

OBSERVATIONAL ACCURACY IN SPORT

By

GARY N. MILLER

B.A., The University of Western Ontario, 1979

B.Ed., The University of Western Ontario, 1980

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Department of Physical Education

The University of British Columbia
Vancouver, Canada

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ABSTRACT

While numerous studies exist in the literature which have examined the accuracy of eyewitnesses to criminal events, very little research exists in the sport science field that examines the observational accuracy of coaches. The experiment reported here attempted to address this issue using the sport of soccer and soccer coaches. Thirty-six soccer coaches served as subjects in this observational accuracy study viewing videotaped segments of international soccer games. The coaches were randomly selected for one experimental group and two control groups. All three groups watched the same fifteen minute pretest videotape and answered a questionnaire relating to the recall of the goals scored, shots taken and missed opportunities to shoot. The experimental group was trained to observe the critical events of match play. They used a training videotape containing excerpts of 7 professional soccer games. Instances of critical elements of match play were illustrated in a progressive manner using the videotape as an orienting activity with specific priming instructions. Control group one watched the same videotaped instances but only answered the questionnaire they received in the pretest. Control group two also watched the same videotaped excerpts as the other two groups but were asked to prepare a training sessions that they would use based upon their observations of the videotaped games. All three groups then completed the same posttest watching the same game segment with the identical number of goals, shots and

missed shooting opportunities as the pretest videotape. The dependent variable was the percentage of correct responses that each subject displayed when answering questions about these three critical events. Results indicated that, on the average, coaches seem to be incapable of remembering more than 40% of information that pertains to how goals are scored. Their recall of events that lead to shots and missed shooting opportunities was no better than 20% correct. An analysis of variance was performed on the data and it was found that subjects were better able to recall events during the posttest than during the pretest. The training program on directed observation resulted in better recall for the experimental group than the two control groups. A Scheffé post hoc analysis revealed that all subjects recalled the events leading to the scoring of goals more accurately than they recalled the events leading to shots and missed shooting opportunities.

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CHAPTER 1

INTRODUCTION

Several recent studies (Franks and Miller, 1986, Franks, Elliot and Johnson, 1985) have shown that coaches have difficulty in remembering critical events that occur during sporting competition. This seems to be the case for all levels of coaching experience. When a coach is asked to make decisions on what has transpired during a competitive event they can be in error as much as 60% of the time (Appendix 2 Pilot Study). Despite this fact there appears to be little research designed specifically to investigate the process of observing events in a sporting environment.

Despite the lack of research into the general area of observational accuracy in the field of sports science, there has been a considerable body of applied research that deals with the accuracy of observers in criminal situations. The comparison between eyewitnesses to a criminal situation and eyewitnesses (coaches) to a sporting event is intuitively appealing. Generally, it appears that eyewitnesses to criminal events are unreliable and in certain circumstances inaccurate.

Neisser (1982), in his research on eyewitness testimony, stated that perception and memory are decision making processes affected by the totality of a person's abilities, background, attitudes, motives and beliefs, by the environment and by the way recollection is eventually tested. The observer is an active rather than a passive perceiver and recorder, reaching conclusions on what has been seen by evaluating fragments of

information and reconstructing them. The observer is motivated by a desire to be accurate by imposing meaning on the vast amount of information that floods the senses, but also by a desire to live up to the expectations of other people.

Several sources of unreliability appear to be present in eyewitness testimony (Clifford and Hollin, 1980, Clifford and Scott, 1978). These sources are listed below.

(a) The insignificance of the events that were observed. Insignificant events do not motivate people to bring fully into play the selective process of attention. (b) The length of the period of observation which limits the number of features a person can attend to. (c) The less than ideal observation conditions which apply, such as distance, poor lighting, fast movement and the presence of crowds. All of these interferes with the efficient working of the attention process. (d) The witnesses themselves may be observing under stress. This response is manifest in increased heart rate, blood pressure and flow of adrenalin. A person under extreme stress is not a reliable witness. (e) The observer's physical condition. That is, a person who is too old or too sick may have an impaired perception of the event. (f) The tendency to see what we want or need to see. This has been termed perceptual bias. (g) Observers forget the original information with the passage of time. (h) Talking to others influences the content of the information and reports become more accurate and complete when moving into the testimony phase before the trial. (i) Questions to a witness may also bias the response when the witness is

encouraged to fabricate testimony. (j) The observer can also be persuaded to conform to the majority opinion. (k) The effects of suggestion are maximized when figures of authority do the testing.

In uncovering the reasons why these observers could be unreliable or inaccurate, several studies have proposed suggestions. Clifford and Hollin (1980), set out to investigate how the violence of a witnessed event and the number of perpetrators involved in such an event influenced the accuracy of the witnesses testimony and identification. The principal finding in this study was that the testimony of witnesses to a violent incident was significantly poorer than that given by witnesses to a nonviolent incident. The explanation presented was that observed violence generates arousal or stress in the witness causing a narrowing of attention to a limited range of information. Similarly, Clifford and Scott (1978) tested the hypothesis that the completeness of the eyewitness report decreased as a function of the increasing emotionality of the crime. This would indicate the adverse effects that high levels of arousal and stress may have on perception. The testing of this hypothesis in their experiment showed that the eyewitness recall of details from a violent incident was significantly less than recall of a nonviolent incident. The general effect that has been isolated is that the emotionality surrounding an incident can affect both accuracy and completeness with respect to the testimony of both the victim and the witnesses.

Wells and Leippe (1981), suggested that if attention is paid to a criminal's face during an event, this may preclude processing of other less central details and that accurate recall for trivial or peripheral factors may imply less, rather than more, encoding of the criminal's facial features. The results of their work suggest that the majority of the eyewitnesses were attending to the thief's characteristics and processing little information about the peripheral factors, such as room trivia, and room layout. Along the same lines of enquiry, Wells and Loftus (1984) found that when we look at a face, we see it as a whole percept rather than as a set of discrete visual features. This may derive from a preconscious pattern analysis that involves sequential processing of the different features. This does not mean that each facial area is accorded equal attention. The evidence indicates that some features are given more attention than others, which in turn enhances their encoding.

Brown, Deffenbacher and Sturgill (1977), examined the possibility that eyewitness identifications are biased because observers are much better able to recognize a face than to recall where they saw it. The results supported the theory that recognition of faces is much better than recall of circumstances of an encounter, raising the possibility that on some occasions witnesses might base their indictments on face recognition alone.

Research on victimization as a determinant of eyewitness accuracy was conducted by Hosch and Cooper (1982) using three

eyewitness conditions: a no-theft control condition, an impersonal calculator-theft condition, and a personalized watch-theft condition. The results showed that the rates of accuracy indicated that presence of a crime significantly increased identification accuracy. They found it likely that the criminal act catches witnesses' attention such that they encode more information about the thief, although being the victim of the crime did not significantly modify accuracy of identification. It was found that the victims were more aroused and upset than were the other witnesses, thus mitigating any effects of heightened attention.

A number of common misconceptions about eyewitness testimony were summarized by Loftus (1984). Firstly, witnesses remembered the details of a violent crime better than those of a nonviolent one (wrong - the added stress that violence creates clouds our perceptions). Second, witnesses are as likely to underestimate the duration of a crime as to overestimate it (wrong - the more violent and stressful the crime the more witnesses overestimate its duration). Finally, the more confident a witness seems, the more accurate the testimony is likely to be (wrong - there may be little or no relationship between confidence and accuracy).

In making comparisons between criminal situations and sporting situations, it is apparent that there are differences but, interestingly enough, there are also many similarities. For example, during competition, the coach's arousal level does fluctuate depending upon the sequence of events in the game

(i.e., if the game action is concentrated around one of the goal areas, then there is a possibility of a goal being scored or conceded and the arousal level will increase). The perceived seriousness of the game includes important and non-important competition, (i.e., the coach of an Olympic team whose job is often dependent upon the game's outcome versus the local coach who is coaching because a son or daughter is on the team). The coach has a problem during a team game directing attention away from central features of performance (i.e., the scoring of a goal) to the more peripheral features (i.e., a long pass in the defending half of the field that switches the play from one side of the field to the other). The biases a coach brings to a sport situation can distort the perception of the event (MacDonald, 1984). Finally the coach can often remember the goals that were scored in a game but not the events leading up to a goal (Franks and Miller, 1986).

As stated earlier, the problems that are associated with observation in eyewitness testimony and teaching/coaching as stated above are quite similar. These include the length of the period of observation, observation conditions, level of observer arousal, the tendency to see what one wants to see, forgetting the original information after a passage of time, the type of movement response anticipated, the number of people involved and the speed of the movement being observed. All of these factors can lead to a deterioration in the accuracy of observation. If observers are to recall accurately the events that occur within a certain period of time then they must develop a systematic

framework that will prime the observation process and direct their perceptions objectively. This should help eliminate some of the problems that have been observed in several recent studies (Franks and Miller 1986, see also the two pilot studies described in Appendice 2 and 3).

In an attempt to develop a framework that coaches could use to direct their observational process, a model for organizing perceptions was adapted from Newtonson (1976). Newtonson outlined the measurability of this perceptual organization as it related to observer accuracy and proposed a model of the observational process that had implications for the skilled observer. He suggested first that observed actions are defined and delineated by changes in features of a stimulus array, and second, that behavior perception was received as a process of feature monitoring. When one or more of these features change state then the postulated break-point was said to have occurred. These break-points are locations in the ongoing sequence where a change in state of one or more features occurred. Newtonson goes on to suggest that meaningful action is assumed to exist only when a minimum of two break-points involves a common feature transformation. The basic premise, therefore, was that changes in ongoing behavior should be the unit of analysis and observation of ongoing behavior, that included distinctive intervals, would be more memorable than a flow of behaviour that had undefined intervals.

The implications of Newtonson's work are that behavior perception imposes a short term memory load on the observer:

therefore, feature selection is imperative and a skilled observer is one that selects the least redundant set of critical features for perceptual organization of the event, which gives maximal information gain from the event. Also veteran (skilled) observers develop a specialized set of predictive features for use in observation. Newton (1973) arrived at these implications through research conducted using a methodology of trying to measure what subjects perceive as a meaningful event. While one person may see an action as extending over twenty seconds another person may see it as two actions, one eight seconds in duration and another extending over twelve seconds. Newton and Engquist (1976) found that subjects who used breakpoints as an observational aid were significantly more accurate in action descriptions, rated the sequence as more intelligible, and more accurately judged the sequence of events than subjects who did not use any such observational aid. These results suggest that breakpoints are the basis for the formation of perceptual units of behavior.

In summary, the key factors of behavior observation appear to be the variability with which individuals segment their observations of critical features and the development of a specialized set of predictive features for use in these observations. Therefore, a coach, in order to more accurately perceive and remember events, needs to develop a systematic and specialized set of predictive features for use in observation. An important difficulty faced by any investigation of observer accuracy is the definition of an adequate criterion against which accuracy may be scored.

In an attempt to develop a framework that could be used by coaches (specifically soccer coaches), it was imperative that a simple description of the game be proposed. This description had to be general enough to allow all instances of play to be included, and yet specific enough to allow for breakpoint information to be extracted from an ongoing event. The framework designed for this study is illustrated in Figure 1. This flow chart extends all play from a repossession to a goal being scored. Goals are scored from shots that originate from opportunities to shoot. These opportunities are created from several key elements of play that have been derived from the analysis of many soccer games (see Franks and Thomson, 1982; Reep, et al, 1971; Reep and Benjamin, 1968). These key factors of game play (set plays, crosses, penetrating passes and dribbles) lead to goals being scored and, therefore, emphasize the expectation of shots being taken and goals being scored.

The purpose of this research was to investigate the effects of a training programme designed to improve the accuracy with which soccer coaches observe and then recall certain key events that occur during a soccer match. This training programme attempted to direct their observations in such a way that the coach was able to prioritize key events during competition and hence recall them more accurately after the competition. The basis upon which the subjects were trained centred around the framework presented in Figure 1 and a series of orienting activities were designed that emphasized the flow of action outlined.

The use of orienting activities has proven beneficial in other fields of research. Hannafin and Hughes (1986) have defined an orienting activity as a "mediator through, which new information is presented to the learner" (p.239). One method of using orienting activities is to give advanced organizers to potential learners (Mayer, 1979). When considering the specific case of using advanced organizers to orient the observational process, the more inexperienced the observer the more beneficial the orienting activity will be. From a practical perspective it would appear that the use of orienting activities in an educational program designed to improve the observational skills of student coaches would be beneficial.

