

## **Performance Analysis in Applied Contexts**

Keith Lyons,  
Australian Institute of Sport.

### **Abstract**

*This paper discusses an approach to performance analysis that is grounded in applied contexts in Australia. This approach is built upon a long term commitment in Australia to understanding and transforming performance in elite sport contexts. What is distinctive about the Australian experience is that it has emerged outside the higher education system. Performance analysts in the institutes and academies of sport have worked closely with their sport programs to deliver ecologically valid support for elite performance. Applied science is 'normal' science in Australian sport. In order to exemplify the applied context of performance analysis in Australia, four examples of projects are presented. The first three come from winter sports. Work underway to gather data in winter sports is also reflected in attempts to analyse performance in canoe slalom. The quest for ecologically valid data is now prioritising field based study notwithstanding the difficulties presented in outdoor water sports. This project is focused on applied contexts. The group working together embodies the possibilities created when staff from a range of disciplined backgrounds come together with a view to servicing and transforming elite performance. Performance analysis is flourishing in Australia and papers in this volume demonstrate the range of work in progress. What is important to stress is that in the arrangements for the servicing of Australian sports in institutes and academies of sport it is possible to build teams of sport scientist who can work together to offer integrating insights into learning and performance.*

**Keywords:** Performance analysis, applications, Australia, winter sports, canoeing

### **1 Introduction**

This paper discusses an approach to performance analysis that is grounded in applied contexts in Australia. This approach is built upon a long term commitment in Australia to understanding and transforming performance in elite sport contexts.

The elite sport system in Australia is serviced by a national institute of sport and eight state and territory institutes and academies of sport. John Bloomfield has provided a very detailed background to this structure in his account of *Australia's Sporting Success* (2003). Each of these institutes and academies engages in performance analysis and does so in ways that integrate disciplined insights. This practice is quite distinct from traditional approaches to the teaching of sports science in universities. Within the last year these institutes and academies have developed a Performance Analysis Network to share better practice and to explore interdisciplinary integration.

### **2 Performance Analysis as an Applied Science**

In 1997 the Australian Institute of Sport hosted a two day workshop entitled '*Where Does Australia Want to Go with Notational Analysis?*'. The workshop drew upon a

range of experience in game analysis and a practice of servicing sport that dated back to the foundation of the Australian Institute of Sport (AIS) in 1981. The workshop came up with a consensus statement that work in Australia should focus on performance analysis rather than notational analysis. Important recommendations from the workshop were:

- The establishment of a national network of practitioners in and people interested in performance analysis.
- The AIS should act as a catalyst for this national network.
- The development of a national resource network to share information about hardware platforms, software systems and the practice of analysing performance.
- A commitment to education and training that empowered coaches to use performance analysis tools.

By 2002 the Australian Institute of Sport had established a Performance Analysis Unit that built upon innovative approaches to the analysis of elite performance in the state and territory institutes and academies of sport. Australia also had a cultural capital of the analysis of professional sports to inform its practice.

What is distinctive about the Australian experience is that it has emerged outside the higher education system. Performance analysts in the institutes and academies of sport have worked closely with their sport programs to deliver ecologically valid support for elite performance. Applied science is 'normal' science in Australian sport. Involvement in applied contexts has stimulated scholarship in performance analysis in Australian higher education but much of the practice of performance analysis remains unpublished in academic forums.

All performance analysts in Australia work with digital technology. In order to establish a national standard in performance analysis, the National Sport Science Quality Assurance Program (NSSQAP) facilitated a workshop in October 2004 that led to a consensus statement about performance analysis in Australia. The NSSQAP's role includes:

- Monitoring quality assurance issues and working with institute and academy of sport staff to critically evaluate all aspects of function likely to affect the reliability and accuracy of results.
- Promoting a collaborative and coordinated national approach to the servicing of sport.

