Title

Notational analytic processes in elite sport practice: An exploratory investigation of the perspectives of a sport scientist, coach and athlete.

Authors' names

Theodoros M. Bampouras, Colum Cronin, Dr. Paul K. Miller

Authors' affiliations

Theodoros M. Bampouras, University of Cumbria, Faculty of Health and Wellbeing, Sport and Physical Activity, Bowerham road, Lancaster LA1 3JD,UK;
theodoros.bampouras@cumbria.ac.uk

Colum Cronin, University of Cumbria, Faculty of Health and Wellbeing, Sport and Physical Activity, Bowerham road, Lancaster LA1 3JD,UK;
colum.cronin@cumbria.ac.uk

Dr. Paul K. Miller, University of Cumbria, Faculty of Health and Wellbeing, Sport and Physical Activity, Bowerham road, Lancaster LA1 3JD,UK;
paul.miller@cumbria.ac.uk

Abstract

In recent years, there have been an increasing number of studies exploring the benefits of notational analysis both for sports and the sport sciences. Comparatively little empirical research exists, however, pertaining directly to the application and use of notational analysis. The aim of this paper is to explore the in-practice application of notational analysis. A sport scientist, an international coach and a former professional athlete, all having used notational analysis and unrelated to each other, were interviewed on their extensive experience in the use of notational analysis. The results indicated that, although the object and receiver of notational analysis process, the athlete is not included in the process itself, with the coach acting as the gatekeeper. An extrapolative argument is made with regards to the potential impacts of this practice, not least those on the motivation of the athlete.

Keywords**:** athlete-centring; black box; coaching; performance analysis; qualitative research

INTRODUCTION

Notational analysis, in its simplest terms, is the process of recording and analysing the movement of athletes during performance [1]. From the standpoint of the sport scientist, it is an approach that can robustly bring together theory and practice [2]. As a practical coaching tool, meanwhile, its manifest purpose is to provide objective (and often directly evaluative) data that inform and support the coaching process itself [3] in a range of constructive ways.

Hughes and Franks [4] cite five functions of notational analysis as being "...of paramount importance to the coaching process, the initial *raison d'être* of notational analysis…" These are: a) to provide immediate feedback, b) to assemble materials for database development; c) to indicate areas that mandate improvement; d) to evaluate specific aspects of performance, and e) to operate as a selection mechanism in assisting coaches and athletes. Franks [5], furthermore, posits that the techniques of performance analysis, including notation analysis itself, could and should provide a solid evidence base for coaching practice and athletic performance. Hughes [6] correspondingly argues that notational analysis, biomechanics and motor learning approaches (under the broader rubric of "'performance analysis") can provide objective evidence to inform the undertakings of coaches and athletes, but further maintains that active collaboration between coaches, athletes and those providing the data (be they biomechanists, psychologists or notation analysts) is instrumental in the development of informed practice.

This particular focus, upon the central role of collaboration in building effective practice, is evident elsewhere in the extant corpus of literature pertaining to performance analysis. Bartlett [7], for example, recognizes that feedback from performance analysis needs to "…provide coaches with information that adds to

what they can see for themselves." McGarry [8], similarly, argues that the provision of appropriate information to coaches *and* performers is central to the business of improving both individual and team performances, while Lyons [9] empirically articulates a series of outcome-successful collaborations between performance analysts, coaches and athletes. A variety of notational analysis applications which may influence coaching practice and athletic development have to date been reported. These include time-motion analysis [10, 11], investigations of play and scoring patterns [12, 13], physiological responses and demands [14-16] and behavioural studies [17, 18], including coaching behaviour [19-22]. Notational analysis itself has been shown to have a diversity of structures [23] and its use is documented with respect to a variety of sports [24-30].