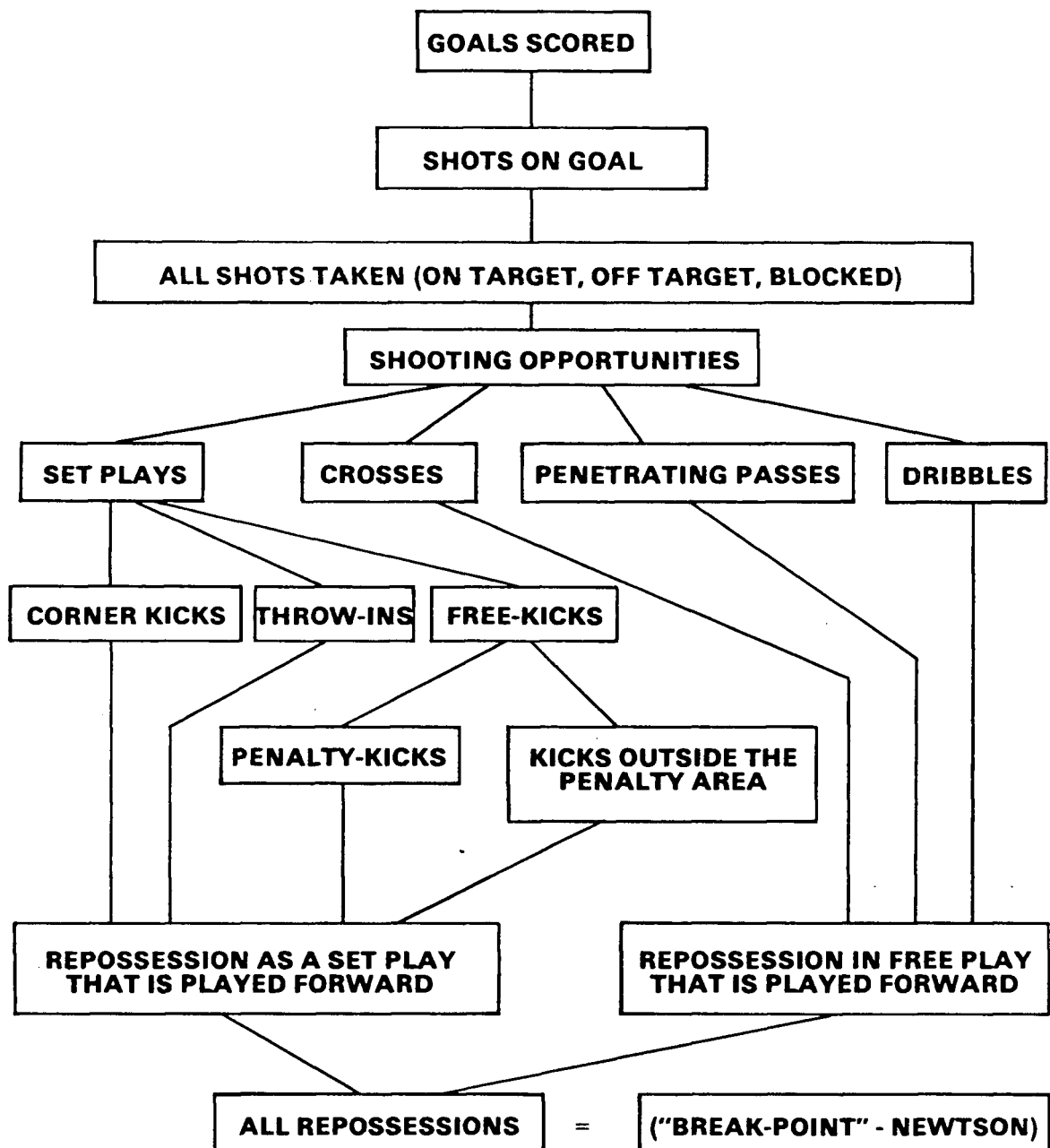
It was felt that directing the coaches' observations around orienting activities in the form of advanced organizers such as ball possession, set plays, crosses, penetrating passes, missed shooting opportunities, shots and goals would highlight the critical events since this was priming (Wickelgren, 1979) the coach to anticipate a missed shooting opportunity, a shot on goal and a goal being scored. In order to test this activity it was necessary to design a study in which a group received a standardized training program that included specific orienting tasks.

These training tasks were in the form of audio visual material. Coaches viewed excerpts from games and were instructed on how to parse the information flow according to the framework illustrated in Figure 2. This Experimental Group was compared to two Control Groups that did not receive the training

program. Both these groups, however, were exposed to identical visual training material but were not exposed to the orienting instructions. Firstly, Control Group Two was considered as the true control condition and was given tasks that would be expected of them under normal game observation conditions. That is, they discussed the video excerpts and decided upon appropriate corrective training procedures. The second control group (Control Group One) was used to investigate the possibility that coaches' memories for events such as goals, shots and missed shooting opportunities would improve just by practising the recollection of these key events after each video excerpt. This group was, therefore, given a memory recall task after viewing each video excerpt.

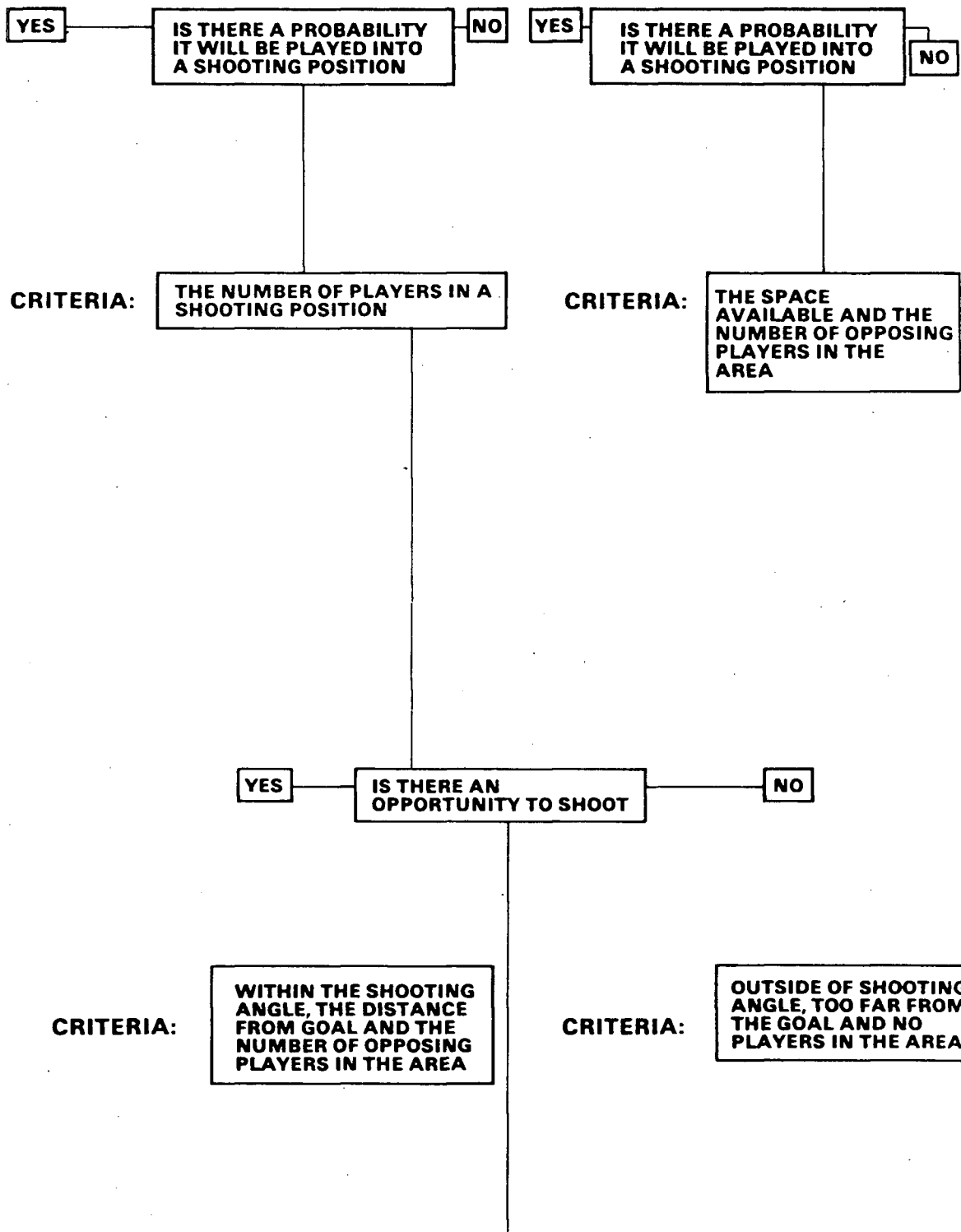
FIGURE 1

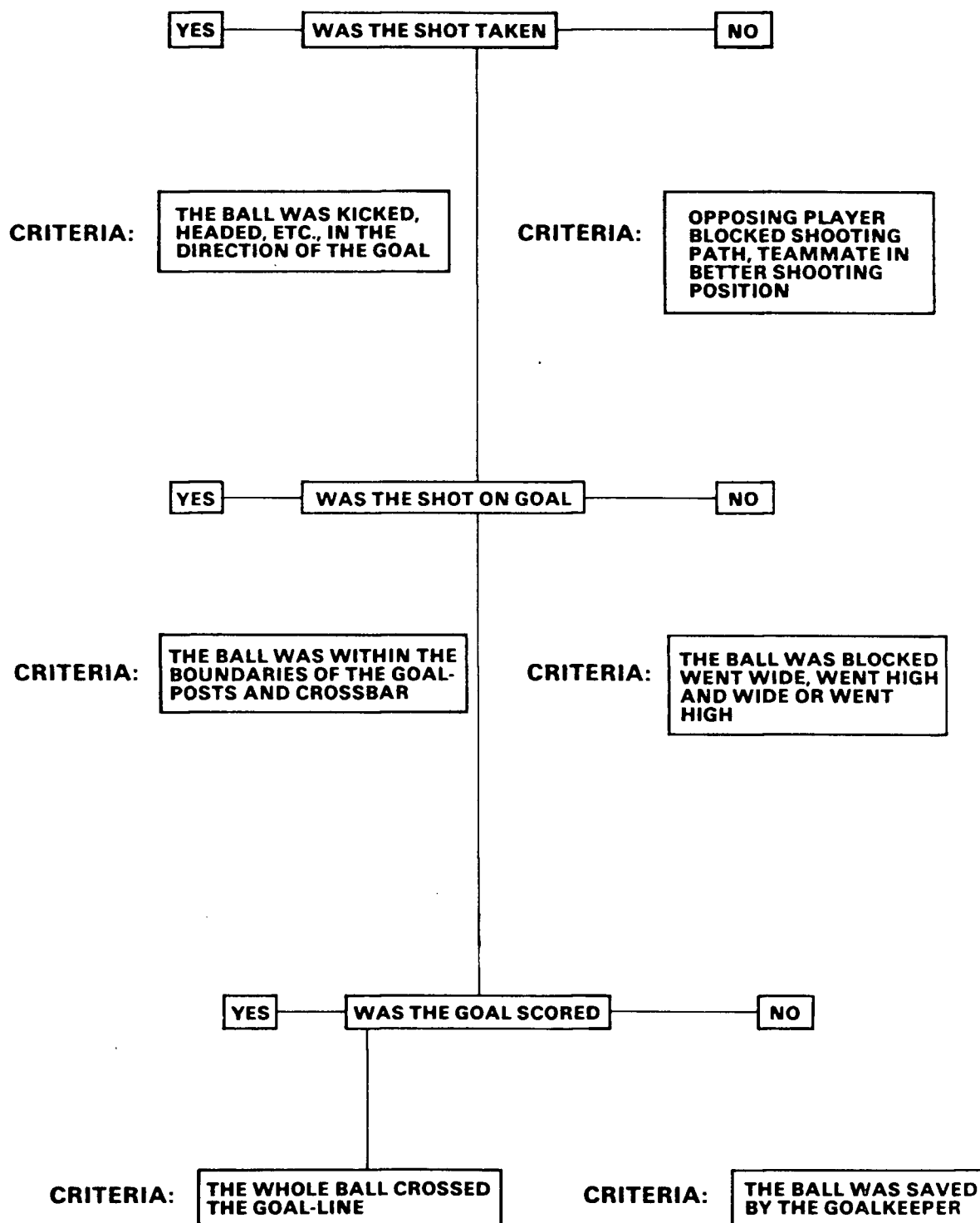
THE CRITICAL FEATURES OF SOCCER



FLOW CHART OF TRAINING PROGRAM







CHAPTER 2

METHOD

2.1 Subjects

The subjects were 36 male and female soccer coaches ranging in age from 20-55 years old. All had attained their Level 3 or "C" License coaching certification level within the National Coaching Certification Program and their coaching experience ranged between two and twenty years. They had no formal training related to quantitative performance analysis and were randomly chosen from The Ontario Soccer Association's group of Level 3 and "C" License coaches (Approximately 200). The subjects were randomly assigned to three operational groups which included one experimental group and two control groups consisting of 12 subjects per group.

