

**UNIVERSITY OF NEWCASTLE UPON TYNE
DEPARTMENT OF EDUCATION**

**DECISION MAKING BY EXPERT COACHES: AN
INVESTIGATION INTO APPARENTLY INTUITIVE
PRACTICE**

Ed.D.

JOHN W.B. LYLE

31st AUGUST 1998

NEWCASTLE UNIVERSITY LIBRARY

098 14282 7

Thesis VI

UNIVERSITY OF NEWCASTLE UPON TYNE

DEPARTMENT OF EDUCATION

I certify that all material in this thesis which is not my own work has been identified and that no material is included which has been submitted for any other award or qualification.

Signed:

(John W.B. Lyle)

Date:

31st August 1998)

**And I say that life is indeed darkness save when there is an urge
And all urge is blind save when there is knowledge**

(Kahlil Gibran, The Prophet)

ACKNOWLEDGEMENTS

I owe a debt of gratitude to a number of individuals who have helped me greatly in the demanding task of part-time study. The most important of these is my wife, Sue, whose unwavering love and support has allowed me to focus single-mindedly on completing this thesis. It's time to repay that debt.

I have learned a great deal from the supervision of Dr Madeleine Atkins. I am grateful for her attention to detail, her insightful comments, and for continuing to point me in the right direction. I have also received financial support for four years of degree study from Moray House Institute of Education and the University of Northumbria for which I am grateful.

For

Sue

Joanne and Andrew

**And the unquestioning love and faith of my
Mum and Dad**

Abstract

Decision making by experts in dynamic, complex and interactive contexts is an apparently intuitive practice. The behaviour and the cognitive organisation, which it represents, is under-researched. Traditional decision theory is characterised by a laboratory-based experimental approach into static problem solving. The purpose of this study was to investigate whether existing theories of decision making could explain time-constrained decision making in naturalistic settings. The context for the study is the decision making of volleyball coaches during games. The coaching process and the practice of sports coaches, although under-conceptualised and with few examples of comparable studies, represents a paradigm example of such non-deliberative behaviour. Given this background, the study was an exploratory one with potential implications for sports coaching education and for decision research in naturalistic settings.

Self-reported accounts of decisions taken were generated by Stimulated Recall (SR) from a group of 12 expert volleyball coaches. The coaches were shown videotaped footage of competition matches and six decision incidents identified. They were asked to describe the decisions and the reasons why they were taken. The transcripts were coded and analysed for the extent to which they could be categorised according to existing models of decision making and the cognitive organisation on which they were based. The SR data were supplemented by semi-structured interviews. The methodology was essentially qualitative in nature.

Although there were examples of Schema and Schema Script Model behaviours, the coaches' decision making was predominantly explained by an Interactive Script Model. Situation assessment, anticipatory modelling and an apparent desire to control decision making were important. The coaches' practice was less non-deliberative than expected. The Interactive Model is not one that has received any significant attention in the existing decision literature. In particular, the contested and serial nature of the task environment, and the limited number of action decisions available, appeared to play a significant part in constraining the coaches' decision making.

The study concludes with a brief exploration of the emerging Naturalistic Decision Making movement. Although under-conceptualised at present, this would appear to have considerable potential for explaining decision making in such settings. A number of suggestions are made for enhancing decision making in the education and training of sports coaches.

CONTENTS

	Page
Title Page	i
Declaration	ii
Acknowledgements	iii
Abstract	iv
Contents	v
Tables and Figures	vi
1. Chapter One: Introduction	1 – 21
2. Chapter Two: Review of Literature	22 – 76
3. Chapter Three: Methodology	77 – 138
4. Chapter Four: Findings	139 – 199
5. Chapter Five: Discussion	200 – 261
6. References	262 - 281
7. Appendices	
A: Layout of Volleyball Court and Camera Angle	282
B: SR Prompt Sheet	283
C: Example of Letter to Coaches Seeking Corroboration of Transcript	284
D: Interview Schedule	285 - 286
E: Letter to the Scottish Volleyball Association and the English Volleyball Association Requesting Assistance with the Identification of Expert Coaches	287 - 289
F: Supplementary Questionnaire`	290 - 291
G: Example of Coded SR Transcript	292 - 293
H: Example of Interview Transcript	294 - 302
I: SR Data Summary	303 - 305

TABLES AND FIGURES

Tables

	Page
1. Units of Analysis per Model Category	139
2. Action Decision Incidents	141
3. Model Category by Action Decision Incident	141
4. Action Decision Incidents by Model Category	142
5. Distribution of Model Categories by Coach	143
6. Distribution of Schema Model meaning Units	155
7. Distribution of Script Schema Model Meaning Units	158
8. Distribution of Interactive Script Model Meaning Units	163
9. Distribution of Solution Category Meaning Units	170

Figures

1. Delineation of a Research Field – Conceptual Model (Decision Making by Expert Coaches)	64
2. Conceptual Model of Decision Stages	65
3. Conceptual Model of Volleyball Game Process	66
4. Conceptual Model of Decision making in the Study Context	67
5. Potential Camera Angles	96
6. Coach Sample Characteristics	121
7. Interview Venues	124
8. SR Coding Frame	132 – 135
9. Problem Framing Categories	145
10. Klein’s Integrated Version of the Recognition-Primed Decision Model (Klein 1998: 27)	247

Chapter One

Introduction

The research on which this document reports is based on an application of theories about non-deliberative decision making to the cognitive behaviour of sports coaches in the sport of volleyball. Generally, research is targeted at the resolution of problematic, often contemporary issues, the improvement of current practice, or the testing of theoretical propositions. In addition, research problems in a particular field may have more specific purposes. Amongst these are: the need to apply theoretical understandings into demanding and untested contexts; the need to 'stop' occasionally and review and synthesise the received wisdom in an area; and the need to base education and training on a rigorously achieved understanding of professional practice. The sports coaching context presents a challenge to the researcher in relation to each of these purposes.

There has been relatively little research into non-deliberative decision making particularly in situation, which are dynamic and complex. Non-deliberative in this context refers to a 'condition' in which the individual decision maker does not have the time or the certainty of information available to analyse fully the circumstances, to predict with certainty the problem, or to consider in a logical manner the alternatives available. Traditional

laboratory experimentation into decision making has been based on selection of alternatives within static problem solving. In contrast, this study is field based and centred on an activity that is contested and has a high level of uncertainty. In addition the coaches' activity is made more challenging and interesting by its apparently intuitive character. In this context it is perhaps not surprising that the education and training of sports coaches is underdeveloped and under-researched. There is an absence of research on coaches' behaviours and coach education remains limited in scale and ambition. In the light of these factors, research into the cognitive organisation that accompanies decision making is fulfilling a variety of purposes

The study is designed to illuminate understanding of the relationship between existing theory and the coaches' decision making behaviour. It is anticipated, therefore, that there will be implications for professional preparation in this area. In addition, the generic cognitive organisation, which underpins this behaviour, should have a more general relevance for decision making research.

This introductory chapter now goes on to present the arguments which form the basis of the choice of research issue and illustrates how the study has evolved from the 'problem identification' stage. Having placed the research in its professional and academic context, the development of the research questions is described.

Rationale for the Study

Sports coaching (in the UK) is an occupational practice in which the absence of a theoretical basis for professional practice both reflects and contributes to its embryonic

crystallisation as a profession. This is also instrumental in its lack of status (Lyle 1986, Coaching Review Group 1991, Woodman 1993). The apparently unidimensional nature of the coaching role masks a wide variety of occupational roles, responsibilities and situational demands. These are not well understood. In addition, the specific sports themselves may support either amateur or professional participants looked after by coaches who are either amateur or professional, and either full- or part-time. Indeed, the majority of the UK's estimated 100,000 coaches are in fact volunteer, part-time club coaches (Coaching Review Panel 1991). The delivery pattern may range from school sport, through community provision to recreational and elite club sport. The standards of participation are on a continuum from foundation, through participation and performance to excellence (ESC 1997: 5). There is not as yet an appropriate conceptual framework, which recognises and embraces the scale, scope and complexity of this practice, nor is there a body of knowledge that has informed policy and practice.

Nevertheless, the importance of sports coaching to sports development has been acknowledged. The publication of *Coaching Matters* (Coaching Review Panel 1991) focused this attention and acted as a template for research and development policy. The contribution of coaches and coaching at all levels of the continuum of performance has been recognised (National Coaching Foundation 1993, Scottish Sports Council 1994, Department of National Heritage 1995).

Insofar as the role of the coach is interpreted as being synonymous with that of the sports teacher (Horn 1987, Douge and Hastie 1993, Chelladurai and Kuga 1996), there is a body of knowledge and theory which is relevant. Whilst investigating the interactive decision making of coaches, Jones, Housner and Kornspan (1997) illustrated the role ambiguity

between coaching and teaching. This research is an example of the extent to which the theoretical basis for exploring coaching effectiveness is dependent on research into teacher behaviour (Lyle 1998). However, when the distinction between performance and participation is more clearly explicated, the knowledge available from research on teaching fails to explain and predict coaching practice satisfactorily. Sherman and colleagues (1997) point to the absence of adequate models of the coaching process. In evaluating this, Lyle (1996) argued that theory construction has been hampered by a range of factors including a research emphasis on athlete performance, work-place orientated research in the USA and a dearth of university based education and enquiry. This has been exacerbated by the eclectic nature of the knowledge base, which draws from many sub-disciplines, and the esoteric mysticism of practitioners.

Recent Government policy (DNH 1995) and the advent of a performance sport strategy based on a British Academy of Sport (Sports Council 1995) have further highlighted the importance of coaching. The advent of revenue funding for top-class sportspersons, based on the distribution of National Lottery resources to sport, has revolutionised the financing of elite sport in the UK. Both major political parties (Bottomley 1996, Labour Party, undated) support this emphasis on discernible 'medal success'. Nevertheless, sports coaching is acknowledged to have a role beyond elite sport. In addition to improving standards of performance, coaches are considered to be central to increasing numbers of participants, nurturing emerging sporting talent and facilitating more general sports development (Sports Council 1993, NCF 1995). Given this acknowledgement of the pivotal role for sports coaching, it is disappointing that there has been so little attention to theory development in spite of the more general progress in sports science research. Reilly (1992) has charted the establishment of a sports science research community in the UK,

noting its “recognition ... as an academic discipline and a valid area of professional practice” (1992:5). The need to establish credibility in sports science has resulted in the majority of the work being linked closely to established disciplines (physiology, psychology, and biomechanics). This has focused the research onto sports performance and performers. However, Burwitz and his colleagues (1993) stressed the need for applied and interdisciplinary research, and identified the coaching process as an under-researched area. Abraham and Collins (1998) point to the inadequacies of the behavioural assessment approach, which has characterised much of coaching research. More significantly, they highlight the absence of an impact on coach education, being unaware of any formal coach education systems that explicitly exploit the results or methodologies of either the behavioural or the expertise-based literature (1998:60). It is clear, therefore, that there is no existing theoretical framework for coaching practice that has been applied widely and successfully. Despite the wealth of coaching research in the USA, Sherman et al (1997) come to a similar conclusion, and the impact, particularly on performance sport, has been limited. However, a number of writers have provided a starting point for conceptual development (Cote et al 1995, Salmela 1995, Lyle 1996) to which advances in the theoretical understanding of the coaching process and the behaviour and practice of coaches can be addressed.

Coach education in the UK has been criticised for a number of shortcomings. The features most often highlighted are the lack of quality control, emphasis on technical and tactical knowledge, and its minimalistic scale (Coaching Review Group 1991, Lyle 1993, Bond and Whittal 1996). However, these historical criticisms are not surprising in the context of a largely voluntary, part-time activity. This is in contrast to the accreditation schemes in Canada and Australia, the influence of university education in North America, and the

state sponsored degree education and career pathways in the former 'Eastern Bloc' (Campbell 1993, Riorden 1991, 1993). The efforts of the National Coaching Foundation have redressed some of this 'deficit'. There have been considerable changes to coach education with the introduction of competence-based education and training, reflecting a more general momentum towards CBET (Sport and Recreation Lead Body 1992, NCF 1994, Scoular 1995). The developments in National Vocational Qualifications have focused attention onto the nature, content and structure of coach education. However, there have been doubts about the demand and the capacity of Governing Bodies of Sport to deliver the assessment and programmes required and change and development continues to take place.

The constraints on development have been exacerbated by the absence of a 'full-time' profession and no consensual professional body, nor need for a licence to practise. Of more relevance for this study is the fact that competence-based approaches have not yet been implemented fully at more advanced levels in coaching. There is a general acknowledgement that coaching practice at these levels is a cognitive exercise and that behavioural (and knowledge-based, see Abraham and Collins, 1998) systems are inadequate tools for assessing these 'higher order' competences. Criticisms of the competence approach range from the conceptual (time slice assessment; dispositional measurement) (Hyland 1994) to the ideological (mistaken concept of learning) (Halliday 1996).

The complementarity between coach education and the theoretical understanding of coaching practice is very poor. There is a problematic link between the coaching practice of expert or advanced coaches and the design and delivery of coach education

programmes. As a result, the significance of cognitive skills, such as decision making, has yet to be incorporated satisfactorily into coach education. One of the principal shortcomings of competence-based education and training in general is its inability to embrace preparation for situations characterised by uncertainty, uniqueness or a moral context (Carr 1993). This is an important element of this study, which focuses on the sports coaching process which subsequent argument demonstrates is characterised by its unpredictability.

Recent changes to coach education have included a much-increased use of the 'mentoring' concept (NCF undated). Mentoring is a current buzzword in management training and, in its various forms, has a long tradition in industry and education (Kinlaw 1993, Parsloe, 1995, Lewis 1996, Lyle 1997). Mentoring is a way of guiding the learner or apprentice to make best use of experiences. The experience and knowledge of the mentor is available to the learner in a variety of formal and informal ways, and the immediacy of feedback and training in the practical and applied context accelerates the learning process. This has received very strong support from experienced coaches who "overwhelmingly supported the idea of implementing mentor-type coaching apprenticeship programs" (Gould et al 1989: 341). One of the most appealing aspects of the mentor-apprentice relationship is the potential for focusing the practise of cognitive skills. However, it is not clear that research on mentoring has focused on issues of cognitive organisation consonance between mentor and apprentice, far less the assumption of an adequate body of knowledge and understanding about the cognitive skills themselves.

Yiannakis (1998) has provided a model for applied research that helps to situate this study. He distinguishes between what he calls basic research (theory building or testing),

applied research (explanatory, operational), knowledge transfer phase (for example, into occupational practice or professional education), and implementation (what are the contextual problems of making this work). This study will use existing theoretical understandings about decision making to evaluate whether they provide sufficient explanatory and operational understanding of the practice of expert coaches. This is clearly applied research. However, it is equally clear that the benefits of the research should impact on the knowledge transfer phase. This can be interpreted as coach education, and it has already been demonstrated that there is insufficient understanding of how coaches can be trained to the highest level. It is clear from the literature that there has been little theoretical development of coaching behaviour (Lyle 1996). The central concern that has prompted this research study is that the education of coaches (particularly to become expert coaches) will happen in a conceptual vacuum unless the volume of enquiry into coaching practice is increased (for examples see Lyle 1992, Hardy and Howard 1995, Cross 1995). In its current stage of development, some basic questions have yet to be asked or answered. Abraham et al (1997) and Abraham and Collins (1998) have begun to develop such a framework and, in particular, have identified coaching as a cognitive skill in which decision making is paramount. One of the “central distinguishing features of professionals’ work is that of discretionary judgements” (Beckett 1996:135). In other words, decision making (which is successful, relevant, and appropriate) is a mark of the professional and the nature of that decision making process may be the benchmark of the expert (Dreyfus and Dreyfus 1986, Chi et al 1988, Eraut 1994).

Decision making, along with its family skills of reasoning and problem solving, is a branch of cognitive psychology (Evans 1989). This field of psychology has an extensive subdivision of legitimate interests ranging from neuropsychology through probability

heuristics for consumer behaviour and on to the contextual features of clinical decision making. Much of the literature is focused on decision making in a deliberative fashion and couched in terms of problem solving. The fairly extensive writings on decision making under conditions of uncertainty refer to a lack of data necessary to make the most 'appropriate' decision and largely involve probability judgements (e.g. Hansen and Halgeson 1996). Few studies deal with non-deliberative decisions caused by time pressures exacerbated by uniqueness and complexity. Nonetheless, the instrumentality of researchers in the field is summarised and presaged by Lockhead (1980:153)

The internal state of the person determines what information will be sought next, and determines the importance of information producing a decision or value judgement. Thus the important question for researchers is to learn where these internal states come from, what their antecedents are, and how these are manipulated.

The cognitive organisation (thinking, reasoning, accessing, storing) through which decisions are made has received considerable attention and is the theoretical underpinning for the study. Although a review of the relevant literature will demonstrate that an experimental psychology approach, which employs controlled laboratory experimentation of processual, contextual or personal variables, is most common, there is some support for an holistic approach to the cognitive system (Clark and Crossland 1985). Bernsen (Baddeley and Bernsen 1989) recognises that cognitive science has a biological and mechanical implementation. However, he suggests that the central level of analysis should be the cognitive 'system'. Stages in the decision making process – problem identification, decision framing, and decision choice – when identified in reductionist experimentation, may be characterised by rigorous methodology. However, the more holistic systems approach, which emphasises the validity and applicability of the 'more-difficult-to-

investigate field studies', is perhaps less attractive (for both pragmatic and ideological reasons) to researchers. It has to be acknowledged that cognitive research is a problematic research field. Any non-biological modelling or inference about cognitive procedures requires a level of abstraction from observable or reported behaviour. Considerable attention has, therefore, been given to the efficacy of research tools for cognitive skills enquiry, such as verbal protocol analysis or process tracing (Ford et al 1989).

One particular approach has been to focus on expert decision making. There are two reasons for this: firstly because it is the epitome of skilled practice and secondly, by using comparisons with novice practitioners to learn more about the development of expert cognitive behaviour. In general, experts recognise patterns in a problem to a greater extent than novices and are able to make sense of these at a level of abstraction which assists problem-framing (Adelson 1984, Chi, Glaser and Farr 1988, Etringer, Hillerbrand and Claiborn 1995). Efforts continue in order to understand how the procedural knowledge and production rules of the expert (Anderson 1990) are 'shortcut' in conditions of uncertainty or professional practice (Custers, Boshuizen and Schmidt 1996). The influence of the environmental context is also relevant (Klein 1993, Johnston-Laird and Shafir 1994, Kushniruk, Patel and Fleiszer 1995). It seems likely that experts have a cognitive mechanism for hypothesising rapidly from a 'breadth first' approach in which potential problem-solutions are sifted.

Apparently intuitive, often sub-conscious, reasoning is described by Boreham (1994) in contrast to the more deliberative, analytical and explicit behaviour of the novice. The experts' cognitive style is largely 'routinised' and under schematic, frame-recognition control. Evans (1989) describes a schema as a "knowledge structure which is induced or

learned from experience, contains a cluster of related declarative and procedural knowledge, and is sensitive to the domain and context of the current focus of cognitive activity” (1989: 84). These schemata are the frameworks through which we represent the world to ourselves. This tacit, intuitive mode of reasoning was modelled by Dreyfus and Dreyfus (1986) and elaborated by Broadbent (1993). A good deal of work has been done on clinical decision making by experts. Schmidt et al (1990) describe how doctors move from memory based knowledge structures to memories of specific illnesses and then to memories of specific patients as they become more expert. This reinforces the move to implicit behaviour by stressing the use of ‘scripts’ based on particular instances. Scripts are particular kind of knowledge structures that predict sequences of events, including likely solutions to problems. Experts recognise the similarity of cases to previous examples and apply highly idiosyncratic ‘recipe’ solutions.

This brief resume and introduction to the area demonstrates that there is sufficient complementary work to constitute a body of knowledge and sufficient sub-division of interest to develop the field. There are also many under-explored issues. A number of theoretical/conceptual frameworks are available within which to understand better expert behaviour – from the template response to pattern recognition (Boreham 1989), to Schmidt et al’s (1990) ‘scripts’, to the meta-cognitive mental model suggested by Eraut (1994). Therefore, any research which has the characteristics demonstrated in this study, namely non-deliberative, field-based, expert behaviour, has the potential to contribute to understanding in the field.

There were a number of other factors which helped to identify the research issue, in addition to the need for research on coaching behaviour and the potential impact on coach

education. In an earlier study (Lyle 1989, Lyle 1992) coaches' practice was seen to be 'intuitive' rather than 'systematic', and demanded further explanation. The research involved testing the aptness of an ideal model of coaching practice on a sample of 30 experienced coaches. The coaches' behaviour was clearly not explicitly systematic but the study suggested that the apparently intuitive behaviour constituted a lack of understanding (and of conceptual development) rather than an adequate description of practice. Follow-up work replicated these findings (Cross 1995a, 1995b). In addition, the author had a conviction based on personal experience as a coach of international performers, and as a coach educator, that decision making was a discriminating factor in coaches' expertise. Much the greater part of this experience was in the sport of volleyball which emphasised (particularly in the game management role) the complex and non-deliberative aspect of decision making. This personal conviction has been overtaken by a number of writers who have interpreted coaching as a dynamic, largely cognitive, process which, *prima facie*, requires constant regulation and, therefore, implies the pre-eminence of decision making (Cote et al 1995, Salmela, 1995, Lyle 1996, Abraham and Collins 1998). The final factor, which has already been alluded to, was the absence of development in coach education and the realisation that any advances in understanding cognitive skills would and should impact on the embryonic development of coach education structures, content and procedures (for example, mentoring and/or the development of mental models).

Rationale of the Study (Deriving the Research Problem)

The purpose of this section is to sustain an argument, which moves from a general description of the issue to the identification of the research question. The broad area of study is decision making by sports coaches. Almost 30 years ago, Cratty (1970), an

eminent sports psychologist, identified the problem: “coaching decisions must be made rapidly”, the value of research “depends first upon deciding what types of decisions coaches must make. A second step is to explore the degree to which ... research has or has not provided information leading towards more productive decision making behaviour” (1970:46). Abraham and Collins suggest that little progress has been made in clarifying the relationship between the cognitive skills of the coach and the most prevalent approaches to coaching research. It will become clear from this preliminary review of the supporting evidence that there is sufficient material which identifies the issue but that the central question of non-deliberative decision making remains unexplored.

There would appear to be an extensive literature on decision making by coaches but, for the most part, its relevance to the focus of this study is tangential. In such research, decision making is interpreted as a leadership style (e.g. Chelladurai 1993, Chelladurai and Quek 1995). Interest has centred on more or less autocratic/democratic behaviour and the satisfaction of clients. The majority of studies are based on the work of Chelladurai (see Chelladurai and Haggerty 1989), and most often focus on the teaching paradigm (Lyle 1998).

Jones, Housner and Kornspan (1997) investigated coaches’ interactive decision making but their experimental task was a simplistic skills teaching exercise. They point to the use of systematic observation studies (see Abraham, Collins, Smethurst and Collins 1997, for a critical review) but stress the cognitive aspect: “to understand fully the phenomena called coaching, it is imperative that direct observation techniques be supplemented by methods for exploring the thought processes of coaches” (1997:455). The use of the teaching of basic skills by coaches as a basis for experimentation has emphasised the

relevance of similar studies carried out with sports teachers (Housner and Griffey 1985, Griffey and Housner 1991, Byra and Sherman 1993).

A distinction can be drawn between coaches' decisions for which there is relatively little time pressure (Jones, Housner and Kornspan 1995) and those characterised by the need for an immediate or almost immediate response. Sports coaching practice reflects this distinction. The coach's functions can usefully be categorised into three levels – direct intervention (the coach and performer working together in training or competition), indirect responsibilities (planning, monitoring, negotiating), and managing the external environment (equipment, finance, facilities, recruitment etc.) (Lyle 1996). It is immediately obvious that the coach's 'direct intervention' behaviour is more likely to be characterised by non-deliberative behaviour: some decision making (for example, planning the programme) will be sufficiently non-constrained to permit deliberative decision making. Much of this decision making will be characterised by routine activity. Where there are substantive issues to be resolved, it is likely to be termed problem solving. There are many instances, however, in which coaches must take instant decisions – the need for time-outs during competition, dealing with injury, player substitution, control of practice drill loadings, contingency reactions to tactical crises etc.. The need for non-deliberative decisions is to be found more extensively in some sports than others. This is dictated by the role of the coach during competition and the interactive nature of training, and is more prevalent in team sports. In these circumstances there is a continuous and contested momentum flow between two players or teams, and a high degree of uncertainty about outcomes and performance. One of the coach's roles is to manage this competition context. It is also this context which is absent from research on decision making.

The significance of the research for sports coaching is increased by two factors. Firstly, the work of Lyle (1992) and Cross (1995a) suggests that even apparently deliberative decision making may be characterised by seemingly 'intuitive' practice. Coaches, like other experts, devise 'professional shortcuts' to minimise the number of substantive contingency decisions to be taken, and operate within routines. Secondly, there are a number of factors that create uniqueness in the coaching environment. Workers who have studied 'hot action', the term given to behaviour under conditions of time pressure (Schon 1993, Beckett 1996) emphasise the fluid and dynamic nature of such a context. Lyle (1996) demonstrates that coaching is characterised by its multi-variable nature, uncertainty of outcome, non-linearity of stimulus-response, influence of human consciousness, the effect of the instrumental competitive action by others, and the interdependence of performance variables. The difficulty of control and prediction in such circumstances of complexity and potential novelty precludes a simplistic, analytical approach. The complexity of the process is a fertile ground for professional shortcuts and apparently intuitive behaviour. An awareness of this complexity is at least a partial explanation for the dearth of coach education practice related to decision making. This is recognised as one of the failings of coach education for experienced coaches and demonstrates why attention has been focused on technical content and declarative knowledge rather than decision making skills and procedural knowledge.

There are a number of sources that help to focus attention onto coaches' decision making and its place in coaching practice. Cote et al (1995) reviewed the area and concluded, "there are no comprehensive frameworks that represent the complex reality within which coaches work" (1995:2). Cote et al's paper identifies a very similar research problem to that identified in this paper and reinforces the paucity of conceptual development. Their

contribution is to focus on the mental models adopted by coaches to structure their knowledge, although they say little about how these are constructed or deployed. Lyle (1996) has commented that (1996:29):

There need to be systematic procedures for investigating the criteria for decision making used by our most experienced coaches ... (this) conceptual model has identified contingency planning, recipe planning and fine tuning, (and) professional shortcuts in decision making for which cognitive matrices of criteria have (yet) to be established.

In a recent paper which employed depth interviews with experienced coaches, Salmela (1995) reinforced the place of metacognition in his conclusion to a study of expert coaches (1995:13):

.. it becomes clear that a large number of issues, which borrow from a variety of psychological domains, are tightly integrated into a metacognitive form of knowledge which experts possess and are able to verbalise. A number of contingencies are brought into play which allow their decision making and operational styles to be precisely formulated into effective ways of coaching.

Salmela's synthesis appears to be entirely apt and summarises the nature of expertise which expert coaches possess. However, it does not add to the problem of 'how the capacity he describes is put into action'. This has obvious implications for education and training.

Gould et al (1989), however, imply caution when they speculate that "coaches employ key concepts and principles in their coaching but have difficulty identifying them" (1989:342). Similarly, Salmela recognises the difficulty in accessing such cognitive structures when he comments that "academics ... cannot compete with these integrated concepts put forward from experience by these expert coaches" (1995:13). Although these difficulties are no

different to those experienced in research into cognitive skills in other fields, there is implied criticism of the approaches adopted in previous studies.

There is no doubt that coaches are required to engage in complex cognitive activity and that such cognitive behaviour is under-researched. There is a limited literature or research tradition in this area, although more recent writing is identifying the problem. There is an appreciation that a 'form of cognitive organisation' (or more than one) is engaged but at present no synoptic conceptualisation of how this (or these) are operationalised. Such literature as there is has identified the contexts in which research is required. Although sparse, it has served the function of highlighting the problem. In doing so, the potential contribution of this study is more clearly demonstrated.

Development of the Study

The rationale for the study has identified a coincidence of factors, which point to the identification of coaches' decision making as an appropriate area for study. The analysis of the coaching process, the researcher's experience as a coach and educator, and the currency of the education and training issues involved, create a focus on the significance of decision making in the coaching process and on the need to understand how these decisions are made. Regardless of whether the coach is characterised as a professional, a practitioner or an expert, the overall issue of problem solving in contexts of time pressures and the non-deliberative decision making which this implies remains relevant. It has become clear in this introduction that there is a dearth of academic research dealing directly with the issue despite the more recent recognition that coaching is a cognitive

exercise and ought, therefore, to be reflected as such in coach education and training policy.

Coaching has been characterised by both its deliberative and non-deliberative functions. There is no doubt that, in some sports, the management of the strategy, tactics and resources in the competition context is a significant part of the coach's role, both in proportion and in significance. The lack of attention to this function partly stems from the absence of a theoretical and conceptual framework within which to understand it. The application of existing theories in this context would be sufficient justification for the study. However, it is not immediately obvious that the particular demands of the expertise demonstrated by coaches in these circumstances can be fully explained by current theories.

A number of questions which have yet to be addressed satisfactorily have emerged over a period of time:

- (a) What is the nature of the cognitive (or metacognitive) process which facilitates decision making?
- (b) How do expert coaches make decisions in conditions of 'hot action'?
- (c) Coaching practice appears to be characterised by 'intuitive decision making'. Is this accurate and what is the nature of the intuition?
- (d) In coaching practice, which are the significant discriminatory factors around which decision making is centred?
- (e) Are the discriminatory elements codified into recognised 'rules of practice'? and
- (f) In which ways is the decision making of novice coaches different from expert coaches?

The research which follows is validated by its attention to these specific questions and it therefore makes a contribution to the development of knowledge and understanding. The study should intend to be feasible but rigorous and should have an actual or potential application to professional practice. It is appropriate to ask questions with the potential to provide a wide-ranging explanatory power, that is, which are fundamental, generate and support further research, and illuminate practice and inform education and training. In devising the research questions, it has been assumed that (a) there is no substantive theoretical development or research literature which addresses the issue; (b) there is no other discipline or professional context which displays a sufficiently well-developed set of theoretical principles which offer an immediately obvious transfer to the coaching context; and (c) there is, however, a body of complementary knowledge within which the research study can be situated.

A further set of factors has been taken into consideration:

- (a) having argued the point at length that sports coaching is a cognitive exercise, it would be inappropriate to pursue a behaviour observation approach;
- (b) there is a cogent argument that a ‘metacognitive, holistic or complete systems’ approach is most appropriate in a situation in which so little is known about coaches’ decision making. In other words, it would not be appropriate to pursue a reductionist, experimental approach which is removed from the reality of practice at this early stage of exploration in the area;
- (c) in any research into this issue, the fundamental problem of accessing individuals’ cognitive activity will be present.

For the reasons identified above, a broadly qualitative approach will be used. The context will be the field-based investigation of coaches’ decision making in meaningful

competition. Careful consideration will be given to the procedure for inferring the coaches' cognitive activity. The research is not based on theory testing through a set of empirically powerful hypotheses. The claims made for the research findings will therefore be assessed against a more general set of expectations derived from the explanatory power of existing frameworks.

Statement of Purpose

The purpose of this study is to devise and carry out a research project, which provides an answer to two questions. The first explores the nature of the cognitive organisation of knowledge and experience which enables it to be accessed in such a way as to make effective and efficient decisions. The second centres on whether this cognitive organisation is individually structured. The following research questions give direction to the study:

- (a) To what extent can elements of theories of cognitive organisation adequately explain the accounts of non-deliberative decision making by expert coaches generated during stimulated recall?**

- (b) To what extent does the individual coach's 'theory of action' appear idiosyncratic?**

A more detailed methodology will be presented following the review of the relevant literature. The review will fulfil a number of important functions. At the more general level, an evaluation of the literature is necessary to situate the study in the existing

literature and to assess the level of support from existing research and theory. The extent to which the field is coherent in relation to decision making and also to sports coaching should be established. However, in terms of the rigour of the potential study, the review fulfils two further functions. Firstly, it contributes significantly to the construction of conceptual models, which in turn contribute greatly to the operationalisation of the study. The identification of the relevant variables is important in a poorly theorised field. Secondly, the review establishes the strength of the theoretical framework against which the study's findings can be analysed and discussed.

Chapter Two

Review of Literature

There are a number of purposes for the review of literature. The review provides an understanding of the field, which then informs a series of stages within the research process. The hypotheses or expectations are derived from this understanding, and it is these expectations that provide the basis for the claims made for the findings from the investigation. Perhaps more importantly, the interpretation of the field, which follows from the review, is converted into a series of conceptual models. These models underpin the methodology which is selected as the most appropriate to tackle the research questions. The discussion stage of the study is also informed by the review since this is an opportunity to compare the findings to previous studies. It is also an opportunity to use the understanding of the field provided by the review to explain the substance and significance of the findings.

The objective, therefore, is to review, that is to describe and evaluate, the literature relevant to the study area. This will involve providing a sufficiently detailed account of literature sources that are either seminal, typical, or, in themselves, provide an overview of the field. Each part of the study area is evaluated. The intention is to identify those sources that contribute significantly to an emerging understanding of each of the

elements of the study area. The focus of the review, therefore, will be on theoretical development in cognitive organisation and decision making. In addition, it is important to search for the scope and extent of the existing application of such a theoretical framework to applied fields, and, in particular, to sports coaching. It is also important to establish the status of research into decision making in sports coaching and whether this has been informed by the more general literature available. The relationship between the intended study and previous similar studies of sports coaching is of particular relevance.

The research questions themselves determine the substance of the review. Therefore, the key words will be ‘expert behaviour’, ‘decision making’, the ‘cognitive organisation’ which this represents, and the special conditions of the study – coaching, apparently intuitive behaviour, non-deliberation, and volleyball. The structure of the chapter takes the form of a review of appropriate literature sources in the following areas:

- (a) the concepts of decision making, intuition and non-deliberation;
- (b) expert behaviour;
- (c) how decision making has been explained. This will begin from a broad perspective on professional thinking and move to more specific research on elements of decision making. This section is the principal focus of the review;
- (d) the contributions made by the literature on sports coaching and teaching; and
- (e) a review of the contribution of volleyball literature.

The chapter concludes with an explanation of how the literature has informed and been integrated into the construction of the conceptual models of the decision making process, and with the expectations for the investigation’s findings, which can be substantiated by the literature.

Decision making and intuitive behaviour

The nature of decision making

The issue of what constitutes decision making appears to be deceptively simple. However, this is not the case. Svenson (1996) identifies four types of ‘decision problems’, each requiring appropriate psychological processes: (1) automatic and unconscious decisions involving no reference to alternative choices (expanded later in reference to Klein’s (1993) recognition-primed decision making); (2) decisions about which there is no conflict between attributes and attractiveness, and the solution is obvious. These include metastrategic decisions and repetitive decisions; (3) decision making where there is a choice between alternatives with goal conflicts. “Most of the existing decision research literature treats problems at this level.” (1996: 254); and (4) decisions in which neither the alternatives nor the attribute are fixed. Svenson characterises these as ‘real-life’ decisions, and comments that in these situations there may be “just one alternative that is considered and the decision therefore concerns a choice between the status quo alternative and one other alternative” (1996: 256). The main point made in the article is that decision making is best considered as a process.

The distinction between decision making as a ‘choice’ activity with structured alternatives and clear goals, and less well structured ‘problem decisions’ is at the heart of alternative research paradigms in this field. Teigen (1996) distinguishes between the traditional experimental, laboratory-based judgement/decision making research (J/DM) with structured, contrived problems, and natural decision making (NDM) which is ill-structured, ‘messy’ and untidy, and with less ‘givens’. He contrasts the ‘choice tasks’ of

the experimental tradition with the daily life decision characteristics identified by Karlsson (1988): one alternative, a creative act, and imbued with self-investment. A similar distinction was identified by Devine and Kozlowski (1995). The traditional problem solving literature is characterised by them as having “typically studied expertise in the context of tasks with formal, quantifiable rules, established procedures and demonstrably ‘correct’ answers.” (1995: 295).

Cannon-Bowers, Salas and Pruitt (1996) identify a paradigm shift in decision research from the “sterile, contrived decision making situations with results that were of little consequence to real-world decision makers” (195), to naturalistic decision making (NDM). They encompass the work of Orasanu and Connolly (1993) in devising a list of factors that are central to NDM: uncertain dynamic tasks, multiple event feedback loops, meaningful consequences, multiple goals, time constraints, decision complexity, multiple players, the level of congruence of organisational and personal goals, quantity of information, and level of expertise (1996: 198). NDM researchers are said to be more concerned to describe patterns in decision behaviour rather than to identify normative behaviour towards prescribed choices¹. Cannon-Bowers and colleagues cite the work of Brehmer (1990) who draws a link between the real-life timing inherent in dynamic tasks and the concept of an action decision rather than decision choice. This reinforces the process notion of decision making in natural settings. The authors acknowledge the likely impact of time pressures on the psychological processes associated with decision making. Although they go into little detail on the ‘how’ of decision making, they do juxtapose Klein’s (1993) recognition-primed decision model and the time available, and also

¹ One issue which would appear to have received relatively little coverage is the question of the effect of emotion and perceived attachment to meanings on individuals’ decision judgements (Strack and Neumann 1996). Experiments are normally carried out in a ‘neutral’ state of mind. There would appear to be some

speculate on Hammond's (1993) contention that factors in the task environment will lead to a more analytical or intuitive strategy.

Brehmer (1992) conceptualises the decision making function as that of "an attempt to gain control i.e. as an attempt to achieve some desired state of affairs" (1992: 212). He stresses the point that 'dynamic decision making' is an on-going process and that decision makers are constrained by the environment. Decisions are made "when the environment demands decisions from them" (1992: 213). The dynamic nature of the environment was also studied by Kersholt (1994) in an experimental task involving judgements about an athlete's fitness level. In dynamic task environments, which he characterised as demonstrating continuous change, currency of information flow, and uncertainty, he comments that time pressure is caused by the developing situation and not by artificial deadlines, and that action rather than judgement strategies are required. The findings suggested a speeding up of information processing, the use of thresholds ("waiting until a specific value was reached" (1994: 101)), and attempting to increase 'waiting time' by beginning to monitor the situation earlier. He concludes that individuals achieve an "illusion of control" (1994: 102).

In the more traditional J/DM experimental paradigm (with 'static' tasks), time pressure brings with it increased speed of information processing, more non-compensatory judgements², increased risks taken if negative outcomes are anticipated, and greater weight given to negative consequences (see Edland and Svenson (1993) for a review and Verplanken (1993) for an example of the research approach).

considerable scope for investigating naturalistic decision making as affected by emotional reaction to the situation. In contested games sports this could prove to be a significant variable.

² This refers to the heuristics employed to make choices between alternatives. These are described in a later section.

It is important to recognise that decision making is not simply a matter of probability-based choice decisions between structured and evident alternatives, but that there is a concept of the action-decision which may be more prevalent in NDM and is likely to involve one or a limited number of alternatives. This has face validity for coaching and will be explored later in the study. Also important is the recognition that NDM may involve not one (choice) decision point but a series of interrelated and perhaps incremental decisions.³ All decisions could be interpreted as problem solving (resolution of conflict between alternatives or decisions occasioned by goal-interpreted activity in the environment), but not all problem solving involves a constrained decision episode. There is a semantic and epistemological untidiness in the field, and clear evidence of research paradigms with particular conceptions of decision making attributes and priorities. This suggests that the literature should be interpreted with care.

The nature of intuitive cognition

Another characteristic of decision making in the research problem was its 'apparently intuitive' nature. The word intuitive was used to frame the problem, connoting time (and other) constrained decision tasks without apparent deliberation. In this sense, intuitive refers to a class of decisions, and it may be that the concept of intuition would be helpful in understanding such decisions.

Claxton (1998) suggests that intuition has been an uncomfortable subject for psychology but that cognitive science is "resuscitating the idea of the 'intelligent unconscious'"

(1998: 220). Claxton first establishes the place of implicit learning, quoting Lewicki et al (1992) as demonstrating in the laboratory the “superiority of non-conscious, non-intellectual learning when dealing with situations that embody, over time, complex patterns of contingency” (1998: 218). He then explains how this is accessed through non-conscious association (1998: 218/219):

It is self-evident that cognitive strategies that work well for problems that are well-defined and capable of accurate decomposition and representation in verbal-symbolic terms will be much less effective when the problem is ill-defined and/or cannot be decomposed into describable components.

Intuition may rely on information that is not merely inarticulate but which is, in addition, of a rather faint or fleeting quality: liminal or even sub-liminal.

... sub-threshold priming produced by a semantic network by ‘speedy activation’ (Yaniv and Meyer 1987). Some kind of quasi-neural activation spreads out from the epicentre (Greenfield 1995) generated by the stimulus, even though the level or duration of activity at the epicentre may not be great enough to exceed the notional threshold of consciousness.

Claxton distinguishes ‘speedy association’ from the slower ‘creative’ intuition, and stresses that there are education and training implications for management, education and the legal profession.

The distinction between the processual and the creative was also identified by Wierzbicki (1997). Having defined intuitive decisions as “quasi-conscious and sub-conscious information processing, leading to an action, utilising aggregated experience and training and performed (most probably) by a specialised part of the human mind” (69), he goes on to distinguish between ‘repetitive and operational’ decisions and ‘creative and strategic’. Wierzbicki suggests that experts have a reluctance to rely on aggregative, multi-criteria

³ This is labelled in many papers as ‘interactive decision making’ – see Housner and Griffey 1985, Tan 1996, and Jones et al 1997.

decision aids, and that attention to pre-decision stages is required to assist holistic interpretations, particularly those that are not routine.

The place of intuition in relatively routine decisions⁴ by professionals is discussed by Easen and Wilcockson (1996) in a review paper. They conceive of intuition as a “spontaneous, effortless, non-conscious, unexplained (to the intuiter) phenomenon” (1996: 670). Although they acknowledge the distinction between process and content, their conceptualisations are not put in the context of decision making. This is necessary to ‘contextualise’ the ‘spontaneity’ of which they speak. Their paper is valuable for emphasising the place of knowledge and experience and the potential for post-intuitive deliberation. In addition, they draw attention to Benner and Tanner’s (1987) distinction between pattern recognition and similarity recognition. This implies different cognitive strategies for accessing generalised categorisations (discussed later as schemata or scripts) and those based on specific cases. An example of the application of decision making concepts encompassing intuitive judgements being applied to a professional context is to be found in Moore (1996).

A good deal of the later writing on professional and expert thinking and decision making (for example, Eraut 1994) refers to the work of Hammond et al (1980). Hammond and his colleagues (see 1993) are concerned to distinguish between intuitive and analytical cognition, but significantly, they suggest that these are extremes on a cognitive continuum: “our approach rejects the traditional dichotomy between intuition and analysis. It is based on the premise that both cognitive processes and task conditions can

⁴ Such decisions may require interpretations and may be formulated in response to dynamic and even novel circumstances. However, they are retrieved from existing repertoires, or varieties thereof, and cannot be considered truly ‘creative’. Where intuitive decisions cannot provide answers, with which the individual feels comfortable, a later process of more deliberative decision making is likely to be triggered.

be arranged on a continuum from intuition to analysis” (1993: 146). With reference to studies which compare these styles, they point to the shortcomings in previous research which have failed to compare like with like. The authors contend that intuitive cognitions are ‘induced’ by particular configurations of task characteristics: large numbers of cues; perceptual measurement; continuous, highly variable cue distribution; uncertainty and brief time periods (p.149). The authors are quite explicit in their theoretical predictions (abstracted from 1993):

If (a) the task presents many redundant cues (attributes), (b) the cue values are continuous, (c) the cues are displayed simultaneously, (d) the cues are measured perceptually, and (e) the subject has available no explicit principle, scientific theory, or method for organising cues into a judgement, then the subject will employ intuitive cognition.

As a result of their experiment, Hammond and his colleagues concluded that expert judgement would be more accurate if there was a correspondence between task properties and cognitive properties. They also note that in situations of constrained cognitive style (for example because of time pressures) accuracy of judgement would vary with the place of the task on the continuum.

Sloman (1996) provides support for the intuitive, visual recognition means of reasoning. He contrasts the rule-based approach with that of ‘associative reasoning’, which is based on a recognition of similarity in a problem. The associative approach is automatic but capable of generalisation.

There is no doubt that in the decision making context described by this study, the term intuitive is appropriate for categorising the cognitive style induced by the complex, dynamic nature of the task, and the expertness of the coaches, and the absence of deliberation. There is some explanation possible for the non-conscious association

between perceptions, knowledge structures, and previous cases. However, the cognitive organisation induced and the mechanisms for accessing these memory structures needs to be explored further, since the literature admits quasi-deliberative processes, routine and novel solutions, and fast (reactive) and slower (more creative) intuitive behaviour.

Decision making by experts

The research question directs the study towards decision making by experts. There are a number of reasons for this: expert behaviour is a benchmark for education and training; the effects on performance are likely to be most pronounced with experts; and the literature will show that cognitive decision modes demonstrate development process stages⁵. This latter feature is best demonstrated through the comparison of novice and expert performance, which Hoffman et al (1995) describe as “a paradigm in cognitive research on expertise” (1995: 131).

It is important to realise that a good deal of the literature has treated expert decision making as flawed. Shanteau and Stewart (1992) describe how expert decisions are subject to the same biases as novices (Tversky and Kahneman 1971), perform less well than simple predictive models (Camerer and Johnson 1991), and that expert decisions lack validity and reliability. They do note, however, that more recent literature adopts a more positive view of expert behaviour. This is reflected in Shanteau’s (1992) paper. He presents a very critical analysis of the existing research, citing poor sampling and inappropriate comparisons. He details a ‘theory of expert competence’. The nub of this is that expert judgement is dependent on task characteristics and domain specificity, which

⁵ This is dealt with in a later section.

he illustrates with a table of good and poor expert performance. Interestingly for this study, poor expert performance is associated with dynamic stimuli, decisions about behaviour, less predictable problems, unique tasks, and problems which are not decomposable and where there is subjective analysis and few decision aids (1992: 259)⁶. In such circumstances, expert judgement may be less distinguishable from that of others, and is less verifiable or easily replicated.

Nevertheless, cognitive science research has identified ways in which expert behaviour is different to that of novices. Chi, Glaser and Farr (1988) review the nature of expertise. They comment that “experts perceive large meaningful patterns in their domains” (1988: xvii). This has been demonstrated in a naturalistic setting with the cognitions of fire-fighters (Klein 1990). Chi and colleagues also note that “experts see and represent a problem in their domain at a deeper (more principled) level than novices; novices tend to represent a problem at a superficial level” (1988: xix). Devine and Kozlowski (1995) emphasise the importance of domain-specific knowledge structures for decision making by experts and characterise them as having “speedy recognition of common domain specific patterns and the use of efficient search heuristics in conjunction with a set of solution routines. “ (1995: 294). The place of early recognition of patterns is often emphasised. Adelson (1984) suggests that experts perceive patterns in “abstract conceptually based representations” (1984: 483) whereas novices organise their perceptions at a much more superficial level. She suggests that the expert represents information as a ‘procedure’ and can, therefore, recognise and match more quickly because the process is not confused by the details (1984: 495). This perception was supported by the evidence from an experiment into the use of knowledge structures by

⁶ This seems to sum up the study context very adequately.

medical practitioners. Schmidt and Boshuizen (1993) found that experts used knowledge in an 'encapsulated mode' while comprehending a case, whereas students used 'elaborated' knowledge.

Hoffman et al (1995) provide a very extensive review of the literature on experts. Their focus is on the difficulties of knowledge elicitation from experts and they conclude that a triangulation of contrived experimentation, interviews and staged investigations are required. The paper is useful for emphasising the problematic (methodologically) nature of 'tacit knowledge', which is thought to characterise expert behaviour in which cognitions become routinised, declarative knowledge becomes procedural, and 'intuitive' access is developed to knowledge structures.

Randel et al (1996) describe an experiment into expert behaviour in the naturalistic decision making tradition. They employed an electronic warfare task to study the decision making process of more and less expert technicians. Their findings were that "experts put their emphasis on deciding on the nature of the situation, while novices are more concerned with deciding the course of action" (1996: 593). The previous experience, and stored solutions, of the experts allowed them to concentrate on appraising the situation. The authors also identify a capacity to focus on the most meaningful elements of the display and to have more developed memory structures: "expertise appears to take the form of a complex model of potential situations" (1996: 595). These mental simulations allow experts to interpret their perceptions and to predict outcomes with minimal effort. This capacity of the expert to focus on and make use of situation assessment to short-cut the decision making process has been demonstrated in clinical studies. Hobus et al (1987) reported a study into determining the use of initial

contextual data in the diagnosis of patient illness. Experts produced 50% more correct diagnoses and utilised the data more. This study supported the use of 'case scripts' in decision making against the propositional knowledge frames of the novice. Kushniruk et al (1995) investigated medical decision making in conditions of uncertainty and limited information. Verbal protocol analysis was carried out on data derived from 'thinking aloud' during treatment and management decisions. Expert subjects tended to focus on developing a more refined situational analysis of the decision problem. This suggests that experts situate cases alongside previous examples more so than do novices. A paper by Custers et al (1996) reported an investigation into the speed of case information processing by experts. They found that experts did process the data more quickly and processed typical data more quickly than atypical data. Experts seemed to possess "a particular sensitivity for completely prototypical cases, that is, patient descriptions in which both contextual factors and complaints, signs and symptoms are in line with the default values for the applicable illness script." (1996: 394). A clear picture emerges from these studies, in which the expert uses a developed knowledge structure to recognise patterns, employs a situational assessment to constrain the possibilities⁷, and then models the consequences of a small number of solutions/diagnoses. This may be a relatively fast and even 'quasi-intuitive' process. More deliberative, analytical and elaborate consideration is given when there is evidence of dissonance in the expectations and outcomes, or the situation is recognised to be unique and 'unrecognised'.

