

## TECHNOLOGY AND HALF-PIPE SNOWBOARD COMPETITION – INSIGHT FROM ELITE-LEVEL JUDGES

Jason W. Harding<sup>1, 3, 4</sup>, Kristine Toohey<sup>5</sup>, David T. Martin<sup>1</sup>, Allan G. Hahn<sup>2</sup>, Daniel A. James<sup>4, 6</sup>

- (1) : Department of Physiology, Australian Institute of Sport, AUSTRALIA  
PO BOX 176 Belconnen ACT 2616  
Phone +61 2 6214 1126 Fax +61 2 6214 1904  
E-mail: Jason.Harding@ausport.gov.au
- (2) : Applied Research Centre, Australian Institute of Sport, AUSTRALIA  
PO BOX 176 Belconnen ACT 2616  
Phone +61 2 6214 1577 Fax +61 2 6214 1603  
E-mail: allan.hahn@ausport.gov.au
- (3) : Olympic Winter Institute of Australia, AUSTRALIA  
1/1 Cobden Street South Melbourne VIC 3205  
Phone +61 3 9686-2977 Fax +61 3 9686 2988  
E-mail: Jason.Harding@ausport.gov.au
- (4) : Centre for Wireless Monitoring and Applications, Griffith University, AUSTRALIA  
170 Kessels Road Nathan QLD 4111  
Phone +61 7 3875 5036 Fax +61 7 3875 5384  
E-mail: d.james@griffith.edu.au
- (5) : Department of Tourism, Leisure, Hotel & Sport Management, Griffith University, AUSTRALIA  
170 Kessels Road Nathan QLD 4111  
Phone +61 7 373 55239 Fax +61 7 373 56743  
E-mail: k.toohey@griffith.edu.au
- (6) : Centre of Excellence for Applied Sport Science Research, Queensland Academy of Sport, AUSTRALIA  
170 Kessels Road Nathan QLD 4111  
Phone +61 7 3875 5036 Fax +61 7 3875 5384  
E-mail: d.james@griffith.edu.au

**TOPICS:** Snowboarding, Half-Pipe, Technology, Inertial Sensors, Competition, Automated Judging, Community Perception

**Abstract:** Automated and objective information specific to half-pipe snowboarding has now been made available with micro-technology and signal processing techniques. In consultation with the practice community this has been introduced into training and competition in Australia. It is understood that any integration of technology into elite sport can effect change beyond the original purpose and can often generate unintended consequences. We have therefore evaluated the perceptions of key members of the elite half-pipe snowboard community in regards to how emerging technology could interface with the sport. Data were collected via semi-structured, open ended interviews with 16 international, elite-level half-pipe snowboard competition judges. This study revealed 8 dimensions and 42 sub-dimensions related to the community's perceptions to 5 major themes that emerged during interviews. The major themes included: 1. Snowboarding's Underlying Cultural Ethos 2. Snowboarding's Underlying Self-Annihilating Teleology 3. Technological Objectivity 4. Concept Management 5. Coveted Future Directions. There was dominant perception that an underlying self-annihilating teleology could exist within competitive half-pipe snowboarding. This was believed however to pose a distant threat on judging protocols to reliably assess performance. Judges sampled in this study were largely in favour of using automated objectivity to enhance the judging process however, with a number of caveats. Most importantly that objective information is to be used as a judging aid and not for automatic generation of scores. This would address the most prevalent concern that integrating any automated objectivity into snowboarding could potentially remove freedom of expression and the opportunity to showcase athletic individuality - traits valued by the practice community. Our data highlight that successful implementation of emerging technologies in sport will be not be based on the type of technology developed but instead by the integration process which must feature a large element of control imparted to the key players within the sport.

**Key words:** Snowboarding, Objectivity, Judging, Community, Technological Integration

### 1- Introduction

Half-pipe snowboarding is not a traditional Olympic sporting discipline. Snowboard competitors are required to perform an aerial acrobatic routine on a half-pipe made of snow (Figure 1) and performances are assessed with a subjective measure termed 'overall impression'. The sport is focussed upon the aesthetic [B1] where the method by which athletes achieve the competitive purpose is of utmost importance [W1]. Theoretically snowboarding like other boardriding sports exists indistinguishably between the vague boundaries of lifestyle, art and sport. It is believed half-pipe snowboarding's underlying

anarchist, non-conformist, punk rock ideology, alongside the community's somewhat paradoxical view that a focus on style, execution and overall run composition is both a positive and negative aspect of its performance assessment method [HT1], will ensure ongoing partition from more traditional Olympic sports and their conventions. Perhaps as a result, the sport has until very recently received little attention from sport science and has had little to do with scientific enquiry into elite performance.



