment (Ellmer & Rynne, 2016) and enhancing skill development was highlighted by seven of the coaches as outlined by C8:

> One of the biggest tools that I like to use actually is whenever I work with athletes, I like to have a group of others so that they don't feel so much pressure quite on themselves and they'll actually learn a lot from each other…everybody has strengths and weaknesses and something that might be easy for them might be hard for somebody else and vice versa.

In summary, it was clear that coaches were sophisticated in their use of varied tools and approaches in order to achieve athletic goals. Considerations of safety still emerged but processes used also reflected a well-considered balance of specific to generic skill development, most particularly with regard to developing the athlete's adaptive capability.

6.3.3 Theme 3 - Planning, Reflection and Adaptation

While developing an athlete's adaptive capability is one critical element of the coaching process in action sports (as identified in Chapter 5), the adaptability of the coach is also constantly being tested. A key part of the balancing act identified by responses from the coaches, involved achieving a solid enough structure, and planning far enough ahead, while remaining flexible and adaptable at mico-, meso- and macro-levels. According to C3:

> I have my plans, I have my spreadsheets and I have my ideas. I keep a lot of statistics and potential ideas. I'm constantly asking about their runs. We discuss that kind of stuff. However, I am also ready to fly by the seat of my pants if I see the need for that to happen.

Again, it was the different situations and contexts of the coaches interviewed that provided different answers to the question on planning timeframes. The most succinct long-term planning timeframe being from August through to the end of the competition season the following March (C7), and the most extensive being two Olympic quadrennials = 8 years (C1). The vast majority (n=9) of the coaches mentioned the Olympic quadrennial as a key governor of their planning focus driven by their funding mechanism and the priority of Olympic success for elite athletes and National Teams. As you will recall, athletes interviewed in Chapter 5 identified the transition to mainstream and the focus on the Winter Olympics as a pinnacle event every four years, in changing the dynamic in terms of the need to peak, and delivery of a particular run and/or tricks, compared with the previous ongoing annual cycle.

All coaches reported having written plans, and unsurprisingly, at the elite level, in line with the collaboration in decision-making and autonomy-supportive climate discussed earlier, athlete involvement was perceived as critical. Levels of planning along with levels of focus were mentioned by the coaches and as C2 put it:

> I don't think it's healthy for [athletes] to look too long-term, especially as we're coming to these last 16 months, the Olympics. I think it's got to be looked at in that three-month, six-month type cycle so they can see logical steps to where the end goal is.

Many of the coaches recognised the importance and requirement for athletes to remain task-focussed and the importance of daily goalsetting, however, C10 highlighted the need, at times, for more of a Machiavellian approach (cf. Cruickshank & Collins, 2016):

> …if it's a new trick that I want them to acquire, I might not even tell them. I might have them start warming it up and then if I see they're ready and they're riding well, that's when that new trick comes in. "All right, what do you think about trying this?" I've found a lot of success with that. Whereas, sometimes with planning ahead of time they almost shut down right when they show up.

Periodisation in terms of intensity versus duration, progression versus outcome, training versus competition, on-snow training versus off-snow training, overload versus recovery, skill acquisition versus consolidation, peaking, energy management and burnout, were some of the considerations of the different coaches in their approach to planning. The quadrennial was broken into key phases by most, and then the annual plan based on the competition season and off-season was considered relative to need-to-do competitions, development competitions, training camps and locations, facilities available, and athlete need. Coaches that had been in their roles for a number of years had tended to have found a workable annual structure and tweaked last year's plan based on reflection and feedback. Periodisation was reviewed as the year progressed, measured against benchmarks, and occasionally needed to be adapted to account for things like injury or periods of bad weather. According to C2:

> …unfortunately when you talk about a national team…you've got guys that are either 100% fit or they're not, and so you're kind of managing that. So I think, for me, it gets down to having a pretty comprehensive plan and a comprehensive set of benchmarks of where each athlete needs to be, and then concentrating on those things that are going to get them there.

Constraints to planning were another aspect impacted by coaching context, however, budget, weather and facility access/availability, were the most cited elements. Other constraints to planning included a lack of clarity on the athlete's part in their

personal vision, rules imposed by national governing bodies, desire to participate in backcountry filming, the impact of family members, and of course, time running out.

As previously mentioned, the need to adapt plans not only at the macro level, say due to a major injury, but also at the meso and micro levels was a fundamental part of the coaches' role. Changes in form both positive and negative could have an impact on the optimal schedule; a good result at one event could lead to access to an elite invitational event such as the Winter X-Games for example, although an athlete may only find out a few weeks prior resulting in the need for a rapid change of plans. A form slump and lack of results on the other hand could also lead to an in-season switch in focus. While these factors may be generalised to a range of sports, nuances of P&P (and other action sports performed in the outdoors) in terms of adaptation are centred around the impact of the weather and the condition of, and access to, training facilities. As C1 sated:

> The adaptability and agility of the coach and the athlete to the plan in our sport is really, really important…we have to make changes on a regular basis. Not so much due to the planning not being correct, but more so the, the environment side of things – the field of play.

Perhaps this is one of the most useful qualities of the coach: his/her ability to maximize the training effect by adapting in-session to the ever-changing conditions (retaining situational awareness, cf. Moran, 2014), to ensure energy is being invested in the most appropriate areas. C2 suggested: "I think an adaptable good coach [needs] to have not just one plan. I think you've got to go on the days where you have a contingency for a contingency." The pre-cursor to adaptation was underpinned by the reflective process aimed at optimizing performance and where appropriate minimizing injury risk.

As per Schon's (1983) differentiation between reflection-in-action and reflection-on-action, coaches identified both processes as being a core part of their work. For example, C6 mentioned use of video as a tool for performance analysis and self-analysis combined with reflection-in-action:

> I'll always watch [video] and watch it again. Wait a period of time, re-watch it, and just police myself. Make sure I'm happy with my feedback. I'm thinking, "What can I upgrade? Can I give that feedback better? Can I present that information better".

C4 identified reflection as an ongoing tool:

> I reflect on my coaching all the time…I think about…what I'm trying to do to help an athlete to accomplish what they want to accomplish and I think long and hard and often about what the best way to go about that is, and also the best way for me to be acting so that I'm having as positive of a impact as possible and we're actually going to achieve what we're trying to achieve.

Many of the coaches (n=7) discussed the use of reflection as a self-improvement tool and the necessity to be continually evaluating and learning from their own performance. C8 identified the need for reflection on own performance and the performance of others in order to remain competitive as a coach:

> …that constant self-criticism [has] definitely been a part of coaching forever. And that constant strive of is there something that I could learn from others and am I too closed minded and just constantly looking to be one step ahead of everybody else.

For the P&P coach, it is clear that planning, action, reflection, learning and adaptation are occurring on an ongoing basis and at various levels in their practice. Mastering these elements and maximizing learning is critical in order to be effective. An aspect of P&P that has continually been referred to and that has a central impact on the deployment of this action-learning cycle (Argyris & Schön, 1974; Kolb, 1984; Revans, 1998) is the high levels of risk inherent within the activity.

6.3.4 Theme 4 - Catering for the high levels of risk inherent within the activity

Similar sports such as Freestyle aerials have competition performance limits put in place by the sport's governing body to attempt to moderate the high levels of risk within the activity. For example, inverted manoeuvres are limited to three somersaults in competition (FIS, 2016). New jumps or modifications must first be proposed in writing and approved by the FIS Freestyle committee so they can be assigned a degree

of difficulty crucial for their accurate scoring under the Freestyle judging system. P&P however has judging criteria that actively promotes innovation and progression and, as described in Chapter 2, applauds new and ground-breaking manoeuvres being performed in competition for the very first time. With less restrictions, the responsibility for sound risk-management is arguably put squarely on the shoulders of the athlete (and by proxy the coach) and as mentioned is a core part of the successful coach-athlete relationship.

In terms of formal risk management, many of the coaches (n=5) mentioned the use of a checklist including an evaluation of the level of preparation, the physical and mental state of the athlete, along with environmental conditions to assess whether the time was right to attempt high end tricks and expand an athlete's comfort zone. One of the coaches presented this concept as a formal tool, indicating that the coach provided the green light for trick progression when enough boxes had been ticked, while others mentioned assessing these factors (and others) on an ongoing basis when helping the athlete to decide on the right time for pushing their limits. 'Individual danger management' is a skill developed informally by recreational P&P participants (Pabion-Mouriès, Reynier, & Soulé, 2016, p. 588). The coach's role, in line with an autonomy-supportive climate mentioned earlier was therefore to facilitate the development of these skills in the competitive athlete. Another tool to manage the injury risk was formal injury debriefs (mentioned by three of the coaches) conducted by coach, athlete and support staff following a moderate or greater severity injury to learn from the situation and where possible minimize the chances of a similar subsequent injury occurring.

> Basically, the things I really try to reflect on is if there was ever an injury. I spend a lot of time trying to analyse those. And I have trouble with people that say, "Oh well, injuries happen." No. That is a horrible answer. It is your responsibility to try to find something in that, that you could have done better. (C9)

The planning process and in particular the periodization of risk was mentioned by nine of the coaches as an important risk-management tool; a finding in line with the

extensive planning identified in research on extreme sport participants (Brymer & Schweizer, 2013). Establishing in advance, periods where progression is the focus, and pulling back on the risk factor at certain times of the year, were mentioned as coaching strategies crucial to achieving the fine line between success and failure. I will discuss the periodization of risk in more detail in Chapter 8.

In two cases, coaches mentioned gaining more first-hand information from the environment by actively testing the facilities themselves, while the majority (n=9) included continual evaluation of and adaptation to the weather conditions as part of their practice. C1's approach:

> …you're reading it, you're looking at the flags, you're looking at the clouds, you are looking at the snow, you are feeling the snow, you are trying to be in the field of play as much as you can with the athlete so you can understand what it is like and what is going on so you can help…facilitate those decisions.

Collaboration in decision-making as discussed earlier in this chapter was a key element in the risk-management process that relied on a coach's professional judgment on when to intervene and when not to. This fits well with the ideas of Shared Mental Models (or SMMs), which are a feature of naturalistic decision-making research (Cannon-Bowers, Salas, & Converse, 1993).

Previous work has focused on strategies for creating and opportunistically using time within the environment including "reflection-on-action in context" in order to make decisions and adapt in the field (Collins & Collins, 2015). I can certainly personally relate to the observation that "at times the adventure sports coach appeared to be doing nothing practically though was clearly highly cognitively engaged" (p. 629). Adventure sports coaches (according to Collins & Collins) by definition must be able to perform the sport to a reasonable level in order to maintain contact with their students. This requirement is less implicit amongst elite action sports coaches who can choose to travel in the environment with their athletes, (a tactic used especially in the slopestyle discipline where the course is longer than the halfpipe, or in a one-on-one coaching

situation); or operate in a stationary fashion for example at the top of the halfpipe or slopestyle course (a tactic often used when the number of athletes is large, or at competitions). According to C4: “the coach is not necessarily a demonstrator of skills of techniques or tricks because presumably at the elite level that would be above the coach's ability level generally speaking anyways, so there's no need for that.” As such, the current sample of elite P&P coaches sometimes have time while the athlete is completing the uphill phase of their lap on a chairlift or surface tow or snow-mobile to process information, to analyse data, to consider the next course of action or choice of feedback and, importantly, to reflect on their performance, practice and as discussed earlier engage in meta-cognition. C7 explained this opportunity:

> …if, for instance, the rotation [on the lift] is taking a lot of time and I'm at the top by myself, then of course, I have time in my hands to figure out what I'm doing and reflect on what I'm doing sort of on the spot, and maybe change something if I feel like it.

At other times, the coach will need to engage in rapid-fire (referred to as naturalistic or intuitive) decision-making and make split-second decisions if and when they are aware (reflection-in-action) of a red flag in the environment such as an increase in wind speed.

Whilst the majority of the coaches interviewed were used to working in isolation, some (n=3) were routinely working with other assistant coaches and thus had the benefit of being able to check or audit their thinking around risk-management and decision-making with a third party before communicating with the athlete. C5 discussed the deployment of this benefit:

> …in my case, I'm lucky that [decision-making is] very collaborative. I've got a great assistant coach and so we spend a lot of time discussing things like [risk management]. That's where there's huge value in having someone else who's good to talk things over with because it's a grey area...rarely is it 100% black and white…so having someone else with good knowledge to help bounce back and forth, "Well, I'm seeing this. I think this."…that's probably my best tool to help me double-check when it comes to…guide someone into that new, scary, risky trick zone.

P&P coaches have a variety of both formal and informal tools and strategies to assist them in their risk-management. As discussed earlier in this chapter, ensuring that athletes are developing sound risk-management skills and taking ownership for their decision-making around risk is pivotal to success in the (often) long-term coach-athlete relationships in existence at the elite level. As such a crucial element of elite action sports, it would be interesting to establish how elite coaches develop these skills. I would imagine informal and experiential learning would be the primary mode of learning, but could this be improved with a focus in formal coach education, or indeed other methods including peer review and mentoring? A scan of the Canadian (perhaps the most thorough snowboard coaching programme available in the world) snowboard coaching assessment guidelines and evaluation standards finds risk management mentioned albeit only once and buried in an appendix (Canada Snowboard, 2016). A further in-depth discussion of risk-management specific to P&P will be presented in Chapter 9's practical implications section.

Perceived Differences Between Action Sports and Mainstream Sports?

In case some of the differences between action and mainstream sports have not yet been highlighted sufficiently, here are a sample of some of the differences mentioned by the coaches that also summarise some of the challenges for the action sports coach. For C2 it was about culture:

> I think that when you look at surfing and snowboarding in particular, which I've been involved in the most, I think they're very culturally based sports. I like to call it the sport of black sheep. That's all the kids think they're different, but they've found this flock of people that are all different. So I think respecting the culture of those sports is really important, and understanding that in a subjective sport that we're in, that style and throwback to the culture is a really important part of what we deal with.

According to C4 self-belief and risk-taking are the hallmarks:

> So action sports are different in that, in my view, the strength of the mind in believing and seeing complicated movement patterns that are extremely dangerous to perform, and then getting yourself back to your feet, that mental strength is probably the biggest strength of an action sports athlete…The ability to

> take risks and believe that you're going to come through it, is kind of a hallmark of action sports that I think isn't as overt in other sports.

For C9 it was all about experiencing and managing fear:

> Fear…It's what I would do a research project on if I had to. No one's nailed it. No one's figured out how to crack the code of how one kid can and one kid can't manage fear…the absolute difference between these sports and any other sport, period, period, period, period, just capital F-E-A-R, fear. So different. So different. That's it, mitigating fear, and being able to put it aside and do what you love and try to reach your dreams and achieving what you didn't think possible for yourself. It's all wrapped around fear.

I will endeavour to get closer to cracking the code in Chapter 8. Meantime, with all this focus on differences, C5 reflects that while differences to mainstream sport are perceived by action sports participants, perhaps these differences are not in fact as substantial as first thought:

> We're different from all the other sports, all the other athletes. That can sometimes translate to anyone just not wanting to be compared to anyone else. They all want to be a unique individual. I'm questioning more lately that that is something specific to action sport and thinking, "You know what? I bet you can talk to a swimmer or a track star or anyone. People are people. They all want to be a unique individual." [I] used to think it was a little bit unique to us, but it's probably more of just a human thing to a certain extent.

6.4 General Discussion

Referring back to research objective 3, I am confident the study in this chapter has achieved its aim. As stated in the methodology, I felt it important to allow participants to range freely within the structure provided by the questions. Reflecting this approach, a broad range of responses resulted. Accordingly, for the purposes of this thesis, I have considered responses up to this stage in the chapter that hold a majority view including counter-perspectives where they exist and as appropriate. Subsequently, I have developed a 'minority report' looking at specific reasons which might underpin a number of outlying perspectives endorsed by one or two coaches out of the total sample.

Given the comparative youth of the disciplines within the mainstream, and the associated recency of any formal coach education processes (much more advanced in certain nations than others), there was an impressive sophistication in both the range of

tools and quality of reasoning displayed across the majority of coaches. Extending from the sense of community identified as a feature of the sports in Chapters 2 and 3, coaches seemed willing to share practices and ideas to a greater extent perhaps than their mainstream sport colleagues. As such, the majority view provided a positive picture for the current state and future potential for the development of coaching in P&P.

There were also, however, some interesting and noteworthy minority viewpoints. These appeared to fall into three categories. The first minority perspective appeared to emanate from socio-political differences between different nations. Coaches hired to work in far eastern cultures exhibited a greater *lead from the front* orientation than their western counterparts. Specifically, due to a lack of action sport specific history, experience and intelligence, along with rigid sporting structures, coaches were more likely to operate in an action sport consultant role transferring western action sport intelligence to eastern high-performance sporting culture.

The second minority report related to gender differences. Whilst differences between men and women and consequent differences in approach were endorsed as a majority view, it was notable that the single female participant coach saw these differences as much smaller and far less significant. Whilst increasing female representation in coaching is a cross-sport concern (e.g., Fahmy, 2011), this represents an important dimension for critical consideration. As a start to this, I specifically examine differences between male and female athlete responses as a feature of analysis in Chapter 7.

Finally, whilst dynamical systems and non-linear pedagogic approaches are hot topics in other sports (e.g., Chow, Davids, Button, & Renshaw, 2015), these approaches were only mentioned by two of the respondents and then tangentially. From a personal perspective, this makes reasonable sense. The combination of movement complexity, the construction of new and more complicated skills from other earlier learnt

components and the necessity for high levels of cognitive investment to counter the inherent risk seem to make the motoric requirements of this sport less suitable for the unconscious approach. Of course, the fundamental elements of the skills are well addressed by pan-theoretical techniques such as analogy, and there have been examples of implicit motor learning strategies applied to P&P (e.g., Masters, 2013). On the whole however, P&P appears to be a pre-dominantly cognitive domain.

The next step from evaluating information gleaned from the coaches on the optimal approach to P&P, is to gain the insight of the athletes themselves and to compare and contrast their perspective on what constitutes good coaching. This is the focus of Chapter 7.

CHAPTER 7

AND HOW DOES THAT FEEL? ATHLETE EXPERIENCE OF COACHING IN PARK AND PIPE

7.1 Introduction

To what extent do action sports athletes themselves value the input of coaching in their technical development? What training tools do they use the most, and how involved is the coach in their delivery? To follow on from the in-depth perspectives of elite P&P coaches, the next step was to achieve research objective 4, to gain an expanded volume of results and survey the athletes themselves, to glean their perspective and to compare and contrast to the perspective of the coaching sample. As such, an online survey was created and completed by P&P athletes. Building on the data described in Chapters 5 and 6, I was particularly interested in the following:

- Athlete perceptions on the usefulness of different training aids and coaching tools
- Athlete preference for coach involvement
- The extent to which these varied across the stages of learning (i.e. skill acquisition or skill refinement)

Given the opinions expressed by the coaches on perceived differences between the sexes and related to performance level, I also wished to check whether gender and performance level exhibited any significant differences across the factors listed above.

7.2 Results and Discussion

For the purposes of clarity and succinctness, quantitative results from the data analyses were collapsed into one table, shown below as Table 7.1. The usefulness of each tool was measured along with the level of coach involvement and the percentage of the sample that used the tool for that particular trick. Participants completed the survey with respect to a new trick that they had recently learnt (identified by 'L' in respective

column headings), and for a trick that they had recently refined (identified by 'R' in respective column headings. The combination of mean scores for both learnt and refined tricks is presented in the respective columns titled 'Combined'. Subsequent presentation of the results is based on the three bullet-point aims plus the additional considerations described in the introduction to this chapter. Results are considered and discussed using this same structure of subheadings, with both quantitative and qualitative data presented.