Expert-novice differences have also been a significant part of research into teachers and teaching. Byra and Sherman (1993) summarise the findings. Expert teachers made deeper inferences about classroom events (Carter et al 1988) and "recognise and rectify problem

⁷ This assumes a 'script' cognitive structure (unfolding sequence), which is discussed in the next section.

situations during interactive teaching more readily” (1993: 46). Schempp et al (1998) cite a number of papers as examples of interest in expert teaching behaviour in physical education – Griffey and Housner 1991, Housner and Griffey 1985, Schempp 1997, Siedentop and Eldar 1989, and Tan 1996, 1997. Schempp and his colleagues characterise the expert teacher as having “amassed a large quantity of knowledge and possessing elaborate cognitive schemata for meaningful interpretation and effective decision making ... (providing) ... a framework for differentiating relevant cues and attending to more salient information “ (1998: 343).

There is no doubt that decision making by experts has a number of distinctive features. Expert-novice research has pointed to the tacit nature of experts’ procedural knowledge, their capacity for interpreting pattern recognition, and the centrality of situational assessment. Problems are conceived of in abstract terms and this short-cuts the consideration of alternatives. This is made possible because the expert has built up a knowledge structure, which is based on experience and allows for efficient recognition, simulation and judgement. Shanteau (1992) provides a useful reminder that expert judgement is more readily distinguished from less expert judgement in identifiable circumstances and tasks. This study, which involves coaching, is problematic, in this sense, since it is characterised by less well structured and less verifiable problems. Naturalistic decision making promises a valuable extension of expert research. The more difficult question is the nature of the cognitive organisation that might produce such expert decision making, and it is this question to which the review now turns.

Cognitive organisation

The issue of how individuals structure, order and access their cognitive activity in relation to decision making is central to the research questions in this study, and central to the development of models of decision making. What form of cognitive ‘processing’ takes place when individuals make decisions? There has been an attempt to bias this review towards less-deliberative forms of decision making but this is much less well dealt with in the literature. Judgement/Decision Making research (see Goldstein and Hogarth 1997 for an up-to-date review) has paid considerable attention to time-pressure in decision choices but these studies are largely artificial, deadline-induced studies of alternatives⁸ (see Payne, Bettman and Luce 1996 for a review). The review begins with more general accounts of the cognitions related to decision making and moves to more specific accounts of research studies.

Overview of cognitive organisation

Eraut (1994) provides a valuable summary of the work done in the area, albeit a descriptive overview. His contribution is primarily in the education of professions and the need to distinguish between different types of knowledge. Eraut acknowledges the distinction between deliberative and ‘hot’ decision making. He suggests that routine decisions are based on a “combination of tacit knowledge and intuitive decision-making” (1994:111), which makes them difficult to monitor. The process is a cognitive one but “pattern recognition and experiential insight” (1994: 113) contribute to early stages of the

⁸ The reader should be reminded of the distinction drawn earlier between ‘choice decisions’ and ‘action decisions’.

process and give the impression of intuitive activity. He elaborates on the work of Dreyfus and Dreyfus (1986) who described a five stage model of skill acquisition – novice, advanced beginner, competent, proficient and expert. As the individual moves to expert status, decision making is based on an intuitive grasp of situation awareness and the deployment of tried and tested solutions. Most expert behaviour is considered to be ‘on-going’ and ‘non-reflective’. This is a useful descriptive model, but more detail is required on how such expert decision making is operationalised. Eraut (1994: 149) synthesises the concepts involved in the area and provides the framework for a set of models in which he distinguishes between instant, rapid and deliberative modes:

	Increasing timeframe →		
<i>Analysis</i>	Instant recognition	Rapid interpretation	Deliberative action
<i>Decision</i>	Instant response	Rapid decisions	Deliberative decision
<i>Action</i>	Routinised unreflective action	Action monitored by reflection	Action following a period of deliberation

Schmidt et al (1990), in describing how doctors move from memory based knowledge structures to memories of specific illnesses and then to memories of specific patients as they become more expert, reinforce the move to implicit behaviour but stress the recourse to ‘illness scripts’ based on particular instances from experience, diagnostic data, consequences and contexts. Unlike less experienced practitioners, who apply causal models based on production knowledge, experts recognise the similarity of cases and apply highly idiosyncratic ‘recipe’ solutions. The paper emphasises, therefore, the idiosyncratic nature of theories of action, and the place of tacit knowledge structures in personal hypothesis testing, which closes down the option range. In a very valuable paper, Boreham (1988) elaborated on three models of cognitive organisation: the rational

model, the template model and the interactive model. The first of these, the use of theory and logic to work out solutions, is dismissed by Boreham since expert-novice distinctions are not caused by rule-governed reasoning. The template model is based on the use of schemata, which represent 'types' of situations and their appropriate responses in a stereotypical way. This is based on Minsky's (1977) frame theory. Recognition of the frame or schema automatically triggers off the appropriate response from the store built up through the trial and error of experience by the expert. Boreham comments that there is a need for a human discretionary element to the template model. His third model, termed interactive, allows for the individual to create a new 'diagnosis' from fragments of the earlier frames and the data from the contextual information. This suggests a somewhat slower form of decision making than the automated response of the previous models.

In a later paper, Boreham (1994) proposes a 'dual cognitive architecture' to explain the intuitive, implicit practice of experts which he contrasts with the rather more deliberative, analytical and explicit behaviour of the novice. Processing in the latter case will be "serial, slow, effortful, capacity limited, easily stopped and propositional" (1994: 174). The more automatic, unconscious implicit processing is fast, effortless and procedural. Boreham calls upon the support of Broadbent (1993) for the simple distinction between the two, that is that the implicit is a direct response to an input, whereas the explicit involves a mediational process. He suggests that the former style is not available to introspection and is under 'schematic' control. The individual structures 'routines' for everyday activity but may not have the schemata to deal with irregularity, therefore calling on the explicit style for novel situations. Throughout the paper there is an assumption of non-conscious cognitions and these are brought into play as a regulatory

process for identifying novelty and irregularity. There is a distinction drawn between routine responses and more analytical processes but the author does not address the response to non-routine issues which are time-constrained.

Caplan and Schooler (1990) drew attention to the distinction between rule-based processing, which involves the use of schemata or concepts, and episode-based processing which is a “relatively holistic processing of an event involving minimal identification of component aspects of meaning” (1990: 215). In problem solving based on the latter, similarity recognition is used to match to similar previous experiences the solutions from which are then used in the new problem. However, Caplan and Schooler identify difficulties in applying the analogy-based approach with complex problems, which involve “multiple decisions, which may be inherently open-ended in nature, .. (and) .. in comparison with simple tasks, ... may be described on many characteristics or dimensions” (1990: 216):

Given the relatively large number of dimensions on which complex problems can differ, similarity-based retrieval of previous complex problems or tasks could easily lead to the retrieval of problems that are similar not in the characteristics critical for successful problem solution, but on some other dimension(s) or characteristic(s) that are irrelevant or even misleading to the solution. (1990: 216)

In the context of coaching, the apparent similarity of games to previously experienced examples may mask differences in a key dimension. This points to the need for expert identification of key features of the decision space.

The value of perceptual capacities in pattern recognition was recognised by Kirlik et al (1996) who demonstrated in an experimental environment that perception training could improve elements of decision making in complex tasks. The authors point to pattern

recognition, experiential knowledge and simple perceptually-based heuristics as the key to efficient decision making in complex, dynamic tasks. They provide a very concise description of the decision making process in such circumstances (1996: 288/299):

Empirical research by Brehmer (1990) and Brehmer and Allard (1990) strongly supports the notion that individuals tend to adopt heuristic (nonalgorithmic) task simplification strategies to cope with the demands of complex dynamic environments. ... The evidence suggests that at least the major components of the decision task in dynamic environments are dominated not by cognitively intensive (controlled) processes but, rather, by perceptually guided 'automatic' processes.

These heuristics, together with the set of analytical strategies an individual may possess, combine to enable effective dynamic decision making across a wide range of task situations. It is important to note, however, that as dynamic decision making becomes more skilled, individuals appear to rely more heavily on perceptual and pattern-recognitional heuristics and less on analytical strategies.

Klein's (1993) recognition-primed decision theory is a development of the immediate reaction to the perception of the problem space. He stresses the situational assessment which allows the experienced worker to immediately generate the most appropriate response based on previous experience. The individual adopts the solution associated with the 'recognition', which obviates the need for consideration of multiple alternatives. This reinforces the 'recipe-led' executive command response to recognised patterns. There is a danger, however, of routinised responses without adequate modification. This is presented in the literature in its most extreme form as a 'general heuristic', that is, a generic response to a problem which has a reasonably high probability of being successful but is not precisely derived from that particular problem and may not be effective without modification (Johnston-Laird and Shafir 1994)⁹. This has been called

⁹ This encapsulates the core/generic/key skill argument for generalised problem solving skills in education – but also points to the potential weakness of lack of practical transferability.

‘weak rules hypothesising’. There is a danger in coaching that such an approach characterises the approach of the novice or a coach whose analysis is ‘weak’.

Goldstein and Weber (1995) propose 4 categories of decision making based on the way knowledge is employed to evaluate alternatives – nondeliberative, associative, rule-based, and schema-based – each of which implies a different cognitive organisation. Nondeliberative deals with routinised decisions and the use of stereotypes and episodic memory to generate the actions taken and their consequences. They compare this to the expert’s intuitive decision making. Associative deliberation is also close to intuitive behaviour. An associative semantic network provides a stream-of-consciousness flow, which might provide feedback on a course of action. Rule-based deliberation includes explicit and implicit use of plans or procedures to guide decision making. This category can include both analytical and more intuitive strategies. In the final category, schema-based deliberation owes much to ‘explanation-based decision making’ (Pennington and Hastie 1993) and involves the construction and testing of models or structures of declarative knowledge. Scripts, mental models and categories are special cases in this model.

Schemata and scripts

The use of the terms schema (plural schemata) and scripts abounds in the literature and it is important to be aware of the meanings attached to them. Boreham (1989) defines schemata as “stereotypical representations of situations experienced previously (1989: 187). The schema is stored in memory and includes in it the appropriate response and the ‘typical’ outcome or consequence. The production is capable of modification by the

application of 'rules'. Evans (1989) describes a schema as “a knowledge structure which is induced or learned from experience, contains a cluster of related declarative and procedural knowledge, and is sensitive to the domain and context of the current focus of cognitive activity” (1989: 84). Kinderman and Humphries (1995) describe schemata as “constructions or ‘mental models’ (Johnson-Laird 1985) of the world, hierarchically organised knowledge systems consisting of mental representations of objects, people, events and situations” (1995: 437). Although constructed in different ways, schemata are our individualised frameworks through which we represent the world to ourselves. They can be elaborate or simple, accessed through automatic pattern recognition or more deliberative memory-based analytical cognitions, and are based on experiences. Although the knowledge structures are abstractions, the individual’s personal experience facilitates recognition and activation of appropriate elements (Brooks et al 1991). Weber (1993) draws on the work of Norman et al (1989) to describe the range of access: “a fast associative recognition process in which the set of presenting symptoms is considered as a whole, and a slower analytical feature-by-feature analysis, activated after the failure of the pattern recognition process” (1993: 1162).

A script, in the context of cognitive organisation, is a particular kind of knowledge structure. Custers, Boshuizen and Schmidt (1996) identify three main components of what they term ‘precompiled packages describing a general sequence of events’: enabling conditions, an understanding of the phenomenon presenting (for example, an understanding of what a specific illness means, or what constitutes and causes demotivating behaviour in school-children), and how the phenomenon will be perceived. The individual’s knowledge structures will also associate prescribed solutions although these may be idiosyncratic. Custers and colleagues propose that scripts are activated by

individuals 'filling in' the default values in the script by what is observed. There seems little doubt that the initial stages are very important in activating appropriate hypotheses about the problem (that is, which script to fill in) and, therefore, the decision required.

An example of this is the diagnosis of illness scripts, which have figured significantly in the decision making literature. Most discussion of scripts acknowledges the earlier writing of Abelson (1981). He defines a script as (1981: 717):

a hypothesised cognitive structure that when activated organises comprehension of event-based situations. In its weak sense, it is a bundle of inferences about the potential occurrence of a set of events and may be structurally similar to other schemata that do not deal with events. In its strong sense, it involves expectations about the order as well as the occurrence of events.

Clearly the use of schemata or scripts does not produce an algorithmic solution, that is, one which has a guaranteed match between the problem and the action decision. Cheng and Holyoak (1985) propose 'pragmatic reasoning schemas' which are neither context-free rules nor memories of specific cases. Their practical approach to 'narrowing down' options invokes principles related to the context and the objective.

Cognitive organisation assumes that knowledge is stored by the individual in some form of schema or framework. This knowledge is not simply declarative (i.e. 'about' things) but is propositional (relationships between concepts) and procedural (a knowing 'how').

Knowledge structures are both abstractions and specific instances stored in memory.

Anderson (1982, 1990) proposes that declarative knowledge becomes propositional knowledge and that experts learn production rules which allow them to use 'if ... then' reasoning and to recognise similar productions in varying problems. Devine and Kozlowski (1995) conducted experiments into the performance of high and low knowledge individuals. They discuss the possibility that when dealing with ill-structured tasks, high knowledge individuals, who are perhaps no better than others in these

circumstances, will make better use of additional contextual information which is easily categorised. They found some support for reduced information search in well-structured decisions. Earlier in the review it was noted that experts' knowledge is stored in tacit form, i.e. it is not easily accessed or verbalised. Clearly this has some advantages for effortless cognitive performance but is difficult to elicit. Hoffman et al (1995) suggest that depth interviews and contrived (perhaps better expressed as 'indirect') methods are required.

Kinderman and Humphries (1995) suggest that an individual's involvement in short 'vignettes' or perhaps role play is necessary for the development of scripts, and they go on to consider how this might be developed in professional training. Scripts would appear to be a very useful tool for comprehending and operationalising process related events. It seems clear that the value of the script in decision making is in comprehending likely consequences, and is enhanced by speedy identification of the necessary script. Early recognition, enabling conditions and hypothesising are important elements, to which the review now turns.

Situational assessment

Evans (1984) distinguishes between choice processes, which may or may not be analytical, and the 'pre-attentive' phase in making judgements, which he terms heuristic¹⁰. He describes these processes as "pre-attentive, rapid and indescribable by the person using them" (1984: 452). Evans' heuristics identify the 'things' about which

¹⁰ Evans' use of the term in this way contrasts with the consensual use, which is a 'rule of thumb' mechanism for deciding between alternatives particularly in conditions of some uncertainty.

judgements need to be made. Clearly this places the emphasis on early detection. Levin and Jasper (1995) propose and test their suggestion that noncompensatory strategies are used to 'narrow down' the range of options, after which compensatory mechanisms are employed to 'compute' a final choice. The authors found support for their proposals, which they term 'phased narrowing' and, importantly, identified that the key attribute used in the noncompensatory early detection remained important at later stages. This reinforces the importance of early decisions: "it would appear then that in multistage decision making, decisions made in the early stages are particularly crucial to the decision that is finally made" (1995: 7) (another way of putting it is that individuals tend to stick to decisions once made).

Situation assessment is also recognised to be important in naturalistic settings. Federico (1997) found some support for a relationship between naval officers' metacognitions about elements of situational assessment and their performance on situation assessment tasks. Randel et al (1996) point to the criticality of the time factor in complex, dynamic settings and emphasise the situational assessment element of recognition-primed decisions in such circumstances. The correct assessment of the situation reduces the need for multiple options to be considered. This might be thought of as analogous to the 'breadth-first' approach at the problem framing stage. In complex dynamic situations, there is a need to continue the monitoring of the unfolding situation for two reasons: firstly, because the action decision 'point' may be the crucial issue, and secondly, because amendments to the solution may be required. Some form of modelling seems likely here. In papers referred to earlier, Custers et al (1996) emphasised the importance of 'enabling conditions', and, although in their study the effect size was small, found some support for the significance of the integration of information about enabling

conditions for later stages of diagnosis. Hobus et al (1987) found that experts were able to use information from enabling conditions more effectively, and Kushniruk et al (1995) found that experts tended to focus on developing a more refined situational analysis of the decision problem. The issue of early and correct identification of the problem (problem framing) is particularly important in complex, dynamic problems in naturalistic settings. This is unlike the decision choice experimentation of much of judgement/decision theory in which enabling conditions and environmental conditions are treated as non-problematic givens (other than for their probabilistic weightings).

In rapid unfolding situations, such as volleyball games, there is no time for probability based 'simulation heuristics' (Kahneman and Tversky 1982). It may be necessary to invoke heuristic (in the sense of selective key attribute) based recognition short cuts, but with a 'weighting' attached. Individuals may selectively attend to the environment on the basis of experience and may operate a 'crisis threshold' approach to cope with the scale and complexity of the information. It has been suggested that coaches operate on a system of performance triggers or thresholds (Lyle 1996: 25):

Progress within a performance range will not trigger substantive changes to the programme: nor, indeed, will reduced performance or lack of progress although this will be allowed to continue for a limited period of time before being investigated and evaluated, and action taken.

The study of chaos and complexity in modern science (Waldrop 1992; Lewin 1992) has prompted a revision of approaches to contexts which may be characterised as complex systems (Barton 1994), although Stein (1989) warns against attributing the rubric of complexity to the simply complicated. Nevertheless, McNaughton (1989) is an example

of the neuro-physiological contribution to the science of complexity, which may provide some insight into cognitive organisation. His ‘basin of attraction’ (some messages are more important than others) and its potential for being reinforced during activity is a useful concept for understanding key attractors and situation assessment.

In experimental, well-structured problems, little attention is paid to hypothesis generation (Weber et al 1993). In routine cases, and in simplistic scripts, there is the “uncontested activation of a simple diagnostic category by the (set of presenting symptoms)” (1993: 1152). Experts may also be able to employ case-based recognition to supplement more analytical processes. In their study, Weber and his colleagues found that hypothesis generation was sensitive to clinical information and background factors (enabling condition), were based on likelihood rather than severity of consequence, and included at least one ‘severe consequence’ option. In the context of coaching, the coach will be asking questions such as ‘what is likely to happen if?’. Hypothesis generation is related to what is termed forward or backward reasoning. In rule-based problem solving, forward reasoning involves the use of given data to generate a hypothesis: backward reasoning generates the data on the basis of a hypothesis. Patel et al (1990) found that in medical diagnosis inaccurate diagnoses were accompanied by backward reasoning. They argued that disjunctive or non-salient data induces the backward reasoning in an attempt to account for the disruption to the expected pattern. It is important to remember that these comments apply to analytical problem solving. In an interesting paper, Dougherty et al (1997) examined the mechanisms by which individuals generated causal scenarios. They found that using a ‘single path reasoning strategy’ increased the individual’s confidence in the scenario. The individuals created a few scenarios at the early stages of the problem but quickly reduced these to one or two alternatives.

Situation assessment is a very important part of the decision making process, and clearly there is an attempt to simplify this feature. Deliberative, analytical sifting at an early stage (the compensatory mechanisms) may have to be reduced in the non-deliberative context to a similarity-recognition prompting of a solution based on a triggering of a key attractor.

Anticipation and amendment

An important aspect of decision making is whether the individual can anticipate and/or amend and adapt to the changing conditions likely to be experienced in dynamic, interactive circumstances. This may involve monitoring the unfolding script or having the capacity to alter the decision space. The latter may be more important in serial, interactive events. Schon's (1983, 1987) work has received considerable attention and is applied widely in teacher education. He stresses the professional's practical competence (procedural knowledge) in 'divergent situations'. In conditions of uncertainty, instability and uniqueness, professionals draw upon their own experience in a highly intuitive manner. His basic premise is that professionals are capable of 'reflection-in-action', a quasi-conscious, critical re-examination leading to fairly immediate action. Eraut (1994) is critical of Schon but his comments are very apt for an insight into this study: "reflection is best seen as a metacognitive process in which the practitioner is alerted to a problem, rapidly reads the situation, decides what to do and proceeds in a state of continuing alertness" (1994: 145). Metacognition in this context, therefore, involves pattern recognition, reframing, option closing, and a feedback mechanism on action – perhaps a rapid hypothesis testing according to a tacit personal theory of relevant action.

Beckett (1996) is also critical of Schon's premises. In a very closely argued paper, his view is that there is 'no such thing' as reflection-in-action. He suggests that the professional is making a judgement to continue (or not) and that this is linked 'reflexively' to sub-episodic aggregations, but not 'reflectively'. Beckett makes a case for 'anticipative action'. He suggests that a concept of 'feedforwardness' might be useful to explore: what he calls "an anticipative conversation with our practices is closer to what goes on in 'hot action'" (1996: 149). Brehmer (1992) also uses the term 'feedforward' when he suggests the use of models to predict the state of complex systems.

J/DM and time pressure

There is an element of non-deliberation for the individuals in this study. This is perhaps more obvious in naturalistic settings, and in these situations it has already been noted that individuals are focused on action decision making rather than choice decisions. However, there are some useful lessons from the J/DM experimental tradition. Payne et al (1996) note that under time pressure (usually 'deadline' induced) people accelerate their processing, are more selective, and change decision strategies from more depth first to breadth first. Payne and colleagues draw on their earlier work (Payne et al 1990, 1993) to validate their effort/accuracy theory. Their recommendation is that individuals in constrained circumstances should generate and scan multiple options on an attribute basis, rather than consider each alternative in isolation. In an interesting comment (1995: 131), they emphasise the opportunity/cost element of constrained decisions. They quote Eisenhardt (1993:121): "the decision making dilemma in such environments comes from the fact that it is easy to make mistakes by deciding too soon and equally ineffective to delay choices...". This seems likely to be a factor in limited choice action decisions in

which the decision is centred on 'to act or not, and when'. Custers et al (1996: 386) comments that atypical information can be expected to take more time to 'fit into' a script than typical information, although it is not clear whether this is a problem of script identification or the default-filling elimination of options.

As has already been stated, decision theory is based on research, which has followed the experimental, laboratory-based investigation of mostly static choice-based decisions. Although these are not directly analogous to the context of this study, a number of potentially useful principles have been established. The distinction between compensatory and non-compensatory choice strategies has been formulated in these studies. Compensatory strategies are cognitively complex and analytically sophisticated: for example, linear models give a weight to each attribute within a decision alternative and aggregate these to make a choice; additive difference models compute weightings across attributes and then sum the differences. In the context of volleyball coaching, coaches may have to decide between the disruption to the opposition advantage of taking a time-out and the disadvantage of the disruption to their team. The compensatory strategy might consider time, score, psychological effect, the maturity and experience of the opposition, the strength of the service-reception formation etc.. In non-compensatory models, the rules are simplified to reduce the complexity and high scores on one dimension do not compensate for low scores on another: conjunctive strategies reject decision alternatives that do not meet a minimum criterion; elimination by aspect strategies examine each alternative via a process of ranked dimensions; lexicographic strategy selects by choosing the most attractive alternative on the most important dimension (after Ford et al 1989). The coach may decide that momentum disruption is more important than any other effect. Research has determined the situations in which

different strategies are employed. For example, Billings and Marcus (1983) found that different strategies were used by decision makers during information acquisition and integration into decisions stages. Beach (1990) found that individuals switched to the simpler strategies after the initial screening-out stage. With an increase in perceived importance, individuals used more speed but were more careful and rejected fewer options (Beach 1993). In a review article, Ford et al (1989) found compelling evidence that non-compensatory strategies were most often employed.

In an experimental task, Hansen and Helgeson (1996) confirmed their hypothesis that, with time pressure, individuals will focus on displayed rather than calculated information and will employ non-compensatory strategies. Very interestingly, they identified what appeared to be a loss-minimisation heuristic with time pressure. This might be interpreted as conservatism – a reluctance to take chances (perhaps non-consciously acknowledging the uncertainties involved). In a very interesting paper, Lipshitz and Bar-Ilan (1996) identified three heuristics for problem solving: do not rush into action; diagnose as early as possible prior to taking action; and choose solutions with a wide range of ‘coverage’. Although these might seem unrealistic in non-deliberative contexts, they might appear to be useful guiding principles in naturalistic settings.

There is a very extensive literature on J/DM and a growing literature on NDM. In trying to find theoretical support for non-deliberative decision making, it has been necessary to adopt an eclectic approach to the literature. It is clear that there is support for apparently intuitive responses to pattern recognition drawing upon schematic organisation of knowledge and experience stored in memory. It is not so clear that this occurs in more complex, uncertain situations. There is a strong possibility of an ‘associative’ level of

non-conscious monitoring based of perceptual similarities. Event script is well documented and operates by establishing the default criteria at an early stage. This then triggers an holistic appreciation of the hypothesised event, including the necessary actions. This would appear to be rapid but perhaps not instant. More analytical, deliberative decision mechanisms are available when less time constrained. In all circumstances situation assessment is important and a trigger mechanism appears to operate on key variables in the environment. Anticipation is less well understood because of the complex and incremental element of some naturalistic settings. The lack of evidence is a partial reason for this study.

Lessons from the literature on sports coaching

The rationale for the study drew upon a range of literature sources to justify the value of the work and to demonstrate the need for such research. The purpose of this part of the review is to identify any sources, which have a direct bearing on the study, how it might be carried out, and what expectations there might be from its findings. Overall, there has been little rigorous investigation into sports coaches' decision making outwith the episodic, experimental setting. This relationship between teaching and coaching paradigms has not helped coaching research (Lyle 1998). In summing up the literature, Lyle (1996) says "with a few notable exceptions, there is no reference to the conceptual underpinnings of coaching practice. Where prescriptions exist, they tend to be episodic, based on the teaching paradigm and simplistic 'objective' models" (1996: 17). Despite the resources invested in coaching education and the support for elite performer programmes throughout the world, influential writers feel able to aver that coaching is an art form (Woodman 1993). Nevertheless, there is an increasing recognition that coaching

is a cognitive activity. Franks et al (1986) constructed a quasi-quantifiable coaching model to assist direct intervention¹¹ decision making by the coach. Having reviewed the research literature on coaching behaviour, Abraham and Collins (1998) conclude that coaching expertise is “a knowledge of making correct decisions within the constraints of the session. Thus coaching is not a behaviour to be copied but a cognitive skill to be taught” (1998: 68).

Unfortunately, there are few research studies to support this assertion. Cote et al (1995) used knowledge elicitation procedures to structure the knowledge of expert coaches into a conceptual model. They found that coaches constructed a mental model, which was used as a ‘working model’ to guide the coaches’ day-to-day decisions in a deliberative context. Although the authors discuss some of the properties of knowledge schemata, this is not based on any findings. In a similar type of study, Salmela (1995) interviewed 21 expert coaches, each of whom had coached for over 10 years. While Salmela did not present any specific insights into non-deliberative decision making, he summarised in a way that makes it clear that coaches operate as experts, using tacit knowledge which can be accessed and non-conscious procedures that are difficult to investigate. They have “a metacognitive form of knowledge which experts possess and are able to verbalise. A number of contingencies are brought into play which allow their decision making and operational styles to be precisely formulated into effective ways of coaching” (1995: 13). To some extent this helps to explain the reaction of authors Gould et al (1990) who were disconcerted that “less than half of the coaches sampled felt that there exists a well-defined set of concepts and principles for coaches” (1990: 337), in a study of elite

¹¹ Direct intervention is referred to by Lyle (1996:21) as encompassing training sessions, competitions and other purposeful interactions between coach and performer. In the context of this study, the coach’s management of the competition environment, including match coaching decisions, is certainly embraced by this term.

American coaches. However, the coaches also cited experience and interactions with other coaches as their primary means of developing knowledge. It seems highly likely therefore that the coaches operate to these concepts and principles but that they are largely tacit.

The nature of the competition and the coach's role is very sport specific (Cote et al 1995) and it was this that forced Bloom (1997) to focus on pre- and post-competition behaviours. Perhaps the key is that there have been few studies of coaches' operating practices, which have focused on decision making, and even fewer naturalistic studies of coaches. Lyle (1992) investigated the coaching practice behaviour of 30 experienced coaches of national and international performers. He concluded that "there seems to be little doubt ... that the detailed implementation of the coach's intentions and the crisis management of the process is not approached in an overtly systematic fashion. Coaches take decisions based on feelings or intuitions" (1992: 467). This balance of rational intention and apparently intuitive implementation has been replicated in several follow up studies (Cross 1995, 1995).

In an interesting study, Duke and Corlett (1992) investigated the factors influencing basketball coaches' time-out decisions. They cite Leet et al (1984) as reinforcing the potentially important nature of coaching decisions on performance, and commented on the lack of previous research: "despite acceptance of timeouts and substitutions as important parts of many sport contests, the circumstances surrounding how coaching intervention decisions are made have been studied very little and we have limited insight into how coaches themselves understand their own decision making" (1992: 334). The study investigates why rather than how coaches made decisions. They identified the

physical state of the players as most often leading to a timeout. The authors acknowledge that coaches will employ heuristic approaches to make sense of the 'chaotic stimulus array' in the game and are likely to reduce the game to relatively few factors in order to engage in more rational decision making.

There is another series of sources within the literature, which has dealt with coaches' decision behaviour. This is based on a teaching, episodic interpretation of coaching but has focused more closely on the theories already referred to throughout this review.

Jones, Housner and Kornspan (1997) investigated the interactive decision making and behaviour of experienced and inexperienced coaches. In an earlier paper (Jones, Housner and Kornspan 1995), they had demonstrated that experienced coaches used contextual information (enabling conditions) more so than inexperienced coaches. This work replicated and supported other papers on physical education teachers (Housner and Griffey 1985; Griffey and Housner 1991; Byra and Sherman 1993) in which "experienced physical education teachers appear to make use of routines or mental scripts that include specific task structures, management strategies and instructional statements" (1997: 456). In the 1997 study, Jones and his colleagues found that experienced coaches made fewer changes to plans and had more alternatives available. However, the studies were behavioural analyses and very limiting: future research should "move beyond assessments of the type and frequencies of behaviours and cognition and begin to address ... how experts integrate and apply knowledge" (1997: 467).

As stated above, these studies are reflective of a more general approach to teaching expertise¹², although it is worth noting again the confused conceptualisations of teaching and coaching¹³. The work in this field is similar in nature to the contrived conditions noted in experimental decision theory research. For example, in the Housner and Griffey (1985) study, which is very widely cited, the teachers taught only 4 children and there were only 6 subjects (3 experienced and 3 inexperienced). More naturalistic studies would be welcome.

In general the assumption is that (Tan 1996: 152)

Differences in the kinds of schemas (or knowledge structures) developed may lead experienced and novice teachers to focus on different types of environmental cues. ... Experienced teachers are more adept at identifying important cues in the teaching environment critical for decision making (and) they are more adept at matching problems with solutions while teaching.

In Tan's study, he found that the perceptual maps of experienced teachers were more complex and better organised. Interestingly, he concludes with a familiar plea that more work is required to link teachers' schemata with teaching behaviour. A study by Graham et al (1993) focused on the 'situational decision making' of physical education teachers. This was explained as "when teachers are planning, (their) predictions are anticipatory and based largely on beliefs acquired from previous experience. In classroom sessions,

¹² Work by Calderhead (1981, 1987) was originally reviewed as this study began. His work, and that of others, replicates the sources and findings referred to in this review. A decision was taken to focus on the physical education literature in teaching since it most closely approximated to the coaching literature.

Calderhead (1987:2) quotes Doyle (1986) as characterising the teaching context by its multidimensionality, simultaneity, immediacy, unpredictability, publicness, and history. These seem very apt descriptions of the match coaching contest. However, much of the writing is descriptive. It acknowledges that teachers operate within schemata-driven knowledge structures, in an interactive fashion, but this is not explored in a theoretical way. There is, however, an assumption that schemata (content knowledge, procedural/instructional strategies, and schemata about children) are being developed during pre-service and in-service practice. This field of study is more directed to professional development and education than decision making per se.

the predictions are made more existentially through a process of giving and receiving cues” (the authors cite Bolster 1983: 296). There is a description of previous research but no developed theoretical explanation. Graham’s results replicated previous findings but the authors were self-critical of the contrived nature of the methodology.

The papers reviewed above present a clear picture of an underdeveloped research area. There is a good deal of related research in teaching and, when interpreted within a teaching/coaching paradigm, this reflects the more general theoretical work done on cognitive organisation. However, there is no substantive body of work either on coaches in the competition situation, or in the context of their more generic ‘performance coaching’ process (see Lyle 1998). Although the terms interactive teaching and situation decision making are used, the issue of non-deliberation has not been explored. Nevertheless, the use of knowledge structures, scripts and early situation assessment appear apposite, but are not explored in theoretical terms in the literature reviewed.

Volleyball

It is perhaps not surprising that volleyball-specific sources are not useful for their insights into decision making from a theoretical perspective, since the majority are designed for a more general, usually playing, audience. On the other hand, it is perhaps more surprising that coach education materials do not deal with match coaching issues more directly. This is also a reflection of the more general shortcomings of coach education for experienced coaches, that is, those who have moved beyond participation coaching. It should be recognised that coach education is dependent on courses, role-

¹³ A good example of this is the article by Pieron and da Costa (1996)

play, mentoring (albeit rudimentary) and learning from experience, and not transmitted in 'finished' sources. Abraham and Collins (1998) discuss proposals for coach education at some length and suggest mentoring, case approaches, hands-on, and general problem solving approaches in addition to declarative knowledge. It is perhaps inappropriate, therefore, to criticise coach education for not transmitting procedural knowledge (knowledge how to) in a more suitable form and then also be critical of the lack of published sources¹⁴.

Volleyball as an interactive team sport, played at all levels, and by both sexes, is used as a context for studying any social-psychological research issue (e.g. Starkes et al 1995; Alexander and Krane 1996), and issues of specific interest to volleyballers about the performance of the game (e.g. Fellingham et al 1994; Katsikadelli 1997) will also be published in academic journals.

The non-research literature on volleyball falls into a number of categories. The first of these are the sport-specific 'textbooks', which deal with the techniques and tactics of the game. These convey information about how the game is or should be played and will contain information about the drills and exercises, and perhaps with more advanced texts, the physical conditioning requirements, match analysis techniques etc. (e.g. Sellinger 1986; Frohner 1993; Neville 1994). There are also those books, which are 'about' the game – anecdotal, historical, event-orientated. These may contain some insights into coaching strategies (e.g. Beal 1985). There are some 'how to' books which also contain sections on coaching. In an early one of these, Nicholls (1973) identifies reasons for

¹⁴ Another possibility, but one which is difficult to assess, is that the sport has simply not attended to the theoretical issues related to decision making during match coaching. This would not be surprising given the tacit nature of the coaches' expertise and its (potentially) idiosyncratic nature.

calling timeouts and using substitutes. These include “when the opposing team gains three successive points through its serving, smashing or blocking; when the opponents have reached one of the stages i.e. 4,9 or 13 points and your team is two or more points adrift; and when all timeouts have been used and it is necessary to break the concentration of the opponents at a vital point in the game, a substitution can be used” (1973: 209). These ‘rules’ are repeated in a number of sources and may form the basis of ‘procedural rules’. A more modern text by Herbert (1991) has a short section on match coaching responsibilities. Amongst other things, he suggests that a coach must “possess adequate recognition skills, which manifest in the ability to evaluate the team’s performance in relation to the plan and to recognise when adjustments are needed” (1991: 192). More interestingly, he goes on to say that the focused, insightful coach can see “through to the fundamental components of the game and can zoom in on its critical elements ... the undifferentiated mass can overwhelm us, but we must learn to select certain items for focus” (1991: 193). He then goes on to suggest a number of strategies for ‘reading the game’. The inexperienced coach could understand these recommendations, but would not (in all probability) have the developed capacity (schemata, scripts etc.) to carry it out without purposeful and/or successful experience.

There are a number of further sources contributing some understanding about the game. Statistics can be useful for conveying elements of the scale and uncertainty of the task facing the coach. The Final Report of the FIVB World League (FIVB 1994) indicates that the average length of the matches in the final stages was 2 hours 01 minutes; the longest set was 67 minutes and the longest match was 3 hours 03 minutes; the most

frequently recurring scores in the 291 sets were 15-12 (40 games)¹⁵ and 15-13 (32 sets)¹⁶.

There are also a number of magazines published within volleyball. These are normally for members of the national associations and may contain 'technical tips and insights' This is a way of disseminating knowledge and good practice. In one of these Hippolyte (1990) suggests that the most important factor for the coach is to constantly assess the 'condition' of the game. Hippolyte (1993) went on to publish a book outlining his philosophy about coaching. In this he draws from a wide variety of sources including historical writers on warfare tactics and strategy. In books such as those identified earlier (e.g. Selinger 1986; Herbert 1991, Neville 1994), the notion of strategy and tactics is interpreted as a matter of player formations and interactive movements, with basic principles of overload, surprise and 'percentage/risk' plays. Hippolyte's book is more concerned with match coaching strategy and the accompanying tactical implications. He is particularly keen on a sense of tempo and rhythm (and its variation) in the play and the contributory factors to the creation of momentum. His suggestions both advise and assume that the coach can 'read the game', although the philosophy of his coaching is evidently more about control than reaction.

Overall, the volleyball literature does not attend to the theoretical issues behind decision making in coaching practice. To a variety of extents and in more or less accessible fashions, it provides the principles which will be built up into the coach's schemata when integrated with 'if ... then' scenarios, conditions and experience of consequences.

¹⁵ One set finished 22-20

¹⁶ It would be reasonable to surmise that the most frequent set scores were those in which the coaches' match coaching capacities would be most tested.

Integration of the Literature and the Creation of a Conceptual Model

As has been indicated before, the purpose of the review of literature is to delineate the field, to evaluate the coherence of the materials available and to evaluate the theoretical underpinnings available to the study. More specifically, at this stage, it is necessary to come to a position about the potential explanations available to account for the cognitive organisation behind the decision making of the individuals within the study context. A conceptual model is needed to establish the relationship between the relevant variables and, as a consequence, to shape the methodology.

Care needed to be exercised in the creation of the models of decision making. Since it was evident from an early stage that the literature on non-deliberative decision making was an under-researched area, it would be necessary to summarise the literature available and to use an induction process to suggest models from the existing explanations. At this stage it is not a question of which models are most relevant, but what range of models is required to develop an understanding of the research question. Inevitably, and quite deliberately, there is a degree of linkage between model identification and the known assumptions of the research context. For example, it has been assumed that the coaches' decision making is apparently intuitive and non-deliberative, and that decision making within the match context is constrained by the ritual/legislative mechanisms available and the resources available. For all the reason adduced above, it is necessary that the model identification stage is transparent, and the explanations are therefore given at some length.

It will also be obvious that a degree of 'untidiness' should be expected at this stage. It is a naturalistic decision context, the overall category (non-deliberative) is under-developed, and the expectations of the coaches' behaviour cannot be firm. Whilst there will be an acceptable level of rigour in the methodology and the claims made for the findings from the study, the models of decision making themselves must at this stage be a little speculative. This is another reason for detailing the thinking behind the identification of the models.

There were four stages in the conceptual 'building' process:

- (a) The first is a preliminary model identifying the research field, basic relationships between concepts, and the sorts of questions raised. This model is capable of refinement, and its primary purpose is to act as a 'primer' for the researcher.

Figure 1 (page 64) depicts this model. It is relevant to note that the model was developed on the basis of preliminary reading and the researcher's insight into the issues, and would not be constructed in this form at a later stage in the study. A more refined interpretation of the theoretical decision making concepts has since been developed. However, the questions indicate a perceived direction for more intensive literature searching.

- (b) The second stage was to refine the model more closely in the light of the theoretical constructs, which would form part of the final model. It was also necessary to move from the 'scattering' of the research field to a clearer view of the decision process itself.

Figure 2 (page 65) depicts this second stage model. At this point there has been no attempt to make the model conform to a non-deliberative pattern. There are two features: firstly, an acknowledgement of the terminology of the decision process, and secondly, a distinction between a purely executive response to a pattern recognition and a similarity-based recognition process. In addition, some of the key factors to be incorporated into the final model have been identified. From this point it was possible to finalise the reading and attempt to produce working models of decision making appropriate to this context.

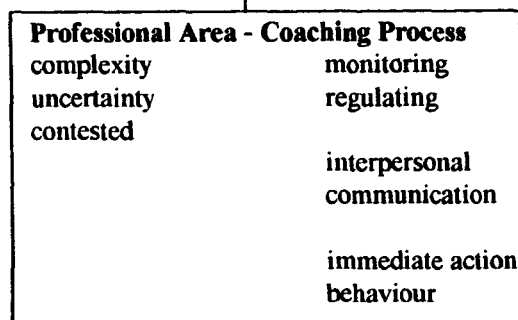
- (c) It is necessary to identify the task environment associated with the study. For this reason a conceptual model of the volleyball match coaching process was created. This is depicted in Figure 3 (page 66). This model details the likely factors within the decision process, which are occasioned by the task environment i.e. the game rules and the role of the coach.

- (d) The final identification of the decision models has to be concise enough to be useful in the methodology. These models would form the basis of the operationalisation of the data collection procedures and would form the basis of the subsequent analysis and discussion. The final categorisation of models is shown in Figure 4 (page 67).

As indicated above, it is necessary to demonstrate some of the thinking, which was induced by the literature. This is presented in a list form. The induction process involved the creation of patterns from the literature and, significantly, included a

Figure 1: Delineation of a Research Field - Conceptual Model (Decision making by expert coaches)

Decision-making by coaches
(professional knowledge / instrumental action-related)



Hot Action
(e.g. match control)

Process Context
* crisis thresholds
* recipe-routines
* theory/principles

HOW

Deliberative
(e.g. schedule planning)

Meta-Cognitive System

Q. What is the nature of the meta-cognitive approach adopted by expert/competent coaches

Skills Experience Knowledge Personal Char.

EXPERT

NOVICE

← Education

possible cognitive organisation

Schemata/frames (context related variations of principles)	Script (library of case law)
----------------------------------------------------------------------	----------------------------------------

Q. Are scripts/schemata ideographic?

Q. How is knowledge/experience integrated into the decision-making process?

Q. Are there common context 'attractors'? What are they?

Contextual Patterns

Executive Routines	Situation Recognition	Hypothesis Testing + heuristic Develop
Amend		

Tacit Knowledge

Q. Can coaches rationalise decisions?

ACTION DECISION

Q. Do experts make decisions differently from novices?

Q. Appears intuitive

Q. Do novices recognise patterns?

Q. What degree of 'reflection' is possible?

Q. Can novices amend recipes/routines?

Figure 2: Conceptual Model of Decision Stages

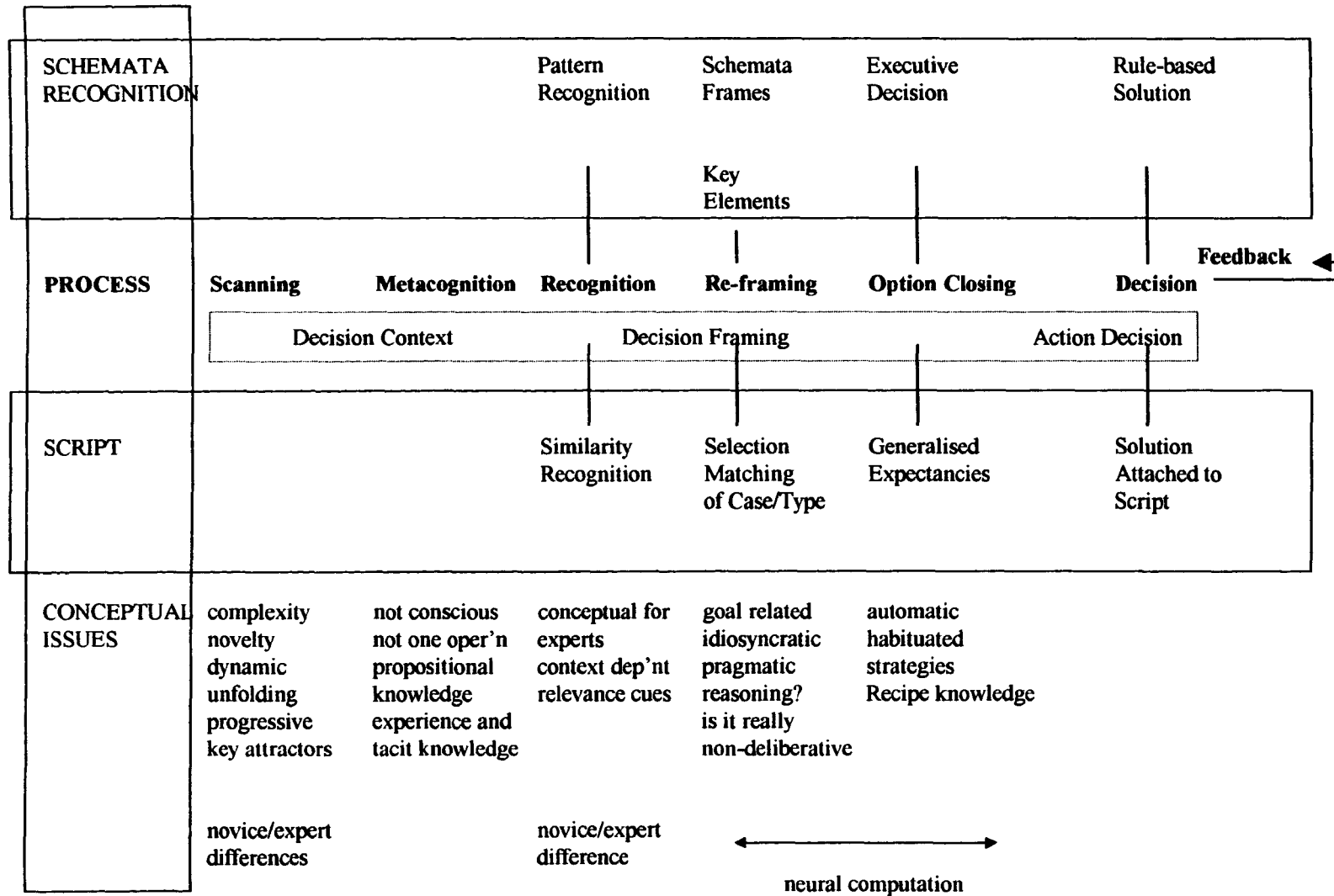


Figure 3: Conceptual Model of the Volleyball Game Process

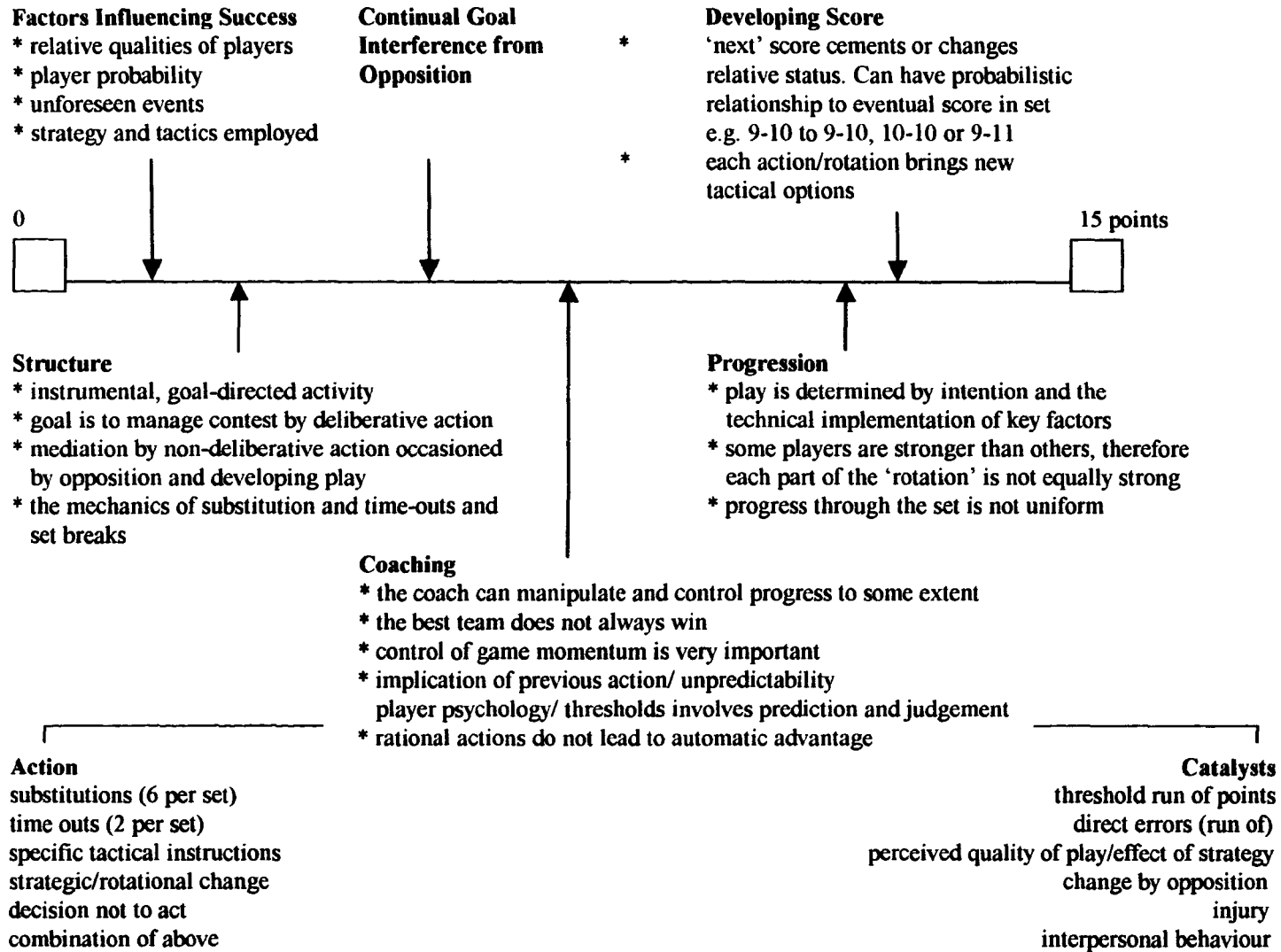
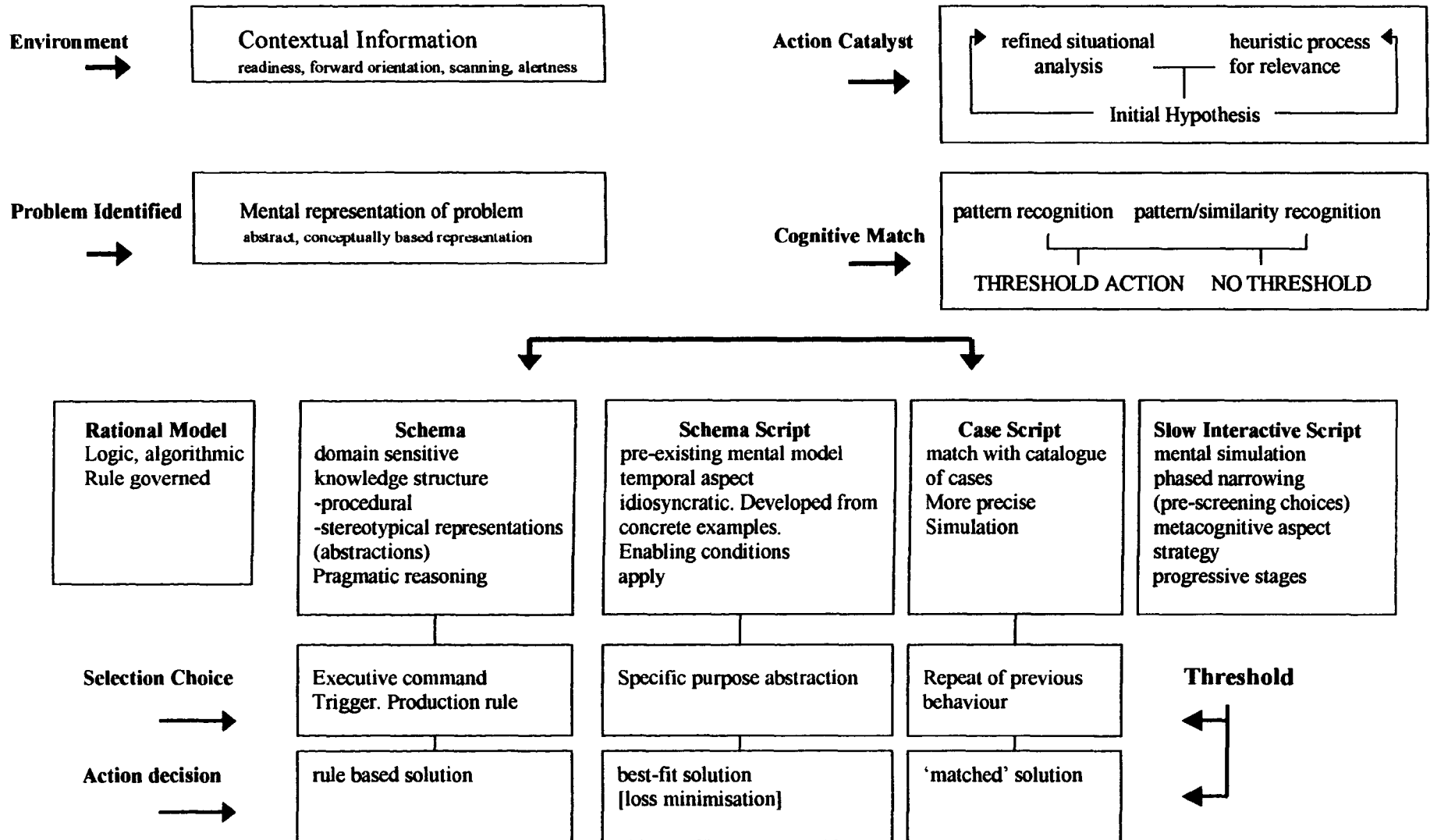


Figure 4: Conceptual Model of Decision Making in the Study Context



process of rationalising the evidence in the volleyball context of the study being undertaken. The points made are not sequential.