**Figure 1.** Australian half-pipe snowboard athlete in training. Breckenridge Colorado USA 2008. Image: Ben Alexander.

Although half-pipe snowboarding is judged by subjective measures, it has been documented that a strong relationship exists between a number of objective key performance variables (KPVs) such as air-time (AT), degree of rotation (DR) and an athlete's competition score [HT1, HS1]. Total air-time (TAT) and average degree of rotation (ADR), combined by multiple regression exhibit a very large correlation with an athlete's subjectively judged score and account for approximately 50 percent of the shared variance associated with that score. This correlation was based upon video analysis of two Federation Internationalé de Ski (FIS) World Cup half-pipe snowboarding finals (Bardonecchia Italy 2005). There is potential for automatic calculation of this information to benefit training and competition judging protocols currently reliant on subjective measures. The integration of automated objectivity could allow coaches to assess athlete progression and training load in sport specific measures and as previously proposed could provide judges with an electronic 'memory board' (a record of an athlete's run characteristics currently written by hand) enabling their focus to shift toward execution and run composition when judging.

Until recently the only method available to objectively calculate information on performance variables in half-pipe snowboarding was by using video analysis software. The capture and post run processing of video data however, is not automatic and is labour intensive preventing rapid information feedback. We have therefore promoted the use of micro-technology and signal processing techniques to provide automatic calculation of sport specific objective information. The capability of tri-axial accelerometers (100Hz) to accurately and reliably calculate information on air-time during elite-level half-pipe snowboarding has recently been documented [HS1]. Additionally, the potential of raw tri-axial rate gyroscope data to classify half-pipe snowboarding aerial acrobatics will enable automatic classification of aerial acrobatics. Such automated assessment is theorised to introduce a measure of objectivity into the environment in which half-pipe snowboarding takes place which has been void of objectivity since its inception. Successful integration of this concept however, is reliant on positive practice community's positive perception of its utility and a willingness from researchers to consider the sporting discipline's underlying cultural ethos and coveted future directions.

Subjective perception of style and run execution has been previously identified by a small sample of the practice community as the main weakness of current subjective judging protocols. Interestingly and paradoxically, in this study subjective perception of style and run execution was also been identified as the main strength of current subjective judging protocols [HT1]. The fact the same component of current competition judging criteria can be perceived as both strength and weakness offers some insight into snowboarding's underlying cultural ethos and reveals that both attributes are valued by the practice community. The perception the current competition judging criteria that rewards freedom of expression and potential to display athletic individuality is of the utmost importance to the practice community. Competition judging criteria has therefore taken into account what athletes value. Whether this focus can be maintained indefinitely in an era when there are calls for more objectivity in judging Olympic sports, is largely unknown. In addition to these external influences, internal forces also need to be considered. Previous research [HT1] has uncovered an awareness of what has been termed sport's overall self annihilating teleology [M1]. In elite half-pipe snowboarding, this is most likely to occur when increased numbers of athletes achieve optimal performance and outgrow the existing structure of the competition. It is theorised the integration of objectivity into

judging protocols could in some ways address this issue. There are limits to its acceptability. For example, the practice community sampled unanimously opposed judging using objective information alone as it would remove what it considered to be prevailing judging strengths; that there is subjective perception of style and run execution which allows athletic freedom of expression. Amalgamation of objectivity with current subjective measures was however positively perceived by the practice community as it was believed to improve judging reliability and still retain what the practice community values [HT1].

This paper extends on our previous findings and has sought assessment from a wider international community of elite-level half-pipe snowboard competition judges. The perception that an underlying self-annihilating teleology could exist within the discipline's competitive arena is further examined from a judging standpoint and the objective information judges perceive as potentially important elements of competition outcomes are revealed. This research focuses on initiating and maintaining a progressive partnership ideology with the practice community. In doing so it preserves a balanced approach sympathetic to the sporting discipline's underlying cultural ethos. This paper also affords elite-level competition judges a forum to communicate their perceptions on the potential impact and future management of proposed technological change within their sport.