7.2.1 Demographics

The sample included a range of experience from national level competitors through to the elite with twelve X-Games and/or Olympic medallists. Of the 71 participants that completed all of the demographic information, 59 (83%) had some form of coach, 12 (17%) did not have a coach. Participants included 52 males and 28 females (5 unknown), ranging in age from 15 to 35 years (mean age = 22.95; SD=4.62) representing 18 nations across five continents, with a mean 6.89 years competing (SD=3.89), and a mean 5.55 years receiving coaching (SD=3.88). The participants were made up of 43 snowboarders who reported competing in halfpipe (n=20), slopestyle (n=32) and big air (n=25); 38 were freeskiers who reported competing in halfpipe (n=26), slopestyle (n=19), and big air (n=7). Some athletes competed in multiple disciplines, the discipline of 4 of the participants was unknown. Of the completed responses, 34 (46%) could be classed as elite competitors having achieved major event finals results or above, and 40 (54%) could be classed as developing competitors having competed from national level up to international level events without yet having qualified for a major event final.

Tool	Usefulness; mean (S.D.)			Coach Involvement; mean (S.D.)			Used by (%)	
	Combined	L	R	Combined	L	R	L	R
To fine tune/improve this trick I received subjective feedback on my technique	3.24 (.97)	3.19 (1.02)	3.31 (.90)	3.06 (.88)	3.14 (1.09)	3.03 (1.04)	88.1	91.7
To fine tune/improve this trick I watched video of myself to help me fine tune/improve it	3.23 (.98)	3.36 (.95)	3.08 (.99)	2.91 (.86)	2.93 (1.05)	2.92 (1.01)	90.5	88.9
As I got ready to attempt the trick, I prepared by doing simpler forms of the trick	3.21 (1.08)	3.45 (.91)	2.92 (1.20)	2.44 (1.14)	2.76 (1.08)	2.39 (1.12)	91.7	73.6
As I got ready to attempt the trick, I used imagery including vision from an internal perspective	3.12 (1.00)	3.21 (.93)	3.00 (1.06)	1.90 (.77)	1.91 (.97)	1.83 (.90)	89.3	71.4
In learning this trick, I focused on the trick as a whole	3.11 (.79)	3.08 (.76)	3.14 (.83)	2.55 (.85)	2.57 (.92)	2.52 (.98)	95.2	95.8
Before dropping in for early attempts I deliberately amp myself up or calm myself down prior to dropping in	2.98 (1.03)	3.13 (.94)	2.81 (1.10)	1.83 (.81)	1.84 (.89)	1.81 (.91)	90.5	81.9
As I got ready to attempt the trick, I used imagery including how the trick feels	2.97 (.99)	2.95 (1.03)	2.99 (.94)	1.85 (.73)	1.81 (.92)	1.84 (.82)	86.9	90.3
To fine tune/improve this trick I received objective feedback on my technique	2.91 (1.08)	2.90 (1.14)	2.92 (1.02)	2.87 (.91)	2.89 (1.11)	2.88 (1.03)	81	87.5
As I got ready to attempt the trick, I thought about and rehearsed in my head the rhythm of the trick	2.90 (1.05)	3.05 (.99)	2.72 (1.10)	1.87 (.80)	1.97 (1.05)	1.78 (.83)	86.9	80.6
As I got ready to attempt the trick, I used imagery including vision from an external perspective	2.85 (.93)	2.92 (.97)	2.76 (.88)	1.94 (.83)	1.86 (1.03)	1.97 (.91)	86.9	87.5
In learning this trick, I broke the trick down into components	2.67 (1.14)	2.92 (1.07)	2.39 (1.17)	2.28 (.88)	2.31 (1.06)	2.27 (1.10)	81	68.1
Before I even started on the trick I identified particular challenges up front	2.67 (.97)	2.89 (.96)	2.40 (.93)	2.25 (.73)	2.45 (1.02)	2.08 (.93)	86.9	81.9
Before I even started on the trick I thought through the advantages (pros and cons) of this move	2.61 (1.00)	2.63 (.98)	2.58 (1.03)	2.34 (.91)	2.46 (1.06)	2.20 (1.03)	81	87.5
In learning this trick, I focused on specific body parts	2.60 (1.08)	2.49 (1.11)	2.72 (1.04)	2.21 (.92)	2.15 (1.08)	2.23 (1.08)	69	77.8

Before dropping in for early attempts I used music to help influence my mood state	2.58 (1.24)	2.61 (1.27)	2.54 (1.21)	1.21 (.47)	1.14 (.48)	1.27 (.57)	60.7	59.7
As I got ready to attempt the trick, I prepared with off-snow apparatus	2.52 (1.23)	2.70 (1.22)	2.31 (1.22)	2.03 (.94)	2.27 (1.13)	1.88 (1.05)	65.5	54.2
Before I even started on the trick I considered a schedule of when, where and how I would work towards this trick	2.49 (1.09)	2.77 (1.03)	2.15 (1.07)	2.21 (.83)	2.58 (1.10)	1.84 (.90)	73.8	58.3
As I got ready to attempt the trick, I watched others doing this trick live	2.42 (1.17)	2.56 (1.14)	2.25 (1.18)	1.55 (.67)	1.55 (.85)	1.53 (.73)	64.3	62.5
As I got ready to attempt the trick, I watched video of others doing this trick	2.39 (1.22)	2.61 (1.19)	2.14 (1.20)	1.50 (.63)	1.65 (.84)	1.39 (.68)	63.1	47.2
Before dropping in for early attempts I talk to myself and have keywords I use to help cue and perform this trick	2.29 (1.23)	2.32 (1.25)	2.25 (1.21)	1.75 (.92)	1.73 (1.01)	1.78 (1.06)	58.3	56.9
As I got ready to attempt the trick, I talked to other athletes about their experience with this trick	2.13 (1.09)	2.33 (1.05)	1.89 (1.11)	1.46 (.68)	1.57 (.92)	1.38 (.75)	65.5	43.1
As I got ready to attempt the trick, I prepared with on-snow apparatus	1.94 (1.25)	2.16 (1.33)	1.69 (1.10)	1.74 (.98)	1.91 (.97)	1.59 (.99)	34.5	25
In learning this trick I focused on what my equipment was doing	1.67 (.96)	1.70 (.99)	1.64 (.94)	1.39 (.68)	1.41 (.81)	1.36 (.68)	27.4	31.9
As I got ready to attempt the trick, I used imagery including audio	1.29 (.69)	1.31 (.68)	1.28 (.72)	1.19 (.53)	1.20 (.66)	1.16 (.48)	16.7	12.5

Table 7.1 Training aid and tool use as rated by participants.

Note: The table shows combined scores for use, together with separate scores for learning (L), and refining (R) tricks. Thicker horizontal lines are used to split ratings of 3, 2, and 1.

7.2.2 Perceived usefulness of tools

Referring back to Table 7.1, the perceived usefulness of tools is shown by the order of the combined scores, and the mean and standard deviation ratings calculated across participants. I will mention this again in the statistical analyses section later on: I am fully aware of the limitations of this study, and the caution to be taken when interpreting comparisons between variables in terms of both statistical and real-world significance. Using a combination of the data, my own experience as a coach and the input of the coaches in Chapter 6, I will interpret the data and discuss differences across variables. Throughout this section, I consider these data in detail, augmenting quantitative data with selected quotes. For clarity, the source of each quote is coded as follows:

- Gender – M or F
- Discipline – SBHP (Snowboard Halfpipe), SBSS (Snowboard Slopestyle), FKHP (Freeski Halfpipe), FKSS (Freeski Slopestyle)
- Level – E or D – Elite or Development.

Accordingly, a code of M/SBHP/E would be for a male snowboard halfpipe elite athlete.

Based on the findings in Chapters 5 and 6, it is not surprising that 'receiving subjective feedback', 'watching video of myself', and 'doing simpler forms of the trick' had the highest usefulness scores. As I have highlighted to this point in the thesis, and as indicated by the percentage of athletes in this survey using coaches (83%); receiving subjective feedback on performance from a coach is a common factor in trick acquisition and refinement amongst P&P athletes. The use of video has been widely supported and using a progression of tricks to build towards more complex manoeuvres has also been demonstrated as implicit to the progression of the sport in Chapter 5. A step-by-step approach was intuitive for many; for example, "fine-tuned the ally oop 3,

and 5 before going to 7 again" (M/SBHP/E). One athlete indicated that taking a step backwards in the amount of rotation was required in order to prepare a pre-requisite manoeuvre for the new trick: "when I learned front 720, I stopped to do front 540 but I needed to redo this trick to get a better front 900" (F/SBHP/E). Another athlete identified that doing simpler forms of the trick was beneficial in addition to finding smaller features before progressing: "if I would have had a feature to try a simpler form of the trick on, I would have done that. I remember wishing there was a smaller jump for me to warm the trick up on. Usually I find this very useful" (F/SBSS/E).

Rounding out the top-five useful tools, 'imagery including vision from an internal perspective' (for example, "I used a lot of visualization before performing the trick" F/FKHP/D) and 'focused on the trick as a whole' achieved mean usefulness ratings above an ordinal score rating of 3 indicating all of these top-five tools sit (on average) on the scale between *quite useful* and *very useful*. The usefulness of different types of imagery was high with 'imagery including how the trick feels' ranked seventh, and 'vision from an external perspective' ranked tenth out of the twenty-four tools surveyed. Providing further detail on how imagery was used, one athlete stated that they "exercise some of the movements required for the trick while visualizing" (M/SBSS/D); and another mentioned using "pre-movement towards grab before I dropped in" (M/FKHP/D). One athlete mentioned using a combination of imagery and self-talk: "do some imagery before dropping in of myself talking through the steps of the trick" (F/FKHP/E).

The next highest scoring batch of tools was led by arousal control, and it tended to be calming down rather than 'amping-up' that seemed to be more appropriate. Achieving a calm mental state prior to pulling the trigger on a new trick was unsurprisingly a popular theme: "mindfulness - breathing techniques" (F/FKHP/E), "for me it is very important to calm myself before I try a new trick" (M/SBHP/E). One

athlete had a pragmatic approach to arousal control: “rationalise the reward vs risk of the trick in my head to calm myself down” (F/FKHP/D), while another honed-in on specific process goals “I found this trick quite difficult for a week or so, I found that clearing my mind and only concentrating on speed and the set of the trick was very helpful” (M/SBSS/D). This focus on one or two processes, in particular the take-off, was shared specifically by another athlete: “I have the key point of the trick to remember every time I do it: patient on take-off, throw down the pipe” (M/SBHP/D), and you may recall was discussed specifically by coach ‘C8’ in Chapter 6 as something that coach encouraged.

‘Receiving objective feedback on technique’, ‘rehearing the rhythm of a trick’, and ‘breaking a trick down into components’ were all ranked in the top-half of useful tools, followed by the planning components of ‘identifying particular challenges up front’, and ‘thinking through the pros and cons of the trick’. ‘Focussing on specific body parts’, for example, “I would rotate myself/my upper body to the direction of the spin focusing on my head so that it would turn too” (F/SBSS/E), and ‘using music to influence mood states’ were towards the top of the bottom half of ranked tools, obviously still useful for some, although not as widely used. This is exemplified by “music was prior to coming to the drop in of the jump I was to do the trick on” (M/FKSS/D) versus “I never listen to music” (M/SBSS/E). Preparing with off-snow apparatus also appeared to be an individual preference, very useful for some who mentioned: “did it on trampolines [a thousand times]” (F/FKHP/E), “when trying new tricks, I break it down on trampoline, practice the movement with various take off positions on tramp (with/without a board), from tramp to mat” (M/SBSS/D). Whereas other athletes did not necessarily need off-snow apparatus: “It's not a technical or dangerous trick, that's why I didn't try it on foam pit” (F/SBHP/E).

In terms of considering a practice schedule, some athletes obviously had a very clear preparation routine that helped them build towards their new trick: "[I] had a set progression in my head. Front-3 two times, front-5 two times, front-7 two times, and then front-9" (F/SBSS/E). Others mentioned a more organic approach:

> It was a trick that mostly evolved to becoming a 9. I just wanted to work on unique tricks. I wanted to have different tricks that I came in spinning from different directions, different blind angles, riding a way [I] normally don't ride. Things came together so I tried a 7. Went well so tried a 9. Low risk so not much preparation going into it other than just going for it.
>
> (M/SBHP/E)

Many favoured spontaneity, avoiding any prescriptive or structured preparation. "Not much other than to have a go"(F/SBSS/E); "Preparation? Just Do!" (M/SBSS/D). Others used an outcome focus; the position of a trick, and its integration within a competition run was a key consideration: "thought about how it would fit into my run" (M/FKHP/D), "decided when I should be putting it into contest and where in my run" (F/SBHP/D).

Watching others do this trick live' (e.g., "looked at other people's dub 12", M/FKHP/E) and 'watching video of others' were clustered along with 'self-talk' (e.g., "thought through two key words dropping in", M/SBSS/E) towards the bottom of the middle batch of tools from a usefulness perspective. The average was notably sitting between *a little useful,* and *quite useful*. In terms of the lowest mean scored tools for combined usefulness 'prepared with on-snow apparatus', 'focused on what my equipment was doing', and 'used imagery including audio' were deemed the least useful tools. All three scored a mean rating between *not at all* useful and *a little useful.* It is clear that the current sample of P&P athletes are unlikely to include audio representations of their tricks while performing imagery, and do not deem focusing on what their equipment is doing as particularly useful. Perhaps at this level of performance it is not about mastery of their equipment anymore, rather, it is about use

of the equipment. The low overall scores for preparation with on-snow apparatus, including the on-snow airbag, may be a function of it being a discipline specific tool, more useful in the halfpipe and less useful in slopestyle to date apart from the more popular landing bags; for example, the "Chiba Kings Japan, Airbag" (M/SBSS/D). Only 34.5% of respondents used this tool to learn a trick, with 25% using it for trick refinement. The scarcity of access to these tools, may also have influenced the usefulness score: as one athlete mentioned: "I wanted to do the trick first on the airbag, I had to wait for the perfect setup for that" (M/SBHP/E). Another athlete in the sample who did not train with a programme also highlighted the access issue: "I don't have a full time or official coach and limited access to safer training techniques like airbags or water ramps" (M/FKHP/E).

Other tools identified as being useful, in addition to those asked to be rated specifically in the survey, included the concept of 'mirroring tricks' i.e. landing a trick in one direction or on one wall of the halfpipe and then completing the mirror image of the same trick in the opposite direction, in the opposite stance (switch) and/or on the other wall of the halfpipe: "A few years of snowboarding, doing the regular Miller Flip so much that it was only natural to try it switch"; "I can land the regular version of this well, mirroring the trick was key" (M/SBSS/D). A clever tool mentioned by one of the athletes to help acquire a new trick that is a mirror of a previously learnt trick was to use video software to create a mirror image of the original trick, thus allowing the athlete to model and image off a video of themselves: "[I] mirror imaged the video shot of my L Dub 12 to give [me the] ideal view" (M/FKHP/E).

Physical preparation was mentioned as an additional tool by one athlete: "physical conditioning such as gym work, prep programme, swimming... etc" (M/SBSS/D), while various other specific mental skills in addition to the imagery and coping strategies prompted for in the survey were cited. These included: "do a routine

like clapping my hands together twice before every drop" (M/SBHP/D); and progressive muscular relaxation: "I would breathe in and tense muscle groups, then release them on my exhale. I went through all muscle groups and then I would be in a good headspace and calm" (M/SBHP/D). Promoting confidence was mentioned by two athletes as a useful way of preparing for a new trick: "when I'm trying a new trick, I'm focused on specific technical points and I try to convince [myself] that I'm able to land it" (F/SBHP/E); "I generally visualize performing the trick. Landing in my head first, convincing myself I can do it, I try to become calm and happy with my skill so I already know I've got it" (M/SBSS/D). Another athlete indicated the need for full commitment: "I think about putting [it] all in and doing the trick at hand as well as I can. How I feel before and during the trick affects the performance of the trick quite a lot" (M/SBSS/D). Some routines were slightly more esoteric! One athlete mentioned that they "always give my coach a hug" (F/SBSS/E), before dropping in for a new trick (more on the involvement of the coach later).

It was clear that environmental factors, including weather and facilities, were an integral factor in the planning for trick progression at both a macro and a micro level. One athlete mentioned that other tools included "planning regarding facilities and locations i.e. link it in with trips I had coming up" (M/FKHP/D), while another identified that they needed to "wait at the top of the pipe until the gust of side-winds stopped" (M/SBHP/D). This athlete identified that weather could potentially be a stressor: "weather conditions were crucial in being calm and ready to try the trick for the first time" (M/SBHP/D). An element in the environment that was seen as an enabler of performance was a supportive peer group: "motivation of other riders learning new stuff, doesn't even have to be the same trick, just people around being pumped" (F/SBSS/E); "do it with some friends in a fun environment so it didn't feel so scary" (F/FKHP/D); "have one or two close ski friends up top to build confidence and maintain

a level head" (M/FKHP/D); "I was riding with my friend at the time, who didn't coach me" (M/SBSS/D).

A further tool that was not prompted for in the survey involved the transfer of a trick from a jump to the halfpipe: "I used a jump trick that is very similar to get the feeling of the trick and brought it to pipe" (M/SBHP/D). Likewise transfer from the pipe to a jump: "I have done the double in a pipe so many times that I kind of had a feeling for the trick" (M/SBHP/E). One athlete mentioned an alternative approach to priming a trick: "did it on flat snow at the top of the half pipe" (F/FKHP/D). Working on fundamental technical skills was an additional process mentioned by one athlete: "had to make sure some of my bad habits with switch spinning were almost non-existent" (M/SBHP/D), while adjustments to existing movement patterns were also mentioned: "reconstructing the way I did the trick before (back 10 double) by flattening the cork" (M/SBSS/E).

7.2.3 Athletes Preference for Coaching Involvement

This is shown as the 3rd major column in Table 7.1. Receiving subjective feedback on technique had the highest coach involvement (the only tool with a mean score above three indicating that coach involvement on average was *quite a lot*), followed by coach involvement in 'watching video of myself' (presumably after filming the athlete). According to one of the athletes: "my coach helps me the most by filming the trick, and he often identifies mistakes that I should work on" (M/SBSS/D). Unsurprisingly coach involvement in 'receiving objective feedback' was also highly ranked – third highest for both learning and refinement of tricks. The planning elements of 'thought through the advantages (pros and cons) of this move', 'identified particular challenges up front', and 'considered a schedule of when, where and how I would work towards this trick' had moderate coach involvement, as did 'focused on the trick as a whole', 'broke the trick down into components', and 'focused on specific body parts'.

‘Prepared by doing simpler forms of the trick’, for example, “I made sure I had front 900's dialled with the help of my coach and worked through adding another 180” (M/SBHP/D), was another tool with moderate coach involvement. With combined mean scores between 2.21 and 2.55, these elements on average sat between *a little* and *quite a lot* of coach involvement.

Preparation with off-snow apparatus, (for example “I practiced in trampoline and water ramp with my coach before performing the trick on snow”, F/FKHP/D) had a mean combined coach involvement score of 2.03, indicating coaches were involved *a little*. The average for the learning trick (mean=2.27) was understandably higher than the average for the refinement trick (mean=1.88), given refinement generally involves adjusting an existing movement pattern while learning involves acquiring a new movement pattern and is therefore more likely to involve the input of a coach. Preparation with on-snow apparatus had a combined mean of 1.74 for coach involvement, again with higher mean coach involvement in learning (mean=1.91) versus refining (mean=1.59). These relatively low scores for coach involvement in preparation with on-snow apparatus, may also have been impacted by the relatively low use of these tools (34.5% for learning and 25% for refining).