- Will coaches base judgements on the ‘current interpretation’ of the players, or their accumulated knowledge of them, or both? Short term memory of the players’ current ‘form’ may conflict with schemata or case held knowledge. Would this have to be built into a new ‘script’ every time?
- There needs to be a realisation that ‘interaction’ decisions are not so free standing as may have been assumed. These may include spur of the moment decisions but do they aggregate into an unfolding picture?
- The literature on experts suggests that routines and short-cuts should be built into the models, and that these will give the impression of being intuitive.
- It will be accepted that individuals have various types of knowledge (declarative, propositional, and procedural) stored in knowledge frameworks of different sorts – schemata, scripts. It will also be accepted that abstract frames will be accessed differently from script (which are more event/process related) and case memory.
- Schemata or frames are accessed via ‘trip’ patterns or markers. Schemata are acknowledged to be idiosyncratic. It is to be expected that there will be key factors, which will trigger responses. It is not clear whether or not these will show more similarities or differences between coaches.
- Schmidt et al’s (1990) suggestion for a recollection of specific cases will be built into the models. It is not clear at this stage what would constitute the ‘case’ – would it be the game, the set, or sub-episodes. An alternative is that it might be the behaviour of specific players.

- At this point, an assumption is being made that the decision models represent modes of decision making and these are available (within the limits of expertise and experience) to all coaches. Evidence is required on the deployment of these modes.
- Considerable emphasis has been placed on generating hypotheses and on rapid scanning and situation assessment. It has to be assumed that this takes place and will have to be accommodated in the models of decision making. It seems likely that the situational awareness influences a 'slower' more interactive process of decision making.
- There is a distinction to be drawn between recognition of an 'instance' (albeit representative of a threshold occurrence) and 'condition' or set of circumstances.
- The script is problematic in the sense that there are too many uncertainties (including the contested nature of the game) to be sure of the anticipated outcomes. Does this suggest a different type of script or more of them? (This brings to mind the evidence of expert teachers who 'stick to the plan' during interactive decision making more so than do novices.)
- It is not clear if the non-deliberative nature of the coach's role will prevent 'pragmatic' schemata, that is, modifying production rules within abstract schemata. There may be pattern recognition of schemata-based interpretations of the context, but what degree of amendment or modification is possible (assuming that the analytical thinking redolent of experimental conditions does not apply).
- This is not a decision alternatives context in the sense that coaches have sufficient time for a deliberative consideration of all alternatives. Coaches will have choices but these will not be dealt with in the probability-based analytical mode normally used in decision theory research. However, there may well be some considerable value in

translating some of this work to the dynamic context from the normally static problems of the laboratory, but this is for the future.

- The notion of a 'working hypothesis' has appeal. However, would this refer to the expected consequences from a script or a series of sub-scripts? An alternative would be a 'super-script', which operates on a more interactive basis.
- The 'unfolding' nature of the game means that decisions are rarely tested or evaluated in purely rational ways. Decisions are overtaken by events and it may be the mark of 'expertness' to choose solutions that have some significant impact on the course of a set or game. It is also possible for solutions to be appropriate but not to have the desired effect because of the contested nature of the environment.
- Decisions are made by coaches for short term and longer term reasons. Therefore, the decision models have to admit not only problem contexts but more strategic decisions, which are, of course, less likely to be non-deliberative. However, the possibility of the coach deciding not to take action or to delay action needs to be built into the potential model. Much of the literature (for instance on medical diagnoses, and naturalistic studies of emergency workers) assumes that an action decision has to be taken.
- It is clear that there is an element of routine in decision taking, much of it automatic. Other terms used are repetitive and operational. It is not clear whether this could apply to some of the decision taken by coaches, but this is a possibility.
- Eraut's (1994) 'state of alertness' to describe a rapid awareness of the future implications of as yet unforeseen events is a useful concept. This may describe a more 'metacognitive' state of affairs, i.e. thinking about deciding.

- Using Boreham's (1994) analogy, an appropriate level of activation will automatically release 'products' from the memory system. This again raises the issue of thresholds to activation. Kersholt's (1994) work supports this.
- Is it possible that a threshold pattern recognition automatic response could be triggered at any time – particularly when other decision making modes are in operation?
- It has to be accepted that, in the majority of occasions, a state of uncertainty is the normal state of affairs. Much of the literature says that when something unusual happens, the individual switches into a slower, more explicit form of reasoning and decision making. This may hint at a halfway house, dual mode, approach. There could be a slower, more interactive approach, with a constant sub-conscious monitoring of the situation.
- It might be assumed that the scripts of experienced coaches would include assumptions about 'real-time' consequences. The laboratory 'deadline' research tends to focus on the normative decision outcome rather than the effect of the decision in its real-time context.
- Brehmer's (1992) reminder about dynamic decision making being an on-going process needs to be built into the models. Again this suggests the interactive approach.
- A useful concept is that of 'decomposition'. It reinforces the notion that the dynamic chaotic stimuli in the game may not be easily decomposed by all but the expert, and, even then, the room for error (perhaps, simply variation) must be considerable. Either the coach will use heuristic approaches with built-in biases and unreliability, or will attempt to regain the (illusion of) control by employing a degree of deliberation and analysis.

- At all stages the expert will deploy ‘short-cutting’ techniques: pattern recognition, key factor focus, routines, tried and tested solutions.
- The literature has already been evaluated as poor in terms of its attention to non-deliberative decision making. There is a debate which has not yet been held but which may be illuminated in the study about the distinction between ‘instant’ and ‘rapid’ decision making. Eraut’s (1994) model may be useful for this purpose.
- The alternatives/choice research identifies non-compensatory strategies in time-pressured decision making. This may be similar to script decision making in that one alternative (that having had most success in the situation in the past) is deployed. This might also be characterised as slow interactive hypothesising.
- The hypothesising approach may be appropriate since the uncertain environment makes forward reasoning difficult in the non-deliberative context. Such hypothesising needs a mental model (a simulation) of the likely outcome against which the unfolding data can be monitored.
- The associative deliberation – the unfolding script – is similar to Beckett’s (1996) sub-episodic reflexion. In the context of teacher research and interactive scripts, this might be better termed ‘serial deliberation’
- One of the recommendations from the research is to adopt a breadth first approach when under time pressure (since there is no time for a serial analysis of alternatives). Again this assumes a number of alternatives, whereas the normal decision might be whether to act, delay in order to confirm or decide against action (it should also be noted that these, of course, are also alternatives).

The models identified in Figure 4 were devised as a result of the substance of the review of literature and some attempt to configure these in the context of the study. If volleyball

coaches' decision making in non-deliberative situations is to be explained by the current theories, it should be susceptible to explanation based on these models.

At this stage, of course, the models are not being evaluated. They merely represent the range of potentially explanatory models of decision making. It was also important to attempt to bring some simplicity to the conceptual field: first, for its own sake, but perhaps more importantly, to render the models useful in any methodology employed. Five potential models were identified. The first of these was rejected for practical purposes since there was no evidence of it applying in human behaviour, naturalistic decision contexts.

- (a) Rational Model: rule governed, algorithmic response to pattern recognition of stimuli. In this model the coach would react automatically to a logically computed analysis of all factors involved and the abstract schemata available would calculate the optimum solution. This model could not cope with the dynamic complexity of the decision task facing the coaches.
- (b) Schema Model: this uses a domain sensitive knowledge structure, which is triggered by pattern recognition from the environment. It is dominated by production rules, which trigger executive command solutions. The coach would 'recognise' a problem in the game and the solution would immediately 'come to mind'.
- (c) Schema Script Model: this is a pre-existing mental model of a condition. The script focuses on enabling conditions and predicts (in a non-conscious way) the consequences of the script condition. The script has an associated best-fit solution. In this instance, the coach is able to predict, to some extent at least, the unfolding sequence of events and is prepared for the appropriate decision behaviour.

- (d) **Case Script Model:** in this the coach recognises in the pattern a similarity to a previously experienced example. This triggers a repeat of the previous (if it has not been a negative outcome) decision behaviour.
- (e) **Slow Interactive Script:** The decision behaviour is governed by an interaction with the environment (what was termed a serial deliberation). This produces a slower version of a script, which is capable of constant amendment. In this model, the coach is engaged in a more conscious management (insofar as this is possible) of the incident.

These models will be used in the methodology associated with the research question.

Expectations

At this stage, it is normal practice to identify the criteria against which the findings of the study can be evaluated. In experimental theory testing, it would be usual to identify a set of hypotheses by which the study's findings could be 'proved' in a statistically acceptable fashion. In qualitative research there is an extensive range of possibilities, ranging from hypotheses in more structured studies to no pre-designated expectations about what might be found, in more exploratory studies.

The following factors apply in this study:

- The research field is under-theorised in relation to non-deliberative decision making;
- The overall approach is not a theory-testing one;
- The study is intended to be exploratory;
- There are few if any examples of similar research;

- The analysis is intended to be qualitative, with the support of descriptive statistics as appropriate.

In these circumstances, it is appropriate merely to express a number of tentative expectations based on an interpretation of the literature, the intentions of the study and the discussion of the problem as expressed in the rationale.

It is anticipated that:

- (a) The assumptions made in the study will be confirmed: non-deliberative decision making; expert behaviour (tacit but verbalisable knowledge, abstract problem framing, intuitive behaviour); retrospective accounts of decision making by coaches can be used to infer cognitive activity.
- (b) The theoretical models of the cognitive organisation associated with decision making will explain the collated evidence of the coaches' decision making.
- (c) Direct and indirect evidence will confirm idiosyncratic knowledge structures about key factors in shaping decision framing and choice.
- (d) Coaches will employ more than one mode of decision making.
[Expectations (b), (c) and (d) are expressed in the spirit of 'null hypotheses'.]
- (e) Coaches' accounts will display evidence of pattern recognition and routinised solutions.
- (f) There will be evidence of thresholds applied to pattern recognition.
- (g) Coaches' accounts will display evidence of action decisions and non-compensatory choice strategies.
- (h) The case script model will be evident in critical incident decisions.

- (i) Analysis of the coaches' accounts will be influenced by several volleyball specific factors: limited choice of solutions; difficulty in reading the situation assessment (largely caused by the opposition); coach expectations (simulations) structured around predictable game patterns.
- (j) The dynamic complex nature of the task environment for decision making will demonstrate itself in a lack of precision and confidence in situation assessment and prediction.

Chapter Three

Methodology

Introduction

The purpose of this chapter is to describe, explain and defend the research strategy adopted and the methods chosen to elicit the evidence necessary to address the research questions identified earlier. Each piece of research is different and distinctive and it is therefore necessary to argue for the appropriateness and sufficiency of the methods selected, in the particular circumstances of that research. All research strategies and techniques have strengths and limitations and these have to be understood in relation to the particular research question. The purpose and limits of this research were outlined in the introduction: the study is concerned with decision making by expert coaches in the sport of volleyball. The focus of the study is on the cognitive organisation of knowledge and experience and the mechanisms through which these can be accessed during non-deliberative decision making in conditions of 'hot action'.

The purpose and boundaries of the study begin to structure the issues that need to be addressed by the research strategy:

- (a) there is a tension to be resolved between experimental control of variables in laboratory conditions and the more 'naturalistic' setting in which the selected activity is carried out;
- (b) it is necessary to employ 'second order' techniques with which to infer or derive cognitive activity and these will involve self-reported thoughts or other 'process' techniques;
- (c) it has already been demonstrated that the field is insufficiently theorised to permit the extrapolation of hypotheses, around which to construct a theory-testing investigation. This suggests the need for descriptive research, which is used to seek explanation and understanding and to generate further questions. The research is likely, therefore, to be 'descriptive', that is, identifying what 'is', rather than 'normative', that is, identifying what 'ought' to be.

The starting point is to discuss the needs of the constituent parts of the research questions along with the utility of the different methods available to address the following questions and expectations:

Q. To what extent can elements of theories of cognitive organisation adequately explain the accounts of non-deliberative decision making by expert coaches generated during stimulated recall?

Q. To what extent does the individual coach's 'theory of action' appear idiosyncratic?

The following expectations were generated from the review of literature:

1. The assumptions made in the study will be confirmed: non-deliberative decision making; expert behaviour (tacit but verbalisable knowledge, abstract problem framing; intuitive behaviour); retrospective accounts of decision making by coaches can be used to infer cognitive activity.
2. The theoretical models of the cognitive organisation associated with decision making will explain the collated evidence of the coaches' decision making.
3. Direct and indirect evidence will confirm idiosyncratic knowledge structures about key factors shaping decision framing and choice.
4. Coaches will employ more than one mode of decision making.
[Expectations 2,3 and 4 are expressed in the spirit of 'null hypotheses'.]
5. Coaches' accounts will display evidence of pattern recognition and routinised solutions.
6. There will be evidence of thresholds applied to pattern recognition.
7. Coaches' accounts will display evidence of action decision and non-compensatory choice strategies.
8. The Case Script Model will be evident in critical incident decisions.
9. Analysis of the coaches' accounts will be influenced by several volleyball specific factors: limited choice of solutions, difficulty in reading the situation assessment (largely caused by the opposition), coach expectations (simulations) structured around predictable game patterns.
10. The dynamic complex nature of the task environment for decision making will demonstrate itself in a lack of precision and confidence in situation assessment and prediction.

Research Strategy

There can be no doubt that any evaluation of decision making in cognitive science will reveal that the normative experimental paradigm has been dominant. The research has taken the form of controlled tasks requiring deliberative problem solving, with a search for procedural solution rules and decision strategies. More recently there has been an emphasis on the cognitive processes involved and this has integrated the work with more general cognitive science on memory, learning and knowledge acquisition. Montgomery and Svenson (Montgomery and Svenson 1989) trace this development (1989:xi)

Psychological studies of human decision making started out from normative models formulated outside psychology. The main issue in this early research was: how well do people's choices or judgements agree with normative requirements? However, in recent years there has been a growing interest in the cognitive and evaluative procedures behind a particular choice or judgement. In addition, several studies have focused on how decision makers represent and structure information about the choice alternatives. Hence recent research has been conducted on process and structure in human decision making.

The authors also summarise the research techniques involved (1989:xi):

The increasing focus on processes and structures in decision making research has been paralleled by methodological advances. Decision making processes are studied by a number of process-tracing techniques such as think aloud reports and registration of eye movements. Decision structures are studied by the same techniques as well as by methods for analysing written documents and other accounts in which decisions are described or justified.

Hoffman et al (1995) provide a categorisation of methods for eliciting knowledge from experts. They identify analysis of tasks, various forms of interviews, and contrived

(experimental) tasks from which expert behaviour or knowledge is inferred. The method selected “must make sense as a way of revealing strategies, sequences, and facts about knowledge organisation” (1995:132).

The term ‘naturalistic’ has come to be used for decision making which deals with evidence of “how decisions actually are made, rather than on how they ‘should’ be made” (Beach 1997: 9). Cannon-Bowers, Salas and Pruitt (1966) review what they term a paradigm shift from the “sterile, contrived decision-making situations, with results that were of little consequence to real-world decision makers” (1996:195) to action contexts characterised by a dynamic matrix of human factors, and complexities of task and environment. Orasanu and Connolly (1993) identified the factors involved in Naturalistic Decision Making (NDM): ill-structured problems, uncertain dynamic environments, time constraints, multiple players and multiple goals. It is immediately clear that these elements have a goodness of fit with the research problem in this study. Cannon-Bowers et al (1996) do not discount laboratory research and point to the need for a measure of experimental control in laboratory and field settings, which investigate problems that are consistent with NDM principles.

The ‘naturalistic’ approach is less suited to the controlled experimentation of the normative rules associated with problem solving. Kahneman (1993) points to the ‘cold’ research characteristic of this problem solving research, which is rational, logical and aloof. This contrasts with realistic decision making, which is highly involved, and influenced by passions, desires and motives (Strack and Neumann 1996). Nevertheless, descriptive/naturalistic decision making may provide evidence that individuals are different

in consistent ways. Clearly the real-life setting is more suitable for approaching an holistic understanding of the whole integrated decision making process.

Fischhoff (1996) points to the limitations of 'standard' decision making research for producing applied and applicable findings. In contrast to controlling the experimental stimuli to expose the cognitive process, he proposes that subjects should be 'turned loose' within understandable but dynamic, real-life circumstances. These studies "may open opportunities for new structured tasks, studying the unexpected behaviours systematically" (1996:245).

Teigen (1996) suggests that a more balanced view can be obtained by distinguishing between questions of what is being studied and why it is being studied. Thus the merits of the traditional versus NDM approaches can be assessed for contributing to science or for solving practical problems. Teigen refers to the work of Karlsson (1988) in differentiating between decision making and choice. Choosing may be a rather 'cleaner' process than the action context of decision making, which is more creative, personally value-laden, and apparently has few realistic, viable alternatives. Teigen (1996:250) concurs that real-world research is necessary to capture the richness of this decision making: "real world situations are not easily and certainly never completely captured by the vocabulary of the lab ... (these situations) form a gold mine for extracting new questions" (1996:251).

Recent developments in sports science and cognitive science have begun to address the criticism that the dominant paradigm in science, empirical reduction and deductive theory testing, has failed to shed light on the working of the 'system' in its interaction between the organism and the environment and has had a limited influence on behaviour modification

and education. In an early paper, Martens (1979) bemoaned “logical positivism, operationalism as specified by behaviourism and laboratory experimentation” (1979:57). He questioned the value of existing research output and suggested a change to field settings, real actors and the untidiness of real life. Clearly, however, it is this untidiness, and the complexity of real life, which is less attractive to many researchers and their research designs. There has been a paradigm shift in research into decision making and motor skills. Insofar as the issue is the mechanism involved in sub-conscious decision making the parallels to this study are striking. There has been a recent emphasis on the ‘ecological’ approach (Davids 1988; Weeks and Proctor 1991; Davids et al 1994), which “maintains that there is a direct link between perception and action and utilises research models that resemble as closely as possible the real sports skill” (Reilly 1992:17). The ecological approach has also been used in teaching to refer to the relationship between the individual and the environment (Yinger and Hendricks-Lee 1993).

The ecological approach eschews the experimental reduction of a movement to one which does not reflect the naturalistic movement. Part of the reason for this is that it makes demands on the human system as an integrated interdependent whole. Clark and Crossland (1985) proposed a systems approach (1985:16)

... structures and configurations of things should be considered as a whole rather than examined piece by piece. In a highly complex system like the human mind or human body all the parts affect each other in an intricate way, and studying them individually often disrupts their usual interactions so much that an isolated unit may behave quite differently from the way it would behave in its normal context.

Such a view need not be seen as an attack on the experimental approach. Rather, the specificity of normative decision making research can be better appreciated and applied when the synoptic overview of the regularities of real-life decision making is fully appreciated. This suggests a recognition of ‘levels of enquiry’. Bernsen (Baddeley and Bernsen 1989) recognises that cognitive science has biological and mechanical implementation. He suggests that the central level of analysis should be the cognitive ‘system’ and not a reduction to sub-systems. Busemeyer et al (1995) acknowledge the interdisciplinary nature of decision science and the applied nature of its goals. They quote Marr (1982) who suggested three levels of explanation in this field: the behavioural, the representational and biological. At the first level, investigation of the computation/decisions may be little more than descriptive. At the second level, the processes involved need to be understood. The third level involves brain mechanics.¹

The challenge, therefore, is to design an investigation which:

- (a) adopts an holistic approach to the problem;
- (b) employs data/evidence gathered from a naturalistic setting;
- (c) engages with the cognitive ‘system’ and its interaction with the environment (rather than with the neuro-physiology of the ‘level three’ brain mechanism);
- (d) provides sufficient scope and scale to justify intra-sample generalisation, and thereby lends weight to the hypotheses generated; and
- (e) addresses the challenge of inferring cognitive organisation from individual and retrospective techniques.

¹ Altman (1995) is a review of the neurobiological study of decision making. One aspect of this field is the study of the decision making capacities and characteristics of individuals who have had brain damage.

Stimulated Recall

The most significant challenge is to identify and operationalise a technique with which to investigate cognitive processes and structures. The most common approach is process tracing (Ford et al 1989; Harte et al 1994; Someren, Barnard and Sanaberg 1994). In this approach, techniques such as verbal protocol analysis or information boards are used to focus on the intermediate steps between information availability and the decision outcomes. “A fundamental principle of this research is that cognitive process should be studied by collecting data during the decision process” (Ford et al 1989:76). There is a longstanding and continuing debate about the extent to which ‘think aloud’ techniques provide access to introspective, higher order mental processes. Nisbet and Wilson (1977) argued that verbalisations were subject to judgement biases, although Ericsson and Simon (1980) have claimed that verbal protocol analysis has value because, as a product of cognitive processes, it can be subjected to subsequent analysis.

Ericsson and Simon (1993) suggested that verbalisation does not significantly affect the normal course of cognitive processes (Russo, Johnson and Stephens 1986). However, there are difficulties with the differences in individuals’ verbal expressiveness (Burton et al 1990), and the length and complexity of the task being solved (Patel and Groen 1986). Particular issues are the problem of retrospection and short-term memory, and the representativeness of the protocol in tasks dependent on automated or tacit knowledge. Hoffman et al (1995) go so far as to say that “think aloud problem solving (with protocol analysis) can be inefficient in

knowledge elicitation” (1995:144). However, in contrast to process tracing, these authors review and offer support for the ‘test cases’ approach and ‘event recall interviews’, in which probes are used to facilitate recall. This is similar to Klein et al’s (1989) ‘critical decision method’. Klein and his colleagues found that recall of difficult cases was a valuable means of invoking reasoning strategies.

It becomes clear that process-tracing by verbal, think aloud techniques, despite its popularity in problem solving experimentation, is not appropriate in situations in which significant verbal communication is part of the individual’s behaviour during the decision making episode and less defensible as a method in real-life problem solving circumstances. In the context of this study, therefore, it became necessary to consider an alternative approach. The issues to be overcome are the individual’s capacity for direct reporting of introspective reasoning and the need to maximise the subject’s employment of short-term memory. A potential answer was the use of stimulated recall and subsequent analysis of verbal accounts of decision making.

Stimulated recall (SR) is used extensively in research into teaching (Clark and Petersen 1981; Housner and Griffey 1985; Krause 1986; Parker and Gehrke 1986; Allison 1987; Butefish 1990; Allison 1990; Walkwitz and Lee 1992; Byra and Sherman 1993; Ennis 1994; Martinek and Griffith 1994; Anthony 1994; Tan 1996; Tjeerdsma 1997) and continues to be popular. Indeed, Housner and Griffey (1985) were of the view that “the study of interactive decision making has been conducted almost exclusively through the use of stimulated recall during videotaped replay” (1985:45). The method is also prevalent in counselling and

psychiatry/medical interview research (Martin et al 1986; Morran et al 1989; Dershimer and Conover 1989; Halford and Sanders 1990; Sanders and Dadds 1992; Cleary and Groer 1994; Cegala et al 1995). SR is a generic procedure in which videotaped behaviour is replayed to the subject in order to stimulate recall of the subject's thinking/reasoning during an identified 'episode'. There is considerable variety in implementation. The majority of studies involve a structured time-sampling of the video-taped period (Housner and Griffey 1985; Martin et al 1986; Morran et al 1989; Byra and Sherman 1993) or identification (by researcher and/or subject) of critical incidents (Walkwitz and Lee 1992; Ennis 1994).

Occasionally the videotape of the interview/lesson is supplemented by 'think aloud' procedures (Allison 1997; Tjeerdsma 1997). These are used for analysis or to assist the subject's recall. The normal procedure is for a recall/probe technique to be used to generate/facilitate the subject's thinking during the episode being replayed. The instruments and methods used to stimulate and record these thought process also vary. The general pattern employed is a series of structured, but relatively open-ended, questions posed to the subject as soon as possible after, or during, the viewing of the videotape. Questions are centred on a description-thinking-noticing-alternative behaviours structure (e.g. Housner and Griffey 1995; Walkwitz and Lee 1992) or are designed more specifically to reflect the focus of the study (Martin et al 1986; Fernandez-Balboa 1991; Lee et al 1992; Byra and Sherman 1993; Tjeerdsma 1997). Another approach employed is 'thought listing' following the viewing of a segment of tape (Morran et al 1989).

In an interesting experiment, Omodi and McLennan (1994) used a head-mounted camera to investigate complex decision making in a sporting context. They reviewed the method, noting that “investigating complex decision making in the sort of complex environments which are typically encountered in real-world settings has proved extraordinarily difficult to accomplish directly” (1994:1411). They re-assert that a number of alternatives (thinking aloud, random thought sampling, task interruption) alter the naturalistic setting, and they speculate on the issue of affective recall which is important in assisting recall (but may affect emotional recall). In their study, they found that videotape recall responses were 2-4 times greater than free recall, although the latter was qualitatively more organised, logical and dispassionate and suggests, therefore, that it was subject to a more reflective and considered response. In an earlier study in a sports context, Baddeley and Hitch (1977) established that basketball games could be recalled best when issues of memory decay and interference were obviated. Therefore, questions should be asked about “only the last time (the subject) experienced the matter in question” (Baddeley 1979:18).

Few studies have treated SR as a problematic methodology. Lee et al (1992) noted the general concern with supplementing incomplete memories and Tjeerdsma (1997) acknowledges the possibility that the subject is reacting to what is viewed on the videotape rather than recalling the taped episode. There have been few attempts to review the methodology itself (see Tuckwell 1980; Calderhead 1980; Yinger 1986). Calderhead (1980) provides a valuable insight into the stimulated recall method, drawing on its use in teaching research for his explication of its limitations. He notes that there are issues arising from the subjects’ anxiety, the limitations of the visual cues (not from the subjects’ perspective),

whether tacit knowledge can be verbalised, and conscious censoring of the recall by the subject. Calderhead, therefore, stresses the need for rapport, familiarity with the technique, and 'screening' the research goal from the subject. There is no doubt that all techniques have some limitations in the degree to which they elicit accurate (but who could validate this!) accounts of reasoning or other cognitive output. Retrospective accounts are open to the charge that the individual can introduce a measure of 'sanitising' the verbal accounts of the recall process. Hoffman et al (1995) identify a number of possible biases in judgements, some of which may be evident in recall: maintaining a personal consistency of reporting, using hindsight, or confirming perceived hypotheses or research goals. The authors note the problem of verbalising implicit knowledge but interestingly found that 'contrived' (indirect) methods were useful for accessing sub-conscious procedural knowledge.

Despite the theoretical shortcomings of the SR method, variations of the generic approach are widely used and many of the studies treat SR as non-problematic, often making no detailed reference to the method itself. Yinger (1986), however, has provided a detailed account of SR, from its original use, to an evaluation of its validity for accurately reporting teacher interactive thinking. Yinger's basic point is that retrospective accounts of thinking involve intermediate inference and generative processes. He suggests that SR may not provide the immediate retrospective probing necessary to access short-term memory or episodic long term memory traces, which store the real-life experience. Otherwise the SR videotape produces a 'new view', which is subject to the "luxury of meta-analysis and reflection" (1986:271) which was not available to the individual at the time of the original episode. In a critical comment, he notes "the result of this opportunity for reflection is that

the subjects report what they are currently thinking and take the opportunity to elaborate the reasons for their interpretation of the videotape” (1986:271). The implication from Yinger’s analysis is that questions that depend on probing tacit/procedural knowledge or for cues to the original action may reflect subsequent confounding interference.

Inevitably, therefore, there are some limitations with the SR method and decisions about its use become a matter for a judgement of the balance between the advantages of the specificity and reality of the action context and the extent to which particular procedures can bring rigour to the retrospective verbal reporting of cognitive activity. From the limited literature on the ‘best practice’ of techniques, it is necessary to reduce anxiety, limit the perception of judgmental probing, reduce the intrusion into the action, stimulate rather than present a novel perspective/insight, make the retrospection as immediate as possible, allow the subject a relatively unstructured response, and employ an ‘indirect’ route to the research focus. Kahnney’s (1986) lukewarm support is that “the best we can hope for is information in a subjects’ statements that permits us to infer that particular mental processes occur in a given task situation (1986:49). It is also necessary to remember that the overall research rationale is to provide naturalistic/descriptive evidence to contribute to the early stages of conceptual insight into non-deliberative decision making. At this stage, therefore, the external validity of the investigation and the extent to which the coaches’ comfort and familiarity allow them to verbalise the immediate antecedents of their action decisions, outweigh the confounding judgements. Reflections on the SR method employed will be a valuable by-product of the research.

The research strategy, therefore, is to adopt an holistic approach to the generation of accounts of decision making by expert coaches, to which current theories can be applied and evaluated for their usefulness. Experimentation loses the interaction of the environment and the cognitive system as a whole, and observation is an inadequate mechanism for recording or inferring such activity. Survey methods are inappropriate since they involve generalised responses to issues and fail to investigate with the appropriate degree of depth the 'how and why' questions. Interviews hold some promise because of the potential depth of enquiry but fail to address the demands of specificity and a naturalistic setting. Given the desire to investigate the naturalistic/descriptive accounts of real-life decisions, and having judged that process-tracing methods (verbal think aloud, random thought sampling, and task interruption) were inappropriate in 'field' settings, it was necessary to adopt a form of retrospective analysis of the sort characterised by stimulated recall. It was necessary also to ameliorate some of the methodological shortcomings identified above.

There are limits to the scale and scope of any particular research project and it was necessary to compromise between the depth and richness of the data/evidence and the generalisability and comparability of the data. The emphasis on expert behaviour was argued to be appropriate for this study, and this restricted the number of subjects available. Nevertheless, the research strategy is founded on exploratory and descriptive accounts, albeit with a rigorous search for consistent patterns of cognitive organisation about decision making within the sample. There is no intention to generate statistical inferences about the larger population of experts or volleyball coaches. However, in adopting a rigorous qualitative

methodology, it is anticipated that the representativeness of the sample of expert coaches will allow academic speculation about the relevance and consequence of the findings.

Qualitative research methods have the potential to generate a richness of nuance which reflects the subtlety of interaction between human action and a complex environment (Locke 1989). These approaches have characterised some recent research into coaches and coaching. Cote et al (1995) argued that it was necessary to ask expert coaches directly about “important concepts and strategies” (1995:2) because the more experimental approaches to such a complex task domain had resulted in an incomplete conceptualisation of the field. The approach to identifying the mental models that they assumed assisted coaches to simulate and predict new situations was to use in-depth interviews. It was argued that experts have the domain knowledge to respond successfully to open-ended questions. This approach is defended on the grounds of methodological ideology (Martens 1979) and the view that “qualitative research procedures have become increasingly refined and sophisticated” (Salmela 1995:3). Forms of interviews, with structured analysis (Strauss and Corbin 1990; 1994; Cote et al 1993) have been employed to investigate a number of expert coaches and performers (Scanlan, Stein and Ravizza 1991; Russell and Salmela 1992; Rutt-Leas and Chi 1993; Cote et al 1995; Salmela 1995; Abraham et al 1997).

The research strategy outlined above conforms to this broad approach in that it invites expert coaches to contribute directly to the study, focuses on the whole system interaction with the environment, and finds value in the structured interpretation of qualitatively-obtained evidence. Such a form of analysis will be applied to the evidence generated by the SR

response to decisions taken by the coaches. In addition, the evidence from the SR responses will be complemented by semi-structured interviews employing open-ended questions.

Research Design

The study was based on a descriptive (as opposed to normative), non-interventionist, 'one-shot' survey of expert coaches' decision making, followed by a qualitative analysis of the accounts of decision making generated. The research design had the following characteristics:

- identification of a representative group of volleyball coaches;
- collation of evidence from a naturalistic decision making context involving coaching practice, and in which one would expect to find non-deliberative decision making. The most obvious and appropriate context was the volleyball game, in a recognised and meaningful competition;
- cognitive organisation assumed to be represented by the process/mechanisms by which the coach translates the decision action catalyst into a decision behaviour;
- retrospective generation of accounts of decision making by stimulated recall technique, employing videotaped records of the game/decision context;
- analysis of the accounts of decision making, employing units of measurements based on existing theories of decision making, and looking to find common patterns in the coaches' cognitive organisation;
- the analysis and discussion to be informed by a semi-structured depth interview.

The study involved, therefore, the videoing of volleyball games in which the representative group of coaches were engaged; procedures for generating retrospective verbal accounts of a number of identified decisions; analysis of the accounts generated; and interpretation of the units of analysis in the context of existing literature on non-deliberative decision making. The stimulated recall technique and the organising and interpreting of semi-structured qualitative data was an ‘indirect’ process for investigating cognitive behaviour.

Design of Relevant Instruments

The research design required two specific instruments:

- (a) SR procedure; and
- (b) Semi-structured interview schedule.

SR Procedures In an earlier section the stimulated recall (SR) method was described as a generic approach and for this reason it was necessary to devise a specific procedure to suit this investigation. In its entirety, the SR procedure may be considered a test instrument. The problematic issues were:

- (a) what to video and from where;
- (b) what constituted a decision and how it should be identified; and
- (c) which questions to pose to elicit the verbal account.

(a) The videoing of volleyball matches on behalf of coaches is a commonplace occurrence. For ease of organisation the video camera is normally sited immediately behind the service

baseline and in the centre of the Court.² This captures much the greater part of the play, although the final product demonstrates movement parallel to the net better than distance from the net. The camera is not normally moved between sets: in alternate sets the team will be on different sides of the net. This was rejected as a valuable tool for stimulating recall, although it should be noted that it has significant value in acclimatising coaches to having video cameras around the court.

The guiding principles were: the coach to be in the screen, the net play was more significant than the back-court play, the coach's team was more relevant than the opposition, it would be helpful to have the score visible.³ The researcher used his volleyball coaching experience to sift potential camera angles. The most likely angles (A-E) were tested on a local (National League Division 2) team and coach, and were explored at length with the Pilot Study coach. As a result of this, the camera angle was amended from position B to position F.

A compromise had to be reached between capturing sufficient supporting context from the game and focusing on the coach to stimulate recall decision behaviours.

² See Appendix A for an illustration of relevant camera angles.

³ This was possible because the team bench (see Appendix A) is situated beside the scorer's table, and manual scoreboards are operated from this point.

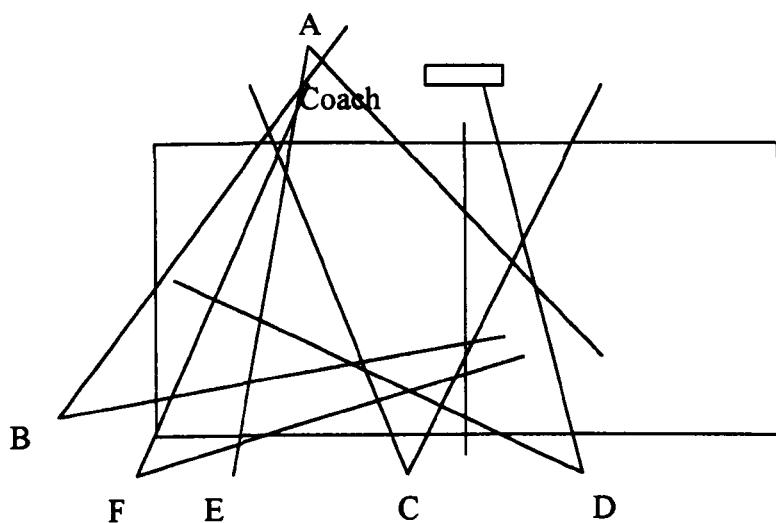


Figure 5: Potential Camera Angles

(b) There was a need to make a judgement on the number of accounts of decisions in each game that could be requested from the coach. Relevant considerations were that the decisions should be few enough to make them identifiable and 'memorable' from the coach's perspective, but sufficiently large in number for practical collection, bearing in mind that each game had to be visited in remote locations and on separate occasions, and secondly that there should be minimal interference with recall. This meant that decisions should not be recalled from too early in the game, in case later decision recall interfered with those memories. The initial decision was that 6 decisions should be identified from the final set of the game. It became obvious from the Pilot Study that there were fewer action decisions than anticipated and that the 6 decision accounts should be generated from the final two sets. This was carried out successfully on all but one occasion in which the subject was unable to recall more than 4 incidents in the manner specified.

The underlying principles to guide the identification of the decision incidents were: that the influence of the researcher should be minimised in order to avoid contamination of the research process; that there should be a variety of decision ‘types’; and that there should have been an element of non-deliberation or time pressure in the decision.

The subject was shown a video replay of the final two sets with the following instructions⁴:

“Please view the whole of the final two sets in today’s match. You can stop the tape at any time. Your task is to identify the most vivid incidents in which you feel you had to make a decision quickly. We will record these with a short description.”

The subject reviewed the tape and identified incidents. These were noted by ‘type’ and by score and tape time reference, for retrieval and record purposes. The researcher had also kept a record of likely incidents during the sets, although these, of course, would be less full since it relied on behavioural and score related cues only.

The final list of incidents was reviewed by both the subject and the researcher for a balance of decision ‘types’.⁵ A catalogue of likely decisions types was compiled by combining the researcher’s experience, discussion with the Pilot Study coach, and analysis of the rules, regulations and logic of the game. The type of decision refers to the action behaviours implemented by the coach (or purposefully deciding not to implement) and this is restricted

⁴ Repeated as Appendix B.

⁵ The final balance of decision ‘types’ in the study was 36% timeouts, 36% substitutions and 29% tactical.

by the rules and the capacity of the players to deal with change. The decisions were simplified to:

1. Substitutions
2. Timeouts
3. Tactical changes (including specific instructions onto court, strategic and rotational changes)

NB Decisions not to act are included in the appropriate category.

Each of the types is predicated on the coach's role to manage the contest – that is, to attempt to influence the outcome of the game by exploiting the relative resources and strengths and weaknesses of each team.⁶ The list was not extensive and was discussed with the national Director of the SVA.

The following points were relevant:

- Decisions should not be perceived only as the more obvious 'choice between alternatives' (Clark and Peterson 1986). This is a very limited view of the decision incident and, in fact, limits the application of existing theory (e.g. on non-compensatory decision heuristics).
- Decisions are always likely to be based on the possibility of change. This is reinforced by the emphasis on non-deliberative decisions.
- The use of video and the application of the matrix placed the focus on decision incidents which led the coach to an action decision, and which was demonstrated in decision behaviour. Even where the decision outcome was 'not to take action', the antecedents of the decision incident became clear and there was some form of behavioural clue that the decision was being taken.

⁶ see Figure 3 for a summary of the factors involved.

- The decision ‘type’ matrix has been based on the game context/outcome/ coach role amalgam. This alleviates the necessity for identifying the reasoning in advance and assists recall by identifying a coaching action.
- Throughout the game, the coach will have constant interaction with the players on court. The rules allow the coaches to communicate, providing that they are sitting on the team bench. Each coach must make a decision about the balance of instruction/advice/ feedback against the players’ capacity (and willingness) to receive a constant stream of stimuli. Inevitably the communication is selective but very significant in scale in higher level matches. For the purposes of this study, the constant stream of motivational comments, and the reinforcement of technical/tactical advice will not be considered part of the decision making matrix of incidents. In some teams, the coach (or, very often, an assistant coach) will signal service instructions to the players. This will not be highlighted in the matrix, but coaches may identify what they perceive to be significant or critical changes in service information as a tactical decision incident.

(c) The earlier review of the SR method indicated that recall is assisted in one of two ways: either a pre-designed set of more or less structured questions, or a less structured interview situation. For the purposes of this study it was necessary to ask for recall but not to structure the response since this would impose an additional cognitive structure to the recall which might influence the subject’s account.

Having identified the decision incident, the subject was given the following instructions:

“Please review each incident and the decision made. Describe the decision and why you made that particular decision. Please elaborate on any element of the decision. May I also say before you begin, that I would rather you were honest and say little about an incident rather than create an explanation.”

Each subject was reminded that the decision not to take action was an appropriate incident.⁷

The subject then viewed the video extract to recall the decision. The researcher used follow-up probe questions of two kinds: (a) to establish if the decision incident was related to the game situation, and (b) to establish a ‘reason’ comment if the coach had focused on the description element. The need for the probe question was established in the Pilot Study in which accounts of incidents focused on the description of the incident and the factors involved, rather than the reasons for taking any decision. The latter element generated more relevant cognitive process-related accounts.

The outcome of the SR procedures was a group of 6 accounts of decision making incidents for each coach subject. These were transcribed and given a code number. Each transcription was sent to the subject with a request to amend any inaccuracies or instances in which the subject’s intended meaning had been misrepresented.⁸ Seven of the subjects returned their transcripts with very minor typographical and proper name spelling amendments. The

⁷ It seems likely that coaches will be less comfortable with the notion of ‘non-decisions’. Whilst understanding the principle, identifying the distinction between a decision catalyst followed by the choice not to change, and the decision incident not having reached the threshold for change, will be difficult for the coach. The majority of selections, therefore, are likely to be action decisions. This will be given further attention at a later point in the discussion.

⁸ See letter Appendix C.

transcripts of decision incidents are referenced by set score and videotape sequence, and catalogued. All evidence was retained and is available, as it was recorded in the field.

Decision accounts vary in length and depth, dependent on the subject's verbal style and capacity to verbalise the reasoning associated with each decision. Subjects had no difficulty with recall of incidents, and once stimulated by the identification of the incident appeared to have immediate and usually extensive access to their reasoning process. Whilst acknowledging the limitations associated with the SR method, it was apparent:

- (a) from the lack of attention to the detail of the video-clip that the subjects were accessing their cognitive recollections of the incident and not 'an alternative version' created by the 'new view of the incident'. The method was therefore successful in its stimulation effect.
- (b) The majority of the subjects have experienced post-school education and are in professional occupations. It is not surprising, therefore, that they were able to bring a conceptual and syntactical order to their verbal accounts. This also suggests that, despite the immediacy of their recollections, the subjects were able to bring a degree of reflection and order to their accounts.

Nevertheless, it is important to remember that the accounts were not being treated as the outcome of a verbal protocol method, but were an indirect method of accessing cognitive activity, and were subject to subsequent analysis.

Semi-structured Interview Following the SR procedures, a semi-structured interview was carried out with each coach. There were two purposes to this: (a) to provide supporting

evidence for illuminating the discussion; (b) to provide specific supplementary evidence with which to address the research question. In the case of the second of these two purposes, the focus was on (a) the commonality of heuristic approaches; and (b) general accounts of the coaches' experiential development.

In contrast to questionnaires, interviews provide a richer and deeper source of data, are more likely to provide insight into issues, and have the capacity for flexibility and the following up of relevant, unexpected or interesting issues. Interviews, of course, are more time-consuming, subject to researcher bias and provide additional analysis problems.

The interview situation creates a social dynamic which has the potential to enrich the quality of the interchange, but which increases the likelihood of researcher bias, which therefore has to be guarded against. There is an opportunity to clarify meanings and to have an immediate validation of responses. In the text which follows, there is an indication of the circumstances and procedures which, it is argued, diminished the likelihood of researcher bias.

The interview was semi-structured, that is, there was a pre-determined set of questions/prompts, which were designed to elicit open-ended responses. The responses were not restricted but a limited follow-up of responses was carried out (a) to ensure the emphasis of the probe was attended to, (b) to clarify responses, and (c) to follow up unexpected responses.

The structure of the interview schedule was derived from

- The literature on cognitive organisation

- The researcher's volleyball insights
- The desire for an emphasis on the development/genesis of cognitions, and
- The creation of textual accounts for secondary analysis.

Questions were derived which were based on:

1. Rapport building
2. The influence of other coaches
[patterns; valued characteristics]
3. Development of volleyball knowledge and insight; previous playing experience
[patterns; experiential vs formal development]
4. Perceived strengths and weaknesses
[patterns; decision making; cognitive behaviour vs skills and knowledge]
5. Dealing with novelty; remembering
[patterns; cognitive accounts, storage]
6. Response to scenario; rules
[patterns; cognitive structures, heuristics]

The following prompt sheet was used in the interviews⁹:

Before the interview, let me assure you that all names will be deleted from the transcripts and the final text.

⁹ Repeated as Appendix D.

In order to ensure that the same questions are asked of all coaches, I will read out the questions. I may then follow up your responses with additional questions.

1. First of all, let me ask you if the result of the game was what you expected.
2. For how long have you been coaching, and what was your previous playing experience?
3. Who has been the most important influence on you as a coach? Which characteristics do you recall most?
4. Where do you feel that your volleyball knowledge and insight developed from?
5. Which were the most important influences? What lessons did you learn as a player that have helped you as a coach?
6. What do you think that your strengths and weaknesses are as a coach?
7. What would you do in the following situation? Your inexperienced zone 4 hitter has made 2 direct errors (one into the net, one long diagonal) from adequate sets. He is in zone 4 rotation having been substituted on at 6-8 in the first set for an experienced zone 4 player. The score is now 6-10. What will you do? Why?
8. Despite your experience, you are bound to come across unique situations when coaching in a game or in training. How do you deal with a situation that is novel to you?
9. As a coach, how do you remember games?
10. Are you conscious of what prompts you to make decisions during a game? Do you ever reflect after a game and wonder what prompted you to make a decision or why you made it?
11. Do you have any sense that there are any rules to what you are doing? Are there many coaches who would make similar decisions to those that you make?

The following extensive list relates to the implementation of interview procedures in this instance and the extent to which these minimised the threat of researcher bias:

- Rapport building questions (No. 1) and procedures proved to be unnecessary. The extensive process involved in setting up the meeting, attendance at the game, already knowing the coach or having mutual acquaintances, interchange on volleyball matters on an informal basis during the period, all contributed to the situation in which the subjects were responsive.
- Attempts were made to establish rigour in the procedures (Lincoln and Guba 1985). A knowledgeable interviewer created credibility. Returning the transcripts to the subjects ensured respondent checking.
- It was not evident to the subjects that there was a 'correct' response to any of the questions, nor a 'common thread' which would alert them to an appropriate set of responses.
- In terms of age, gender, culture or status, there were no evident barriers to communication. Again, any differences would have been eased by the interviewer's involvement in the sport. Insofar as it is possible to judge from the experience, the interviewees did not feel threatened, did not feel the need to convey a 'party line', were not afraid to express any opinions, had the comfort of dealing with a 'known' topic, and were honest and not subject to self-aggrandisement. It is likely, however, that the subjects were capable of reflecting on their responses in such a way that giving a

‘considered response’, and appearing to have a developed ‘expertise’ would have ordered and influenced their responses.

- Following the Pilot Study interview, the subject was further questioned on the extent to which he felt that he had been ‘led’ by the interviewer. It transpired from this analysis and on reflection that the wariness of bias had limited the interviewer’s follow up questions too greatly.
- An independent checker listened to two of the tapes and confirmed that there was no leading of the subject. This is further complemented by the nature of the study in which there was no ‘developed position’ to which the subject coaches could be guided.
- Subjects were assured that there were no correct answers and that it was the nature of the responses which would be analysed subsequently.
- All interviews were audio-taped and fully transcribed. Transcripts were sent to the subjects for verification of accuracy and meaning.
- As a result of the Pilot Study, a number of changes had been made to the question schedule
 1. The scenario question was moved to later in the schedule.
 2. The question on the influence of other coaches was simplified.
 3. The ‘lessons learned as a player’ question was added.
 4. ‘remembering games’ was not referred to as a difficult question, and ‘as a coach’ was added.
 5. A question on bad coaches was removed.
 6. Questions were added on prompting and the presence of ‘rules’ in decision making/coaching.