There has, thus, been a progressive and pervasive recognition of the benefits of notational analysis both in sports and in the sport sciences, and an extensive corpus of work has emerged relating to the development of notational analysis applications and, in particular, to the design of notational analysis systems [18, 31-33]. There has correspondingly, however, been comparatively *little* empirical research that pertains directly to the application and use of notational analysis by professionals in real-world sporting situations, and the specific human impacts thereof. Calls for more evidence in this area were made over a decade ago [7] but, to date, there has been distinctly limited contribution of this order (for example, investigating the delivery of performance analysis feedback by youth football coaches [34]).

The aim of this paper is, thus, to generate an exploratory analysis of the in-practice application of notational analysis. The resultant inducted models should

provide a firm basis for future deductive study that is grounded in the practical experience of in-the-field professionals, rather than in abstract hypothesis.

METHOD

An inductive case-study approach was employed to highlight the range and complexity of issues surrounding notational analysis provision within the concrete practices of international elite sport, as recommended by Franks [5] and Lees [1].

Participants

With institutional ethical approval, and using purposive sampling, participants were selected to be interviewed due primarily to their extensive experience in the use of notational analysis. Moreover, in order to ensure that a holistic, multi-layered account of these experiences of notational analysis was compiled, participants were also selected in terms of their specific representation of each of the three key roles related to its application: a sport scientist, an international coach and a former professional athlete. The participants themselves were, however, unconnected, each having been involved in a different sport (Tae Kwon Do, Netball and Rugby, respectively). There are two key benefits to using this ‘mutually exclusive’ approach in the selection of participants:

1. It ensures that commonalities and patterns emergent of the data relate to the broad use of notational analysis itself in sport, rather than to vagaries characteristic of a given sport or particular group, and;
2. It facilitates free expression among participants, who may venture opinions without the concern that their own professional counterparts are also involved in the study [35].

At the time the interviews were conducted, the sports scientist had been working with an International standard martial arts athlete and his coach for over 4 years and had developed the notational analysis system they used; the coach had been an international team manager and coach in netball and implemented notational analysis as part of the preparation for and during the under 19 European Championships; and the athlete was a former Rugby League international with a broad experience of notational analysis in-practice. All participants were made fully conversant with the aims of the study, and provided informed consent to that effect.

Procedure

The central collection procedure followed in this study is based on that utilised by Roberts *et al*. [36]. The research questions and selection criteria were initially identified. Subsequently, a general interview-based approach was identified as most likely to elicit the kind of data required from participants and, finally, the interview questions were formulated. A list of systematic but open-ended questions was constructed to chiefly focus upon participants' introduction to notational analysis, their experiences of its use and their views regarding its effectiveness, and therefore facilitating two key outcomes: (a) all participants would present opinions on the same key topics (thereby ensuring a degree of lateral comparability of response), and (b) there was also sufficient flexibility within the schedule for participants to voice novel or unexpected ideas. This approach ensured an inductive output, grounded in participant experience, rather than one that reproduced researcher-led assumptions [37]. Individual, in-depth interviews were then conducted. Researchers conducted each interview to reduce the potential error and bias that can emerge from single-investigator interviews [38].

Analysis

Analysis was conducted using the systematic qualitative data analysis process outlined by Miles & Huberman [39], consisting of data reduction, data display and data verification/conclusion drawing. Through the above process, the data was selected and simplified, and then displayed in a way that would help to draw conclusions. Finally, triangular consensus validation, which involves a third person experienced in qualitative analysis, was employed, in order to remove any possible effects of misinterpretation [38, 40, 41]. Recurrent and consistent themes were then tabulated and schematised diagrammatically, and dissonant perspectives were explored in relation to participant standpoint with a view to elucidating how they may have emerged *in situ*.

RESULTS

Analysis of the data identified the following general "consensus model" of the notational analytic process in-practice (Figure 1) built only from consistent, uncontested themes evident in all three interviews. It should be noted that this schematisation embeds two concepts derived from Bruno Latour's [42] seminal analyses of scientific systems in-action. The first, the "Black Box", refers to the set of processes and activities involved in the production of scientific knowledge from raw data, processes which are complex and often contingent, but which are also often opaque to those not directly involved in them (measurement techniques, data collection methods, analytic procedures and so forth). The second, the "Immutable Mobile" is the output of the black-boxed activity (a package of graphs, charts, models etc.), a condensed, finalised and task-oriented report which has transsituational relevance, practical application and comparability to other "mobiles" of similar order.