Interestingly, mean scores for coach involvement in the various types of imagery were relatively low, ranging from 1.85 to 1.94 despite a high proportion of athletes using these tools for learning tricks (86.9% to 89.3%, apart from ‘imagery including audio’ which scored a combined mean of 1.19 and was only used by 16.7% of participants). This suggests that coaches had little involvement in imagery with athletes. Moving further down the priority list of coach involvement, ‘rehearsed in my head the rhythm of the trick’ scored a combined mean of 1.87. ‘Amp myself up or calm myself down’ scored 1.83 for coach involvement, while the mean combined score for

self-talk (‘talk to myself and have keywords I use to help cue and perform this trick’) at 1.75, was also relatively low.

Coach involvement in ‘using music to influence mood state’, ‘focusing on what my equipment was doing’, ‘talked to other athletes about their experience’, ‘watched video of others doing this trick’, and ‘watched others doing this trick live’, all had mean scores in the range 1.21 to 1.55 suggesting limited coach involvement. Also, that these tools if used, were more athlete driven. In one case a coach’s attempted involvement in restricting an athlete from listening to music was ignored: “my coach always tells me not to ride with music so ‘I can feel the speed by my ears’, I don’t do that” (M/FKSS/D).

While it was clear that, across the sample, coaches were generally and specifically involved in trick progression and refinement; some athletes still preferred learning in a coach’s absence. Reflecting some of the issues discussed in Chapter 3, some athletes fiercely defended their independence, even when using and valuing the services of a coach. “I learnt the trick while just skiing with my buddies. I was never the type of person who took orders well from other people. I learnt from a coach how a body can move in space, but did not attempt the tricks till my coach was not around” (M/FKSS/D). In some circumstances, there were clear cases where coach involvement was not required; “the coach wasn't needed because it was all mental in my own head” (M/SBHP/E).

7.2.4 The Extent to Which These Varied Across the Stages of Learning

When learning a new trick, athletes appeared to utilize more planning and preparation compared with refining an existing trick, and invested more mental energy when learning new tricks at the top end of their ability level. This was also the case for tricks perceived as more dangerous or difficult than others. One athlete mentioned with respect to a learning trick “as it wasn't a hard trick (higher end of the technical scale) it

didn't require a huge amount of effort to achieve" (M/FKHP/D). Logically, higher mean scores for learning trick tool usefulness included 'used on-snow apparatus', and seeking external input ('watching video of others doing the trick', 'talking to other athletes about their experience with this trick', and 'watching others do the trick live'). There was a large difference in the percentage of participants doing simpler forms of the trick in the learning example (91.7%) versus the refinement example (73.6%). One athlete mentioned with respect to the refinement trick "this trick was not difficult or dangerous that's why I didn't try simpler form[s] before or airbag. But for a more difficult trick, I would do this kind of training" (F/SBHP/E).

Likewise, the use of imagery 'from an internal perspective' was utilized by more participants in a learning compared to a refinement situation, (L=89.3% vs. R=71.4%) while use of imagery 'including vision from an external perspective' was similar (L=86.9% vs R=87.5%) and use of imagery 'including how the trick feels' was slightly higher (L=86.9% vs. R=90.3%) in the refinement situation. Perhaps reflecting a focus on building blocks in the learning context, the % of participants who 'broke the trick down into components' was higher (L=81% vs R=68.1%). Conversely, 'focused on specific body parts' was used by a slightly greater proportion of the sample (L=69% vs R=77.8%) in the refinement example.

In some instances, refining a trick was somewhat ad hoc: "I just thought about it on the day, weighed up the pros and cons on the lift and made the tweak/change there and then" (M/FKHP/D). Or it occurred without as much preparation and planning: "it was just a small change to a trick I could already do, so we just had to go try it. I wouldn't say a lot of prep was needed" (M/SBHP/D). According to another athlete with respect to a refinement trick: "I calmed myself down but I didn't have to prepare too much because I think that the trick is not that hard" (M/SBHP/E). Trick refinement was identified as a training focus when not in the ideal physical state required for trick

progression by one athlete who "started [a refinement] due to injury which reduced the level at which I was able to ride" (F/SBHP/E). One concern with trick refinement in terms of changing the grab on an existing trick was how that difference in body position would impact the trick: "I was the first to do frontside double nose so the only challenge I felt was how my rotation would change" (M/SBHP/E).

While there were obviously differences between learning and refining tricks, there were also many similarities (indicated by tools with a similar % of use across L and R columns). Imagery use across trick refinement and learning, while higher in the latter, was still a consistent theme: "same as last trick. Exercise some of the movements that are needed for the trick while visualizing" (M/SBSS/D).

7.2.5 Other Factors – Gender, Level of Performance

As a follow-up to the suggestion in Chapter 6 on the differential use of tools and coaching by the sexes, I ran a series of investigative independent t-tests across the mean rankings for tool use and coach involvement. Of these, only two reached significance on the coach involvement factor: 'prepared with off-snow apparatus' ($t(68) = 2.02$, $p < .05$) male mean = 2.43, female mean = 1.88; and 'received objective feedback on my technique' ($t(61) = 2.07$, $p < .05$) male mean = 2.66, female mean= 3.2. This provides some evidence that female athletes were less likely to involve coaches in their off-snow training, and were more likely to receive objective feedback from their coaches.

In questions relating to tool usefulness, three tools reached significance in trick refinement: 'watched others doing this trick live' ($t(69) = 2.36$, $p < .05$); male mean = 2.41, female mean =2.06. 'talked to other athletes about their experiences with this trick' ($t(69) = 2.20$), $p < .05$); male mean = 1.91, female mean = 2.35; 'talk to myself and have keywords that I use to help cue and perform this trick' ($t(69) = 2.24$, $p < .05$) male mean = 2.13; female mean = 2.44. Whilst several other factors approached significance, the combination of ordinal data, low power and number of tests means that

these results, suggestive of more open and integrative styles of female athletes, must be tentative.

Follow up investigations were also carried out on the impact of performance level. Participants who had achieved placings in major event finals were grouped into an *elite* category, while those that competed below this level were aggregated into a *development* category for comparison. Again, the combination of ordinal data, low power and number of tests means that these results must be considered tentative. On the learning trick 'identified particular challenges up front' ($t(72) = 2.42$, $p<.05$), development athletes found this planning element significantly more useful (mean = 3.13), than elite (mean = 2.59). Development athletes also 'prepared with off-snow apparatus' ($t(72) = 2.93$, $p<.05$) to a greater extent (mean = 2.88), than elite (mean = 2.12). Perhaps these differences reflect that development athletes are, in comparison to elites, entering new territory in increasing their trick repertoire. As such, they may be more likely to rate the usefulness of identifying challenges, and preparing off-snow compared to their elite counterparts who have had more experience and are better at acquiring new tricks. On the refinement of tricks data set, only one tool achieved a significant difference: 'focused on specific body parts' ($t(69) = 2.17$, $p<.05$); elite (mean = 3.03) found this more useful than development (mean = 2.51).

As far as coach involvement went, in the learning context, three out of twenty-four tools were significantly higher for development athletes compared with elite. Development athletes involved their coaches more when they 'used imagery including how this trick feels' ($t(64) = 2.02$, $p<.05$), (development mean = 2.06; elite mean = 1.61). Development athletes also involved their coaches more (mean = 2.48) as they 'prepared with off snow apparatus' ($t(64) = 2.40$, $p<.05$), than elite (mean = 1.85). Finally, the development cohort involved their coaches more (mean = 2.12) when they 'deliberately amp myself up or calm myself down' ($t(64) = 2.57$, $p<.05$) than the elites

(mean = 1.58). These findings are understandable given development athletes are more likely to be learning their trade (and therefore relying on coach input more for skill acquisition and arousal control) compared with elite athletes who are more likely to be applying these previously learnt techniques themselves. In terms of coach involvement in skill refinement, development athletes involved the coach more (mean = 2.69) when they 'prepared by doing simpler forms of the trick' ($t(61) = 2.26, <.05$) than elite (mean = 2.06). On twenty of twenty-four scales, the development athlete group had higher mean scores than elite for coach involvement (for both trick learning and trick refinement), providing further evidence for the greater reliance on coaches amongst development level athletes.

7.3 Comparisons and Contrasts to the Coach Perspective

The data acquired in the surveying of athletes provided a useful lens in studying the most useful training aids, coaching tools and coach involvement in P&P. When combined with the perspective of the coaches in Chapter 6, the picture becomes clearer for tools that work including strategies for tool deployment: generally, the athlete data supported the perspectives of the coach.

The usefulness of video feedback was indicated by the athletes in line with the coaches and is obviously a widely used and powerful tool. Corroborating the coach perspective that in-session video feedback is the most effective, one of the athletes highlighted the importance of "making sure we had a video camera to review the footage on hill" (M/SBSS/E). In support of previous discussion around the benefits of modelling, one athlete indicated their specific strategy for utilizing video feed-forward: "I had my favourite video of someone doing a back 900 is normal speed and slow-motion saved to my phone to watch while I was on snow" (M/SBHP/D). On the whole, however, watching others (either live or via video) received relatively low usefulness ratings amongst the athletes, mirrored by a cautiousness to encourage this approach by

the coaches. As discussed in Chapter 6, this may be due to a promotion of individual creativity at the core of the sport as opposed to a routinized, 'cookie-cutter' approach. Notably, at SSNZ I use a powerful tool that blends the benefits of video feed-forward, modelling (against one's own image and sometimes others), and imagery that is an evidence based technique for enhancing performance. More on this in the practical application section of Chapter 9.

Despite being regarded widely as a useful tool, imagery scored towards the bottom end for coach involvement. This could be due to a number of reasons – perhaps imagery is a skill that is so implicit in an athlete's preparation routine (as suggested by C5 in Chapter 6) that coach involvement is not required. Alternatively, perhaps coaches are not as skilled in the deployment of imagery as they could be. The majority (n=7) of coaches in Chapter 6 claimed to use imagery with their athletes; one did not, one 'not very often', and a third coach only via the sport psychologist. Either way, it would appear that imagery (especially vision from both an internal and external perspective, and kinaesthetic imagery considering the rhythm of the trick) is an extremely fruitful tool for the coach to exploit with athletes, on and off-snow, in both trick learning and refinement.

It is clear across both athletes and coaches that a step-by-step progression, including performing and mastering the right pre-requisite tricks, is an important part of learning new high-risk tricks. This to ensure that movement patterns can be executed as desired but also to give both athlete and coach the confidence that execution of a new trick is likely to be successful and safe. Coaches and athletes alike mentioned the concept of stepping back down the difficulty level and amount of spin or flip within a trick in order to prepare for new moves. The careful and deliberate use of airbags as a step to remove some of the unknown of a new trick, to achieve repetition and of course

patterning of the new move with reduced risk is a useful tool sought by some athletes and utilized sparingly by coaches especially in the halfpipe discipline.

Calming down before learning a new trick and focussing on simple cues were common themes amongst the athletes. Some of the coaches in Chapter 6 also considered arousal control and the regulation of emotion as important elements. The level to which these skills were deliberately developed in the athlete by the coach, or occurred as a secondary process over time and experience in the environment, was unclear however. Consequently, this appears a highly useful element of the coaches' toolbox to explore and develop (I will look more closely at the topic of self-regulation in Chapter 8). Providing simple cues especially in the 'heat of the moment' and narrowing information down to the *useful few* rather than the *confusing many* was sensibly an approach backed by some of the coaches in Chapter 6. Athlete confidence gleaned from their preparation and the support of those around them including the coach and their peers helped them to achieve the commitment required to safely take the 'giant leap' towards landing a new trick for the very first time.

The role of the coach in helping the athlete to plan, and the appropriate adjustment of the schedule in order to optimize training, have emerged from both athlete and coach perspectives as an integral part of P&P. As discussed in Chapters 5 and 6, the use of PJDM (Collins & Collins, 2014; in both the athlete and the coach) will assist with decision-making both on and off-snow. The extent to which a coach provides structure and at the same time provides flexibility will vary based on the needs of the athlete. It is clear that optimal learning and progression requires the right blend, and an understanding from both coach and athlete of when to *push*, when to *drill*, and when the coach should back off and allow the athlete to engage in *play* to harness creative energy and explore new areas of execution and performance (I will refer to these different approaches in Chapter 8).

With respect to gender differences, we found some evidence from the athlete sample to support the contentions of the majority of coaches in Chapter 6, that female athletes tended to prefer a greater amount of structure and input than their male counterparts. The differences were not massive however, and, as mentioned earlier, the low statistical power of these findings makes them tentative. There was greater support for the impact of the performance level of the athlete on multiple dimensions of coach-involvement, highlighting the need for careful consideration of long-term athlete development in P&P. Utilizing a focus on skill development, including teaching an athlete how to effectively use training aids at the development level, versus a focus on athlete ownership and responsibility at the elite level for training aid use would appear a sound general differentiation for the coach to make.

7.4 Summary – The Joint Picture

Research objective 4 has been achieved. As discussed and presented in Chapter 5, this survey has highlighted the *individual* nature of skill acquisition amongst P&P athletes with varying levels of preference for an array of tools. With some consensus on what are more useful and less useful tools from the athletes, coupled with the coaches' perspective in the previous chapter, this work has helped to clarify and provide some context for the P&P coach on strategies they already use that they should continue to maximize. It has also introduced new tools, or tweaks to existing tools that they may wish to investigate integrating into their toolbox in the future. It is clear that selecting the right tool for the right athlete at the right time (cf. PJDM – Collins & Collins, 2016), is a critical element of being an effective high-performance P&P coach, in order to optimize athlete learning and maximize rates of progression. With a comprehensive understanding of the technical tool-box used in P&P coaching completed, I now change direction by referring to another key element in optimizing performance crucial for awareness in both the athlete and the coach; namely, self-regulation.

CHAPTER 8

THEORETICAL CONSIDERATIONS AND PRACTICAL CONSEQUENCES IN RISK MANAGEMENT/MITIGATION

8.1 Introduction

As highlighted by participants in the core studies reported in Chapters 5, 6 and 7, P&P is an undoubtedly challenging sport. The high levels of personal risk, combined with the tight social structures and ego commitment to the role of the P&P athlete, mean that all face some degree of challenge. Importantly, and unlike some other sports settings, this extends across both the competitive (e.g., 'will I win/do myself justice') *and* training (e.g., 'will I be able to learn/complete this move safely?') environments. As such, and building on the content from earlier chapters (both explicit and implied), I felt that an appreciation of the theory underpinning self-regulation in such circumstances, together with tools which can cater for this, are key essentials for the P&P coach. Accordingly, in this chapter I firstly explore the major theories which apply, together with some exemplar research completed recently which helped me to explore these constructs. In the second section, I consider some data, both quantitative and qualitative, through which I have explored the implications of risk. Finally, I offer some practical procedures through which my colleagues and I have tried to cater for and counter these issues.

8.2 Theoretical Perspectives

After careful consideration, I suggest that there are two major theories which apply in P&P. These are Resource Depletion Theory (RDT), as placed within work on self-control and self-regulation or SR (e.g., Vohs, Baumeister & Schmeichel, 2012) and the almost ubiquitous if ill-defined ideas of Mental Toughness (MT - Jones, Hanton, & Connaughton, 2002). Other ideas are apparent but would seem of questionable applicability for the P&P environment. For example, the 'adrenaline junky' idea which

has led some to see action sports participants as almost addicted to the 'high' of risk (e.g., Buckley, 2012; Heirene, Shearer, Roderique-Davies & Mellalieu, 2016). As I have discussed in earlier chapters, including interviews with athletes in Chapter 5, elite P&P athletes are certainly positive about the lifestyle and achievement but seem less so about the risks! Otherwise, the perceptions of risk as a severe challenge and a factor to be controlled would seem a contradiction. Certainly, recent research attests to the variation in participant motives across extreme sports (Barlow, Woodman & Hardy, 2013) so I am comfortable staying with the RDT/MT focus.

Work on self-control and SR has shown the wide-ranging issues which can occur for individuals low in this key skill (Crockett, Raffaelli & Yuh-Ling, 2006; Magar, Phillips & Hosie, 2008) although almost all of this has focused on trait characteristics and chronic behaviour in wide social contexts. More recently, sport studies have shown interesting, potentially causative links between SR and sporting outcome (Toering & Jordet, 2015) with the impact on practice behaviours as a potentially important mechanism (Toering, Elferink-Gemser, Jordet, Pepping & Visscher, 2012). Even here, however, the impacts are from trait-like behaviour to chronic outcomes.

As a parallel development in mainstream psychology, however, ideas of both MT and SR as potentially transient and variable, state characteristics have emerged. With SR for example, Baumeister and colleagues offer views on the exertion of self-control which "…appears to depend on a limited resource. Just as a muscle gets tired from exertion, acts of self-control cause short-term impairments (ego depletion) in subsequent self-control, even on unrelated tasks" (Baumeister, Vohs & Tice, 2006, p. 351). These ideas underpin RDT, which suggests a number of factors such as motivation, personal beliefs and practice as influences against 'running out of' SR capacity. In MT, originally presented solely as a trait, there has been an increasing

recognition that it too can vary across situations, once again depending on the presence or absence of certain factors such as personal motivation, belief/expectation and self-efficacy (cf. Gucciardi, Hanton, Gordon, Mallett & Temby, 2015). As identified by Crust, Swann and Allen-Collinson (2016), accepting limits and avoiding "costly perseverance" (p. 606 – see also Lucas, Gratch Cheng & Marsella, 2015) is a positive feature of MT in extreme sports settings. So, for my purposes here, catering for depletion in the short term whilst building resources for the long term emerges as an important psychological focus for P&P coaches and support staff. Furthermore, since depleted self-control effects on skilled task performance have already been shown in laboratory situations (McEwan, Martin & Bray, 2013), this direction of study seemed justified.

8.3 Evidence for the Role of Depleted Self-Regulation

If RDT is a genuine factor in P&P skill development, then performers would show development in 'bursts' rather than as a steady progression. Notably, however, this pattern would not necessarily be universal, since those 'better equipped' on the SR front would cope better and for longer with pressure. Therefore, to really examine for the presence and impact of SR strength, coupled with RDT, an individual focus against tricks of high perceived challenge was necessary.

There are several sources of supporting data. Looking back to the coach and athlete studies in Chapters 5 and 6, for example, this is just what is apparent. There are undoubtedly a number of factors which generate the progress in bursts pattern which was typically apparent. Access to appropriate facilities, including airbags (in some cases) and snow (in all cases!), is just one such pragmatic issue. There were also, however, patterns of development which, I suggest, show an 'emotional periodisation'. Namely, athletes getting things set up in phases so that the first attempts of a trick could be timed to meet set dates or for optimum conditions. Often, this related to pre-

determined time-frames in order to achieve sufficient repetition to transition a new trick to specific competitions, the catalytic influence being major events such as the X-Games and more recently the Olympics for example. Notably however, other periodised plans saw trick development focused on optimum conditions, such as softer snow of a summer training camp.

Coach interviews in Chapter 6 also showed an awareness of these factors. Coaches were very aware of the need to time when to push and when to hold off: making these decisions relied on a good deal of carefully developed awareness; an ability to read athletes' mood early through body language, signs of physical and emotional fatigue, verbal cues, etc. This was used together with, in many cases, developing the skills to manipulate mood through a variety of subtle and sometimes not so subtle actions, statements and approaches.

Results from the athlete survey reported in Chapter 7 also evidence the emotional periodisation approach. Participants highlighted the high emotional effort invested in acquiring new and high-end skills in planning, preparation and execution versus the comparatively straight forward and sometimes ad hoc approach to refining existing simpler and/or well-rehearsed skills. Of interest, plans were made for the next day and mental preparation done, with alternatives built in depending on conditions. As one multiple medallist snowboarder stated:

> I always go up to the mountain with a plan, right? And I think that's also key and I've seen people get hurt when they are kind of lackadaisical when they go up to the mountain, so I have a plan A and only a plan B maybe a C, right? Because halfpipes are different, weather's always different.
>
> (M/SBHP/E)

The point here being that plans were built around the quanta of mental energy needed across the day. This athlete went on to stress the importance of developing *then using* the mental energy to best effect.