2.2 Experimental Design

The study employed a randomized groups design in which the interaction between groups and pretest and posttest performance was of concern and was designed to test the relative merits of a specific training program that was designed to improve a group of coaches' observational skills. The design of the study is presented in Table 1.

2.3 Environment

The groups were seated in a classroom and viewed a 20 inch television set. The definitions of the criterion code (Appendix 6) were explained and posted on a chalkboard for the subjects to

TABLE 1
EXPERIMENTAL DESIGN

GROUPS	PRETEST	TRAINING	POSTTEST
Experimental	View Videotape and answer questionnaire	View Training Program of seven sequentially prepared videotapes plus orienting activities	View videotape and answer questionnaire
Control (1)	View videotape and answer questionnaire	View seven videotapes and answer a questionnaire after each tape	View videotape and answer questionnaire
Control (2)	View videotape and answer questionnaire	View Seven videotapes and engage in a group discussion and complete a personal analysis	View videotape and answer questionnaire

refer to throughout the Pretest, Training and Posttest periods. All questions were answered prior to the Pretest and Posttest videotape being shown. A questionnaire (Appendix 7) was then distributed and the three critical events (goals, shots and missed shooting opportunities) were explained and questions answered. The subjects were requested not to write anything down on the questionnaire until the videotaped game segment had been viewed. Once the videotape had finished the subjects answered the questionnaire. The subjects were given as much time as they required to answer these questions. The questionnaires were then handed in to the experimenter.

2.4 Videotape Construction

a) the Pretest was a segment of a 1986 World Cup Game played between Belgium and the Soviet Union. The videotape included a total of three goals, three shots and three missed shooting opportunities. The total number of events leading up to these nine critical features was 190.

b) Training - The seven videotapes that made up the training segment of this study consisted of 15 minutes of game action each and included the 9 critical features of 3 goals, 3 shots and 3 missed shooting opportunities. The first videotape was a European Cup game between Rapid Vienna (Austria) and Everton (England). This videotape was used to examine what happened after a team regained possession of the ball.

The second videotape was a game between Manchester United (England) and Everton (England). This tape was used to examine what happened after a team had a set play (corner kick, free kick and throw-in).

The third videotape, a game between Scotland and Spain, examined crosses into the penalty area together with the events leading up to the cross.

The fourth videotape was a game between Sheffield Wednesday (England) and Coventry City (England). This tape was used to examine what happened after a penetrating pass was made together with the events leading up to the penetrating pass.

The fifth videotape was a game between Luton Town (England) and Everton (England). This tape was used to examine the events leading up to the missed shooting opportunity and what happened following the opportunity.

The sixth videotape was a game between Grimsby Town (England) and Arsenal (England). This tape was used to examine the events leading up to the taking of the shot.

The seventh videotape was a game between Watford (England) and Walsall (England). This tape was used to see the events leading up to the scoring of goals.

c) Posttest: The fifteen minute videotape used in the posttest was a segment of a 1986 World Cup game played between West Germany and Scotland. The videotape included three goals, three shots and three missed shooting opportunities total from both of the teams. The total number of events leading up to these nine critical features was 190.

The description of the pretest videotape, the training videotape and the posttest videotape is included in Appendix 8.

2.5. Procedure

Pretest

All subjects completed the same Pretest in which they viewed a 15 minute segment of a soccer game. This excerpt from an international game did not have any commentary. The following instructions were given to all groups prior to viewing:

1)

"You are the coach of Team A(designated on the screen). At the end of the viewing period you will be asked questions relating to three categories:

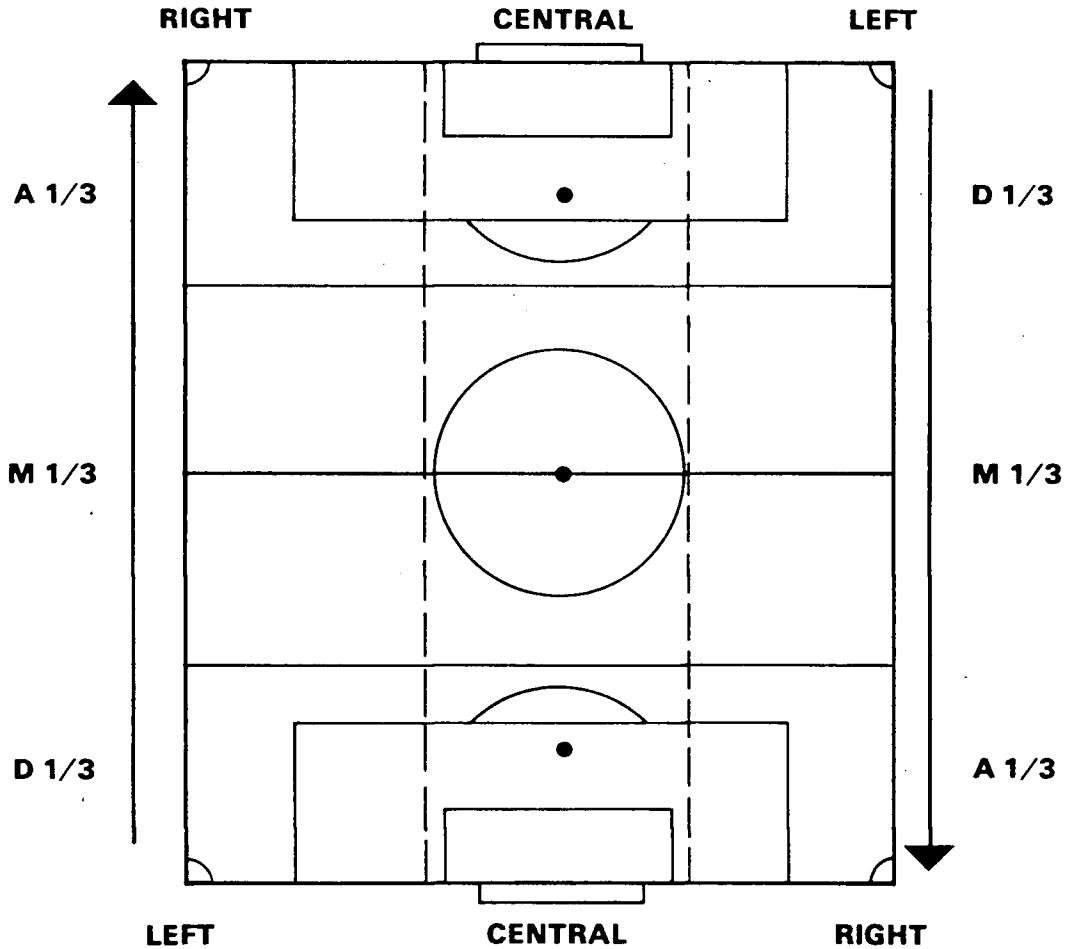
- a) the scoring of goals
- b) the taking of shots
- c) the missed opportunities to shoot

Do not talk during the viewing session.

Are there any questions? The questionnaire (Appendix 7) and criterion code (Appendix 6) will be explained on the board and will be left there during the pretest. The field will be broken down into numbered areas (see Figure 3.) An example of a critical event occurring will be shown in point form on the board."

Goals, shots and missed shooting opportunities were examined focusing on their origin on the field in terms of location and event. That is, what was the event and where on the field did it originate and end. The subjects were required

FIGURE 3
NUMBERED AREAS OF THE FIELD



to write down the event (technique used), the position (location on the field) and the sequence of events that led to these 3 critical events. An example of this sequence would be Team A, a long pass from area D 1/3 right to A 1/3 right, a cross to A 1/3 central and a shot on target that resulted in a goal.

TRAINING PROGRAM

The training program consisted of all three groups watching the seven videotapes as previously described. The experimental group was trained in a progressive manner to increase their awareness of: a) changes in ball possession, b) set plays, c) crosses, d) penetrating passes, e) missed shooting opportunities, f) shots taken and g) goals scored. Each session was built upon the previous training, (i.e., while observing crosses they were still being asked to observe change of possession and set plays). Therefore, they were examining a sequence of events. After viewing the videotape they were asked questions about these key factors and then shown an edited videotape to clarify the answers to these questions.

The Experimental Group watched each videotape as the experimenter stopped the tape to identify the key factors pertaining to that particular videotape. (Each tape is described in Appendix 8). The flow chart for the program of training the Experimental Group is shown in Figure 2.

Each videotape progressed from the previous videotape until a won possession resulted in a goal. This means a won possession (first factor) resulted in a set play (second factor) that resulted in a shooting opportunity (third factor), a shot

TABLE 2
CODING OF GAME EVENTS

An example of the coding of the events leading to a goal
being scored in the Pretest Game U.S.S.R. versus Belgium *

<u>EVENT</u>	<u>TEAM</u>	<u>LOCATION</u>	<u>DESCRIPTION</u>
TI	U.S.S.R.	RA 1/3 - RA 1/3	SFP
SFP	U.S.S.R.	RA 1/3 - RA 1/3	
C	U.S.S.R.	RA 1/3 - CA 1/3	MG
PK	U.S.S.R.	RA 1/3 - CA 1/3	GOAL

* See Appendix 6 for definition of codes

(fourth factor) and a goal (final outcome). This method of training was progressive and was designed to increase their awareness of the sequential dependancy of events in a soccer game.

At the end of the seventh videotape the subjects were shown 3 examples on each videotape of where ball possession was won on the field, what technique was used to play the ball and where on the field the ball was played towards.

Control Group One watched the same seven videotapes as the Experimental Group and completed the same questionnaire that they had previously received on the Pretest. The environment was identical to the Pretest and after each 15 minute videotape they completed the questionnaire. They answered the questions on missed shooting opportunities, shots and goals. It was hypothesized that if the skills of recollecting missed shooting opportunities, shots and goals was just a function of repetition and experience (seeing shooting opportunities, shots and goals over seven videotapes and being asked to recall them) and not directed observation (being given the progressive training program), then this group should be equal, if not better, at recalling events than the Experimental Group on the Posttest.

After viewing the fifteen minute videotaped excerpts Control Group Two discussed, amongst themselves, their thoughts on each of the games. They were then asked to do what they would normally do after observing a game (i.e., write down their analysis and formulate a training plan for the following week). After each 15 minute game, the training plans were collected.

They included practice sessions of shooting, passing, defending, set plays, etc. This is what coaches do to improve their team's performance based on their subjective analysis. This plan focused on improving the weaknesses of both teams.

POSTTEST

The posttest consisted of the experimental and control groups observing the first 15 minutes of a soccer game and answering the same questionnaire as was given in the Pretest. This game was different from the pretest game but the critical features were identical in the following manner; the same number of missed shooting opportunities, the same number of shots, the same number of goals, the same number of events leading up to the critical features and the same amount of time for viewing.

2.6 Data Analysis

The method of measurement that was used to test the coaches' recollections of these critical features in both pre and posttests involved an itemized list of events leading to missed shooting opportunities, shots and goals. Accounts were taken of the event and the order in which the event was placed (see Table 2). That means, the coach may recollect the event but place this event incorrectly in the total sequence of events or in the wrong location on the field. The games were previously analyzed and each event, team, location and description were recorded (see Table 2). Each component was marked as being either correct or incorrect and was then converted to a percentage correct value for each category of goal, shot and missed shooting opportunity.