FIGURE 1 NEAR HERE

Fundamentally, this model describes a circular process in which athletic performance is measured, the data processed and interpreted by coach and scientist within a black-boxed sub-process, an immutable mobile is produced and this is fed back to the athlete who then integrates the feedback into further performance, which is in turn measured. The process is not, however, a "perfect circle"; there are key interventions at certain nodes that have significant impacts upon the relationships between key participants. The cornerstone concepts underpinning this broad model are systematically evidenced in Tables 1- 3 (below).

In Table 1, qualitative consensus evidence is provided for a broad interpretation of the athlete's role within the notational analytic process as being concurrently, and virtually exclusively, one of "object" and "audience."

TABLE 1 NEAR HERE

Table 2 shows evidence for the presence of the first of the notational analysis "information gates" shown in Figure 1 (marked "IN"), a node at which specific information is either allowed to pass through, or prevented from doing so by given agents or agencies. It is clear herein that the coach assumes (and is seen to assume) the gatekeeping role between the athlete and the key scientific tasks involved in the collection of notational analytic data; i.e. she directs both the form and content of interaction between scientist and athlete during data collection.

TABLE 2 NEAR HERE

In Table 3, evidence is displayed for the second of the information gates ("OUT" in Figure 1). Here the coach, once again, assumes the primary gatekeeping role, but in this case with respect to the athlete's access to the immutable mobile.

TABLE 3 NEAR HERE

The collected data evidences that, in these cases, a central feature of the working relationship between the sport scientist and coach are the clear and distinctive roles delineating the input of theoretical/scientific knowledge on (by the scientist) from that of practical/sport specific knowledge (by the coach). These mutually-understood positions form the basis of a practical negotiation regarding the use of the data from which the immutable mobile ultimately emerges. In Figure 2, a process model of this activity (contained within the "Black Box" section of Figure 1) is generated using only uncontested themes within the coach and scientist interviews; this is due, as will be further elaborated in the discussion, to this section of the process being largely (and actively) "hidden" from the athlete.

FIGURE 2 NEAR HERE

Evidence for the largely symbiotic, but externally opaque, coach-scientist activities involved in the production of the immutable mobile is displayed in Table 4.

TABLE 4 NEAR HERE

DISCUSSION

Results of the study confirmed the use of notational analysis across three distinct sports, and with respect to a variety of technical and social configurations. The scientist recounted extensive *direct* collaboration with a coach:

> *"Coach and myself we done everything, he couldn't do it without me, I couldn't do it without him."*

The participating coach, meanwhile, did not work directly with a sport scientist in her professional capacity – instead conducting her own notational analysis – though reported that it would be "highly desirable" to foster exactly such collaboration; in short, to:

> *"…have somebody come in and just [do] the stats and the interpretation of them rather than [me] watching, coaching and trying to do something else."*

And similarly, regarding her own experience of using notational analysis:

> *"[Notational analysis] was really difficult to do when you are watching the game, coaching, substitutes, distractions like getting subs warmed up,*

watching the umpire. I think you need it to be your one job and one job only for it to be successful."

Consonant with the work Hughes and Bartlett [23], which maintains that collaboration between sport scientists and coaches is instrumental for the success of notational analytic systems, both participants above identify the reflexive importance of the "coach" and "scientist" roles in systemic implication. These roles are, however, both in principle (as outlined by the coach) and practice (as outlined by the scientist) fairly fixed at the primordial sites of actually doing notational analysis; fundamentally, and where both are involved, the coach ideally "directs" and the scientist ideally "collects." Moreover, although the athlete's performance is both the subject and object of notational analysis by definition, athletes themselves (in all three participant accounts) were accorded minimal access to the *technical* process via "gate points" within the *social* (i.e. interpersonal) process; essentially, the athletes were actively alienated from the means by which outputs related to them are generated and, critically, this was taken *as given* by coach and scientist alike. In several places in the data, the scientist can be seen to explicitly emphasize the "necessary" black-boxing of the notational analysis process, on the grounds of the athlete's capacity to actually *comprehend*:

"...no, no, no...the athlete, it is too much for him, it is too over him, we can't give the athlete all the information we gather because he is not going to cope with that."