- It had been decided to tell coaches that all names would be taken out of the final report. However, some consideration had been given to the possibility that the thought processes and flow of responses would be altered by the subject attempting to depersonalise any accounts. It transpired that this was not a live issue for the coaches and all used 'real' names without any hesitation. It seems likely that the accounts were not perceived as evaluative of individuals (other than the normal coaching evaluation of good/bad performance), and coaches were all remarkably candid. Nevertheless, subjects were later assured that all names would be altered in any public account of the investigation.
- One coach responded to the transcript by indicating that he felt that he had not conveyed the 'considered' meaning that he felt he was capable of. He was offered the opportunity to amend the transcript in a significant way but this opportunity was not taken. One other coach had appeared to be a little in awe of the research process, and, in addition had less capacity to verbalise his reasoning. His responses were shorter than most of the others.

The outcome of the interview procedures was a set of 12 interview transcripts, which were then subject to analysis and interpretation.

Pilot Study Report

The aim of the Pilot Study was to evaluate the potential of the findings for the main study (do recall responses reflect cognitive organisation sufficiently to allow investigation?) and a number of subsidiary objectives: to evaluate the use of the equipment, to test the protocol/procedures, to try out the interview schedule, to evaluate researcher techniques

during interview, to evaluate the selection of incidents method, to evaluate recall quality, and to explore coding procedures.

As a result of the Pilot Study, insight was gained into the following: coding of recall, coding of interview, evaluation of findings (implications for the continuation of the research), table of 'decision characteristics', evaluation of coach's response to PS, interview questions and 'manner', and evaluation of the coding matrix (the detail of the changes made to the coding frame have already been incorporated into this chapter).

Further conceptual consideration (to that already carried out as part of the rationale for the study and as a result of the extensive preliminary reading) was undertaken to assist in the analysis of the data. This was necessary for two reasons: (1) to get a much clearer idea of the 'alternative' models in order to conceptualise the possible responses of the coach; how these would 'operationalise' themselves in the coach's responses, and (2) to assist in the coding of the coach's SR responses. A number of additional points emerged:

- The importance of the coaches' framing of the problem was reinforced.
- The issue of what constitutes a 'case' was identified. It is possible that the coach could be recognising two sets of similarities - the unfolding of the game/set and the behaviour of the individual players.
- Coaches will work with the same players for extended period of time. Most decisions will involve players (or be based on player behaviours or predicted future behaviours) whose behaviours are well-known to the coach.

- It is clear that coaches are not faced with an unpremeditated decision point. The coach can predict that decisions may have to be taken (with some stages in the game more likely to involve 'greater impact' decisions than at others). Each decision point (interpreted as before, during, or after a 'playing point' in the game) has antecedents, which describe a pattern to the coach. It is the 'new' impact of a point outcome on the pattern which may generate a decision
- It is also important to recognise that action decisions may be conceived of as being in 'groups'. There is a future and past orientation to any of the decisions taken. It may be possible to 'retrieve' inappropriate decisions; to reinforce appropriate decisions; or to attempt new strategies. Because of the future orientation and the 'pattern development', it may be thought that the game is unfolding much as a case is unfolding, and that the heuristic or hypothesis-action decision is like hypothesis testing.

Pilot Study Coach The small number of coaches who qualify for expert status and who fulfil the study requirements provided a problem in identifying a suitable pilot context. A coach was chosen who fulfilled the majority of the 'expert' criteria but whose experience in working with a national league team was not yet fully appropriate. The coach was known to the researcher and agreed to take part in the study, and to a number of additional elements about the process itself.

An illustration of the level of the volleyball context was that the game selected was the Scottish Cup Final.

Pilot Study Procedures The procedures employed have been fully documented elsewhere.

However, a number of procedural lessons were learned as a result of the pilot phase.

- A number of lessons were related to the management of the equipment e.g. the tapes needed to be zeroed and labelled in order to be more efficient in liaising with the coaches.
 - Following the result of the coach's comments on the angle of viewing (reported separately), the viewing angle was moved slightly, to take in more of the court.
 - The researcher did not make a separate list of incidents before the tape was viewed by the coach. This should have been done (noting the place on the tape by the counter), although (1) there were not all that many incidents (the coach noted 9, of which we took 6); (2) it seemed appropriate at the time to make the range of incidents a subject of discussion with the coach. The researcher could still (being aware of the matrix of possibilities) guide the coach if he felt that a category of incident was being missed out, and that there was a suitable (meaning that the coach recognised it) example.
 - The coach did use the video because on two occasions he noted that he had been engaged in some 'bench activity' but could not recall what it was about.
 - Overall the taping worked well.
 - A room at the Sports Centre was used, which was quiet and the process was undisturbed.
- The main findings from the SR session were (1) the coach could clearly recall incidents that had happened during the 4th set [we did not use the 5th set because it is a 'rally point set' - a particularly fast form of the game, and this will not always be available in 3-0, and 3-1 matches.]; (2) the SR took place approximately one hour from the end of the game, it seems clear that memory decay is not an issue; (3) we did not repeat the filming of the incidents: the coach stated that he could clearly recall the incidents and did not need to

review the tape. (I feel from his answers that this was clearly the case.) The tape actually defines the 'problem' rather than what was done about it. There seems no doubt that the SR (as a mechanism/procedure) was able to get the coach talking about the incidents. The stimulation was successful; the coach was recalling rather than re-assembling new visions from the tape.

- The prompting during the SR session by the researcher was not as detailed as it could have been. This was as a result of trying too hard not to be 'biased' or 'intrusive'. Having reviewed the transcripts and spoken to the coach, a slightly more active role could be taken in stimulating the responses.

Analysis of SR Transcripts The devising of the appropriate procedures is dealt with elsewhere. As a result of not capturing the meaning apparently expressed by the coach, or of discriminating sufficiently between theories of cognitive organisation, it was necessary to re-consider the coding and to contemplate the thought that the techniques were incapable of generating the appropriate evidence. The conclusion reached was that the 'open coding' had been carried out sufficiently well, but that there had been insufficiently rigorous thinking about reducing this to meaningful categories.

The following section contains a series of comments, which arose from further consideration of the problem of conceptualising the models in order to code the transcripts.

- There had been a failure in the early thinking and coding about distinguishing between the reasoning behind the need for a decision, and why that particular decision had been reached
- Action Spaces are contested spaces. This means ‘actively contested’ in the sport sense. The complexity of the variables and the intent to disrupt by the opposition means that expectations of successful outcomes are not algorithmic. An Action Decision could be entirely appropriate (by whatever judgement) but the outcome may not be successful. This continuity of the process also needs to be acknowledged.
- Having asked for their action decisions and having stressed that they should be the ones that can be recalled best, the coach may be applying a ‘hierarchy’ effect.
- It seems clear that the ‘progressive’ nature of some of the problems (they can be seen to emerge over a number of points/instances) means that the coach is able to operate a ‘decision tree’ approach. We could speculate (this is from experience) that what happens is that a pattern/momentum begins to emerge. The coach does not have the resources to take action every time a possible problem arises, there are too many possibilities.

It emerged that it may be more appropriate to think of much of the coach’s decision making as ‘short term problem solving’; applying heuristic interpretations of the problem and implementing solutions within an incremental appreciation of an unfolding situation. There would appear to be a deliberative element (at least in anticipation - which may become an important concept) to many of the decisions. Overall, the conclusion was that the process was providing sufficient material for a consideration of the issues surrounding cognitive organisation and decision making by coaches in the selected context.

The SR accounts have some relevant features: (1) almost all of the time was spent ‘framing the problem’; (2) the Action Decision is often taken-for-granted, having been implicit in the question or selection of incident; (3) on a number of occasions comment is made about the success of the Action taken; (4) there are a large number of comments about the immediate past behaviour of the players (with some assumptions about likely behaviour therefore in the future). However, clearly there are great dangers in trying to read too much into one set of SR responses - particularly when it has been acknowledged that they could have been fuller if more follow up questions had been employed.

Pilot Study Coach Interview The transcript was sent to the coach involved. He corrected a small number of inaccuracies and confirmed that the text ‘said what he wanted to say’ and that the researcher had not led him into any statements.

A simple narrative analysis of the interview was carried out, since each question was to be analysed separately for its illuminative contribution to the interpretation and discussion. A number of valuable insights were gained:

- The coach makes a strong case for learning from experience rather than courses (issue here of whether coaches have any declarative knowledge on which to draw). He clearly feels that there is a way of thinking which is ‘coach-like’. From a course, he notes that the interaction produced “the way of thinking maybe that might be appropriate ...”.

- He was capable of identifying strengths and weaknesses. Motivation, commitment, and tactical knowledge mentioned. Reiterates that ‘knowledge’ has come from interaction with previous coaches.
- His response to a new situation is to approach it analytically. He gives a clear indication that he is not an ‘intuitive’ coach. Interestingly, he notes the potential for ‘being paralysed’ in a game and unable to take a decision. A suggestion here that he tries to take the ‘non’ out of ‘non-deliberative’.
- Remembers games by critical incidents “and sometimes by people”.
- Identifies certain catalysts to Action Decisions: not conforming to the game plan. Says “it probably doesn’t happen on the spur of the moment. Also says “outcome driven in a lot of cases”.
- Interestingly notes that he matches expectations (perhaps rules) to the player’s level of ability. “I’m not sure I could necessarily explain it without going into a lot of time about each individual player and what I can expect them to do ...”. This is tacit knowledge which he feels can probably be explained (part of his logical, rational approach!). “I guess that I don’t really think about the decision-making process, about what it is that makes me make those decisions.”
- His final comments are very interesting. He is able to identify some putative rules (“3 or 4 points on service receive”etc. etc.), but he says “I’m not sure they’re as hard and fast as [gives another example]”. He feels that the structure of the game contributes to a kind of ‘higher order’, “knowing what sort of things happen and when”.

The comments were very useful, and the outcome was to (1) formalise the list of questions; (2) add a question or two to probe more specifically as to the commonality of Action Decisions. The interview was supportive of the SR responses. This coach clearly tries to take a logical, rational approach to his coaching. He feels that the structure of the game leads to some rules being available, but that these are not 'hard and fast' and have to be amended in the light of player capabilities. He tries not to make non-deliberative decisions.

Conclusions from the Pilot Study

- The Pilot Study fulfilled its purpose in that it raised issues about practical procedures, and analysis, and about the conceptual understanding underpinning the study.
- Despite the shortcomings, or rather issues raised in its implementation, the evidence gathered suggested that, with modest amendments, the full study should go ahead.
- The researcher should probe a little more deeply during the SR response follow ups (it should be possible to distinguish between the coach's original response to the incident and the follow up question).
- It already seems clear that the conceptual understanding needs to be developed slightly. There are issues raised: how non-deliberative?; the place of decision-narrowing; the question of anticipation; the problem framing over time.
- The SR procedure worked very well. There was no evidence that the coach had any difficulty recalling incidents or thoughts, or reasoning, in the timescale given. There was no memory decay.
- There were not that many incidents identified. It may be that this is understandable (discussed earlier the need to threshold/prioritise action decisions) and this needs to be

accepted. The alternative is to offer incidents from 2 sets. This may (although I suspect not) cause interference (confusion) in recall.

- Insofar as it is possible to have a developing ‘picture’ of the coaches’ behaviour from one example, it seems that coaches are anticipating the unfolding situation of the game. They then try to control this - sometimes by anticipatory actions, sometimes when the situation reaches one of the rule-action points, sometimes when the unexpected (not actually unexpected but the least desired of the potential happenings) happens. This is why there is an attempt to mitigate the non-deliberative element, because it suggests loss of control.

The Pilot Study reinforced the perception that the methodology employed was appropriate and that it had the capability to address the research questions and throw considerable light on the expectations generated.

Identification of Expert Coaches

The design of the research study calls for the identification of a group of expert volleyball coaches. The literature has focused on the meaning and characteristics of expertise (Dreyfus and Dreyfus 1986; Chi, Glaser and Farr 1988; Shanteau 1988; Hoffman et al 1995) and the “comparison of expert-novice differences is a paradigm in cognitive research on expertise” (Hoffman et al 1995:131). Hoffman and his colleagues go on to suggest that the selection of experts has not been a practical problem (Mullin 1989). Experts have been selected on the basis of experience and qualifications (education, further training, and acknowledged success) and peer acclaim. Borrowing from craft guild terminology, Hoffman et al (1995)

suggest that operationalisable criteria should be based on experiential, social, cognitive and performance-related criteria.

A number of factors are relevant in this instance:

- (a) in a small and specialised domain, coaches would be likely to be known to each other and to organisers within the sport;
- (b) the total number of expert coaches would not be expected to be large;
- (c) sports participation in volleyball is not normally a full-time occupation and coach education structures are not regarded as differentiating between coaches;
- (d) absolute measures of success are very dependent on team resources and therefore concentrated on few individuals, and it is likely that a more all-embracing measure of successful performance would be required.

For these reasons it was decided that peer recognition, experience and involvement with national league first division teams and/or international representative teams would be appropriate. Coaches also had to be currently working with a team.

Contact was made with the Directors of volleyball for the Scottish Volleyball Association (SVA) and the English Volleyball Association (EVA). Each of these individuals was known to the researcher and also were very experienced coaches, although neither was currently working with a team and, therefore, not appropriate for the group. Contact was made by telephone and by letter. The letter included the following text along with a request to identify a group of expert coaches:

- the individuals should be expert as distinct from novice. In theory there could be many of them in the country,
- (given the developmental stage of the sport) expert does not mean ‘in comparison to other coaches around the world’ – but you may want to take into account any (meaningful) international coaching awards or experience,
- you would expect these experts to have demonstrated their superior levels of knowledge and skills in an applied fashion and for this to have been recognised by their peers – coaches of the most successful teams, consistently producing good performers/teams,
- coaches should have demonstrated their expertise in a context in which the fullest range of coaching capacities is required – performance sport, probably meaning senior club volleyball,
- you would expect there to be a gap between the group of individuals identified and the next ‘bunch’¹⁰

Names and addresses of coaches, clubs, home venues, club administrators, and team secretaries were made available by each Association, as were fixture lists for 1997-1998 national league games and Cup competitions in each country.

The identification of coaches took the following form:

- lists of all 1st and 2nd Division men and 1st Division women’s team coaches were obtained from the National Directors;
- each was invited to identify expert coaches using the advice cited above;

¹⁰ Letter to SVA and EVA (see Appendix E).

- The SVA identified 8 in Scotland and 5 in England, the EVA identified 10 in England (expressing the view that the National Director in Scotland knew the coaches there better than he did).
- Discussion took place with each Director
- Of the 8 Scottish coaches, 2 were player-coaches and 1 was considered doubtful because of her relative lack of experience and tenuous club link¹¹ (it had been decided that player-coaches [those who make match management decisions whilst playing on court] would be subject to a different decision making context and should not be considered for the group);
- Of the 10 English coaches, 3 had also been identified by the SVA Director, 1 was a player-coach, 1 was not coaching in a club context, and 2 were considered insufficiently experienced with top level teams. One further coach was added to the list following a re-consideration of the list of 1st Division team coaches.
- This resulted in 12 expert coaches (with one possible alternative)

It should be noted that this process produced a group of coaches from those currently working in club volleyball in Scotland and England, who could be said to be expert. This is not a sample of those available, but an identification of those who qualified for this category.

¹¹ This coach was a possible member of the expert group. However, her role within the team with which she was connected was more of a 'consultant coach'. She did not attend training sessions and only attended home matches. In some ways this was unfortunate since the expert group consisted entirely of males. This was a reflection of the current situation within volleyball and not a selection issue. For example, in England, the registered coaches of all Division 1 Men, Conference A and B Women, all Senior and Junior International team coaches are male.

Each of the coaches was contacted by telephone and invited to take part in the study.

Coaches were told that (a) their home game would be videoed; (b) the researcher and the research would not be intrusive during the game; (c) the research was about decision making and more would be revealed at the time; and (d) the study would require approximately 1½ – 2 hours of their time as soon as possible following the end of the game.

All coaches selected agreed to take part in the study. It had been decided that telephone contact was the most appropriate because the researcher was known by 7 of the coaches and the remaining 5 were aware of his previous involvement in volleyball. Access was therefore facilitated by the researcher's familiarity and history of involvement in the sport.

A number of relevant factors emerged from the identification process:

- The ease of access to the 'sample' was greatly facilitated by the researcher's credibility as a volleyball 'insider'. At this stage (and later in the implementation of the procedures), rapport, relationship and trust were able to be built up very quickly because of the shared domain knowledge, evident and previously demonstrated commitment to the sport and perceived integrity (i.e. would be empathetic to coaching, the sport and the competitive context).
- It was made clear to coaches that the study was not evaluative in the sense that their decision making would be judged as appropriate or inappropriate. It was stressed to them that this was not possible nor intended. Efforts were made in this way to reduce any threat to the coaches.

- No coaches had to be persuaded to take part. A letter of support from the National Volleyball Associations was considered and had been agreed with the Directors, but proved to be unnecessary. Several coaches stated that they “enjoyed this sort of thing”, and all were keen to see the results of the study.
- With such a limited number of expert coaches, it might be possible to deduce the identity of any one coach from examples used. It is important to register, however, that not one of the coaches asked about confidentiality or anonymity. It was clear that anonymity was not an issue. Nevertheless, individuals were assured that the normal principles of anonymous reporting in public accounts and confidentiality of access to data would be honoured.¹²

Figure 6: Sample Coach Characteristics¹³

	Age	Sex	Further / Higher Educ.	Occupation	Years Coaching	Representative Teams	Level of Award
a	38	M	HE	Teacher	10+	Yes	FIVB 3
b	35	M	HE	Teacher	10+	No	FIVB 2
c	39	M	FE	Buyer	10+	Yes	FIVB 3
d	41	M	HE	Lecturer	5 - 9	Yes	SVA Tutor
e	42	M	None	Volleyball Dev't Officer	10+	Yes	FIVB 3
f	34	M	FE	Sports Events Manager	5 - 9	No	EVA 3
g	47	M	HE	Logistics Manager	10+	No	SVA 3
h	42	M	HE	Teacher	10+	Yes	SVA 3
i	40	M	HE	Housing Manager	10+	Yes	FIVB 3
j	38	M	HE	Teacher	10+	Yes	FIVB
k	44	M	HE	Lecturer	10+	Yes	FIVB 3

¹² It is interesting to note that 2 coaches asked for the videotape on an opponent. This was declined on each occasion.

¹³ Information returned from 11 coaches (see Appendix F). There is no significance to the list order. FIVB is the world governing body of the sport.

Procedures / Scheduling

Some of the details of the procedures have already been identified in the section on the research instrument and the devising of the representative group of coaches. This section describes the carrying out of the procedures and the issues involved. Broadly, the following programme was adhered to: conceptual development and research focus; preliminary reading; methodological approach; literature review and study expectations; data collection; analysis and interpretation of evidence; discussion; evaluation of research findings.

Scheduling Each coach was contacted by telephone, and, using fixture lists obtained from the EVA and SVA, a research programme was worked out. A tentative programme was mapped out to encompass all coaches before the end of the 1997-98 volleyball season, and to attempt, where possible, to minimise travelling. A number of practical problems had to be overcome: amendments to the fixture lists, local arrangements between teams, the timing of the game within the day, the unpredictability of cup fixtures, and the perceived (by the coach) difficulty of the game¹⁴ for the coach and team. It proved possible to schedule all coaches and games but attempts to minimise travel were not successful.

¹⁴ Some consideration had been given to the possibility of restricting data collection to sets in which the set score reached a threshold level (e.g. 15 – 10) which indicated a level of competition and therefore ‘pressure’ on the coach and team. This was rejected for two reasons. Firstly, it was impractical when data collecting in remote locations to reject either of the final two sets because of the need to rearrange the visit. Secondly, it was realised that the issue of ‘pressure’ is very individual and targets set and reached, or not reached, will be very influential on the coach’s conduct. The coach may be dissatisfied with performance, and may react ‘as if under pressure’, even in sets in which the scores appear to describe a comfortable victory.

Data collection was arranged as follows:

a -	Perth, Sat, Feb '98	g -	Sheffield, Sat, March '98
b -	Leeds, Sun, Feb '98	h -	London, Thurs, Mar '98
c -	London, Sat, Feb '98	i -	Bellshill, Sat, March '98
d -	London, Sat, Feb '98	j -	Falkirk, Sat, April '98
e -	London, Sat, March '98	k -	Kirkliston, Sat, April '98
f -	Loughborough, Sat, Mar '98	l -	Glasgow, Thurs, April '98

Collection Procedures:

- Arrive at venue in time to meet the coach, familiarise with the surroundings, and reduce the novelty/impact on coach and players;
- Set up equipment. There were no occasions when the desired view was impeded, although there had to be some informal negotiation with linesmen.¹⁵
- On each occasion the video camera had a viewing window (3x4ins) which displayed recorded view; the camera was operated from batteries and on occasions from the sports hall mains electricity supply; spare batteries and videotapes were always carried, with tripod, extension leads, and portable monitor.
- The camera was set up on the side of the court on which the team would be playing in the second set. The first set was used to test the equipment.
- Videotaped recordings were then taken of the 2nd, 3rd, 4th and 5th sets as necessary. The camera position was changed at the end of the 2nd and subsequent sets.

Nevertheless, there were two games in which the coaches indicated that they had at some stage, not felt the need to react to the game flow itself because of the 'comfortable' situation created by the score. This will be discussed later, in the context of 'thresholds' for action.

¹⁵ On one occasion (in Glasgow) there was some doubt about filming until the last minute, since the Sports Centre insisted on an Indemnity Form obtained in advance. This was contrary to normal videoing practice for the sports teams, and was intended for public broadcasting filming on Council property. A 'new' manager had to 'check this out' (and apologised profusely after the match).

- The video-recording system displayed the running time of the tape. The researcher took a note of the major incidents in the game (substitutions, time-outs) for both teams and observable coach behaviours and recorded the tape reference and game score.
- Prior arrangements had been made with the subjects about the likely venue for the SR procedures. The SR procedure was to take place as soon as possible following the end of the game. This meant, however, that there might be some difficulty in carrying on the collection procedures at the game site – particularly for evening games. It was suggested to subjects that they might feel comfortable at home rather than a sports centre if they wished this.¹⁶

Figure 7: Interview Venues

Coaches	Home	Sports Centre	Timescale
	1	6	Within 1 hour
	2	-	Within 2 hours
	3	-	Within 6 hours
Total 12	6	6	

The immediacy of the SR procedures and the interview were comparable with other SR studies.

¹⁶ Some consideration had been given to restricting data collection only to coaches at their home sports venues. This was to prevent them feeling rushed during the interviews and to allow them to continue with transport arrangements. However, this was discussed with coaches and, on a number of occasions, it suited the coaches to take part at away matches or in one case, at a tournament. No coaches expressed any wish to ‘speed up’ procedures – indeed, it was the researcher who eventually had to break up the social and volleyball discussion which often followed. 8 coaches were interviewed following home games, 1 at a tournament (away), and 3 at away games.

- Each game took a different length of time. The general pattern was a 2-hour period at the game, 1 hour for the SR procedures and 1 hour for the interview. The 'closeness' of the game, the coach's post-game responsibilities, travel arrangements, the number of incidents identified and the degree of informal and social interchange influenced the total period of the data collection.
- The subjects were given a short break following the SR procedures and the interview then took place. Interviews were audiotaped with permission.

Analysis

Two forms of evidence required analysis: the subject's accounts of their decision incidents and the rather more structured interview transcripts, which resembled an open-ended questionnaire. The purpose of the analysis is two-fold: to make sense of the evidence collected, and to do so in a way which will illuminate the research questions and the expectations/hypotheses expressed at an earlier stage. In this investigation, the central question is whether the existing theoretical understanding of (non-deliberative) decision making adequately accounts for the evidence accumulated on the expert coaches in the study. It is clear that the fundamental approach will be a qualitative methods approach to the analysis of textual data, in other words, some form of coding, synthesis and interpretation of the meaning expressed in these verbal accounts. In some forms of qualitative methodology, it is likely that analysis will take place during and after data collection. In studies in which the researcher is an active actor and in which there is the gradual emergence of theory, this could be appropriate. In this instance, however, it has been the intention to pursue the data

collection rigorously (within the bounds of the method employed). There is no doubt that there has been a developmental element to the study. This is evident in the development of the conceptual models and the changes to the coding frames. It is also the case that the Pilot Study was an important stage in the process. Nevertheless, analysis took place after the data collection had been completed in order to preserve its integrity and not to influence the researcher's part in the process.

There are a number of issues to be considered in the overall approach and in the procedures to be employed:

- There is a clear distinction to be drawn between coding text using a pre-specified coding frame and the techniques required for open coding (Atkins 1984; Cote et al 1993). In this instance, the research question is specifically focused on the potential explanatory power of existing theories in the field. In addition, the SR procedures have been designed to elicit narrowly focused accounts. For these reasons it is appropriate to employ a pre-specified coding frame. The interview transcripts have a rather more open-ended character but form part of a fairly structured set of questions. Despite this, the interview schedule is composed of distinct, albeit related questions, and cannot appropriately be treated as one body of evidence. Given that the evidence from the second set of textual accounts has the function of supplementing the interpretation of the first, it is appropriate to employ a more unstructured data approach to analysis, but the emphasis will be on the quality of insight provided by the individual coach, rather than any category distribution analysis.

- Two distinct approaches are possible in answering the research question. In the first, the unit of analysis (see next bullet point for a discussion of this) can be analysed for the extent to which each distinctive theory is best suited to account for the decision incidents. To some extent this becomes a ‘best-fit’ analysis and may lose the richness of intra-incident evidence. The second approach would be to accumulate the evidence from all of the units of analysis, decide whether this exhibited a recognisable pattern, and then compare it to existing explanations.

The method adopted will employ a multi-level approach:

1. unit of analysis for best-fit of identified cognitive organisation;
 2. evaluation of the best-fit for explaining the accumulated pattern described by the coaches’ accounts;
 3. evaluation of those elements of the accumulated pattern which are not currently explained by the existing theoretical accounts.
- Any coding frame works by the aggregation of smaller units into larger more synoptic units until the data are suitably represented by these descriptors and they can be used to search for patterns and for comparison. In open-coding, the text/words are divided into units of measurement or meaning which are then given a tag or family name, which represents a range of similar meaning units. These are subsequently aggregated into categories to which a measure of conceptual analysis and insight is applied (Bloom et al 1997). A characteristic of ‘meaning units’ (Tesch 1990) in the rich textual accounts in this and similar studies is that they are composed, not of one word (Atkins 1984:256), but by one idea, concept or piece of information.

This is a significant issue in open-coding and for inter-coder reliability checking. In this study, it is also a significant problem. Although using the pre-specified coding frame, this is detailed at the level of categories, and the 'tags' have to be inferred from an analysis of the theories that the tags represent. In addition, the tags are not sensitive to this particular study. This means that the basic job of relating the meaning units to the appropriate tags requires a (learned and practised) judgement.

The implication for the method of analysis is that a coding frame has to be established which represents the existing theories, and that this requires a degree of 'filling out' to create the necessary tags. There are two further stages for this study:

- (a) the existing theories may have to be interpreted for the extent to which they would be identifiable in the non-deliberative context of the study. This is a difficult methodological point. The rationale for the study was partly based on the premise that there were few if any satisfactory accounts of non-deliberative decision making in complex circumstances. It would be pointless to carry out the study simply to state that this assertion was correct. It is more appropriate to apply the existing theories to the non-deliberative context and to then make an evaluative judgement of their potential for explanation and future use.
- (b) Subsequent interpretation of the findings will place these findings in the context of the particular decision constraints imposed by the volleyball game context. A measure of the volleyball application also needs to be introduced at the meaning unit – tag identification stage.

- A distinction has to be drawn between the unit of analysis used to create the coding structure and the unit of analysis used for comparative purposes (Silverman and Solmon 1998¹⁷). All research methodologies are essentially comparative and in this instance, the study will hope to establish patterns in the way that the coaches' accounts have been interpreted. However, the basic unit of measurement (sometimes called the unit of analysis) is dependent on the length of explanation and the capacity for explanation and description demonstrated by each subject. It is inappropriate, therefore, to 'make too much' of the total number and distribution of the basic meaning units. For this study, the unit of analysis will be the decision incident. Therefore, there are 70 units of analysis, rather than the 747 meaning units themselves.

It is necessary now to describe how the coding frame was devised and the procedures employed to ensure sufficient rigour in the process of analysis. This next section describes how this was achieved.

Each of the stages leading to the development of the coding frame was based on two linked processes – analysis of the relevant literature and the conceptual ordering and re-presenting of the material. The extrapolation of the coding frame categories was based on the models described in chapter two – Figures 1 – 4.

Extrapolation of the Coding Frame The creation of the coding frame was achieved in a number of stages. The initial coding categories were derived from a consideration of the

¹⁷ Although this reference applies to quantitative analysis, it is a useful reminder of the need for rigour in the comparison process.

literature. This resulted in 12 categories, which were reduced to 6: 1. Problem Identification [Prior Consideration of Problem; Problem Description; Antecedents]; 2. Action Decision [Action Decision; Explanation]; 3. Evaluation of Action Decision [Evaluation]; 4. Pattern Evaluation [Pattern Feedback; Immediate Game Feedback; Pattern Developing]; 5. Case Description [Immediate Case Feedback; Case (Player Details)]; 6. Rules [Schemata Rules].

This coding frame was used on the textual account generated in the Pilot Study. As a result of the Pilot analysis:

- It became obvious that the meaning being expressed by the coach was not being captured by the frame;
- The identification of categories from the literature and the open-ended coding of the Pilot account (tags) had been carried out satisfactorily, but the creation of categories had not been successful.

The new set of categories was used on the Pilot Study accounts of the decision incidents and the conclusion of the Pilot Study was that the overall study was viable:

- | | |
|------------------------|---------------------------------|
| 1. Problem Framing | 5. Previous Instance Reasoning |
| 2. Action Decision | 6. Individual Player Background |
| 3. Evaluation | 7. Should ... if Reasoning |
| 4. Context progression | |

Following a more extensive review of the literature, some changes were made to the coding frame. This frame was used on a sample of 30 incidents from the study data. The coding frame consisted of 7 categories, 3 of which represented alternative models of cognitive organisation, and had representative tags attached:

- | | |
|---------------------------|-------------------------------|
| 1. Problem framing | 5. Pattern Recognition |
| 2. Action decision | 6. Metacognitive Control |
| 3. Evaluation | 7. Explanation/interpretation |
| 4. Similarity recognition | |

As a result of this stage of the analysis and a further stage of reflection on the Conceptual Model (Figure 4), some final changes were made to the coding frame. The coding frame used in the analysis was as illustrated in Figure 8 (pages 132 - 135), to which exemplar meaning units have been added to illustrate the Category Tags.

Coding Reliability

Although only one researcher carried out the coding, it is important to obtain a measure of the reliability of the coding exercise by carrying out a check on the accuracy of (a) the identification of the meaning units and (b) the allocation of meaning units to coding categories.

(a) Identification of Meaning Units

A member of University academic staff was asked to identify meaning units in a sample a 10% of the SR transcripts. The individual concerned had experience of research and a familiarity with the game of volleyball, but was not an expert in the game.

The total number of meaning units identified was very similar:

	Researcher	Tester
Total No. of Units	69	75
	100%	108.6%

Figure 8: SR Coding Frame

	Category	Tag	Exemplar Meaning Unit
A	Problem Framing	i	Abstract Reasoning
			<ul style="list-style-type: none"> a. we weren't scoring points so we were siding out reasonably freely but not scoring points because we were not focused at that point. [WC1] b. we were up against three, the three top blocker, we weren't passing that well, the ball was probably going to go to the outside hitter wherever it went. [NA1]
		ii	Specific Instance
		<ul style="list-style-type: none"> a. No. 7 has missed a number of serves. [IL1] b. We were in transition and Paul the setter came way off the net back towards position one, and, to get a ball, and the outside hitter just sort of swiveled around inside the 3 metre line. [JW1] 	
		iii	Key Attractor
			<ul style="list-style-type: none"> a. Can't afford to lose momentum. [MB1] b. The score was very tight [JW1]
B	Action Decision	i	Description
			<ul style="list-style-type: none"> a. I told him that and specifically I told him to set a particular set. [TD1] b. I didn't react directly, but the subsequent play when they got the point, I then took the time-out. [MB5]
		ii	Purpose
			<ul style="list-style-type: none"> a. That was to put a serving specialist in backcourt and to tighten up. [IL1] b. To slow down and play percentages and safe volleyball [BD1]
C	Cognitive Representation		
		1	Schema
		i	Recognition of pattern
			<ul style="list-style-type: none"> a. It all of a sudden appeared. [TD3] b. It was just at that moment, I thought, perhaps its better that I talk them through it. [HL5]

Figure 8: SR Coding Frame

	Category	Tag	Exemplar Meaning Unit
1		ii	Evidence of rule governed behaviour a. We then reached a situation where there had been a cluster of points building against us, so I had to break the flow at that time. [MB2] b. 2 or 3 points I don't feel comfortable with, 4 or 5 is the stage I would start to feel comfortable with a substitution for the sake of a substitution. [VK3]
		iii	Imperative behaviour a. I had to make it now. [BD1] b. That was almost a gut reaction situation, two stupid points, two bad errors. [CF5]
	2	iv	'should .. if' reasoning a. Well, by rights I know that I should be calling a time-out here. [JW5] b. Perhaps I should have taken the time-out at 5-2 because the same type of error had persisted at the net. [VK5]
		<i>Schema Script</i>	
2		I	Similarity to generalisable examples; instance framing a. We were having problems siding out. [NA1] b. We were having a problem with them hitting over the setter, and the No. 1 couldn't get the line right. [IL6]
		ii	Related to expectation of players; enabling conditions a. I felt convinced by the outcome of the match. [VK1] b. The nature of No. 13 is that when he gets frustrated he really goes into himself. [BD1]
		iii	Temporal 'this will happen'; forward reasoning a. I knew that Andrew coming in would bring that all back in together again. [CF2] b. They hadn't got used to her so she was going to win points just because of being unusual. [KT5]
3	<i>Case Script</i>		
		I	Specific reference to previous game a. [No example]

Figure 8: SR Coding Frame

	Category	Tag	Exemplar Meaning Unit
		ii 'been in this situation before'	a. Subconsciously I was remembering the, us not closing out a couple of matches that we should have closed out, and ended up losing them. [JW4] b. [No example]
4	<i>Interactive Script</i>	iii 'tried this before'	a. I've had to learn to back off a wee bit. [MB3]
		i Unfolding pattern plus threshold	a. If we didn't put it fight at that point they may then have got into a point of 6-all, 7-all, 8-all and, you know, later in the game, when it might have been harder to change it round. [WC1] b. I think that had it gone to 7-2 or 8-2, we were giving away the set. [NA1]
		ii Choice narrowing; hypothesizing	a. We got to a position where it could have gone a lot worse. [IL1] b. If it becomes a major problem then we'll deal with it, but I was happy in my mind at that point that, no let's let them ride that. [GR2]
		iii Strategy - metacognition	a. No. 2 would have played at some point during the set. [IL1] b. Because we were in control at that point, and we were fairly comfortable. [CF1]
		iv Framing; modelling	a. in that set, I had used or I was going to use, in my mind, the other subs, ..., so I was aware that I had a number of subs left. [BD2] b. When he went back to serve I felt at that stage we needed a wee bit of energy. [TD6]
D	<i>Heuristics</i>	i Expectations of success	a. I want to do it while it would have a greater impact. [GR1]

Figure 8: SR Coding Frame

Category	Tag	Exemplar Meaning Unit
E	ii Evidence of 'best fit'	<p>b. I felt that it would have made more of an impact in doing that. [WC3]</p> <p>a. I was going to lose something in terms of his blocking ability, his hitting power, but I had to accept that. [CF1]</p> <p>b. The other girl most likely isn't a better hitter but because of the unusual way she is effective. [KT3]</p>
	iii Evaluation of outcome	<p>a. I would have preferred to make it earlier actually, rather than later. [BD1]</p> <p>b. I think they listened to, and I think things got a little bit better after that. [JW3]</p>
	iv Explanation	<p>a. but it was a logical decision because the player that came on plays in the same position as her, and she's one of the most stable passers in the team. [NA5]</p> <p>b. I was waiting for a natural break, it wasn't coming. [HL4]</p>
	Other	

Of the total number of meaning units, 44 (64%) were matched exactly, and 12 (17%) had the same parameters as the researcher but had been divided into two. Only 7 (10%) were substantially different in composition. The results were considered to be satisfactory, following an investigation of the 'divided units'. The tendency to create smaller units was a result of identifying separately (a) technical explanations and further elaborations on a theme. It was considered, therefore, that there should be some confidence that the meaning units had been identified appropriately.

(b) Allocation to Coding Categories

The results of the allocation to Coding Categories test was lower than had been hoped for. In a (different) sample of 10% of Units of Analysis, the coincidence between Coding Categories A – E was 71%.

The correlation between sub-categories was lower: exact matches were recorded in 60% of meaning units.

Although these are lower than anticipated, a number of factors have to be taken into account:

- The coding framework was complex with 24 sub-categories. In the context of a multi-researcher investigation, considerable training in coding would have been undertaken to ensure the reliability of the assignment of meaning units. However, for reliability testing purposes, extensive training would have defeated the purpose of mitigating researcher

bias. To a considerable extent, therefore, the second coder was being asked to assign units with a minimal exposure to a complex coding framework.

- It was also the case that an extensive knowledge of volleyball was helpful in interpreting the meaning units.
- Apportioning meaning units to the main coding categories A – E was the most important factor in terms of identifying decision models.
- The most important factor in expressing confidence in the reliability of the coding was that no systematic errors could be detected in those instances in which the coders differed. Of the 12 categories differently assigned, only 1 was diagnosed on more than one occasion into another category.

An example of a coded SR response is given in Appendix G and an example of an Interview transcript is presented in Appendix H.

Presentation

It is almost inevitable that the presentation and interpretation of the evidence will largely be conducted by the written word. However, it is important to search out patterns in the evidence and this will be assisted by the use of descriptive statistics. These will take the form of simple frequency and distribution tables. This is a useful presentational device in “studies that use some type of observational instrument that codes designated categories of behaviour” (Thomas and Nelson 1996:375). The tables will provide combinations of:

- Units of measurement x Coding categories
- Units of analysis x Types of decisions x Selected coding categories

The summary statistics assist in the process of interpretation and discussion, but this is largely dependent on a narrative account of the evidence. In this form of qualitative analysis the presentation of evidence, its interpretation, and the continuation into discussion of the implications are woven into one account. Nevertheless, there is a structure to this account:

1. Patterns in the evidence (including the use of illustrative exemplars from the data) collected and an analytic narrative (see Thomas and Nelson 1996:374);
2. Relationship to the expectations generated from the review of literature;
3. Explanations for the findings in the light of the literature available and the limitations imposed by the study;
4. Evaluation of the findings for a judgement on the research questions;
5. Conclusions drawn in the form of claims made for the study; and
6. Implications for the issues raised in the introduction (education, coaching) and for further study.

Chapter Four

Presentation of Findings

This Chapter describes, illustrates and provides a brief analysis of the evidence collated from the Stimulated Response coach transcripts and from the coaches' interviews. A table summarising the Meaning Units by coding category and by coach is presented as Appendix I.

Appendix I demonstrates that much the greater part of the textual responses was considered to be relevant and, of that, only 7% of Meaning Units (MUs) could not be attributed to one of the pre-selected coding categories. This is perhaps not surprising since the coaches' responses were very directed and focused, and follow-up questions were likely to be relevant. The tables that follow present a secondary analysis of some of this data.

Table 1: Units of Analysis per Model Category

	C1 Schema	C2 Schema Script	C3 Case Script	C4 Interactive Script	C5 Other	
Total MUs	34	67	3	144		248
Total UofA	7	11	1	43	8	70
	10%	16%	1%	61%	11%	100% UofA

- Following the review of literature, the coding frame was based on a number of potential models of decision making, each representing a different mode of cognitive organisation. The findings from the SR analysis are very clear. The category Interactive Script [this was described as a ‘slow’ version of the schema script model] is clearly the most favoured style, accounting for 61% of Units of Analysis (UofA). This is followed by Schema Script with 16% and Schema with 10%. The ‘Other’ category represents those UofAs about which no model category could be ascribed.
- The summary table (Appendix I) demonstrates that individual SR accounts contained MUs which could be ascribed to different model categories.¹ The table above shows the total number of MUs in each model category coding. When the Other category is taken into account, the MUs follow a very similar pattern to the UsofA. This is an interesting confirmation of the pattern, since the devising of the UsofA involved a judgement of principal or fundamental orientation (albeit this was not a difficult judgement).
- The Interactive Script was a model category not discussed in the literature but supported by elements of decision theory. This will receive much fuller attention in the discussion chapter which follows.

Following a review of the likely types of decision to be made by coaches, there was an attempt during the SR procedures to achieve some balance in the types of action decisions taken. The following two tables illustrate this balance and its impact on the model categories.

¹ The appropriateness and likelihood of this is discussed later in the Chapter.

Table 2: Action Decision Incidents

Time-out	25	36%
Substitution	25	36%
Tactical	20	29
	70	100%

- These categories are summary titles and represent acknowledged contexts within the sport. However, they do not illustrate the variety accompanying each of the categories and these are presented in Table 4.
- There are potentially more substitutions than time-outs in a volleyball set, but it is likely that the significance of the time-out will have brought this action to the attention of the coaches in the study, in addition to the research design desire for balance of incidents.

Table 3: Model Category by Action Decision Incident

	C1	C2	C3	C4	C5
Time-out	6 [86%]	2 [18%]		16 [37%]	1 [13%]
Substitution		1 [9%]		22 [51%]	2 [25%]
Tactical	1 [14%]	8 [73%]	1 [100%]	5 [12]	5 [63%]
	7 [100%]	11 [100%]	1 [100%]	43 [100%]	8 [100%]

- There are some interesting and potentially significant patterns emerging from this data. The Schema model category is not extensive as a proportion of the total but is very distinctively distributed to the time-out action incidents. A similar pattern can be seen with the Schema Script category, but here the tactical action incidents are prevalent. There is only one instance of Case Script (which is discussed at length later in the study).
- A different pattern emerges from the Interactive Script UofAs. These are distributed, for the most part, between two incident categories – time-outs [37%] and substitutions [51%], with far fewer tactical incidents. Clearly, these patterns will

receive further discussion. It does seem likely that the substitution would be susceptible to the ‘slow script’ approach, but the time-outs need further investigation and discussion.

- The ‘Others’ category consists of those SR responses about which it was difficult to come to a firm conclusion as to its model orientation. These were more prevalent in the tactical incident category.
- It is important to interpret Table 3 with the overall distribution of model categories in mind. Although it is informative (and potentially very significant) to identify the relationship between time-outs and Schema, between tactical incidents and Schema Script, and between substitutions and Interactive Script, the overall distribution of model categories has to be borne in mind. Thus,
 - Of the total number of time-outs: 24% are C1, 64% are C4
 - Of the total number of substitutions: 88% are C4
 - Of the total number of tactical incidents: 40% are C2, 20% C4, 20% C5

More insight may be gained into the distribution of model categories by identifying the action decisions in more detail.

Table 4: Action Decision Incidents by Model Category

		C1	C2	C3	C4	C5
		Schema	Schema Script	Case Script	Interactive Script	Other
Substitution	Substitution		1		17	2
	Preparation				5	25
Time-out	Time-out	5	2		12	
	Requested	1			2	1
	Considered				2	25
Tactical	Instructions	1	7		5	3
	Non-perf. related		1			2
	Considered			1		20
Totals		7	11	1	43	8
						70

- The patterns identified previously are reinforced to some extent. The relationship between substitution and C4 is strengthened. The action of asking a substitute to be prepared and ready to go onto court is likely to be part of a lengthier process.
- The ‘process’ element is further illustrated in the time-out incident category. Where time-outs have been considered but not taken, they are in the C4, Interactive Script model category. This reinforces the overall emphasis on the ‘slow script’.
- The tactical action decisions form a much more untidy pattern, and it seems that this incident category will demonstrate much greater variety than the other two. This will receive attention in the more detailed analysis of model categories which follows.

It is important to search for distinctive patterns in the distribution of MUs and model categories between the coaches in the study.

Table 5: Distribution of Model Categories by Coach

Coach	1	2	3	4	5	6	7	8	9	10	11	12	Total
C1	1	1	1	1							2	1	7
C2	1	2		2	2		2					2	11
C3	1												1
C4	3	3	3	2	4	5	3	6	3	6	3	2	43
C5			2	1		1	1		1		1	1	8
Average MUs	9.6	11.3	7.5	12.6	11.5	10.3	8.8	11.8	12.	12.5	6.5	13.6	

- To some extent the pattern of model category distributions within the 6 incidents for each coach is likely to follow the overall distribution. However, there are two distinct sets of coach profiles: (a) 8 of the coaches have profiles, which include at least two and usually three categories; (b) 3 of the coaches are exclusively Interactive Script [albeit one had an ‘other’ category included]. In the discussion which follows, it will

be important to pay attention to the possibility that coaches have the potential to act with a range of cognitive organisations, and that coaches may also have a predisposition [however developed] to act in one principal mode.

- The average number of Meaning Units per coach was 10.7. This reflects the length of the SR response and it seems unlikely that there is a pattern to this, other than to recognise that the individual coach's capacity and willingness to respond will be constrained by a number of factors, including (a) verbal and intellectual capacity; (b) confidence in describing his opinions/thoughts; (c) the extent of the 'descriptive' part of the response; and (d) the need for probe questioning following the initial response. It is also the case that a Meaning Unit could be a few words or a combination of sentences. It is interesting, nevertheless, that the two most extensive sets of responses came from the two most experienced, international team coaches.

Analysis of Coding Framework Categories

Problem Framing

This section centres on two issues: (a) whether the framing of problems is carried out in an abstract (which is characteristic of expert behaviour) fashion or by reference to specific instances; and (b) the extent to which the problems identified reinforce or otherwise the assumption built into the study that the coaches' decisions will be taken in response to complex, untidy, difficult to frame situations.

Of the 70 UsofA, 25 had abstract problem framing, 18 had specific instance framing and 9 had both. In many instances, the coach assumed that the problem was summed up in

the ‘incident question’ framed by the researcher, and went on to deal with the decision making process. There was no evident pattern to the distribution of the two principal modes, whether by coach or by model coding category. However, analysis of the statements made about the framing of problems reveals the ‘expertness’ of the process.

Problem framing statements can be categorised into 4 categories

Figure 9: Problem Framing Categories

Abstract	1	Game Situation Analysis
	2	Tactical Analysis
Specific	3	Individual Instance
	4	Individual Pattern

1. Game Situation Analysis²

This is characterised by an abstract, synoptic, usually strategic summary of the game situation, within which is contained an implied problem for the coach’s team. The assumed and overriding concern is to ‘manufacture’ game winning circumstances.

- *We weren’t doing the things in preparation that make things happen [KT4]*
- *We were struggling a little bit to move forward at that point [HL1]*
- *I wasn’t happy that they were thinking very much within their own game plan, I didn’t think that they were playing against the opposition [GRI]*
- *We’ve lost a couple of matches because we haven’t closed out the set in areas that we were supposed to close it out [JW4]*

² Throughout this Chapter illustrative examples are given from the coaches’ SR responses. Each example is referenced by the coach and the incident number.

- *It wasn't a sense of, okay we've won the point, we're back on the road again, it was a general way that they were going about things [CF6]*

2. Tactical Analysis

This category is still abstract in the sense that it is a synoptic overview of the current situation but expressed in very specific technical or tactical terms:

- *I felt that we were doing okay in serve and transition from that area, but still having too much difficulty siding out [KT4]*
- *They were read and react blocking at that stage and making the block quite comfortably [BD5]*
- *The opposition, the speed of the ball wasn't of any great, it wasn't causing us timing problems [GR1]*
- *With the service receive it was difficult for our setter to set to other people so therefore she was our only attacker at the time [KT1]*
- *We had lost control of hitting at that stage [VK2]*
- *Realigning the defensive position a little bit, the blocker was setting it too far [NA1]*
- *I thought that we were losing the game in block defence and in actual fact I was pretty confident that our side-out unit could continue to function [TD4]*

It is noteworthy, and perhaps characteristic of the expert, that the analyses are couched in terms of the coaches' own team's performance. This suggests a focus on issues / problems about which the coach has some degree of control and which have followed from analysis and evaluation. There are a much smaller number of framing instances in

which the opposition is evaluated, but this also leads to an implication for the coach's team:

- *Initially when I was watching him in the warm up when the setter was going through two, he had a lot of difficulty setting them, so initially I was attacking him, attacking that side of the net [CF3]*

3. Individual Instance

The specific instance problem framing is of two types: the first focuses on very specific instances within the game:

- *He had just been tooled [JW2]*
- *I felt that, speaking to him between the time-outs, he wasn't feeling well [WC4]*
- *Richard the setter came way off the net back towards position one [JW1]*
- *I'd given No. 13 instructions [BD4]*

4. Individual Pattern

The second category again focuses on the individual, but frames the problem as a pattern of behaviour. The implication is that the specific instance is one of a series of instances and is viewed as confirming this pattern or is a threshold to action:

- *No. 7 had missed a number of serves [IL1]*

- *The setter was reacting to a very poor pass on service receive and instead of establishing a control position and dealing with the ball properly [MB5]*
- *He wasn't finishing the set off, he was pulling back on it so the ball didn't have the right flight line [CF4]*
- *The pass wasn't very good at that point and he was beginning to take the soft option, so that his sets were stable but in actual fact they were beginning to tune into that, which is exactly what they wanted [TD1]*
- *Although hitting errors had been our problem in the early part of the set, and he had delivered relatively good ball to the spikers, as the spikers lost control of the game. The setter then lost control of running the game [VK6]*

Summary

- Although the problems are expressed in a simplistic way, there is no doubt that they convey the complexity of the problems about which coaches were assumed to be dealing. It is clear that the problems are contested (by the opposition), multi-variable, concerned with the quality of performance of individuals, and not susceptible to simplistic solutions.
- It is likely that the coaches have brought a degree of synoptic overview to the problems. This has two implications. The first is that this abstract, strategic, 'patterned' approach is characteristic of expert behaviour. The second is that the coach may be reacting to the stimulated response with a degree of interpretation which has benefited from retrospection and to which the coach has brought a degree of 'ordering'.