CHAPTER 3

RESULTS

The design used in this study was a three-factor mixed design with repeated measures on two factors (Edwards, 1960). Three groups of subjects received all of the treatment conditions and were compared as in a completely randomized design. This permits the comparison of the three group's performances and the evaluation of the variations in performance shown by subjects under all three treatment conditions with both factors (pretest/posttest) presented. Subjects in this study ($N = 36$) were randomly sampled from Level III soccer coaches in the province of Ontario and were comprised of thirty-six subjects that completed identical pretest and posttest experimental sessions. Between these tests all groups were exposed to various observational training regimes explained earlier (see Method section).

The pretest and posttest comprised of a series of questions that were designed to assess the observational accuracy of the coaches after they had watched thirty minutes of a videotaped soccer game. Questions focused upon three critical areas of tactical concern and these areas formed the basis of what shall be termed conditions: goals, shots and missed shooting opportunities. Subjects were required to recall game events and the position at which that event took place in the correct serial order, prior to the three category conditions (goal, shot or a missed shooting opportunity). The dependent variable was

the percentage of correct responses that each subject displayed when answering questions about these three critical events or conditions.

The scores ranged between 0% correct to 71.8% correct for the whole experiment. The raw data, sums, means and standard deviations for each of the group's pretest and posttest scores are categorized under condition (goals, shots, missed shooting opportunities) and are tabulated in Tables 3, 4 and 5.

All groups displayed an overall accuracy during the pretest of 16.8% and during the posttest, of 21% with standard deviations being 4.4 and 6.1 respectively. In the main, pretest and posttest scores were poor (<22%). This was not unanticipated since earlier research (Franks and Miller, 1986; Franks, Goodman and Miller, 1983; also see pilot study data in Appendix 2) had indicated that the memory of coaches for critical events in a soccer game was no better than chance levels. On the average, coaches seem to be incapable of remembering more than 40% of information that pertains to how goals are scored, a fact that would appear to be of uppermost importance to the decision making that is fundamental to the winning and losing of games. Having determined that the coaches' memory for the events that lead to goals was poor, it was not surprising that their recall of events that lead to shots and missed shooting opportunities was no better than 20 % correct. That is, coaches even at this level (Level III), could not accurately recall what sequential events led to the taking of shots or missed shooting opportunities.

TABLE 3

Experimental Group % Correct Scores for Events Leading to Goals, Shots and Missed Shooting Opportunities in Pretest and Posttest Evaluations.

DESIGN	PRETEST			POSTTEST		
<u>GROUPS</u>						
COND. 1			COND. 2	COND. 3		
COND. 1	COND. 2	COND. 3	COND. 1	COND. 2	COND. 3	
S1 54.6	0	8.3	46.8	25.6	20.8	
S2 4.6	2.5	0	18.7	5.1	8.3	
S3 50	0	6.2	57.8	12.8	16.6	
S4 23.4	7.6	10.4	40.6	17.9	20.8	
S5 15.6	3.8	18.7	29.6	8.9	22.9	
S6 57.8	39.7	35.4	71.8	58.9	41.6	
S7 25	0	12.5	45.3	6.4	0	
S8 26.5	0	0	50	0	16.6	
S9 12.5	3.8	12.5	43.7	12.8	31.2	
S10 6.2	2.5	10.4	28.1	10.2	14.5	
S11 10.9	0	0	15.6	2.5	16.6	
S12 4.6	0	0	54.6	26.9	18.7	
<hr/>						
Σ 291.7	59.9	114.4	452.6	188	228.6	
M 24.3	4.9	9.5	41.8	15.6	19	
SD 13.026						

TABLE 4

Control Group One % Correct Scores for Events Leading to Goals, Shots and Missed Shooting Opportunities in the Pretest and Posttest Evaluations.

DESIGN		PRE TEST		POST TEST			
GROUPS							
COND. 1		COND. 2	COND. 3	COND. 1		COND. 2	COND. 3
S13	54.6	7.6	18.7	34.3	24.3	16.6	
S14	62.5	12.8	16.6	46.8	26.9	16.6	
S15	50	16.6	39.5	62.5	32	12.5	
S16	20.3	7.6	10.4	31.2	15.3	0	
S17	29.6	6.4	22.9	29.6	16.6	20.8	
S18	35.9	3.8	37.5	42.1	8.9	27	
S19	56.2	24.3	18.7	62.5	28.2	14.5	
S20	31.2	6.4	12.5	31.2	14.1	8.7	
S21	6.2	1.2	14.5	28.1	3.8	0	
S22	14	6.4	0	12.5	8.9	8.3	
S23	43.7	10.2	0	35.9	29.4	0	
S24	51.5	23.0	12.5	60.9	33.3	6.2	
Σ	455.7	125.5	203.8	477.6	241.7	141.2	
M	37.9	10.4	16.9	39.8	20.1	11.7	
SD	12.931						

TABLE 5

Control Group Two % Correct Scores for Events Leading to Goals,
Shots and Missed Shooting Opportunities in the Pretest and
Posttest Evaluations.

DESIGN		PRE TEST		POST TEST		
GROUPS						
COND. 1			COND. 2			
COND. 1			COND. 2			
COND. 1			COND. 2			
S25	60.9	19.2	6.2	54.6	17.9	6.2
S26	10.9	0	0	54.6	0	0
S27	12.5	0	16.6	10.9	7.6	4.1
S28	39.0	8.9	6.2	42.1	3.8	6.2
S29	14	3.8	0	9.3	0	0
S30	15.6	5.1	14.5	9.3	5.1	10.4
S31	54.6	12.8	18.7	40.6	8.9	0
S32	32.8	10.2	12.5	18.7	17.9	12.5
S33	34.3	0	18.7	23.4	17.9	0
S34	39.0	0	0	14	8.9	14.5
S35	15.6	5.1	6.2	17.1	2.5	10.4
S36	60.9	0	25	46.8	11.5	0
<hr/>						
{	90.1	65.1	124.1	341.4	102	64.3
<hr/>						
M	32.5	5.4	10.3	28.4	8.5	5.3
<hr/>						
SD	12.136					

An analysis of variance was performed on the data and the results are displayed in Table 6. As can be seen there were no significant differences in the main effects for groups. There were, however, significant differences between performances during the pretest and posttest for all groups across all conditions ($F_{1,33} = 147.3, p < .001$), indicating that overall, subjects were better able to recall events during the posttest than during the pretest. This conclusion has to be qualified when one examines the Group by Pretest/Posttest interaction ($F_{2,33} = 49.6, p < .001$). After graphing this interaction (see Figure 4) it would appear that the performance scores of the experimental group were mainly responsible for the increase in posttest scores. Therefore, the training program which systematically directed observation resulted in better recall for the Experimental Group than the two Control Groups.

A Scheffe' post hoc analysis of the Conditions main effect ($F_{2,33} = 81.3, p < .001$) revealed that all subjects recalled the events leading to the scoring of goals more accurately than they recalled the events leading to shots or missed shooting opportunities. Figure 5 illustrates how the various training programs affected all the groups in their ability to recall the events leading up to these three critical events. Again, it appears that this finding supports the previous studies conducted by Franks and Miller (1986) and also the pilot study data (reported in Appendix 2). Although the events that precede each of the above categories: goals, shots, missed shooting opportunities are essentially the same (Reep et al, 1971; Reep

TABLE 6

ANALYSIS OF RESULTS

Sum of the Squares, Degrees of Freedom, Mean Squares, F Ratios and Level of Significance.

SOURCE	ss	df	ms	f	p
TOTAL	64,979.61	107	-	-	-
BETWEEN SUBJECTS	19,822.881	35	-	-	-
GROUPS	2,165.487	2	1,082.7	2.0	n.s.
ERROR b	17,657.394	33	535	-	-
WITHIN SUBJECTS	45,156.729	72	-	-	-
PRETEST/POSTTEST	965.202	1	965.2	147.3	P<.001
CONDITIONS	24,649.62	2	12324.8	81.3	P<.001
GROUPS X PRETEST	2,024.467	2	1012.2	49.6	P<.001
POSTTEST					
GROUPS X CONDITIONS	236	4	59	0.38	n.s
PRETEST/POSTTEST	604.818	2	302.4	3.6	P<.05
X CONDITIONS					
GROUPS X PRETEST/	538.83	4	134.7	1.62	n.s.
POSTTEST X CONDITIONS					
ERROR 1	673.02	33	20.39	-	-
ERROR 2	10,000.656	66	151.5	-	-
ERROR 3	5,464.113	66	82.7	-	-

and Benjamin 1968; Franks and Thomson, 1982), the memory for these events would seem to be influenced by the consequentiality of the events. Consequences both in terms of overall team results and consequences for the coach in being able to recall what led to critical events as defined by players and the public.

The interaction between Conditions and Pretest/Posttest revealed significance at the $p < .05$ level ($F_{2,66} = 3.6$). In an examination of the groups in Figure 5, it would appear that the results for all groups in both goals and shots benefited from the training program but the recall of missed shooting opportunities did not improve. However, when one examines each individual group's performance (see Figure 6), it becomes clear that the recall of missed shooting opportunities by Control Groups 1 and 2 did not improve while the Experimental Group's recall scores doubled.