And:

"[We provided] the information that we wanted to provide, which was not always everything, it was never everything because it is too much."

Similarly the coach also maintained that athletes not only were, but *should be* excluded from the process:

> "*The notation is the first step in identifying or confirming there is an issue. I don't believe the notation would go directly to a player to be honest as by just saying to them you are not catching the ball or not receiving this pass I don't think a player especially at under-19 level could work why she is not receiving it.*"

This matter, in particular, raises the inevitable dilemma of the "self-fulfilling prophecy" where matters of exclusion or restriction are concerned [43]; i.e. if athletes are actively debarred *from* participating in notational analytic processes, then there is no practical arena being provided in which they may acquire the pertinent skills and capital *to* engage in that process, and thereby the grounds for their exclusion further ossify.

There can be little doubt that notational analysis is demonstrably used as part of the process of improving performance, and there is widespread (and growing) consensus regarding its efficacy in this respect. While, at the elite level in particular this instrumentality is (and arguably *should be*) the abiding concern, it might be contended that the "locking-out" of the athlete from the process itself reflects a short-termist, ends-oriented technical rationality – loosely, what Max Weber [44] famously termed *zweckrationalität* – to the very concept of "what is effective." The assumption of incapacity, it is fair to say, rarely expedites multifaceted skill development. What, we may ask, could be the more subtle social-psychological gains

of allowing athletes to challenge themselves intellectually as well as physically? What might be the longitudinal performance gains of them feeling included, or valued in *this* way? Research in the humanistic tradition, i.e. that which is philosophically rooted in the work of Carl Rogers [45, 46] and Abraham H. Maslow [47, 48], has recurrently argued that the empowerment of athletes through their inclusion in a variety of decision-making activities can have variety of a positive performance-functional outcomes [49]. In particular, Mageau and Vallerand [50], building on the work of Deci and Ryan [51], suggest that providing athletes with greater autonomy can have a constructive impact on *motivation*. Furthermore, authors who specifically consider the pedagogic role of the coach suggest that the encouragement of athletes to engage in decision-making, and in structured reflection upon their own performance, can have significant benefits both educationally and socially [52-54][1]. To paraphrase Maslow [48] himself, "self-actualisation" is seldom achieved by those who have little choice but to rely on extrinsic regulation.

Data from this study suggest that notational analysis as presently practiced, thus, may be a device through which imbalanced power dynamics between athletes, coaches and sport scientists are reproduced. As the interviewed athlete explicitly claimed:

> *"We were never given the option to say you want to do it or not, how do you think it is going? Is it beneficial towards us or not? We were never given that kind of control."*

[1] This "athlete-centrism," the placement of the developmental needs of athletes at the very heart of the sport process, is consistent across much humanistic and holistic research [59] and, while recognising the potential motivational, educational and social benefits of a holistic and empowering approach to working with athletes, however, it is important to consider that holism is itself a culturally-specific concept; "degrees" of holism are an important consideration for practitioners [60] and thus practitioners may include athletes in their process to greater and lesser extents.

The coaching-specific research of Cushion and colleagues [55, 56] and Potrac & Jones [57] indicates that power-relationships in sport settings are highly complex phenomena in need of more expansive study. The specific role-configurations described by all participants herein, for example, confirm (with respect to the phenomenon of "doing notational analysis") clear accordance of primacy to that of the coach, and something of a subordinate status to that of the athlete.

