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Identification and Analysis of the Mental Imagery Content of Ski Racers

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ABSTRACT

In order to answer the following questions:

1) What is the nature of the mental images visualised by the students within their spontaneous mental imagery training process?

2) Is there any relationship between the components of the mental imagery process (the mental images themselves) and the level of performance of the person involved in the mental imagery practice ?

Thirty ski racers (average age = 15.9) were divided in two performance groups and asked to execute and describe their usual mental imagery training sessions. The transcripts were gathered and a structural qualitative analysis procedure was conducted. As a result, a list of mental imagery codes (or components) of the mental imagery process of the participants was produced and the findings of the application of “T-Test” technique demonstrated that 2 specific codes were significantly (alpha level of 0.05) related to the level of performance of the imagers.

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CHAPTER ONE: INTRODUCTION

SPORT PSYCHOLOGY:
A NEW HIGH SCHOOL CURRICULUM IN ALBERTA

This study investigates the Psychological Training Skill (PST) of "mental imagery" from a different and unusual perspective, the field of education. Based on the review of literature, mental imagery (mentally repeating physical actions) has been mostly studied within the specific field of sport psychology, and the more general field of sports sciences. This transition from the domain of sports sciences to the educational field is justified by the fact that a new curriculum has been approved and is being taught in the Alberta School System, "Sport Psychology 1451". In this first section, I would like to present the contextual background that permitted the development of this new curriculum and in turn, led to the identification of the particular problem area of this investigation.

Defining Sport Psychology and Psychological Skills Training (PST)

The term "sport psychology" defines two different domains. One meaning relates to the professional practice of psychological interventions with athletes. The main objective of this group of specialists[1] has been to facilitate and/or enhance sports performance (Murphy, 1995). The other interpretation of the term refers to the academic discipline found in

[1] i.e. "sports psychologists"

Universities sports sciences and physical education departments. The interest of the partaker within this realm of research has been the investigation of the psychological factors that influence sports and exercise participation, and the psychological effects of the involvement in those same activities (Murphy, 1995). These two interpretations have one thing in common, they both relate to practices (professional and academic) directed and exclusively reserved for very narrowly defined groups of individuals. The professional sector of sport psychology ("sport psychologists") has focused its attention and resources toward elite athletes, while the academic field of sport psychology ("scientific researchers") has been reserved for university professors, graduate students and some undergraduate students enrolled in physical education programs. Historically, the two preceding sectors have established and broadened the recognition and knowledge base of the sport psychology field. Parallel to this development, I also believe that the field of sport psychology will not be complete until such services, or at least the knowledge and skills associated with this field, are made available to a broader population through the high school system.

Since the early 70's, psychological skills training (PST) has been part of the development of elite athletes (Burton, 1991 from Sinclair & Sinclair, 1994). Psychological Skill Training, as defined within the field of sport psychology, includes such topics as goal setting procedure, auto-regulatory process, arousal control techniques, mental imagery training, and stress management techniques (Whelan, Mahoney and Meyers, 1991). More specifically for educators, Petlichkoff (1991, from Sinclair & Sinclair, 1994)

stated that there is a need for the delivery of PST services to young athletes from an educational perspective, rather than from the usual clinical perspective. In other words, PST should be available within a context that is easily and readily accessible to young athletes, namely the school system.

Combining a bachelor's degree in physical education, a certificate in educational science, experience as a high school and junior high teacher, graduate studies in sport science (sport psychology) and being an ex elite athlete, I came to the conclusion early in my teaching career, that young athletes in particular and high school students in general, would benefit from a sport psychology course. Following my convictions, I developed a curriculum that has since been approved by Alberta Education and became a new course taught at the high school level in the province in 1994, "Sport Psychology 1451[2] ".

Developing a Curriculum:
A Procedure of Inclusion and Exclusion

In 1992, I was hired as an educational consultant at a private school for ski racers. During the first year, I "consulted" with many athletes. The general topic of these consultations were explicit; all of the students were searching for ways to enhance their sports performance. During those sessions, we discussed specific sport psychology and mental training techniques such as mental imagery, stress management and goal setting procedures.

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[2] Sport Psychology 1451, 2451 and 3451 have also been approved

A parallel, and unexpected result of these sessions was that many other topics, more general in nature, were also discussed. Such topics included coach / athlete relationships, athletes self-determination, parental pressures and other external pressures to perform, making sense of their athletic endeavours in the scheme of their life, and problems relating to clear and personal motivations for competing. From these discussions, I realised that some specific and unique needs were not being addressed within the school where I delivered my services as a "Sport Psychology Teacher". In short I realised the students needed to:

1) learn specific psychological skills (or PST) as defined within the field of "sport psychology",
2) to be involved in an educational process in which they would develop a personal philosophy regarding the act of competing; more than just learning the mental training techniques, they needed to become self-reliant and autonomous regarding their "mental game".

These outcomes became the premise of my future interventions as an educator. I decided to develop a sport psychology course that would achieve these objectives.

At the beginning of the procedure, I established criteria that would guide my critical decisions of inclusion and exclusions of possible material within the emerging curriculum. I was fully aware that my role as a curriculum developer would help me to "legitimate particular beliefs while delegitimating others" (Kincheloe, 1993, from Slattery, 1995). Three criteria served as safeguard and promoted an objective perspective in the

development of the curriculum:

1) needs of the specific clientele (addressed above);

2) empirical support in the sport psychology literature; and,

3) actual use by athletes and coaches.

Empirical Support for the Components of the Curriculum

After realising that a sport psychology and mental training course for young athletes had to be more than teaching self-affirmation and relaxation techniques, as it is often the case in "how to" books found on the market, I proceeded with a review of the sport psychology literature. My objective was to include topics within the curriculum on the basis of empirical data from scientific studies in the field. This process turned out to be very frustrating; the field of research in sport psychology defines itself as "scientific" and the intervention of "applied sport psychologist" is supposedly based on empirical data, yet I found very few studies confirming the effectiveness of PST in the promotion of enhanced performance in sports. The results of most research on topics such as goal setting, auto-regulatory process, multiple component interventions, and arousal control are to date, non-conclusive. The only exception to a certain extent, was the domain of mental imagery.

Actual Use by Athletes and Coaches

Through my readings and discussions with students, one fact emerged with undeniable clarity: "Mental Imagery"or "Visualisation" was the most popular of all the PST used by athletes (Weinberg, 1982; Whelan, Mahoney &

Meyers, 1991). Orlick and Partington (1986), Mahoney and Avener (1977) and Meaney (1984) conducted interviews in which athletes listed mental imagery as their preferred PST. Furthermore, interviews with coaches (Howe, Barber, McKenzie & Streinbrink, 1990) suggest that mental imagery was the PST most often advised by coaches as a psychological performance enhancing technique.

Based on my review of literature and discussion with the students involved in the program, I included many topics in the initial curriculum: Introduction to Sport Psychology, Goal Setting, Pre-Competition Routine, Stress Management, Mental Imagery, Focussing and Attentional Skills, Peer Pressure, and Building a Personal Mental Training Program. Interestingly enough, only one of those topics satisfied all of the three criteria I had previously identified; Mental Imagery. All of the others were included because I felt they were supported by the literature (yet not conclusively) and made sense within the context of the development of young elite athletes.

Teaching a New Course

The procedure of approving locally-developed courses promoted by the Ministry of Education in Alberta requires that the course be taught for one year before the curriculum is submitted for approval. During this first year, I transposed my thoughts to the real life situation of the classroom. Among the topics taught, the most popular was the "mental imagery" module. This situation did not surprise me. The human fascination for this ability to imagine and create an internal and distinct reality was documented as far back

as the Greek civilisation (Blanc-Garin, 1974). The teaching of the module on mental imagery became a crucial element of the curriculum I designed and implemented. The athletes all wanted to learn to visualise better, the coaches involve in the program wanted to know more about the topic, and anecdotal events seemed to suggest that the act of visualising the physical actions of ski racing facilitated the actual real life performance of the sport by the students involved in the sport. Naturally, as an educator, I wanted to know more and initiated the present investigation, gathering material, reading all I could find on the topic of mental imagery and visualisation.

In summary, I became a sport psychology teacher and curriculum "developer" because I recognised a need within the educational clientele I was teaching. The most original contribution I have made so far to the educational field was to **transfer** the field of sport psychology from its present status as a subdiscipline of the very "academic" sports sciences domain, to the high school classroom. More importantly, the attempt to justify all of the components of the course by using scientifically recognised data and criteria made me aware of the shortcoming of the field of "academic" or "scientific" sport psychology. It became apparent I was facing a dilemma: Sport Psychology investigations of Psychological Skills Training have, in most cases, been conducted from within the boundaries of the traditional scientific paradigm; yet, this paradigm does not seem to be adequate in regards to the practical application of the data gathered. In the reality of my exposure to sport psychology it seems that "Sport Psychologists" from the professional and the academic realm, are primarily "teachers"; they distribute theoretical

and practical knowledge with the general objective of facilitating the sports performance of the participants. From a "clientele's" perspective, it seems that education regarding PST is desired and demanded rather than clinical psychological introspection and/or psycho-analytical procedure. Both specialisations of the field, sport psychologist and researchers in sports science do not address this need.