FIGURE 4

**INTERACTION BETWEEN
PRETEST AND POSTTEST
AND GROUPS ON THE PERCENTAGE OF
CORRECT ANSWERS.**

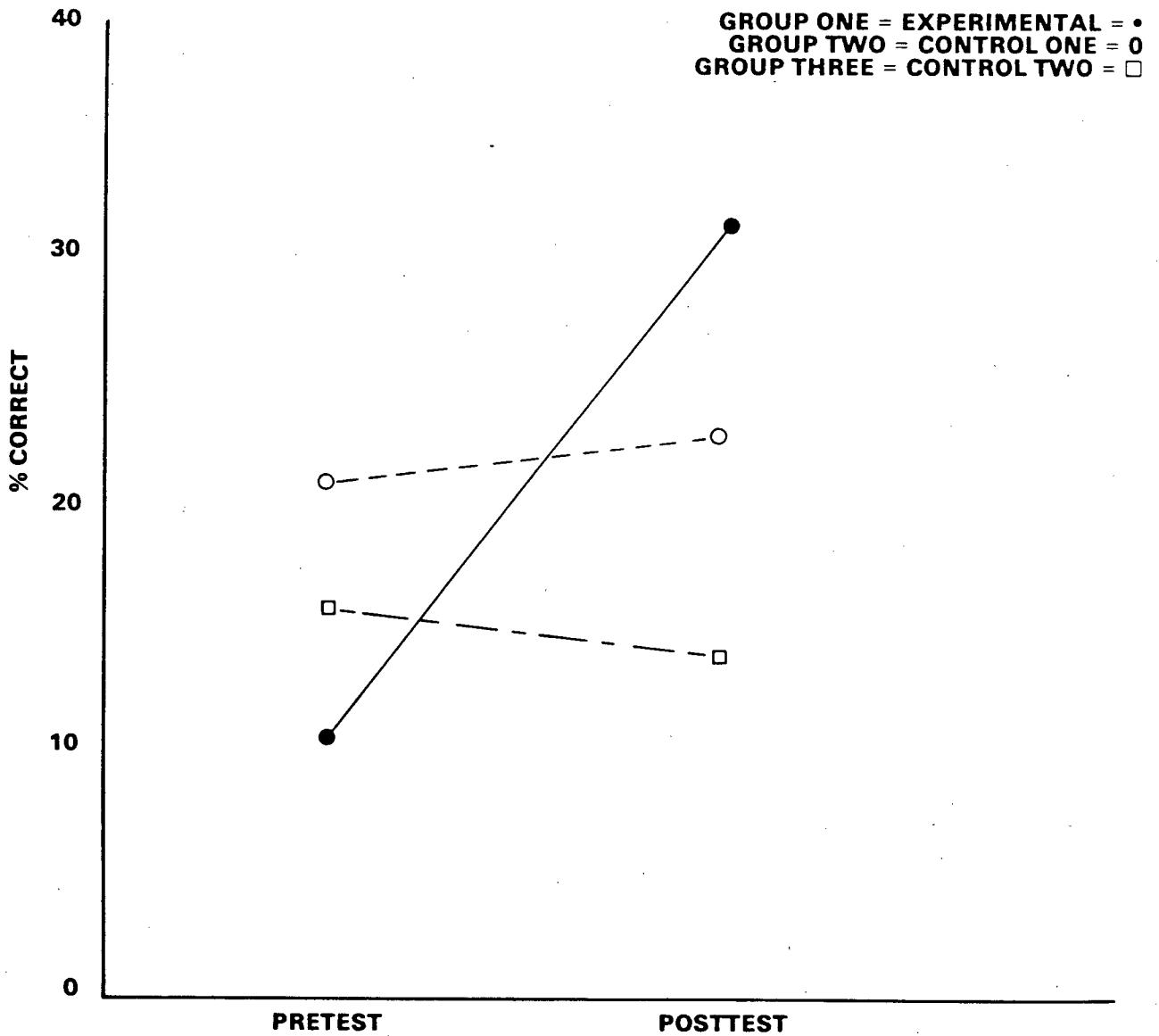


FIGURE 5

**INTERACTION BETWEEN PRETEST/POSTTEST
AND CONDITIONS ON THE PERCENTAGE OF
CORRECT ANSWERS.**

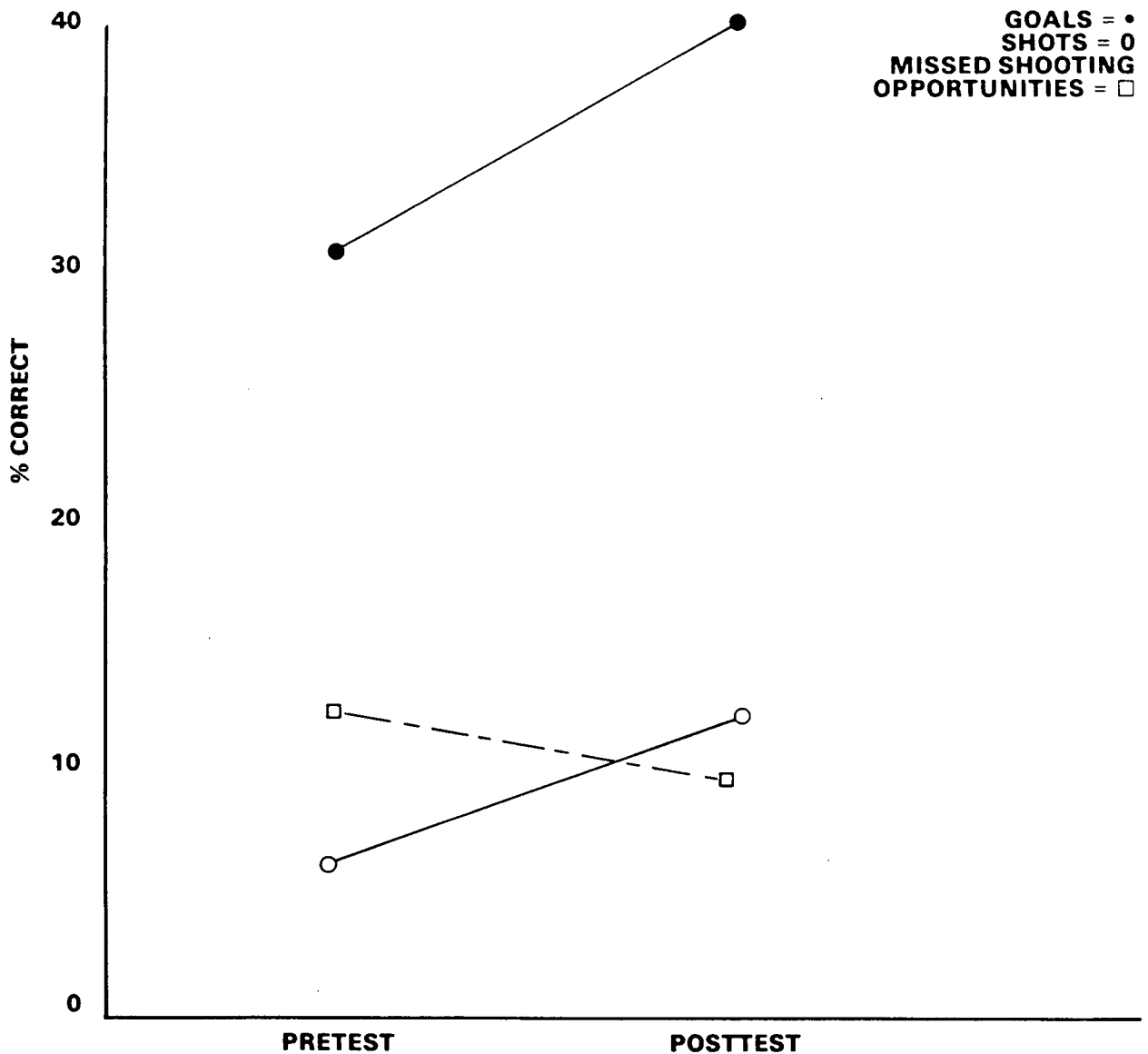
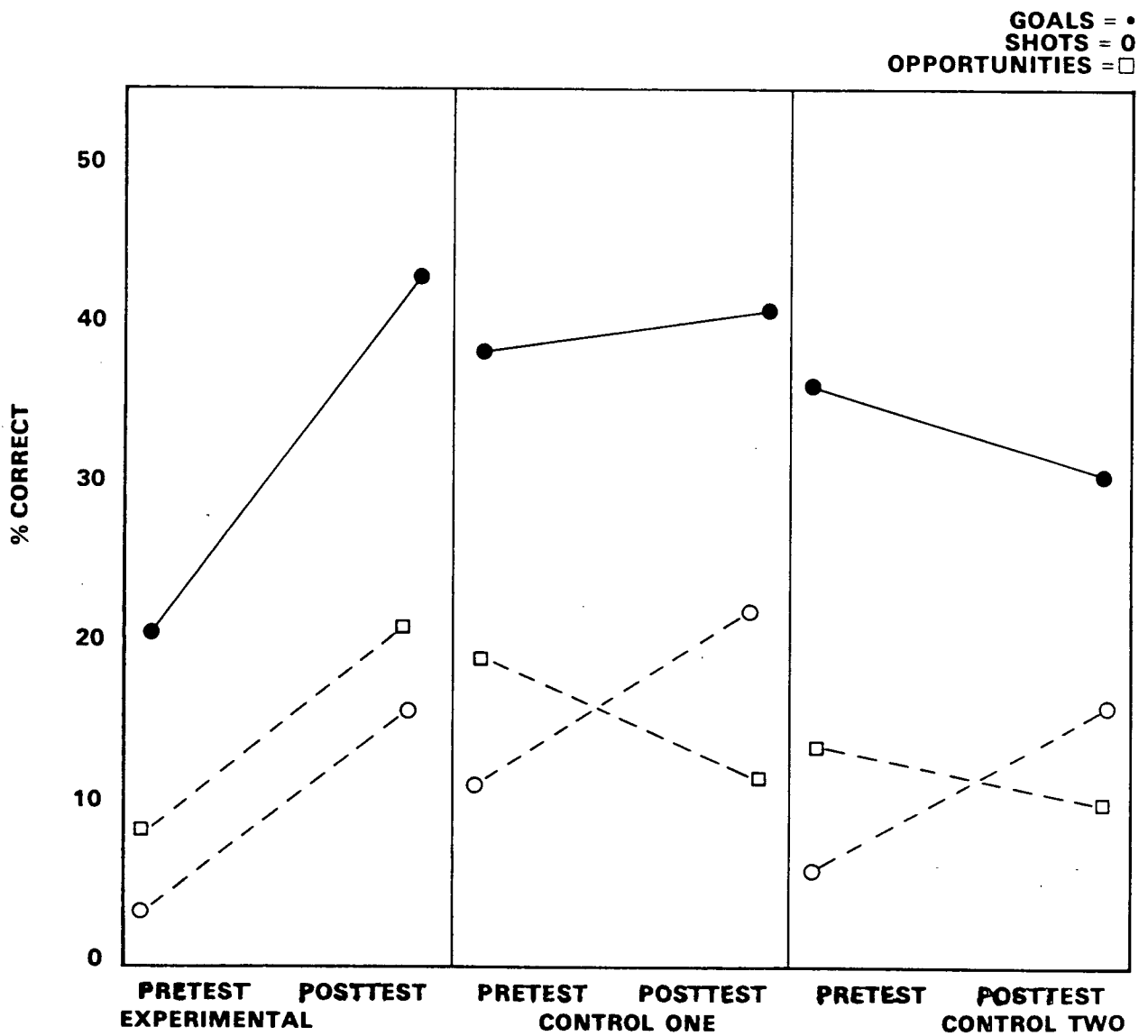


FIGURE 6

**INTERACTION BETWEEN PRETEST/POSTTEST
AND CONDITIONS ON THE PERCENTAGES
OF CORRECT ANSWERS FOR EACH GROUP.**



CHAPTER 4

DISCUSSION

The ability of coaches to remember specified key events that occurred during a 15 minute video segment of a soccer game appears to be extremely limited when coaches are asked to recount, in sequential order, the event and location of that event. However, these conclusions are made with a note of caution. Yuille and Cutshall (1986), in a case study on eyewitness memory of a crime, stated that filmed events (videos) in eyewitness research does not qualify as a "forensically relevant paradigm" and may be of limited value for generalizing to real world situations. The essence of their criticism centered around the fact that witnesses to a live event reported more action details and these details were more accurate than those reported by viewers of a videotaped version of the same event.

Hence, it would appear that the relatively unemotional sterility of a laboratory setting would lead to an underestimation of the coaching recall ability. The constraints of the task and training procedure necessitated that video excerpts be used in this particular study. That is, it was impossible to have coaches view similar pretest and posttest segments of games if these pretest and posttest conditions had to be live events. Also, since this was a comparative study, the performance scores on all three groups would have been affected. Although it was not possible to examine the interactive effects of this ecological modification on the

training program, given that the recall of these coaches may have been underestimated, it still appears that reliable accounting of game action is poor. This is not a new finding and is supported by many other studies (pilot studies in Appendix 2). What is interesting, however, is that the remembering of events that lead to goals is superior to events that lead to shots or missed shooting opportunities. It has been found that the events leading to shots and missed shooting opportunities are no different than the events leading to goals. Why is it then that the events leading to goals are recalled more accurately? A possible answer has been offered by Neisser (1982). He has suggested that as a result of a certain event occurring the consequences can change a person's life (consequentiality). Extending this idea to the present study, it is highly probable that coaches perceive goals as being of greater consequence than shots or missed shooting opportunities. This would appear to be a sound proposition since goals do indeed lead to the winning of games. The consequences are not only directed to the game but also to the coaches themselves. It is a fact that coaches are expected to be able to recollect how goals are scored after the game. Players may question the coach, spectators may discuss goals with the coach and even the media may have many questions that require a sound knowledge of these events.

Whereas, a knowledge of how goals are scored is critical, the memory of these events should not be emphasized such that they depress the recall of other equally critical events such as

shots and missed shooting opportunities. Therefore, any training program developed to aid the observational skills of coaches must be equally distributed among the group of critical events that has been postulated here.

The major finding in this study was that a systematic observation training program such as the one designed for the experiment did effect an improvement in the coaches ability to recall all three critical events. This improvement was evident for all categories (goals, 22%, shots, 11%, and missed shooting opportunities, 12%). Why did this training program result in the improvement of the recall ability of coaches? The Control Group performances imply that it did not seem to be due to repeated exposures to video excerpts of action segments followed by group discussions by the coaches. In fact, the results from the recollection of Control Group One revealed that performance on missed shooting opportunities decreased slightly (8%) while goals remained unchanged. It is difficult to offer an explanation for this. Indeed, reports from subjects involved in that control group indicated that the experience had been extremely beneficial and perceived that it had helped them greatly to be better coaches in terms of improving their quality of observation.

The improvement in the experimental group's performance could not be attributed to the fact that the coaches had been given some training on simply recounting goals, shots and missed shooting opportunities in the posttest for the second time. Control Group One did show some improvement in the recalling of

goals and shots but showed no improvement in recalling missed shooting opportunities. This Control Group Two had been given the specific task of just recounting goals, shots and missed shooting opportunities.