- It is implied in many of the coach responses that the coaches have employed a mental model of the situation. This has a past perspective in that it is based on instances/experience, and a future perspective, in that it is able to predict a problem situation.
- The coaches' capacity for verbalising the problem suggested that they could deal with complex issues.
- There are a smaller number of examples of specific instances, which have acted as catalysts for decision behaviour. However, in the majority of cases, and across all coaches, the coaches have the capacity to analyse problems in abstract, synoptic, principled ways. The problem framing is centred on the status of the conditions for winning the game and focuses either on the overall status of the game³ or on the 'problematic' contribution of one of more individuals.

Key Attractors

The focus on problem framing was an opportunity to identify 'key' or common elements, which had underpinned the coaches' analysis of the circumstances in which they found themselves. Identifying these sets of principles is important for contributing to one of the main research questions in the study, on the commonality of decision heuristics. The SR responses of the coaches were expressed in slightly different ways but provided remarkably stable views on what was important within problem framing.

By far the greatest preoccupation was with the 'state of momentum' within the game and the set in particular. This was linked to a number of less prevalent concerns about the

³ The Key Attractors for such judgements are dealt with in the next section.

unfolding score. A second group of concerns were about the nature of the mistakes being made by the team and/or individual players.

It was very clear that 'momentum' was used as a barometer of comfort:

- *They had started to build up some momentum [VK2]*
- *We wanted the momentum change [KT3]*
- *It was a momentum type of thing [CF6]*
- *I didn't think that we were losing the place [CF2]*
- *I was bothered about gaining momentum for the next set [KT3]*
- *I felt the game wasn't slipping away from us at the other times [KT2]*
- *Here we've got 2 or 3 points in a row and I felt that we needed to break the momentum [KT2]*
- *Not lose momentum [MB1]*
- *To break the rhythm of play [HL2]*
- *Change the rhythm of the game [TD6]*

The overall flow of the game (momentum) was related to some specific fears. Particular concern was expressed about losing clusters of points:

- *Cluster of mistakes [KT1]*
- *There were too many points in a row [NA5]*
- *A string of errors in a row [NA6]*

The coaches are also concerned that these points or 'reversal situations' should not happen too quickly to be contained:

- *The game turned away from us so quickly at the end [TD4]*
- *If the situation exploded [HL1]*

Because of the interest in momentum and the score, the coaches also recognise when fortunes are even:

- *I'm thinking that the game is getting a little tight [JW4]*
- *So that balanced the game out [IL3]*

The second major set of attractors are centred on the coaches being more concerned about mistakes made by the team (and therefore having an assumption about being controllable), rather than the points being 'won' by the opposition. Coaches are particularly concerned about mental errors:

- *It wasn't the fact that they had scored the points, it was the fact that they had come off our errors [IL3]*
- *They weren't points that they won, they were just mental errors that we made [CF5]*
- *Slipping away through mental errors rather than anything else [NA6]*
- *Players not switched into the game [WC1]*

Summary

The coaches have an overriding concern about creating and maintaining momentum within the play. This is closely related, although not exclusively, to the unfolding score-line. There is a trend within the coaches' statements for them to wish to control the situation as much as possible.

The key attractors are about change and the need for change, in order to maintain control and momentum. This is recognised in the principle of the action decisions which follow:

- *I may have made the change to swing it our way [IL4]*
- *Keep talking or you can do something [TD2]*
- *It was important to deal with that immediately [MB5]*

Action Decision

The second group of coding categories dealt with the coaches' decisions and the purpose attached to the solution adopted. There were a large number of responses coded to these categories (in total 21% of all Meaning Units). This was not surprising since the SR stimulus question invited the coaches to expand on the incident and on the decisions taken. The coaches would also feel comfort in responding directly to action which they had taken. **[It is important to note that a later section in this Chapter deals at greater length with the solutions adopted and offers some analysis. The 'action decisions'**

coding category was a descriptive account of the action taken by the coaches. In the later section, evaluative comments are analysed.]

The SR responses were divided into two groups: those which elaborated further on the action decision, and those dealing with the ‘purpose’ for the decision.

- *I called a time-out and just really to say I've given him these instructions [BD4]*
- *I told them not to focus too much on the attacker [JW3]*
- *I remember shouting to him when he came onto the front court [BD3]*

However, the great majority of statements were restatements of the problem with the solution adopted by the coaches. These were expressed in technical or psychological terms:

- *I wanted to run tempo plays around the middle hitter [BD5]*
- *We wanted to run transition particularly from position 2, rather than from the middle, and that made it easier to run the transition [NA3]*
- *It was that he would become the swing hitter [BD3]*
- *It was to break the momentum and emphasise the fact that we were getting cut to bits [JW3]*
- *I was happy to let them ride that and deal with the emotion of the game at that point [GR3]*
- *Because he had been successful in the previous 2 sets [IL4]*
- *I didn't take one because I didn't know what else to tell them [JW5]*
- *Basically to slow it down and play percentages and safe volleyball [BD1]*

Summary

The focus of the study is on how coaches make decisions and much less on the appropriateness of those decision. For this reason, less has been made of this section of the coding frame than of others. However, a number of interesting comments can be made:

1. It is clear that the coaches were in no doubt about the purpose attached to their action decision. Rational, logical (and perhaps technically appropriate) explanations were to hand.
2. The coaches provide an explanation for their choice of action decision but do not discuss alternatives. [This is dealt with a little further in a later section.]
3. The Discussion Chapter will focus in more detail on the nature of decisions, but it would appear from these responses that coaches are responding to the problems they have formed in rational, trained ways. No impression is given that these decisions are intuitive, sub-conscious or inexplicable. However, the limitations of the SR procedure do have within them the possibility of secondary ordering of the coaches' thoughts, and this may lead to a more ordered and 'tidy' set of responses than is the case during the 'hot action'.
4. There is some reinforcing of the impression from the coaches' responses that they attempt to maintain the management control of the game, and focus, therefore, on solutions within their control.

C1: Schema Model Category

The Schema model of cognitive organisation was discussed at some length in the review of literature. It derives from a ‘recognition’ model of decision making and assumes (in a similar way to motor theories of behaviour) that the recognition of appropriate situations ‘triggers’ a pre-selected response. It was argued that such a situation was possible in volleyball match coaching since it contains potentially non-deliberative circumstances. The coding framework was designed to capture these principles: recognition of pattern, evidence of rule governed behaviour, imperative behaviour, and ‘should ... if’ reasoning.

Table 6: Distribution of Schema Model Meaning Units

	No. of Meaning Units	
Recognition of Pattern	7	21%
Evidence of Rule Behaviour	12	35%
Imperative Behaviour	10	29%
‘Should ...if’ Reasoning	5	15%
Total	34	100%

C1 MUs accounted for just 14% of the Model Category MUs, and 7 Us of A were designated as C1 (10%). There are relatively few examples of C1 decision behaviour and almost all of these are linked to time-out incidents. It is not surprising that the two should be connected: the time-out is an ‘immediately available’ response for the coach and can, therefore, be a general response to recognition-primed situations.

Coaches clearly did recognise situations in a fairly immediate way:

- *It all of a sudden appeared [TD3]*
- *Just immediately before it, I looked and thought, no let's stop it [HL5]*

- *That was almost a gut reaction [CF5]*
- *Well by rights I know that I should be calling a time-out [JW5]*

The notion of imperative decision making is acknowledged:

- *I had to stop it at that point [TD3]*
- *It was obviously time to take a time-out [VK5]*
- *The fact that the pass broke down, meant that I had to influence the game at that point [TD3]*
- *We reached a situation where there had been a cluster of points building against us, so I had to break the flow at that point [MB2]*

The theory assumes that the coaches have a set of rules, which apply to certain situations.

These appear to be related to major crises and the cumulative effect of the immediate past rally outcome on the score⁴:

- *You get into a situation where you lose 3 points consecutively, there is a need to interject and break the rhythm of the game at that point [MB2]*
- *I would tend to take my time-outs earlier rather than later [VK2]*
- *I normally go on 3 or 4 points [JW3]*
- *Normally I'd probably go to 3 points, 2 or 3 points, at that point in the set, definitely no more than 3 [JW3]*

⁴ It had been anticipated that there might be 'major incidents' in the games – serious injury, disputes with officials. Fortunately for the players and teams, but disappointingly for the breadth of the study, these did not happen!

- *If a player's beginning to make a mental mistake, ... you have to correct that immediately [TD3]*
- *Perhaps I should have taken a time-out at 5-2 because the same type of error had persisted at the net [VK5]*

Summary

Although it is a small proportion of the total, C1 decision behaviour was present and distributed between 6 of the coaches in the study. It is clear that the coaches recognised situations in which the response was almost automatic. Interview data should help to establish whether coaches contextualised this recognition. Despite the small numbers, it seems likely that this form of decision making is close to non-deliberative and is related largely to the calling of time-outs.

A number of interesting issues need to be discussed:

1. The nature of the recognition and whether a threshold is in operation.
2. This is important because the number of time-outs available is very limited, and the 'automatic' part of the coaches' reaction is likely to have an element of conscious control.
3. Do coaches share their 'frames' of reference for recognition?

C2: Script-Schema Model Category

This model was derived from the literature on decision making and interpreted in the context of non-deliberative decision making. As in the first model, it is necessary to 'recognise' the situation, but, in this case, this is not a specific 'picture' but a

generalisable example, which then requires further processing. The response is not so immediate and automatic, although, with expert behaviour, this could be sub-conscious or a tacit process. The individual recognises the ‘enabling conditions’ of the problem, rather than the example. This is a potentially earlier stage in the process (expert behaviour) and is akin to reading/interpreting the first important principles in a script, and predicting the likely outcome. This may lead to a decision to act to pre-empt before the problem emerges or before it reaches serious proportions. The recognition triggers off a link between the instance and the enabling condition. The enabling condition provides an interpretation of the instance. These lead to recipe-type solutions.

The coding frame meaning units employed were: similarity to generalisable examples, instance framing; enabling conditions, related to expectations of players; and forward reasoning, ‘this will happen’.

Table 7: Distribution of Script Schema Model Meaning Units

	No. of Meaning Units	
Similarity to generalisable examples Instance framing	16	24%
Enabling Conditions Related to expectation of players	42	63%
Forward Reasoning ‘This will happen’	9	13%
Total	67	100%

This Model Category accounted for 27% of the total of Meaning Units ascribed to Model Categories and 16% of the Units of Analysis. Although not nearly the predominant category, it was certainly a significant approach, and was distributed across 6 of the coaches in the study. It was anticipated that this approach would be common in decision making in situations in which some deliberation was involved. It was necessary to

evaluate whether this type of reasoning would be evident in the more time-pressured circumstance of the volleyball game.

Coaches recognised generalisable instances:

- *But again we had a service error [MB4]*
- *When I was looking at the situation, when Polonia had the ball, and were about to serve ... [BD3]*
- *We were having problems siding out [NA1]*
- *As soon as I saw the ball in Polonia's hands [BD4]*
- *When the previous point had failed [HL6]*
- *It was something that we'd looked at before and done before [NA2]*
- *It looked necessary at that particular time in the game [NA3]*
- *Because we hadn't rehearsed it in training [BD3]*

Coaches are then able to verbalise enabling conditions, particularly (but not surprisingly in the context of the sport) about the players. These expectations are based on (relatively) long-term experience of the players:

- *I know he's best to be left to let the pattern unfold [TD1]*
- *I know that the hitter I spoke to is slow in his movements [JW1]*
- *She drifts out of the game now and then [KT1]*
- *He doesn't always follow instructions [IL5]*
- *No. 13 really struggles when people talk to him [BD4]*
- *He then carries these problems with him and he gets annoyed with himself [MB1]*

- *Generally, is when we're siding out, sometimes we lack organisation [BD3]*
- *They tend to be a bit erratic [NA2]*
- *He sets patterns and they are very particular [TD2]*

Occasionally statements are made which have a dual purpose of framing the problems and linking to an assumption that the player could be expected to do better:

- *The setter that was on was just going for one option [BD1]*
- *For No. 8 who was beginning to make too many mistakes [KT1]*
- *It was the fact that he was playing hot and cold in there [WC2]*

Having recognised an instance, and found a generalisation 'enabling condition' set of frames to which it refers, the coach makes predictive assumptions about the future:

- *We could easily have gone on a long slide and we were running out of ideas [NA1]*
- *He was either going to go back to his good plays or he was going to slip back into where he was a set earlier [BD4] (Good example of uncertainty in decision framing)*
- *In the back of my mind I always knew that the guys would wake, somebody would wake up [JW5] (don't decide too early)*
- *The combination plays wouldn't be effective because they would just go with the ball [BD5]*

Summary

There is a 'style' of decision making which is centred on recognising the situation, but which has a processing element which is not present in a purely Schema decision.

Although the coaches can verbalise the enabling conditions, it does seem likely that the process will depend on a tacit set of assumptions about the unfolding pattern of play and a 'recipe' style set of solution frames which are stored as a bank of solutions should the prognosis be negative. The solution can be accessed without consideration of alternatives. The significant issue is the place of the variability in enabling conditions – in essence, the 'hardness' of the judgements about the players and their capacities.

This is a significant decision style. There is a need to discuss this approach in the context of limited decision alternatives and the contested nature of the decision arena.

C3: Case Script Model Category

There is some evidence in the literature of using specific case recollections to provide shortcuts to solutions. These are then either confirmed by subsequent activity or an amended solution is adopted. For the volleyball coach this would involve recollecting previous incidents in matches, specific plays or specific player reactions as exemplars when problem framing, and applying the solutions that were applied on the previous occasion. This possibility was built into the conceptual model and the coding framework.

Only one Unit of Analysis was coded to Case Script and even this was not a strong example, since it appeared to be based more on a series of previous examples. In incident MB3, the coach describes his interaction with a player. Given the error which occasioned the incident and with most other players, the coach would have intervened in some fashion. With this player, the coach has learned not to intervene:

- *So I've had to learn to back off a wee bit [MB3]*

There is one other example in which the coach is indicating that the lessons learned from previous specific instances are being heeded:

- *Subconsciously I was remembering us not closing out a couple of matches that we should have closed out, and end up losing them [JW4]*

Summary

There is only the most minimal of evidence to indicate the use of this approach to decision making, and on the basis of the study, it cannot be described as a common approach. This does not seem to be difficult to understand. The complexity and variation of contexts, players, situations etc. with which the coach is faced, suggests that the coach is more likely to use generalisations (Schema Script) rather than specific games. The frames used in the Schema Script approach can be thought of as constructions based on many cases.

There was an expectation before the data collection stage that the case script model would be appropriate in response to particularly critical incidents. This and the question of what constitutes a case require more discussion.

C4: Interactive Script Model Category

Following the review of literature, it was argued that another potential decision making model was the Interactive Script, or ‘slow script’. This assumed a less reactive approach in which, although the eventual decision incident is time-pressured, there has been a conscious cognitive process leading to that point. This approach was predicated on the basis of the limited decision choices available to the coach, the place of strategy and opposition, and the possibility of the coach attempting to minimise the non-deliberative element of the process. The Interactive component, therefore, assumed some of the characteristics of deliberative decision making.

The categories used in the coding frame were: unfolding pattern, plus threshold, choice narrowing and hypothesising, strategy and metacognition, and framing or modelling.

Table 8: Distribution of Interactive Script Model Meaning Units

	No. of Meaning Units	
Unfolding Pattern	34	24%
Use of Threshold		
Choice Narrowing	23	16%
Hypothesising		
Strategy, Metacognition	42	29%
Framing, Modelling	45	31%
Total	144	100%

Meaning Units ascribed to these categories accounted for 58% of all MUs. Units of Analysis at 43 (61%) were by far the most numerous. It is hardly surprising, therefore,

that all coaches employed this approach. Indeed 2 coaches employed this approach for each of their six decision incidents.

The coaches' statements within the SR responses are best described under 5 headings: synoptic perspective/modelling; process; threshold; strategy; and choice narrowing/hypothesising.

Many statements indicate that the coaches in the study have an overview of the position within the game and create a working model of the situation:

- *Because the game appeared well within our control [VK3]*
- *I felt that one of the reasons why we weren't moving the game along was because we were playing off 4 players as opposed to playing off 6 players [WC2]*
- *My recollection is that we had less than 2 first tempo hits at that point, and we were losing the set [TD1]*
- *In that set, I had used or was going to use, in my mind, the other subs, so I was aware that I had a limited number of subs left [BD2]*
- *We were in control at that point, and we were fairly comfortable [CF1]*
- *We had the fire power to side out any errors we were making [HL3]*
- *I wanted to wait until the middle player came to the front court [WC3]*
- *In my mind I felt that if we could hang on until 15 gets into position 4, I could bring Neville on and he might make the difference at that stage [BD6]*

The coaches' reaction to the SR question and further probing is to indicate an awareness that a process is in place within the game:

- *They were beginning to have a run of points [KT2]*
- *It was the sequence leading up to that [HL2]*
- *when I made the sub to counter the slide, I was hoping obviously the reaction would be immediate but obviously it wasn't [BD2]*
- *it was something that evolved [CF3]*
- *the game was running out [NA4]*

Although it seems likely that the coaches recognised that a process was unfolding, the action decisions needed to have a catalyst, and this was provided by a threshold point being reached:

- *I think that had it gone to 7-2 or 8-2, we were giving away the set [NA1]*
- *If we didn't put it right at that point, they may have got into a point of 6 all, 7 all, 8 all [WC1]*
- *I didn't want it to happen for a third time [WC1]*
- *It looked like we might run out before the next break in the sequence [HL4]*
- *By then the damage would have been done [IL3]*
- *The first time that he demonstrated that he still wasn't finishing, I took him off court to ... [TD5]*
- *We couldn't really allow them to go to 11 or 12 with us on 6, so the score was important [NA4]*
- *I didn't react directly but the subsequent play when they lost that point, I then took the time-out because these things had aggregated [MB5]*

There was also an example of the threshold not being breached:

- *I'm not going to break a scoring run simply to make a point like that [GR2]*

One of the compromises that the coach has to deal with is that between the planned strategy for the game and the way the game actually unfolds. The statements of the coaches indicate that there is a strong element of strategy influencing decisions:

- *That was in some respects pre-planned [CF2]*
- *So it was really almost a strategic thing to bring him in at that point [CF2]*
- *I wanted to use this game, to get ready for the final [HL3]*
- *I told him he was going to go in anyway [JW6]*
- *Even if 7 had been serving well, I would have put 2 in after he had finished serving to tighten up the defence [IL1]*
- *I had decided to bring him off at the end of his service [WC4]*

However, on a number of occasions, the coaches recognised that the action decision was not occasioned by anything happening on the court:

- *There was no action or catalyst that created that [WC6]*

Although the catalyst may be a prepared strategy or an on-going tactical change, which is less likely to be a response to negative circumstances, the coach will have monitored the 'game situation' in order to judge that the change is 'permissible' i.e. no immediate sufficiently negative impact is anticipated.

An important feature of deliberative decision theory is narrowing the problem and therefore the selection of the most appropriate solution. It was important to ascertain whether the coaches demonstrated this:

- *Despite the fact that they won the point, I continued on with the time-out because things hadn't changed at that stage [CF6]*
- *When we lost 2 more points, there was a kind of 'well we need to slow the game down even more' [BD2]*
- *I may have waited until later to bring him in, if we hadn't lost those 3 points in succession [CF2]*
- *The first few serves just emphasised what I'd been thinking [CF3]*
- *Then No. 8 hits a winner, and then we leave it and see what happens [KT5]*

In one example, the coach had already tried a solution, which clearly didn't work:

- *I'd already put information onto the court about the block and it wasn't making any difference [TD2]*

Summary

The scale of this approach means that it will have to figure significantly in the discussion which follows. This approach was characteristic of by far the greater majority of action decisions. There was strong evidence that the coaches' decision making had elements of process and threshold, synoptic overview and strategy and option narrowing.

If this approach was characteristic of the coaches in the study and could be generalised to the wider population, it raises a number of issues about the decision making process:

1. The extent to which it is or is not deliberative;
2. The balance between the unfolding process component of the decision making, the action catalyst and subsequent 'speedy' response;
3. The training of coaches to develop choice narrowing capacities, recognition of thresholds, etc.;
4. Some work needs to be done on the relationship between the structure of the game and the limited choice alternatives which it offers, and the Interactive Script approach.

C5: Unascribed Units of Analysis

Of the Units of Analysis, 8 (11%) could not be ascribed, for one reason or another, to one of the previous model codes. It is important to examine these to ensure that they do not represent an alternative model or identifiable pattern.

NA3; KT2 In each of these cases, it was difficult to make a judgement on whether the coach had recognised a generalisable instance or was employing the 'slow script'. Each demonstrated a process component.

GR2; VK3 These decision incidents were acknowledged by the coaches (although the coaches had identified these during the selection procedures) not to be

occasioned by court action, being a tactical non-decision and a strategic substitution.

- JK4; IL5 After deliberating about these incidents and examining the coaches' statements, they are best described as 'reinforcing information to players' rather than new decisions. These incidents were more characteristic of the (constant) feedback to the players during the game.
- IL6 This was a routine substitution. This type of incident will be given attention in the discussion which follows. It suggests that there are structures within the game that are dealt with as part of a game routine and require no substantive decision making. Returning a player to the court may be an example of this.
- TD4 The coach on this occasion had been firm about including this as an example of 'pressured' decision making. The coach has a limited period of time between sets in which to write down for the second referee the rotational order for the ensuing set. Once written down, the players must adopt this rotation. However, this period of time is also used to speak to players. It can, therefore, be a difficult time for the coach. This coach obviously felt that he was under some pressure when choosing and operationalising his rotation order. However, it was very difficult to ascribe this to a model category.

Summary

There was no overall pattern to these UsfA other than they were varieties of deliberative decision making. Nevertheless, a number of issues were raised which require further attention.

Solutions

This was the title given to the coding categories which focused on the choices or solutions adopted by the coaches. It was anticipated that the SR statements would provide clues about the theoretical model categories and links to existing decision theory. The coding frame identified those meaning units, which the coaches in the study employed when discussing or elaborating on the substance of the decision taken and in which some form of analysis or evaluative comment is given. The category was composed of four sub-groups: expectations of success; evidence of 'best fit'; evaluation of outcome; and explanation.

Table 9: Distribution of Solution Category Meaning Units

	No. of Meaning Units	
Expectations of Success	11	11%
Evidence of 'best fit'	13	13%
Evaluation of Outcome	28	29%
Explanation	45	46%
Total	97	100%

Meaning Units in this category accounted for 40% of the total expressed by the coaches. This is a very substantial proportion, but seems hardly surprising since the orientation of the SR procedures was towards the decisions taken. The first three sub-divisions were prompted by the literature on decision theory, the final one was intended to capture the

more technical descriptive elaborations on decisions, which it had been anticipated that the coaches would give.

1. Expectation of Outcome

Statements in this section shed light on the strength of the coaches' expectation about the likely success of the decision solution adopted. It becomes clear that the action decisions are considered by the coaches to be 'weak heuristics' in terms of their potential success:

- *Hopefully change and save us which it almost did [BD1]*
- *If you use the interjection, it can sometimes be counterproductive [MB2]*
- *It might have been counterproductive [HL1]*
- *If it had been closer, I would have hesitated to have put him on [CF1]*
- *Hoping that it would spark things off a bit [JW3]*
- *Maybe it did a little bit, but not as much as I had been hoping [JW4]*
- *Whether it's by luck or judgement ... [KT5]*

However, some decisions are viewed as stronger than others:

- *It was a safe strong substitution to make [BD1]*

The previous group of statements indicates that the coaches in the study recognise that the solution adopted is not guaranteed to be successful, even if appropriate. A further group of statements demonstrates that the solutions themselves are not totally appropriate in the given situation:

- *I was going to lose something in terms of his blocking ability but I had to accept that [CF1]*
- *I didn't want to bring him off, I wanted to start with my first 6 [TD5]*
- *The team would have needed a lift that I might not have been able to supply in that way [TD4]*
- *It's still a dangerous game [JW5]*
- *It's a calculated gamble [TD6]*

The coaches had views on the actual outcome of the decision taken. Although this was not strictly a recall matter, it is surprising that coaches did not comment to a greater extent on the actual outcome of the action decision. 15 (21%) of the 70 UsfA included comments on the outcome. Some further discussion on this is required, as it may be a contributory factor to the type of decision making approach adopted. The views expressed about the actual outcome were often focused on the coaches' role:

- *I wanted to do it when it would have a greater impact [GR1]*
- *I would have preferred to make it earlier rather than later [BD1]*
- *I felt that it would have made more of an impact in doing that [WC3]*
- *I should have looked to have interjected earlier rather than leave it to that stage [MB6]*
- *I left it a bit late actually [BD6]*
- *He accepted that information from me. He didn't significantly change [TD1]*
- *It nearly didn't work because he went to the middle [IL6]*

Summary

The statements made by the coaches provided some very clear evidence about the extent to which they anticipated that the decisions taken would lead to a successful outcome.

These limited expectations will have to be considered in the context of:

1. A limited range of options available;
2. Solutions almost always being less effective than the original capacity which is being replaced and which has not succeeded (presuming that the best rotation and tactics have already been adopted). This is another way of saying that many of the problem situations are irretrievable because of the relative abilities of the teams. This requires further discussion.
3. Expert coaches might argue that the action decisions on which the study has focused are more concerned with 'fire fighting' and their coaching qualities have been demonstrated in the preparation and proactive behaviour which is less observable.

It seems likely that the coaches don't comment greatly on the anticipated outcome because (a) it is seen as a process and not a one-off action, and (b) there is no absolute measure of successful outcome that can be attributed to one decision. The language used is often about aspiration rather than effect:

- *Hoping to protract the game somewhat [MB6]*

Coaches acknowledge the contextualisation of the decisions, and the extent to which the outcome is influenced by the opposition:

- *Whether it was right or not depended on the block and the situation on the other side of the net [NA3]*
- *Against another team, I wouldn't have let it go that long [JW5]*

In a very insightful comment, one of the coaches [JW5] recognised that there was an 'appropriate' solution, but decided not to take it because he judged that its success would be limited.

This was a very valuable group of statements, and will be usefully supported by the interview data. Specific comment is required on the coaches' awareness of the 'lateness' of their decisions, and their recognition of the limited resources available to them.

Interview Data

Introduction

Two groups of questions were used in the interviews with the coaches. The first set of questions was fairly specific, and was related to evidence about the coaches' characteristics, history, development of knowledge etc.. These questions were intended to shed light on the development of the coaches' expertise, and would be used as supporting evidence. The second set of questions was more related to the substance of the research questions and was intended to supplement the findings from the SR investigation. This set of questions focused on what might be termed 'how' questions, that is, they enquired about cognitive activity in an indirect manner by relating each question to volleyball.

[Questions 1 to 5 constituted the first set, questions 6 – 10 the second set.]

Although relatively open-ended, there was a structured approach to the interview and this approach delimited the range of responses. The specificity of the questions means that, although each question has to be treated separately, the analysis of each response is likely to fall within a quite predictable pattern. The approach used is a simple open coding, which will account for any, no matter how varying, response from each coach. The responses from each coach, within each question, will be analysed for distinct meaning units and these will then be categorised, and any patterns identified.

The intention is to seek for evidence of two patterns within the responses: (a) summary analyses of patterns within each question; and (b) any discernible pattern across the answers given by each coach.

Each of the questions is treated in turn. There is a summary analysis of the responses to the two sets of questions, and there is a 'pen picture' of the coaches in the study, from the accumulated responses.

Question 1: For how long have you been coaching, and what was your previous playing experience?

- The coaches' average length of time coaching was 15 years. This ranged from 7 years (although both of the two coaches with 7 years experience were Physical Education teachers with many years of player-coaching experience) to 28 years.
- Three quarters of the coaches operated in Division 1 of the National Leagues, including 4 National Championship winners. The three coaches who currently

operated in Division 2 had very extensive Junior International Team experience.

Altogether, 8 of the 12 coaches had National Team experience. The group of coaches included the current Senior National Team coaches and the Sport Sheffield coach⁵.

- 5 of the coaches had very extensive National League Division 1 experience – 3 of these were former International players. A further 5 coaches had less extensive Division 1 experience. Two of the coaches had little if any significant competitive playing experience. One of these was a ‘late starter’ into the sport, and the second is the Great Britain coach and currently the most involved in National Team programmes.
- Figure 6 (page 119) was constructed from the sample coaches’ responses to a short questionnaire. The information in the table about the coaches’ age, years of experience, representative team coaching experience, and levels of coaching qualifications confirm the coaches’ ‘expertness’. In general the coaches had benefited from Higher Education and enjoyed professional occupations.

Summary

There is no doubt about the coaches’ experience or ‘expertness’, as measured by length of coaching experience, involvement in performance level volleyball, and qualifications. The pattern is for the coaches to have emerged from a considerable playing background, although there are exceptions to this.

⁵ As part of a performance development scheme in England, players have been encouraged to live, study and train in the City of Sheffield. A development coach is provided as part of that City of Sheffield/Universities/EVA scheme. In addition to the development work, a men’s and women’s team now play in the respective National League. The coaches of these teams were part of the study.

Question 2: Who has been the most important influence on you as a coach?

- Each of the coaches was able to name at least one coach who had influenced him significantly. Most named more than one. Ten of the coaches identified Ralph Hippolyte⁶. All coaches identified at least one overseas coach⁷.
- The relationship with the influencing coach was one of three kinds: coach/player, coach/coach, or mentor/education programme. The development programme run in the UK, and the 'squad system' in which coaches are encouraged to attend National Team training sessions has encouraged communication and interaction.

Summary

It is clear from the responses that the coaches had interacted with other more (at the time) experienced coaches and had a clear perception that they had a significant influence on them. There was a significant amount of interaction within the group, and by implication, between coaches at this level. There is some evidence of the coaches being influenced by 'mentor' figures at the playing or initiation stages, and being influenced in a more structured way within development programmes at a later stage.

⁶ The Sports Council provided funding for an extended Great Britain performance plan for men's volleyball. As part of this, an experienced overseas coach was employed, both to coach the GB teams and to contribute significantly to coach education and development. The pervasiveness of this coach's name in the study coaches' responses attests to his influence.

⁷ This might not be surprising given that such a high percentage of the coaches identified the same individual. However, 5 of the coaches identified another overseas coach. Again this is not surprising. Volleyball in the UK is a 'minor' sport in terms of development, and in comparison to many other parts of the world. It is unlikely that the game in the UK would, as yet, have produced coaches with the same level of credibility and experience. However, there is some evidence of this within the group since 5 of the coaches identified the National Volleyball Director in Scotland, and 3 identified one of the coaches in the study.

Question 2a: Which of that coach's characteristics do you recall most?

- It is important to remember that 7 of the coaches were talking about the same individual (and that, as a consequence, only five different individuals were being spoken about). There was some consensus about that individual's breadth of knowledge and the range of influences he was able to bring to the coaching process.
- The coaches' responses could be grouped into four categories: interpersonal relationships; technical skills; personal qualities; and 'overall approach'
- Four of the coaches identified interpersonal factors related to the coaches' capacities for positive coach-athlete relationships.
- Two of the coaches identified their mentor coach's 'analytical skills'.
- The personal qualities included approachability, communication skills, work ethic and assertiveness. In general, those identified appeared to be 'strong' figures.

Summary

There is insufficient evidence on which to identify any pattern. The coaches in the study clearly valued their mentor coaches' personal qualities, whether expressed in range of knowledge or interpersonal approach.

With hindsight, it would have been more appropriate and valuable to have phrased the question to focus on 'coaching' rather than the 'coach'.

Question 3: What lessons, if any, did you learn as a player that have helped you as a coach?

- Nine of the coaches responded to the question.
- There was a clear pattern in which the more experienced coaches referred to the ‘feeling’ of playing and how that translated itself – individualisation, effort, intensity, discomfort. The less experienced coaches referred to a more ‘detached’ role comment.

I made errors and expected people to accept those errors as a player, and as a player, I gave, I always gave 100% or as near as damn it, and I look at these players and I know that they are doing the same [HL3]⁸

- It was clear that the issue of decision making by players, and the difficulty for the coach of helping and interpreting for players when they are seeing things from a different perspective and from a different time frame, was important.

Sat on the bench and seeing actions and, is not always as easy to unravel when you're on there making much quicker decisions and much more focused decisions [WC3]

I have to teach players to be able to make decisions for themselves [GR3]

I'm not actually on the court, and again when we have meetings the players will come back and say, this is how we see it, it's a reminder to me that you're not looking at it as a player's perspective [CF3]

⁸ Excerpts from the interview transcripts are referenced by coach initials and question number.

Summary

It seems likely that previous experience will have been built into 'experience related knowledge frameworks' and that the recognition of the difficulty of the coach's role in influencing decision making on court is significant. There is no evidence from this superficial evidence of the extent to which playing experiences influence decision frames.

Question 4: Where do you feel that your volleyball knowledge and insight have developed from?

- The first pattern to emerge was the impact of being involved in teaching or other sports (4 coaches)
- The most significant pattern to emerge was the influence of speaking to other coaches and learning from their work (7 coaches)

And be around coaches, to hear how they react to certain situations, hear how coaches, different coaches demand different things of different players [GR4]

I'm able to sit down and talk to coaches in other countries about what they see and it's the range of experiences I've been allowed [TD4]

I think working with people and listening to what they've got to say, and actually making mistakes, I think without making mistakes you don't learn at all [NA4]

- There was support for travel (linked to the previous comments on the need to relate to overseas coaches of greater experience), and for wider reading, but very little for coach education courses. On the other hand, individual comments were made about the process of development '*willingness to learn*', '*making mistakes*', '*analysing practice*'.

Summary

Coaches are clearly comfortable with the notion that they have 'propositional knowledge' that is knowledge of how to do things and not simply declarative knowledge, that is, knowing about, or of, things. A significant part of this has been acquired from interaction with other volleyball experts. There is a sense of 'meta-ordering', that is, coaches accepting that they are continually 'organising' their knowledge and experience. However, the interaction is obviously absorbed into tacit frameworks also. Coaches appear to be acknowledging this cognitive absorption and structuring.

Question 5: What do you think your strengths and weaknesses are as a coach?

- There was a very full response to this question.
- Strengths were divided into two groups – 'technical' aspects of the coaches' roles (7)

I select the tasks and the complexity of training very appropriately [BD5]

My strengths are, I believe, in preparing players, the training environment [HL5]

Strategically, I'm fairly solid at that [CF5]

and 'player relationships' / 'team building' (5 coaches)

I know that I have a good relationship with my players [GR5]

I haven't had too much criticism about my man management [JW5]

My ability to relate to the players [CF5]

- Two coaches emphasised the 'balance' in their strengths and their approach

It's the ability to fold in different situations and recognise when different things are required [TD5]

- The weaknesses were not the polar opposites of the strength criteria, and were much more diverse. The most common weakness was identified as a personal quality: e.g. two of the coaches said that they were not tolerant enough with the players, and three said that they were not 'hard enough' in their expectations.
- Two coaches said that their match coaching was a weakness; two identified something about their overall approach ('drift', and 'negativity'); and 3 mentioned factors that were the opposites of the earlier strengths – man-management, technical knowledge and lack of analysis.

Summary

The responses appeared to be honest and evaluative. The responses are those that might be expected since the coaches are expert in a team sport – their strengths are 'expertness' in the mechanics of coaching, and in team management. It is perhaps a mark of

expertness that the coaches could, and were willing to, identify strengths and weaknesses. The weaknesses were not of 'expertness' but about personal qualities and approach.

This was not a 'how' question, and it is not surprising that little was said about decision making – it is, however, implied in the strengths criteria identified. The focus was on role and personal qualities.

Question 6: What would you do in the following situation? Your inexperienced zone 4 hitter has made 2 direct errors (one into the net and one long diagonal) from adequate sets. S/he is in zone 4 rotation having been substituted on at 6-8 in the first set for an experienced zone 4 player. The score is now 6-10. What will you do?

- 8 of the coaches said 'it depends'. They would not give a response without contextualising their solution. They clearly said that their solution was contingent upon a set of circumstances. In addition, two further coaches gave an initial response (both said 'take her off') and then added 'but it depends'.

Difficult to give you a straight answer because it will depend on the opposition .. level .. importance [CF6]

Depending on the importance of the game and depending what I want to achieve for the player [KT6]

It would depend on the context of the game [MB]

- 6 of the coaches immediately invoked the ‘importance of the game’, i.e. the competitive context and by implication the match objectives.
- Almost all coaches pointed to the immediate pre-history of the decision.

Why did I bring her on? For some reason I've brought this player on, it's not working [HL6]

It could be that the principal hitter had failed to follow instructions or had a brain storm or had got injured, or whatever [VK6]

- 2 of the coaches said that they would leave the player on. These were 2 of the 5 coaches who identified the ‘developmental needs of the player’, which was really another contingency factor.
- The great majority of coaches described their technical options in some detail.

Summary

The most striking feature of the responses was the contingent nature of the response and of the solutions themselves. Clearly decision frames had a contextual basis. All of the coaches had no difficulty in verbalising the ‘conditions’ for their decisions.

Immediate antecedents of the decision were important. Without expressing it in such terms, the decision framing, consideration of alternatives, action decision process was a feature of their responses. Coaches clearly had a wide repertoire of options/variations/alternatives to match their perception of the circumstances.

Coaches described a solution related to an assumed problem/objective. They did not discuss alternatives. There was a limited degree of commonality in the detail of the solutions, but this was difficult to judge, since the coaches had assumed an individually perceived problem context.

Question 7: Despite your experience, you are bound to come across unique situations when coaching in a game or in training. How do you deal with a situation that is new to you?

- 5 of the coaches acknowledged that they could not be prepared for all eventualities

probably I don't deal with at all, if I'm honest [NA7]

you can imagine situations arising that do cause that panic or no immediate response [VK7]

sometimes you can react to a situation and sometimes you can't [BD7]

- 5 coaches responded in way that suggested that they would analyse or try to make sense of the situation

try to make some assessment of the situation even if it is new [WC7]

I'd probably try to figure out what is going on [NA7]

I would probably try to take a step back if I could [CF7]

I usually let it unfold first, and don't judge it very quickly [GR7]

In addition, 2 coaches said that they would try to avoid the novel

I try to avoid things that are novel, that are new [JW7]

- In addition to the responses that indicated a deliberative approach, 2 coaches explicitly said that they would ‘problem solve’.
- There were a number of phrases used which gave some indication of the processes involved

Not all that many solutions [paraphrase VK7]

Every situation is unique in some respects [CF7]

I think it's just association. You're linking [GR7]

One on the memory bank [WC7]

That's where experience comes in, or instinct [IL7]

The human mind has to assimilate these problems [KT7]

Summary

There is an acceptance of uniqueness, and an acceptance that solutions cannot be ready on hand for every situation. It is even accepted that there may not be a solution to a problem. The coaches apparently attempt to problem solve, i.e. be deliberative, rather than make hurried decisions.

It seems clear that there is an acceptance of a cognitive activity. Words such as memory, association, store and intuition are used. There is an assumption (admittedly with interpretation of the responses) of an element of ‘information processing’.

The contingency and the complexity in the responses indicate that the solving of such situations is not viewed as a simple or straightforward problem solving exercise.

Question 8: As a coach, how do you remember games?

- Most of the coaches pointed out at some point in their responses that they created and stored information on almost all games – video, statistics, notes – and that these were subject to analysis, and could be called upon for factual recall.
- 6 of the coaches suggested that they conjured up mental pictures or images of the games

so you would get a mental picture of the game [CF8]

I remember generally the performance [CF8]

Normally it's mental, I just remember, my memory [BD8]

It tends to be more a global perspective [MB8]

I can visualise most of the game [JW8]

- The most important finding perhaps is that the coaches say that they cannot remember everything – they have selective storage, but they are able to verbalise their key points (their words).

One half of these responses were about poor play – *negatives, errors, things players don't do, and visualising better the bad games.*

The other half focused on major momentum movements within the games – *transition, turning points, big momentum swings, overall rhythm.*

Summary

It is clear that there are key factors within the games for each of the coaches and that there is a large degree of variety in these criteria. This suggests that the frames representing the storage (and accessing and organisation of these) are likely to be very individual.

Question 9: Are you conscious of what prompts you to make decisions during a game?

- the coaches interpreted the question in one of two ways: either as an enquiry about the rules within which decision were made, or secondly about the decision process itself.
- 8 of the coaches said yes, either directly or through the substance of their responses
- Two coaches said that they were not conscious of what prompted them to make decisions, but went on to make the very significant statements given in full in the summary.
- Three of the coaches noted the pre-determined decisions, which reflected the structured nature of the sport, and the developmental/selection issues that accompany team sports.

Some of them are pre-determined [BD9]

- The coaches acknowledge that they react in some way to the game

There are warning signs that I need to be aware of [BD9]

It's normally looking at the team, at the way the team is going, and knowing that something needs to change [JW9]

There are obviously situations in which there is an external prompt [HL9]

I was watching the game to try to pull influences on my decision making as early as I could see them [TD9]

Other than the dynamics of the game itself [GR9]

- Where rules were mentioned, these were similar to those identified earlier in the SR responses.

Summary

There were two important outcomes from the responses to this question. The coaches had a clear idea that some decisions were pre-determined by their strategy or by the limits of what was available, and others were in response to the exigencies of the game. There was, therefore, at least on the surface, a distinction between deliberative and non-deliberative decision making.

Two quotations were particularly apt in the context of the study, and speak for themselves:

I think I can often recall afterwards why I've made that decision, but then what actually, what processes I've gone through to actually say I'm now going to make a decision, I don't think I'm too conscious of [WC9]

I wouldn't go away and say the decisions I made today I made for the following reasons. I think again a lot of this information has just become stored, and I accept that it is stored. [VK9]

Question 9a: Do you ever reflect after a game and wonder what prompted you to make a decision or why you made it?

- The overwhelming response to the question was 'yes' (9 coaches). It seems clear, however, that the coaches interpreted this as an invitation to comment on whether they evaluated their coaching performance, and the decisions made.

Yes, I'm sure, for instance a good example is ... it cost us four points so that was a big mistake [BD9a]

Oh yes, I look at the game, and it's easy to turn round and think, if only I'd done that, or thought of this then, or if I hadn't done that [KT9a]

I don't necessarily reflect on why I made a decision, but I will reflect on the outcome of decisions, and the processes that go on [GR9a]

- 5 of the coaches were more specific about the decisions on which they would focus

certainly it tends to be, why didn't you do something earlier [IL9a]

I reflect more on what prompted me not to make a decision [JW9a]

I probably reflect on why I didn't do a decision rather, or why I was inactive about a point, rather than the actions that I did [HL9a]

- Two further points were interesting. The majority of the coaches' responses indicate that they view the decisions in a logical, rational way (even if they tell others that it is spontaneous [JW9a]). Three coaches recognised the possibility of 'reactive' decisions: *'well I just felt that that's what was needed'* [WC9a], *'it's a kind of emotional thing'* [CF9a], and *'particularly if it's been a gut-reaction decision'* [CF9a]. The reasons 'found' afterwards may have been post-hoc rationalisations: *'Or that later I cannot find a reason for'* [CF9a].

Summary

The clear message was that coaches were concerned about the decisions they had made and did reflect upon them. Although there was a recognition of inexplicable decisions (the gut reactions, emotional reactions), it is clear that coaches have explanation for their actions, and that these are rational, at least subjectively so. The coaches appear to be uncomfortable with decisions for which there is no explanation.

The coaches ponder the outcomes of the decisions. This leads them to focus on perceived mistakes and lack of action.

Question 10: Do you have any sense that there are any rules to the way that coaches make decisions?

- This question provoked the lengthiest responses from the coaches.
- There was a clear agreement that a framework or a set of principles exists

I do think that there's an unwritten framework that coaches work around [CF10]

There's a framework there that you work to [NA10]

There are basic unwritten rules that you use [BD10]

So there's an unwritten set of guidelines you might say [MB10]

So there are some broad guidelines [IL10]

- It was clear, however, that the coaches were conscious that these principles had to be applied to the situation or the team

Absolutely, and you make the rules in practice [TD10]

Not the rules ... these are my rules of coaching [VK10]

I think they're more to do with experience than anything else [BD10]

But I think it's experience how you apply things [IL10]

- Where coaches went on to describe some of the rules or guidelines, these were similar to those identified in the SR responses: - mental focus, playing rhythm, momentum, clusters of points and key scores.

Summary

The responses were very uniform. The coaches had no trouble in identifying that there were guidelines, but that these had to be 'actively applied' in each situation. One coach (the most experienced international coach) felt that the rules had to be unique to a team and that over-reliance on 'rules' would result in the players relying on fixed rules instead of trying to solve the problems themselves [TD10]. The most often quoted guiding principle was the status of the momentum within the set/game.

Additional Comments

During the course of the interviews, there were occasions when the conversation was extended or the responses were not directly in relation to one of the questions. There are a number of comments from the coaches in the study, which are worth recording. It is acknowledged that these are selected and chosen for their perceived relevance.

In response to a comment from the researcher about 'instinct', one coach responded:

It's experience, you'll throw a player in because it worked two matches ago, so you throw the guy, so you win and everyone says good substitution, the other two times it failed, and it's, I suppose you're weighing things up subconsciously [KT]

He goes on to sum up the coach's dilemma

Is there anything else I could have done in those situations to change the outcome.

Should I have changed something, or did I change something and it didn't work, what should I do next [KT]

However, another coach expounds a different ideology – one which is more educational and puts the emphasis on the players

I might suggest that coaches learning or intellectual input into the game is not as much 'in your face' knee jerk as that, it's not as dynamic as that. I think. I don't think I can win a game for my team by making split second decisions that's going to turn a game. [GR]

Overall Summary

Insofar as the interview data were intended to support discussion and the findings from the SR responses, it would be inappropriate to attempt to identify definitive, summary conclusions. Nevertheless, it was possible to identify issues to which attention should be given in the discussion which follows.

- The coaches reinforced their branding as experts. The length of time of coaches, their ranges of experience, their capacity to discuss their role and its related concepts in abstract terms and their knowledge about the process suggested that they were experts. (It is acknowledged that this is an inference from the depth and perceived quality of their responses.)

- The coaches had a developed propositional knowledge, represented as knowledge frame structures. This appears to have developed over time, from experience, through sharing and interaction and, most importantly, was as a result of a learning process.
- The contingent nature of the application of the coaches' knowledge to decision making was very evident.
- Given that the focus of the interview was on decision making, it would have been strange had the coaches not responded to this. However, there was every indication that decision making was central to the coaches' role and that it was recognised to be both important and problematic.
- There was a set of guidelines or principles within which the coaches operated. There was a common language, but it is very clear that the coaches expect the 'rules' to need to be applied in context and that this is a mark of expertise.
- Coaches were able to call upon solution strategies. These were problematic and the coaches worry over their outcomes and the coaches' own performance in application.
- There is an acceptance that cognitive processes are at work, that there is a relationship between game happenings and the decisions made, but that it is not understood how the cognitive processes operate. The notions of memory, storage, recall, association, and intuition are evident in their responses.
- The coaches aim to operate rationally and with control, but recognise the limitations of their solutions, the possibility of gut-reaction, emotional and 'instinctive' responses.

Summary of Findings

The study has provided rich detailed evidence of the thinking of coaches about the decisions taken by them in the 'hot action' of the volleyball game. It is clear that a number of patterns have emerged within the data, and will allow, at this stage, a number of summative statements to be made:

- There is a clear preponderance of Interactive Script action decision behaviour by the coaches in the study.
- The data suggest that the coaches employ a mixture of styles, although a number of coaches evidenced the use of one style only.
- There was clear evidence of contributory elements of a number of styles within each Unit of Analysis.
- There was an indication that styles C2 (Schema Script) and C4 (Slow Script) worked together. One explanation might be that coaches created individual game scripts which are informed by their existing knowledge and solution frames, and built up of enabling conditions as they develop. Mental models are created which provide a synoptic overview of the set and the game. Because of the limited options available (both human resource and game structure), it is necessary to wait until a threshold (individually constructed?) has been reached. This may be breached immediately in a crisis situation, in which case immediate action is taken. The coach has the capacity to react with a Schema (automated) approach, if the pattern recognition is sufficiently strong, but it may be that even this is tempered by the knowledge of a limited range

of actions. The C2/C4 combination contains an element of prediction in the script. This is informed by the knowledge frames built up from experience. It also seems likely that the game has a structure which assists with prediction. Part of the expertness on display, is the recognition of the 'direction of the script', either before the opposition, or soon enough for some pre-emptive action to be taken.

- The 'deliberateness' of the decision framing and action allows some elements of decision theory to be evidenced. An example of this is the component of 'decision option narrowing'. The coach is in a position of constantly hypothesising about the likely outcome, but this can be altered very significantly by each subsequent outcome within the game. Once again, early recognition of the appropriateness of the hypothesis is important. The narrowing of possibilities becomes a process of 'confirming' from the evidence available. The coaches in the study appeared to be able to do this (accepting that there may be an element of post-event rationalising). This may be a distinction between novice and expert coaches.
- The 'enabling conditions', which experts use to interpret the script, would appear to be strongly based on individual player qualities and on the momentum within the scoreline. Coaches placed a very great deal of weight on the momentum status of the set. There is some further analysis required on the balance between the coaches' interpretation of the pre-existing enabling expectations of each player and their 'emerging condition' as the game unfolds. One might expect that the pre-existing expectancies would act as a 'blocking mechanism' to recognition of the players' current form
- There was a clear relationship between the use of the Schema style and the time-out solution. This is indicative of a wider relationship between the action structure of the game and the range of solution available to the coach. The use of substitutions

assumes a degree of preparation, and it may be difficult to employ if a crisis threshold is breached.