As an educator developing a new course, I decided to adopt a different perspective and transfer the investigation of PST from the very traditional field of Sports Science, and by large extent from the scientific paradigm promoting **Quantitative** methodology, to the educational field and execute a **Qualitative** investigation of a topic that would enhance the actual material comprised in the newly developed curriculum "Sport Psychology 1451". My intention, through the present investigation, is to explore a specific area of the field of sport psychology; namely mental imagery, from a distinct and new educational perspective.

PROBLEM AREA

The specific problem investigated in the present study originated from a series of events that took place within the context of the high school course Sport Psychology 1451. It was during one classes on the topic of "Mental Imagery", that a group discussion led to the identification of the problem area. After the students were told to use mental imagery everyday as a psychological training technique, one student proposed the following question:

You tell us to visualise, to imagine ourselves skiing, but what ***specific images*** *should I visualize?*

The question seemed quite simple at first, the student wanted to know the specific nature of the images that would facilitated and/or promote performance enhancement. I gave the usual explanation I had read in the literature; you should visualised yourself succeeding, you should relax before your visualisation sessions, you should try to adopt an internal perspective (see yourself as if you were part of the action by opposition to an external perspective where you are an external spectator of the action) and, finally you should try see yourself succeeding. In retrospect, these suggestions constitute the usual instruction given to athletes, they are almost "cliches" within the field of sport psychology. As the discussion went on, I soon realised I was incapable of specifying the specific mental images the students **should** visualize. The student who posed the initial question, added:

You don't understand, I want to know exactly what ***elements*** *of skiing I should visualise; should I imagine the movement of my feet, should I imagine the entire process of ski racing or should I feel the emotions I would live during a race ?*

I was unable to suggest a definite answer. The session ended and the students were asked to complete the following assignment: "Visualise

yourself skiing as you would normally do and describe the images you see." In the meanwhile, I revisited the bibliography on the topic of mental imagery; it seemed that the actual components of the mental imagery process had never really been "described", even less so "analysed".

The following class, descriptions of the mental imagery process were submitted by the students, and we reviewed and compared them. To the surprise of all the participants and myself, the mental imagery components visualised were quite disparate from one participant to the other. During a discussion that followed, it was suggested that maybe all of the best ski racers visualised similar mental imagery components. This assumption was based on all of the group common sense and intuition. I decided this question should be properly investigated.

Purpose of the Investigation

From these events which took place within the context of developing and teaching the curriculum of the course, "Sport Psychology 1451", the concept for the proposed investigation was formulated, in order to achieve the following objectives:

1) improve the theoretical and practical knowledge supporting the curriculum of the course Sport Psychology 1451;
2) improve the content of the specific module on the topic of mental imagery; and,
3) respect the emergent information suggested by the clientele.

In summary, the two following questions have been posed and investigated:

1) What is the nature of the mental images visualised by the students within their spontaneous mental imagery training process?

2) Is there any relationship between the components of the mental imagery process (the mental images themselves) and the level of performance of the person involved in the mental imagery practice ?

In short, the investigation attempted to answer the broader question suggested by the students: **“What Mental Images should I visualise ?”**

CHAPTER TWO: REVIEW OF LITERATURE

GENERAL REVIEW ON MENTAL IMAGERY

The concept of mental imagery refers to "all those quasi-sensory and quasi-perceptual experiences of which we are self-consciously aware and which exists for us in the absence of those stimulus conditions that are known to produce their genuine sensory or perceptual counterparts" (Richardson, 1969, pp. 2-3). Historically, the interest for mental imagery as a psychological training technique for sports came to the forefront following the publication of a series of interviews (Suinn, 1982; Orlick & Partington, 1986; Mahoney & Avener, 1977; Meaney, 1984). Within these interviews, many elite athletes acknowledged the fact that they used mental imagery as a major component of their psychological training.

Historically, in terms of methodology and rationale, the application of the mental imagery procedure to sport enhancement has been a logical continuation of the studies conducted in the field of visualisation and the learning of complex motor tasks (Van Gyn, Wenger & Gaul, 1990). Grouios (1992) identified three-hundred (300) studies on the topic of mental imagery, some dating as far back as the late 1800. Many of those studies indicated that mental imagery practise can enhance the performance of motor tasks (Richardson 1967, a & b; Corbin, 1972, Weinberg, 1982; Feltz 7 Landers, 1983; Silva, 1983; Suinn, 1983; Oxendine, 1984).

Despite these findings, many authors such as Richardson (1967 a & b), Weinberg (1982), Suinn (1982) and Feltz & Landers (1983) have been cautious

in their report that mental imagery actually facilitates the execution and the performance of motor tasks. In most cases, the studies have been executed within a behaviourist context, limiting the investigation to a system of stimuli and responses. The investigators did not pay much attention to the actual images visualised by the participants, their attention was focused toward the effect of mental imagery practices on the performance of motor tasks. One of the shortcoming of the behaviourist paradigm, is stated by Capra (1982):

> *The basic behaviourist assumption was that the complex phenomena could always, at least in principle, be reduced to combination of simple stimuli and responses. Thus the laws derived from simple experimental situations were expected to apply to more complex phenomena, and conditioned responses of ever increasing complexity were seen as adequate explanations of all human expressions, including science, art, and religion.*
> *(p. 174)*

Within the field of sport psychology in general and in the investigation of mental imagery in particular, the simple stimuli-responses relationship has not produce the expected results; it did not conclusively transfer to the broader, more complex arena of sports performance. As an example, some studies might have shown that visualising facilitates the execution of a

basketball free throw (Hall & Erffmeyer, 1983, for example), but it has not necessarily improved the performance of the same athlete in the more complex and unpredictable environment of a basketball **match**.

In summary, the effectiveness of the practice of mental imagery and visualisation in sport enhancement has not yet been unquestionably demonstrated (Murphy & Jowdy, 1992). Until now, the investigation of the mental imagery process has led to the identification of some imagery "mediators" such as attaining a state of relaxation or the actual perspective of the subject visualising, that might enhance the effectiveness of the overall process of imagery. However, investigators in this specific field have been in search of new avenues to explore. Chevalier, Hall & Nadeau (1990), summarise the state of the investigations in the field of mental imagery in this way:

> *Two main questions are being studied:*
>
> *the largely studied question of the **EFFECTS** of the practice or mental imagery on the acquisition of motor abilities,*
> *and ...*
> *the rarely studied question of the **NATURE** of the images visualised during the practice of mental imagery .* (p.18)
>
> (author's translation)

SPECIFIC REVIEW :

IDENTIFYING AND ANALYSING THE NATURE OF THE MENTAL IMAGERY PROCESS

The present study will focus on the second question defined by Chevalier, Hall & Nadeau (1990); identifying and analysing the nature of the mental images visualised by athletes. This type of investigation is almost absent within the mental imagery literature; the detailed description of mental imagery sessions and processes as practised by subject of investigations have rarely been, if ever, presented by authors. Actually, only one study (Chevalier & Renaud, 1990), has presented a detailed description of the mental images visualised by the subjects. This situation is unforeseen since many authors, amongst them Paivio (1985), Burhans Richman & Bergey (1988), Wollman (1986), Howe, Barber, Mackenzie & Streinbrink (1990), Feltz & Landers (1983), and, Jowdy & Murphy (1992), suggested that it would be important to define, present, and analyse the content of the mental imagery process of the participants within investigations on mental imagery.

In defence of the bulk of studies that do not present a detailed description of the mental images process visualised by their subjects, it is important to point out that mental images are by nature, an abstract and a fleeting concept. Since no instrument has yet permitted direct access to the actual mental images, researchers who have executed their investigations within the modern scientific paradigm, have been careful and reticent to define and publish the nature of the mental images visualised within their investigations. The phenomena of mental images is identified with great

difficulty and not easily quantified.

An example of a Qualitative analysis of the mental imagery components

As stated earlier, Chevalier & Renaud (1990) attempted to analyse the evolution of the NATURE of the mental images of a cross-country ski course. The subjects were a group of fifteen (15) cross-country ski racers. They were randomly divided in two groups, control and experiment. Both groups had to complete a 3.6 kilometre course as quickly as possible (competitive rhythm). The participants subsequently had to mentally review their performance and produce a drawing of the course as they remembered it. Following this "pretest" stage, both groups were submitted to a unified physical training regime. The experimental group were also submitted to a structured and controlled mental imagery training program. This program was composed of four steps:

Step 1: Studying the latest drawing of the course they produce.

Step 2: Visualised and mentally repeat the course. The subjects had to watch a videoscopic tape of the course. This tape was composed of three (3) segments:

The first contained images of a cross-country skier completing the course;

the second contained images of the course from the perspective of a camera mounted on the helmet of a cross-country racer completing the course; and,

the third contained no images.

During the viewing of this last section, the participants were instructed to mentally review the course.

Step 3: Draw the course. Following the viewing of the videoscopic tape, the subject had to produce a drawing of the course. This drawing had to include as much information as possible.

Step 4: Relaxation practice and mental repetition of the course. The subjects had to listen to a audiotape relaxation session. This relaxation session was followed by instructions directing the subjects toward the visualisation of themselves completing the course.

The procedure comprised of the four steps was executed six (6) times, or twice a day for a period of three (3) days.