The workshop noted the importance to be attached to the use of metadata in performance analysis and agreed a national metadata standard (the Australian Government Locator Service) and a thesaurus to standardise nomenclature (the SIRC Thesaurus). The availability of a metadata standard for discovery has added a further dimension to a national network of performance analysts working in applied contexts. The standard permits an aggregation and sharing of resources throughout the elite sport system in Australia.

### **3 Some Examples of Work in Applied Contexts**

In order to exemplify the applied context of performance analysis in Australia, four examples of projects are presented. The first three come from winter sports. Australia is the driest continent on the planet. Despite this environment, performance analysts in Australia have been keen to work in winter sports in order to compete at the Winter Olympic Games.

A recent project has sought to develop expertise in the **skeleton bob** event. Following an initial talent search program in September 2004, a team of sport scientists and sports medicine staff have worked together to provide an analysis rich environment for accelerated learning and performance. By November 2005, two athletes who had not competed in the sport prior to the talent search program had placed 6<sup>th</sup> and 15<sup>th</sup> at the first two world cup events of the 2005-2006 season. Analysis of skeleton bob performance at the Salt Lake City Winter Olympics 2002 and on-going monitoring of world best practice provided a data rich environment for accelerated learning. The investment in analysis has challenged the conventional wisdom about sport expertise. Within one year, one of the identified athletes had placed 13<sup>th</sup> in the World Championships with less than 120 slides on skeleton bob courses. The final stage of the project prior to the 2006 Winter Olympics has been to explore aerodynamic modelling of technique and to use recommended modifications in competition to continue the dynamic interaction between observed performance and athlete learning.



Plate 1: Testing at the Wind Tunnel at Monash University, Melbourne

Those involved in the project have worked as a team to analyse performance in training and competition and have used a range of data to develop performance. Key factors in the success of the project have been:

- Outstanding athletes

- A high quality training cohort
- An expert coach
- Rich augmentation
- Extensive sport science and medicine support
- Adventurous learning progression
- Early competition experience
- Technological innovation

Performance analysis teams have also developed in aerial skiing and snowboarding. In **aerial skiing** there has been a determined effort made to augment real time training environments and to link different kinds of training environments to competition contexts. Particular emphasis has been placed on point of view perspective cameras that give the coach opportunities to share what the athlete is seeing (see Plate 2).

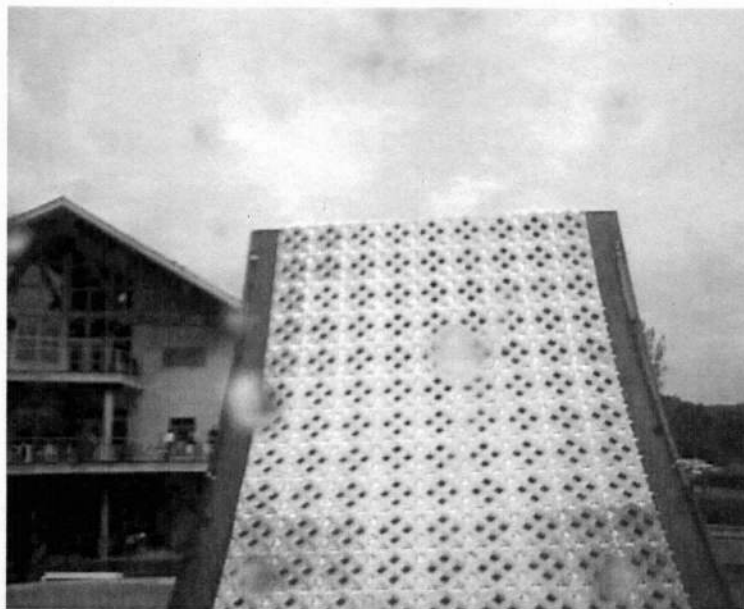


Plate 2: Point of View Camera Perspective at Lake Placid, USA

In **snowboarding**, a determined attempt has been made to make use of micro-technology to gather rich information to provide augmented information for coach and athlete. Data collection in training and competition indicates that individual air-time (AIRind), total air-time (AIRtotal), and total degrees of rotation during halfpipe snowboarding are important indicators of success in competition. Data from micro sensors used two World Cup competitions (33 completed halfpipe snowboard runs from 16 athletes). Data are plotted in Figure 1 and the real-time output is presented in Plate 4.