> you wanna optimise every single day, …, you wanna make the most of it because you got your coach there you know already going into it mentally you're like 'This is a training camp, we gotta get ready, here's what I wanna do, let's get after it.
>
> (M/SBHP/E)

Supporting this view, several athletes talked about the need to build SR strength; to "put money into the bank, then spend it carefully when it will be of most benefit" (M/SBHP/E).

As a final piece of evidence, I refer to one of the tracking devices we have developed for use with our athletes in SSNZ. Figure 7.1 below is an example, covering a one-month training period.

Figure 8.1 Exemplar performance tracker

The pattern of risk shown here makes the point nicely. The athlete 'builds up' to a block of high risk/high failure runs (shown in purple and yellow respectively), takes a break, goes again at a lower level, another break then a peak block of work then a final rest followed by a 'consolidation' block to embed the new tricks (cf. Carson & Collins, 2016). The figure also shows other ideas from this thesis; for example, the need to

monitor and work on all spin directions. For the present purpose, however, the periodisation of effort is clear, with the athlete building up, working hard at high risk, then taking time to recover in a manner akin to classic concepts of periodisation. This pattern is easily apparent when these factors are monitored. As a useful extension to the simple runs per day count provided in Figure 8.1, innovative systems to monitor physical load in P&P are being developed by Snowsports New Zealand using inertial measuring unit devices to accurately track the number, type, direction and amount of rotations in a training session, along with cumulative landing forces along the lines of previous work in P&P using this type of technology (e.g., Harding, Toohey, Martin, Hahn & James, 2008; Harding & James, 2010; Scher et al., 2016). Providing useful data on physical indices of loading, other markers impacting emotional loading including 'perceived risks taken', and 'crashes endured' complements this data to give a more accurate holistic picture.

8.4 Practical Steps to Counter Negative Influences

So, given that emotional periodisation is a way in which athletes and coaches can and often do cope with the SR challenges of training and competing in P&P, what methods can be discerned and developed? Given the importance of the coach-athlete relationship (Jowett, 2017), both generally and particularly in such a high-risk domain as P & P, the power dynamic between coach and athlete is a key aspect of SR optimisation.

A primary feature of my data from both coach and athlete accentuates the coach's role in empowering athletes via an autonomy-supportive climate: this was almost universally endorsed. A key part of the role was to help the athlete to accurately assess when to put the hammer down and when to back off. There were several facets to executing this role, including:

- A high level of trust between coach and athlete (as per Chapters 6 and 7)

- Guidance from the coach on training load management (both physiological and emotional)
- Coaching awareness of fatigue, fatigue management and smart decision-making
- Careful weather forecasting to try to maximize and be ready/recovered for optimal conditions
- Individual differences: some athletes need to be encouraged and given permission to progress, some athletes need to be given permission to 'call it' (finish the session)
- Awareness of the optimal number of repetitions of a risky manoeuvre to achieve learning growth while avoiding too much fatigue and injury risk

A blend of classical combined with naturalistic decision-making, indeed PJDM (as introduced in Chapter 3) incorporating all three types of reflection (on-action, on-action-in-context, in-action) as outlined by Collins and Collins (2015), are the cognitive processes in play for the coach. The above list of elements, either individually or collectively, are reflected by the following selection of quotes:

> I think it's important to have that trust with your coach and when I say trust it means they have to be on the same page as you…you have to be vocal with them, let them know how your body's feeling, um, where your mind's at.
>
> (M/SBHP/E)

> I didn't realise how much working on that [new trick] took out of me, then all of a sudden it seemed to hit me, and I was struggling even to do basic stuff. So I think the best thing for me is to take two days off and then get back into it when I've recovered and I'm back on my game.
>
> (F/FKHP/D)

> It's a big trick and it's high risk, it's day five of the camp and while it's the last day and we really want to get it done out here, I just think there's too many red flags. [the athlete] spewed up last night with food poisoning, and he told me he was feeling pretty tired this morning, I think we should work some more into the bag, come away in one piece and come back to taking it to snow another time. What do you think?
>
> (Elite Freeski Halfpipe Coach)

With more experienced and mature athletes in particular, decision-making can become a joint discussion between athlete and coach, where decisions can be audited and the appropriate outcome agreed:

> So I have a confidence I'm like a little scared a little nervous obviously, but when that coach that you have that trust says 'No dude you've got this' then you're like 'OK he's telling me I got it he can see it from another set of eyes'
>
> (M/SBHP/E)

In fact, the coach can build emotional periodisation into the structure of day-to-day coaching, thus making the need for variation explicit and a normal, accepted part of day-to-day work. My colleague Sean Thompson (personal communication, December 5th, 2016) has developed a 'Push-Drill-Play' structure, which can be used as a daily, weekly or longer element in planning and periodisation. For example, each element can be specified in an athlete's annual plan to describe and differentiate training meso cycles (4-8 week focus), at the micro-cycle level (weeks), or even in terms of a session breakdown. The same approach can be linked to the stages of learning new tricks (cf. Fitts & Posner, 1967). For example, athletes can be asked to *Push* at the cognitive stage, to *Drill* as the skill progresses through the associative stage, then *Play* as the skill is automated. Further work to embed the skill then returns to *Push* as the skill is taken to a new level of mastery through further refinement; through combinations into and out of the trick, a grab change, or incorporation in a high level competition run for the first time, for example.

A third factor is the need for athletes to focus on daily recovery mentally as well as physically. Clearly, the impacts involved in P&P can be taxing, whilst activities such as 'hiking the pipe' (walking up the side if lift cycles are too long, unavailable or inappropriate) at altitude can make training a physically demanding event. Most of the time though, when generally working with gravity rather than against it, P&P athletes' energy expenditure and workload is comparatively low (Zebrowska Zyla, Kania, &

Langfort, 2012). As this thesis has shown, however, the emotional challenge can be very high, especially when athletes are taking new tricks to snow for the first time. Accordingly, ensuring sufficient mental recovery is a big feature of life for these athletes. On a daily basis, for example, coaches and support staff would ensure time away from structured practice and other activities for athletes to decompress. 'Vegging out in the hotel room' is an important element of maintaining quality on the hill, not just a mark of idleness! Importance of regular 'anchor sleep' is another aspect for attention, whilst the regenerative *and* learning benefits of sleep are still being realised across sport (cf. Antony, Gobel, O'Hare, Reber & Paller, 2012). On a longer-term basis, facilitating engagement in other low-risk but stimulating activities for 're-creation' would be part of the planned process for any training camp. Athletes in most sports get used to living in a close proximity bubble. Getting away from the venue, and indeed each other, is just good sense. Trips for surfing, skating, into different towns or just shopping as 'retail therapy' serve to maintain focus on the high-risk days planned. Finally, as a macro concern across the athlete's career, good practice would encourage life balance and other goals for distraction from the stressors of training and competition; pressures which can be characterised as living life on a knife edge.

Finally, there is a need to address the range of emotional challenges which the athlete encounters, building their skills and confidence to cope proactively (Thatcher, Jones & Lavallee, 2012). In the present context, arguably the major emotional concern is fear. Of course, fear has a dual role: on one hand it has potential to be the most debilitating emotion to performance, both directly in competition and indirectly by limiting development. On the other hand it is crucial in terms of informing smart decision-making and keeping an athlete safe. The adrenaline junkie idea has been thoroughly discredited – an athlete who feels no fear would not last long in such high-risk environments! Accordingly, one psychological strategy that is more likely to be

under the specialist's (Sport Psychologist) realm than the coach is the concept of rationalising fear.

From a psychological perspective, fear has a triple effect. Firstly, it discomforts and changes the focus, making athletes more likely to dwell on and rehearse, either overtly or covertly, making mistakes. This, in turn, increases both the likelihood of occurrence and emotional challenge of attempting the trick (MacPherson, Collins & Morriss, 2008). Some (erroneously in my view) see this inhibition as a type of Lost Move Syndrome, or the 'Yips' as it is known in Golf. Thought stopping or relaxation/mindfulness are often the prescription of choice but, since controlling fear whilst staying aware is such a core part of P&P, I would support the development of conscious control rather than avoidance (cf. Winter, MacPherson & Collins, 2014).

Secondly, even if the fear doesn't actually stop the athlete executing the trick, it can disrupt the timing, placing too much emphasis on one part of the movement. In fact, this can be almost as bad, as the athlete internalises/embeds a flawed way of doing things which is really hard to clear. Working on this early to build and embed the right rhythm and consequent feel is key here (cf. MacPherson, Collins & Obhi, 2009) with the use of 'video templates', showing the athlete as self or similar-other model executing at the right pace, a very useful coaching tool.

As the third challenge, fear exerts a chronic effect, 'eating away' at the athlete as s/he struggles to control the intrusive thoughts. Similar to those experienced when returning from injury (e.g., Salim Wadey & Diss, 2016), this pattern can lead to a negative spiral of both acute and chronic disruption. Recognizing that it is the perception of the fear, rather than the arousal itself that is the problem (cf. Raedeke & Stein, 1994), my preferred solution has involved the use (from a specialist) of Rational Emotive Behaviour Therapy (REBT – Ellis, 1957; 2004; Turner & Barker, 2014).

8.5 Conclusion

The aim of this chapter has been to consider the implications of SR; a major factor for such a mentally demanding high-risk sport. On the basis of the data within this thesis, I would suggest that P&P athletes could usefully be surveyed and compared to the extreme mountaineers examined by Crust et al. (2016), not least for the similarity that too much MT in action sports (especially without enough experience) can result in injury or even death via impaired decision making. Data are clearly supportive of a short term, transient and context-specific type of MT, through which athletes make informed decisions about the acceptability of risk. This awaits further work and is highlighted as an area for further investigation in the final chapter of the thesis.

From an applied perspective, I have listed several steps and procedures through which emotional pressures can be monitored, controlled for and addressed. The use of mental skills training as an adjunct to these ideas is another important feature of the modern P&P experience (cf. Chapters 3 and 6 as particularly relevant). As such, work here is paralleling but also extending in depth and range, work on psychological skills training in other challenging domains (e.g., High Intensity Sports - Birrer & Morgan, 2010). Investment in skills development is often seen as a longer term, even career long factor; in my experience, however, much can be achieved through short, intensive and challenge-specific interventions. Certainly positive changes can be affected in relevant skills with short term intense interventions (e.g., five days of meditation – Tang et al., 2007). The optimum use of support specialists is another topic for further investigation. For the present, however, the importance of optimising SR and MT in P&P athletes is an important applied issue and also one with a sound theoretical grounding.

CHAPTER 9

CONCLUSIONS, GENERAL DISCUSSION AND RECOMMENDATIONS FOR FUTURE STUDY

9.1 Introduction

Following several years of reading, reviewing, interviewing, surveying, analysing, discussing, debating, writing-up, submitting, responding, reflecting (and of course coaching!), it is time to pull this thing together and present the 'so what' of the thesis. Referring back to the four primary research objectives of this thesis introduced in Chapter 1 (see 1.4 Research Objectives), it is clear that these objectives have been met and a significant contribution to the knowledge base within the sport has been achieved. A review of the messages emerging from each of the three sections of the thesis, along with further commentary, will be followed by a description of how this has impacted my role, coaching practice, and links to systemic structures at SSNZ. A case study is presented to illustrate some of the points raised. Considerations for other action sports are followed by suggestions for further research.

9.2 Messages Emerging from the Thesis

9.2.1 The Social Setting

In Chapter 2, I explored the nature of P&P and its participants from a bio-psycho-social perspective. The progression versus injury challenge was highlighted along with the inherent stressors: physiological and the less visible psychological and emotional factors. Complementary training activities, including other action sports particularly skateboarding, were outlined along with their cultural and social similarities. The many impacts of the transition to Olympic status and the associated evolution of high performance approaches and support were also introduced; progressively greater psychomotor demands, earlier specialisation, and an increased network of support personnel were some of the key changes in the landscape. It was

suggested that splits in the social fabric remain, the progression versus style debate continue, along with the advent of professional coaches in the mix, seeking to enhance performance while retaining the credibility and trust from their athletes that is a requirement to have optimal impact. A rejection of coaching by some members of the community was highlighted by commentators referred to in Chapter 3 (Ojala & Thorpe, 2015) although, as discussed: clarity in the sample of interest (in my own work, P&P participants with *elite competition goals*) was important to establish. While embracing P&P's alternative roots (some feeling that coaching is not a good idea), even during the time I have been completing this thesis, there has no doubt been an increasing acceptance of coaching and, I would like to think, a parallel improvement in coaching practice. In promoting a solution focussed approach to enhancing P&P coaching performance, clearly a menu of approaches and a broad spectrum of understanding of coaching theory is required. Not to mention a sharp handle on the nuances of athlete motivations, personalities, learning preferences and tendencies specific to action sports athletes.

Additional specific solutions offered to the coach in Chapters 2 and 3 focussed on mitigating the high injury risk. As indicated, this can be achieved in part by considering:

- appropriate conditioning,
- long-term athlete development,
- developing the mental skills required for longevity and success,
- optimizing pre- and rehabilitation,
- keeping on top of and pursuing innovations in hardware and equipment,
- monitoring athlete training load,
- promoting athlete autonomy and self-awareness.

To conclude this section in review of the social setting, it is timely to consider recent changes. A concerning social element that I have become more aware of as my studies have progressed, and an emerging issue towards the end of the 2018 quadrennial, are the diminishing numbers of elite competitors in the halfpipe disciplines, particularly amongst men (both in freeski and snowboard). At the Olympic test event in PyeongChang in February 2017, for example, there were only 33 participants in the men's freeski halfpipe event (29 ladies), and 33 in the men's snowboard halfpipe event (27 ladies). This is down from 48 male freeskiers (27 ladies) and 63 male snowboarders (37 ladies) at the 2014 Olympic test event in Sochi in February 2013, and demonstrates an overall 30% decline in participation at the elite level. When the maximum four per nation quota allocation is applied to the 2018 test event, as per an Olympic field, this number is reduced to 28 male freeskiers and 28 male snowboarders in attendance (less than the field size of the Olympics themselves at 30 men in each discipline). There are many possible explanations for this, including the introduction of Slopestyle as a new Olympic discipline in 2014, and changes to the World Cup quota system since 2014. Slopestyle is a more accessible discipline, given that there are jumps and rails at ski resorts all over the world, whereas Olympic size halfpipes for regular riding/training are few and far between, with this number decreasing given the operating costs of building and maintaining them.

For a more optimistic perspective, Frank Wells, world renowned halfpipe builder, accepts that there is an inherent elitism due to the scarcity of twenty-two-foot halfpipes, and that 'sportification' is driving a wedge between high performance and recreational exponents of the sport. However, according to Wells, changes in participation are merely an effect of the continual evolution and adaptation, a central hallmark of action sports. The focus should not be on fearing change, but more importantly adapting with it: "transitions are the future, and are being introduced as

features within slopestyle courses. Small pipes are returning and gaining popularity for the general public to use" (F. Wells, personal communication, April 5th, 2017). Look outside the P&P niche, and there are other changes in the competitive arena: banked slaloms are increasing in popularity as a generation of freestylers are aging and turning to other forms of the sport with less impact and injury risk. Like-wise, other avenues for the retired professional are to join the increasing numbers of people accessing the backcountry. While the market for snowboards has been in decline in recent years, the sale of 'split-boards' for touring outside the ski area boundaries are on the increase (Oakes-Ash, 2016). In short, opportunities in the P&P long-term athlete development model in the 'sport for life' category are numerous.

There is no doubt that the only constant in action sports is change. I have documented changes in the P&P disciplines as they have transitioned into Olympic sports, and have explored the social setting dynamic which continues to evolve as they bed in. The future is bright in terms of the position and increasing interest in P&P disciplines at the Winter Olympics, along with other actions sports within the Olympic movement. The addition of Skateboarding, Surfing and Climbing to the summer Olympics will provide a broader hot-bed of challenges to the action sports community who may wish to consider the learnings from P&P in order to get a head-start on competitors by considering how best to pro-actively manage these challenges.

9.2.2 Trick Progression in P&P, Methods of Coaching and Athlete Response

Chapter 5 focussed on investigating the nature of trick progression in P&P, while continuing themes in Chapters 6 & 7 provided a clear picture from both coach and athlete perspectives. An arrhythmic and highly individual development pattern was highlighted, with both inter and intra participant differences: some athletes take longer to learn tricks; some tricks take the same athlete longer to learn. Likewise, the number of repetitions required before successfully performing a trick in competition varied

substantially. A broad general movement vocabulary was recommended to support learning at more complex and specific stages; ensuring all four directions of spinning are developed at the same time was stressed as an important factor in promoting transfer and progression. The use of trampolines for general aerial awareness and then air bags for specific transfer were highlighted as popular training aids especially for those at the elite level with access to high-end (and high-cost) training facilities. The Winter Olympics, as the pinnacle target of competition performance every four years, has superseded the previous annual X-Games target, providing funding and support via national team structures and mainstream sponsorship. Also, however, creating a unique pressure as athlete's have been thrust into the national limelight. With a 60/40 ratio of new tricks (acquired in the current quadrennial) to established tricks (acquired in the previous quadrennial), a tripartite breakdown of learning & progression, consolidation and execution, along with maintenance of the existing repertoire (cf. 'push, drill, play' in Chapter 8) is required for the P&P athlete.

Homing in on trick progression, there are generally limited opportunities due to a requirement for the right combination of variables to come together. Physical, psychological and emotional readiness on the part of the athlete, along with optimal facilities and weather, are all requirements; each described and explored in detail earlier in this thesis. Sometimes it takes a competition to achieve the right blend, other times a training camp can meet the need, occasionally progression can occur when the athlete is least expecting it – just playing. Creating these somewhat nebulous opportunities through high quality planning and adaptation is a high priority for the coach, while maximizing them when the stars *do* align becomes the short-term priority. Some view the role of the coach in this context as taking away any excuses for the athlete, to allow them to channel all of their focus into what they can control, a requirement to surpass previous performance standards and break into new territory. If the struggle becomes

too much, or the risk of injury becomes too high, then providing an excuse for the athlete to allow both body and ego to live to fight another day is the coach's alternative course of action. Channelling energy into other productive activities with a switch of focus to consolidation, maintenance or simply calling it and taking some time off to recover becomes a decision for the coach using their professional judgment.

Chapter 5 identified that around 60% of training and preparation occurred on-snow and 40% occurred off-snow. It is clear, therefore, that the role of the coach and deployment of the inter-disciplinary support team requires energy to be invested in *both* domains, along with careful periodisation and collaboration to manage the injury risk. Complementary off-snow action sports were found to provide numerous benefits in terms of agility, coordination, mental challenge and release. Pre-habilitation and movement conditioning emerged as nuanced variations applicable to P&P in addition to traditional pillars of strength and conditioning and rehabilitation, while recovery (including physical, and notably emotional benefits) was a critical component of sound planning.

Chapters 6 & 7 provided insight from the coach, then the athlete, into a variety of strategies and tools to optimally support the aforementioned progression. Manipulating the physical environment is the first thing that the coach can turn their attention to, initiated in pre-season planning including mimicking the competition environment in training. Innovative facilities targeting reduced risk and increased volume, providing safe and feedback-rich learning environments are also highly sought after (and come at a significant financial cost). The coach must beware of looking for silver bullets, especially if this involves taking short-cuts. The opportunity costs of making the environment safer must be taken into consideration – is short-term gain sufficiently enhancing performance in the long-term or merely kicking the can of injury-risk further down the road with a false sense of accomplishment? The integration of air-

bags in halfpipe training has been going on since 2008, involving plenty of learning on their application. The newer landing bags for slopestyle and big air are currently in high demand, particularly amongst the elite. Notably, however, users are recommended to proceed with caution as their impact and change to the acquisition process is experienced and assessed.