During the "post-test" period, both groups had to complete the same cross-country course at a competitive rhythm (as fast as possible). Immediately after this performance, they had to produce a drawing of the course. Once all of the data was gathered, Chevalier & Renaud (1990) analysed the content of the drawing of the course produce by the subjects throughout the experiment. From this analysis, the authors identified Imagery Codes ("Codes de l'imagerie"[3]). These "codes" alluded to the specific elements included by the participants in their drawing of the visualisation sessions. In other words, Chevalier & Renaud identified the specific **components** of the mental imagery process as visualised by the participants. In all, Chevalier & Renaud identified 10 different types of "codes".

[3] author's translation

According to Chevalier & Renaud (1990), the visualisation process of the experimental group and the control group were different; the experimental group produced a larger number of "codes" than the control group and their drawings were more precise and true to the actual cross-country course.

The Chevalier & Renaud investigation is very helpful within the context of the present study. It presented the only **methodological** process leading to the identification and analysis of the "content" of the mental imagery practice of the participants. Following their investigation, Chevalier & Renaud were able to produce a list of specific "codes" visualised by a group of athletes. In this sense, it followed Wollman's (1986) suggestion to investigate the specific mental imagery experience of athletes in order to identify specific components (or "codes") leading to their isolation as independent variables in subsequent studies.

The present has not isolated "codes" as independent variables as suggested by Wollman, neither has it focused on the progression, or changes, that occurs at the level of the nature the mental images throughout a "structured mental imagery training program" as pursued by Chevalier & Renaud, but it has attempted to produce a list of codes specifically visualised by alpine ski racers. Furthermore, it has explored the avenue suggested by Wollman (1986) by undertaking the identification of any possible **relationship** or **connection** between the level of performance of the participants and the mental images they spontaneously visualised within the mental imagery practice of the participants. In summary, the present investigation has

attempted to identify the components of the mental imagery process of elite alpine ski racers and it helped to collate a list of codes of imagery leading to their eventual isolation as independent variables in further studies.

CHAPTER THREE: METHODOLOGY:

IDENTIFYING THE NATURE OF MENTAL IMAGES

The present study focuses on the **nature** of the mental images visualised by the athletes. The main objective has been to identify and analyse the mental images visualised by the participants. In parallel, it gives priority to the general objective on the topic of mental imagery investigations as stated by Murphy & Jowdy (1992) :

> *...to direct the studies toward a better understanding of the role played by mental imagery within the human performance in order to help athletes optimise their level of performance.*
> *(p. 245).*

A Descriptive and Exploratory Approach

At the present time, no study has directly focussed its attention on the mental imagery content, or the nature of the mental images visualised by athletes. Chevalier & Renaud (1990) studied the evolution and progressive transformation of the mental imagery description of a group of athletes submitted to a "structured mental imagery training program" (Chevalier & Renaud, 1990). In this case, the nature of the images spontaneously visualised by athletes was not investigated. Because of this fundamental distinction and the fact that no precedent has been found in the literature, the

present study has adopted a **descriptive** and **exploratory** perspective. The objective was to yield a broad portrait of the kind of images included in mental imagery process of the young students/athletes involved in the course Sport Psychology 1451. It is important to state that the descriptive and exploratory nature of the investigation has not diminished the precision and the aim of the investigative procedure. The absence of previous data on the topic did not imply that the direction of the study was vague. The investigation has ventured in a clear and specific direction as identified by the two questions posed within the section "problem area".

Participants

The group of 30 participants who agreed to take part in this study was composed of 19 males (63.3 %) and 11 females (36.7%), aged from thirteen (13) to nineteen (19) with an average age of fifteen point nine (15.9).

Please insert Table 1:

Characteristics of the Participants

This total of 30 subjects constituted, at the time of its completion, the majority of students involved in a sport psychology course at the high school level in

Alberta[4] :

Evaluating the Level of Ski Racing Performance of the Subjects

In order to identify any possible relationship between the nature of the mental imagery process of the participants and their level of performance (second question), it was necessary to actually group the participants in terms of their level of performance at ski racing. Two independent specialists[5] were given the task of evaluating the level of ski performance of the thirty (30) subjects. The evaluation used a performance continuum ranging from one (1) to ten (10). The value "1" represented the lowest level of performance possibly achieved by a ski racers of the age group of the group of athletes and the value "10" represented the highest level. This technique of performance grouping by independent professional was preferred to any point system or national ranking in order to assess the **actual** level of ski performance of the participants by opposition to their level of performance in **competition**. As an example, a golfer might be able in practice, to sink 89% of his putts from a distance of five (5) feet. When the same player must execute the same kind of performance in a competition setting (a tournament on television, for example), the inherent pressure of the situation and other factors might prevent him from achieving the same level of performance. For these

[4] At the time of the investigation, only two high schools in Canada offered a course officially identified as "Sport Psychology" to its clientele and the one I implemented is the only one is English language.

[5] Certification from the Canadian Ski Coaches Association

reasons, the idea of using any kind of scoring system[6] reflecting strictly competition performance was abandoned and replaced by an evaluation by an independent specialist. Please note that for the performance assessment procedure, the linear correlation of Pearson between the two independent evaluators was 0.84 (or **r** = 0.84)

Please insert Table 2:

Classification of Subjects According to Their

Performance Level in Ski Racing

The performance evaluation submitted by the independent specialists lead to the classification of all of participants according to their level of performance. Two (2) distinct groups of performance were identified according to the average performance score of the two specialists for each participant; thirteen (13) subjects obtained scores between 4.0 and 7.9 and were assigned to the "low performance" group, and seventeen (17) subjects obtained scores between 8.0 and 10.0 and were assigned to the "high performance" group. The two evaluators suggested the level of performance of eight (8) represented demarcation between the higher level of performance and the lower level of performance.

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[6] For example the International Ski Federation (FIS) system, which ranks all ski racers in the world according to their race results.

Questionnaire on the Use of Imagery

It was pivotal to establish a level of control regarding the use of "mental imagery" or "visualisation" as a psychological training technique by the participants. The objective of this procedure was to ensure that all the participants used mental imagery in a similar fashion. The questionnaire "The use of imagery by ski racers" (please see appendix A), was developed and administered.

The questionnaire was adapted from Hall (1991). It contained fifteen (15) questions relating to the actual use of imagery as a PST by the ski racers involved in the investigation. The questionnaire assessed diverse facts such as:

1) the use of imagery to prepare for training and competing, the extent of the use of imagery in relation to practice time, racing time and free time;
2) the intensity of the kinesthetic sensations perceived while visualising;
3) the degree of structure of the mental imagery training sessions of the participants;
4) the amount of time spent visualising; and finally,
5) the period of time the technique had been used by the participants.

All the questions were answered on a scale from one (1) to ten (10). For example, question three (3) asked: "To what extent do you use mental imagery before practice", the continuum of answers ranged from one (1) "never" to ten (10) "always". To ensure that both groups, high and low performance, did not significantly differed in their use of mental imagery

they were compared on all of the questions of the questionnaire using the "T-Test" procedure.

Please insert Table 3:

Comparison of Both Groups of Performance on

the Variables of the Questionnaire

"The Use of Imagery by Ski Racers"

The results presented in table three (3) showed that the subjects of both groups of performance did not significantly differ on any of the items on the questionnaire (alpha level of 0.05). It was concluded that the practice of mental imagery for the two groups was similar.

Procedure to Gather Mental Imagery Transcripts

Once the participants were divided into two performance groups all having similar mental imagery practices, the next procedure was to gather descriptions of the mental imagery processes of all the participants. The practice of using a drawing of the mental imagery scenario, as in Chevalier & Renaud's (1990) investigation, was not adequate for the present investigation. A **direct description** of the mental imagery process was required rather than a **recall** of the event. Because of the absence of precedent, it was decided that this type of direct description of the visualisation process would be achieved

by asking the participants to visualise and simultaneously described the mental images they saw or felt.

The subjects were ask to individually go into a closed room. A pair of earphones and a microphone were given to them, as well as verbal instructions on how to use these instruments. The subjects were given the following instructions in writing, which were also read aloud by the experimenter:

After the experimenter leaves the room and you feel ready to begin, please do the following:

A) Relax and sit or lay down in a comfortable position (a chair and a couch was at their disposal).

*B) When you feel ready, press on the "record" button on the microphone then proceed to your **usual** mental imagery training for ski racing.*

C) Please speak into the microphone. Describe the mental images you are visualising.

In other words, describe as many of the mental images you are visualising. Your description must be as complete as possible, please describe:

- *what you are seeing*
- *what you are doing*
- *what you are feeling*

- *any other details you are visualising*

Please Note*: It is important that this description of your mental imagery training session be done in the most honest and precise fashion. Do not modify your* ***usual*** *mental imagery training procedure.*

The subjects were then asked if they understood the procedure. All questions and clarifications were addressed and answered by the experimenter. The experimenter left the room and the subjects were left to execute their individual mental imagery training session for ski racing. They recorded their sessions onto audio-tape. These sessions were then transcribed into a computer and printed.

Answering the First Question:

In order to answer the first questions posed within the context of this investigation:

> What is the nature of the mental images visualised by the students within their spontaneous mental imagery training process?

it was necessary to produce a list of the mental imagery components that constituted the subjects' visualisation process. As stated by Chevalier & Renaud (1990) it was necessary to distinguish the nature of the mental images visualised through the identification of the specific "**codes**".