CONCLUSIONS

Using an inductive, qualitative approach, this study has investigated the notational analysis process from the perceptions of a sport Scientist, international coach and athlete from three distinct sports. Results of the study identified four key themes relating to notational analysis itself;

1. The athlete is both the object and receiver of the notational analysis process, but has little access to the process beyond this.
2. The coach acts as an input gatekeeper between the athlete and the notation analysis process.
3. A nuanced and symbiotic relationship exists between the sport scientist and the coach when handling collected data, and developing notational analysis outputs (Immutable Mobiles), but this process is kept largely opaque to the athlete (Black-Boxed).

4. A further ‘gate’ exists between the athlete and the Immutable Mobile, via which the mobile itself is presented in redacted form according the athlete’s presumed capacity to understand it.

Future work grounding and dimensionalising [58] the understanding of the *use* of notational analysis across larger samples and contexts – including, for example, ability levels – which considers the role of the athlete in notational analysis is recommended to assist practitioners as they apply notational analysis systems in the field.

It should be noted, moreover, that the data also insinuate potentially important issues relating to the role of the scientist. While the coach is both an essential and central component in the practical process of notational analysis, and the athlete is essential (as “raw material”) but largely excluded via the active black-boxing of the analytic process *by* coaches (and to a lesser degree, scientists), the scientist is central, but also *optional*. This portrayal of the sport scientist’s role herein as a “hired hand,” albeit a skilled one, will doubtless be familiar to many in the profession. While some scientists do indeed have sustained involvement with particular athletes and teams over substantial durations, it is more common for such involvement to be ephemeral. It may well be contended that there is a space for further investigation of the relationship between role-specific images promoted in the business of doing sport science, and the professional self-images and expectations of scientists themselves. In short, there may well be another self-fulfilling prophecy to explore in terms of programmatic designs and execution; do we think (and act) short-term when we expect short-term? In line with the above observations regarding the potential social-psychological value of integrating the athlete more thoroughly into the technical

process of notational analysis, the “stabilising” of scientists’ roles within the social process may have significant import both for the development of specific notational systems, and for the advancement of the broader technique.

Acknowledgements
The authors would like to thank Dr Evelyn Carnegie for assistance in transcribing the interviews. All authors made an equal contribution to the paper.

References.

1. Lees, A., Science and the Major Racket Sports: A Review, Journal of Sports Sciences, 2003, 21, 707-732.

2. Olsen, E. and Larsen, O., Use of Match Analysis by Coaches, in: Reilly, T., Bangsbo, J. and Hughes, M., eds., Science and Football III, E & FN Spon, London, 1997, 209-220.

3. Brackenridge, C.H. and Alderson, G.J.K., Match Analysis., National Coaching Foundation / Whiteline Press, Leeds, 1985.

4. Hughes, M.D. and Franks, I.M., The Essentials of Performance Analysis: An Introduction, Routledge, London, 2008.

5. Franks, I.M., Evidence-Based Practice and the Coaching Process, International Journal of Performance Analysis in Sport, 2002, 2(1), 1-5.

6. Hughes, M.D. and Franks, I.M., Notational Analysis of Sport, 2nd edn., E. & F.N. Spon., London, 2004.

7. Bartlett, R., Performance Analysis: Can Bringing Together Biomechanics and Notational Analysis Benefit Coaches? International Journal of Performance Analysis in Sport, 2001, 1(1), 122-126.

8. McGarry, T., Applied and Theoretical Perspectives of Performance Analysis in Sport: Scientific Issues and Challenges, International Journal of Performance Analysis in Sport, 2009, 9(1), 128-140.

9. Lyons, K., Performance Analysis in Applied Contexts, International Journal of Performance Analysis in Sport, 2005, 5(3), 155-162.

10. Taylor, J., Basketball: Applying Time Motion Data to Conditioning, Strength and Conditioning Journal, 2003, 2, 57-64.

11. Richers, T.A., Time–motion Analysis of the Energy Systems in Elite and Competitive Singles Tennis, Journal of Human Movement Studies, 1995, 28, 73-86.

12. O'Donoghue, P. and Ingram, B., A Notational Analysis of Elite Tennis Strategy, Journal of Sports Sciences, 2001, 19(2), 107-115.