## 2- Methods

The population for this study was selected by theoretical sampling and included 16 elite-level (professional level, FIS World Cup and Winter Olympic Games) half-pipe snowboarding judges. In light of FIS attempts to construct judging panels comprised of English speaking judges from a variety of nations to minimise potential national bias, the population sample for this study included elite-level judges from the following nations; Australia (n = 2), Spain (n = 2), Czech Republic (n = 1), Sweden (n = 4), New Zealand (n = 1), Netherlands (n = 1), United States of America (n = 2), Canada (n = 1), Slovenia (n = 1), Poland (n = 1). Subjects' level of experience in judging elite-level half-pipe snowboard competition ranged from 4 – 16 years. The results of this study were obtained by interviewing subjects on the impact of technological change on the culture of their sport. In-depth interviews were selected as the most suitable data collection tool because of the rich data that they provide. As a result of the near impossibility of conducting interviews with each international subject in person, subjects were interviewed by email correspondence between 27th January 2007 and 25<sup>th</sup> February 2008. Interviews were structured, conducted via email correspondence, involved posed, open ended questions, and responses were written by each subject. Not all subjects approached for this interview accepted. 16 out of 30 subjects approached for this interview accepted and provided anonymous responses. Interview transcripts were first examined to gain general familiarity. Dominant themes were noted and these formed categories. These categories became the codes by which transcripts were further interpreted. Manual coding was undertaken with a hierarchical three stage process [SC1] beginning with identification of 'open' codes. Open codes provided a broad set of categories with which to conduct subsequent reduction. 'Axial' coding subsequently divided each open code into several axial codes which reflected cultural dimensions employed to measure the perception of the practice community to specific issues. Axial codes were then divided into 'selective' codes. Selective codes provided researchers with the capacity to highlight the content of specific cultural dimensions [SS1]. Labels were selected that best described conceptual contents of each code however, it is worth noting that labels represent researcher interpretation of content [SS1]. The number of occasions selective codes were mentioned revealed the significance of each sub-dimension to major cultural themes. A reliability measure used by [SS1] was adopted by this study. Where Smith and Shilbury calculated an inter-researcher reliability score, this study used one researcher undertaking a test-retest analysis on each interview one week apart hence; an intra-researcher reliability score was calculated. This study generated a satisfactory intra-researcher reliability level greater than 90%, as recommended [MH1]. All subjects sampled were elite-level competition judges and this was accepted as a limitation in assessing a more generalised practice community perception. The intent was to assess this cultural group specifically and results therefore provide insight from an elite judging standpoint and not from the general community. Future studies would benefit from increased sample size and evaluating other international community members including athletes and coaches. The subjects read the 'information to participant' forms and signed 'informed consent' forms prior to taking part. Experimental procedures were approved by the Ethics Committee of the Australian Institute of Sport on 17th August 2006 (ref: 20060807) and in accordance with Griffith University requirements, cleared under special review in January 2008 (ref: PES/01/08/HREC).

## 3- Results

This paper investigated the perception of a sample of elite-level half-pipe snowboard competition judges to the integration of automated objective information into performance assessment criteria. Table 1 shows the 8 axial codes (dimensions) and 42 selective codes (sub-dimensions) related to 5 major themes (open codes) that emerged during the interview process. The major themes were: 1. Snowboarding's Underlying Cultural Ethos 2. Snowboarding's Underlying Self-Annihilating Teleology 3. Technological Objectivity 4. Concept Management 5. Coveted Future Directions. Interview quotes are used within discussion (shown in italics) to highlight significant practice community opinion.

**Table 1.** Prevalent cultural dimensions (7 out of 8) and sub-dimensions (23 out of 42) associated with the major themes.

**Athletic Freedom**

1. Freedom to showcase athletic individuality
2. Athlete driven progression
3. Athlete to control competition performance
4. Non-conformist nature of snowboarding

**The Existence of a Self-Annihilating Teleology**

5. An imminent threat to judging reliability
6. A distant threat to judging reliability
7. A currently occurring phenomenon
8. A positive aspect of the sport
9. A theory without any relevance in snowboarding

**Objective Performance Variables**

10. The importance of air-time and amplitude
11. The diminishing importance of degree of rotation
12. The negative aspects of the 'spin to win' approach

**Technology's Potential Role in Snowboarding**

13. Automating memory boards
14. Beneficial in unfavourable environmental conditions
15. Beneficial where snowboard half-pipes increase in length
16. Beneficial in protest situations

**The Negative Impact of Technology on Snowboarding**

17. Removal of snowboarding's underlying spirit / soul
18. Removal of athletic freedom of expression

**Progressive Partnership Ideology**

19. Scepticism toward integration of technological objectivity
20. Assess athlete perceptions and coveted direction

**Snowboarding's Future Directions**

21. Sport retains cultural ethos and freedom of expression
22. Sport remains partitioned from more traditional sports
23. Sport retains competitive criteria that athletes value

#### 4- Discussion

We have previously documented a capacity for technology and signal processing to calculate objective information on air-time and degree of rotation during snowboarding [HT1, HS1]. Originally investigated to allow objective assessment in training, this concept may also have potential to assist judging protocols and as such has been introduced into training and competition (AIS Micro-Tech Pipe Challenge) in Australia. Focussed on correct management of technological innovation in sport this paper has sought assessment from a wider international community of elite competition judges. As noted by respondent number 9, the consequences of technological change may be irreversible and can potentially corrupt the sport's perceived ethos.