A series of 30 written descriptions of the mental imagery sessions were collected; they constituted "Unstructured Qualitative Data" (Côté, Salmela, Baria & Russell, 1993). This type of data required the use of a qualitative analysis procedure. Qualitative analysis are being applied more often within the field of sport psychology investigations (Côté & al., 1993). Within the field of sport psychology, the gathering and analysis of qualitative data is an extension of adopting the perspective of the "heuristic paradigm" suggested by Martens (1987) and Dewar & Horn (1992);

> *The heuristic paradigm stresses the importance of studying the whole, subjective experience of individuals by examining the way people perceive, create, and interpret their world.*
> Côté & al. (1993) p. 127

Côté & al. (1993) identified a series of investigations where this technique was used within the field of the sport psychology research: Cohn, 1989 & 1991, Orlick & Partington, 1988, Partington & Orlick, 1991, Russell, 1990, Salmela, Russell, Côté & Baria, 1991, Scanlan, Stein & Ravizza, 1991 and Weiss, Barber, Sisley & Ebbeck, 1991. In an extensive review of different kinds of qualitative analysis, Tesch (1990, from Côté and al. 1993) distinguished between two main approaches when using a qualitative analysis procedure: **interpretational** qualitative analysis and **structural** qualitative analysis.

> *The interpretational researcher overlays a structure of her or his own making on the data as a device for rendering the phenomenon under study easier to grasp. On the other hand, structural analysis assume that the structure is actually inherent or contained in the data and the researcher's job is to uncover it.*
> Tesch (1990) p.103 from Côté and al. (1993)

The present investigation adopted the perspective of a **structural analysis** procedure since it was seeking an exploratory perspective on the content of the mental imagery process of the participants. The goal of the methodology was not to impose a defined structure on the data collected; rather, it was to explore and identify any emergent information contained within the mental imagery description. The purpose of the structural analysis was to identify any inherent organisational pattern that might emerge from the analysis of the mental imagery descriptions submitted by the participants.

Côté and al. (1993) have suggested common guidelines for organising and interpreting unstructured data. They present two procedures or "steps" to be completed:

> *First there is a detailed examination of the data to identify topics which best describes the particular segment of text, and,*
> *Secondly, there is the determination of common features which characterise the text segments in order to create and understand*

the relationship between topics

(p. 130)

Or:

1) "Creating Tags": coding meaningful texts segments.

2) "Creating Categories": regrouping similar text segments.

First Step of the Structural Qualitative Analysis Process: Creating "Tags"

The objective of this operation was to produce a series of meaningful text segments that expressed the nature of the information contained within the mental imagery sessions transcripts. This procedure implied the division of each transcript into **"meaning unit"** (Côté & al. 1993). A meaning unit being a segment of information containing one and only one idea or specific piece of information, or as Tesch, 1990 (in Côté & al. 1993) specified:

a segment of text that is comprehensible by itself and contains one idea, episode or piece of information.

(p.131)

Once the operation of identifying the meaning units was completed, the experimenter isolated and **"tagged"** each of the meaning units contained in all 30 transcripts. A "tag" is a word or a sentence describing the nature of the information contained within each meaning units. For example, the

following sentence found in one transcript was identified as a meaning unit:

“I feel the pressure of my boot on the top of my feet”

This sentence constitutes a specific piece of information which is comprehensible by itself and contains only one episode. This specific meaning unit was tagged:

“kinesthetic sensation”

An assistant was trained in identifying and tagging meaning units. At the end of the procedure of differentiating and tagging all of the meaning units, the experimenter and the assistant jointly revised the meaning units and agreed on the tags (or title) given to all of them. At the end of this first step of the structural qualitative analysis, the experimenter and his assistant identified and tagged eight hundred and sixteen (816) meaning units. These meaning units represented the mental imagery “codes”or the simplest units of information identified in the transcript of the mental imagery process submitted by the participants.

Second step of the structural qualitative analysis process: creating “Categories”

The goal of this second step was to “re-contextualise”(Tesch 1990 in Côté & Salmela, 1993) the tagged meaning units into distinct categories that

would lead to a **categorisation** system. It involved listing and comparing all of the tagged meaning units or as Miles & Huberman (1994) described this procedure:

> *Tags with similar meanings are gathered together, and a label that captures the substance of the topic is created to identify the cluster of tags.*
> (From Côté & al. 1993, p.131)

The following will illustrate; the meaning unit referring to the sensation of the boot on the feet of the subject, used as an example was tagged "Kinesthetic sensation", and was grouped with other tags referring to similar perception (for example: I feel the gate on my shoulder...). This categorising procedure continued until theoretical saturation was reached (Glaser & Strauss, 1996 from Côté & al. 1993), or when the categorisation of new data fitted adequately into the organising system without the emergence of new themes and categories.

The structural qualitative analysis of the eight hundred and sixteen (816) meaning units lead to the identification of two dimensions of mental imagery components. The first dimension was composed of "types" of mental images and the second dimension was composed of "contexts" of mental imagery. These two dimensions led to the identification of a series of "categories of mental images". The information contained in the mental imagery transcript was taken out of its original context — the transcripts

submitted by the participants and "re-contextualised"(Tesch 1990 in Côté & Salmela, 1993) into a two dimensional categorisation grid.

Please insert Table 4:

Two Dimensional Categorising Grid

This two dimensional categorisation grid represents the inherent structure of the data gathered. As shown in table 4, four (4) types of mental imagery emerged from the qualitative analysis process:

A) Kinesthetic: Internal perception referring to the body.

For example: when the specific kinesthetic sensation of feeling the pressure of the ski boot on top of the foot.

B) Physical Actions: All movements executed with a precise intention. For example: when the pressure is intentionally applied to the front of the ski boot in order to initiate a ski turn.

C) sensory Perception. When any simulation is perceived through the five (5) senses. For example: when the athletes sees, hears , tastes, touches, or smells any external object.

D) Psychological. Refers to the perception of any psychological occurrence. For example: when a subjects uses self-motivation talk within his/her mental imagery process.

Parallel with the classification in types, another dimension to the categorisation process emerged specifically for the type "C" (sensory perceptions): the **context** of the mental imagery process. It became evident that the subjects visualised images within different contexts. For example, a ski racer could **see** a flag, which was part of the very narrow context of the race course, while another could **see** a spectator, which was part of the broader context of the crowd. Both codes refer to similar types of mental images (sensory perception) but they refer to very different contexts. They actually imply very different types of attentional skills in relevance to the act of competitive ski racing. An athlete who sees the crowd while competing is not experiencing the same kind of focussing as the athlete who only sees the race course. In order to reflect this situation, the environment of the ski race was divided in three contexts relating to different levels of relevance to the action of ski racing:

Context 1: internal environment of the ski racers: his body and mind.
Context 2: the specific environment of the race course.
Context 3: the broader environment of the "slope" or the "hill".

These different contexts of sensory perception formed the vertical dimension of the categorisation grid of mental imagery codes. The identification of these two dimensions, types and context, led to a bi-dimensional classification procedure. A mental imagery code (or specific mental unit) was classified according to its type (A to D) and according to the

context of its occurrence (context 1 to 3).

In order to summarise the qualitative analysis process we may use the concrete example of the following statement as related by one participant:

"I see the gate coming at me"

This segment of information was first isolated as a meaning unit, then tagged "visual perception of gate". It was then categorised according to a specific type of mental imagery codes, in this case sensory perception or type "C". It was also also categorised in accordance to the context of the action as described by the participants, in this case the specific environment of the race course or context "2". The specific meaning unit was assigned to the category "C2".

Finalising the Categorising Procedure:

Identifying the Specific Codes of Imagery

Each tagged meaning unit was placed in one of the five (5) categories determined by the presence of four (4) types and three (3) contexts for the type "C". The categories were "A1", B1", "C1", C2", "C3", and "D1". It is important to note that for the types "A", "B" and "D", the context of the imagery was the internal environment of the ski racers, namely his body and mind.

The categorisation process was not yet completed since it was still possible to differentiate different mental imagery components within each of those categories. For example, the meaning unit, "I see the gate" previously

classified as “C2” (context “2”: the course, type “C”: sensory perception) is different from the meaning unit “I hear the flag of the gate flapping as I go by” which could also be classified as “C2”, but which referred to a different sense (hearing) than the previous example (sight). It was then necessary to determine more specific elements within the categories of the bi-dimensional classification grid, i.e. the mental imagery codes.

Each category was divided in sub-categories of codes or simplest elements of the mental imagery process. Category “A1” was subdivided in eight (8) specific mental imagery codes. Category “B1” was subdivided in four (4) specific mental imagery codes. Categories “C1”, “C2”, and “C3” were subdivided according to the 5 senses if a specific code referred to the specific sense was actually visualised. For example, category “C1” was divided in 3 senses (hearing, sight, and smell) while the categories “C2” and “C3” were divided in two senses (hearing and sight). Finally, category “D1” was subdivided in thirteen (13) specific mental imagery codes. At the end of this procedure, a list of mental imagery codes was identified. This list represents a portrait of the nature of the mental images visualised by the students within their spontaneous mental imagery training process.