13. Abt, G.A., Dickson, G. and Mummery, W.K., Goal Scoring Patterns Over the Course of a Match: An Analysis of the Australian National Soccer League, in: Spinks, W., Reilly, T. and Murphy, A., eds., Science and Football IV, Routledge, London, 2002, 107-111.

14. Deutsch, M.U., Maw, G.D., Jenkins, D.J. and Reaburn, P.R.J., Heart Rate, Blood Lactate and Kinematic Data of Elite Colts (Under-19) Rugby Union Players during Competition, Journal of Sports Sciences, 1998, 16, 561-570.

15. Krustrup, P., Mohr, M. and Bangsbo, J., Activity Profile and Physiological Demands of Top Class Soccer Assistant Refereeing in Relation to Training Status, Journal of Sports Sciences, 2002, 20, 861-871.

16. Reilly, T. and Thomas, V., A Motion Analysis of Work Rate in Different Positional Roles in Pro Football Match-Play, Journal of Human Movement Studies, 1976, 2, 87-97.

17. More, K.G. and Franks, I.M., Analysis and Modification of Verbal Coaching Behaviour: The Usefulness of a Data Driven Intervention Strategy, Journal of Sports Sciences, 1996, 14, 523-543.

18. Franks, I.M., Johnson, R.B. and Sinclair, G.D., The Development of a Computerized Coaching Analysis System for Recording Behavior in Sporting Environments, Journal of Teaching in Physical Education, 1988, 8(1), 23-32.

19. Cushion, C.J., Harvey, S., Muir, B. and Nelson, L., Developing the Coach Analysis and Intervention System (CAIS): Establishing Validity and Reliability of a Computerised Systematic Observation Instrument, Journal of Sports Sciences, 2012, 30(2), 201-216.

20. Erickson, K., Côté, J., Hollenstein, T. and Deakin, J., Examining coach–athlete Interactions using State Space Grids: An Observational Analysis in Competitive Youth Sport, Psychology of Sport & Exercise, 2011, 12, 645-654.

21. Lacy, A.C. and Darst, P.W., Systematic Observation of Behaviors of Winning High School Head Football Coaches, Journal of Teaching in Physical Education, 1985, 4(4), 256-270.

22. Smith, R.E., Smoll, F.L. and Hunt, E.B., A System for the Behavioural Assessment of Athletic Coaches, Research Quarterly, 1977, 48, 401-440.

23. Hughes, M.D. and Bartlett, R., The use of Performance Indicators in Performance Analysis, Journal of Sports Sciences, 2002, 20, 739-754.

24. Janeira, M. and Maia, J., Game Intensity in Basketball. an Interactionist View Linking Time-Motion Analysis, Lactate Concentration and Heart Rate, Coaching & Sport Science, 1998, 2, 26-30.

25. Platanou, T. and Thanopoulos, V., Time Analysis of the goalkeeper's Movements in Water Polo, Kinesiology, 2002, 34, 94-102.

26. Brown, M.B., Lauder, M. and Dyson, R., Notational Analysis of Sprint Kayaking: Differentiating between Ability Levels, International Journal of Performance Analysis in Sport, 2011, 11(1), 171-183.

27. Bruce, L., Farrow, D., Raynor, A. and May, E., Notation Analysis of Skill Expertise Differences in Netball, International Journal of Performance Analysis in Sport, 2009, 9(2), 245-254.

28. Laird, P. and McLeod, K., Notational Analysis of Scoring Techniques in Competitive Men's Karate, International Journal of Performance Analysis in Sport, 2009, 9(2), 171-187.

29. Gilmore, H.J., The Craft of the Caman; A Notational Analysis of the Frequency Occurrence of Skills used in Hurling, International Journal of Performance Analysis in Sport, 2008, 8(1), 68-75.

30. James, N., Notational Analysis in Soccer: Past, Present and Future, , 2006, 6(2), International Journal of Performance Analysis in Sport-67-81.

31. Ali, A. and Farrally, M., Recording Soccer Players' Heart Rates during Matches, Journal of Sports Sciences, 1991, 9, 183-189.