*'We must be very careful as we continue down the road [of amalgamating] snowboard competition and technology. If misused, it has the potential to ruin the pureness we find [in the sport] today'*

Hypothetically, half-pipe snowboard competition could potentially suffer from sport's overall self-annihilating teleology [M1]. The most likely scenario would be increasing numbers of athletes achieving optimal performance, thereby outgrowing the structure of current half-pipe snowboard competition and impinging on the capacity of subjective judging criteria to reliably assess performance. There was dominant perception as noted by respondent number 9, that an underlying self-annihilating teleology [M1] could exist within competitive half-pipe snowboard competition, revealed by ten out of sixteen judges.

*'It would be naive to think that a sport such as snowboarding will never get to a point where very little separates elite level athletes. The separation between riders we have clearly seen in the past will one day no longer be discernable by the human eye alone and at which point we will require the continued assistance that technology provides'*

Whilst a majority of the community sampled believed this theoretical phenomenon could exist within half-pipe snowboarding competition, most perceived it as a distant threat. The most prevalent sub-dimension, as noted by respondents numbered 11 and 16 respectively, related to snowboarding's self-annihilating teleology was labelled, "a distant threat to judging reliability".

*'I do not think snowboarding is there yet'*

*'I believe that most [of the community] understand we are a long way from [suffering the effects of] a self annihilating teleology'*

Interestingly however, two subjects revealed this teleology to be a "currently occurring phenomenon". As noted by respondent number 14, whilst the effects of increasing numbers of athletes achieving optimal or similarly high levels of performance are currently being experienced in elite-level competition, it is actually having a positive effect on judging reliability.

*'This is happening to a degree, but in the case of snowboarding it is making the sport easier to judge by making the runs more comparable. We are still a long way away from the time where every rider will be performing the same run but as the runs get more and more similar it is possible for the judges to look more at execution and less at difficulty'*

Three judges perceived the existence of an 'underlying self-annihilating teleology' and the subsequent hypothesised affect on current judging reliability a "theory without any relevance in snowboarding" (three did not respond to the question). As noted by respondents numbered 11 and 15 respectively, judging criteria focused on "subjective perception of style and overall run execution" retains what is valued by the practice community and will perpetually allow for reliable performance assessment.

*'I am not sure how well the [self-annihilating teleology] theory will apply to snowboarding. Judging when all the top riders are doing the hardest tricks and executing them well is exactly what it means to judge elite-level competitions. In fact, there are usually only a handful that has both the hard tricks and good execution. It's not so much about what they're doing as how they're doing it'*

*'I do not agree [with the concept of a self-annihilating teleology]. In the case of snowboarding the same trick, even the exact same run can be executed in a different way. Unless snowboarding judges start to dictate a certain perfect execution (like gymnastics) there will still be plenty of room to ride differently and to judge those differences in execution'*

Notwithstanding these views and regardless of the existence of an underlying self-annihilating teleology within the sport, it is proposed that automated objectivity could assist judging protocols to assess performance. Previous work however has shown unanimous and vigorous opposition to judging with objective information alone as it would remove the two prevailing judging strengths; that judging is focussed on subjective perception of style and run execution and that it allows athletic freedom of expression. The dominant perception from a wider international community of judges was essentially no different. Where previous work documented support for amalgamating objective and subjective information into judging [HT1], elite judges were largely (albeit cautiously) in favour of trialling automated objectivity as a judging aid only and vigorously opposed its use in determining judging criteria or automatic generation of scores. Adherence to this demand would address concern that integration of automated objectivity could remove what is valued by the community and as noted by respondent number 9, opportunity for athletes to control the delivery of their performance and freely express their snowboarding ability.