Preparing subjects to receive information by means of a systematic approach to observation using advanced organizers employing a priming technique does benefit the subject when a test of their observations is required. In research conducted by Mayer (1979), he states that the function of an advance organizer is "to provide ideational scaffolding for the stable incorporation and retention of the more detailed and differentiated material that follows" (p.372). An advance organizer generally has each of the following characteristics: a) short set of verbal or visual information b) presented prior to learning a larger of body of to-be-learned information c) containing no specific content from the to-be-learned information d) providing a means of generating the logical relationships among the elements in the to-be-learned information e) influencing the learner's encoding process. This research clearly employs these characteristics within it's priming technique.

Recommendations

The results of this research will be utilized within the National Coaching Certification Program in the Level III Technical Course for soccer coaches. There is a definite lack of training in the observation of critical features of the game for coaches at this level. The training program developed in

this study will be utilized to prime coaches into organizing their observations around the critical features of play. This will allow coaches to train their teams with the realization that their training sessions stem from what actually occurred in the previous game and not what they thought occurred.

This type of training program and priming technique could be utilized within any sport as long as the critical features were identified. This is a future area of development for coaches in all sports.

APPENDIX 1

LITERATURE REVIEW

Numerous researchers have been concerned with the reliability of eyewitness testimony (Clifford and Hollin, 1980, Loftus, 1984, Wells, 1983) in criminal situations. The work done by Newton (1976) on the perceptual organization of ongoing behavior is a model by which eyewitness testimony could be explained. A review of the literature which has emanated from that experimental attention is included here.

Memory Research - An Information Processing Approach

Humans can be regarded as information processors and as such process information as it is presented, putting it into a form that allows it to be stored in memory. This happens in a series of stages that involves certain limitations at each stage.

Immediate memory only exists within those seconds when there is more information than the system can handle. Only the materials to which we pay attention are retained for further processing. The attended-to materials (selective attention) enter short-term memory, where they remain for half a minute before those that receive still further processing enter long-term memory. There they remain forever, available for use as needed (Kimble, Garnezy and Zigler, 1980).

Information processing can be described in terms of the processes involved, which are called encoding, storage and

retrieval. Encoding is putting materials into a form that the memory system can handle. Storage is the process of committing encoded material to memory. Retrieval is taking the material that is stored in memory out again.

Research by Newton (1976), states that learning to perceive involves selecting from what is available, although more than one selection may be possible at any time. Increased differentiation occurs as the perceiver comes to know what is relevant and allows attention to be directed to events and objects that have importance for the individual. This relates to one of Newton's (1976) implications stating that skilled or veteran observers develop a specialized set of predictive features for use in observations. Their information processing goes to a deeper level and these features are better retained than others at a superficial level.

Within the organization of memory is episodic memory and semantic memory. Episodic memory is the immediate memories of personal experiences. Semantic memory is later knowledge that contains information that is not associated with a particular time or place. In eyewitness testimony semantic memory has considerable control over how our episodic experiences are perceived, interpreted and stored (Kimble, Garnezy and Zigler, 1980).

A guided memory training program would utilize the concept of priming. Wickelgren (1979) states that the priming effect of memory retrieval is the process by which an inactive, stored association is converted into an active, retrieved association.

Once an association is in the retrieval state, it can be maintained in that state virtually indefinitely by rehearsal. Attentional set is the ability to prepare oneself for a particular class of stimuli. It speeds up reaction times to stimuli falling within the expected set and often retards responses to unexpected stimuli. The activation of the attentional set primes all of the nodes to which it is associated. This makes a person more likely to perceive an expected event than an unexpected one.

Memory Research - Naturalistic Approach

Neisser (1982) states that psychology has followed two routes in the study of memory. Travelers on the high road hope to find basic mental mechanisms that can be demonstrated in well-controlled experiments (information processing); those on the low road want to understand the specific manifestations of memory in ordinary human experience. The lower road has not been well mapped as yet, and much remains to be discovered. Neisser refers to this as the naturalistic study of memory.

Researchers have examined a variety of theories on perception and observation, comparing skilled and unskilled observers. Neisser (1967) examined the cognitive structure of humans and found it may be defined as a nonspecific but organized representation of prior experiences. Recall is organized in terms of these structures because the original experiences were elaborated in the same terms.

Neisser (1982) found that people developed a schemata for accepting events. One of his examples was a news reporter who

builds a framework around the questions who, what, where, when and why. Neisser went on to say that as time runs on and events unfold, there are certain landmarks which occur that we term as historic moments. He discusses the concept of the "flashbulb memory" that suggests a surprise, an indiscriminate illumination and brevity. The permanent registration of the novelty occurs as well as other recent brain events. At a micro-level this can be compared to Newton's break-points.

Earlier, Neisser (1976) had found that perception is directed by expectations but not controlled by them; it involves the "pickup" of "real" information. He stated that in a real situation there is always more to see than anyone sees, and more to know than anyone knows. The perceiver does not pick up all the information as they are not equipped to do so. Perceivers pick up only what they have developed schemata (the internal perceptual cycle that is modified by experience and specific to what is being perceived) for, and ignore the rest. Learners impose their personal organization on materials as they memorize them and this organization is strengthened through practice. Neisser went on to say that once the eye has been set in motion toward a new fixation point, it cannot change its path until it has arrived; little information will be picked up in midcourse. Anticipation actually controls these eye movements and it depends on many factors: the overall plans and intentions, the experience of imagining, and the particular scanning pattern that is being used. In the game of chess, a good chess player's

eye movements are closely related to the structure of the position on the board: he looks at crucial pieces and crucial squares. Chess masters see the position differently - more adequately and comprehensively - than a novice would. The difference between the two are not matters of truth and error but of noticing more rather than less. Welford and Bourne (1976) state that the general outline or schema is imposed on incoming material and shapes both perception and recall. Details which are not fitted by the schema are either ignored or recorded separately.

Mourant and Rockwell (1972) investigated the strategies of visual search by novice and experienced drivers by videotaping their eye movements while driving. The results of the testing showed that the novice drivers: 1) concentrated their eye fixations in a smaller area as they gained driving experience 2) made pursuit eye movements on the freeway route while the experienced drivers made only eye fixations. These results suggest that the visual acquisition process of the novice drivers was unskilled and overloaded. Thus, the search and scan patterns of the novice drivers may be considered unsafe in the traffic context, whereas, novice coaches could face similar problems in analyzing ongoing movement in an athletic environment.

Neisser (1982) stated that previous research documents the finding that most people are markedly inaccurate in reporting such numerical details as time, speed and distance in the reconstruction of automobile destruction.

Eyewitness Testimony

The ability of eyewitnesses to recall, from a multitude of memories, exactly the memory that meets the particular requirements of a particular situation is a problem of retrieval. An item in memory is stored in a code that includes certain physical features as well as its meaning. It's location in memory places it in a network of related items. The retrieval must consist of a search through a region of memory with a range of meaning for an item with particular physical features (Kimble, Garnezy and Zigler, 1980).

Thornton and Zorich (1980) conducted a study to evaluate two training procedures hypothesized to improve observation accuracy. The group of subjects were trained with one of the three sets of instructions aimed at the observation processes. These processes include detection, perception and recall or recognition of specific behavioral events. The first set of instructions simply explained the task (control); the second encouraged careful observation and recording of specific behavior; the third included the instructions given in the second set plus training on the avoidance of eight systematic errors of observation. Observer accuracy was measured by an objective test of behavioral events in the videotape. The results showed that subjects trained under the third set of instructions, training on error avoidance, were more accurate in observation than subjects in the other two groups. Murphy, et al (1982), also conducted research on observational accuracy and had their subjects view videotaped lectures and were asked to

indicate the frequency with which a number of well-defined behaviours occurred in each lecture. These 12 behaviours included using the blackboard, stopping in mid-sentence and pausing for questions. The results showed that the majority of frequency ratings were very low.

The use of guided memory in eyewitness identification was researched by Malpass and Devine (1981) with the rationale that when recognition is requested after long periods of time, the accuracy of the witnesses' recognition can be enhanced by reinstating the context of the witnessed offence through verbal instructions. The results found that context reinstatement through the guided memory procedure increased the rate of accuracy from 40% to 60% correct identifications after a 5 - month delay.

Hannafin and Hughes (1986) found, in their research on orienting activities in computer-based interactive video, that the orienting activity facilitated procedural learning during a short video segment. They use the term, an advanced organizer, that is, a vehicle through which new information can be subsumed meaningfully within individual cognitive structures. The advanced organizer is presented prior to new instruction to prime learners to information. The learners then activate higher-level mental processes which focus on question-relevant information. This can be partially attributed to an increase in attention drawn to the criterion elements of the question. This helps to improve the conditions for processing relevant information.

Observation In Sport

In the sport science area, there has been very little research done on observational accuracy. Arend and Higgins (1976) regard skill analysis to be the systematic study and analysis of human movement in general. The importance of observational movement analysis for the teacher is stressed as a major factor underlying the process of skill acquisition. The strategy includes pre-observation, observation and post-observation information and criteria needed for systematic movement analysis. Pre-observation is the observer's expectancies, observation is the systematic observation and recording of performance and post-observation makes a comparison and evaluation of what was expected to happen and what actually happened. A plan for observation is essential regardless of the techniques used.

Research by Hoffman, (1977) attempted to define the differences between expert and novice coaches while monitoring athletic performances such as gymnastics, golf and softball. The conclusion that can be drawn from this work is that experts (experienced coaches) do not have a standard system for monitoring performance and that a diagnostic strategy, useful in training pre-service and in-service coaches remains illusive. Therefore, there has not been an attempt to train coaches in observing and monitoring athletic performance.

Grieve (1971) attempted to determine the factors that influence a coach's ability to make adjustments in the game. Knowledge of these factors would assist them in improving their

ability. The time factor involves four periods when the coach must utilize their ability to analyse the opponent:

1. preliminary planning(based on previous information)
2. formulating the practice plan
3. analysing during the game
4. analysing after the game

There are numerous factors which influence the coach's ability to make the proper decisions:

1. emotional involvement
2. nature of the sport
3. player influence
4. time of the season
5. location of the contest
6. weather conditions
7. home or away
8. coach's personal problems
9. officials
10. analytical ability of assistant coaches

Experience was found to be the greatest teacher but this does not mean that all coaches have analytical ability as a result of their experience. Inexperienced coaches focus on the performance of the athletes rather than the overall play. This is why coaches need to be trained on their analytical ability to develop systematic observational strategies.

An analysis of visual search activity during sport (Bard and Fleury, 1976) realized that instability was the main

characteristic of sport environments and suggested that this causes specific perceptual problems. It was recognized that an observer selects what he or she deems to be relevant information from the environment and discards or ignores that which seems irrelevant. The object of this study was to analyse the visual search patterns of subjects solving basketball problems (slides) and to determine the characteristics of these patterns. The results showed that the subject's experience had a significant effect on the overall number of eye fixations with experts having both lower number and different type of fixations. While the experts concentrated on the offensive and defensive players, the non-experts focused only on the offensive player.

In two studies on perception in sport, Allard and Starkes (1980) found that players (experienced) compared to non-players (inexperienced) use a rapid visual search specific to the ball as the target in a volleyball environment. This was due to the speed of response in ball location detection and being fast at visual search. In the second study using slides and the basketball environment, players were found to encode information at a deeper level than non-players by recognizing more of the structured slides (one team clearly in possession of the ball). Millslagle (1988) also found that visual search performance differences do exist between the expert and novice players in basketball. The experienced players demonstrated a superior significant recall ability and thus have developed a more refined perceptual system to recall the organization of the game.

In research conducted on the expert-novice differences in knowledge structures of action, Vickers (1983) found that on the basis of sequencing sets of photos, elite gymnasts were both faster and more accurate than intermediate gymnasts in reconstructing gymnastic sequences. The intermediate gymnasts in turn were both faster and committed fewer errors than novice gymnasts. It was also found that the more difficult the gymnastic sequence, the more time was needed to reconstruct the sequence and the greater the number of errors. Vickers stated that experts, although they often possess the same amount and type of information that others do, have developed intricate and often subtle links between pieces of information that are more effective and applicable in a particular situation.

In studying the visual observation patterns of tennis teachers, Petrakis (1986) stated that those involved with the training of teachers need more knowledge effective visual observation patterns. This would help novice teachers become more competent and facilitate their growth. In the testing of expert and novice teachers there was a difference in the scan patterns. Experts were found to focus on central factors (the body) while novices focused on peripheral factors (the racket). The experts also showed anticipation strategies on these fixations (being ahead of the movement).