32. Franks, I.M. and Goodman, D., A Systematic Approach to Analyzing Sports Performance, Journal of Sports Sciences, 1986, 4, 49-59.

33. Ohashi, J., Miyagi, O., Nagahama, H., Ogushi, T. and Ohashi, K., Application of an Analysis System Evaluating Intermittent Activity during a Soccer Match, in: Spinks, W., Reilly, T. and Murphy, A., eds., Science and Football IV, Routledge, London, 2002, 132-136.

34. Groom, R., Cushion, C.J. and Nelson, L.J., The Delivery of Video-Based Performance Analysis by England Youth Soccer Coaches: Towards a Grounded Theory, Journal of Applied Sport Psychology, 2011, 23(1), 16-32.

35. McKenna, J. and Mutrie, N., Emphasizing Quality in Qualitative Papers. (Editorial), Journal of Sports Sciences, 2003, 21(12), 955-958.

36. Roberts, J.R., Jones, R.L., Harwood, C., Mitchell, S. and Rothberg, S., Human Perceptions of Sports Equipment Under Playing Conditions, Journal of Sports Sciences, 2001, 19, 485-497.

37. Silverman, D., Doing Qualitative Research: A Practical Handbook, 3rd edn., Sage, London, 2010.

38. Patton, M.Q., Qualitative Evaluation and Research Methods, 2nd edn., Sage, London, 1990.

39. Miles, M.B. and Huberman, A.M., Qualitative Data Analysis: A Sourcebook of New Methods, Sage, London, 1984.

40. Fleming, P., Young, C., Roberts, J., Jones, R.L. and Dixon, N., Human Perceptions of Artificial Surfaces for Field Hockey, Sports Engineering, 2005, 8(3), 121-136.

41. Scanlan, T.K., Ravizza, K. and Stein, G.L., An in Depth Study of Former Elite Figure Skaters: I. Introduction to the Project, Journal of Sport & Exercise Psychology, 1989, 11, 54-64.

42. Latour, B., Science in Action: How to Follow Scientists and Engineers through Society, Open University Press, Milton Keynes, 1987.

43. Goffman, E., Asylums : Essays on the Social Situation of Mental Patients and Other Inmates, Harmondsworth : Penguin, 1991, 1991.

44. Weber, M., The Theory of Social and Economic Organization, Collier-Macmillan, London, 1964.

45. Rogers, C., A Way of Being, Houghton Mifflin, Boston, 1980.

46. Rogers, C., On Becoming a Person: A Therapist's View of Psychotherapy, Constable, London, 1961.

47. Maslow, A.H., Toward a Psychology of Being, Van Nostrand, London, 1962.

48. Maslow, A.H., Motivation and Personality, Harper & Row, London, 1954.

49. Cassidy, T., Jones, R.L. and Potrac, P., Understanding Sports Coaching : The Social, Cultural and Pedagogical Foundations of Coaching Practice, 2nd edn., Routledge, London, 2009.

50. Mageau, G.A. and Vallerand, R.J., The Moderating Effect of Passion on the Relation between Activity Engagement and Positive Affect, Motivation & Emotion, 2007, 31(4), 312-321.

51. Deci, E.L. and Ryan, R.M., Intrinsic Motivation and Self-Determination in Human Behavior, Plenum, New York, 1985.

52. Jones, R.L. and Standage, M., First among Equals: Shared Leadership in the Coaching Context, in: Jones, R.L., ed., The Sports Coach as Educator: Reconceptualising Sports Coaching, Routledge, London, 2006, 65-76.

53. Jones, R.L. and Bowes, I., Working at the Edge of Chaos: Understand Coaching as a Complex Interpersonal System, The Sport Psychologist, 2006, 20(2), 235-245.

54. Galipeau, J. and Trudel, P., Athlete Learning in a Community of Practice: Is there a Role for the Coach?, in: Jones, R.L., ed., The Sports Coach as Educator: Reconceptualising Sports Coaching, Routledge, London, 2006, 77-94.