*'We must always keep one thing in mind, that is to never remove the snowboarder's ability to display their creativity when riding and we must always provide riders the opportunity to dynamically change and be in control of the delivery of their performance'*

The respondents evidenced a very strong practice community perception of what it means to be a snowboarder and the value of retaining the freedom and individuality that the sport entails (all sixteen judges mentioned some aspect of the underlying ideology associated with the sport). Proposing the integration of automated objectivity into an area of the sport (elite-level judging criteria) with the capacity to alter future directions understandably seems in conflict with the sport's underlying cultural ethos. Unsurprisingly, automated objectivity was not a term used to highlight the sport's cultural ethos and as noted by respondent number 5, opposition to integration of automated objectivity into snowboarding could potentially be quite vigorous.

*'This would be the death of half-pipe snowboard competition'*

In spite of opposition to automated objectivity expressed by a small number of subjects there was dominant practice community perception on the importance of air-time (and relationship to amplitude) on competition outcomes. Thirteen out of sixteen judges perceived air-time an important criterion in competition performance assessment, even though it is assessed subjectively (as amplitude) and were largely in favour of using automated objective information on air-time in some form whilst judging. The most prevalent air-time variable (mentioned by eight out of these thirteen subjects) was average air-time (AAT) as it provides indication of consistency over a complete competition run. As noted by respondents numbered 3 and 10 respectively, the importance of air-time is recognised by both elite-level judging panels and the practice community in general.

*'Air-time is considered for every trick from a judging perspective'*

*'Athletes, coaches, judges, even my own mother agree that the amplitude [associated] with a trick is important'*

Although air-time and its relationship (however tenuous) with amplitude constituted strong community perception, the perception on the importance of degree of rotation toward competition outcomes was not positive. Nine subjects mentioned they would use automated objectivity related to degree of rotation (seven would use average degree of rotation, ADR) in some form whilst judging however, all stated this information is not required and could negatively impact the sport's future directions. Focusing on degree of rotation as noted by respondent number 13, was largely perceived to promote a 'spin to win' approach to competition; an approach strongly opposed by elite-level judges.

*'As for rotation, it seems to have played an increasing role in separating rider's scores over the years but I feel this has sometimes been in error. Not everybody agrees with the "spin to win" approach. More [rotations] is not necessarily better. Of course having said that, a rider who does large degree rotations must be rewarded, provided they have been executed well'*

Judges however expressed an interest in automated and objective information related to other parameters associated with acrobatic rotation including; 1. The smoothness (consistent rotational velocity) of each rotation and 2. The exact degree of rotation (the amount of rotation completed during the air-time phase with objective reference to the amount of rotation reverted or completed after the landing). Unsurprisingly and as noted by respondent number 15, the strongest practice community perception was to allow 'subjective perception of execution and run composition' the most impact on athletic performance assessment. All judges mentioned that any performance assessment method utilised should still contain subjective perception. Judges were largely in favour of allowing subjective perception to contribute at least 50 percent of total competition run score in the theoretical amalgamation of automated objectivity and traditional subjective measures posed by this paper.

*'A trick with high airtime and difficult rotation that is well executed with great style will usually score high. But if a rider is unstable and showing poor execution, not even lots of air time and [degree of] rotation will get him or her a high score'*

Six out of sixteen judges sampled (the dominant perception) would use a combination of average air-time, average degree of rotation and subjective perception (25, 20 and 55 percent respectively) to award performance in the posed hypothetical judging system. Judges however vigorously and unanimously stated they would rather use objective information only as a judging aid. This may therefore be the potential niche for automated objectivity; as a judging aid and as an automated memory board (a record of an athlete's run characteristics currently written by hand). There was dominant community perception that although judges are trained to identify aerial acrobatics and subjectively assess amplitude, a system of automated objectivity could potentially aid performance assessment. As noted by respondent number 9, using automated objectivity in this manner could assist judging without negatively impinging on practice community future directions or the sports underlying cultural ethos.

*'I see great potential for continued advancement and implementation of technology into snowboard competition to produce more accurate outcomes [however]; only if the athlete's ability to perform in an independent and creative [manner] is not compromised'*

## 5- Conclusion

Elite-level judges are largely in favour of trialling automated objectivity as a judging aid and would like to see development of automated competition memory boards. There is however strong opposition of using automated objectivity to determine any component of competition scores or judging criteria. This may be related to the vested interest of the population sampled. As judges they may feel their future career will be compromised if they can be replaced by an automated system of assessment. This may also be related to vested interest in maintaining snowboarding's cultural ethos and what is valued within the sport by the practice community. Judges were not however totally opposed to the idea nor were they opposed to greater consultation within the snowboarding community. There was however strong perception that further development and integration of this concept be conducted in close association with core community members and be controlled from within the sport.

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