Answering the second question

After a list of the mental imagery categories and codes was produced, the present investigation as a secondary objective posed the following question:

> Can any relationship be identified between the components of the mental imagery process (the mental images themselves) and the level of performance of the person practising mental imagery ?

The objective was to execute a quantitative analysis of the qualitative data gathered up to this point. In order to achieve this objective, three (3) procedures were undertaken:

First, it was necessary to determine the level of performance of each participant in order to establish a performance categorisation of all the participants. This procedure was described in detail in the above section "Evaluating the level of ski racing performance of the subjects." Secondly, it was necessary to identify the relative importance of the use of each category and each specific code of imagery for each participant. Finally, it was necessary to compare both performance groups in regard to the use of categories of codes and specific codes.

Identifying the Percentage of the Use of Each Category and Each Specific Code for All Participants

In order to identify any possible relationship between the imagery codes visualised by the participants and their level of performance, it was necessary to rely on the relative use of each code by each subject, this was achieved by:

a) Identifying the total number of codes visualised by each participant (this total composed 100% of the codes visualised).

b) Identifying the percentage (%) for each category of codes (A1, B1, C1, C2, C3, D1) in regards to the total number of codes for each subjects (100%).

For example, fictitious subject #333 visualised a total of one-hundred (100) codes. Out of this total, twenty seven (27) were from the category "C2". The relative importance of this Category (C2) would be 27% of the total of mental imagery codes visualised.

c) Finally, the procedure was repeated not for the **categories** of mental imagery codes (as in b) rather for the specific **codes**.

For example, subject #333 who visualised a total of twenty seven codes classified within the category "C2", had visualised 10 specific codes identified as "C.2.1", Therefore the specific code if imagery "C.2.1" constituted 10 % of the total amount of codes visualised by this subject.

Comparing Both Groups on the Proportional Use of Contexts and Types of Mental Imagery

Since the structural qualitative analysis process of the meaning unit lead to a two dimensional categorisation grid, both performance groups were compared on the percentage use of both **dimension of the categories**, the context of the mental imagery visualised and the types of mental imagery visualised. Two distinct operations were administered. The first operation consisted in comparing both groups on the inclusion of each type and context of imagery and each specific code within their respective mental imagery

practice. The objective was to identify any significant difference (alpha level of 0.05) between the importance (or %) use of each categories and each codes by both groups using the “T-Test” technique.

The second operation consisted of analysing the results using the variable “performance score”, not as a means to divide the subjects into two groups, but rather as an interval scale. A correlation between the relative importance of each mental imagery code (%) and the level of performance was achieved using “Pearson’s linear correlation coefficient” (r).

In concluding this section, and in order to seek answers to the two questions posed, all of the participants’ mental imagery transcripts were gathered and analysed. A description of their content was presented and finally, a series of analytical procedures were completed establishing the presence of possible relationship between the nature of the mental images visualised and the level of performance of the participants. In the next chapter the findings will be presented and discussed.

CHAPTER FOUR: FINDINGS AND DISCUSSIONS

THE FIRST QUESTION

A review of the literature on the topic of mental imagery in sports established that the actual images visualised by athletes, or the mental imagery content, are rarely identified or described by investigators. This situation relates to the fact that a majority of investigations on the topic of mental imagery are conducted from an traditional scientific perspective. This is the case for a majority of investigations in the field of sport psychology (Dewar & Horn, 1992). The content and the nature of mental images was disregarded by orthodox sport psychology researchers because of the difficulties they encounter in directly accessing and measuring the phenomena. This situation is also related to the fact that many investigations have been conducted from a behaviourist perspective where the nature of the mental images was not prominent in comparison the "response" (or change in performance) associated to the "stimuli" of practising mental imagery. This state of fact has created a certain dilemma for the many specialists interested in the applied sector of sport psychology. The bulk of investigations support the partial conclusion that mental imagery helps athletes perform better (Richardson 1967, a & b; Corbin, 1972, Weinberg, 1982; Feltz & Landers, 1983, Silva, 1983, Suinn, 1983, Oxendine, 1984). Yet, in parallel, the researchers have never really defined what kind of images should be visualised within the practice of mental imagery itself. Professionals do not have any indication of the nature of the images they

should suggest to athletes and students who are interested in using mental imagery as a PST. In other words, a sport psychologist, a coach or a high school sport psychology teacher might be able to suggest mental imagery as a psychological training skill leading to performance enhancement, but it is impossible for the specialist in question to suggest **What Specific Images** should be visualised.

The first question addressed this situation. The structural qualitative analysis of the mental imagery transcripts submitted by the participants posed as its objective the presentation of a list of all the codes of mental imagery visualised by the participants.

Please insert Table 5:

List of Codes Identified During the Structural Qualitative Analysis Process of the Mental Imagery Transcripts

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This table represents a portrait or "snapshot" if you will, of the nature of the mental imagery codes visualised by the participants. This description of the imagery content leads to a discussion of three topics:

i) the innovative aspect of the methodology put in place;

ii) the adequacy of using the of the term "mental imagery" to define the process of mentally rehearsing a physical activity such as downhill skiing; and

iii) The nature of future investigations designed to elaborate the knowledge regarding the nature of mental images.

Identifying Mental Images: The Structural Qualitative Analysis Procedure

Before the actual data is presented, the actual **methodology** constitutes the most innovative contribution of this investigation. First, the Structural Qualitative Analysis Procedure developed and applied for this investigation followed the rarely investigated suggestions of many researchers in the field. Paivio (1985), Burhans Richman & Bergey (1988), Wollman (1986), Howe, Barber, Mackenzie & Streinbrink (1990), Feltz & Landers (1983), Jowdy & Murphy (1992), and Chevalier, Hall & Nadeau (1990) all emphasised the fact that the actual nature of the mental images should be investigated in order to better understand the role of mental images within the context of human performance. It also followed the suggestions of Dewar and Horn (1992) and Martens (1986) to question the appropriateness of the orthodox scientific method as a proper way to investigate human behaviour in general and mental imagery in particular. In brief, the methodology applied demonstrated that the study of the **nature** of mental images is possible. It also demonstrated that the nature of mental images can be accessed, if not directly, at least from the medium of a description supplied by the participants. It also demonstrated that the nature of the mental images visualised can be analysed if the investigator abandons a position of foremost **objectivity** and "generates" situations in which the subjects reveal detailed information about a specific domain" (Côté & al. 1993, p. 127). The list of mental imagery codes presented in table 5 does not constitute a final and decisive portrait of the mental images visualised by ski racers. Instead it constitutes a first step leading, it is hoped, to further investigation of the same phenomena in ski racing and

other sports. Finally, it constitutes, for the orthodox field of sport psychology, a means to question and interpret the methodology suggested. Such a process would permit more elaboration of improved methodology than the one presented and would lead to the better understanding of the role played by the nature of mental images in the process of psychological training for sports' performance.

Accurately Describing the "Multidimensional" Nature of Mental Images

Ideally, the sport psychology "specialist" should design and implement practical applications directly related to the results of investigations conducted by the scientific sectors of sport psychology. This is not the case at the moment. This situation is described by Strean and Roberts (1992):

> *Sport Psychology consultants are concerned with helping athletes and coaches. We utilize whatever method of learning helps us to understand the situations and individuals with whom we work. Often, this knowledge comes from experiences rather than experiments. A challenge of applied sport psychology research is to capture this information in scientific fashions that may include a variety of idiographic approaches, such as case studies, observation and clinical experiences.*
> (p.62)

The results presented in table 5 address one issue where sport psychology specialists have relied on their intuitive knowledge rather than on research findings. Practioners have suggested in articles and books to perform mental imagery practices that emphasised much more than images. For example, Terry Orlick in his book "In pursuit of excellence" (1990) suggests that "The refined performance imagery that highly successful athletes have developed almost always involves an inside view, as if they are actually doing the skill and feeling the actions." (p.67). Such imagery practice emphasizes not only the visual components of the imagery training procedure, it suggests to develop and mentally replay the kinesthetic component of the action. Yet, in spite of this "intuitive" knowledge about the multitude of different modalities of the mental imagery procedure, very few specialists have adapted the language used in the field. Suggesting to athletes to use "mental imagery" might lead them to focus their attention on the visual aspect of this technique. As shown in table 5, the reality created in the minds of the participants is filled with kinesthetic, censorial, emotional and psychological components. The idiom "Mental imagery" should be substituted by others such as "**Movement Imagery**[7]" or "**Actions Images Training**" or "**Performance Imagery"** as suggested by some investigators in the field (Chevalier, Hall & Nadeau, 1990; Denis, 1989; Fishburne, 1990 and Orlick, 1990). These expressions more accurately describe the **Multi Modality**[8] (Chevalier & Renaud 1990), substance of mental images.

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[7] "Image de Movement" in french (author's translation)
[8] "Multimodal" in French which is made of many modes (author's translation)

Future Investigation on the Nature of Mental Images

It is anticipated that other researchers in the field of mental imagery will try to identify and analyse the nature of the mental images of athletes and in doing so, that they will challenge and complete the list of mental imagery codes presented in table 5. This kind of expansion of knowledge on the nature of mental images and by ricochet, the role they play in sport performance enhancement, could take place in three different ways. First, investigators could reproduce the methodology presented with similar groups of participants (ski racers and students enrolled in a high school sport psychology courses). This would lead to the construction of a more definitive list of mental imagery codes. Such a list could facilitate the intervention of applied sport psychologists, sport psychology teachers and coaches when suggesting **Actions Images Training** as a psychological skill training technique. It would be possible for them to suggest the precise nature of the images that should be part of the **Actions Images Training** procedure.