55. Cushion, C.J., Modelling the Complexity of the Coaching Process, International Journal of Sports Science and Coaching, 2007, 2(4), 395-401.

56. Cushion, C.J., Armour, K.M. and Jones, R.L., Locating the Coaching Process in Practice: Models for and of Coaching. Physical Education and Sport Pedagogy, 2006, 11(1), 18-99.

57. Potrac, P. and Jones, R.L., Micro-Political Workings in Semi-Professional Football Coaching, Sociology of Sport Journal, 2009, 26, 557-577.

58. Glaser, B. and Strauss, A., The Discovery of Grounded Theory, Aldine, Chicago, 1967.

59. Kidman, L., Athlete-Centred Coaching: Developing Inspired and Inspiring People, Innovative Print Communications Ltd, Christchurch, 2005.

60. Cassidy, T., Coaching Insights: Holism in Sports Coaching: Beyond Humanistic Psychology, Journal International Journal of Sports Science and Coaching, 2010, 5(4), 439-443.

Table 1: Athlete as “Object” and “Audience” of Notational Analysis.

Source	Evidence
Coach	• “We knew it wasn’t working and wanted to know was it a certain player….”
Scientist	• “We give the athlete information we need to give him to achieve the goal.”
Athlete	• “We would play a game on a Sunday then we would have individual analysis through video tape and through stats of tackles made and missed runs, the distance we ran and what position of the field we ran it.”

Table 2: Coach as Input “Gatekeeper”.

Source	Evidence
Coach	• “It was the coaching team that made the decision [what to notate]. We weren’t sure of the stage it was breaking down was it going to the corner or was it on a cross court ball. ” • “We just wanted to see where it was breaking down to be honest. We knew it wasn’t working and wanted to know was it a certain player…..”
Scientist	• “Because it was required by the coach.” • “Because the coach wanted to do notation.” • “To see if we could modify profiles of the guys from the coach demand.”
Athlete	• “A new coach came in, new ideas and he said this is what we will be doing.” • “It is not like we were given a choice it was just put to us.”

Table 3: Coach as Output "Gatekeeper".

Source	Evidence
Coach	• "The notation is the first step in identifying or confirming there is an issue. I don't believe the notation would go directly to a player to be honest…" • "The interpretation of notational is really for me to see if it is going wrong yes or no…." • "If you were getting all this information and all this negative information, I think it has to be in stages."
Scientist	• "...no, no, no...the athlete it is too much for him, it is too over him, we can't give the athlete all the information we gather because he is not going to cope with that." • "It was provided to the athlete the information that we wanted to provide which was not always everything, it was never everything because it is too much."
Athlete	• "We were never given the option to say you want to do it or not, how do you think it is going? Is it beneficial towards us or not? We were never given that kind of control." • Interviewer: "Who was conducting the analysis, who was doing the analysis when?" Athlete: "I honestly couldn't say." • "We found out quite quickly what we were aiming for when we had the feedback off him."

Table 4: Symbiotic, Black-Boxed Activity.

Source	Evidence
Coach	• "There is not a massive amount (of literature) on netball as far as I am aware and also getting access to that literature if you're not in an university (is difficult).." • "It was really useful when done properly. Again I start off with the negatives here but it was really difficult to do when you are watching the game, coaching, substitutes, distractions, getting subs warmed up, watching the umpire. I think you need it to be your one job and one job only for it to be successful." • "If possible have somebody come in and just doing the stats and the interpretation of them rather than watching coaching and trying to do something else.." • "The head coach is very experienced, coaching national level for about 20 years and very much uses her experiences."
Scientist	• "We get the information with the videos and we analyse that with the tool in Tae Kwan Do specifically and then we normally watch it together." • "Coach and myself we done everything, he couldn't do it without me, I couldn't do it without him." • "I did the theoretical background and I gave him homework." • "If they are just specific tactical aspects the coach might be leading but then the way we introduce the training we do it together, but I didn't know anything about Tae Kwan Do so he decides even this matter."