- The data raise the issue of the non-deliberative nature of the decisions. There is no doubt that the coaches visualised themselves taking decisions within a pressured context (of time, complexity and balance of options). From the theoretical perspective, some further discussion is required about the previous stages that have led up to the 'decision point'. There are also a number of decisions within the game, which are clearly deliberative. These include strategic substitutions (for example, to give the bench players a 'run'), and options which have been practised and for which there is a pre-match intention to deploy.
- The coaches displayed expert behaviour. This was evident in a number of ways: a capacity for a metacognitive overview of the context, abstract reasoning in problem framing, the use of enabling conditions rather than specific incidents, the deployment of tacit knowledge, and (very interestingly, and for further discussion) proceeding to solutions without consideration of alternatives.
- There is a strong element of anticipation in the coaches' behaviour. The constant confirmation of the script, with its updating after every point/rally, suggests a new set of 'anticipations' or hypotheses within a constant flow. It seems likely, however, that expert individuals would not be paying conscious attention to such a process, and that there is a subconscious monitoring which, on occasions, reaches a threshold trigger. Although speculative at present, there is a strong suggestion of 'anticipatory reflection' in the coaches' cognitions. As the flow progresses and the options are narrowed, the coach has (subconsciously, using existing knowledge frames) modelled and scanned the potential variations in outcome which may arise. This allows the coach to have the solutions ready (again within a tacit data bank). This recognition of

context has to be tempered or moderated by the (perhaps conscious)

acknowledgement of the limited resources available at any time, and by conscious strategic considerations.

- There is a very strong message in the coaches' statements, which is that they are attempting to bring control to a very fluid and dynamic situation. They attempt to make the non-deliberative context into as deliberative a set of decisions as possible. The metacognition of process, the mental simulation of the unfolding process, and the conservative use of action decisions (often recognised to be taken too late) attest to this. The coaches appear to delay their decisions if possible, in order to be sure of their reading of the game (confirming their hypothesis). Of course, it may be that confirming a major problem is less valuable than acting proactively to prevent it from occurring. This may be another difference between novice and expert coaches.
- Much of the literature suggests that experts operate within routines in order to make sense of their very complex, dynamic situations. There is some evidence of this within the coaches' behaviour. Observation of the coaches, and their use of routine solutions (again because of the limited number available: *we're actually quite limited in the way, in our options, with the personnel that we've got [IL4]*) suggest that their vast experience has provided them with mental models of volleyball games, and that there may not be great variations in the way that sets unfold. The expertness of the coaches will demonstrate itself in the preparation for the games, and in the 'window of management' which is available. This means that some impact can be made by the coach during the set, largely by the timing of the implementation of solutions, but that the coaches acknowledge that the solutions are 'weak' at best, and are complicated by their contested nature.

- The attempt by coaches to make their ‘hot action’ decisions appear deliberative provides an opportunity for elements of decision theory to be applied to the decision making process. Although this has been criticised for its artificial, often laboratory approach, it does indicate a potential for enhanced education and training of the decision making process.
- The extent to which the existing literature can support these tentative findings, and the potential for enhanced education and training, will be dealt with in the next chapter.

Chapter Five

Discussion

This chapter discusses the results of the study in the context of the methodology employed to generate the results and the literature-based explanations available. It then goes on to discuss the implication of the findings and the recommendations both for further research and for policy and practice. The claims made for the study are discussed in relation to the research questions identified as the study was being devised, and in the light of the expectations which arose as a result of the review of relevant literature. The research question was couched in terms of a 'to what extent' question and it was always very unlikely that in an exploratory, naturalistic piece of research, the summative findings were going to be susceptible to a yes/no answer. It is necessary in this chapter, therefore, to attempt a summary explanation for the phenomenon under scrutiny – in this case, volleyball coaches' decision making during match conditions.

A summary interpretation of the conclusion drawn about the research questions would be as follows:

To what extent can elements of theories of cognitive organisation adequately explain the accounts of non-deliberative decision making by expert coaches generated during stimulated recall?

The answer to this is equivocal but can be stated in the following way. If the coaches' decisions are interpreted in a narrowly non-deliberative way, then the available accounts of non-deliberative decision making do not account for the coaches' decisions. However, the coaches' decision making can be accounted for by recourse to a slower form of deliberation, but one that has received less theoretical attention. This serial, or interactive, decision making is assumed in teacher research, but its 'schemata driven modifications to plans' are not explored in terms of their cognitive organisation implications. The discussion will go on to show that this can be explained by assuming a 'slower form of script', which is assisted by a mental simulation of the potential consequences of the variation in the key features of the environment.

To what extent does the individual coach's 'theory of action' appear idiosyncratic?

It is clear that there are a number of shared principles, which act as a framework to decision making: control of momentum appears to be the most obvious central tenet. However, coaches have some considerable variation in identifying the key factors that are used in the perceptual pattern and similarity recognition which influences decision making. It is not possible in the context of this study to draw any quantifiable conclusion about the degree of similarity or agreement.

In summarising the study as a whole, the stimulated recall supported by interview method was a successful means of accessing the coaches' accounts of their decision making during the game. Clearly this has a different set of limitations (memory effect, biases, post-hoc 'tidying' of accounts) than think-aloud and other verbal protocol methods. However, this must be anticipated in naturalistic settings. The naturalistic setting invited a different set of literature sources from those associated with decision theory, which itself had only tangential relevance. Naturalistic decision theory is less precise about the cognitive association associated with its models but appears to offer a valuable set of explanations for interactive decision making which is commensurate with the 'slow script' interpretation.

Although supported by descriptive statistics, the study was qualitative in nature and dependent on a number of elements of interpretation by the researcher – during SR and interview follow ups, during coding and in the categorising of units of analysis.

Nevertheless, there was sufficient evidence of rigour to have confidence that the study produced valid and reliable accounts of coaches' decision making. Although exploratory, the discussion about what turned out to be a 'quasi-deliberative' form of decision making makes a useful contribution to the literature in which interactive decision making plays a significant role.

Discussion of Findings

The distribution of units of analysis, when categorised by the models identified in the review of literature, produced a very clear pattern. Over 60% of the units of analysis could be categorised most appropriately by the interactive model. Three other categories

accounted for 38%, with just one instance of 'case script'. Despite the variation in verbal responses, the distribution of meaning units demonstrated a very similar pattern. The pre-eminence of the interactive model is at the heart of the findings from the study and requires more detailed attention.

It is not sufficient simply to indicate that the interactive category accounted for the great majority of the coaches' decisions. The interactive model was derived from the literature inasmuch as it paralleled the interactive decision making assumed in the literature on teaching in the classroom. However, the 'teaching' model involves a fairly continuous stream of instructional, correctional, feedback, organisational decisions with occasional more significant decisions about the delivery of the intended teaching plan. The coaches' decision making was more directed towards an action decision from a limited menu of choices¹. It became fairly obvious at an early stage of the study that coaches were not making choices between alternatives in the 'static problem, most efficacious return' sense – but that they were making choices in the sense of framing the problem in one of a number of ways such that there was one obvious action decision. What was not at all clear was when, if at all, the action decision should be carried out.

In response to the research question, therefore, the interactive model cannot quite be said to represent the literature, and therefore be an appropriate explanation. One conclusion could simply be that the existing explanations were not sufficient and the first research question should be rejected. A more sensible way forward is to recognise that the existing models of non-deliberative decision making accounted for only a proportion of

¹ From observation and experience, the majority of coaches do maintain an almost continuous stream of comments to the players. The majority of these, however, are feedback and 'motivational' in intent and do not represent the 'change', which characterises an action decision.

the units of analysis but, it is clear that the coaches' decisions are taken in a quasi-deliberative form. There is no indication that the coaches approach the decision making task in a deliberative fashion – the task demands of the environment, the complexity, immediacy etc. mean that decision making is determined by the real-time flow of the set and the game. However, it is equally obvious that the coaches exercise a more strategic, process-sensitive decision making. This needs a much more detailed discussion.

There were some informative patterns in the distribution of units of analysis when compared to the type of action decision taken. The schema model represented decisions in which the coach accessed a programmed reaction decision in reaction to a pattern recognition in the volleyball match. The coaches' responses to question 9 in the interview schedule confirmed that the coaches were conscious of recognising something in the game (see page 189). All but one of the schema model decisions resulted in a timeout.

It was obviously time to take a timeout [VK5]

The fact that the pass broke down meant that I had to influence the game at that point [TD3]

This was not surprising since the timeout is an action decision that can be taken quickly i.e. without specific preparation. In some instances it might be classified as an emergency reaction to a set of circumstances considered to be 'dangerous'². This is certainly what appeared to be happening with these decisions. The coaches perceived an unexpected or unacceptable pattern. It is the 'unexpectedness' which is crucial. This clearly triggers the reaction, which in this case is to bring a halt to proceedings in order that the coach can try to exert some further remedial action. A good deal of the literature focuses on the

² The terminology is that used in the sporting context. The 'danger' refers to the effect on achieving the objectives set for the team within the instrumental nature of the sport i.e. usually (unless the contest is very one-sided) to win the set and the game.

situation awareness aspect of reading the environment. This is clearly important in naturalistic decision making. From the literature and from the coaches' comments, two features of the decision process are prominent: identifying key factors in the environment, and a threshold effect. At some point, the coach has to decide that the situation has become untenable without further coach-led action³. The need for threshold 'values' was anticipated since the coach has a limited number of options available. This further reinforces the coaches' dilemma as being not one of solution alternative but type and severity of problem.

Threequarters of the 'script model' decisions resulted in tactical decisions. These usually took the form of direct instructions to players to carry out a particular tactical action.

I told him that and specifically I told him to set a particular set [TD1]

I was shouting to him, it was that he would become the swing hitter [BD3]

The script schema model implies an event knowledge structure with the likely consequences from a set of enabling conditions (score, players involved, relative abilities, current form, chance) at a particular point in the set. The coach has a fairly immediate understanding – almost a mental modelling – of what is likely to happen from this point forward. It is immediately obvious that the coach would have to engage in a fairly continuous series of scripts since the conditions could change after each point. However, it is just as likely that the next point will reinforce the coaches' understanding of the situation. From the coaches' comments, it would seem that the most important features of the environment are the tactical balance of the game and the 'form' of the

³ It has always to be remembered that in the task environment in the study, there is a continuous flow of actions within the game. With or without action decisions from the coach, the situation will have moved on to a new set of circumstances when the next point, and/or series of points, is concluded. The players (to varying degrees dependent on their experience and capabilities) are also intent on redressing any perceived problems. Whether or not the players perceive the problems in the same way or would choose the same solutions is not established.

players. Individual models of the players are constructed during the games⁴, and these are continuously updated as the players engage in the action. The coaches' expectations of the players then become an important part of 'judging' likely progress. If the tactical balance and players' form is important, it is unlikely that these will be influenced by timeouts. The coach will wish to change the 'situation' more permanently. If the condition continues to worsen, it may then be necessary to substitute players in order to effect change. However, this scenario begins to assume that the coaches' monitoring is taken place over a period of time and that the decision making is more interactive with the changes in the environment.

The interactive model accounted for 64% of the units of analysis. This was termed a slow script model because it was event orientated and was based on mental simulations of potential consequences. However, the coaches' comments appeared to indicate a complex cognitive organisation, which integrated a number of different forms of awareness and with different degrees of deliberation. It was very clear from the coaches' comments that they made decisions on the basis of 'unfolding circumstances'. There could be an 'unforeseen' occurrence at any time, to which the coach might react with an executive command timeout. However, it is much more likely that the coaches' mental simulations of 'what was likely to happen' would anticipate this.

I didn't react directly but the subsequent play when they lost that point, I then took the timeout [MB5]

At this point it is important to picture the coach during the match conditions. In some

⁴ Although not studied specifically in this piece of work, it seems likely that these perceptions are subject to many biases.

instances, there may be a large gap in the points between the teams, or it may be early in the set. In such conditions the coach may not feel pressured by the happenings on the court. At other times, the game may be poised at, for example, 9-11 in the third set, with two sets to one for the opposition and the coach's team serving. As the point is played out, the alternatives become clear, the score could become 10-11, or it could remain at 9-11, but the other team will now be serving. Other factors now come into play. A new rotation will be at the net for the opposition. The coach's team needs a good service reception to ensure a point-saving side-out. Should the coach interrupt the play with a time-out? Why? Should a safe passer be introduced? Is the team unit strong enough as it is? Is there some other form of positive intervention (re-substitute for example)? Instruct the players to change the tempo of the game, to use a specific tactical pattern?

Is there anything else I could have done in those situations to change the outcome?

Should I have changed something, or did I change something and it didn't work? What should I do next?

The solutions to the problem cannot be predicted with certainty, nor a judgement of appropriateness even attempted, because so many of the enabling conditions are held in the coach's short-term memory and are being integrated continuously into previous knowledge structures. The coach's threshold values are also problematic. These are required in order to interpret the seriousness of the situation. What is clear is that in the 3 or 4 seconds available to come to a decision, the coach is having to integrate the immediacy of the last point with the expectations held as a result of the previous point. There will almost certainly (since they are expert coaches) be part of a more strategic approach to the set and the game, which involves deployment of players and tactical options. This is a representation of the coach's interactive script scenario. It is a serial

deliberation, but composed of a series of rapid scripts. The evidence of the coaches' comments suggests that, just as might be expected from experts, the coach will see 'meaningful patterns' and not react to every possible new script. It would be less efficient, and wasteful of energy to have to create and interpret new scripts on all occasions. The coach has witnessed and experienced these situations on many previous occasions, and the outcome of each rally is to reinforce, or amend, the unfolding pattern, which the coach has recognised. At some point the script is reinforced sufficiently and the threshold is triggered such that an action decision is called for.

We couldn't really allow them to go to 11 or 12 with us on 6. [NA4]

Alternatively, the script changes or weakens and action is not required⁵.

This raises another issue: that of thresholds. It was clear from the evidence that the coaches were very sensitive to the appropriate timing of the actions. In the context of limited alternatives and a limited number of action choices, it is important that the decision is taken when the information available has confirmed the coaches' recognition of the appropriate script. However, if the coach waits until the script is confirmed it may well be too late to influence matters. The coach, therefore, will want to take action at a point that is sufficiently confirmed but not too late. This involves expert judgement and re-introduces the issues of uncertainty. Further study is required on the degree of consensus about recognising patterns and triggering action decisions.

The interactive script as displayed by the coaches in the study led to action decisions that were timeouts, substitutions and tactical changes. There was a more evenly distributed

⁵ Although not a specific focus in this study, the coaches' capacity to exert 'positive' decisions rather than reactive ones would be repay attention. It is the researcher's perception from the SR accounts that much the greater majority of decisions were occasioned by opposition-induced 'pressure' or in a no-contest situation.

pattern than in other model categories, although substitutions accounted for just over half of the total. The time-outs associated with the interactive script appeared to be of a different type to the immediate disruption – a more considered attempt to bring a halt to a perceived momentum swing or to try to affect a more underlying problem, which requires an explanation.

Despite the fact that they won the point, I continued on with the timeout because things hadn't changed at that point [CF6]

I didn't react directly but the subsequent play when they lost that point, I then took the timeout because these things had aggregated. [MB5]

Significantly 88% of the substitutions were associated with interactive decisions. This is hardly surprising since substitutions require preparation to carry out. The coach has to recognise the potential need for a substitution, has to give the in-coming player sufficient time to be readied mental and physically, and has to physically have the player in the correct position. Obviously players are to some extent specialists and it may be necessary to have more than one player ready. In such circumstances, it is clear why the interactive script is a more effective way of managing the action decisions associated with substitutions.

This initial section was intended to raise the issues, which arose from the basic patterning of the units of analysis. The chapter will now move to a more detailed examination of the findings.

Analysis of Expert Behaviour

There was little doubt about the expert status of the coaches used in the study. The impression given by their depth and complexity of verbalisation was reinforced by their peer regard and level of experience, and verified by previous experience and qualifications. One of the most important aspects of their decision processes was how they framed the decision problem. Experts would be expected to perceive abstract patterns rather than surface elements. The significance of this part of their behaviour is the emerging importance of situational awareness. In other words, the decision framing relates to the choice of problem rather than an alternative solution.

More of the coaches' meaning units could be classified as abstract reasoning than instance reasoning. However, even the many cases of individual player analysis were couched in terms of a pattern of behaviour from which inferences were drawn. Also of interest was the fact that the coaches analysed the problems almost exclusively in terms of their own teams' behaviour. This reflects an 'advanced' form of analysis, and on a practical level, reflects the fact that the coaches can exert control only over their own players. It is possible that the coaches used hindsight to bring a degree of mental ordering to their accounts, which would not have been so accessible at the time of the incidents. Even so, it is clear that they construct an on-going mental model of the situation and do not react to an immediate pattern recognition (although this threshold response remains a possibility at some stage).

I didn't think we were losing the game in side-out. I thought we were losing the game in block defence and in actual fact I was pretty confident that our side-out unit could continue to function. [TD4]

The emphasis given to the decision framing element of the decision episode in the coaches' SR responses confirms the importance of the situational analysis. It also confirms that this is a process and not an immediate non-deliberative response. It further confirms the complexity of the problems and the lack of an immediate fit between problem and solution. The importance of the 'contingent' factors was emphasised by the coaches in their response to question 6 in the interview, that is the one requiring them to give a response to an artificial scenario. The difficulty the coaches had in responding was that there was insufficient background knowledge – the enabling conditions and immediate antecedents were not available to them and this prevented them from framing the problem without making (unwarranted) assumptions. That the expertness of the coaches should be measured by their assessment of the problem confirms this finding in the literature (see Randel et al 1996).

The responses to question 7 in the interview (see page 185) demonstrate that the coaches in the study accepted that not all problems could be resolved and that there were limited resources with which to resolve them. The sense of control suggested by Brehmer (1992) comes through in the coaches' attempts to respond to novel situations. There is an element of deliberation about the coaches' attempts: *step back [CF7]; let it unfold first, don't judge it very quickly [GR7]*. Nevertheless, there was also an acceptance of some non-conscious activity: *one on the memory banks [WC7]; that's where experience comes in, or instinct [IL7]; I think it's just association, you're linking [GR7]*.

Before moving on to how the coaches make sense of the environment, it is worth reinforcing the contested nature of the task environment. The traditional decision experiment normally employs a computational problem, which requires a balancing of probability-based judgements. In naturalistic decision making, the focus is most often on circumstances in which there is a degree of uncertainty or risk. However, the novel element of this study in comparison to many of the others in the literature is that the task environment is a contested one. Although this has been clearly stated on a number of occasions, the implications need to be understood in relation to the decision framing process. Part of the coach's dilemma is that the intentions of the opposition players and coach are an unknown and have to be inferred. Judgements of the relative technical capacities of the players may be relatively easy to make for expert coaches, and these judgements will inform the solutions adopted. However, any solution, whether tactical, the use of a substitute or an attempt to break the momentum of the play, will be countered by behaviour from the other coach (who is assumed to also be an expert). It must be assumed, therefore, that the decision problem is not a static phenomenon, and, indeed, is made deliberately difficult to judge by the opposition. There are two important consequences from this. Firstly, the situation analysis element of the decision problem is likely to assume very great importance. It is also easier to understand why the coaches should focus on their own teams to attempt a measure of control. Secondly, reference was made in an earlier passage to the 'weakness' of the solutions. This is caused by a number of factors: (a) the complexity of the problems; (b) the 'moving' nature of the problems; (c) the contested nature of the 'anti-solution'; (d) the limited resources available to the coach; and (e) the strong element of risk judgement. The final point refers to the need to act before the problem becomes established but at a stage when its

genesis may be uncertain. As repeated earlier, a coach might therefore make a correct assessment, which brings with it the appropriate solution, but this has no effect because the opposition changes the problem space⁶.

Key Attractors

The literature is very clear about the need for heuristics in conditions of complexity. Individuals use a short-cutting mechanism to effect a judgement on the most efficacious solution. In decision research the decision task is normally static, as are the given conditions, and the heuristic is applied to the choice of alternatives. In this study, it is clear that the heuristic is applied to the problem space, that is, deciding what the problem is (although this may be very obvious in terms of the score) and the underlying cause of the problem. It is also clear that the coach has the subsequent issue of making an evaluation about whether there is anything that can be done about the problem. Applying the heuristic to the problem space was discussed by Evans (1984): what he termed 'deciding what to decide about'. In the coaching environment in the study, the problem is too complex and dynamic to be subjected to deliberative analysis. There is too little time in the sense that the problem (unlike the static problems of the laboratory) is becoming exacerbated whilst the decision space is being framed⁷.

⁶ It must be remembered that the players and the coach, and not simply the coach are shaping the problem space. Individual players will be attempting to 'read the game' and will make individual judgement calls as they execute their plays.

It is inappropriate to think of the coach exerting influence only through match coaching decisions, therefore. The training environment in which the coach works with the players to improve their techniques, tactical appreciation, physical condition, mental approach etc. leads to players being better able to solve the problems created by the opposition on the court itself.

⁷ It is always possible to devise a more dynamic problem. For example, the problem may lessen or disappear altogether, even without the coach taking any action.

It is perhaps not all that surprising that the coaches' attractors should be process related and reflect the identification of underlying causes rather than the observable behaviour (Chi et al 1988, Klein 1990), since this reflects expert thinking. From the analysis of the SR responses, the control of momentum and the nature of mistakes made by players were the principal attractors. The impact of momentum was exacerbated by the speed of change and phasing of points. The coaches' desire to maintain control was mirrored in their emphasis of judgement/mental mistakes by players, presumably because these could be corrected more readily than technical faults. In the interviews the coaches confirmed that playing rhythm, mental focus, clusters of points, key scores and momentum swings were the key attractors in the game. The coaches also confirmed that they did respond to evidence collected from observing the game, although the place of more strategic and developmental⁸ action behaviours were also acknowledged.

The coaches' view, as expressed in the interviews, was that there were guidelines that formed a framework within which the coaches operated, but that these were interpreted individually and applied individually.

Decision Solutions

The purpose of the study was to examine how decisions appeared to be made rather than to adjudge how appropriate the decisions might be. The 'correctness' of the solutions adopted by the coaches may be the focus of a further study, but a full understanding of

⁸ This refers to team building actions by coaches. Younger more inexperienced players have to be given experience on court. This is not always dictated by the flow of the game, although changes such as these would normally be tried out in 'safer' circumstances.

any normative investigation will require an awareness of how the coach's knowledge base is being accessed. It was overwhelmingly evident from the SR transcripts that the coaches' dilemmas centred on the timing of the decision changes and on the probability of the decisions having the desired effect. This latter issue was an acknowledgement that the complexity of the variables influencing a situation could not all be addressed at once (and some, which were couched in terms of relative abilities of players, could not be mitigated at all). There was no evidence that coaches were considering alternative solutions. The coaches linked the problem identification with the solution and the decision became one of 'if' and 'when'. The linking of the solution to the problem is characteristic of the 'script'⁹ approach to cognitive organisation.

The coaches' response to question 6 in the interview was instructive. It was obvious from the responses that the solutions changed as the coaches' interpretations of the enabling conditions changed. Having assumed a set of circumstances, the coaches were able to 'call up' the appropriate solution or recipe. The link between problem and solution reinforces the coaches' apparently intuitive behaviour. However, the SR transcripts demonstrate that there is a degree of deliberation in the decision framing element of the process. The coaches have a dilemma, which is much more to do with the correct interpretation of the problem and its causation. This is the deliberative stage. This could be interpreted as a script selection issue for the coach. In addition to the delineation of the problem and its causes, the coach has to decide what the impact of the solution will be in the longer term. Because this is a dynamic situation (and contested), the coach is trying to deploy the limited number of action decisions to best effect, over a potentially quite

⁹ This implies a use of schemata in their broadest sense. The script designation is applied when the knowledge structure refers to an event or process.

extended period of time. The dilemma might, therefore, be summed up as ‘I understand the problem at the moment, but how serious is it in relation to problems that might arise later? Is the problem likely to impact significantly on the set? The solution is obvious but will it work? If I make changes will this restrict my freedom and flexibility to make more important changes later on?’¹⁰ If I don’t change now, will this problem continue to grow and become insurmountable? Do I have any other strategic/developmental plans in mind, which might supercede my interpretation of the current situation?’

The evidence from the SR responses is that, for the most part and unless a ‘seriousness’ threshold has been triggered, the coach tries to take time to balance these questions – and this leads to the interactive decision making, which became evident. However, given the complexity of the circumstances, these decisions are not deliberative in the sense that a rational consideration is given to all alternatives. The coach is still wrestling with the timing versus appropriateness of the potential decisions, and it is this, which is being done on a sense of ‘feeling’ for the situation. There remains, therefore, a ‘judgement call’, which appears intuitive since it seems to be based on key factors, and, perhaps, non-conscious associations. This is at the heart of the conservatism versus impact dilemma. The coaches’ responses were always that they would have liked to have taken the decision earlier, never later.

The coaches do not need to invent novel solutions: they have these stored as recipes or tried and tested responses. Indeed many of these appear to be routinised. It was noted

¹⁰ The limited number of timeouts available has already be referred to. It is also important to note that when a substitution is made, the player going off can only re-enter the game as a replacement for the player originally substituted. Although there are 6 substitutions possible in each set, their actual use is a little more restricted. In addition, technical changes (usually to do with tactical or individual judgement) cannot be used too frequently. Players have a limited capacity to make constant changes to their systems of play.

earlier that experts make their tasks easier by routinising many of their tasks (presumably allowing them to then focus on the difficult problems). The impression given in the coaches' responses was that a good proportion of the solutions was not only already fixed into the knowledge structures, but these had sufficient commonality and frequency to be considered routine responses.¹¹ This was not an identified part of the study and refers to the appropriateness of the decisions issue. However, there is some evidence from the coaches' responses, including those decisions not chosen for the SR procedures, (and from the researcher's experience) that some problems have routine responses – front court substitutions of smaller players, resting better players in the back-court, substituting after a service, etc.. These routines will also form part of the schemata scripts, which accompany any particular circumstance.

The coaches' comments on the solutions adopted were informative, focusing on the technical substance of the decision (particularly tactical changes) and an evaluative element. The coaches emphasised (see pages 171-172) the intended effect rather than the choice of solution, although it was very evident that their faith in the efficacy of the actions was linked to the dynamics of the circumstances. The coaches did not elaborate greatly on the outcome of the decisions actioned: the dynamic nature of the play means that they had quickly moved on to other concerns. However, this is a very important issue. Unlike 'one-off' major decisions in some NDM contexts or unlike the 'problem solution' approach to decision theory experimentation, the volleyball coaches were engaged in a serial decision process in which the transitory, weak, sometimes ineffective

Execution of the plays or shots selected is dependent on a combination of technical executions and is contested by the opposition.

¹¹ The carrying out of the decisions is also 'routine' for the coaches. They do need, as experts, to give any conscious thought to 'how' to carry out a timeout or substitutions. It should also be remembered that the players will have knowledge structures which will also recognise the potential problems and the solutions

solutions were soon overtaken by the dynamics of the situation. The decisions were certainly not algorithmic responses and many coaches noted that there were pros and cons with each decision.

The decisions on which the coaches focused in the SR procedures were very largely responses to negative circumstances and this raises the issue of ‘deficit decision making’: the coaches are most often engaged in retrieval situations in which the management of decision resources is putting into effect a solution that is perceived to be less strong than the circumstances originally chosen¹². A number of the factors influencing this have already been rehearsed: the solutions are contested by the opposition, the coaches tend to take their decisions later rather than earlier and the problem (although confirmed) has perhaps been exacerbated, the coach has to enact solutions that the team and the individuals concerned have already practised. It does seem likely that the ‘hot action’ of the game will produce a successively less effective series of solutions as the crisis deepens.

This discussion of the solutions or action decisions adopted prompts a consideration of the knowledge schemata used by the coaches, and pre-empted debate later in the chapter. Schemata based on abstract generalisations will not be effective if the players cannot implement the solution.¹³ Either the coach will require very sophisticated schemata

likely to be adopted by the coaches. This allows the players to be ready psychologically for the coach’s changes.

¹² Some further debate might usefully be had on this. Coaches may often select rotations, which they know not to be their strongest potential line-ups (for developmental purposes). This can be redressed in the course of the set. Similarly, the coach may have selected a line-up in response to the anticipated play of the opposition and this turns out not to be accurate. Lastly, players do not always play at an optimum level. It may, therefore, be difficult for the coach to select an optimum line-up at any given time. Changes may, therefore, strengthen the team on court. This does not take into account the fact that in many club sides the strength of the ‘reserve’ players may be noticeably very different in quality to that of the ‘first six’.

¹³ However, this may help to explain a finding noted later that schemata recognition decisions induce timeouts – which do not require player implementation capacities.

which are amended constantly as the team formations and player form is monitored, or another perhaps more deliberative form of decision making may be required.

In summary, then, there is a decision choice being made but it refers to the decision framing and timing issues rather than the choice of solution issue. The solutions adopted are 'weak' in their anticipated effectiveness, for a variety of reasons. The key feature of the task environment, and the one that gives this study its potential contribution to the decision making literature, is its dynamic and serial nature and the limited action decision resources available to the coach. This suggests that the theoretical support for the explanations might be more likely to be found in the naturalistic decision making literature rather than the more traditional static problem decision theory literature.

Decision Models

The Schema Model category was the most obviously non-deliberative decision making. Although it accounted for just 10% of the units of analysis (and 14% of meaning units), the language and phrasing used by the coaches (see page 153) left no doubt about the degree of imperative and rule-governed behaviour. Perhaps not surprising the Schema Model was almost exclusively associated with timeouts, since this offers the coaches their most immediate action response.

The coaches' responses clearly implied the recognition of situations that had progressed beyond a threshold level: the majority of these involved the impact of the previous point on the score, usually opening up a gap, which the coach felt had to be arrested. A number

of key factors were mentioned but there was a clear pattern involving momentum swings or a situation that could not be allowed to develop (such as certain types of player errors).

An important discussion point is that the coaches appeared to contextualise the situation being recognised. One coach acknowledged that he 'should' have taken a timeout [JW5], another that he 'perhaps' should have [VK5]. Another way to put this is that the key trigger is framed within the overall context of the set or game. This could be understood as an elaborate knowledge structure, which took into account the set scores, players involved etc., and this seems entirely plausible. This would suggest an abstract framework of rules governing the decision making, which is subject to a 'recognition-primed action solution. It is interesting, once again, that the coaches' dilemma is not about the solution but about the framing of the problem. This was a theme that recurred throughout the review of literature: reading the situation is the important factor. Another potential explanation is that there are two types of non-deliberative schema behaviour. In the first, the recognition of the problem is based on the appropriate reading of those key factors which are considered appropriate by the coach, but there is an 'over-riding' knowledge structure which recognises some stages of the game as more important than others, and also recognises the importance of the timeout alternative (given that there are only two). The timeouts will have a strategic knowledge schema of their own. This can override the recognition stage. The second decision behaviour is reactive and the threshold effect transcends the overlying schemata. The nature of the knowledge schemata involved needs further research.

There was certainly some evidence from coaches' comments of reaction decisions: *well, I just felt that's what was needed [WC9a]; it's a kind of emotional thing [CF9a]; particularly if it's been a gut-reaction decision [CF9a].*

The evidence points to a recognition-primed decision making in which solutions are attached to the knowledge structures which are invoked by the recognition. However, it is difficult to escape from the language used by the coaches, and the fact that the thresholds are process-related. These suggest that the coaches are recognising the executive command provided by the recognition, but are most often exercising a conscious over-ride, partly because of their uncertainty induced conservatism and partly because of their strategy for the use of a scarce solution resource.

With the Script Schema Model the individual recognises an instance which is the first or early part of an unfolding event or process. Reading the enabling conditions of the instance leads to an understanding (tacit and schemata structure based for the expert) of not only what is happening but what is likely to happen. Experts will read the conditions earlier and more accurately, although there will also be the issue of trying to decide too early with uncertain conditions. The recognition is not of a holistic instance (as in the schemata Model) but of the combination of enabling conditions. These will require technical knowledge and will be categorised by words such as faults, causes, trends, circumstances and conditions. These will depend on volleyball specific knowledge and the expert coach will recognise the more meaningful patterns in the conditions compared to the more superficial reading of them by the novice coach. An important part of the

script is that the instance and enabling conditions have consequences attached to them. These then also have solutions or actions attached where necessary.¹⁴

In the study, the Schema Script Model accounted for 16% of the units of analysis and 27% of meaning units. It is not surprising that the meaning units were spread more widely since comments about individual players would be common to many explanations and cognitive processes. The enabling condition statements often contained evaluative comments and predictions (see page 159).

The script model was recognition-primed but the recognition was not rule-governed, but recognised a 'condition'. This could be interpreted as a 'state of affairs implying a cause and effect and a prediction of consequences'. In this study, a recognition of the state of the set (or in expert parlance, more likely to be the state of the underlying conditions influencing the set). Decisions or solutions are also implied. Rapid scanning, recognition and awareness of solutions will give the appearance of intuitive decision making. To this extent the script is merely another form of schemata based knowledge framework, which can be accessed by the recognition of the appropriate cues. The decisions attached to the script are those that will change the enabling conditions. In the volleyball context these are likely to be tactical options related to player choices and the team's overall strategic or tactical approach. This was confirmed in the study with 73% of the script decisions taking place in association with tactical instructions. The timeout may have the effect of providing a break to the momentum, but may not change the enabling condition.

¹⁴ This is another example of the study having emphasised the negative issues, which arose in the SR responses. These may have been recognised as crises and highlighted by the coaches rather more than positive, proactive decisions. It was acknowledged in the review of literature that negative consequences are recognised before positive ones. Nevertheless, the coach will have to recognise advantageous conditions because decisions should be taken to maintain this position and the opposition coaches are likely to attempt to reverse the situation.

However, the substitution would also be a change to the conditions but is a fairly drastic move (and does raise the threshold issue again).

The script has the potential to move from a fairly instantaneous recognition to a ‘merely’ rapid one since the coaches’ comments very often implied a threshold effect. (This might be explained as: the player’s second similar mistake invokes a recognition that the player has this weakness. The coach ‘knows’ what the consequences of the player continuing to do this will be, but has to consider the probability of successful change, the advantages and disadvantages of an alternative course of action, and the state of the momentum and team rhythm at the time.) Although the coach has a non-deliberative option, which to the outsider may appear intuitive, it may seem more prudent to apply the ‘conservatism’ approach and seek some confirmation of the problem. Once again, firming up the perception may be too late, but the coach may have ‘learned’ that some caution is often effective (meaning that the problem resolves itself¹⁵). There was some strong evidence from the interview responses in question 9a that their after-the-fact reflections were often about why they had not taken some decisions at an earlier stage. Because the script is a knowledge framework about an event or process, it has the potential to be made deliberative, that is, interactive.

The script implies a ‘model’ of the event. A stage beyond this would be for the coach to actively consider a number of further model or scripts. Thus the coach is aware of the current script but is able rapidly to ‘model’ proposed changes and their consequences. In addition, the coaches may anticipate the forthcoming scripts depending on the outcome

¹⁵ Or that the players have resolved it by appropriate behaviour. This can include the opposition players who may themselves contribute by making mistakes or taking the wrong options.

of the next part of the event (the next point). In a sense the coach is reflecting forward, and the appropriate script does not come as a surprise – it is ‘very ready’ to be accessed.

It was anticipated before the data collection stage that the coaches would exhibit a Case Script approach to decision making. This is based on the work of Schmidt et al (1990) who argue that individuals move, with increasing expertise, to a situation in which they based decisions on their similarity to previous cases that they have experienced. This is an advanced form of expert short-cutting in which the scanning of the enabling conditions reveals a similarity to a previous case. This recognition brings with it the solution that was tried successfully in that instance. The evidence collected in this study suggests that this form of decision making and its cognitive organisation was not employed by the coaches, to any great extent. However, there are a number of problematic issues, which require attention.

The evidence collated from question 8 in the interview schedule confirmed that coaches could conjure up mental images of their past games. However, the most important finding was that the coaches said that they could not remember everything and that their conscious memory retrieval is selective. Case Decision Model may be based on long term memory association, but the coaches indicated that they used key features of the game to remember them in a conscious cognitive way – negative features, errors, defeats – these accounted for half of these specific responses. The other half focused on major momentum catalysts within games.

There is potential in volleyball for a similarity to previous instances/events to be recognised. However, what should the ‘unit of recognition’ be: the situation within the

set, the episode etc.? Clearly the situation within a set could be very similar to one experienced previously. It does seem likely, however, that these would be surface similarities since the team, the competition, and the players involved are not going to produce an exactly similar scenario.¹⁶ The nub of the issue centres on the extent to which the actions of individual players can be treated as 'cases'. If they are, should they be compared with themselves on previous instances or with other players? The latter is not a tenable position for two reasons. One is philosophical: players should be treated as individuals, not as models of others. The other more practical reason is that the capacities, current form, physical condition etc. are unlikely to be similar enough for the solution to be safely considered to be that which was used previously. The former position is the normal situation in which the coach's generalised knowledge structure about individual players is built up over a period of time and will form part of the schemata, which are accessed through the recognition process.

The players do not act on their own and cannot form an event script by themselves. They form part of the enabling conditions, which inform the recognition of the script. In the example given in the study (page 161), the player is mentioned as having a psychological mind set, which is best treated by being left alone when a mistake has occurred. In the example, it is the mistake and its attendant conditions that form the similarity, not just the solution. The one case identified is in fact a very weak example.

The most appropriate statement is to say that the Case Script Model has proved to be problematic in this example and that the place of the individual player needs further

¹⁶ There is, of course, the coaching philosophy described earlier in which the coach focuses on the actions that can be taken by that coach's team and does not take the opposition into account. This does not seem like a very sophisticated strategy. The coach may only be able to affect directly one side, but the actions of the opposition must be at least anticipated, if not predicted.

attention. One final point may be instructive. In the dynamic circumstances explored in the study, coaches have been shown to adopt a recognition scanning approach to decision framing, which then brings with it an action decision, rather than a choice decision. Nevertheless, coaches have been shown to be conservative in their action decisions because of the limited number available and the desire to balance certainty of framing against impact of solution. It is a plausible explanation that coaches would be reluctant to exercise a 'case-based judgement' if they recognised it to have merely a similarity to their present circumstances. The Case Script Model is not widely reported in the literature, and there needs to be some further work on the relationship between the generalisations derived from previous cases, and the use of the case solutions as a convenient short-cutting mechanism. One potential issue is the storage of 'cases' in long term memory structures and the ease with which they can be accessed in a fashion that has practical value. How many would be stored, and what would be the trigger for recognising them? In the context of the dynamic, uncertain, multi-variable circumstances of the volleyball match, the abstract generalised knowledge structures would be likely to mask the 'case' unless there was a very strong similarity trigger (perhaps with an element of crisis about it). There was insufficient evidence in the study to draw any strong conclusions about this.

The creation of the Interactive Decision Model stemmed from a consideration of the literature and the task environment. Most importantly, the literature on teaching (and coaching, when interpreted in this episodic way) refers to 'interactive behaviour' and links expert behaviour to the individual's capacity to deal with the uncertainty and dynamic nature of the environment. Although, it was clear that there was a non-deliberative element to this, the cognitive organisation implied by such interactive

decision behaviour was not articulated other than to say that it depended on the use of schemata. There were a number of elements of the environment that began to forge an understanding that the coaches would not be completely non-deliberative. There are a limited number of choices available to the coach. This suggests that there would need to be an 'overview schema' to contextualise any executive response. The play itself forms a process, which is incremental and aggregative in its effects. In addition, it became obvious that coaches would attempt a measure of control over the decision making throughout the set or game as a whole. In other words, there would be a strategic element to be built into the decision making. In summary, the coaches would either have a very sophisticated schemata system to control the different layers of priorities in decision making¹⁷, and this would involve short-cutting mechanisms based on a small number of key factors, or a quasi-deliberative process is taking place. The Interactive Model was an eclectic one, drawn from the literature, and conceptualised as a 'slow script'. The coach will recognise an event script but will reflect forward to other alternative scripts by modelling potential scenarios, until a threshold trigger invites action, or the script is confirmed and action is permitted by a more strategic overview. There is a time pressure, which prevents completely deliberative consideration of the environment.

The evidence from the study suggests that this is the prevalent mode of decision making: 61% of decision episodes could be categorised in this way¹⁸. A number of assumptions can be drawn from the coaches' responses (see pages 164-165). The coaches retain a short-term memory strategic overview of the progress of the set. This is couched in terms of cause and effect, and the progress of the score. It is evident that the coaches perceive

¹⁷ It is worth reiterating here that the coach's dilemma is not one of choice of solution, but one of application of the solution.

¹⁸ 58% of meaning units were classified under this model category.

the set in 'periods of play' (presumably making it more manageable in this way). There is a timescale and prediction element in the coaches' comments. Lastly, and as in other models, there is a threshold element to the coaches' decision making. However, one of the most important findings from the coaches' comments is that they are engaged in a process of confirming their impressions. This is evident in the coaches' use of the thresholds and their narrowing of possibilities:

The first few serves just confirmed what I had been thinking [CF3]

Then No. 8 hits a winner, and then we leave it and see what happens [KT5]

Despite the fact that they won the point, I continued on with the timeout because things hadn't changed at that stage [CF4]

The effect is to produce an interactive model, which is a combination of previous models. It has schemata scripts through which the coaches understand the unfolding set. The emphasis is still on decision framing and confirming the choice of script. The solution is contained in the script but the coaches' dilemma is whether to implement or not. However, the process is dynamic, and there are potential changes with every rally (although it seems that the coaches will 'see the game' in periods of play in order to ease the cognitive activity required). Once again, thresholds trigger schemata responses. One way of conceptualising this is to think of the strategic schema (stored as a short term plan for the set/game) 'moving' the thresholds within the dynamics of the game. Three of the coaches noted in their responses to question 9 that they implemented pre-determined decisions. It is important to remember that much of this will appear intuitive: carried out by association and schemata/script recognition at a non-conscious level.

However, it is necessary to discuss how the coach can be ready for the alternative decision actions implied by the interaction model. This is not in terms of the cognitive decision making organisation but the practicalities of having substitutes prepared, timeout comments and tactical options ready. The nub of the argument is based on the notion that one way of shortcutting the choice narrowing is to anticipate what might happen. Because of the dynamic circumstances, the coach can anticipate rather than predict what the situation will be as the result of the next rally. This is a practical example of Eraut's (1994) 'constant awareness'. The coach is aware of the current script, the solutions implied by this and at a non-conscious level the triggers required to set this off. The coach then uses a 'reflective anticipation' (what would happen if) to imagine the variations in progress of the play – perhaps not on every point, but in groups of points. This implies a rapid cognitive organisation but with a degree of deliberation. The coach will use potential scripts (i.e. those they have modelled) to 'understand' the anticipated future. One might assume that experts would have a facility for modelling the future better. They will choose a small number of likely scenarios because they can predict more accurately. The impression of intuitive behaviour is maintained because the coach has already 'understood' the implications of the rally outcome when it happens. Accompanying this recognition is the appropriate action decision (if triggered). Clearly there are a number of assumptions built into this explanation, but it certainly merits further research.

The 'slow script' is therefore capable of modification/confirmation as it progresses. A constant recognition process feeds at a non-conscious level the appropriate script. At the same time the strategic planning can be built into the forward reflection. This also accounts for decisions initiated by the coach, which are not induced by action on the

court. The strategic decision (for example to substitute a young player for experience) can be part of the forward model providing that it is not 'over-ridden' by an unforeseen event. Not all actions will have their catalyst on the court but they will be permitted by the current script. One consideration might be that the game of volleyball is very structured (rotations, side-outs, patterns to tactics) and this may assist the modelling process because the number of options is limited. This suggests that the coaches' decision behaviour in this sport should be compared to that in others.

The forward modelling of options also helps to explain how action decisions may seem to be routine (and made deliberately this way to characterise expert behaviour). Some action decisions will already have been built into the coaches' modelled scenarios. Providing these scripts progress as expected, the action decisions (for example, re-substitutions when a backcourt player comes to the front-court) can go ahead. It was unfortunate for the study (although clearly not for the individuals involved) that there were few if any real crises, as in those occasioned by injury and inter- or intra-team conflict behaviour, since these would have provided example of emergency recognition schema scripts over-riding the existing scripts.

Methodological Limitations

Before examining the claims made for the study, it is necessary to evaluate its methodological limitations. Clearly these would affect the certainty with which the research questions and their attendant expectations can be answered. The study is essentially qualitative in nature and the principal objective of the methodology is to convince the reader of the rigour with which it has been approached (Locke 1989).

Qualitative studies are not always reproducible in their entirety, and the researcher, therefore, has to convince the reader that the evidence has been collected, analysed and interpreted in ways that are open to scrutiny, and are appropriate for the claims being made. There is a tendency to focus on the negative aspects (if any) of the methods employed. It is important, therefore, to state at the outset of this short section that the claims made for the research acknowledge the inherent limitations of the methods used to generate the necessary evidence, but that they have been executed with the rigour necessary to provide a confident assertion of the findings.

This evaluation focuses on the issues of the Stimulated Recall method, transcript analysis as a mechanisms for accessing cognitive organisation, the sample size, the naturalistic approach to design, researcher bias, and the analysis of the coaches' accounts of their decision making. The methodology chapter was very full and this is relied upon to convince the reader of the procedural mechanisms employed (pilot study, questionnaire design etc.).

The central issue is the Stimulated Recall (SR) method and its attendant limitations (see Yinger 1986). These have already been covered very fully and involve the immediacy of the recall, the image accessed by the video image, the extent of the incursion into tacit knowledge, the potential for secondary ordering of the cognitions, and the potential for bias in the responses. Attempts were made to mitigate some of these potential shortcomings, and this dealt successfully with reducing memory decay. In the absence of further evidence, the coaches' responses appeared to reflect what would have been tacit knowledge in other circumstances. In retrospect, and from an overview of the coaches' accounts, it seems likely that there has been some ordering of the cognitions. The

coaches have undoubtedly been able to retrieve the decision episodes but in their verbal accounts, they have brought a sense of semantic and, probably, schemata-based, order to their responses. Insofar as the method involves retrospection rather than process tracing, this has to be expected. However, it is possible that this has impact on two important parts of the findings. Firstly, the more ordered responses would be more likely to be interpreted as 'interactive' rather than recognition-primed. Secondly, one of the biases likely to be present in the coaches is a desire to seem more in control. This was recognised by Brehmer (1992) but this inherent bias in reporting decision making may also lead the interpretation towards more apparently deliberative activity. These apparently negative findings have to be reviewed against the fact that process tracing would have destroyed the naturalistic environment.

The reliability of the coaches' prompted responses to the incidents identified was therefore acknowledged as a problematic issue. The main concern was the extent to which the coaches reordered their thoughts before or during the recall process. Although there is no previous practice with which to substantiate this suggestion, future studies might examine the possibility of a test-retest procedure (perhaps after 1 week) in order to establish the degree of reordering of responses that is taking place. An increased level of reordering would be an interesting finding in its own right, would validate earlier comments about events being stored in a 'deeper' level of memory from which 'abstracted' recall takes place, and would demonstrate the need to elicit an 'immediate' reaction from the coaches.

The difficulties of investigating cognitive organisation were acknowledged at an early stage: the naturalistic setting exacerbated this. The SR method has limitations, but there

was no better method available to generate the evidence necessary. Like all indirect methods of obtaining evidence of cognitive activity, the findings have to be appreciated with that awareness.

There is undoubtedly a weakness in the inferences about cognitive organisation that can be made from verbal accounts. In this instance the inferences are being made in an indirect manner, that is, the coaches are not being asked to comment or generate their own perceptions of their cognitive activity. Nevertheless, judgements about the association with categories of cognitive organisation must be evaluated in two ways. Firstly, the traditional experimental design of the decision theory school has attempted to isolate cognitive activity by creating 'reduced' and static problems in settings that are not real, natural nor applied to practice. Alternative approaches, such as this one, are much less controlled but have the advantage of valid decision contexts. Research has, therefore, to be understood within the tradition in which it is applied. Secondly, the model design, literature support, and arguments about the analysis of the coaches' accounts have been set out very clearly in the methodology, and the assumptions made therein are subject to scrutiny.

The sample size used for the study was relatively small, even for a small-scale survey, and to enable generalisation to be made within the sample. Once again, the evaluation of the methodology has to balance advantages and disadvantages. The search for patterns within 12 expert coaches' accounts of decision making behaviour will be less convincing than if the number was greater. However, it was important that the coaches could be categorised as experts and this was the more important condition.

The potential for researcher bias within the study is significant and, in the research design and data collection procedures in particular, great care was taken not to contaminate the process. The researcher's involvement in volleyball could have been problematic. There were a number of practical advantages to do with access to coaches, rapport with coaches and understanding of the natural setting. Insight could also be called upon for SR procedures and interviews. However, it is also possible that the researcher could have become too familiar with the context. The only defence against this is for the reader to evaluate the steps taken to eliminate bias at all stages. One point is very important. Because of the shared understanding of volleyball knowledge, it was possible for coaches to describe their decisions and other cognitions without having to reduce them for explanation and so distort the flow of their verbal accounts. This also had the effect of making the analysis of the transcripts more dependent on volleyball knowledge. This is something to be taken into account in studies that develop from this one.

Another element of the methodology with potential limitations is the analysis of the SR and interview transcripts. For this reason the procedures associated with this were outlined in some detail in the methodology chapter. No coding frame reflecting the model categories existed and one had, therefore, to be devised. The coding procedures were again described in some detail. Reliability of coding was checked by an inter-rater test. The figures for this test were not as high as would have been preferred. However, there were two factors involved. Firstly, the SR transcripts required considerable volleyball insight and it was difficult to match this against research experience. Secondly, the training in coding that would have been characteristic of a multi-researcher team was not appropriate for a post-analysis reliability test, since this would have unduly influenced the test.

A decision was taken (and justified) to employ a pre-structured coding frame with which to analyse the data. Future research might benefit from a comparison of the outcomes between the pre-structured frame and a more open, 'grounded' approach. Such an approach might also be justified in the context of the limited theorising about coaching behaviour (although the decision to 'test' models from the traditional J/DM paradigm was prompted by the need to address the existing literature). It would be a valuable exercise to compare the conceptual/derived slow interactive model (which was inferred from the literature) and the findings from the grounded approach. It may also be useful for investigating individuals' differences within the general behaviour pattern.