Secondly, the codes presented in table 5 could be isolated as independent variables in future studies. For example, a group of subjects could be asked to visualise a mental imagery scenario composed uniquely of images of a specific nature such as code "A.1.1: Differentiated muscles". The results on performance of the visualisation of this specific code could be compared to the visualisation of other specific codes. This type of investigation might lead to the identification of truly efficient mental imagery scenarios. It could also bridge a gap between the orthodox and the heuristic factions present in the field.

Finally, it would be interesting to duplicate the Qualitative Analysis Procedure used in this investigation in order to access the mental imagery components visualised by participants involved in other activities. For example, such a procedure could be reproduced with participants involved in other sports, in dance and any other form of performance. The result could then be compared across these diverse endeavours in order to identify any similarities regarding the nature of the images visualised. Such a broad perspective would help achieve the overall objective of the study of mental imagery as stated by Murphy & Jowdy (1992) :

> *...to direct the studies toward a better understanding of the role played by mental imagery within the human performance in order to help athletes optimise their level of performance.*
> *(p. 245).*

The conclusion of the discussion on the result of the investigation of the first question (the findings presented in table 5), do not only represent a list of the nature of the mental images visualised by ski racers but also represent an advancement of the mental imagery module contained in the high school course “Sport Psychology 1451”. It will now be possible to discuss the nature of the mental images visualised by the students enrolled in the course and to compare them to the ones identified throughout this investigation. In addition to improving the course curriculum, a better understanding of the nature of mental imagery has occurred.

THE SECOND QUESTION

A bi-dimensional categorisation system emerged from the structural qualitative analysis procedure detailed in the methodology section. The categories of mental images and specific codes of mental images were identified. In order to answer the second question, both groups of performance were compared on their relative use or inclusion of each category of code of mental images in their respective mental imagery practice.

Please insert table 6:

Comparing Both Groups on Proportion (%) of

Types and Context of Mental Images

Table 6 shows the two performance groups devoted approximately the same percentage (%) of their total mental imagery process to all the types and all the contexts of mental imagery. The greater use (yet not significant at the alpha level of 0.05) difference is found in the proportional use of codes of imagery from the type A.1 “kinesthetic sensation”: 55.1% of the mental imagery process of the high performance group was devoted to codes from this category, compared to 45.3% for the low performance group.

Please insert table 7:

Comparing Both Groups on Percentage (%) of

Codes of Mental Images

The next operation consisted in comparing both groups on the inclusion of each specific code within their imagery practice. Please note that because of the great number of codes and the very limited use of some of them, only the four (4) results closest to the alpha level of 0.05 were presented in table 7. Amongst those results, two reached the acceptable alpha level of 0.05. The first one relates to the relative use of the code **"precise technical action"** where the high performance group devoted 22.8% of the total of their imagery components to this specific code while the low performance group devoted 10.3% of their total imagery components to this code:
(T = -3.13, p = 0.004).

The second result relates to the use of the specific codes **"Sight within the context of the external environment of the race course"**. The ski racers in the high performance group devoted 2.5% of their components to this code, while the low performance group devoted 0.3% of their components to this code (T = -2.10. p = .045). Table seven (7) also presents results that do not achieve the acceptable alpha level of 0.05, yet that are still interesting to emphasise; the low performance group seemed to produce much more codes **"Non ski performance-related actions"** with 3.27% of their total amount of codes visualised, compared to .06% for the high performance group (T = 1.94, p = .063). The low performance ski racers also seemed to favour the visualisation of **"Gross technical actions"** codes; they devoted 14.7 % of their total imagery process to this code compared to 8.2 % for the high performance group (T = 1.87, p = .072).

This second question relates directly to the interest of the students

involved in the course “Sport Psychology 1451” in terms of the possible content of their mental imagery process. They wanted to know precisely what kind of mental images they should include during their mental imagery training sessions. In light of the results presented in table 6 and 7, the answer is more simplified and becomes more precise.

First it would be suggested that they focus on the visualisation of very specific technical actions instead of visualising more general movement. For example, a ski racer will be directed to visualise the action of his feet when initiating a turn, rather than the action of his entire legs.

Secondly, the ski racer would be asked to restrict the mental imagery “projection” to the specific context of the action, in this case the ski course as defined by the gates planted in the snow and the specific terrain surrounding these gates. However this kind of answer would be too simplistic if the other results presented in table 6 and 7 were not considered. The suggestion should be headed by presenting a general overview of the result of this investigation. In general, the high level performers visualised codes that related to specific technical action and emphasised the kinesthetic sensation related to those actions. By comparison, the low performers visualised codes of actions more general in nature. A bigger portion of their mental imagery content was devoted to actions that were not directly related to the task of ski racing.

In summary, the answer to the questions posed by the group of students would be to emphasise the specific technical actions suggested by their coaches, to include a strong kinesthetic modality to the visualisation process, and to restrict the context to the specific race course.

The preceding interpretation of the results shown in table 6 and 7 are not conclusive. However, the trend that emerged regarding the technical precision of the codes visualised by both groups has been tested with a different kind of results analysis. The results were analysed using the performance scores, not as a means to divided the subjects in two groups, but rather as an interval scale. They were then correlated to the percentage (%) of inclusion of each code and context and type of mental images. Instead of the "T-Test" procedure, "Pearson's linear correlation coefficient, (r)" was applied.

Please insert table 8:

Linear Correlations for Types and Contexts for All Participants

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Table eight (8) reports the correlation between the coefficients for the type, the contexts, specific codes and the performance score of all participants. Please note that because of the great number of codes identified, only results superior to 0.30 were included in table eight (8). Not all of the correlation coefficients were significant. No definitive correlation between any of the variables listed and the level of performance of the participants was identified. Nonetheless, the correlation coefficients as presented seem to indicate certain tendencies:

1) The higher the performance, the more codes from the category "kinesthetic perception" were used, more specifically the specific code "differentiated muscles".

2) The lower the performance of the participant, the more codes "sensation of power", "non-technical actions", "auditory perception (context 1,2, and 3) and "visualisation" were visualised.

These results of the correlation analysis are in accord with the results presented in table 6 and table 7; the higher the level of performance of the participants, the more specific to the technical action of ski racing the content of the mental imagery process becomes.

At this point, it has been possible to identify certain patterns and state the fact; namely **that the high performance ski racers visualised different mental images than the lower performance ski racers**. This kind of finding might not fit the usual and widespread traditional scientific paradigm underlying most of the research in sport psychology (Martens 1979), yet the methodology presented and the results achieved are in accord with the proposition of Dewar and Horn (1992). They suggest that "sport behaviours cannot be meaningfully isolated and studied independently of the context in which they are played". Dewar and Horn (1992) also emphasise that investigators must explore alternatives ways of understanding and exploring behaviours in sport and to "treat these as credible and useful contributions to the field". These findings lead to a discussion of two topics:

1) the use of Mental Imagery Codes as a technical assessment tool; and,

2) the theoretical supports for the findings of the second question.

Mental Imagery Codes as a Technical Assessment Tool

In light of the results presented, some suggestions can be made in terms of possible practical applications for ski racing coaches. The actual images visualised seem to represent a good illustration of the level of understanding of the technical actions required to achieve a high level of performance. These findings could be interpreted in the sense that the low performance group has not yet fully understood exactly what specific technical actions should be executed on the ski hill in order to improve their performance. This state of fact is reflected in the nature of the images visualised by the skier: the images visualised duplicate, in the mind of the skier, the actions and the kinesthetic sensation executed in reality. If this finding is supported by other investigations, it might be possible to develop a technical evaluation tool, a grid of assessment of the mental imagery content if you will. This kind of instrument could be applied outside of the context of the ski hill and save both time and resources for ski racers and ski coaches. For example, a ski racing team could visualise before going to a training camp on the snow. The coaches could then analyse the codes contained in the imagery transcripts submitted by the races and assess the level of technical development of each athlete in regards to the preferred technical actions that should be displayed. A program could then be designed before training would actually start and the precious and costly time on snow could be used more efficiently. **In summary, the mental imagery process can be seen as a precursor for improved performance**. Furthermore, **it could also be used as a technical developmental assessment tool indicating the level of technical**

development of the athlete outside of the usual arena of competition and training. It could be used as a powerful "off the hill training" assessment and training tool.

Theoretical Support for the Findings

In order to follow the suggestions of Marten (1979 and 1987) and Dewar & Horn (1992) emphasising the importance of elaborating a new paradigm in sport psychology, this investigation explored the content of the mental imagery process and developed a new methodology to access the mental images visualised. Because of the innovative, exploratory and descriptive nature of this investigation, the finding cannot be totally explained by using existing theories based on the orthodox, scientific epistemology that underlined the field of sport psychology since the late 1800 (Davis, Huss & Becker, 1995). Models such as **Psychoneuromuscular** theory which proposed that mental imagery facilitates motor skill performance by favouring the slight innervation of the muscle being mentally solicited (Corbin, 1972; Richardson, 1967b), or **Symbolic Learning** theory which stipulates that learning occurs because the subject has to cognitively prepare and plan for performance, (Denis, 1985) cannot explain the findings of present studies. Neither theories proposed an analysis of the imagery as visualised by the subjects.