Even with innovative training facilities available, however, it appears that a focus on fundamental technical skills remains and there is no substitute for getting the basics right. The comparatively low-volume nature of trick progression in P&P means by default that to harness the most learning, the quality of that trick progression becomes paramount. Motor imagery, combined in some examples with modelling, emerged time and again throughout Chapters 5, 6 & 7 as pivotal tools for an athlete to enhance confidence, achieve enough preparation and priming, and enough in-session adjustment. While not specifically mentioned, using imagery in post-session review and reflection is another opportunity to get the most learning out of each and every session. In terms of maximizing feedback within the environment, sources of information are often plentiful. These including other coaches, peers, judges, and social media, although obviously, careful selection and filtering may be required. The practice schedule and sequence of progression becomes a key component in maintaining or building confidence while maximizing retention.

Once a learning environment has been established, deciding when to leap into the learning pit then finding a way out becomes the coach's next challenge. Balancing structure in the training plan with the need for adaptation, along with optimal periodisation of load, risk, and challenge helps meet this objective. Achieving this at macro, meso, and micro levels (cf. Abraham & Collins, 2011) is both an on and off snow pursuit requiring meticulous focus and monitoring. Navigating these waters through a self-reflective process while maintaining situational awareness increases the

probability of accurate risk-management and quality decision making at all stages of learning. A number of formal tools have emerged that provide assistance when time is prioritised for their use. Returning to a social factor to conclude, the catalyst for all of this optimal learning is the coach-athlete relationship. Provision of an autonomy-supportive climate, developing greater autonomy as athletes develop, operating in a spectrum of roles and styles depending on athlete need and individual differences, collaborating in decision-making and facilitating the athlete to lead their own programmes, were all strategies employed by elite P&P coaches. Awareness of potential gender differences, while coaching the needs of the athlete in front of you regardless of gender, was perhaps the take-out from the investigation into gender differences. Finally, and importantly, trust, as an imperative in the athlete-coach relationship, allows each party to get the most out of each other and cope effectively with both the objective and subjective risks involved.

9.2.3 Psychological Perspectives on the Coaching Process

Appreciating the need for self-regulation in the P&P athlete and catering for this is essential for the coach. After considering appropriate theoretical perspectives demonstrated to be applicable to P&P, and facets inherent in the sport which support the need for self-regulation and mental toughness, Chapter 8 considered practical application of the concept of emotional periodisation to the coaching process and also systemic structures to optimize performance. The power dynamic between coach and athlete was considered, the push, drill, play approach was discussed, and the importance of sufficient emotional (in addition to the standard physical) recovery was stressed. Having summarised the main themes to arise from the thesis thus far, it is time to review their implications for practice.

9.3 Implications for Practice – Placing Results in Applied Context

I have been privileged to have had the opportunity to coach New Zealand P&P athletes at an elite level since the Torino 2006 Winter Olympics, and was certainly in the right place at the right time (working as the Head Coach of a prominent regional programme) when the SSNZ High Performance Programme (formally the Winter Performance Programme) emerged as a funded entity in 2004. Drawing on my earlier degree in Sports Coaching and personal experience as an international competitor, my path of study and development since then has included a Master's degree in Physical Education from the University of Otago (2006-2009), valuable professional development via participation in HPSNZ's Coach Accelerator Programme (2009-2012), and ongoing on-the-job learning. My current practice is impacted by all of these contributions, and more recently by my participation in this doctoral course of study.

Clearly, as shown by my 'position statement' in the Introduction, gaining knowledge and improving practice in my current role as Head Coach of the SSNZ P&P High Performance Programme, targeting winning outcomes in 2018, 2022 and beyond, was my main reason for embarking on the Professional Doctorate. Accordingly, this section is probably the most important to my employers, if not also to myself. In each of the following sections, I highlight recent changes and innovations that I have made within my own practice, or had input into in the organization's systemic approach before considering other developments suggested or supported by the thesis.

9.3.1 Coaching

To be honest, I perceive myself to be quite a well-read and open-minded coach, which was initially part of my motivation in commencing this programme of study as the next chapter in my professional development. As a result, completing this thesis has more reinforced than revolutionized my coaching practice. Particular areas to which I now allocate a more considered and evidence-based focus include – planning and

periodization, progression (including preparatory tricks and pathways), the development and ongoing enhancement of a general movement vocabulary, and the more comprehensive use of imagery and modelling. Risk management has always been a critical part of the role; my knowledge and understanding of this aspect has seen particular recent growth. This in turn helps to increase my ability to help the athletes and coaches I am working with to push their limits while minimizing the risk of injury. I next provide an overview of some specific elements of my coaching practice that have evolved over the course of writing this thesis, impacting both directly and indirectly on:

1. the SSNZ Team Coaching Approach;
2. the SSNZ Progression Checklist, and;
3. the SSNZ P&P Technical Components Model.

One of the pivotal themes to emanate from Chapter 6 was the imperative of the trust dynamic between athlete and coach. Knowing the athlete, a keen perception of where they are at, physically, psychologically and emotionally, and being able to respond to their needs, were highlighted as central to a successful working relationship in a risky domain where the stakes are high and mistakes can be career-ending. When a one-to-one 'lead coach' model is present, whereby each individual athlete selects and works with their own coach, trust is most likely to be accomplished. However, this model does not suit sustainability or viability of a limited budget (or athlete/coach talent pool). Some nations with large teams have a discipline focussed coaching team with a lead (and sometimes assistant) coach for each discipline working with multiple athletes. As a relatively small team, fluctuating in number and discipline from one Olympic cycle to the next, currently with 12 carded athletes spread across freeski and snowboard, halfpipe, slopestyle and big air disciplines; the SSNZ P&P High Performance Programme opted for an alternative approach. Instead a 'Team Coaching Approach' has been cultivated aimed at maximizing performance impact for athletes, while

minimizing risk for the programme. The imperative of the trust dynamic has posed questions and challenges to this new approach along the way, which will be introduced below along with how they have been answered.

Based on the fragility of the SSNZ 2014 quadrennial coaching approach, including a career-ending injury to one of the snowboard coaches in 2013 and a coach-athlete relationship breakdown, a new and more robust team coaching approach was developed and adopted by the Snowsports NZ Park & Pipe High Performance Programme for the 2018 quadrennial. Evolving based on reviews from year-to-year, the team coaching approach (see Appendix E for the most recent SSNZ Coaching Team Charter) involves an extension to the previous, simple lead-coach model. Thus, whilst each athlete can define who their primary coach is from the selection of skilled and experienced coaches employed, a second layer of support and cover is in existence, both in an overt and a covert fashion with respect to the athlete. Athletes spend time at different training camps and comps being exposed to coaching input from multiple coaches within the coaching team; coaches pair up to provide competition cover in lead and assistant coach capacities at major events. Behind the scenes, coaches are having input into the performance planning of other athletes within the programme; coaches are encouraged to be involved in brainstorming solutions to various performance questions both formally and informally as a team. The coaching team charter (Appendix E) was devised to ensure role clarity, and that rules of engagement were understood and followed. Regular reviews of the charter allow for check-ins and updates following blocks of coaching.

In review of the approach as a whole, so far, there have been plenty of benefits. Coaches working more collaboratively in contrast to a previous siloed approach has seen input and challenge, and promoted a more reflective and curious coach who has a community of practice to engage with to solve problems and issues. From a long-term

perspective, sustainability is promoted with multi-skilled coaches in long-term roles, continuing to hone their skills and experience. This is preferred to the previous scenario where new coaches (to the high-performance environment) arrived with new athletes, with the coaching role at risk from athlete injury or loss of form. The team coaching approach aligns with the vision of the New Zealand High Performance Coaching Plan 2011-2020 (High Performance Sport New Zealand, 2011). In the thick of a training session or at a competition, the coach has a second opinion to refer to and can turn to his colleagues to provide external input and a further level of support and feedback to complement the internal audit of the decision-making process, in real-time. For example:

> It's a big trick and it's high risk, it's day five of the camp and while it's the last day and we really want to get it done out here, I just think there's too many red flags. [the athlete] spewed up last night with food poisoning, and he told me he was feeling pretty tired this morning, I think we should work some more into the bag, come away in one piece and come back to taking it to snow another time. What do you think?
>
> (T. Pyatt, personal communication, June 19th, 2017).

One of the most impactful elements of the team coaching approach has been the positive ability of non-lead coaches to cover coaching responsibilities at major events, for example at the 2017 World Championships, when one of the coaching team needed to take time off for paternity leave. The current coaching team is poised with the nimbleness and agility to adapt to changing situations and circumstances (e.g., injury to athletes, arrival of a new athlete, unavailability of coaches, loss of form or de-carding of athletes) with complementary skillsets that can provide essential challenge to the status quo.

I now return to the pivotal nature of trust in the coach-athlete relationship in action sports and the importance of knowing the athlete. This contribution is a perspective that is potentially at odds with a team coaching approach: the personal and experiential component has the potential to be lost when an athlete is passed from one

coach to the next. How then can the benefits identified of a team coaching approach remain? Critical aspects that we have found from testing the approach are unsurprisingly a combination of high-quality communication (including structured and effective athlete handovers) and keeping egos in check. The Coaching Team Charter provides additional 'ground rules' such as assisting athletes *through* lead coaches to ensure that athletes are not confused via different inputs and contradictory approaches or statements. The team coaching approach has its weaknesses, and potential for confusion. However, the benefits appear to outweigh these drawbacks which lessen when effectively managed. The ultimate review will involve the debrief from the 2018 Winter Olympics next year when the performance impact of the coaching team and team coaching approach can be assessed against its ultimate objective of athlete performance at the Games.

The coach interviews in Chapter 6, interested me in the concept of a progression checklist, a tool identified and used by one of the coaches interviewed. I instigated the development of a formal risk-management tool to assist SSNZ P&P coaches working with athletes on trick progression, through appreciative inquiry with coaches and key support staff. The creation of the tool (see Appendix F) has raised awareness amongst the coaches, indeed in my own practice, and is a useful reference that some coaches store on their smart phones to access in the field.

Also flowing out of Chapter 6, the concept of whole-part-whole or component coaching from a technical perspective encouraged me to work with a colleague on the SSNZ Technical Components Model (see Appendix G). This model was developed both as a planning tool (in terms of elements of technical performance to focus on at different stages of acquisition) and a communication tool in terms of developing a shared language between athlete and coach and across the coaching team. The relatively simple model, based on existing terminology from the New Zealand Ski

Instructors Alliance, outlines and links the when ('phases of a trick'), with the what ('movement components'), to the how ('principles of form'), common to each of the competition feature types within P&P (jumps, rails and transitions), completing the loop by considering the why (judging criteria).

9.3.2 Meta-Coaching (and Metacognition)

My role as Head Coach involves leading the SSNZ P&P Coaching Team, engaging in meta-coaching by overseeing and checking-in with each of the other members on an ongoing basis, providing assistance and support, both in person and remotely at training camps and competitions. Progress against individual athlete performance plans are regularly discussed, decision making and tactics are reviewed, and I am also involved in promoting coaches' continuing professional development. I have a wider responsibility to encourage coaches at a regional level, spending time with them and providing mentorship both on and off the hill, also inputting into the strategic direction of the SSNZ coach pathway. While transfer for the applications of this thesis are inherent and implicit to my interactions with all coaches I engage with, formal impact has also been noticeable via coach education programmes. A recent initiative has seen the launch of a regional coaching qualification in New Zealand to advance and upskill the coaches working at regional programmes, coaching the grass-roots and talent development (the first and second of five) levels of the SSNZ athlete pathway. Course content includes off-snow coaching theory and on-snow application modules targeted at exploring some of the systems and philosophies used in the high-performance setting. As the applied elements of the course are developed in coming months, reference back to the findings from elite coaches in Chapter 6 and across the athletes in Chapter 7 will help inform the specifics of course content for example the importance, use and role of imagery and video feedback in P&P. Another feature for transfer has been the 'Rocket ship Skills Profile', described in more detail later and in Appendix H. The use of

common structures such as this enhances the degree of SMMs across the coaching pathway (cf. Webb, Collins & Cruickshank, 2016) and introduces essential precursors such as directionality (Willmott & Collins, 2017) which were highlighted through Chapters 5, 6 and 7.

Reading and learning spawned from Chapter 6's risk-management discussion, led me to adapt previous work on the use of PJDM in the adventure sport domain (Collins & Collins, 2016) to a P&P specific model of coach planning, action, reflection adaptation and learning (see appendix I). This model and its description forms a section of the coaching theory course content of the SSNZ regional coaching qualification. The extended learning and application to P&P that I have experienced in adapting and presenting the model is outlined here as a supplement to the discussion in Chapter 6.

PJDM; the synergetic use of both classical decision-making (CDM) and naturalistic decision-making (NDM) in combination with an audit process (e.g., Collins & Collins, 2016), provides a sound theoretical basis for the high-performance action sports coaching context at the individual coaching level. As I explained in Chapter 6, while at times working in isolation; opportunities for collaboration, co-coaching and meta-coaching in P&P and other action sports allows not only an internal audit of the decision-making process, but additionally an external audit. There are, of course, clear benefits, but also potential risks, of increasing the number of people inputting into the decision-making process, especially when the time required to make a response is limited. Additionally, especially in NDM, there is risk potential in heuristic traps. The action sports coach (and athlete) should be acutely aware of these, along the lines of McCammon's (2004) work related to recreational avalanche accidents. I have recently seen McCammon's (2004) 'consistency' heuristic negatively impact decision-making where a coach has stuck with original assumptions about the time-frame for trick acquisition by basing this on a left spin direction, and finding out it frustratingly took

significantly longer with the same athlete to the right. The 'social facilitation' heuristic can be a coach's best friend when they know an athlete needs a little encouragement to get that first attempt out of the way, but can also become the enemy when the peer-group inadvertently push an athlete too far. The 'scarcity' heuristic is evident with approaching bad weather, or on the last day of a training camp (this of course tends to coincide with higher levels of athlete fatigue), when coaches (and athletes) may be prone to pushing things a little too far for fear of not making the planned progression or achieving the desired goals. Again, knowledge is power, and if the coaches are aware of these heuristic traps, engaging in meta-cognition by auditing their decision-making against these traps should help to avoid them or at least acknowledge their presence.

I believe that the inclusion of the reflective process and decision-making, along with the introduction of a number of formal tools for immediate use, are critical elements of coach education, providing valuable insight to the developing coach on key strategies for continuous improvement and acquiring a sound and effective decision-making process.

9.3.2 Systemic Structures

It should be clear by now that the social milieu needs to be taken into consideration, especially in the genesis and transmission of novel approaches to the P&P athlete. That said, athletes that have emerged within a system are, in my experience, more easily influenced than athletes that have seen a system emerge around them. At the end of the day, P&P is about performance and, in the competitive arena, all athletes are looking for a competitive advantage. At SSNZ, the coaching and athlete support team aim to achieve this for our athletes through bespoke systems, including comprehensive individualised performance planning and monitoring. The current SSNZ approach has been developed over time, taking other sports' planning approaches into consideration and involves several elements widely used in the high-performance

sport domain. However, subtle adjustments to suit P&P as an action sport, include a number of specific nuances, introduced and outlined here, with further detail of their application provided in the case study in Section 9.4.

Quad Planning

Reflecting SSNZ's rolling eight-year cycle strategy, long-term planning for an athlete commences with a look at the next four, then eight years of their career including key milestones and expected outcomes as they track toward achieving and sustaining Olympic gold medal performance.

Skills Profiling

The SSNZ Rocketship Skills Profile, a development based on the Dreyfus model of skill acquisition (Dreyfus & Dreyfus, 1980), is a breakdown of elements of successful P&P performance and a measurement tool for assessing where an athlete's skillset is at against world-class performance in each element. Performance sub-categories including *mental skills, on-snow movement, off-snow movement,* and *physicality & robustness,* for example, are broken down further into key competencies. A *trick sheet,* where athletes list their level of mastery of all of the jump, rail and transition tricks in each of the spin directions, provides a visual representation of an athlete's 'bag of tricks'. Importantly, this indicates directional preference if there is one and identifies weaker directions to spend time on to improve. The system has evolved through multiple iterations over a number of years with the input of SSNZ staff and sport science discipline specialists. The profiling tool is an advancement on previous, simple, one to ten proficiency scales, providing a short description of requirements to be scored at each of the five levels of the SSNZ athlete pathway from 'grass-roots' (level one) to 'elite podium' (level five). This approach gives each level clear and tangible rather than perceptive ratings. The tool can be completed by the athlete themselves and by their coach or discipline specialist to encourage comparison of perspectives, self-

awareness and dialogue of where an athlete is really at. The tool has an educational benefit especially at the development level: athletes (and their parents, and coaches) can learn about holistic development and are provided with ideas for goals and future areas of focus. Once profiling has been completed and agreed, the next stage in the performance planning process is to prioritize needs, followed by identifying the optimal training and competition schedule along with support provision to deliver against those needs.

Progression Modelling and Athlete Tracking

Accurate athlete tracking is achieved by providing objective data to support subjective inferences from the coach. In completing an initial 'scoping paper' as my first project on this Professional Doctorate programme, I was drawn to the concept of describing and accurately measuring the vast progression that has occurred in this sport (as mentioned in Chapters 2 & 5). With the future in mind, and aiming to answer the crucial performance question 'what competition runs are going to win medals in 2018 and 2022?', I set about using historical data on key performance markers linked to the sport's judging criteria including 'average rotation index' (linked to *difficulty* and *progression*), 'average amplitude' (linked to *amplitude* and *progression*), and 'variety index' (linked to *variety* and *progression*), to predict future performance. This led to discipline-specific Sport Progression Modelling (see Appendix A for an example), tracking these measures over time and predicting their future levels. Subsequently, continued monitoring of the gold standard at the pinnacle event each year has seen updated progression modelling of the sport. This has enabled comparison of current NZL athlete performances (in both training and competition), using the same objective markers to be annually tracked, against the gold standard, identifying performance gaps for each athlete then planning and targeting future competition runs. These performance measures (in combination with traditional competition outcome measures)

have had and continue to have a range of uses at multiple levels within the SSNZ high-performance system including:

- At the programme management level – a.) supporting funding applications to the high-performance programme's investor (High Performance Sport New Zealand: HPSNZ) by accurately demonstrating that we know where our athletes need to be and know where our athletes are currently at, b.) making investment decisions on individual athletes;
- At the performance planning level: planning future required performance levels to achieve desired outcome goals, and;
- At the coaching level: setting realistic performance goals for athlete's annual plans.

Still in their first quadrennial, the modelling has been tweaked each year to account for ongoing progression. The actual performance levels of the 2018 Olympics (which are fast upon us), will be very interesting to compare with initial estimates back in 2014, and will have a validating effect in terms of continuing progression trends through to 2022.

Currently applied to P&P, these tools have certain transference and application particularly to other action sports that have experienced and continue to experience similar performance progression, and can be as clearly measured in terms of linking the judging criteria to objective performance markers. The disciplines of mountain-bike slopestyle, skateboard big air and cable wakeboard, amongst many others, appear to be ideal candidates to adopt a similar approach.

Ideal Run Video Template Project

Chapters 5, 6 & 7 have reported the widespread use of video feedback in P&P. All of the SSNZ High Performance coaching team use video feedback with their athletes (usually on a daily basis) both in the field and off snow including both industry

standard and innovative strategies. These include wireless video transmission from remote filming locations to capture the best angle for augmented feedback relayed to the coach at the top of the slopestyle course and athlete riding the chairlift, and using video for live measurement of amplitude in the halfpipe for example. More detailed analysis is generally completed off-snow, including split-screen video synchronization comparing an athlete with model performance and the mirroring of tricks to provide an athlete with an image of themselves completing a particular trick in the opposite direction (as mentioned in Chapter 7). As an adjunct to the extremely useful and widely used motor imagery and (to a lesser extent) modelling strategies (also discussed in Chapters 5, 6 & 7), video is also used as a source of feed-forward. An athlete's 'ideal run' can be stitched together from components, combining video of their own best single trick performances and/or model athlete's performing yet-to-be-learned manoeuvres. In this fashion, future goal runs can be viewed as tangible, and progression can be monitored in terms of increases in both amplitude and execution, as an athlete's personal best performances of each trick in the sequence is added to the initial template.