The purpose of an article on observation for teaching and coaching by Barrett (1979) was to share information gained about the process of observation that has implications for teachers and coaches as they assist others to improve their observation

skill. An important factor is the ability to identify and analyse critical features which are important to the movement being performed. The observer must be able to select those features of the movement that will have the greatest influence on it's performance at the moment. This can be related to the eyewitness research as eyewitnesses must be able to identify the critical features of the crime (event) that was committed (occurred) and be able to report them.

The various factors that affected observer success with the principle of analysis are illustrated below:

1. Concentration - the inability to maintain focus on what they were observing for long periods of time. Distraction occurred through emotional involvement, pulse of activity, equipment, other students and their position in relation to the class.
2. Type of movement response anticipated - the more the subjects knew ahead of time what movement might occur during the observation experience, the easier they felt it was to observe.
3. Ability level of the students - the extremes in ability level served as a distraction for some observers.
4. Number of students - the more students (over 8) in the situation the more

difficulty the observers had attending to their plan for observation.

5. Speed and repetition of movement - the speed of the movement and the number of times the observers saw the movement affected their ability to observe.

Implicit in the principle of analysis is the idea of being prepared in advance.

Barrett presented the principle of planning, which states that observers who try to see everything often end up perceiving nothing. This seems to hold true with all observers regardless of their observation ability. Besides being able to analyse the movement being observed, planning for observation seems the next most essential step. Without it, observers tend to miss more than they see. Therefore, observers needed a scanning strategy which involved a scheme for what to observe, when and for how long.

The final principle was that of vantage point as many observers are often in extremely poor positions to see. The recognition of where the good and poor spots were, became increasingly easier as they became more aware of how their position directly influenced what and when they could observe.

In summary, a further study by Barrett (1979) on the implications of observation of movement for teachers, four concerns were examined.

1. The skill of observation - observation plays a very critical role whether

skill analysis is viewed as task specific, as the analysis of human movement in general, or as the identification of developmental sequences.

2. Understanding movement - the need for a knowledge base as a prerequisite for skilled observation is implied rather than suggested.
3. Factors affecting observation - concentration, speed of the movement, number of students, observer's personal skill ability and the lack of a visual strategy.
4. Teaching observation - skillful observation will not develop automatically, it needs carefully designed guidelines and the observer's abilities need practice.

Sport Analysis

Franks and Goodman (1986) stated that subjective information gained from the coach is of some use but it does not describe the athletic performance completely or accurately. They stated that a complete and accurate description of the performance should be designed before training sessions can be initiated. The major concern of this discussion was the establishment of a sound base for the evaluation of first the identification of the key factors of performance and then

prioritizing these key factors. There are critical elements in the game and they are placed in logical sequence. The third step is acquiring the information and because coaches encounter problems in memorizing, assimilating and categorizing all the events in a performance, then a recording method is needed.

Research on performance analysis by Franks, Goodman and Miller (1983), stated that the ideal situation for a coach would be to have one assistant coach videotape the competition and another assistant coach record game statistics, thus providing the head coach with a record of the critical events videotaped which would permit a detailed editing of the game videotape. Such conditions would be far superior to the present situation where coaches commit to memory all the critical events of the game and attempt to recall them for the design of the next practice.

In a study done on a general model of team sports by Franks, Wilson and Goodman (1987), a microcomputer was used to analyze and describe the events in the sport of Field Hockey. The hypothesis put forward was that an accurate and detailed description of the sequence of events in a performance was potentially of more use to the coach than a qualitative description that was typically gained from subjective analysis. The critical events of competition were recorded in real time and selected items of team play (critical events) were sequentially stored. This would provide coaches with accurate game event information that is so vital to error detection, correction and overall performance assessment. This analysis

would help to supplement the observations made by a coach and direct their observations toward specific game events, but not every coach has access to this technology.

Franks, Goodman and Miller (1983) identified two error sources for coaches when they relied heavily upon subjective assessment of game actions:

1. The first area was highlighting which involves occurrences in a game that stand out. These could include goals, controversial decisions by officials and technical achievements by players. This tends to distort the coaches assessment of the complete game. This would relate to the von Restorff effect where distinctive cues at an intermediate point in free recall result in a pseudo-primacy effect (in Neisser, 1982).
2. The second area was human memory which has its limitations and the impossibility of remembering all the game events. Emotion and personal biases and expectations can also effect the memory process. Material in short-term memory will only remain for half a minute before any long-term memory processing occurs.

The alternative is quantitative analysis with the use of a computer, which records game statistics and a videotape. The events would be coded in real time on the video and they would be fed into an interactive computer video. This would allow the coach to have immediate video access of specified game events,

for feedback to the players. Such an approach employs this technology which utilizes a structure to categorize events and presents them in a systematic summary form.

An example of how a framework may help direct coach's observations and collect relevant data was completed by Franks and Goodman (1986). The study focuses on key elements of performance that could be applied to analyze quantitatively the performance of an athletic event. This was discussed with respect to both team and individual sports. Their model of sport analysis relies heavily upon quantifiable data collection using modern technology (microcomputers).

Once the performance errors have been detected with the use of a systematic analysis, a structured programme of instruction can be designed to meet the needs of the team. The researchers term this method "practice by objectives" i.e., identify the ways in which criterion performance is achieved and develop practices to fulfill the objectives that have been identified as a consequence of comparisons between criterion and actual performance.

The evaluation of a performance in a soccer context, includes: a) determining the structure of the performance i.e., where on the field did our team win and lose possession of the ball b) priority events are placed in a hierarchical scheme c) acquire the information i.e., competition related events are recorded efficiently (microcomputer). This leads the coach into planning the next practice with clear objectives and evaluating the session afterwards. The hierarchical scheme of the structure

of performance could be termed as Wickelgren (1979) does, a set of nodes associated in a branching structure that could constitute a plan, in this program, for scoring a goal.

Franks (1988) proposed a systematic framework for the analysis of Association Football (Soccer) based upon a quantitative analysis gained from all levels of competition. Within the team play, Franks found that certain events follow one another in a predictable and sequentially dependent manner within the rules of the system. He went on to discuss how goals were scored, what leads to the scoring of goals, the importance of set plays, an analysis of crosses, and defending. A framework for analysis was then set up to collect all of the data from the competition.

Franks made recommendations on the key factors of successful performance for players and for coaches stating that a large portion of coaching entails the detection and correction of errorful performance. In order to detect and analyze performance in a continuous team game such as soccer, it is essential that some record of performance, other than subjective opinions gained from casual observation, be obtained. The basic finding in research on the accuracy of coaching observations is that it is extremely errorful as human memory is subject to definite limitation and is easily biased by personal expectations.

Franks recommends that coaches record the critical events of competition. This would lead to a framework for analysis. This could be done using a pencil and paper checklist, a

sophisticated computer aided recording system, an audiotape recording of observations or a videotape of the entire game. Each of these methods provides a memory aid for the coach, but he recommends the videotape as the best data recording device as it has the additional benefit of allowing the coach to provide the players visual feedback on their performance.

The sport related research considers several factors that are related to the eyewitness testimony of crimes and the ensuing structural framework that must be put in place to improve observer accuracy. The structure of the performance must be developed first; secondly, the critical events must be identified in relationship to the structure; thirdly, the systematic observational framework is used to direct the coaches' observation and aid them in their recall of the critical events.

The systematic framework that has been developed for the purpose of this research is presented in Figure 2 and the detailed statements used within the framework in Appendix 8. This framework will direct coaches' observations towards certain critical events in the game and assist them in anticipating these events prior to them occurring I would expect that once this priming has occurred then the coaches' recall of these events will be much higher than if they were not exposed to this systematic framework.

APPENDIX 2

PILOT STUDY 1

Coaches must be able to focus on the critical events to obtain some form of accuracy and need the training to do so. Franks and Miller (1986) compared eyewitness testimony in criminal situations to observations made by coaches following a sporting performance. An experiment was undertaken in which novice coaches were tested on their ability to observe and recall critical technical events that occurred during one half of an international soccer game. These critical events included ball possession, passing, crosses, set plays, goalkeeper contacts and shots at goal. Three randomly assigned experimental groups were given instructions either prior to or following the game. This secondary concern was to determine if variations in pre-event instructions would have any effect on the observations of the coaches. These instructions varied in the amount of information that was given to direct the observations of the coaches toward a final post game questionnaire. The group that had the lecture on key factors of performance prior to viewing should have shown superior observational qualities than the control groups. The results showed that there were no statistically significant differences between experimental groups, but there were differences in the ability of coaches to recall certain categorized events more accurately than others.

The overall observational accuracy of the coaches was 42% with the category of set plays being better recalled than ball

possession, goalkeeper contacts, crosses, shots and goals. This could have been due to the discontinuity of set plays as the continuous nature of the game stops and is started in an organized format for set plays. These stoppages in action may be used by the observer as a framework around which the game events can be organized. This point was made previously by Newton (1976) who defined action that is perceived, as a change of stimulus array. He went on to propose that behaviour perception should be viewed as feature monitoring and when one of these features change state then a breakpoint occurs. The definition of what are considered to be breakpoints in the action becomes critical if we are to understand the process of observation.

From this initial study of observational accuracy of coaches several problems were encountered that were examined in Pilot Study 2. The problems included the use of novice coaches who would not have any directed system of observation for the game of soccer. The number of critical events that they had to observe would have been so extensive it would exceed the limits of short term memory. The problems would be solved by: (1) using experienced coaches as subjects (2) allowing a period of training for directing observations (3) reducing the number of critical features that should be observed (4) identifying the organizing principles of behavior observation for specialized groups of coaches.

APPENDIX 3

PILOT STUDY 2

In a follow-up to the preliminary study by Franks and Miller, (1986), experienced coaches were also asked to recall certain events in a game they had just watched. The purpose of Pilot Study 2 was to overcome the problems in Pilot Study 1 regarding the training of their observational skill.

PROBLEM 1 - Using Experienced Coaches - The experienced coaches held a C License in the National Coaching Certification Program and were taking the first part of their B License course.

PROBLEM 2 - A Period of Training - The coaches were trained for twenty minutes on focusing in on certain critical features in the game prior to the testing being started.

PROBLEM 3 - Reducing the Number of Critical Features - The five critical features included goals, shots, missed shooting opportunities, set plays and crosses. This was one critical feature less than what was used in the preliminary study.

PROBLEM 4 - Identifying the Organizing Principles of Behaviour Observation - The training program involved the organizing principles of team analysis that was used in Franks and Goodman's study (1986).

The results showed that the coaches were 64% in error overall but when the five critical feature categories were analyzed individually, goals were recalled most accurately (72%). Therefore, the experienced coaches while being superior at recalling information relative to goals, were no better than

novice coaches at recalling other key elements of team play. The critical feature categories were derived from previous studies done on the game of soccer by Reep and Benjamin (1968), Franks and Thomson (1982), 1982 World Cup Analysis.

Coaches were very accurate in recalling goals but their memory of shots and other features were poor. But shots are very crucial because they lead to goals, therefore, goals are a consequence of shots. Consequentiality refers to how something changes as the result of an event occurring.

The goal may be a benchmark (Newtson, 1976), that becomes important after the event. I would suggest that benchmarks should be more widespread. Therefore, the proposed study is a systematic training program aimed at developing a schemata of predictive features (see Figure 2) for soccer coaches. In order to do this, a logical, systematic approach to the game was developed (see Figure 2 and Appendix 8). This was done from previous quantitative analysis of the game of soccer by Franks and Thomson (1982). These results lead to Pilot Study 3 which would attempt to look at the critical features of goals, shots and missed shooting opportunities and the events which led up to them.

APPENDIX 4

PILOT STUDY 3

INTRODUCTION

In the third study, Level III (experienced) coaches were used again. The critical features were comprised of goals, shots and missed shooting opportunities to determine exactly how much observational error there was for goals compared to shots compared to missed shooting opportunities. The events leading up to goals, shots and missed shooting opportunities were determined by comparison to the objective analysis of the videotaped game.