Plate 3: Fixed Camera Perspective at Mount Bulla, Australia

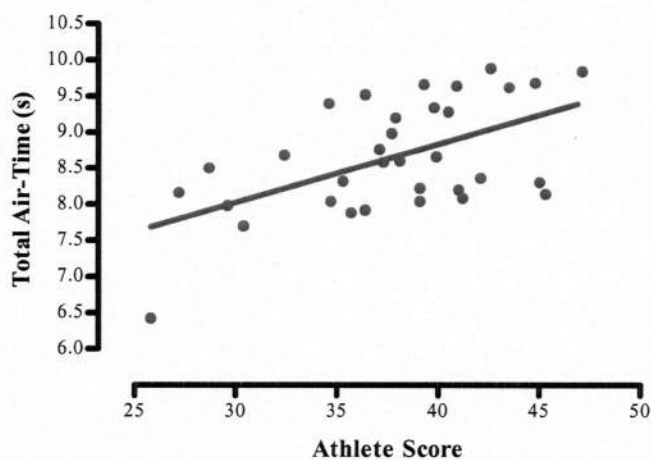
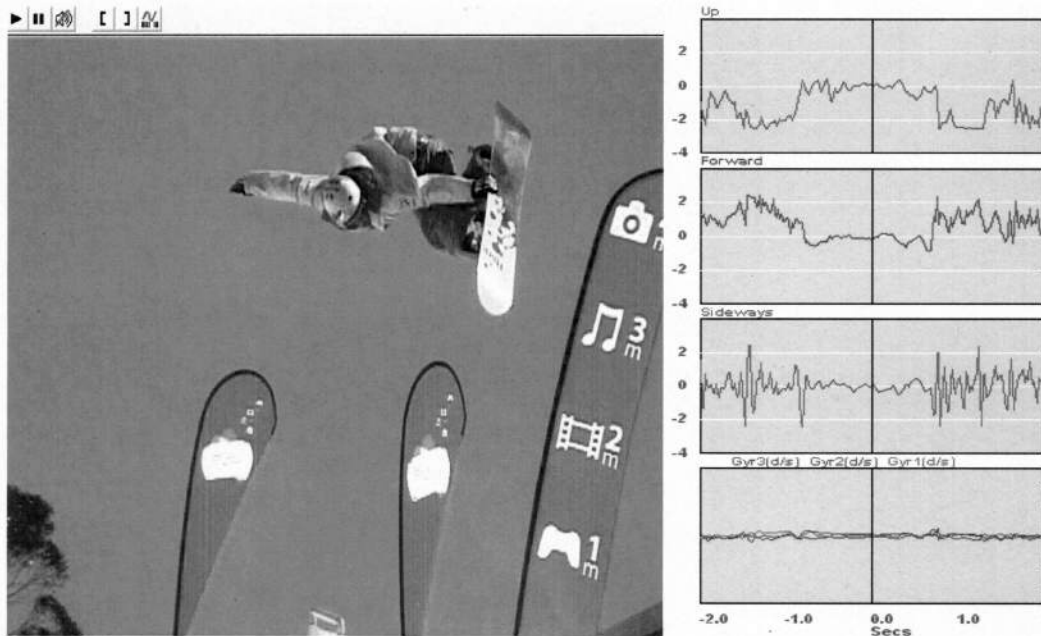


Figure 1. The effect of the total airtime (accumulated over a completed halfpipe snowboard run) by male half-pipe snowboarders on their run score during two FIS World Cup competition finals (Harding, 2005).

Work underway to gather data in winter sports is also reflected in attempts to analyse performance in **canoe slalom**. The quest for ecologically valid data is now prioritising field based study notwithstanding the difficulties presented in outdoor water sports.