Periodising Risk – PUSH, DRILL PLAY

Introduced in Chapter 8, the concept of phasing the macro, meso, and micro-cycles of an athlete's performance plan into three different levels of emotional engagement and risk, is another system that has salient transfer to other action sports. Providing the coach and athlete first with a framework for their training focus, an initial plan followed by in-context adaptations can be made as required to ensure that training time is being utilized no matter what the facilities or weather on the day happen to be. For example, the focus of the week might be to land a frontside triple-cork 1440 for the first time on snow – a 'Push' focus; on day one, the weather is not conducive to high-end performance so the coach suggests a switch to a 'Play' mindset, working on new

grabs on a fronstside corked 720 (similar take-off and landing patterns to the triple-cork). Emotional resources are saved for the next day where the weather forecast is more favourable, and the athlete is confident knowing they have done some safe and preparatory work towards their goal and have simultaneously looked beyond with a future grab change primed for once the goal trick has been landed.

9.4 Putting the Pieces Together – A CASE-study:

The prodigious talent of a young NZ P&P athlete (referred to hereafter as 'N') was recognised by SSNZ's High Performance Programme in May 2014, as the structure and programme to PyeongChang 2018 and Beijing 2022 was being formulated following the debrief from the Sochi 2014 Winter Olympics. At the tender age of 12, rather than being carded immediately, the NZ domestic season was spent in a pre-carding phase, carefully profiling N's skills by using the 'Rocketship Skills Profile' tool to identify his strengths and work-ons, improving key performance elements including his neuro-muscular control for example, and getting to know him and his family. A performance plan for Athlete N was developed initially looking at his long-term development via a 'Quad Plan' for the 2018 and 2022 Olympic cycles, outlining key outcome, performance and process milestones that would be expected of an athlete tracking towards an Olympic podium in 2022. An annual plan was completed identifying key competition and training periods in the upcoming northern hemisphere winter season to develop Athlete N. In October 2014, acknowledging the potential perils of early specialisation (Baker, 2003), while recognising that P&P should be classed as an early-specialisation sport alongside gymnastics and diving (Bailey et al., 2010); N was officially carded at 'High Performance Development' (HPD) level (the third level of five in SSNZ's athlete pathway, and the first level where athletes receive direct high-performance investment). N's rise through the ranks, goal achievement and arrival at the elite level has been an impressive journey over the past three years: At 15

years old, N placed 8th at the Olympic test event in Korea in February 2017 and is currently on track for a top-eight+ performance at the 2018 Olympics and a podium in 2022.

There is no doubt that many factors and variables go into optimal progression and performance. Family, coaching, support, environment and experience combine to create a champion (cf. Collins, MacNamara & McCarthy, 2016). Accordingly, here follows some of the initiatives and actions promoted/facilitated by this thesis which have potentially been making a performance impact for Athlete N.

Understanding Long-term Development

Reading completed around long-term development in the preparation of Chapter 2, along with informal research into some of the sport's child prodigies (notably discussions with Chloe Kim's father Jong) provided some excellent evidence and insight. Understanding some of the potential risks of involving such a young athlete in a high-performance system, combined with a clear pathway of holistic development planned with eight years in mind instead of rushing to short-sighted targets has helped shape both the emphasis and focus of N's support provision. Specifically, a shift from a focus on cutting edge technical progression to broadening N's technical base, has helped reduce injury risk and has set him up for recent technical advancements. Learning strategies for anxiety control, along with bouncing back from a number of learning opportunities including under-performance and errors in competition (cf. Collins & McNamara, 2012); has bolstered N's mental toolbox allowing him to thrive at major events in the 2018 Olympic qualifying period including the Olympic test event in Korea.

Directionality

I identified early in Chapter 2 and followed up with discussion and confirmation in Chapter 5, that the ability to spin in all four directions is an important trait of a

burgeoning P&P athlete. N, as a newcomer was targeted as a candidate ripe for measurement and influence. Initially, completing the *trick sheet* component of the Rocketship profile, an overview of N's current bag of tricks including a left spin direction preference was identified. By completing a self-report diary (see Appendix J) including the amount of time focussing on each of the four directions over a 2-month period in 2014, and receiving monthly reports (see appendix K); an analysis and corrective feedback, followed by a shift in directional focus was achieved to ensure N was balancing his energies across the four directions. With the support of N's personal coach and a keen focus in performance planning on developing in a balanced fashion in all four directions, N has benefited both from a broad movement vocabulary in terms of skill acquisition, and simultaneously from the recognition of the judges. At the Olympic test event in February 2017, N was one of only four finalists (out of a ten-man final) to execute a competition run spinning in all four directions, and has a strength to his run options in terms of the *variety* component of the judging criteria approaching the 2018 Olympics and beyond.

Holistic Development Considered via Rocketship Skills Profile

While the *trick sheet* identified spin directions to work on, other elements of N's Rocketship including *mental skills* components (as mentioned earlier), *off-snow movement* and *physicality & robustness* have been a focus of support provision and effort both in-season and in the off-season. Improving scores in Rocketship markers along with increasing physical and psychological maturity has paralleled N's competition advancements which are likely to see him eligible for a promotion to 'elite' level carding (the fourth level of five in SSNZ's athlete pathway) in the near future.

Personal Coach Exposed to & Integrated into the SSNZ Team Coaching Approach

N's development as an athlete has occurred at the same time as the development of his personal coach's experience at the elite level. N has benefited from the team

coaching approach which has seen multiple coaches and support team members impacting his performance both directly through lead support at training camps, and indirectly through assistance, support and mentoring of N's personal coach. From exposure to the Olympic environment through an opportunity to coach at the Youth Olympic Games in 2016, to fast-tracking experience via work opportunities at commercial training camps, N's coach has grown in leaps and bounds and is on track to be selected to represent New Zealand in PyeongChang 2018.

Run Tracking and Planning Based on Sport Progression Modelling

Objective performance markers of gold medal competition runs were estimated for 2018 and 2022, including average rotation index and average amplitude. These have provided a clear picture of future runs required. I have found across the board and unsurprisingly from tracking these elements for each athlete in our programme, while also looking at trends in the sport, that these markers are related: it is unusual and difficult to achieve substantial gains within a 12-month period in both (note the increase in rotation index in Athlete N between 2016 and 2017 in Figure 9.1, and the accompanying decrease in amplitude in the same time period in Figure 9.2). The plan for N's development has therefore been to focus on the acquisition of tricks in the third year of the quadrennial delivering an increased rotation index, to allow a subsequent shift to a focus in amplitude (and execution) in the fourth year of the quadrennial. As such a 'build the run' and then 'perfect the run' approach has been taken, considering next steps beyond 2018 in the process - future-proofing performance by targeting all elements of the judging criteria critically including *variety*.

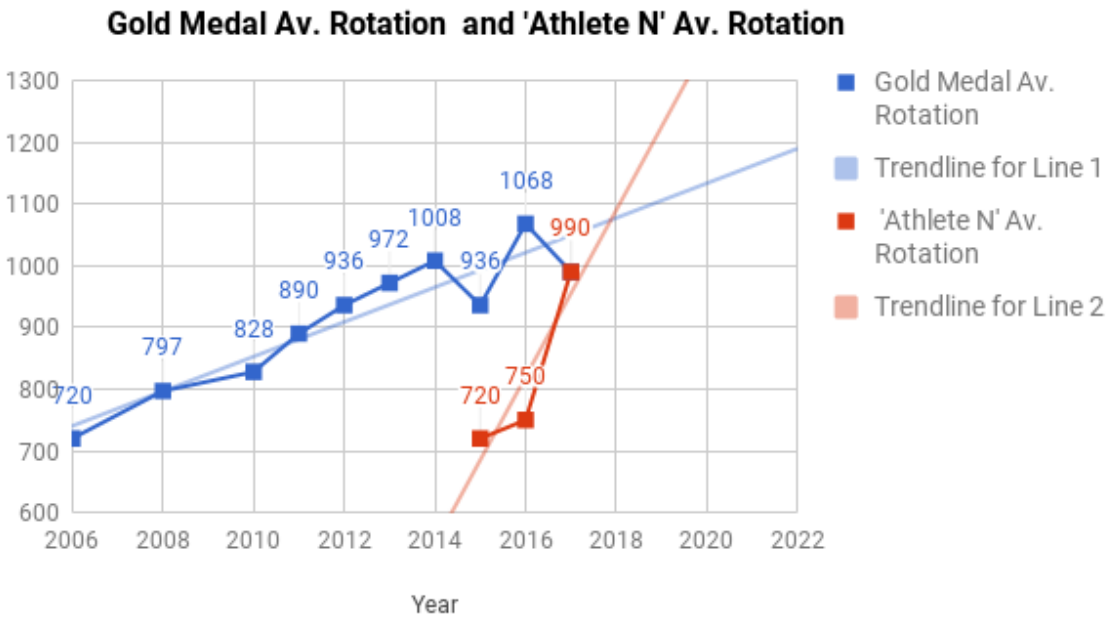

Figure 9.1 Performance Tracking – Rotation

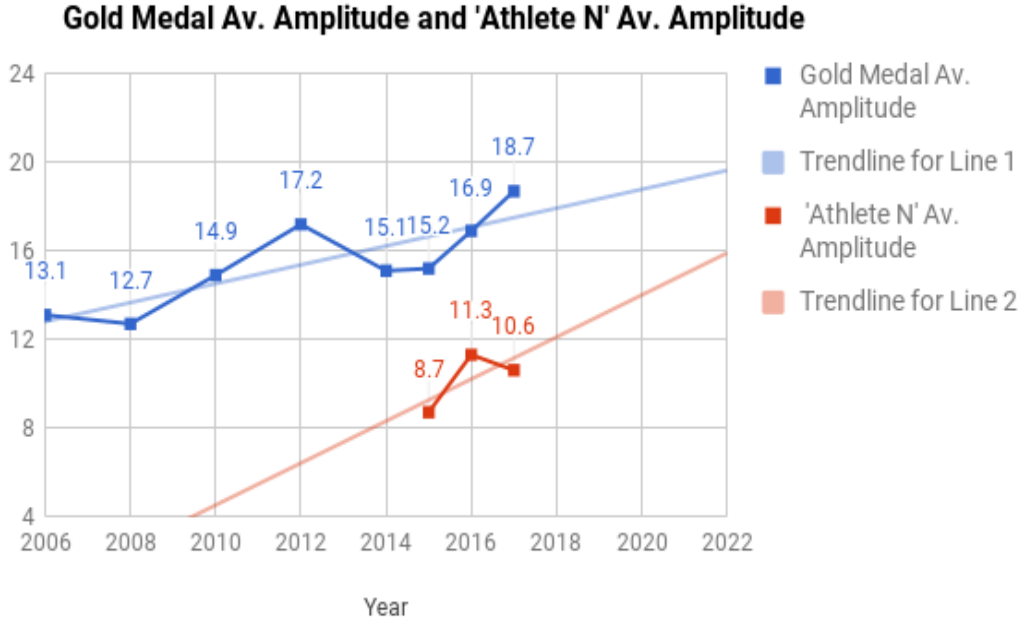

Figure 9.2 Performance Tracking – Amplitude

PyeongChang 2018 Ideal Run Video Template

Given the importance of the use of imagery in P&P as a training aid found in Chapters 5, 6 and 7; it will be no surprise that imagery use has been a cornerstone of N's mental skills toolbox. Developed over the years with the support of the team's sport psychologist, and utilized in training and competition, N's use of imagery is a strength. In tandem with the run tracking and planning based on sport progression modelling mentioned above, N has benefited particularly in the 12-month period in the lead in to PY2018 from the use of a video template of his planned Olympic run. Stitching individual clips together of N's best single tricks into a yet-to-be landed run, as outlined in Section 9.3.3 of this chapter, has provided him with a powerful priming tool via motor imagery of a future performance arguably with high functional equivalence (see Appendix L). N and his personal coach have been very receptive to the video template concept and have used it to brainstorm and compare different run options by changing the sequence of tricks in the template. A further benefit has been the boost to confidence, witnessing the overall quality of the run continue to improve as the amplitude of individual tricks has increased replacing previous tricks in the template.

9.5 Generalisable Considerations for Other Action Sports

I have referred to various other action and adventure sports throughout this thesis, pointing to some of the similarities in culture, challenge, environment and performance. As I have mentioned on numerous occasions within this thesis, many of the findings are not just specific to P&P but are generalisable to other action sports.

Psycho-social Challenge

In particular, the soon-to-be Olympic sports of Surfing, Climbing and Skateboarding are likely to experience some of the changes that snowboarding and, more recently, freeskiing have experienced as they have transitioned into the

mainstream. The uniqueness of a first outing as an Olympic sport provides those that wish to exploit this new circumstance with an opportunity to learn from both the successes and the mistakes of those that have been there before. Surfing as a well-established competitive sport with one focal discipline may benefit from its simplicity, while Skateboarding's Olympic disciplines of 'Park' and 'Street' and Climbing's combined disciplines in the Olympic format may have an impact on subsequent participation and discipline specialisation along the lines of what has been seen in snowboarding and freeskiing.

The impact of Olympic status includes the opportunity for high-performance funding, a potentially prized cash injection for struggling national associations. However, this investment comes with accountability, and investment protection in the form of 'bean counters' who may or may not understand action sport. Understanding and adapting to the sport is a critical piece for any support provider, the range of 'ologists mentioned in Chapter 2 that have become commonplace in P&P will have new sports to get to grips with. The viability of professional coaching in these sports as a knock-on effect will also likely increase, presenting opportunities, growth and raising the bar of athletic performance.

Coaching Challenge

Professional coaching is still absent in some action sports, new to others, and evolving in the rest ("Pit Crew: Grooming Groms", 2015). Achieving respect from the athletes, buy-in to the coaching process, and managing resistance to coaching (as discussed in Chapter 3 with respect to snowboarding) will be challenges for the coaches and the sports as a whole to face.

Undoubtedly, the suite of performance enhancement tools discussed in Chapters 5, 6 & 7, that have evolved in P&P, along with the Rocketship Profile, the Progression Checklist, the Sport Progression Modelling and Ideal Run Video Template tools

described in this chapter, can be easily adapted to a variety of other action sports. Indeed, the continuing collaboration, influence and sharing of ideas is only likely to be extended as a hallmark as the action sports niche continues to grow and transition to the mainstream. The periodisation of emotional challenge concept: push, drill, play, can also be directly transferred to any action sport (and many others), individualised to both the context and athlete.

Athlete Challenge

Current elite performers in soon-to-become Olympic sports will need to consider the implications of the change and identify if new targets of Olympic success align with their personal goals and values. While it is an assumption that most people would willingly subscribe to an opportunity to represent their country on the global stage, the Olympics have not been without their fair share of controversy, and have been notably shunned by action sports athletes in the past (e.g., Haakonsen, 2014). As the stakes and the number of stakeholders increases, the successful action sports athlete in the new environment will need to ensure they continue to focus on the critical few elements that will positively impact their performance, making the most of the additional support on offer while avoiding distraction and any negative impacts of too much *noise* in the support system.

9.6 Next Steps – Recommendations for Future Investigation

Although largely focused on procedural and coaching innovations, this thesis has also prompted numerous directions for future investigation. Primary recommendations target further work specific to the sport, both as individual skill sets and overall coaching methodologies. Accordingly, in this final section I highlight some of these ideas, relating back to current research where appropriate, starting with what I feel are the three most major elements.

Imagery

While imagery and modelling are currently widely used across sport in general and increasingly in action sports, I have identified the potential to further tap these powerful tools. Invoking a broader range of senses and including the rhythm and relative timing of the skill to aid in acquisition are suggestions to enhance this aspect (cf. MacPherson, Collins & Obhi, 2009). The degree of functional equivalence of motor imagery to achieve complex motor actions that have not yet been performed warrants further research. Examining the 'projective scope' of imagery in this instance is urgently needed (cf. Collins & Carson, 2017). The interactive role of coach-psychologist-athlete in learning how to, and maximizing, use of imagery in the daily training environment is another area requiring consideration. Specifically, the interplay between these three, a feature of the relationships which I promote, seems to hold lots of positives for enhancing both the rate and quality of skill acquisition, as well as the subsequent 'embedding' of these skills (Carson & Collins, 2016).

Repetitions

The extent to which repetition in the acquisition process is necessary for emotional reasons (less nerves, greater confidence) rather than only embedding the trick motorically (cf. Carson & Collins, 2016) is an important issue which awaits further investigation. Specifically, I am keen to address the number of repetitions question; what is it, why is it different and what aspects of skill acquisition are at play. It would be interesting to see the specific number of repetitions required, inter or intra performer, to groove the motor programme of a skill. Furthermore, and, if so, how/whether this can be reduced. From an applied perspective, the optimal integration of airbags to accelerate or strengthen acquisition and refinement could provide valuable direction to enhance their current utilisation From a process perspective, to what degree are the underpinnings psycho-emotional - an important aspect of confidence; OR psychomotor

- performing the movement in a variety of different conditions to develop it through the associative to autonomous stage of skill acquisition? Research and process in gymnastics tends towards the latter but then both variability and safety are more tightly constrained. Included in with this are several procedural issues (e.g., the ideal focus of attention – cf. Wulf and colleagues) which will contribute to the answer.

Coach PJDM

PJDM of the coach and its application to optimise athlete progression is the third major area for exploration. One of the clearest findings to emerge from this research is the high degree of individualization apparent across the sport - greater perhaps than would be found in more established CGS sports. Consequently, the way in which the coach works to optimize his or her provision for the individual athlete whilst also perhaps selling new ideas and grooming new approaches, is probably the biggest area of potential benefit for the coach.

Minor foci:

In addition to these primary recommendations for future investigation, and given the relative lack of research into action sports, this thesis prompted numerous other avenues of study to explore both theory and practice. The potential for minimizing injuries through innovations in hardware and equipment is an obvious target for further work. Concussion is a hot topic in contact sports currently, research specific to P&P including optimal helmet design for example, would be useful. On a similar note, further research is required to determine the best combination of traditional strength and conditioning versus movement conditioning approaches, both from an injury prevention and a performance enhancement perspective. Directionality emerged as a particularly fruitful area for immediate exploitation and future investigation. Further measurement and investigation of a balanced approach to spin directions and the subsequent impact on high end acquisition is warranted. An optimal long term development model aimed

at elite performance specific to P&P has not yet been thoroughly researched. Retrospectively (and prospectively) profiling the development of super-elite P&P athletes, comparing them with athletes that are not as successful, would be one way of establishing more information on enablers and barriers to success at each stage. Access to high-quality training facilities within a feedback-rich environment has been shown to be essential to optimize the skill acquisition process. Investigation into increasing the quality and quantity of feedback in the environment, including activation of *all* senses, is an area which deserves further consideration. Sonification (e.g., Schaffert, Mattes & Effenberg, 2011), the use of audio templates to enhance/internalise rhythmicity is an obvious candidate for attention. Progression modelling has been demonstrated as a powerful tool. Further exploration and refinement of the potential for and limits to the rate of progression will benefit the action sports community and coaches in particular; increasing their awareness of what is possible, achieving the right balance of risk versus reward, most importantly reducing injury and informing practice.