METHOD

The coaches were divided into an experimental and two control groups. They were told that they would be asked to recall the critical features of goals, shots and missed shooting opportunities after observing a fifteen minute segment of a videotaped game. All three groups received the same pretest (view the same videotape and answer the same questionnaire) (See Appendix 7). The experimental group was then put through the following seven videotape training program: The first tape clarified examples of won ball possession. The second tape presented examples of set plays. The third tape showed examples of crosses. The fourth tape showed examples of penetrating passes. The fifth tape showed examples of missed shooting opportunities. The sixth tape showed examples of shots taken and the seventh tape showed examples of goals scored. This procedure stimulates the process of elaborative rehearsal which

deals with new information in terms of it's meaning as processing is taking place at a deeper level (Kimble, Garnezy and Zigler, 1980).

The first control group answered the same questionnaire after each of the seven different videotapes without any training. The second control group did their own personal analysis after each of the seven videotapes.

RESULTS

The results showed that goals were again recalled more accurately than shots and missed shooting opportunities by all three groups. The experimental group recalled goals more accurately (an increase of 29%) than Control Group 1 (21%) and Control Group 2 (8%) in the posttest. Therefore, a detailed study will be done on goals, shots and missed shooting opportunities with all three groups. Each event and location must be described leading up to the goal, shot and missed shooting opportunity. This will give a better indication of the success of the training program.

GENERAL DISCUSSION

The three pilot studies that were conducted leading up to the final study give a clear indication to the researcher focusing in on the specific critical features that must be first observed and then recalled by experienced coaches. The initial research used novice coaches to test their ability to observe and recall critical events that occurred in one half of an international soccer game. The results showed that there were differences in the ability of these novice coaches to recall

certain categorized events more accurately than others. From this study it was decided that the following study would use experienced coaches, a training period to direct observations, reduce the number of critical events to be observed and identify the organizing principles of behavior observation.

The first experiment utilized experienced coaches and trained them to direct their observations. Five critical event categories were observed and the results showed that these coaches were very accurate in recalling the goals but poor with their memory of shots, missed shooting opportunities, etc. Therefore, from this study it was decided that Pilot Study 3 would utilize experienced coaches again observing the critical events of goals, shots and missed shooting opportunities only.

The third Pilot Study used experienced coaches again examining the critical features of goals, shots and missed shooting opportunities. The training program consisted of videotapes on a) ball possession, b) set plays, c) crosses, d) penetrating passes, e) missed shooting opportunities, f) shots and g) goals. This progressive manner of training resulted in the Experimental group recalling goals more accurately than the two Control groups. Therefore, a detailed study was to be done using experienced coaches, a similar training program to Pilot Study 3 and a pre and posttest examining the correct recall of the context surrounding goals, shots and missed shooting opportunities, for and against.

The purpose of the study was to design a training program that will improve the perceptual organization of soccer coaches

and direct their observations toward the more accurate identification of the critical features of the game: a) creation of shooting opportunities, b) the taking of shots and c) the scoring of goals. If a coach is able to focus on the critical features of the game as identified in the previous experiment, then the observational framework that will be used in training to modify and improve performance, will be substantiated. Therefore, it was necessary to identify the events that had a higher probability of leading to shooting opportunities. These events were ball possession, set plays, crosses and penetrating passes (Franks and Thomson, 1982).

APPENDIX 5

CRITICAL GAME EVENTS

GOALS SCORED

The objective of the game is to score goals and the final result of the game will depend on the number of goals that are scored. In Pilot Study 2, the highest level of observational accuracy attained by the coaches was in the goals category. In a study on training people to recognize faces, (Woodhead et al, 1979) subjects were less accurate in identification when emphasis was placed on isolated facial features. They concluded that considering the face as a whole would be more accurate. Therefore in tracing back how a goal originated will give the coach an idea of the whole event. (Newton's breakpoint).

SHOTS ON GOAL - The goals that are scored originate from a shot on goal. Research states (Reep et al, 1971) that shots are a random occurrence during a game and shots on goal are a random occurrence of all shots that are taken. Research shows (Olympic Team Report, 1983) that for every four shots on goal, one goal will be scored. Shots that are kept low (below 8 feet) have a greater chance of becoming a goal (Franks, 1988).

ALL SHOTS TAKEN - The shots taken include those that are on target, off target and blocked by players on either team. Results show (Olympic Team Report, 1983) and (Reep, 1971) that for every ten shots taken, one goal will be scored.

OPPORTUNITIES TO SHOOT FROM A GIVEN AREA OF THE FIELD - The physical demands of shooting on goal from thirty-five yards away result in all goals originating from within this area of the

field. This area has been termed the attacking one-third. If the ball is repossessed in this area of the field there is a greater chance (65%) of the team scoring a goal rather than in the middle one third (25%) and defending one-third (10%) (Reep and Benjamin, 1968; Franks and Thomson, 1982; Franks, Goodman and Miller, 1983).

SET PLAYS - This is the total number of set plays (corner kicks, free kicks, throw-ins) that occurred. Results show that 30% of all goals are scored from set plays (World Cup Analysis, 1984, Franks, 1988).

CROSSES - This is the total number of crosses that occurred. The ball is played from a flank position into the penalty area. Results (World Cup Analysis, 1984, Franks, 1988) show that 25% of all shooting opportunities that are not set plays, result from crosses. Results (Franks, 1988) show that crosses that were contacted by an attacker have an 8:1 goal ratio and crosses that lead to shots have a 5:1 goal ratio.

PENETRATING PASSES - Penetrating passes are balls that are played between or over defenders into space. Attackers can run onto the ball in this space which creates a one-on-one situation with the attacker and the opposition's goalkeeper or a crossed ball 80% of goals are scored from 4 passes or less (Reep, 1979).

DRIBBLES - This critical feature occurs when an attacker dribbles the ball past a defender and then has an opportunity to shoot the ball or cross the ball.

CORNER KICKS - These are balls played from the corner of the field into the middle of the goal area. A high percentage of

shooting opportunities result from this set play when the ball is an inswing kick to the near post area (Franks, 1988).

THROW-INS - These are balls thrown in from the side of the field. If a player can throw the ball a long distance then it is similar to a corner kick and creates shooting opportunities.

FREE-KICKS - These are balls that are placed at locations on the field where fouls have occurred. These can either be direct shots at goal or indirect (played twice or more) shots at goal.

PENALTY-KICKS - If a foul occurs inside the penalty area a penalty kick is awarded. The goalkeeper stands on the goal line, the ball is placed twelve yards out from the goal line and one attacker has a direct shot at goal. The rest of the players must remain outside the penalty area. A very high percentage of goals are scored from this free kick.

KICKS OUTSIDE THE PENALTY AREA - These are free kicks that are taken from other locations on the field other than the penalty area. The defending team must stand at least ten yards away from the ball until it moves.

REPOSSESSION AS A SET PLAY THAT IS PLAYED FORWARD - When the ball is won from the opposing team for a set play. At the set play the ball is played forward into a shooting position.

REPOSSESSION IN FREE PLAY THAT IS PLAYED FORWARD - When the ball is won from the opposing team in free play. In free play the ball is moved forward into a shooting position.

ALL REPOSSESSIONS - This occurs when the ball is won from the opposing team. There are over 200 repossessions in one game (World Cup Analysis, 1984, Franks, 1988). The repossession of the ball is a natural break-point (Newtonson - 1976).

APPENDIX 6

CRITERION CODE

1. Won Possession (W.P.) - A team has won possession of the ball.
2. Lost Possession (L.P.) - The opposing team regains the ball through a tackle, a poor pass, kicked out of bounds or a shot saved by the goalkeeper.
3. Throw-In (T.I.) - The ball goes out of bound at the sides of the field and it is thrown back into The field of play.
4. Shot on Target (S.O.T.) - A shot that is saved or becomes a goal.
5. Missed Shooting Opportunity (M.S.O.) - A shot which is not taken (player dribbled or passed off).
6. Square Pass (S.P.) - Teammates are parallel and the pass travels across the field.
7. Back Pass (B.P.) - Pass played in direction of own goal.
8. Forward Pass (F.P.) - A pass played towards the opponent's goal.
9. Direct Free Kick (D.F.K.) - The ball is placed at the point of a foul.
The ball can be hit directly at the goal.
10. Cross (C) - The ball is played from the wing position into the penalty area.

Criterion Code (Continued)

11. Far Post (Far P.) - The goalpost farthest from where the ball is situated.
12. Goalkeeper's Kick (Goal K.) - The ball is kicked from out of the goalkeeper's hands.
13. Goal Kick (G.K.) - The ball is placed on the six yard line and kicked out of the penalty area.
14. Goal (G) - The whole ball has crossed the goal line
15. Shot High (S.H.) - A shot over the crossbar.
16. Shot High and Wide (S.H.W.) - A shot above the crossbar height and wide of the goal.
17. Shot Wide (S.W.) - A shot that is below the crossbar height that crosses the endline.
18. Shot Saved (S.S.) - A shot that is caught, punched or deflected by the goalkeeper.
19. Shot Blocked (S.B.) - A shot that is knocked off of it's original path by an opponent or teammate.
20. Attacking 1/3 of the Field (A 1/3) - The part of the field from the goal line to 35 yards out into the field of play.
21. Middle 1/3 of the Field (M 1/3) - The part of the field from 35 yards out from one goal line to 35 yards out from the other goal line.

Criterion Code (Continued)

22. Near Post (N.P.) - The goalpost nearest to where the ball is situated.
23. Mid-Goal (M.G.) - The central part of the penalty area at the penalty spot.
24. Indirect Freekick (I.F.K.) - The ball is placed at the point of a foul. The ball must touch two people before it enters the goal.
25. Right (R) - Right side of the field (20 metres in from the sideline).
26. Left (L) - Left side of the field (20 metres in from the sideline)
27. Central (C) - Central section of the field (the middle 20 metres of the field).
28. Corner Kick (C.K.) - The ball is placed in the corner of the field and kicked into play.
29. Penalty Kick (P.K.) - The ball is placed 12 yards out from the goal line and kicked at the goal.
30. Drop Ball (D.B.) - One player from each team kick the ball after it has dropped from the referee's hands and hit the ground.
31. Penetrating Pass (P.P.) - A ball played between or behind defenders into space.

Criterion Code (Continued)

32. Dribble (D.) - A player runs with the ball at his feet and beats a defender.
33. Long Pass (L.P.) - A ball passed over 15 metres.
34. Short Pass (L.P.) - A ball passed under 15 metres.
35. Running with Ball - Running with the ball in open space.
(R.W.B.)

APPENDIX 7

QUESTIONNAIRE

GAME ANALYSIS

1. Describe in point form the sequence of events leading up to the scoring of each goal. Start with the goal first and recount the events using the terms from the Criterion Code and the field positions only.

[illegible]

2. Describe in point form the sequence of events leading up to the taking of each shot (not the shots that were goals). Start with the shot and recount the events using the terms from the Criterion Code and the field positions only.

3. Describe in point form the sequence of events leading up to each missed shooting opportunity (not the shooting opportunities that were goals or shots). Start with the missed shooting opportunity and recount the events using the terms from the Criterion Code and the field positions only.

APPENDIX 8

TRAINING PROGRAM

COACHING ANALYSIS 15 MINUTE SEGMENTS

EXPERIMENTAL GROUP

1. WON BALL POSSESSION

- Looking for the probability of a change in possession.
- Where on the field the possession was won.
- The chance of going forward with the ball to create a shooting opportunity.

2. SET PLAYS

- Was the ball played forward.
- Was the ball played into a shooting position.
- Were there players in a position to take a shot.

3. CROSSES

- Did the attacker beat a defender prior to crossing the ball.
- Was the ball crossed into the penalty area.
- Were there players in a position to challenge for the ball.

4. PENETRATING PASSES

- Was the ball played between or behind defenders.
- Were there attackers running onto the ball.

5. SHOOTING OPPORTUNITIES

- Is the ball being played into positions within the shooting angle.
- Can the player shoot.

6. SHOTS TAKEN

- Is the shot on target.

7. GOALS SCORED

- Is the shot a goal.

CONTROL GROUP 1

- They will watch the seven videotapes and complete the same questionnaire that they received in the pretest (Appendix D).
- They will not discuss their answers with the other coaches.

CONTROL GROUP 2

- The control group will discuss amongst themselves their thoughts on the seven videotapes.
- They will write down their analyses and formulate a plan for next week for Team A.

APPENDIX 9

National Coaching Certification Program

	Level I	Level II	Level III	B License	A License
Technical	16 hours	16 hours	16 hours	2 years	2 years
Theory	14 hours	21 hours	35 hours	Over two years Technical & Theory Combined	
Practical	One Season	One Season	C License 24 hours		

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