Recently, new theories have emerged from the clinical areas of psychology, emphasising two elements neglected by the older framework but present in the finding of this investigation. These include the

psychophysiological components of the imagery process and the meaning of the images for the imagers (Murphy and Jowdy, 1992). Amongst these new models, **Ahsen's Triple-Code** theory emphasises the complexity and the diversity of mental images. Ashen emphasises the multimodal diversity of the nature of the images visualised when using mental imagery as a PST. The multimodality demonstrated by this investigation is presented in three components within Ashen models. The first component of the "Triple-Code" model are the **images** :

> *The images can be defined as a centrally aroused sensation. It possesses all the attributes of a sensation but it is internal at the same time. It represents the outside world and its objects with a degree of sensory realism which enables us to interact with the image as if we were interacting with the world.*
> (Ashen, 1984, p.34 from Murphy & Jowdy, 1992)

The result of table 5, 6, and 7 demonstrated that the reality "constructed" through the mental imagery process is made-up of many elements of the real situation of ski racing. Through mental imagery, ski racers truly build an internal reality which permits them to interact with the images as if they were **"the real world"**.

The second component in Ashen Triple-Code Theory is the **somatic response** or the physiological change that takes place when an image is produced. The present investigation had not put in place a means to evaluate

the degree of such a response. This could have been done by following the methodology associated with the psychoneuromuscular explanation of mental practice, which suggests the measurement of muscular activity during the practice of mental imagery. It was felt that such a practice (measuring muscular activity) would have distracted the participants from visualising their "usual" mental imagery training scenario. Nevertheless, the description of the mental imagery process by the participants did not provide a clear measurement of the muscular activities still referred to this kind of activity through the description of kinesthetic sensations. It is important to specify that the important body of knowledge emerging from the field of psychoneuroimmunology suggests a strong link between the mind and the body. Those measurements are accessible to empirical investigation using various technology such as electroencephalograph and electromyograph (Murphy & Jowdy, (1992).

Finally, Ashen lists the **meaning** of the images for the imagers as the third component of his multimodal description of the phenomena. The findings presented support the importance of a meaning that is specific to the imager. When asked to visualise the action of skiing, the participants produced a multitude and diversity of mental images that reflect the different significance of the action for them. In terms of a practical application, it is necessary to be careful when proposing mental imagery scenarios. In light of this personal interpretation, due to the diverse meanings given to the images by different participants, the list of codes published becomes a key element in directing athletes in their mental imagery training. Instead of generalising

the findings and suggesting the same content of imagery to all, the facilitator could direct the imager to select some codes of imagery (or “images”) from the lists produced and to experiment with many of them in order to find some that are adequate in terms of the somatic responses desired and a positive meaning for each imager.

In concluding this section, it should be emphasized that the practitioners and the researchers should approach the phenomena of mental imagery with full awareness of the diversity and complexity of its internal components. They should also perceive the process as one that is highly diversified and changing according to the imager. Mental images are a multimodal internal reality created by the imager, it is not advised to generalise the findings of any research on the topic. Instead, it would be better to offer a diversity of possible codes and lead the imagers into a process of developing a personal **Actions Images Training** session that fits the images of the desired technical performance, the specific somatic responses anticipated and the desired meaning pursued by the individual participant. Any specialist suggesting the use of **Actions Images Training** as a PST should direct the user in defining precisely what specific images should be visualised, what psychophysiological responses are desired and what specific meanings are inherent to the images visualised.

CHAPTER FIVE:

CONCLUSIONS

This investigation represents an innovation in the field of sport psychology research. First of all, it has been conducted from the perspective of structuring and implementing a new high school course in Alberta: "Sport Psychology 1451". Alternative topics for high school curriculum are needed in this end of the century. Projects such as charter schools and specialised schools for the performing arts and athletics, require an adaptation of the material taught in response to the demands and the needs of the specific clienteles attending those institutions.

Furthermore, the different and innovative perspective chosen has helped promote the investigator to avoid the habitual paradigms in place in most of the departments of sports science interested in the psychological components of sport psychology. As stated by Strean and Roberts (1992):

> *We are not attempting to set forth a new orthodoxy; rather we are attempting to make it more difficult to cling to the old one.* (p.62)

This study has permitted a broader and more integrative methodology. It avoided having to restrict the investigative procedure to the traditional scientific methods and to the findings on a strictly empirical enquiry.

The methodology followed many innovative suggestions that have emerged from the field of research on mental imagery. It explored the **nature**

of the images visualised during the practice of mental imagery as suggested by Chevalier, Hall & Nadeau (1990), Paivio (1985), Burhans Richman & Bergey (1988), Wollman (1986), Howe, Barber, Mackenzie & Streinbrink (1990), Feltz & Landers (1983), and Jowdy & Murphy (1992). It applied a **qualitative** investigation procedure that differs from the usual quantitative procedure promoted by a behaviourist approach. It followed the recommendation of Martens (1987) and Dewar and Horn (1992) to adopt a **Heuristic** perspective that stresses the importance of studying the "whole subjective experience of individuals by examining the way people perceive, create and interpret their world" (Côté & al. 1993). In doing so, it directed its focus toward Murphy & Jowdy's (1992) suggestion of striving to "understand the role played by mental imagery within the human performance in order to help athletes optimise their level of performance" (p. 245).

This investigation has not operated under the pretension of providing answers to explain all of the suggestions listed above. Nonetheless, the innovative and consciously different approach must be seen as a deliberate attempt to differentiate itself from other studies in the field of sport psychology in general and on the topic of mental imagery in particular. This need for differentiation is the result of a profound dissonance felt throughout the completion of the review of literature on the topic. I feel the paradigms and the methodologies expressed in most of the material reviewed are for the most restrictive and do not address the real questions that are posed by athletes using mental imagery as a PST.

Another innovative aspect of this inquiry was the fact that it addressed

the two most important questions posed by athletes when confronting mental imagery: "What mental images should I visualise?" and " What images do better athletes visualise?". Because they do not fit the orthodox scientific paradigm, these two questions are not usually answered by investigations conducted in the realm of the sport psychology field; yet, they constitute the important question for the "users". In order to investigate these questions, a new and different methodology had to be developed and implemented. Most certainly, the methodology presented will be contested within the field of sport psychology research, but it is hoped that it will have the effect of widening the probe of researchers interested in the topic of mental imagery.

The list of codes visualised by the participants (table 5) will become a tool demonstrating the diversity and the complexity of the mental images visualised during the process. It will support the "renaming" of the topic of mental imagery to "**Action Images Training**" and emphasise the multi modality of the nature of the images mentally created by the participants. This list of mental imagery codes will also allow students interested in using "Action Images Training" techniques to choose certain codes and test their effectiveness in regard to performance enhancement. The list of codes will also permit a self-enquiry activity, allowing students the analysis of the nature of their own imagery content. The findings of this investigation will permit me, as a teacher and a consultant, to suggest specific codes of imagery to the students interested in using Action Images Training as a PST leading to enhanced sports performance. These suggestions will not be "definitive", but my goal is not to generalise and oversimplify the complex procedure of

mental imagery. I hope instead to be able to direct students in choosing specific codes of imagery that will be adequate for each of them. I hope to personalise their Action Images Training sessions.

Finally, this investigation leads to the identification and support of a theoretical framework explaining the complexity of the phenomena of mental imagery, i.e. Ashen's Triple-Code Theory. In comparison to the more traditional models explaining mental imagery, namely the Psychoneuromuscular and the Symbolic Learning Theory, it adopts a wider perspective, via Ashen's Triple-Code theory which illustrates the mulmitmodal component of the mental imagery procedure.

This investigation initiates the groundwork for the completion of further innovative studies in the field of mental imagery:

1) The analysis of the content of mental imagery sessions could lead to the development of tables that would help coaches assessing the technical development and proficiency of athletes.
2) It would be interesting to isolate specific codes identified within this study as independent variables in further studies. This kind of investigation might lead to the identification of specific codes that facilitate performance enhancement.
3) The comparison of mental imagery transcripts across different sport activity and even across other disciplines such as dance and the martial arts might identify similarities in the nature of the images visualised by high performers in all of those fields.

Finally, this study has investigated the psychological training skill in

"mental imagery" from a different and unusual perspective in the field of education. It is hoped that this transition from the domain of sports sciences to the educational field will justify and legitimise further studies emphasising the practical and educational aspects of psychological training skills. It is also hoped that these findings will be integrated and transmitted to high school students through curriculums such as "Sport Psychology 1451".