As a follow up to my preliminary attention to mental toughness in Chapter 8, further investigation into the role of, and context specific components of mental toughness required for optimal performance in action sports/P&P would be a useful endeavour. Data are clearly supportive of a short term, transient and context-specific type of MT, through which athletes make informed decisions about the acceptability of risk. Self-regulation and the periodization of risk perception on an individual basis – how does that really work? Comparisons and contrasts to other Olympic (e.g., Slalom kayaking, Windsurfing); soon-to-be Olympic (e.g., Climbing, Surfing, Skateboarding); and non-Olympic (e.g., Skydiving, Freestyle moto-cross, Parkour) action sports provide a wider group and complementary contexts for examination.

As with many sports, P&P would benefit from a longitudinal research approach. I hope my thesis has made an impact providing retrospective data and reflections from

high-end athletes and coaches. The athlete survey in Chapter 7 provides some useful snapshots of those at different stages of the pathway, however, further longitudinal studies are required to further inform our understanding. For example, while I measured progression in terms of months from first trial to landing in competition, it is difficult to measure all of the general and specific training that took place within that period directed towards development and mastery of a trick. Clearly, further longitudinal research is required to achieve greater clarity in this regard.

9.7 Closing Words

As stated at the conclusion of Chapter 5, and as a final comment to conclude this thesis, research in support of performance and progression should ultimately complement and promote rather than thwart the aesthetics inherent in subjectively judged events and a core feature of action sports. There is room for both progression *and* style!

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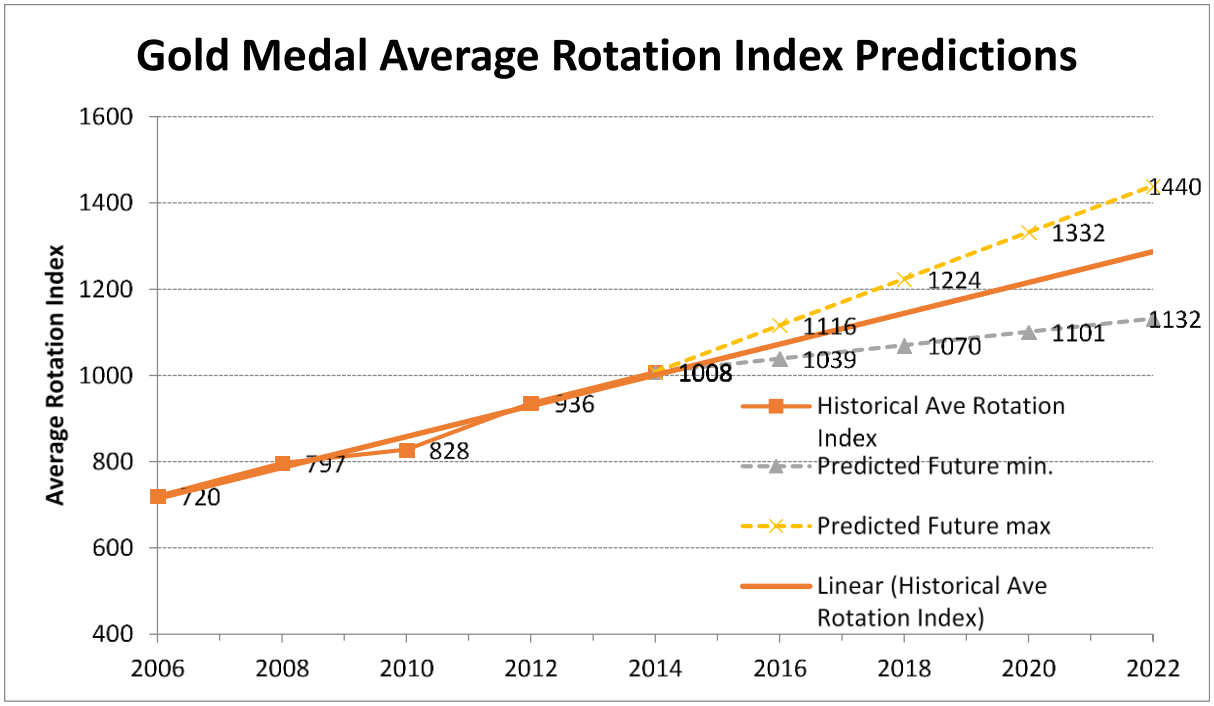
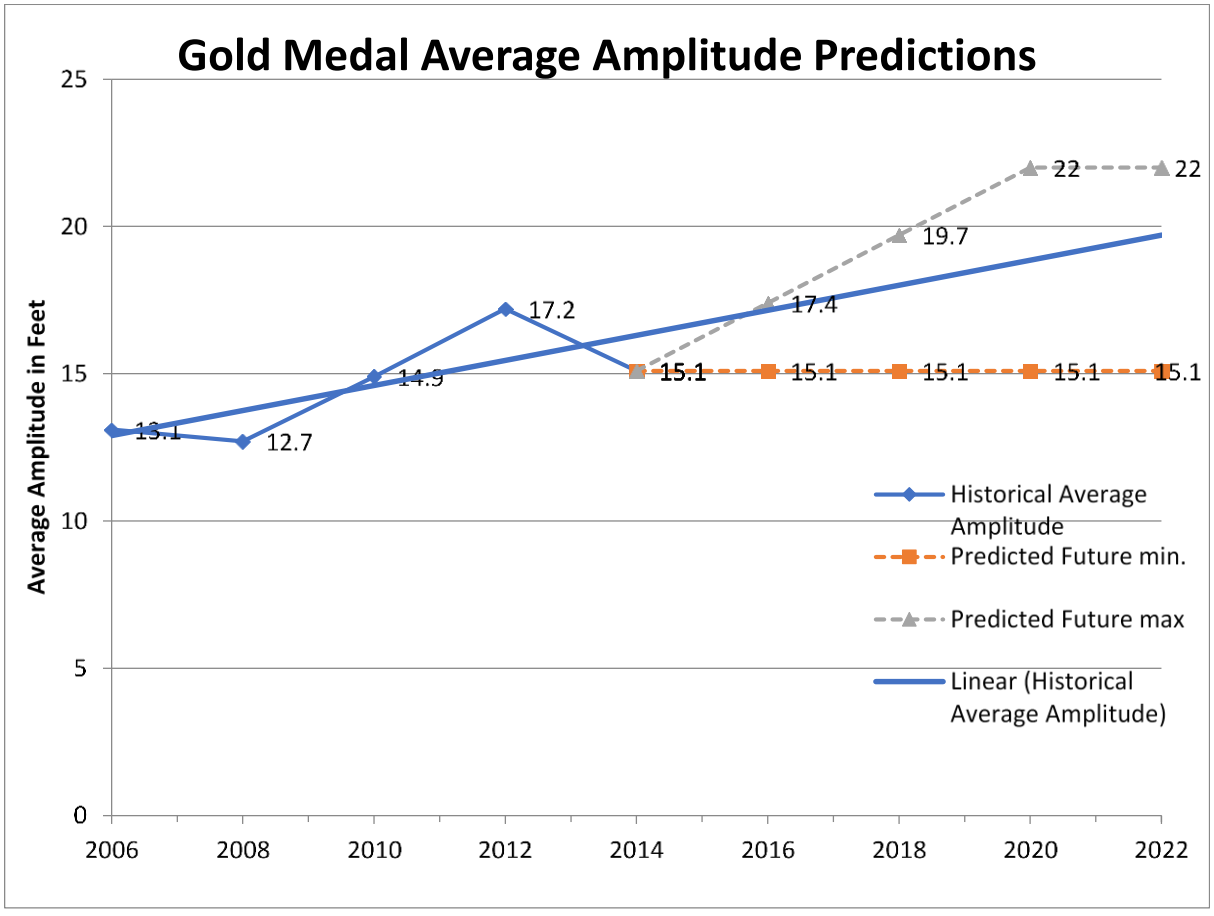
Appendix A: Tracking Performance Progression – Men's Freeski Halfpipe





Appendix B: Foam-pits and Airbags

Shaun White's On-Snow Foam Pit, Silverton, Colorado, 2008

A Typical Training Camp Setup with Halfpipe Airbags, BKPro, Mammoth Mountain, California, 2016

Landing Bag, Mammoth Mountain, California, 2017

View from the Side

View from Above

Appendix C: Action Sports Coaching Survey

Action Sports Coaching

WELCOME

Thanks for considering taking part in my research on learning tricks and coaching in action sports. As a coach myself, I am interested in exploring strategies used by action sports athletes and the involvement of coaches to better help athletes in their progression. The research is part of a Professional Doctorate I am completing in Elite Performance at the University of Central Lancashire.

The series of questions which follow should take you roughly 10-15 minutes to complete. The questions include yes/no, multi-choice and open-ended questions. All your answers will remain strictly confidential, your participation is voluntary and you can stop completing the survey at any point if you choose. By submitting a completed questionnaire, you are giving your consent to participate in the study – if you are under the age of 16, please consult with your parents before completing the questionnaire. At the end of the questions, you will be asked for some descriptive information about yourself. If you would like to skip this section and save time you can provide your name and we can obtain the descriptive information from the FIS website. If you would prefer not to give your name, please leave this cell blank but answer the descriptive questions that follow.

If you have any further questions about the research, feel free to contact me at:

Tom@snowsports.co.nz

Thankyou for taking the time to read through my introduction and considering taking part in my research.

You will be asked to think about 2 recent tricks that you have been working on. For the first section please refer to a new trick that you have recently learnt; for example adding 180 to an old trick, learning a new trick in a new direction, or transferring a new trick to snow. For the second section please refer to a current trick which you have refined or modified; for example, taking it to a different feature, learning it with a new grab or variation, or taking it for the first time from training to competition.

Action Sports Coaching

SECTION 1

Refer to a new trick that you have recently learnt

* 1. Name of trick:

* 2. “Before I even started on the trick, I…”

	I did this?	How useful was this?	My coach was involved/helped me?
…thought through the advantages (pros and cons) of this move			
… considered a schedule of when where and how I would work towards this trick			
…identified particular challenges up front			

...completed some OTHER planning:

* 3. "As I got ready to attempt the trick, I..."

	I did this?	How useful was this?	My coach was involved/helped me?
…watched video of others doing this trick			
…watched others doing this trick live			
...talked to other athletes about their experience with this trick			
…used imagery including vision from an internal perspective (what I can see when doing the trick)			
…used imagery including vision from an external perspective (what the trick looks like)			
…used imagery including audio (what the trick sounds like/what I can hear when doing the trick)			
..used imagery including how the trick feels			
…prepared with off-snow apparatus (e.g. trampolines, foam-pits etc)			
…prepared with on-snow apparatus (e.g. air-bags)			
…prepared by doing simpler forms of the trick (e.g. doing 540s to prepare for a 900)			
...I thought about and rehearsed in my head the rhythm of the trick			

...completed some OTHER preparation:

* 4. “Before Dropping in for early attempts I…”

	I did this?	How useful was this?	My coach was involved/helped me?
…talk to myself and have keywords I use to help cue and perform this trick			
…deliberately amp myself up or calm myself down prior to dropping-in			
…use music to help influence my mood state			

...use OTHER methods to help

* 5. “In learning this trick I…”

	I did this?	How useful was this?	My coach was involved/helped me?
…focussed on specific body parts			
…focussed on what my equipment was doing			
…broke the trick down into components			
…focussed on the trick as a whole			

* 6. “To fine tune/improve the trick I…”

	I did this?	How useful was this?	My coach was involved/helped me?
…watched video of myself performing the trick to help fine tune/improve it			
…received subjective feedback on my technique (e.g. line, take-off, timing, amplitude, axes, grabbing, landing)			
…received objective feedback on my technique (e.g. amplitude, grab-hold etc.)			

Action Sports Coaching

SECTION 2

Refer to a trick that you have recently refined or tweaked (for example by adding a different grab, taking it to a different feature, taken from training to landing in competition for the first time):

* 7. Name of trick:

* 8. “Before I even started on the trick, I…”

	I did this?	How useful was this?	My coach was involved/helped me?
…thought through the advantages (pros and cons) of this move			
… considered a schedule of when where and how I would work on refining this trick			
…identified particular challenges up front			

...completed some OTHER planning:

* 9. "As I got ready to attempt the refined trick, I..."

	I did this?	How useful was this?	My coach was involved/helped me?
…watched video of others doing this trick			
…watched others doing this trick live			
...talked to other athletes about their experience with this trick			
…used imagery including vision from an internal perspective (what I can see when doing the trick)			
…used imagery including vision from an external perspective (what the trick looks like)			
…used imagery including audio (what the trick sounds like/what I can hear when doing the trick)			
..used imagery including how the trick feels			
…prepared with off-snow apparatus (e.g. trampolines, foam-pits etc)			
…prepared with on-snow apparatus (e.g. air-bags)			
…prepared by doing simpler forms of the trick (e.g. doing 540s to prepare for a 900)			
...I thought about and rehearsed in my head the rhythm of the trick			

...completed some OTHER preparation:

* 10. “Before Dropping in for early attempts I…”

	I did this?	How useful was this?	My coach was involved/helped me?
…talk to myself and have keywords I use to help cue and perform this trick			
…deliberately amp myself up or calm myself down prior to dropping-in			
…use music to help influence my mood state			

...use OTHER methods to help

* 11. “In learning this trick I…”

	I did this?	How useful was this?	My coach was involved/helped me?
…focussed on specific body parts			
…focussed on what my equipment was doing			
…broke the trick down into components			
…focussed on the trick as a whole			

* 12. “To fine tune/improve the trick I…”

	I did this?	How useful was this?	My coach was involved/helped me?
…watched video of myself performing the trick to help fine tune/improve it			
…received subjective feedback on my technique (e.g. line, take-off, timing, amplitude, axes, grabbing, landing)			
…received objective feedback on my technique (e.g. amplitude, grab-hold etc.)			

Action Sports Coaching

Background Information

* 13. How would you best describe your current coaching situation (tick all that apply)

- [ ] I have a coach that I personally contract
- [ ] I am coached as part of a regional or private training programme
- [ ] There is a coach supplied by my national team that I work with
- [ ] There is a coach supplied by my national team but I do not work with them
- [ ] I do not have a coach
- [ ] Other (please specify)

* 14. How many years have you worked with a coach?

15. Full Name (as per FIS license): *Thankyou - you can click on "Done" at the bottom. If you wish to remain anonymous leave this blank and please complete biographical questions 16 to 20.*

16. In what year were you born? (enter 4-digit birth year; for example, 1976)

17. What Nation do you represent?

18. Disciplines you compete in (you may select more than one)

- [ ] Snowboard - Halfpipe
- [ ] Snowboard - Slopestyle
- [ ] Snowboard - Big Air
- [ ] Freeski - Halfpipe
- [ ] Freeski - Slopestyle
- [ ] Freeski - Big Air

19. Number of years competing:

20. Highest level competed at:

- ◯ Regional events
- ◯ National events
- ◯ International events
- ◯ World Cup
- ◯ Olympics
- ◯ Major event finalist
- ◯ Olympic finalist
- ◯ Major event podium
- ◯ Olympic podium

Appendix D: Invitation Email

Dear,

I am a Professional Doctorate student supervised by the School of Sport, Tourism and the Outdoors at the University of Central Lancashire. I am researching coaching in action sports. For this project I have developed a short online survey to collect responses from international freeski and snowboard competitors (male and female). The research has received ethical approval from the UClan Research Ethics Committee for STEMH (Science, Technology, Engineering, Medicine and Health).

I was wondering whether it would be possible for you to circulate information about my project to your athletes? Your help would be valuable to my project as it would allow my survey to reach a wide number of athletes who might be able to provide very meaningful data for this study.

I have included further information in the 'call for participants' below and have attached a detailed participant information sheet to this email which should be forwarded along with the information below. Please don't hesitate to be in touch if you have any questions. Many thanks indeed for your help!

Kind regards,

Tom Willmott

CALL FOR RESEARCH PARTICIPANTS

Thank you for considering taking part in my research. I am a Professional Doctorate student supervised by the University of Central Lancashire. I am researching Coaching in action sports. For this project I have developed a short online survey to collect responses from international freeski and snowboard competitors. The survey should take about 15 minutes to complete and participation is voluntary. This survey has been approved by the UClan Research Ethics Committee STEMH (Science, Technology, Engineering, Medicine and Health).

If you would like to complete the anonymous survey, please follow this link https://www.surveymonkey.com/r/SWTX2FL

If you have any further questions about the research, feel free to contact me at tom@snowsports.co.nz

Thank you for considering participating in my research!

Appendix E: SSNZ Park and Pipe Coaching Team Charter

PARK & PIPE COACHING TEAM CHARTER

Team coaching Approach (our WHAT)

What is 'Team Coaching' in the SSNZ Park & Pipe Context?

The SSNZ Park & Pipe On-snow coaching team (currently Sean, Mike, Tom, Bruce, Bud, Mitch) have been operating as a coaching team since day 1. The 2014-2018 SSNZ High Performance strategy identifies using a 'Team Coaching Approach in order to enhance the 'daily training environment'. Any time more than one coach is directly or indirectly positively impacting athletic performance, 'Team Coaching' is taking place. Our aim is to maximize the potential of this positive impact. The concept of 'Team Coaching' was initially discussed and focussed on in terms of the on-snow coaching team, this was formally extended in May 2016 to include the wider support team working together to impact athlete performance. The Team Coaching Approach complements the Lead Coaching model. The Team Coaching approach is individualised to cater for the needs of the athlete and resources of the programme on an individual basis.

Examples of Team Coaching in action:

- Multiple coaches contributing into the performance plans of athletes
- Coaches having indirect input into non-lead athletes via the coach
- Coaches having direct input into elements of a non-lead athlete's performance
- A support team member working with a lead coach to solve an athlete's performance issue
- On-snow coaches and support team members assisting the lead coach by providing feedback in training and competition

What Team Coaching is NOT:

- Over-coaching (team coaching will not necessarily be visible on a daily basis)
- Confusion
- Misalignment
- The opposite of Lead Coaching

Purpose (our WHY)

Coaching a winning culture of athletic excellence.

Vision (our WHERE)

Our Park & Pipe programme is a slick – world leading operation – with a progressive and collaborative culture that gets the best out of

everyone (coaches, athletes, supporters). We are the greatest park & pipe coaching team of all time.

Bold Goals

2018: 7 medals

2022: 15 medals

Values

Drive	We maintain motivation and enthusiasm towards the vision
Perseverance	We keep on keeping on
Courage	We challenge comfort zones
Innovation	We learn to be better
Accountability	We own it, we do it, we get results

Rules of Engagement

We will:

1. Provide good athlete hand overs and hand backs
2. Encourage athletes to own their Individual Performance Plans
3. Maximize each other's strengths
4. Engage in problem-solving as a team
5. Look out for each other
6. Assist athletes through lead coaches
7. Aim to deliver a consistent message

What we will see from now to May 2017

What we will see:

- A continued improvement in 'above the line' behaviours
- Coaches strengths are being maximized to impact performance
- Athletes are clear about and leading their plan for 2018 and beyond
- Tom to spend time with each coach
- Coaches spending time together on-hill and socially
- Coaching athlete accountability

SSNZ Progression Checklist

Does the benefit of attempting a trick outweigh the injury risk?

CRITERIA	GO/NO-GO?	
Has SKILL PREParation been completed? - Physical (pre-requisite tricks, trick landed on other apparatus) - Mental (can the athlete see the trick?)	Go	No-Go
Is the athlete PHYSICALLY READY? - Fatigue - Soreness - Niggles - Positive Neuromuscular Screen - Is the athlete as strong and robust as they need to be?	Go	No-Go
Is the athlete MENTALLY/EMOTIONALLY READY? - Confident - Focussed - Are there external modifiers?	Go	No-Go
Is the ENVIRONMENT CONDUCIVE? - Feature/Terrain - Weather - Snow - Light	Go	No-Go
Is it the RIGHT TIME for trick progression?	Go	No-Go
Is EQUIPMENT appropriate?	Go	No-Go
Does the athlete have appropriate SPEED & CONTROL?	Go	No-Go

Is the trick ACHIEVABLE?	Go	No-Go

Background:

The SSNZ Risk Management Tool was developed based on the need to assist coaches and athletes in making smart decisions around trick progression and ultimately aims to reduce injuries that are a result of poor decision-making. The tool provides a checklist for coaches and athletes to consider prior to making a decision on whether attempting a trick is a "Go" or a "No-Go". It can also provide information on what to work-on, change or wait for, in order to turn a "No-Go" situation into a "Go". The tool provides a framework to assist coaches and athletes in their "Professional Judgment and Decision Making" around whether it is appropriate (or not) to attempt a trick.