It must also be borne in mind that the field of study was acknowledged to be under-theorised in relation to non-deliberative decision making. The study was, therefore, intended to be exploratory. The research questions are couched in terms of the relationship between existing theoretical explanations and the accounts of the coaches. It is not possible to do other than speculate about potential explanations for what has been found by drawing upon the relevant literature – albeit the arguments appear very plausible. Further, more closely directed research is required to explore the decision mechanisms. However, it is possible to state with some confidence that the intentions of the study have been carried out effectively and with rigour. Within the limitations of the methods employed, the representations of the coaches' decision behaviour can be treated with some confidence. The claims made for the study are dealt with more specifically in a later part of the chapter. These claims are supported by research that has been carried out with rigour and the findings should be interpreted with some confidence in the methodology employed.

The Claims made for the Study

Within the limitations expressed in the previous section, the following claims are made for the findings from the study. The statements are expressed in a concise fashion and reflect the earlier parts of this discussion chapter. The study itself is shaped by the research questions devised at an early stage. Although these are expressed in a simple way, the answers are rarely so simple.

The first question said: to what extent can elements of theories of cognitive organisation adequately explain the accounts of non-deliberative decision making by expert coaches generated during stimulated recall?

- Elements of existing theories of cognitive organisation, culled from decision theory and naturalistic decision making, explain the non-deliberative decision making of the coaches in the sample. The behaviour is recognition-primed and directed to an action decision rather than a choice decision.
- However, non-deliberative models of cognitive organisation do not account for the majority of decision episodes by the coaches in the sample.
- A model inferred from the literature, which represents interactive decision behaviour, can identify those decision episodes not categorised by non-deliberative decision making.

The following statements are supported by the findings from the study:

- Serial and interactive decision making is not yet explained adequately by the literature on cognitive organisation.

- The validity of the interactive model is attested to by the literature on teaching, but has not been sufficiently articulated in terms of its cognitive operationalisation.
- The serial (that is, incremental and aggregative) and contested nature of the task environment is novel to the literature and forms a worthwhile research field.
- Although elements of decision theory (that is, the traditional laboratory-based experimental approach to decision making research) can provide insights into the decision making of the coaches in the study, the naturalistic setting and the emergence of a naturalistic decision making research field offer more potential help for future studies.

The second research question said: to what extent does the individual coach's 'theory of action' appear idiosyncratic?

- There is some evidence of a set of shared principles within the group of coaches in the study.
- Detail from the key attractors in problem framing and solutions adopted reveals differences between coaches.

The following statements are supported by the findings from the study:

- There is a degree of commonality in the coaches' schemata. It is not possible to appraise this in quantitative terms.
- There is some consensus on the indices considered to be important: particularly momentum and its sub-categories (key points in the set scores, clusters of points, and points lost speedily), and mental errors.

- In the study, the use of the various models of decision making was distributed through the coaches. Coaches used all models, although there were two coaches who used only the interactive model in the decision episodes identified for the study.
- Coaches differ in their interpretations of the common framework and accept that it should be applied in context.
- The commonality was supported by the fairly formal structure and pattern to the game, the limitations in decision ‘resources’, and the apparent influence of coach education. The differences were supported by the reliance on learning by experience from other coaches, and the influence of coaches’ philosophies about coaching.

A list of expectations was generated at the conclusion of the review of literature. These covered issues large and small and are an extension of the research questions. It was anticipated that the study would provide responses to these expectations. This is one way of testing the assumptions on which the study was based and the relevance of the existing literature. They also provide a bridge between the review of what is thought to be relevant literature and the volleyball/coaching context of the study. If the study findings are significantly different to the expectations, this is a problematic issue to be attended to or further research conducted. What follows is a concise account of the expectations and the responses based on the study findings:

1. *The assumptions made in the study will be confirmed: non-deliberate decision making; expert behaviour (tacit but verbalisable knowledge, abstract problem framing, intuitive behaviour), retrospective accounts of decision making by coaches can be used to infer cognitive activity.*

- (a) The coaches' decision making as represented by the accounts of the decision episodes in the study could not be adequately described as non-deliberative.
- (b) Expert behaviour was confirmed in the cognitive behaviour exhibited by the coaches in the study.
- (c) It is likely that a definite response to the third assumption will need to await further research. The procedures employed appeared to be successful, particularly in the exploratory context of the study.

2. *The theoretical models of the cognitive organisation associated with decision making will explain the collated evidence of the coaches' decision making.*

- (a) The existing models of cognitive organisation associated with non-deliberative decision making did not fully explain the accounts of the coaches' decision making generated by the SR procedures.

3. *Direct and indirect evidence will confirm idiosyncratic knowledge structures about key factors in shaping decision framing and choice.*

- (a) A summary interpretation of the evidence available from the study is that coaches do have idiosyncratic knowledge structures, threshold points and key factors on which they concentrate. This is complemented by varying perspectives on the role of the coach and technical interpretations about volleyball. However, there is evidence of a common framework.

4. *Coaches will employ more than one mode of decision making.*

(a) The evidence from the study suggests that coaches employ more than one mode of decision making. However, there were two coaches whose mode of decision making was categorised completely as interactive. Further research is required on the possibility of a link between decision mode, experience and 'perceptions of control'.

5. *Coaches' accounts will display evidence of pattern recognition and routinised solutions.*

(a) There was clear evidence that coaches' decision processes were initiated by pattern recognition. An interpretation of the coaches' accounts suggests that the action solutions adopted were 'attached' to the knowledge schemata or scripts and in that sense were routinised. It also appears likely that some decisions form part of a pattern within the game (for example, substituting after service, returning players when in the front court) and in that sense are routinised.

6. *There will be evidence of thresholds applied to pattern recognition.*

(a) It is clear that thresholds play a very significant part in the coaches' decision making. Further research is required on this issue. It would appear that coaches can respond to executive command when the threshold is sufficiently strong. For the most part, coaches recognise that they are managing limited decision resources and impose a further level of cognition on the pattern recognition. However, this does not seem to be entirely deliberative.

7. *Coaches' accounts will display evidence of action decisions and non-compensatory choice strategies.*

(a) The research evidence from decision theory suggested that under time pressure coaches would employ non-compensatory strategies. NDM literature suggested that most naturalistic decisions are concerned with the implementation of the 'appropriate' decision and not a selection from alternatives. The evidence is that coaches in the study demonstrate a clear link between decision framing and solution. The choice of alternatives is not part of the strategy.

8. *The case script model will be evident in critical incident decisions.*

(a) A very small percentage of decision episodes were categorised as Case Model and this expectation was therefore not supported. Two issues are worthy of further attention. There were no critical incidents of the type including injury, interpersonal conflict, or even teams losing to 'lesser' opponents. Further investigation is needed into this model. There is also some debate possible about what constitutes the 'case'.

9. *Analysis of the coaches' accounts will be influenced by several volleyball specific factors: limited choice of solutions; difficulty in reading the situation assessment (largely caused by the opposition); coach expectations (simulations) structured around predictable game patterns.*

- (a) There is no doubt that the coaches' decision making was influenced by the task environment. The specific elements of the game were characteristic of dynamic, multi-factor, and uncertain settings, with a degree of time pressure. The task environment was particular for its serial nature and for its contested nature. These should be taken into account in evaluating and replicating this or similar research.

10. The dynamic nature of the task environment for decision making will demonstrate itself in a lack of precision and confidence in situation assessment and prediction.

- (a) The pre-eminence of situation assessment was confirmed in the study. In addition, it was clear that the contested and dynamic circumstances contributed to a sense of 'weak solutions'. This was partly a facet of the 'retrieval' position and the coaches' conservatism in enacting their decisions.

The expectations related to the effect of the task environment have largely been supported. These expectations were generated from the decision theory literature. The decision making models were expressed more as 'null hypotheses' because of the exploratory nature of the research. The absence of similar research meant that there were no previous studies from which to draw. The study began by seeking explanations for the apparently non-deliberative decision making of volleyball coaches. It has become clear that the coaches' dilemma is an 'action decision' one and the task environment is characterised by its serial, incremental nature. The coaches' decision making is interactive, but not only in a dynamic and uncertain environment but one which is contested and dependent on a qualitative delivery of the action decision. The contested

nature of the environment brings problems of situation assessment and the impact of action decisions. The interactive model of decision making and its cognitive organisation is not yet fully explained.

Further Explanations

To this point the discussion has focused on the findings in the context of the literature reviewed before the data collection, the methodology itself and the analysis and interpretation of the data. It has become clear that the sources sought for explaining the coaches' accounts of the decision making have not provided a complete picture.

Naturalistic Decision Making was described in the study, in contrast to the more traditional behavioural decision theory. Reference was made to this approach to understanding decision making because the setting was naturalistic and two aspects of the approach – recognition-primed decision making (Klein 1993) and the action decision rather than choice decision seemed appropriate. Reference was made to a number of complementary sources, which shed some light on the study. However, this was the extent of the absorption of NDM into the study. The study was more influenced by the interactive teaching literature, and studies derived from clinical research, which were based on decision theory research. The models of decision making devised for the study were not based on NDM sources, other than for the similarity between the Schema Model and the recognition-primed decision model (RPD). Having reached a point at which the explanations about cognitive organisation sought for the volleyball coaches' decision making have proved to be inadequate, and with hindsight, it would be fruitful to

explore the potential in NDM for explaining some of the findings of the study and for underpinning future research.

NDM is in the process of establishing itself as a force within psychological research (see Flin et al 1997, Zsombok and Klein 1997 and Klein 1998): “NDM researchers are still experiencing something of an identity crisis in their attempt to establish a place for NDM within general decision theory, while striving to demonstrate how it has something new to offer” (Flin et al 1997: 4). Although the boundaries of the research field are being established at present, the general approach is more evident. The unrealistic, static, experimental approach of the traditional behavioural decision theorists is eschewed as not reflecting real-life decision making. Perhaps more significantly, its emphasis on setting normative standards and identifying individuals’ limitations in comparison to ideal solutions asks a completely different set of question from NDM, which is more concerned with how experienced or expert decision makers make decisions in conditions of stress: “NDM is directed at understanding the demands the task domain places upon the decision maker” (Klein 1997: 17). At this stage in its development NDM is concerned with descriptive models of decision making (Rasmussen 1997). NDM is focused on the use of experience to make decisions and on the solving of practical problems. Orasanu and Connolly (1993) defined the task environment of NDM.

One of the shortcomings of NDM is that it has often been thought to be synonymous with recognition-primed decision making. However, there are a number of models¹⁹, which

¹⁹ Amongst these are the Beach’s Image Theory (see Beach 1997), Lipshitz and Strauss’ RAWFS model (Lipshitz and Strauss 1996), Orasanu and Fischer’s Decision Process Model (Orasanu and Fischer 1997), and Cohen, Freeman and Wolf’s R/M model (Cohen et al 1996) in addition to Klein’s updated RPD model (see Klein 1998).

proponents of NDM have suggested represent the way individuals²⁰ make decisions in naturalistic settings. The purpose of this short review is to outline a number of models that have some explanatory power in relation to the findings of the study. In most cases the models are at the descriptive stage and many of the cognitive features have not yet been explored fully, not have they a strong history of supportive research studies. Nevertheless, the models selected have an evident appropriateness in the context of the study.

Klein (1998: 24-28) has provided an updated version of the RPD model. The version normally given in all secondary sources is of a pattern recognition of a situation which leads to a known course of action. However, Klein has integrated into the model how it might deal with situations requiring greater diagnosis (including mis-diagnosis not spotted until the expectancies are violated) and those in which the course of action needs to be given further consideration. (See Figure 10: page 247)

There can be no suggestion that the model is immediately applicable to the volleyball coaches' context. However, at a descriptive level, the capacity to explain dealing with novel recognition, identifying unfulfilled expectancies as a monitoring device and using mental simulation to test out potential actions all have resonances with the findings from the study. The model describes expert behaviour and assumes the development of the appropriate knowledge structures. It still not clear that it deals with the serial or contested nature of the game, but it has a very tempting potential capacity to explain how the coach can move from the almost instant to the rapid but with the capacity to engage in a more deliberative mode should the environment demands this.

²⁰ The researchers in this field have focused on two sets of populations for their studies – uniformed

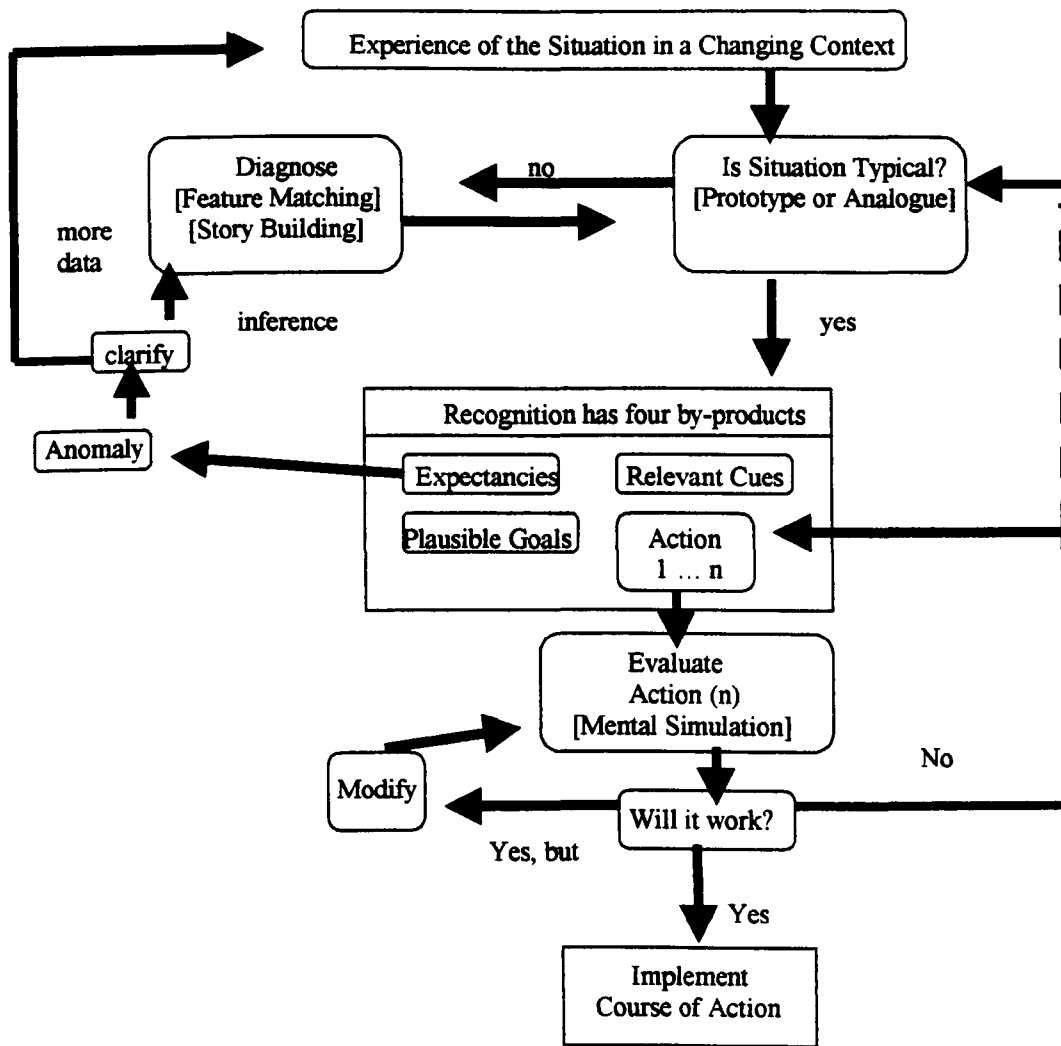


Figure 10: Klein’s integrated version of the recognition-primed decision model (Klein 1998: 27)

Two other comments on Klein’s work are relevant. He discusses intuition and attempts to disabuse the reader of its mysterious qualities: “intuition depends on the use of experience to recognise key patterns that indicate the dynamics of the situation” (1998: 31). This is an attractive interpretation of what is ‘apparently’ intuitive. Towards the end of his book, he summarises what he terms the individual’s sources of power in decision making. These are interesting for their connectivity to the discussion in this study: the

civilian services such as fire-fighters, airline pilots, and policemen, and military personnel making tactical

terminology is different, however. He cites intuition (pattern recognition, having the big picture, achieving situation awareness); mental simulation (seeing the past and the future); using leverage points to solve ill-defined problems; seeing the invisible (perceptual discrimination and expectancies); story telling; analogical and metaphorical reasoning; reading peoples' minds (communicating intent); rational analysis; and team mind (drawing on the experience base of the team). At this stage, these say nothing about the cognitive organisation underlying these assumptions about decision making in naturalistic settings but they hold some promise for such dynamic and contested situation as coaches find themselves in.

Lipshitz and Strauss (1997) propose a model, which they term RAWFS (meaning Reduction, Assumption-based reasoning, Weighing pros and cons, Suppression, and Hedging). This is a heuristic for dealing with the uncertainty in a situation and a number of their concepts throw light on the behaviours of the coaches in the study. The authors describe uncertainty as a 'sense of doubt that blocks or delays action' and categorise it into 3 types: inadequate understanding, incomplete information; and undifferentiated attitudes. They discard the RQP model²¹ in naturalistic settings and propose three strategies: reducing uncertainty, acknowledging uncertainty and suppressing uncertainty. The most significant elements of their proposals are the use of delaying tactics and assumption-based reasoning models to reduce uncertainty.

They suggest that individuals extrapolate from the available information, filling in gaps by assumption-based reasoning. They say that experts can act within their domains by

decisions.

²¹ RQP refers to the heuristic Reduce, Quantify and Plug (see Camerer and Weber 1992). Lipshitz and Strauss (1996) argue that the assumed capacity to seek additional information, apply probabilistic, quantifiable estimates and use a formal rule system is problematic in naturalistic settings.

using this method (Lipshitz and Ben Shaul 1997) and cite mental simulation (Klein and Crandell 1995) and scenario building (Schoemaker 1995): “imagining possible future developments in a script-like fashion” (Lipshitz and Strauss 1997: 153). Their research with defence force personnel confirmed the importance of situation assessment: “these results are consistent with the assertion that naturalistic decision making is characteristically driven by situation assessment” (1997: 158). Incomplete information was primarily mitigated by assumption-based reasoning and ‘forestalling’ was used as a back-up with all strategies.

the RAWFS heuristic presumes that decision makers use both situation assessment coupled with serial option evaluation and concurrent choice. ... the heuristic assumes that decision-making begins with an attempt to understand, recognise or make sense of the situation. If this attempt is successful, decision makers initiate a process a serial option evaluation which they complement, if time permits, by mentally simulating the selected option. When sensemaking fails, decision makers experience inadequate understanding to which they respond ... by using reduction or by forestalling. (1997: 159²²)

The authors do not deal explicitly with the issue of time pressure or serial, incremental circumstances (still focusing on options) but their attention to assumption-based mental modelling is a helpful insight into the behaviour expressed by the coaches in the study and the recognition of forestalling is useful. This needs to be elaborated in the context of being conservative with limited resources and the potential for a worsening situation.

One of the interpretations of the coaches’ cognitive organisation suggested at an earlier stage in the discussion was that there was a strategic schema, which could be imposed in some way on the recognition-primed action choice. Cohen, Freeman and Wolf (1996) propose a Recognition/Metarecognition Model, which has some potential explanatory

²² The text itself is punctuated by references to a flow diagram, which is a useful awareness tool.

power for this issue. The authors identify the limitations of the first stage RPD model and suggest that individuals adopt a two tier process: following the recognition activation and its associated responses, there is an optional process of critiquing and correcting (1996: 207). They describe an empirically based model of the critiquing and correcting, which emphasises metarecognition. The issue of time pressure is problematic and the authors suggest that individuals engage in a 'quick test' to judge if there is time before commitment to a decision is necessary, the consequences of an error are high, or the situation is unfamiliar (see 1996: 211 for a description of the model). "if conditions are appropriate, the quick test inhibits recognitional responding and interposes a process of critical thinking" (1996: 211). One could speculate at this point that the coaches in the study might use a threshold trigger mechanism as part of the 'quick test' stage but if the threshold is not breached, they would decide that, because of the limited decision resources and their knowledge that there are strategic issues, they may choose to enter a process of metarecognition using mental simulations or other more deliberative processes. In the study context this may involve accepting the weighing of reducing uncertainty versus the impact of any solution (and in particular, the impact of the use of resources on future problems). This conforms to the NDM assumption of satisficing rather than optimising solutions. If this model, Klein's integrated RPD model and Lipshitz and Strauss' model are conceived of as having the potential for continuous feedback loops, they may have a potential for describing the interactive scenario apparent in the coaches' accounts.

Kaempf et al (1996) investigated command-and-control decision making by naval personnel, using a variant of the RPD model. Their study is useful for its emphasis on situational awareness in a problem: their data demonstrated that "the most important

decisions were judgements about the nature of the situation, not selections between alternative courses of action” (1996: 227). This is very much in line with NDM responses to typical situations (Hendry and Burke 1995, Flin 1996). Kaempf et al found that individuals used feature matching (referred to in this study as recognising key attractors) and story building if the situation was novel or complex. Story building was different to mental simulation in that it referred to analysis and interpretation of previous rather than subsequent states. There is no doubt that the data from the coaches’ accounts show that they ‘built up pictures’ of what had happened. This had been interpreted as the use of enabling conditions (largely awareness of current form of players) in script options. The story telling is required to make the diagnosis – the hypothesising about the situation – the coach then mentally simulates the outcomes of the preferred solution. However, and most importantly, the coach must take into account what is assumed to be going to happen as the next or next few rallies unfold. Coaches in the serial position must therefore simulate a number of scenarios with a number of solution (the most obvious of which is action or no action).

Orasanu (1997) describes what she calls a Decision Process Model (Orasanu and Fischer 1997), which is based on an application of the RPD model to aviation pilots. There are a number of interesting features in this paper. The application of the model to aviation suggests that a similar model could be constructed for coaches. In the context of aviation, Orasanu and Fischer propose that when time is limited and risk is high, the individual will revert to a rule-based decision. However, in the non-life threatening context of coaching, and in a context in which the framework of rules is not strong, the coach may not have a set of rules (or one in which they feel confident) to apply. One of the Orasanu comments here is interesting and needs further attention. She suggests a ‘default’ option

when there is uncertainty but some time pressure. The coaches were clear that they would apply the rules framework to the circumstances pertaining. However, novices and greater uncertainty or time-pressure may induce a 'default option', which would be likely to be a 'weak solution'. The coach will also be able to 'forestall' in a sport context (see Lipshitz and Strauss 1997 earlier). However, Orasanu's use of the term 'threat' is also a valuable one. The threshold values for recognition-primed action could be interpreted in terms of the perceived threat to the objective of the game (i.e. winning). The relationship between situation awareness and threat values will be different at different stages of the set and the game.²³

The purpose of this section has been served by demonstrating the potential in NDM models representing another decision making paradigm for explaining the accounts of the coaches in the study. The models are descriptive and the cognitive organisations relevant to mental simulations, pattern recognition and situation assessments for example, have not been fully theorised. However it is clear that they offer a good deal of explanatory potential. A future task is to integrate the models available in such a way that they describe the coaches' context and offer some predictive potential.

Recommendations for Education and Training

The recommendations for education and training are not as detailed as hoped for at the outset of the study. The findings from the study certainly suggest ways in which the training of coaches may be improved but there is little research on training and the relative 'newness' of the NDM models has not yet given time for training principles to be

²³ The coaches in the study acknowledged the contingent nature of their situation assessment. Some

fully developed. Perhaps the most positive statement to be made is that what was termed ‘apparently intuitive’ decision making need not imply that it is untrainable. What appears to be intuitive (and what feels intuitive to the decision maker) is an element of expertise that can (presumably) be trained. The question is how can this best be done? The most important issue and one that research of this kind will not resolve is to establish that decision making is a (or more likely ‘the’) discriminating element in coaching expertise. Match coaching is one aspect of the coaching role and unfortunately one that has been relatively ignored to this point.

The original rationale for the study suggested that different modes of decision making, and therefore different cognitive organisation, might be used by different coaches and, perhaps more importantly, by coaches and mentors. It is now clear that coaches use all modes of decision making or even that each of the modes represents a different stage in an integrated model. If this is so, the distinctive requirements at each of the stages of the model would require specific training. It is important to point out that the shortcomings in coach education have already been identified. Unlike more general recommendations about school education or professional training, very little formal training is already in place for coaches at a high level. What there is has tended to be based on advanced declarative knowledge. It is much more likely that coaches' education and training has been influenced by more informal means.

A further issue is the question of generic versus specific training. Should or could training in decision making be improved by studying the decision making process out of

situations might be tolerated at the beginning of a set but not near the end. Clusters of points might be interpreted differently when leading than when behind.

context and on more abstract problems²⁴. Lipshitz and Strauss are in no doubt about the specificity of the training material (1997: 160): “training programmes should aim at teaching novices and mediocre performers the strategies and tactics that are used by experienced decision makers in the same domain”. They contrast this with the abstract lessons from J/DM research. An interesting issue but one which can be resolved is that the coach’s expertise must deal with a different set of resources on each occasion (numbers of players, current form, opposition strength etc.). To some extent, therefore, the coach’s expertise in decision making should be thought of as a process in which default values are assessed at the beginning of the game. These are absorbed within the short-term memory structures. The coach has to develop the skills and principles required to implement the process.

More specific lists of the decision making components can be gleaned from the detail of the study. It is obvious that situation assessment including pattern recognition, key attractors and diagnostic hypothesising, mental simulation involving assumption-based reasoning, knowledge frames or schemata with a range of appropriate solutions, development of threshold triggers, impact-forestalling tactics, and metarecognition capacities (judgement of threat and advantage) needs to be developed within the volleyball domain. Abraham and Collins (1998) have already indicated that coach education is deficient in the development of propositional and procedural knowledge but they failed to be specific about the training strategies to be adopted. It seems clear that

²⁴ See Norman and Schmidt 1992 and Schmidt 1993 for a discussion of problem based learning.

experience by itself will be insufficient²⁵, although it is likely to have an incremental effect on knowledge structures and performance.

Practical measures can be adopted. Experience of the task environment has to be provided, but within a structured learning approach. The development of the procedural capacity has to be complemented by a continuous process of declarative and (abstract or generic) propositional knowledge.²⁶ In conditions of risk, it has been necessary to provide simulation of the task environment. An example is battlefield or aviation research (Klein 1997: 6). However, with volleyball games the coach can experience games in the training or competition environment. Nevertheless, the simulation of games in exercises is one training procedure. This might be video-based and examine real-life examples commentated on by the expert concerned or in interactive-video format.²⁷ Another suggestion is that coaches should experience difficult cases. It may be that coaches would experience these in any event, through time. But in the training context the embryonic expert would be given 'difficult' cases to match-coach. Identifying critical cues is an important capacity. Once again this requires simulation exercises with which to train perception for pattern recognition. A very important training mechanism is to help the coach to review prior experiences. Although this may happen in non-conscious ways, the learning process will be much enhanced by a structured approach which focuses on some of the stages identified above and asks the coach to reflect on the

²⁵ Although the evidence on the effect of training has been interpreted without consideration of the type of expertise being studied (see Camerer and Johnson 1992).

²⁶ A further issue and one which is not given attention at this point is that the focus in this study and within these recommendations is on the expert performer or the individual who is about to enter that stage. There will be further development required of the stages through which individuals progress to become expert and in a way that foreshortens the process.

²⁷ See Omodei, Wearing and McLennan (1997) for a discussion

judgements made during the game. Clearly this might best be accompanied by a video recording and expert mentor notes, although this is a procedure that the coach can learn.

Many of these suggestions are best implemented by expert mentors. This gives the coach an opportunity for some focused ‘situated learning’ (see Lave and Wenger 1991)²⁸ and diagnostic feedback. It is obvious that one of the principal needs is for mentors to understand the decision making process. It could be argued that the results of this study might form part of the process, but it is clear that there is a need for further research and application to sports coaching. There also needs to be mentor training, which is based on self awareness of decision making and the mechanisms outlined above.

Further Research

Part of the purpose of exploratory research is to help delineate a research field. In this instance, the study was conducted within well-trodden research traditions and fields in decision theory and in much less well-developed fields in NDM and in sports coaching more generally. However, because of the exploratory nature of the study it has raised or confirmed a very great number of unanswered questions. Specific mention has been made of many of these in the text and these will not be listed again in this short section. Nevertheless it is possible to make some useful comments about future research.

- The emphasis in future research should be within the emerging NDM tradition rather than J/DM.

²⁸ This has clearly happened to many of the coaches in the study through their interaction with Ralph Hippolyte.

- Whilst the naturalistic setting is appropriate, simulation of the task environment would be valuable for narrowing the cognitive organisation involved and permitting more focused research into cognitive organisation.
- The volleyball context could usefully be narrowed, through simulation or selection from a much wider range of decision episodes, to more time-pressured or ‘crisis’ examples.
- A framework for research could usefully apply a decision stage approach. For example, situation awareness, situation assessment, decision point judgement, thresholds, etc..
- Research is required in underlying neural processes, in naturalistic decision making in situ, in SR and similar methodologies, and in application of training methods.
- The SR procedures proved to be a potentially valuable way of accessing expert behaviour. This could be replicated with other volleyball contexts such as more expert coaches from overseas, coach educators, mentors etc.. Further work is required to judge whether this is an appropriate way of researching less expert decision making in order to build up a picture of the development process.
- Many processes and sub-process were assumed for the purpose of acquiring the descriptive ‘big picture’ about the coaches’ decision behaviour. The construction of mental model and the process of reflective anticipation, the capacity to use key attractors to recognise patterns, and a capacity to integrate strategic decisions with routine ones are all necessary but almost untouched by research.
- A significant omission from the research framework is the part played by the coach’s psychological dispositions. There would seem to be little doubt that stress has an impact on decision making. The coaches’ potential for becoming emotionally

involved in the contest and its effect on their performance is one example of an area that should also be explored.

- The ‘contested’ nature of the task environment has emerged as a potentially very significant factor. Further research is required to investigate the effect of the contested element on the task environment and the differences between contested and non-contested strategies. It also became apparent that the ‘team’ characteristic of the sport had an influence on the ‘strength’ of the situation assessment and the success of the solution adopted. This variable also needs to be given further attention.

Summary

This section consists of a series of summative statements about what is considered to be important to ‘take’ from the study. Overall the conclusion is that the accounts of volleyball coaches’ decision making generated during SR procedures cannot be accounted for by the theories used to categorise their cognitive organisation, although NDM is a very promising source of potential explanations for the interactive decision making identified during the study. A significant finding for comparative research purposes is the serial, incremental and contested nature of the task environment. The expectation about the findings generated from the literature proved to be a valuable framework for the study, and the evaluation provided earlier will guide future studies. As an exploratory investigation, the study has identified a fruitful research field for further exploration.

- A descriptive analysis of the coaches’ decision making might be as follows. Coaches engage in decision framing and diagnosis based on the important stage of situation

assessment. If the situation is sufficiently threatening to the objective, this might lead to a decision point. The solution will have been generated by the pattern recognition process, as one that has been used successfully in the past. If the situation is untenable but too uncertain, a default decision solution may be adopted. The diagnosis will have hypothesised the progress of the game and this is monitored in the next, on-going situation assessment. This can lead to a decision point, to a new diagnosis based on a threshold trigger, or to the continuation of the original hypothesis. This process is continually repeated and is fed by a situation awareness monitoring.

- The decision framing and diagnoses are based on cognitive schemata. In the context of time pressure, rapid diagnosis (particularly recalling that this will involve many potential hypotheses and solutions) is similar to the concept of script schemata. The diagnosis involves two sub-processes. One is a retrospective story-telling, which provides an explanation for the development of the situation and associates, therefore, with solutions. The other is a reflective anticipation or mental simulation, which provides the expectancies against which progress can be evaluated.
- The task environment is inherently uncertain because of the reliance on relatively fragile player qualities and the contested nature of the game. For this reason, diagnoses, hypotheses, simulations and solutions are all inherently 'weak'. Further research is required to assess the 'expertness' of these judgements. The coaches' cognitive capacity to engage in such an effortful cognitive process has yet to be established. It seems likely that the coaches will seek further problem reduction strategies, for example, treating the set in groups of points rather than attending equally to each one. A further example is the 'routinisation' of some decisions within the game.

- The coaches' monitoring processes involve some form of metarecognition, which is not yet fully explored. In critiquing progress, coaches will engage in judgements of the sort that balances impact of action against estimation of threat and desire to confirm the hypothesis. The putative heuristics mentioned earlier, such as don't be hasty and don't judge early, might prove to be apt.
- The notion of intuition in coaching judgements seems very likely to be borne out of ignorance of the processes involved rather than to be an inexplicable phenomenon. The coaches' cognitive organisation is not fully theorised but it seems likely that the mix of non-deliberative and more-deliberative processes has a basis in understandable and accessible neural states.
- The NDM 'movement' holds great promise for application to a coaching task environment that fulfils the boundary characteristics of the naturalistic setting. The extent to which coaches consider alternatives is not yet established, but the evidence from the study points to the characteristic 'one solution' of NDM. This obviates much of the traditional behavioural decision theory research, which is based on concurrent selection in static, often abstract, problem solving. Time pressure in these circumstances is usually deadline induced.
- The coaches' desire for control, which was identified during the study, is part of a psychological framework that has not been given attention. The behaviour of the coach during a game is likely to affect the players and confident, assured coach who appears to be in control of the situation would be of psychological advantage. Whilst this is another area for further study, there is some considerable doubt about the overall effect that the coach's match coaching can have on the outcome of the game.
- The stimulated recall procedures worked effectively for generating accounts of the coaches' decision making. The efficacy of such indirect methods of accessing

cognitive activity must still be unproven. The limitations identified earlier should not be considered to be sufficiently strong to negate the findings of the study – particularly in the absence of more appropriate methodological contenders.

- The interactive decision making context was different from teaching because of its more focused common and instrumental goal (albeit with subsidiary developmental goals) and serial nature, but there is sufficient overlap with the classroom teaching and participation coaching environment for the findings to be considered by workers in these fields.

The appropriateness of the rationale for the study has been confirmed. The field of study was apt and the methodology proved to be challenging, exploratory and applicable. There was sufficient underpinning theory and literature sources to operationalise the study, although the shortcoming of the literature and the under-theorised nature of the field were confirmed. There were very significant changes in perspective and perception over the period of the study and there is no doubt that it was a valuable learning experience for the researcher.

The study itself was carried out in a rigorous fashion and reported in the same manner. In true exploratory research fashion, more questions have been raised than answered. The underlying cognitive processes have not been resolved but that was not the purpose of the study. What has been achieved is to point out the limitations of traditional decision theory for explaining fully the volleyball coaches' decision making and to identify a potential link with NDM to explain the interactive nature of this particular task environment.

References

- Abelson, R. P. (1981). "Psychological status of the script concept." American Psychologist 36(7): 715 - 729.
- Abernethy, B. (1991). "Visual search strategies and decision making in sport." International Journal of Sport Psychology 22: 189 - 210.
- Abraham, A. and D. Collins (1998). "Examining and extending research in coach development." Quest 50: 55 - 79.
- Abraham, A., D. Collins, et al. (1997). "The use of behavioural assessment and associated problems." Journal of Sport Sciences 15: 70.
- Adelson, B. (1984). "When novices surpass experts: the difficulty of a task may increase with expertise." Journal of Experimental Psychology: Learning, Memory and Cognition 10(3): 483 - 495.
- Alexander, V. and V. Krane (1996). "Relationships among performance expectations, anxiety and performance in collegiate volleyball players." Journal of Sport Behaviour 19(3): 246 - 269.
- Allison, P. C. (1987). "What and how preservice physical education teachers observe during an early field experience." Research Quarterly for Exercise and Sport 58(3): 242 - 249.
- Allison, P. C. (1990). "Classroom teachers' observations of physical education lessons." Journal of Teaching in Physical Education 9(4): 272 - 283.
- Altman, J. (1995). "Deciding what to do next." Trends in Neurosciences 18(3): 117 - 118.
- Anderson, J. R. (1982). "Acquisition of cognitive skill." Psychological Review 89: 369 - 406.
- Anderson, J. R. (1990). Cognitive Psychology and its Implications. New York, Freeman.
- Anthony, G. (1994). "Learning strategies in the mathematics classroom: what can we learn from stimulated recall interviews?" New Zealand Journal of Educational Studies 29(2): 127 - 140.
- Argyris, C. and D. A. Schon (1978). Organisational Learning: A Theory-in-Action Perspective. San Francisco, Jossey Bass.

- Atkins, M. J. (1994). "Practitioner as researcher: some techniques for analysing semi-structured data in small-scale research." British Journal of Educational Studies 32(3): 251 - 261.
- Baddeley, A. and N. O. Bersen (1989). Cognitive Psychology: Research Directions in Cognitive Science. European Perspectives Vol. 1. Hove, Sussex, Lawrence Erlbaum Associates.
- Baddeley, A. and Hitch (1977). Recency re-examined. Attention and Performance VI. S. Dornic. Hillsdale, New Jersey, Lawrence Erlbaum Associates: 647 - 667.
- Barton, S. (1994). "Chaos, self-organisation and psychology." American Psychologist 49: 5 - 14.
- Beach, L. R. (1990). Image Theory: Decision Making in Personal and Organisational Control. Chichester, UK, Wiley.
- Beach, L. R. (1993). "Broadening the definition of decision making: the role of pre-choice screening of options." Psychological Science 4: 215 - 220.
- Beach, L. R. (1997). The Psychology of Decision Making: People in Organisations. Thousand Oaks, CA, Sage.
- Beal, D. (1985). Spike: The Story of the Victorious US Volleyball Team. San Diego, CA, Avanti.
- Beckett, D. (1996). "Critical judgement and professional practice." Educational Theory 46(2): 135 - 149.
- Benner, P. (1984). From Novice to Expert: Excellence and Power in Clinical Nursing Practice. Menlo Park, California, Addison Wesley.
- Benner, P. and C. Tanner (1987). "How expert nurses use intuition." American Journal of Nursing 87(1): 23 - 31.
- Berliner, D. C. (1987). Ways of thinking about students and classrooms by more and less experienced teachers. Exploring Teachers' Thinking. J. Calderhead. London, Cassell: 60 - 83.
- Bersen, N. O. (1989). General introduction: a European perspective on cognitive science. Cognitive Psychology: Research Directions in Cognitive Science. A. Baddeley and N. O. Bersen. Hove, LEA. 1: vii - xiv.
- Billings, R. S. and S. A. Marcus (1983). "Measures of compensatory and non-compensatory models of decision behaviour: process tracing versus policy capture." Organisational Behaviour and Human Decision Processes 31: 331 - 352.

- Bloom, G. A., N. Durand-Bush, et al. (1997). "Pre and post competition routines of expert coaches of team sports." The Sport Psychologist 11: 127 - 141.
- Bloom, G. A., J. H. Salmela, et al. (1995). Expert coaches' views on the training of developing coaches. 9th European Congress on Sport Psychology, Brussels, Belgium, Free University of Brussels.
- Bolster, A. S. (1983). "Toward a more effective model of research on teaching." Harvard Educational Review 53: 294 - 308.
- Bond, C. and R. Whittal (1996). Proceedings. First International Coach Education Summit, Leeds, National Coaching Foundation.
- Boreham, N. C. (1988). "Models of diagnosis and their implications for adult professional education." Studies in the Education of Adults 20: 95 - 108.
- Boreham, N. C. (1989). "Modelling medical decision making under uncertainty." British Journal of Educational Psychology 59: 187 - 199.
- Boreham, N. C. (1994). "The dangerous practice of thinking." Medical Education 28: 172 - 179.
- Bottomley, V. (1996). Investment in talent gives Britain a sporting chance. The Daily Telegraph. London: 48.
- Boyce, B. A. (1993). "The reflective process: a tool for coaches." Strategies 7(3): 18 - 21.
- Brehmer, B. (1990). Strategies in real-time decision-making. Insights in Decision Making. R. Hogarth. Chicago, University of Chicago Press: 262 - 279.
- Brehmer, B. (1992). "Dynamic decision making: human control of complex systems." Acta Psychologica 81: 211 - 241.
- Brehmer, B. and R. Allard (1990). Dynamic decision making: the effects of task complexity and feedback delay. Distributed Decision Making: Cognitive Models for Co-operative Work. B. Rasmussen, B. Brehmer and J. Leplat. New York, Wiley: 319 - 334.
- Broadbent, D. (1993). "Planning and opportunism." The Psychologist 6: 54 - 60.
- Brooks, L. R., G. R. Norman, et al. (1991). "The role of specific similarity in a medical diagnostic test." Journal of Experimental Psychology: General 120: 278 - 287.
- Burton, A. M., N. R. Shadbolt, et al. (1990). "The efficacy of knowledge elicitation techniques: a comparison across domains and levels of expertise." Journal of Knowledge Acquisition 2: 167 - 178.

- Burwitz, L., P. Moore, et al. (1993). Future Directions for Performance Related Research in the Sports Sciences: an Interdisciplinary Approach. London, The Sports Council.
- Busemeyer, J., D. L. Medin, et al. (1995). Decision Making from a Cognitive Perspective: The Psychology of Learning and Motivation. Vol. 32. San Diego / London, Academic Press.
- Butefish, W. L. (1990). "Science teachers' perceptions of their interactive decisions." Journal of Educational Research 84(2): 107 - 114.
- Byra, M. and M. A. Sherman (1993). "Pre-active and interactive decision making tendencies of less and more experienced pre-service teachers." Research Quarterly for Exercise and Sport 64(1): 46 - 55.
- Calderhead, J. (1981). "A psychological approach to research on teachers' classroom decision making." British Educational Research Journal 7(1): 51 - 57.
- Calderhead, J. (1981). "Stimulated recall: a method for research on teaching." British Journal of Educational Psychology 51: 211 - 217.
- Calderhead, J., Ed. (1987). Exploring Teachers' Thinking. London, Cassell.
- Camerer, C. F. and E. J. Johnson (1991). The process-performance paradox in expert judgement: how can experts know so much and predict so badly? Towards a General Theory of Expertise: Prospects and Limits. K. A. Ericsson and J. Smith. Cambridge, Cambridge University Press: 195 - 217.
- Camerer, C. F. and M. Weber (1992). "Recent developments in modelling preferences: uncertainty and ambiguity." Journal of Risk and Uncertainty 5: 325 - 370.
- Campbell, S. (1993). "Coaching education around the world." Sports Science Review 2(2): 62 - 74.
- Cannon-Bowers, J. A., E. Salas, et al. (1996). "Establishing the boundaries of a paradigm for decision making." Human Factors 38(2): 193 - 205.
- Caplan, L. J. and C. Schooler (1990). "Problem solving by reference to rules or previous episodes: the effects of organised training, analogical models and subsequent complexity of experience." Memory and Cognition 18(2): 215 - 227.
- Carr, D. (1993). "Questions of competence." British Journal of Educational Studies 41(3): 253 - 271.
- Carter, K., K. Cushing, et al. (1988). "Expert-novice differences in perceiving and processing visual information." Journal of Teacher Education 39(3): 25 - 31.

Cegala, D. J., K. S. McNellis, et al. (1995). "A study of doctors' and patients' perceptions of information processing and communication competence during the medical interview." Health Communication 7(3): 179 - 203.

Chelladurai, P., T. R. Haggerty, et al. (1989). "Decision style choices of university basketball coaches and players." Journal of Sport and Exercise Psychology 11: 201 - 215.

Chelladurai, P. and D. J. Kuga (1996). "Teaching and coaching: group and task differences." Quest 48(4): 470 - 485.

Chelladurai, P. and C. B. Quek (1995). "Decision style choices of high school basketball coaches: the effects of situational and coach characteristics." Journal of Sport Behaviour 18(2): 91 - 108.

Cheng, P. W. and K. J. Holyoak (1985). "Pragmatic reasoning schemas." Cognitive Psychology 17: 391 - 416.

Chi, M., R. Glaser, et al., Eds. (1988). The Nature of Expertise. Hillsdale, New Jersey, Lawrence Erlbaum Associates.

Clark, C. M. and P. L. Peterson (1986). Teachers' thought processes. Handbook of Research on Teaching. M. C. Wittrock. New York, Macmillan: 255 - 296.

Clarke, D. and J. Crossland (1985). Action Systems: an Introduction to the Analysis of Complex Behaviour. London, Methuen.

Claxton, G. (1998). "Knowing without knowing why." The Psychologist 11(5): 217 - 220.

Cleary, M. J. and S. Groer (1994). "In-flight decisions of expert and novice health teachers." Journal of School Health 64(3): 110 - 114.

Coaching Review Panel (1991). Coaching Matters: A Review of Coaching and Coach Education in the United Kingdom. London, The Sports Council.

Cohen, M. S., J. T. Freeman, et al. (1996). "Metarecognition in time stressed decision making: recognising, critiquing and correcting." Human Factors 38(2): 206 - 219.

Cote, J., J. Salmela, et al. (1995). "The coaching model: a grounded assessment of expert gymnastic coaches' knowledge." Journal of Sport and Exercise Psychology 17(1): 1 - 17.

Cote, J., J. H. Salmela, et al. (1993). "Organising and interpreting unstructured qualitative data." The Sport Psychologist 6: 55 - 64.

Cote, J., J. H. Salmela, et al. (1995). "The knowledge of high-performance gymnastic coaches: competition and training considerations." The Sports Psychologist 9: 76 - 95.

- Cratty, B. J. (1970). "Coaching decisions and research in sport psychology." Quest 13: 46 - 53.
- Cross, N. (1995a). "Coaching effectiveness in hockey: a Scottish perspective." Scottish Journal of Physical Education 23(1): 27 - 39.
- Cross, N. (1995b). "Coaching effectiveness and the coaching process." Swimming Times 72(3): 23 - 25.
- Custers, E. J., H. P. Boshuizen, et al. (1996). "The influence of medical expertise, case typicality, and illness script component on case processing and disease probability estimates." Memory and Cognition 24(3): 384 - 399.
- Davids, K.C. (1988). "Ecological validity and understanding sports performance: some problems of definition." Quest 40: 126 - 136.
- Davids, K.C. Handford, et al. (1994). "The natural physical alternative to cognitive theories of motor behaviour: an invitation for interdisciplinary research in sports science?" Journal of Sport Sciences 12: 495 - 528.
- Dershimer, R. A. and S. Conover (1989). "The stimulated recall technique: a qualitative evaluation of an in-service workshop." Hospice Journal 5(2): 85 - 93.
- Devine, D. J. and S. W. J. Kozlowski (1995). "Domain-specific knowledge and task characteristics in decision making." Organisational Behaviour and Human Decision Processes 64(3): 294 - 306.
- Dodds, P. (1994). "Cognitive and behavioural components of expertise in teaching physical education." Quest 46: 153 - 163.
- Douge, B. and P. Hastie (1993). "Coach effectiveness." Sports Science Review 2(2): 14 - 29.
- Dougherty, M. R. P., C. F. Gettys, et al. (1997). "The role of mental simulation in judgements of likelihood." Organisational Behaviour and Human Decision Processes 70(2): 135 - 148.
- Doyle, W. (1986). Classroom organisation and management. Handbook of Research on Teaching. M. C. Wittrock. New York, Macmillan: 392 - 431.
- Dreyfus, H. L. and S. E. Dreyfus (1986). Mind Over Machine: The Power of Human Intuition and Expertise in the Era of the Computer. Oxford, Basil Blackwell.
- Duke, A. and J. Corlett (1992). "Factors affecting University women's basketball coaches' timeout decisions." Canadian Journal of Sport Science 17(4): 333 - 337.

- Easen, P. and J. Wilcockson (1996). "Intuition and rational decision making in professional thinking: a false dichotomy?" Journal of Advanced Nursing 24: 667 - 673.
- Edland, A. and O. Svenson (1993). Judgement and decision making under time pressure: studies and findings. Time Pressure and Stress in Human Judgement and Decision Making. O. Svenson and A. J. Maule. New York, Plenum.
- Eisenhardt, K. M. (1993). High reliability organisations meet high velocity environments: common dilemmas in nuclear power plants. New Challenges to Understanding Organisations. K. H. Roberts. New York, Macmillan Co.: 117 - 135.
- English Sports Council (1997). England, the Sporting Nation: A Strategy. London, English Sports Council.
- Ennis, C. D. (1994). "Urban secondary teachers' value orientations: delineating curricular goals for social responsibility." Journal of Teaching in Physical Education 13: 163 - 179.
- Eraut, M. (1985). "Knowledge creation and knowledge use in professional contexts." Studies in Higher Education 10(2): 117 - 133.
- Eraut, M. (1994). Developing Professional Knowledge and Competence. London, Falmer Press.
- Ericsson, K. A. and H. A. Simon (1980). "Verbal reports as data." Psychological Review 87(3): 215 - 251.
- Ericsson, K. A. and H. A. Simon (1993). Protocol Analysis: Verbal Reports as Data. Cambridge, MA, MIT Press.
- Etringer, B. D., E. Hillerbrand, et al. (1995). "The transition from novice to expert counselor." Counselor Education and Supervision 35: 4 - 17.
- Evans, J. S. B. T. (1984). "Heuristic and analytic processes in reasoning." British Journal of Psychology 75: 451 - 468.
- Evans, J. S. B. T. (1989). Bias in Human Reasoning: Causes and Consequences. Hove, East Sussex, Lawrence Erlbaum Associates.
- Evans, J. S. B. T. (1989). Problem solving, reasoning and decision making. Cognitive Psychology: Research Directions in Cognitive Science: European Perspectives. A. Baddeley and N. O. Bersen. Hove, East Sussex, Lawrence Erlbaum Associates. 1: 85 - 102.
- Federico, P. (1997). "An empirical examination of metacognitive models of situation assessment." Human Factors 39(1): 149 - 157.