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Table 1
Characteristics of the Participants

Variables	Categories	Number	Percentage of total number
Age			
	12-14 yrs old	5	16.6 %
	15-16 yrs old	15	50.0 %
	17-20 yrs old	10	33.3 %
	Average age = 15.9 yrs old	E.T. = 1.55 yrs	
Sex			
	Female	11	36.7 %
	Male	19	63.3 %

Table 2
Classification of the Participants According to Their Performance Level in Ski Racing

Variables	Categories	Number	Percentage of total number
Performance			
	4.0-6.9	9	30.0 %
	7.0-7.9	4	13.3 %
	8.0-8.9	12	40.0 %
	9.0-10.0	5	16.7 %

Average Performance score = 7.51 E.T. = -1.38%

Inter judge Correlation: r = 0.84

Table 3
Comparison of Both Groups of Performance on the Variables of the Questionnaire "The Use of Imagery by Ski Racers"

Variables	Low Performance Group n = 13 (average)	High Performance Group n = 17 (average)	T	P
Q1	7.23	7.76	-1.16	.254
Q2	8.92	9.35	-1.35	.187
Q3	5.62	6.71	-1.53	.137
Q4	6.00	7.00	-1.18	.248
Q5	5.77	6.18	- .49	.628
Q6	8.85	9.00	- .30	.765
Q7	5.92	6.12	- .15	.879
Q8	6.38	6.76	- .43	.669
Q9	4.23	4.82	- .74	.466
Q10	4.00	4.41	- .48	.633
Q11	6.00	6.41	- .45	.656
Q12	6.62	7.47	-1.19	.246
Q13	2.15	3.47	-1.65	.111
Q14	5.55	7.06	-1.38	.180
Q 15	25.00	28.47	- .46	.649

Table 4

Two Dimensional Categorising Grid

	Type A: Kinesthetic Perception	Type B: Physical Actions	Type C: Sensual Perceptions	Type D: Psychological Context
Context 1: Internal Environment: the skiers body and mind	**Category A1**	**Category B1**	**Category C1**	**Category D1**
Context 2: External Environment of the Race Course (specific)			**Category C2**	
Context 3: External Environment of the slope (general)			**Category C3**	

Table 5
Codes Identified During the Structural Qualitative Analysis Process of the Mental Imagery Transcripts

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Category A, Context 1

A.1.1: Differentiated muscles (for example "I feel my ankle flexing")
A.1.2: Undifferentiated member (for example "I feel my arm")
A.1.3: Corporal section (for example "my upper body")
A.1.4: Whole body (for example "I feel my body going forward")
A.1.5: Perception of sensation of speed
A.1.6: Perception of sensation of ease of movement
A1.7: Perception of sensation of rhythm
A.1.8: Perception of sensation of power

Category B, Context 1

B.1.1: Precise technical action (for example "I press my toe on the inside of my boot").
B.1.2: Semi-precise technical action (for example "I lift my left leg")
B.1.3: Actions non-related to ski performance (for example "I wave to my coach")
B.1.4: Gross technical action (for example " I bent my body backward")

Table 5 (continued):
Codes Identified During the Structural Qualitative Analysis Process of the Mental Imagery Transcripts

---

Category C, Context 1:

C.1.1: Hearing

C.1.2: Sight

C.1.3: Voice

C.1.4: Smell

Category C, Context 2

C.2.1: Hearing

C.2.2: Sight

Category C, Context 3

C.3.1: Hearing

C.3.2: Sight

Table 5 (continued):
Codes Identified During the Structural Qualitative Analysis Process of the Mental Imagery Transcripts

---

Category D, Context 1:

D.1.1 Self-motivation
D.1.2 Aggression
D.1.3 Intensity
D.1.4 Concentration
D.1.5 Confidences
D.1.6 Strategy
D.1.7 Desire to win
D.1.8 Perseverance
D.1.9 Visualisation
D.1.10 Sensation of doing well
D.1.11 Arousal control
D.1.12 Efficacy
D.1.13 Anxiety

Table 6:
Comparing Both Groups on the Percentage (%) of Types and Context of Mental Images Found Within Their Visualisation Process

Variables	Low Performance Group (average)	High Performance Group (average)	T	P
Types				
Kinesthetic Sensations	45.3%	55.1%	-1.71	.099
Physical Actions	25.5%	20.7%	.95	.348
Sensual Perception	18.5%	14.3%	.89	.383
Psychological Context	10.4%	9.1%	.38	.704
Context				
Internal Environment (Body and mind)	76.1%	81.1%	-.98	.337
External Environment (race course)	19.3%	14.2%	1.24	.224
External Environment (slope)	4.1%	3.5%	.27	.791

Table 7
Comparing Both Groups on Percentage (%)
of Codes of Mental Images

Variables	Low Performance Group (average)	High Performance Group (average)	T	P
Code A.1.1 Differentiated Muscle	10.3%	22.8%	-3.13	.004
Code C.3.2 Sight, context of the slope	0.3%	2.5%	-2.10	.045
Code B.1.3 Non-ski Performance related technical actions	3.2%	0.6%	1.94	.063
Code B.1.4 Gross technical Actions	14.7%	8.2%	1.87	0.72

Table 8
Linear Correlations Between Performance and Types, Context and Specific Codes

Variable	"r" of Pearson
Type	
A. Kinesthetic Perception	.33
B. Physical Actions	-.15
C. Sensual Perceptions	-.20
D. Psychological Context	-.01
Context	
1. Internal Environment	.23
2. Race Course	-.20
3. Slope	-.15
Codes	
A.1.1 Differentiated Muscles	.40
A.1.8 Perception Sensation of Power	-.39
B.1.3 Non-Ski Performance related technical action	-.42
C.1.1 Hearing context 1	-.33
C.2.1 Hearing context 2	-.35
C.3.2 Hearing context 3	-.33
D.1.9 Visualisation	-.31

APPENDIX A:

Consent form

To **Name of the participant** (or parents and / or legal guardian if participant is under 18 years of age).

This form confirms the consent of **(name of the participant)** to participate in the research project titled "Identification and analysis of the mental imagery content of young alpine ski racers", conducted by Richard Monette under the supervision of Dr. J. W. Friesen in the Graduate Division of Educational Research. The purpose of this study is to identify what kind of images are visualised by young alpine ski racers and to identify any correlation between the nature of those mental images and the level of performance of the subjects.

I have been informed, to an appropriate level of understanding, about the purpose and methodology of this research project, the nature of my involvement, and any possible risks to which I may be exposed by virtue of my participation.

I agree to participate in this project by doing the following:
1) Describe, on audiotape, my usual mental imagery skiing training
2) Complete the questionnaire "Use of Mental Imagery by Ski Racers"

I understand and agree that:

• My participation is voluntary and that I have the right to withdraw from this research any time without penalty.

• Participation or non-participation will have no effect on my position within the program.

• All data will be kept in a secure place inaccessible to other and will be destroyed after three years in
the following manner:
-Shredded in three years or when project has been completed.
- Audiotape will be erased when research is completed.

• Confidentiality will be assured in the following manner:
  - Data will be coded so that I will not be identified

• The risks involved in participating in this study are no greater than the one involve in your usual use
of mental imagery as a psychological training technique for ski racing.

• I will withdraw from the process if I feel uncomfortable when completing the following activities:
  - Description of mental imagery process
  - Answering the questionnaire

I have read understood and agree to the foregoing

Signature: _____

Date: _____

APPENDIX B:
(QUESTIONNAIRE)

The Use of Imagery by Ski Racers

Name: _____

Age: _____

Category: _____

Instruction: Please complete the following questionnaire. There are no good or bad answers. The goal of this questionnaire is simply to gather some information about the way you use mental imagery.

Adapted from C. Hall "The use of Imagery by Rowers"

Introduction:
Mental imagery is a method of seeing yourself in action. It can also include the sensations and feelings associated with a specific physical action, the surrounding of where the action takes place and the atmosphere associated with the environment.

This is a questionnaire designed to assess the use of mental imagery by skiers. there are no right or wrong answers, but please try to answer as accurately as possible.

In the following questions where a scale is given, please circle the appropriate number corresponding to your degree of imagery use.

Q1) To what extent do you use mental imagery in your training ?

1	2	3	4	5	6	7	8	9	10
Never									Always

Q2) To what extent do you use imagery in competition ?

1	2	3	4	5	6	7	8	9	10
Never									Always

If you answered 1 to both questions 1 and 2, do not complete the remainder of the questionnaire.

To what extent do you use mental imagery:

Q3) before practice

1	2	3	4	5	6	7	8	9	10
Never									Always

Q4) during practice

1	2	3	4	5	6	7	8	9	10
Never									Always

Q5) after practice

1	2	3	4	5	6	7	8	9	10
Never									Always

Q6) before a race

1	2	3	4	5	6	7	8	9	10
Never									Always

Q7) during a race

1	2	3	4	5	6	7	8	9	10
Never									Always

Q8) after a race

1	2	3	4	5	6	7	8	9	10
Never									Always

Q9) during an other unrelated training activity (running for example)

1	2	3	4	5	6	7	8	9	10
Never									Always

Q10) during breaks during the day

1	2	3	4	5	6	7	8	9	10
Never									Always

Q11) before going to sleep

1	2	3	4	5	6	7	8	9	10
Never									Always

Q12) When you are using mental imagery, to what extent do you have the feeling of actually skiing ?

1	2	3	4	5	6	7	8	9	10
Never									Always

Q13) Are your mental imagery training sessions structured ? (similar practice each time)

1	2	3	4	5	6	7	8	9	10
Never									Always

Q14) How long have you been using mental imagery in order to improve your ski performance

Please answer in **Months**: _____

Q15) How much time does your mental imagery session for ski racing last ?

Please answer in **Minutes**: _____