One group of performance analysts at the AIS is seeking to combine quantitative and qualitative data on training and competition performance in canoe slalom. This research is addressing three basic research questions:

- The quantity of each type of paddle stroke being used.
- The time spent working upstream and downstream.
- Effective and ineffective paddle strokes of winners and losers.



**Plate 4:** Real-time data output

The focus for much of this work has been the Sydney Olympic Canoe Slalom venue at Penrith which is the daily training environment for the AIS Canoe Slalom program. Three cameras are used to record training and competition performance. These cameras are set to automatically focus during the filming so that as the camera is panned and zoomed the focus adjusts accordingly. The shutter speed is also set to faster than 1/1000 of a second to ensure crisp images are produced. To aid with analysis the paddler is continually framed using the zoom and pan so that only a small amount of leading area (area in front of the paddler) is in the view.

The group has developed a software package to analyse data required to respond to the three research questions listed above. This software is used to notate:

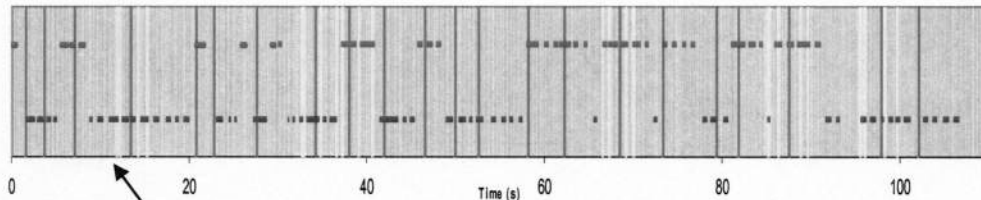
- Stroke duration
- Stroke type
- Frequency of strokes
- Times between gates and sections
- Time in and out of upstream gates
- Penalties
- Stroke patterns
- Race profile

The data gathered are used to describe performance and to transform technique in training environments. The software program was used during the 2005 World Championships held in Penrith. The stroke patterns gathered in lapsed-time notation

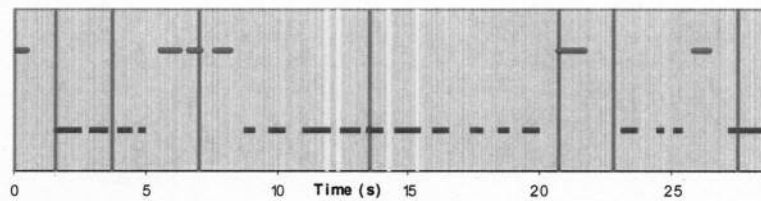
provide interesting paddle prints of performance. Figure 2 shows an overall paddle print of the winner of the C1 class and a segment of the course.

This project is focused on applied contexts. The group working together embodies the possibilities created when staff from a range of disciplined backgrounds come together with a view to servicing and transforming elite performance.

Whole course paddle strokes:



Paddle strokes from the Start to Gate 7



Right side strokes

Left side strokes

Figure 2: Paddle strokes for C1 paddler

#### 4 Conclusion

This paper has presented a small number of examples of performance analysis in applied contexts. Performance analysis is flourishing in Australia and papers in this volume demonstrate the range of work in progress. What is important to stress is that in the arrangements for the servicing of Australian sports in institutes and academies of sport it is possible to build teams of sport scientist who can work together to offer integrating insights into learning and performance. All the cases presented in this paper have a number of young sport scientists involved. This paper is intended to link their work with the founding assumptions of performance analysis.

#### 5 References

- Bloomfield, J. (2003). *Australia's Sporting Success – The Inside Story*. Sydney: University of New South Wales Press.
- Harding, J. (2005). *'The detection of theoretical key performance variables, methods of quantification, associated errors, and the possible use of microtechnology in the role of sport science and performance enhancement for World Cup*

*halfpipe snowboarding and mogul skiing athletes'*. Unpublished paper,  
Australian Institute of Sport, Canberra.