- Fellingham, G. W., B. J. Collings, et al. (1994). "Developing an optimal scoring system with a special emphasis on volleyball." Research Quarterly for Exercise and Sport **65**(3): 237 - 243.
- Fernandez-Balboa, J. M. (1991). "Beliefs, interactive thoughts and actions of physical education student teachers regarding pupil misbehaviours." Journal of Teaching in Physical Education **11**: 59 - 78.
- Fischhoff, B. (1996). "The real world: what good is it?" Organisational Behaviour and Human Decision Processes **65**(3): 232 - 248.
- FIVB (1994). Final Report (1994): World League FIVB. Lausanne, FIVB.
- Flin, R., E. Salas, et al., Eds. (1997). Decision Making Under Stress: Emerging Themes and Applications. Aldershot, Ashgate.
- Flin, R., G. Slaven, et al. (1996). "Emergency decision making in the offshore oil and gas industry." Human Factors **38**(2): 262 - 277.
- Ford, J. K., N. Schmitt, et al. (1989). "Process tracing methods: contributions, problems, and neglected research questions." Organisational Behaviour and Human Decision Processes **43**: 75 - 117.
- Franks, I. M., G. D. Sinclair, et al. (1986). "Analysis of the coaching process." Science Periodical on Research and Technology in Sport(January).
- Frohner, B. (1993). Volleyball: Game Theory and Drills: Effective Training and Strategies. Toronto, Sport Books.
- Gilbert, W. D., P. Trudel, et al. (1995). "Intramural ice hockey officiating: a case study." Avante **1**(1): 63 - 76.
- Glencross, D. J. (1992). "Human skill and motor learning: a critical review." Sport Science Review **1**(2): 65 - 78.
- Goldstein, W. M. and R. M. Hogarth, Eds. (1997). Research on Judgement and Decision Making: Currents, Connections and Controversies. Cambridge, Cambridge University Press.
- Goldstein, W. M. and E. U. Weber (1995). Content and discontent: indications and implications of domain specificity in preferential decision making. The Psychology of Learning and Motivation. Volume 32. Decision Making from a Cognitive Perspective. J. R. Busemeyer, R. Hastie and D. L. Medin. San Diego, CA, Academic Press: 83 - 136.
- Gould, D., J. Giannini, et al. (1989). "Educational needs of elite U.S. National Team, Pan American and Olympic coaches." Journal of Teaching in Physical Education **9**(4): 332 - 344.

Graham, G., C. Hopple, et al. (1993). "Novice and experienced children's physical education teachers: insights into their situational decision making." Journal of Teaching in Physical Education 12: 197 - 214.

Greenfield, S. (1995). Journey to the Centres of the Mind. New York, W H Freeman.

Griffey, D. C. and L. D. Housner (1991). "Differences between experienced and inexperienced teachers' planning decisions, interactions, student engagement, and instructional climate." Research Quarterly for Exercise and Sport 62: 196 - 204.

Halford, W. K. and M. R. Sanders (1990). "The relationship of cognition and behaviour during marital interaction." Journal of Social and Clinical Psychology 9(4): 489 - 510.

Halliday, J. (1996). "Qualifications for teachers in Scottish higher education: competence, quality and reflection." Scottish Educational Review 28(1): 67 - 73.

Hammond, K. R. (1980). Human Judgement and Decision Making. New York, Hemisphere.

Hammond, K. R., R. M. Hamm, et al. (1993). Direct comparison of the efficacy of intuitive and analytical cognition in expert judgement. Research on Judgement and Decision Making: Currents, Connections and Controversies. W. M. Goldstein and R. M. Hogarth. Cambridge, Cambridge University Press: 144 - 180.

Hansen, D. E. and J. G. Helgeson (1996). "Choice under strict uncertainty: processes and preferences." Organisational Behaviour and Human Decision Processes 66(2): 153 - 164.

Hardy, C. A. and C. Howard (1995). "The realities of coaching swimming: a systematic observation study." Swimming Times 72(2): 25 - 28.

Harte, J. M., R. M. Westenberg, et al. (1994). "Process models in decision making." Acta Psychologica 87: 95 - 120.

Hendry, C. and E. Burke (1995). Decision making on the London incident ground. Fourth European Congress of Psychology, Athens, Greece.

Herbert, M. (1991). Insights and Strategies for Winning Volleyball. Champaign, Ill, Leisure Press.

Heritage, D. o. N. (1995). Sport: Raising the game. London, The Department.

Hippolyte, R. (1990). "A philosophy of development and coaching." Scottish Volleyball 12(2): 5.

Hippolyte, R., B. Totterdell, et al. (1993). Strategies of Team Management Through Volleyball. Knockhold, Kent, Epidote.

- Hobus, P. P., H. G. Schmidt, et al. (1987). "Contextual factors in the activation of first diagnostic hypotheses: expert-novice differences." Medical Education 21(6): 471 - 476.
- Hoffman, R. R., N. R. Shadbolt, et al. (1995). "Eliciting knowledge from experts: a methodological analysis." Organisational Behaviour and Human Decision Processes 62(2): 129 - 158.
- Horn, T. S. (1987). The influence of teacher-coach behaviour on the psychological development of children. Advances in Pediatric Sport Sciences. D. Gould and M. R. Weiss. Champaign, Illinois, Human Kinetics. 2: 121 - 142.
- Housner, L. and D. Griffey (1985). "Teacher cognition: differences in planning and interactive decision making between experienced and inexperienced teachers." Research Quarterly for Exercise and Sport 56: 45 - 53.
- Hyland, T. (1994). Competence, Education and NVQs. London, Cassell.
- Johnson-Laird, P. N. (1985). Mental Models: Towards a Cognitive Science of Language, Inference and Consciousness. Cambridge, Cambridge University Press.
- Johnson-Laird, P. N. and E. Shafir, Eds. (1994). Reasoning and Decision Making. Cambridge, Blackwells.
- Jones, D. F., L. D. Housner, et al. (1995). "A comparative analysis of expert and novice basketball coaches' practice planning." Annual of Applied Research in Coaching and Athletics 10: 201 - 226.
- Jones, D. F., L. D. Housner, et al. (1997). "Interactive decision making and behaviour of experienced and inexperienced basketball coaches during practice." Journal of Teaching in Physical Education 16: 454 - 468.
- Kaempf, G. L., G. A. Klein, et al. (1996). "Decision making in complex command-and-control environments." Human Factors 38(2): 220 - 231.
- Kahneman, D. and A. Tversky (1982). The simulation heuristic. Judgement Under Uncertainty: Heuristics and Biases. A. Kahneman, P. Slovic and A. Tversky. Cambridge, Cambridge University Press: 201 - 208.
- Kahney, H. (1986). Problem Solving: a Cognitive Approach. Milton Keynes, Open University Press.
- Karlsson, G. (1988). "A phenomenological psychological study of decision and choice." Acta Psychologica 68: 7 - 25.
- Katsikadelli, A. (1997). "A comparative study of service tactics in high level volleyball tournaments." Coaching and Sport Science Journal 2(2): 3 - 5.

- Kersholt, J. H. (1994). "The effect of time pressure on decision making behaviour in a dynamic task environment." Acta Psychologica 86: 89 - 104.
- Kinderman, P. and G. Humphries (1995). "Clinical communication skills teaching: the role of cognitive schemata." Medical Education 29: 436 - 442.
- Kinlaw, D. (1993). Coaching for Commitment: Managerial Strategies for Obtaining Superior Performance. San Diego, CA, Pfeiffer and Co.
- Kirlik, A., N. Walker, et al. (1996). "Supporting perception in the service of dynamic decision making." Human Factors 38(2): 288 - 299.
- Klein, G. A. (1990). "Knowledge engineering: beyond expert systems." Information and Decision Technologies 16: 27 - 41.
- Klein, G. A. (1993). A recognition primed (RPD) model of rapid decision making. Decision Making in Action: Models and Methods. G. A. Klein, J. Orasanu, R. Calderwood and C. E. Sambok. Norwood, NJ, Ablex.
- Klein, G. A. (1997). The current status of the naturalistic decision making framework. Decision Making Under Stress: Emerging Themes and Applications. R. Flin, G. Slaven, M. Strub and L. Martin. Aldershot, Ashgate: 11 - 28.
- Klein, G. A. (1998). Sources of Power: How People Make Decisions. Cambridge, Mass, MIT.
- Klein, G. A., R. Calderwood, et al. (1989). "Critical decision method for eliciting knowledge." IEEE Transactions on Systems, Man and Cybernetics 19: 462 - 472.
- Klein, G. A., J. Orasanu, et al., Eds. (1993). Decision Making in Action: Models and Methods. Norwood, NJ, Ablex Pub.
- Krause, F. (1986). Subjective theories of teachers' reconstruction through stimulated recall, interview and graphic representation of teacher thinking. Advances of research in Teacher Thinking. M. Ben-Peretz, R. Bromme and R. Halkes. Lisse, Swets and Zeitlinger.
- Kushniruk, A., V. L. Patel, et al. (1995). Analysis of medical decision making: a cognitive perspective on medical informatics. Proceedings - the Annual Symposium on Computer Applications in Medical care.
- Lane, I. M., P. L. Damiano, et al. (1994). "Determining decision making effectiveness using NCAA basketball tournament results." Journal of Sport Behaviour 17(2): 79 - 86.
- Lave, J. and W. Etienne (1991). Situated Learning: Legitimate Peripheral Participation. Cambridge, Cambridge University Press.

Lee, A. M., D. K. Landin, et al. (1992). "Student thoughts during tennis instruction." Journal of Teaching in Physical Education 11: 256 - 267.

Leet, D., T. James, et al. (1984). "Intercollegiate teams in competition. A field study to examine variables influencing contests results." International Journal of Applied Sport Psychology 15: 193 - 204.

Levin, I. P. and J. D. Jasper (1995). "Phased narrowing: a new process tracing method for decision making." Organisational Behaviour and Human Decision Processes 64(1): 1 - 8.

Lewicki, P., T. Hill, et al. (1992). "Non-conscious acquisition of information." American Psychologist 47: 796 - 801.

Lewin, R. (1992). Complexity: Life at the Edge of Chaos. New York, Macmillan.

Lewis, G. (1996). The Mentoring Manager, Pitman Pub./Institute of Management.

Lincoln, Y. S. and E. G. Guba (1985). Naturalistic Enquiry. London, Sage.

Lipshitz, R. and O. Bar-Ilan (1996). "How problems are solved: reconsidering the phase theorem." Organisational Behaviour and Human Decision Processes 65(1): 48 - 60.

Lipshitz, R. and O. Ben Shaul (1997). Schemata and mental models in recognition-primed decision making. Naturalistic Decision Making. C. Zsombok and G. A. Klein. Hillsdale, NJ, LEA: 292 - 303.

Lipshitz, R. and O. Strauss (1997). "Coping with uncertainty: a naturalistic decision making analysis." Organisational Behaviour and Human Decision Processes 69(2): 149 - 163.

Locke, L. F. (1989). "Qualitative research as a form of scientific enquiry in sport and physical education." Research Quarterly for Exercise and Sport 60(1): 1 - 20.

Lockhead (1980). Know, then decide. Cognitive Processes in Choice and Decision Behaviour. T. S. Wallsten. Hillsdale, NJ, Lawrence Erlbaum Associates: 143 - 154.

Lucas, J. (1985). Pass, Set, Crush: Volleyball Illustrated. Wenatchee, WA, Euclid Northwest Pub.

Lyle, J. (1984). "Towards a concept of coaching." Scottish Journal of Physical Education 12(1): 27 - 31.

Lyle, J. (1986). Coach Education: Preparation for a Profession. VIII Commonwealth and International Conference on Sport, PE, Dance, Recreation and Health, Glasgow, E&FN Spon.

- Lyle, J. (1991). The development of an ideal-type model of the coaching process and an exploratory investigation into the appropriateness of the model for coaches in three sports. Stirling, University of Stirling.
- Lyle, J. (1992). Systematic coaching behaviour: an investigation into the coaching process and the implications of the findings for coach education. Sport and Physical Activity: Moving Towards Excellence. T. Williams, L. Almond and A. Sparkes. London, E&FN Spon: 463 - 469.
- Lyle, J. (1993). "A CRASH course in coach education." Performance (Scottish Sports Council) 7: 3.
- Lyle, J. (1996). "A conceptual appreciation of the sports coaching process." Scottish Centre Research Papers in Sport, Leisure and Society 1(1): 15 - 37.
- Lyle, J. (1997). Management training and the sports coaching analogy: a content analysis of six management training products. 5th Congress of the European Association for Sport Management, Glasgow, Scotland, E.A.S.M.
- Lyle, J. (1998). Coaching effectiveness and the teaching paradigm. Active Living Through Quality Physical Education: ICHPER.SD 8th European Congress, St. Mary's University College, Twickenham, PEUK.
- Lyle, J. W. B. (1997). "Managing excellence in sports performance." Career Development International 2(7): 314 - 323.
- Marr, D. (1982). Vision. San Francisco, Freeman.
- Martens, R. (1979). From smocks to jocks: a new adventure for sport psychologists. Coach, Athlete and the Sport Psychologist. P. Klavara and J. V. Daniels. Toronto, University of Toronto: 56 - 62.
- Martin, J., W. Martin, et al. (1986). "Empirical investigation of the cognitive mediational paradigm for research on counseling." Journal of Counseling Psychology 33(2): 115 - 123.
- Martinek, T. J. and J. B. Griffith (1994). "Learned helplessness in physical education: a developmental analysis of causal attributions and task persistence." Journal of Teaching in Physical Education 13: 108 - 122.
- McNaughton, B. L. (1989). The neurobiology of spatial computation and learning. Lectures in the Science of Complexity. SFI Studies in the Sciences of Complexity. D. L. Stein. Redwood City, CA, Addison-Wesley Pub. Co.: 389 - 435.
- Minsky, M. (1977). Frame-system theory. Thinking: Readings in Cognitive Science. P. N. Johnson-Laird and P. C. Watson. Cambridge, Cambridge University Press: 355 - 376.

- Montgomery, H. and O. Svenson, Eds. (1989). Process and Structure in Human Decision Making. Chichester, John Wiley & Sons.
- Moore, P. A. (1996). "Decision making in professional practice." British Journal of Nursing 5(10): 635 - 640.
- Morran, K., D. J. Kurpius, et al. (1989). "Empirical investigation of counselor self-talk categories." Journal of Counseling Psychology 36(4): 505 - 510.
- Mullen, T. M. (1989). "Experts' estimation of uncertain quantities and its implications for knowledge acquisition." IEEE Transactions on Systems, Man, and Cybernetics 19: 616 - 625.
- National Coaching Foundation (1993). Champion Coaching 1993: More Recipes for Action. Leeds, National Coaching Foundation.
- National Coaching Foundation (1994). S and NVO: Implementation Manual. Leeds, National Coaching Foundation.
- National Coaching Foundation (undated). Champion Coaching: Senior Coach Workshop Resource Pack. Leeds, National Coaching Foundation.
- Neville, W. (1994). Serve it Up: Volleyball for Life. Mountain View, CA, Mayfield Pub. Co.
- Nicholls, K. (1973). Modern Volleyball for Teachers, Coaches and Players. London, Henry Kimpton.
- Nisbett, R. E. and T. D. Wilson (1977). "Telling more than we know: verbal reports on mental processes." Psychological Review 84: 231 - 259.
- Norman, G. R., V. L. Patel, et al. (1990). "Clinical enquiry and scientific enquiry." Medical Education 24: 396 - 399.
- Norman, G. R., D. Rosenthal, et al. (1989). "The development of expertise in dermatology." Archives of Dermatology 125: 1063 - 1068.
- Norman, G. R. and H. G. Schmidt (1992). "The psychological basis of problem-based learning: a review of the evidence." Academic Medicine 67(9): 557 - 565.
- Omodei, M. and J. McLennan (1994). "Studying complex decision making in natural settings: using a head mounted video camera to study competitive orienteering." Perceptual and Motor Skills 79: 1411 - 1425.
- Omodei, M., A. Wearing, et al. (1997). Head-mounted video recording: a method for studying naturalistic decision making. Decision Making Under Stress: Emerging Themes and Applications. R. Flin, E. Salas, M. Strub and L. Martin. Aldershot, Ashgate: 137 - 146.

- Orasanu, J. and T. Connolly (1993). The reinvention of decision making. Decision Making in Action: Models and Methods. G. A. Klein, J. Orasanu, R. Calderwood and C. Zsombok. Norwood, NJ, Ablex Pub.: 3 - 20.
- Orasanu, J. and U. Fischer (1997). Finding decisions in natural environments: the view from the cockpit. Naturalistic Decision Making. J. Zsombok and G. A. Klein. Hillsdale, NJ, LEA: 343 - 357.
- Parker, W. C. and N. J. Gehrke (1986). "Learning activities and teachers' decision making: some grounded hypotheses." American Educational Research Journal 23(2): 227 - 242.
- Parsloe, E. (1995). Coaching, Mentoring and Assessing. London, Kogan Page.
- Patel, V. L. and G. J. Groen (1986). "Knowledge based solution strategies in medical reasoning." Cognitive Science 10: 91 - 116.
- Patel, V. L., G. J. Groen, et al. (1990). "Medical expertise as a function of task difficulty." Memory and Cognition 18(4): 394 - 406.
- Payne, J. W., J. R. Bettman, et al. (1990). The adaptive decision maker: effort and accuracy in choice. Insights in Decision Making: A Tribute to Hillel J. Einhorn. R. M. Hogarth. Chicago, University of Chicago press: 129 - 153.
- Payne, J. W., J. R. Bettman, et al. (1993). The Adaptive Decision Maker. Cambridge, Cambridge University Press.
- Payne, J. W., J. R. Bettman, et al. (1996). "When time is money: decision behaviour under opportunity-cost time pressure." Organisational Behaviour and Human Decision Processes 66(2): 131 - 152.
- Pennington, N. and R. Hastie (1993). "Reasoning in explanation-based decision making." Cognition 49: 123 - 163.
- Pieron, M. and F. C. da Costa (1996). "Seeking expert teachers in physical education and sport." European Journal of Physical Education 1(1): 5 - 18.
- Polanyi, M. (1967). The Tacit Dimension. London, Routledge.
- Quek, C. B. (1995). "Decision style choices of high school basketball coaches: the effects of situational and coach characteristics." Journal of Sport Behaviour 18(2): 91 - 108.
- Randel, J. M., H. L. Pugh, et al. (1996). "Differences in expert and novice situation awareness in naturalistic decision making." International Journal of Human Computer Studies 45: 579 - 597.

- Rasmussen, J. (1997). Merging paradigms: decision making, management and cognitive control. Decision Making Under Stress: Emerging Themes and Applications. R. Flin, E. Salas, M. Strub and L. Martin. Aldershot, Ashgate: 67 - 81.
- Reilly, T. (1992). Strategic Directions for Sports Science Research in the United Kingdom. London, The Sports Council.
- Riorden, J. (1991). Sport, Politics and Communism. Manchester, Manchester University Press.
- Riorden, J. (1993). Soviet-style sport in Eastern Europe: the end of an era. The Changing Politics of Sport. E. Allison. Manchester, Manchester University Press: 37 - 57.
- Russell, S. J. and J. H. Salmela (1992). "Quantifying expert athlete knowledge." Journal of Applied Sport Psychology 4: 10 - 26.
- Rutt-Leas, R. and M. T. H. Chi (1993). Analysing diagnostic expertise of competitive swimming coaches. Cognitive Issues in Motor Expertise. J. L. Starkes and F. Allard. Amsterdam, Elsevier Science Publ. B. V.: 75 - 94.
- Salmela, J. H. (1995). "Learning from the development of expert coaches." Coaching and Sports Science Journal 2(2): 3 - 13.
- Sanders, M. R. and M. R. Dadds (1992). "Children's and parents' cognitions about family interactions: an evaluation of video-mediated recall and thought listing procedures in the assessment of conduct-disordered children." Journal of Clinical Child Psychology 21(4): 371 - 379.
- Schempp, P. (1985). "Constructing professional knowledge: a case study of an experienced high school teacher." Journal of Teaching in Physical Education 13: 2 - 23.
- Schempp, P. G. (1997). "Developing expertise in teaching and coaching." Journal of Physical Education, Recreation and Dance 68(2): 29.
- Schempp, P. G., D. Manross, et al. (1998). "Subject expertise and teachers' knowledge." Journal of Teaching in Physical Education 17: 342 - 356.
- Schmidt, H. G. (1993). "Foundations of problem based learning: some exploratory notes." Medical Education 27(5): 422 - 432.
- Schmidt, H. G. and H. P. Boshuizen (1993). "On the origin of intermediate effects in clinical case recall." Memory and Cognition 21(3): 338 - 351.
- Schmidt, H. G., G. R. Norman, et al. (1990). "A cognitive perspective on medical expertise: theory and implications." Academic Medicine 65(10): 611 - 621.

- Schmidt, R. A. (1991). Motor Learning and Performance. Champaign, Illinois, Human Kinetics.
- Schon, D. A. (1983). The Reflective Practitioner: How Professionals Think in Action. New York, Basic Books.
- Schon, D. A. (1987). Educating the Reflective Practitioner. San Francisco, Jossey Bass.
- Scottish Sports Council (1994). Achieving Excellence: Coordinated Action. Edinburgh, Scottish Sports Council.
- Scouler, E. (1995). "S/NVQs in sport and recreation: an update." Scottish Journal of Physical Education **23**(1): 16 - 26.
- Seiler, R. (1990). "Decision making processes in orienteering. An action theoretical investigation." International Journal of Sport Psychology **21**(1): 36 - 45.
- Selinger, A. and J. Ackermann - Blount (1986). Arie Selinger's Power Volleyball. New York, St Martin's Press.
- Shanteau, J. (1988). "Psychological characteristics and strategies of expert decision makers." Acta Psychologica **68**: 203 - 215.
- Shanteau, J. (1992). "Competence in experts: the role of task characteristics." Organisational Behaviour and Human Decision Processes **53**: 252 - 266.
- Shanteau, J. and T. R. Stewart (1992). "Why study expert decision making? Some historical perspectives and comments." Organisational Behaviour and Human Decision Processes **53**(2): 95 - 106.
- Sherman, C., B. Crassini, et al. (1997). "Instructional sports psychology: a re-conceptualisation of sports coaching as sports instruction." International Journal of Sport Psychology **28**(2): 103 - 125.
- Siedentop, D. and E. Eldar (1989). "Expertise, experience and effectiveness." Journal of Teaching in Physical Education **8**: 254 - 260.
- Silverman, S. and M. Solmon (1998). "The unit of analysis in field research: issues and approaches to design and data analysis." Journal of Teaching in Physical Education **17**: 270 - 284.
- Sloman, S. A. (1996). "The empirical case for two systems of reasoning." Psychological Review **119**(1): 3 - 22.
- Someren, M., Y. v. Barnard, et al. (1994). The Think Aloud Method. London, Academic press.

Sport and Recreation Lead Body (1992). Leading the Way in Vocational Qualifications: A Guide to the Qualifications Framework. London, Crown Copyright.

Sports Council (1993). Sport in the Nineties: New Horizons. London, The Sports Council.

Sports Council (1995). The British Academy of Sport: a Discussion Paper. London, The Sports Council.

Starkes, J. L., P. Edwards, et al. (1995). "A new technology and field test of advanced cue usage in volleyball." Research Quarterly for Exercise and Sport 66(2): 162 - 167.

Stein, D. L., Ed. (1989). Lectures in the Science of Complexity. Redwood City, CA, Addison-Wesley Pub. Co.

Strack, F. and R. Neumann (1996). "The spirit is willing, but the flesh is weak': beyond mind-body interactions in human decision-making." Organisational Behavioural and Human Decision Making 65(3): 300 - 304.

Strauss, A. and J. Corbin (1990). Basics of Qualitative Research: Grounded Theory - Procedures and Techniques. Newbury Park, CA, Sage.

Svenson, O. (1996). "Decision making and the search for fundamental psychological regularities: what can be learned from a process perspective?" Organisational Behaviour and Human Decision Processes 65: 252 - 267.

Taggart, W. and E. Valenzi (1990). "Assessing rational and intuitive styles: a human information processing metaphor." Journal of Management Studies 27(2): 149 - 173.

Tan, S. (1997). "The element of expertise." Journal of Physical Education, Recreation and Dance 68(2): 30 - 33.

Tan, S. K. S. (1996). "Differences between experienced and inexperienced physical education teachers' augmented feedback and interactive teaching decisions." Journal of Teaching in Physical Education 15(2): 151 - 170.

Teigen, K. H. (1996). "Decision making in two worlds." Organisational Behaviour and Human Decision Processes 65(3): 249 - 251.

Tesch, R. (1990). Qualitative Research Analysis Types and Software Tools. New York, Falmer Press.

The Labour Party (undated). Labour's Sporting Nation. London, The Labour Party.

Thomas, J. R. and J. K. Nelson (1996). Research Methods in Physical Activity. Champaign, IL, Human Kinetics.

- Tjeerdsma, B. L. (1996). "A comparison of teacher and student perspectives of tasks and feedback." Journal of Teaching in Physical Education 16(4): 388 - 400.
- Tuckwell, N. (1980). *Stimulated Recall: Theoretical Perspectives and Practical and Technical Considerations*. Edmonton, Alberta, University of Alberta, Centre for Research on Teaching.
- Tversky, A. and D. Kahneman (1971). "The belief in the 'law of small numbers'." Psychological Bulletin 76: 105 - 110.
- Van Noord, R. and N. Kagan (1976). "Stimulated recall and affect simulation in counselling: client growth re-examined." Journal of Counseling Psychology 23(1): 28 - 33.
- Verplanken, B. (1993). "Need for cognition and external information search: responses to time pressure during decision making." Journal of Research in Personality 27: 238 - 252.
- Waldrop, M. M. (1992). Complexity: the Emerging Science at the Edge of Order and Chaos. London, Simon and Schuster.
- Walkwitz, E. and A. Lee (1992). "The role of teacher knowledge in elementary physical education: an exploratory study." Research Quarterly for Exercise and Sport 63(2): 179 - 185.
- Weber, E. U., U. Bockenholt, et al. (1993). "Determinants of diagnostic hypothesis generation: effects of information, base rates and experience." Journal of Experimental Psychology: Learning, Memory and Cognition 19(5): 1151 - 1164.
- Weeks, D. and R. Proctor (1991). "Ecological and process approaches to skill acquisition." Journal of Human Movement Studies 20: 291 - 296.
- Wierzbicki, A. P. (1997). "On the role of intuition in decision making and some ways on multi-criteria aid of intuition." Journal of Multi-Criteria Decision Analysis 6: 65 - 76.
- Williams, M. and K. Davids (1995). "Declarative knowledge in sport: a by-product of experience or a characteristic of expertise." Journal of Sport and Exercise Psychology 17: 259 - 275.
- Woodman, L. (1993). "Coaching: a science, an art, and emerging profession." Sports Coach 2(2): 1 - 13.
- Yaniv, I. and D. E. Meyer (1987). "Activation and meta cognition in inaccessible stored information: potential bases for incubation effects in problem solving." Journal of Experimental Psychology: Learning, Memory and Cognition 13: 187 - 205.

Yiannakis, A. (1989). "Toward an applied sociology of sport: the next generation." Sociology of Sport Journal 6: 1 - 16.

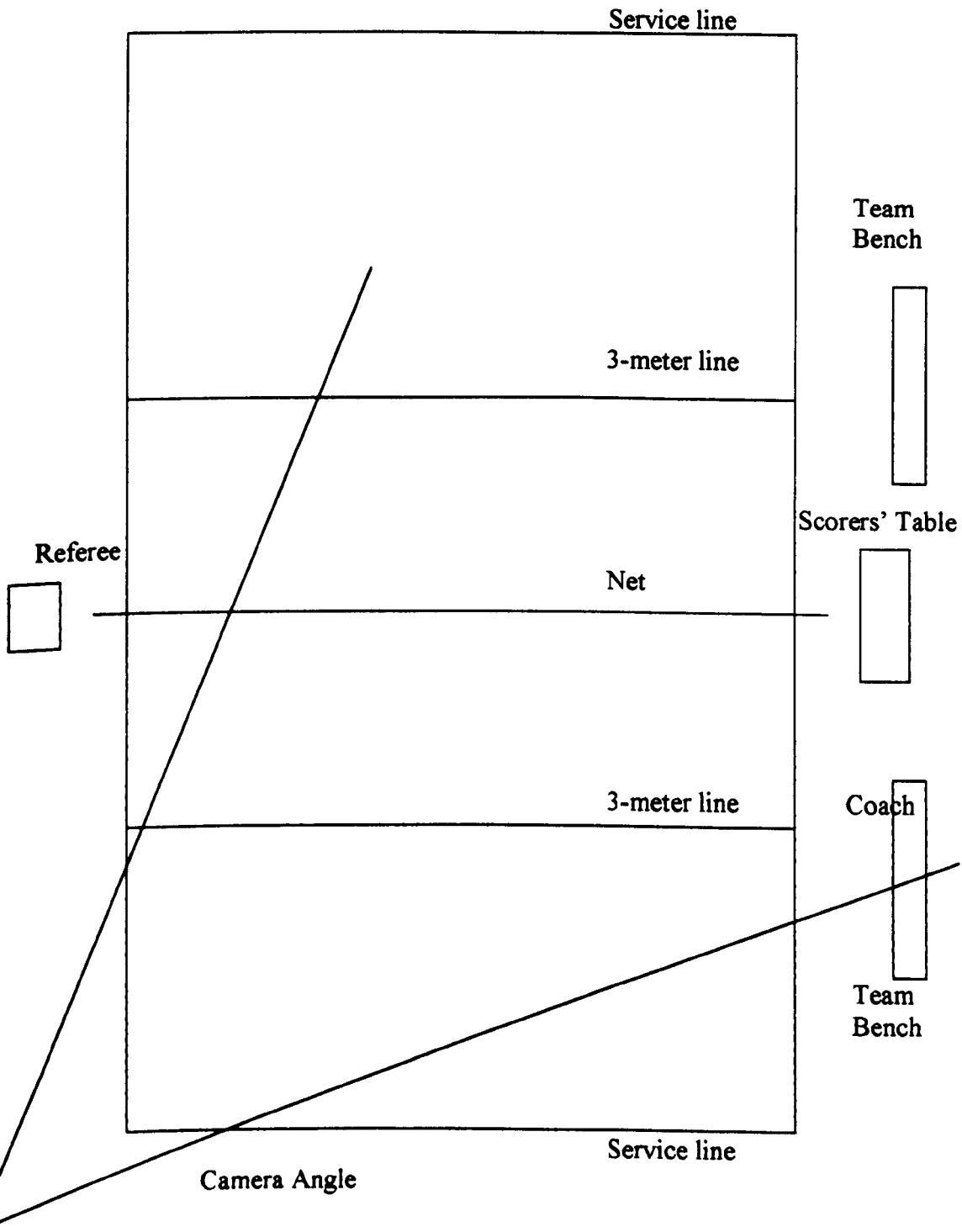
Yinger, R. and Hendricks-Lee (1993). Working knowledge in teaching. Research on Teacher Thinking. D. Day, J. Calderhead and P. M. Denicolo. Lewes, Falmer Press: 100 - 113.

Yinger, R. J. (1986). "Examining thought in action: a theoretical and methodological critique of research on interactive teaching." Teaching and Teacher Education 2(3): 263 - 242.

Zsombok, C. and G. A. Klein, Eds. (1997). Naturalistic Decision Making. Hillsdale, NJ, LEA.

Appendix A

Layout of Volleyball Court and Camera Angle



Appendix B

SR Prompt Sheet

The subject was shown a video replay of the final two sets of the game, with the following instructions:

Please view the whole of the final two sets in today's match. You can stop the tape at any time. Your task is to identify the most vivid incidents in which you feel you had to make a decision quickly. We will record these with a short description.

Having decided upon the six incidents to be used in the study, the subject was given the following instructions:

Please review each incident and the decision made. Describe the decision and why you made that particular decision. Please elaborate on any element of the decision. May I also say before you begin, that I would rather you were honest and say little about an incident rather than create an explanation.

Appendix C

Example of Letter to Coaches Seeking Corroboration of Transcripts

Each of the coaches was sent a copy of the SR and Interview transcripts, with an accompanying letter and a postage-paid return envelope.

Transcript of letter to coach HL on 26 February 1998:

Dear

Many thanks indeed for giving up your time on Sunday – it was very much appreciated.

Can I ask you to glance over the transcripts of the interviews? If you feel that there are (a) factual errors, or (b) that I have failed to elicit the meaning you intended – please amend the relevant pages and return to me in the enclosed envelope.

Good luck for the remainder of the season.

Best wishes.

Yours sincerely

John Lyle

Appendix D

Interview Schedule

The following instructions and questions were read to the subject:

Before the interview, let me assure you that all names will be deleted from the transcripts and the final text.

In order to ensure that the same questions are asked of all coaches, I will read out the questions. I may then follow up your responses with addition questions.

1. First of all, let me ask you if the result of the game was what you expected.
2. For how long have you been coaching, and what was your previous playing experience?
3. Who has been the most important influence on you as a coach? Which characteristics do you recall most?
4. Where do you feel that your volleyball knowledge and insight developed from?
5. Which were the most important influences? What lessons did you learn as a player that have helped you as a coach?
6. What do you think that your strengths and weaknesses are as a coach?
7. What would you do in the following situation? Your inexperienced zone 4 hitter has made 2 direct errors (one into the net, one long diagonal) from adequate sets. He is in zone 4 rotation having been substituted on at 6-8 in the first set for an experienced zone 4 player. The score is now 6-10. What will you do? Why?

8. Despite your experience, you are bound to come across unique situations when coaching in a game or in training. How do you deal with a situation that is novel to you?
9. As a coach, how do you remember games?
10. Are you conscious of what prompts you to make decisions during a game? Do you ever reflect after a game and wonder what prompted you to make a decision or why you made it?
11. Do you have any sense that there are any rules to what you are doing? Are there many coaches who would make similar decisions to those that you make?

In the Results chapter the first question is omitted and the question are renumbered 1 -

10.

Appendix E

Letter to the Scottish Volleyball Association and English Volleyball Association Requesting Assistance with the Identification of Expert Coaches

The following letter was sent to Mr Nick Moody, Director of the Scottish Volleyball Association and Mr Michael McKeever, Technical Director of the English Volleyball Association. Each of the individuals was a personal acquaintance of the researcher.

Dear

I'm writing to ask for your help with my research project. I wrote to you some time ago to get some names of volleyball coaches. I have had to put the data collection on the back-burner until now because of work commitments and the need to carry out a pilot study. I now have the go-ahead and I need your help (and Mike McKeever's) in identifying my sample of coaches.

Put simply I need you to identify a number of expert coaches. It may be useful if I elaborate a little on what I mean.

- The individuals should be expert as distinct from novice. In theory there could be many of them in the country,

- (given the developmental stage of the game) expert does not mean ‘in comparison to others in the world’ – but you may want to take into account any (meaningful) international coaching awards or expertise,
- you would expect these ‘experts’ to have demonstrated their superior levels of knowledge and skills in an applied fashion and for this to have been recognised by their peers – coaches of the most successful teams, representative teams, consistently producing good performances/teams,
- coaches should have demonstrated their expertise in a context in which the fullest range of coaching capacities is required – performance sport, probably meaning senior club volleyball,
- you would expect there to be a gap between the group of individuals identified and the next ‘bunch’,
- you and Mike don’t count!

In short, who are our best coaches?

I would anticipate a list of about 10-12 coaches between Scotland and England. Each of you should feel free to mention names of coaches in the other country. When I receive your responses, I will ‘negotiate’ the final list by telephone with each of you.

I realise that I am asking you for some work on my behalf, and I’m grateful for the help you can give me. My work depends on you identifying these individuals and I hope I can prevail upon you to reply quite soon.

Could I also have a fixture list with some indication of dates and venues, if possible.

I hope that life is treating you well. If I don't bump into you when I'm collecting my data, I will ensure that we sit down for that pint. If that doesn't get a quick response ...

I hope to hear from you soon.

Best wishes.

John Lyle

Appendix F

Supplementary Questionnaire

The following letter was sent to all coaches. Some individual details had been elicited from the Interviews but further details were required to establish the sample group's expert characteristics. It was also an opportunity to repeat my thanks. The responses from 11 coaches form the substance of Figure 6 (page 121).

Dear

Volleyball Research

First of all can I thank you once again for taking part in my research study. I have collected all of the data and I am in the process of analysing it and writing it up, at the moment.

During the interview and in my informal conversation with you, I became aware of some of the personal details of my sample of coaches, but this was rather haphazard. I need to be able to summarise these characteristics – **NO DETAILS OF INDIVIDUALS WILL BE USED.**

Can I ask you to please complete the enclosed short form? Once again, I can assure you that the details will only be used as a summary for the whole group and are confidential. My apologies for the extra 5 minutes work. I enclose a reply envelope.

I hope that you felt that you had a successful and satisfying season and that you will have re-charged your batteries for the coming season.

Best wishes.

Yours sincerely

John Lyle: Coaches' Decision Making

Sample Coach Details

Please complete the form as appropriate.

1. **Name** _____

2. **Age** _____

3. **Gender** Male

4. **Occupation** _____

5. Further and Higher Education Experience

Further Education

Higher Education (degree)

6. Number of Years Coaching in National Leagues

1 - 4

5 - 9

10 or over

7. Level of Coaching Experience [please tick as many as appropriate]

National League

Junior International Team - assistant

- coach

Senior National Team - assistant

- coach

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

7. Level of Coaching Qualification

Please state your highest level of volleyball coaching certificate

Very many thanks, yet again.

Appendix G

Example of Coded SR Transcript

Incident Three: Tactical Call (6-1, 20.54)

CF3

Incident three, this is one where we took an example of service decision making. The one we have in particular, the score was 6-1, and you asked a player to come nearer to you and to serve across to position 1. Explain how that decision came to your mind.

[Initially when I was watching them in the warm-up, when the setter was going through 2, he had a lot of difficulty setting them, so initially I was attacking him, attacking that side of the court, to force him to go to that side, given an unstable ball.]A1 [As the game went on, even with the jump serving, anything we hit straight to them, they were taking, controlling reasonably,]C4i [it wasn't brilliant but they were able to stabilise it,]A1 [so what I then did was to take them on angles to try to force them to go outside, to hit the outside shot.]B2 [So that's why I was bringing the servers across to make sure of the angle.]B1

When was that decision taken, let's say this individual decision where are talking about now, when would, what was the process that would have gone through your mind just at that point. In other words was it almost pre-planned or did you actually look across and say, how did you come to it?

[It wasn't pre-planned in the sense that I went in at the start of the set and decided that that was what I was going to do.]C4iv [I think the first few serves that took place just really re-emphasised what I had been thinking,]C4ii [I just wanted to see what was going on and I knew that we weren't moving them enough, and we'd had the jump servers and the next couple of float servers were coming through.]C4ii [The guy that was called over, when we were serving straight, we were putting too much air on the ball, and popping it up, so I wanted to give them a chance to attack it,]B1 so [it was probably decided on who was serving and it would be their line-up and what they were doing there.]C4iv [I don't think there was any particular point at which I said yes, it was something that evolved.]C4i

Appendix H

Example of Interview Transcript

Interview: Keith Trenam 21.3.98

1. For how long have you been coaching and what was your previous playing experience?

I started playing with the Army, the first year that the Army ever had a team, and then I left the Army and played for Granwood Rockets, and that was 1978. Playing experience, played second division, first division, national cup final as a setter, and then because Leszek Zarzycki who was the England captain at the time, had children and stopped being coach, and they needed a coach, so I took up coaching. For years after that I started bringing a lot of juniors into the game. We were in the second division when I took over, we went back to the first division, then two of the best players left, Lesh came back again and started playing, and we had another guy called Mike Percival, both England players, and both left the same year we got promotion, which then lost the two best players in the team, and we got relegated again. Best parts, we played in the semi-final with that team, with Lesh playing and Mike Percival, quarter-final sorry, with Polonia who had gone 26 games unbeaten, and as a second division team we beat them 3-1. That was quite a nice coaching experience.

When was that coaching starting?

Early 80s. Since then, I went to Newcastle Staffs, and I did level 1,2,3 EVA, Level 1,2,3 FIVB, and I went to coaching clinics, now I'm a senior staff coach and I'm assistant coach to Great Britain, and I run Sport Sheffield as a coach.

2. Who has been the most important influence on you as a coach?

Ralph Hippolyte, because he doesn't say this is the way you do it, he says this is a way. These are the fundamentals, and what you do is try, he's a very good strategic coach, he thinks about what he's doing, he doesn't just say you do it this way. He turns round and says, where is the game going?, you're going to have to play fast with speed and with movement, and you'll have to link until you've got 5 attackers, you'll have to hit more powerfully, how can you do that, so physically then you've got to train to be able to do it, technically you got to change your techniques to where-ever the game's going, so everything is linked and never stand still. Even when you think, that's it, he'll change it, because if you stand still then you're losing something, you've got to always keep going. He takes from so many things, from breathing, movement, control centres, karate, he's also used ballet dancers from the Rambert Ballet, Tai Chi from Martin Blacklaws, all sorts of different things. He's not afraid to go out and take from other sports.

3. Did you learn any lessons as a player that have helped you as a coach?

As a player, that's individual within. Players have to be treated as individuals and each player would have to be treated differently. One of things I learned, not necessarily as a

player, I used to be a PTI in the Paras, was I think the weakest thing about our game, something I want to address with the players, is physically they're not strong enough, physically they don't get pushed hard enough, and physically really affects the mental side of the game, and I think mentally they're not strong enough, and I think that doing physical, not necessarily the physical game but the hurt, if you like, that means that you can put up with the pain and fight through, is something that our players at the moment do not have enough of, that's something that intend to address.

4. Where do you feel that your volleyball knowledge and insight has developed from?

From being associated with that and making, reading a few of his books. I feel that it goes with what is my strength because I'm, obviously everybody works towards his or her strength. I know that strategically or tactically, I'm not as strong as the continentals most likely, but technically from what I've seen of the Continentals, I'm perhaps a lot stronger. If I see something, if Ralph's teaching something I will look for an easier way to teach it and an quicker way of getting there, and my philosophy is if you can make it easy the you do.

5. What do think your strengths and weaknesses are as a coach?

Strength, technical, movement, I would say that I'm very good at teaching movement. I can get different individuals to do different things, if it doesn't work this way, I'll explain it

another way, I'll try and give training aids, different ways of teaching movement to the individuals to get them to move with rhythm, speed whatever.

Weakness - man-management. Once you get to a higher level, not necessarily talking here around the women's team that I coach but around the men's team, I have the volleyball background, it's the man management and interpersonal skills with the players that are my weakness.

How does that show itself?

I don't have a good understanding of what the players feel I don't think, and I find it difficult to, I want to train them and I will turn round and wonder why people don't understand having tried different ways and I think technically they understand but then to get the, to give of their best very time is a motivational thing and this is where I talking about the physical and motivational and when it gets hard you don't pack in, you keep working, all together, and as I've said through my background, you didn't pack in, here it's a bit more, there isn't or doesn't seem to be intrinsic motivation from the players, it has to come, a lot of it from the coach, and of I don't give it, they don't give it, unless obviously the occasions demand it like the men are in the cup-final, so the motivation's automatic, hopefully. Now training is different, if they don't want to get better, and everything had to be led by the coach, or they don't want to put 100% in every time on training than the majority of the session has to be 'sold' by the coach instead of an amalgamation of the coach and players, or even 90% players, with the coach giving advice, whatever. At the moment I'd say that with

the players we've got, if the coach puts a lot a work into making the session hard and it'll work, 7 times out of 10.

6. What would you do in the following situation. Your inexperienced zone 4 hitter has made two direct errors (one into the net, one long diagonal) from adequate sets. He's in zone 4 rotation having been substituted on at 6-8 in the first set for an experienced player. The score is now 6-10. What will you do?

Depending on the importance of the game, and depending what I want to achieve for the player, I can either take him off and give him negative experience, or talk to setter and say only give him, this is where the pre-game set comes in, does the setter go back to him or not straight away. We don't want them to give a free-ball either, by tipping and then. You have to have a background knowledge of what the player's like. If the player has, you want all players to be hard-nosed and keep swinging because they're the go-to people you want to be able to win, depends on their personality. Hopefully they're hard-nosed and will keep hitting. You say to them, if you've got a chance of calling a time-out, you would talk to them during a time-out and say, hit on the safe-side, so instead of going for the line, hit a metre inside, but at the same time, you can say to them let's create a more favorable circumstance for him, if the setter goes to the middle a couple of times, then we can create a one-man block, so it depend how you want to develop, a young player coming in, you want, it depends on the circumstance again, do I want this player, is the game winning important or I am developing player. The scenarios are endless, where are we in the season, where do we want to go to?

7. Despite your experience, you are bound to come situation in the game or in training that are novel, or that are unique. How do you deal with a situation that is new to you?

As in, if it's a situation in the playing experience ..

Something that's happened to you that you don't think you've come across before. The situation . .

This is something I was talking to the players about today actually. I was saying that the game is about problem solving and I cannot teach the players every single problem, otherwise it would be a boring game, and we'd just be standing there and I'd say.. You are trying to create problems for the opposition and they obviously are trying to create problems for you, so the team that problem-solves the best, usually ends up, so you have to give people as many experiences as possible, the human mind has to assimilate these problems as well and then be able to get out of them, and that needs to be trained into teams, the same way as it's trained into the coach. If I see it, then I have to think, yes, what do we have to do to get out of that, and I can help but they need to also have the intelligence, if you like, game play, how do I get out of this problem.

8. How do you remember games? If I said to you, the game you played 4 weeks ago, how you would you conjure that up in your mind.

The opposition obviously, with us this year, for example, our results, well we went on a tour with the Great Britain junior players and we went to France and I remember the games we played and usually around how individuals have played, which then sparks off the memories of other things, because it's a developmental tour that we went on, and we're looking at individuals, I'm in fact thinking about what does this player need and that come back from what I saw in game competition, so I look at a player and say, yes a weakness in passing because I saw this game, where he was picked on, I therefore I remember the games, in terms of what now needs to be worked on in training.

Are there any bits of game that you remember more than others?

Big mistakes, or things that stick out in your mind, obviously big momentum swings, things that turn games. Big spectacular plays, obviously, but spectacular plays shouldn't really affect you that much because they're one offs. The things that swing games, mentally, mental errors are more important to me than physical errors. Physical errors will happen now and again, but if people are making mental errors then I'll remember that because that something we've got to work on and should make as many.

9. Are you conscious of what prompts you to make decisions during a game?

There's the natural things are drummed into you as a coach like when someone makes three points and you've got to think about whether you take a time-out. People are making momentum errors, people are getting three points in front of you, 12 all, so on. There are

things like that, if teams are beginning to run way from you, you get from the book, the book says if you've used both time-outs, all your substitutions and you use them at set times. Sometimes though you've got to stick with it because if you change your team, a lot of times what's happened is, the first set's gone by and you end up changing your team, then you never get going, so you've got to be willing to leave with that team for a while until they start playing and give them a chance to start playing, to again it's a case you have to understand the team, and if you make too many changes too early, then your team never get going. So you've got to weigh up what's happened to them, with the women for example, it's let them play for a while, who's playing well today, it won't be the same six each week, so you've got to keep finding who's playing well today and what position, which might take you until the second set, third set, or four of the six are playing well today.

9a Do you ever reflect after a game and wonder what prompted you to make decisions?

Oh yes, I look at the game, and it's easy to turn round and think, if only I'd done that, or thought of this then, or if I hadn't have done that, what was I trying to achieve. I've got a girl who played today, who has just turned 16, she played the whole match apart from maybe a couple of points, for me that's a big learning curve, as a future player, most likely better than any other players on the court, so I will sacrifice a little bit of quality to get her better now, and depends where we are in the season, we're bottom of the league and it's the end of the season, we can't get relegated because they're expanding the league, so for us the biggest benefit is letting her play.

10. Do you have any sense that there are any rules to the decisions that are being made?

Rules that in a sense, all coaches would be likely to make a similar decision at a similar kind of time, a similar kind of point.

Yes, in one of the sets today, for example, I didn't call and do what a coach is meant to do, which is call both your time-outs, we lose 15-5 and I haven't called both time-outs, but that didn't really matter to me in that I knew I wanted my players to change for the next set and I wanted them to start to up the pace again, so I was prepared to let them. If I wanted to stay competitive throughout the whole game, and pressure the opposition, I wanted to take the pressure off my players a bit more by leaving them on, and not have to worry too much about that set, which gave them a momentum rest, whereas if I'd have had a bigger squad then maybe I'd have subbed more, time-out more and so on. That wasn't giving up, it was understanding that my players needed a mental rest just for a few minutes and then to get back into it, and gave other players a bit of a game as well, so yes, there are rules. And when you have the end of a set that you've lost and you've not used both time-outs, I'd say that I'd most likely broken them.

SR Data Summary

Coach	A1	A2	A3	B1	B2	C1a	C1b	C1c	C1d	C2a	C2b	C2c	C3a	C3b	C3c	C4a	C4b	C4c	C4d	D1	D2	D3	D4	E	Total	1	2	3	4	5	T	S	Ta	
1	2		1	1	1			1	2														3	11			1				1			
2	1		2	1	1			2	1											1			1	10		1						1		
3		1	1		1											3		2	1				1	10				1				1		
4	1	4	4		1						1													11		1						1		
5		3			2			1				1				3				1		1	2	1	14			1				1		
6	1	1	1		2							1							1		1	1		9				1				1		
7	3				1					2	1	2				1								10		1				1				
8	4	2	1	1	3	1										3			1					16				1		1				
9	4				3											1					2		1	11				1		1				
10				1	1														4	1		2	2	11				1			1			
11				1	2														1	1				5				1			1			
12	2			2	1						1					1	1		1			2		11				1				1		
13	1					1	1		1										1				4	9	1					1				
14	1	2	1	1	1						1					2								11				1		1				
15		2		1																				3	6	1						1		
16	4	2		1	1					1	2											1	2	15		1						1		
17	1		1		3											1	2		2					10				1		1				
18			2	2												1						2	1	8					1	1				
20		1		2	3						2					3			1					1	13				1			1		
22	1		1		2						4	1						2	3	3			1	18				1				1		
19		1			1					1	2													5		1							1	
21	2		2		4														1				4	13					1				1	
23	2		2	1	2			2																9	1						1			
24	1		2	2	5						2					1						1		14		1							1	
25				2											2								2	4	10			1					1	
26	1	1		1															2	1				1	7				1				1	
27	3		4														2					1		1	11				1		1			
28	2		1	3	2			2											1			1		12	1					1				
29		2		2	1					1	2													1	9		1							1