Explanation:

"Has SKILL PREParation been completed?"

For athletes to be ready to attempt a trick there must have been sufficient skill preparation which includes both physical and mental components. Physical components include a suitable warm-up, suitable progression from easier moves on the same feature, and may include completing the trick on other apparatus including trampolines and air-bags. Mental preparation includes being able to image the trick which may require modelling off others or building a mental picture of the trick from previous similar experiences.

"Is the athlete PHYSICALLY READY?"

Fatigue from within the session, previous activity, lack of sleep or recovery, a build up over several days or the cumulative effect of a long season will have an impact on whether an athlete is physically ready to attempt a trick or if their physical condition is an indicator of heightened injury risk. The presence of soreness, and injury niggles may promote waiting for a time when these issues have reduced. A neuromuscular screen completed by a SSNZ recognised provider which measures an athlete's balance and control will also provide an indication of injury risk. Has the athlete had an extended break from off snow physical training causing some detraining? Are they close to THEIR physical peak or are they detrained? Has the athlete recently had an illness which may impact on their physical sharpness/strength/vestibular system?

"Is the athlete MENTALLY/EMOTIONALLY READY?"

It is important that an athlete has confidence in their ability to complete a new trick as this is directly opposite to and counters anxiety. If they are not confident the question should be – what further preparation is required to increase their confidence to an appropriate level. Focus needs to be on the task at hand, if an athlete is distracted they are putting themselves at injury risk. External modifiers refer to a range of factors including daily hassles, family life, financial pressures, peer group, competition pressure that might be present in the external environment that may be adding pressure to a situation or impacting it negatively. It will be coach and/or athlete judgment as to whether or not these external modifiers are increasing or reducing injury risk.

“Is the ENVIRONMENT CONDUCIVE?”

A wide variety of important factors are at play here including the terrain or feature – is it well shaped? Has it been tested? Is the weather conducive to performance or is it limiting performance and increasing injury risk: is windspeed acceptable, is visibility good enough, is snow-fall acceptable? Impacted by weather, are the snow conditions conducive to performance? Is the speed consistent, are conditions on the approach, take-off and landing too icy or too soft?

Is it the RIGHT TIME for trick progression?

Is it the right time of the day? Is it the right time of the week? Is there a better time coming up? Is it the right time of the season?

Is EQUIPMENT appropriate?

Are bindings functioning? Are edges sharp enough? Is waxing appropriate for the conditions? For skiers - have DIN setting been checked and appropriate? Is the athlete wearing body armour? Helmet on and good fit?

Does the athlete have appropriate SPEED & CONTROL?

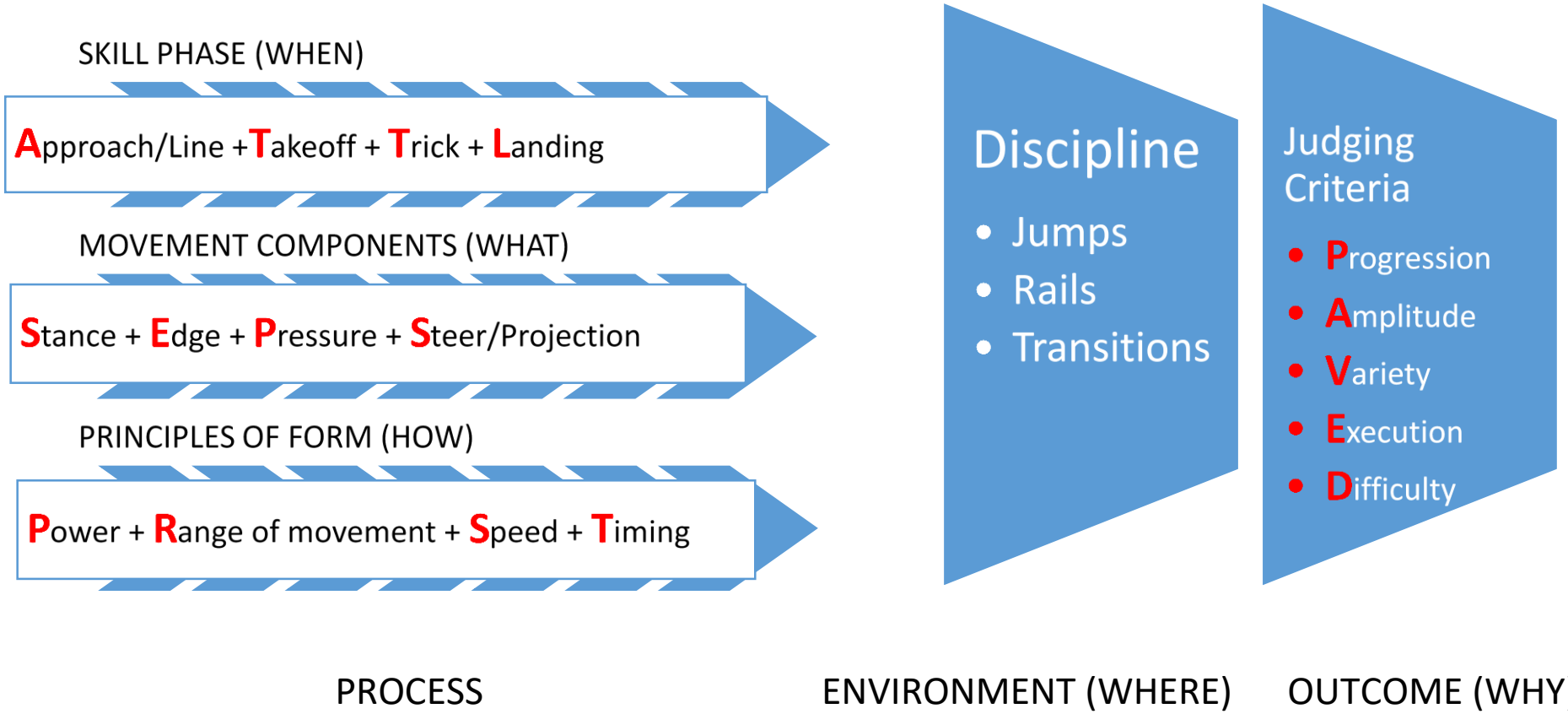
One of the most critical elements of trick progression success (sticking the landing) is speed and control. Does the athlete have the right speed to land on the sweet spot or go big enough in the pipe, do they have sufficient control on the approach, takeoff, in the air and on the landing to minimize injury risk.

Is the trick ACHIEVABLE?

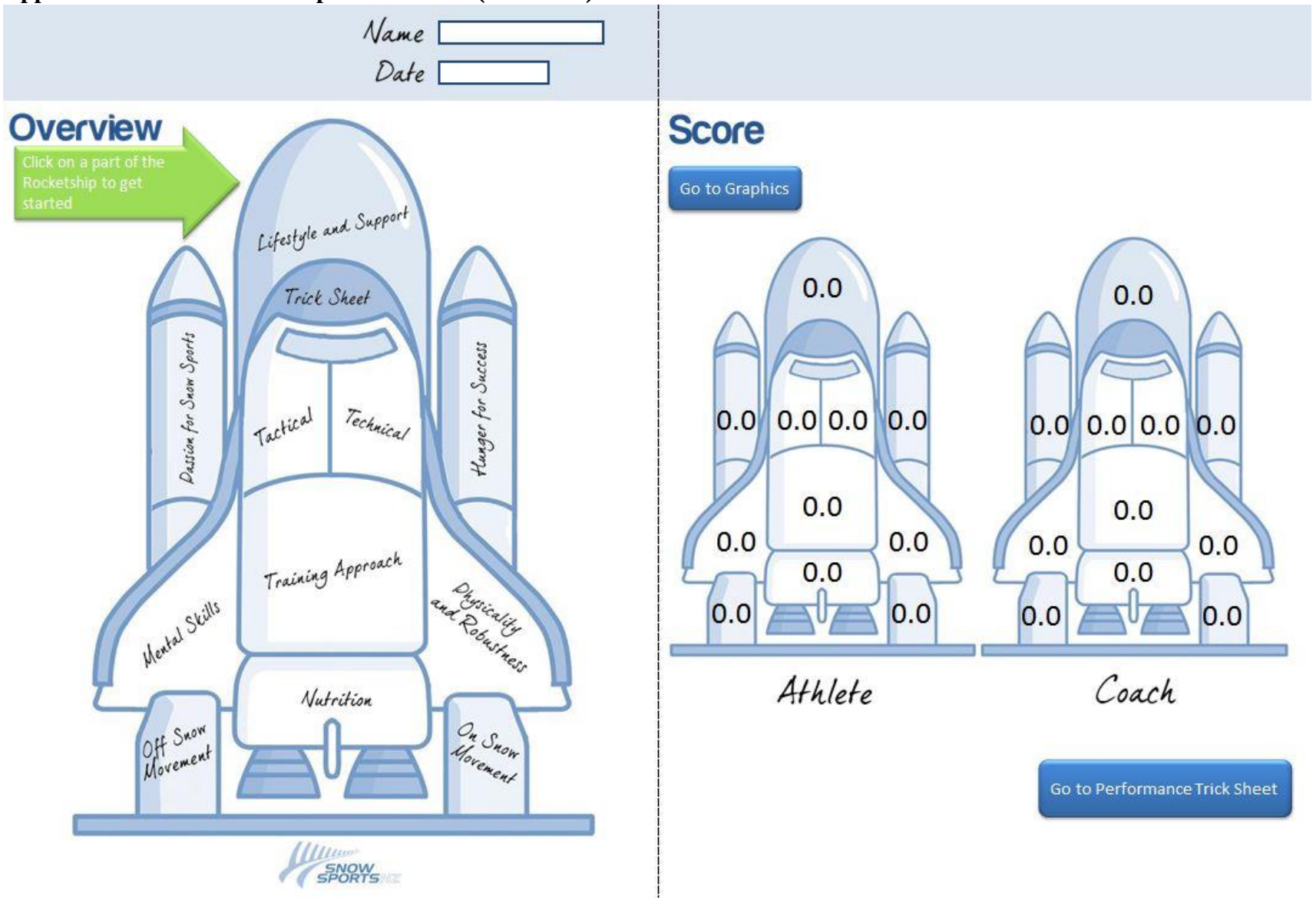
From considering the above elements and asking the right questions, the athlete and coach should be able to answer the over-riding question – “is the trick achievable?” the answer to this question will inform the Go, or No-Go (so what now) decision!

Appendix G: SSNZ Park & Pipe Technical Components Model

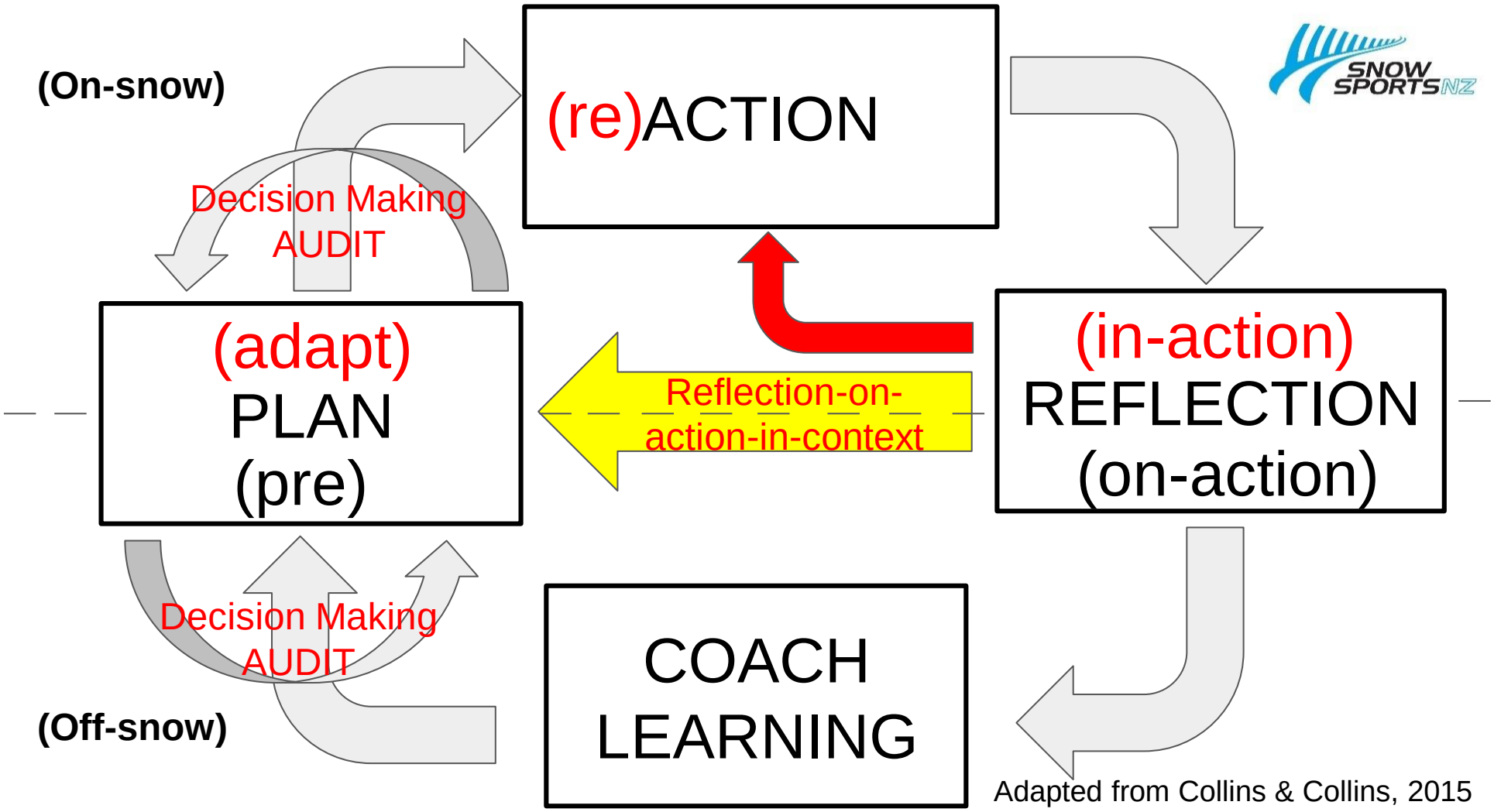
SSNZ Park & Pipe TECHNICAL COMPONENTS MODEL



Appendix H: SSNZ Rocketship Skills Profile (Overview)



Appendix I: Action Sports (Coach) Learning Cycle



Appendix J: Self-Report Training Diary

What is your name?*Required

What date are you reporting on?*Required

Day

Did you shred today?*Required

- YES - please complete the rest of this survey
- NO - please skip through the questions and hit submit at the end

List the TRICKS you worked on today:

What did you work on today?(you can select multiple responses)

- Trick Progression
- Fundamentals
- Freeriding
- Rails
- Jumps
- Halfpipe
- Amplitude
- Execution and style
- Comp - official training
- Competition day
- Air bag

Did you make any breakthroughs today? Please explain

How much of your session did you spend spinning LEFT (Ski) or FRONTSIDE (Snowboard)

How much of your session did you spend spinning RIGHT (Ski) or BACKSIDE (Snowboard)?

How much of your session did you spend spinning SWITCH LEFT (Ski) or SWITCH BACKSIDE (Snowboard)?

How much of your session did you spend spinning SWITCH RIGHT (Ski) or CAB (Snowboard)?

How close to your limit was the risk factor you were training at today?

How many runs were you operating at your highest risk factor for the day?

How many bails did you take today?

How confident are you in the tricks you were trying after today's session?

Add item

Confirmation Page

Show link to submit another response
Publish and show a public link to form results
Allow responders to edit responses after submitting

Send form

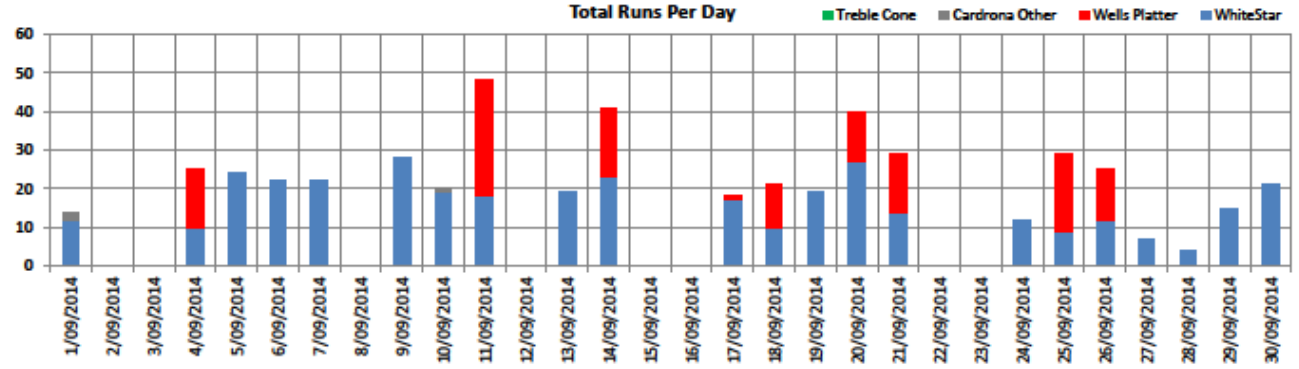
Appendix K: Athlete N Training Diary September 2014

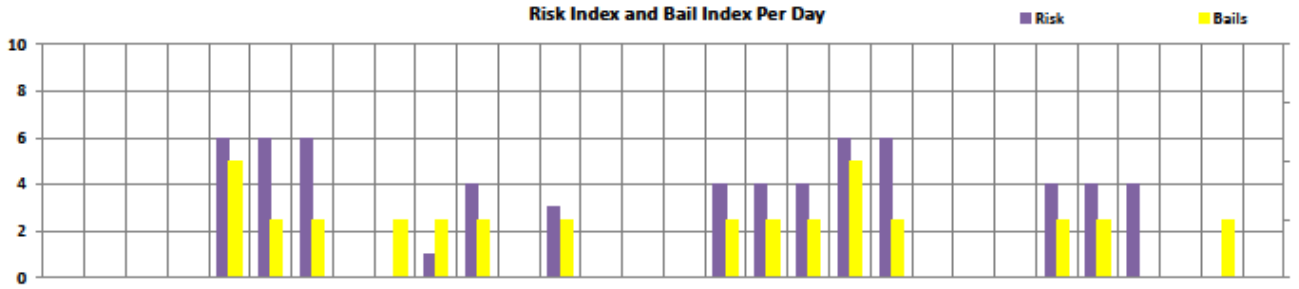
SSNZ Monthly Training Diary Report

September

On-Hill Days	Total Runs	Risk Index Sum	Bail Index Sum
22	503	62	17
		risk rating X number of runs	*bail rating X days*

Spin Direction Tendency	Left	Right
Forward	21	16
Switch	24	33





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Appendix L: Athlete N PY2018 Ideal Run Template

Click on the following link, or copy and paste it into your browser window to view and/or download the video file.

https://www.dropbox.com/s/bxezo54gv6ren7o/Nico%20PY2018%20Ideal%20Run%20%233.mp4?dl=0