Department of Industrial Engineering and Management

The Road to Exceptional Expertise and Success

A Study of the Collective Creativity of Five Multiple Olympic Gold Medalists

Susanna Rahkamo

Aalto University

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A Study of the Collective Creativity of Five Multiple Olympic Gold Medalists

Susanna Rahkamo

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Abstract

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Abstract

This qualitative study is about self-organized and distributed dynamic systems focusing on the process of building exceptional expertise, paying special attention to how creativity contributes to the process. Using grounded theory, the study reveals, which factors and processes built Finnish multi-times Olympic Champions to become unbeatable; and furthermore, provides insight into what the role of creativity is in the process.

This study states that the development of exceptional expertise in sports is a cumulative cyclical spiral that has six factors linked to each other. The factors in the spiral are: 1) questioning and playing with the thought, 2) insight, 3) systemic applications, 4) faith in self, 5) inner drive and 6) persistent work. These factors have been studied separately in various studies, but how they all link together has not been presented before.

In the system of building excellence, the athlete, the coach and significant other people, as well as the culture, the environment, the equipment and the surroundings are in dynamic interaction. From the effect of these interactions, new opportunities emerge as activities evolve. Little sparks of insights appear little by little through collaboration, seeing, probing and reflecting, affecting an exclusive perspective, understanding, view and allowing holistic insights to develop. Therefore, building excellence is a collective activity merging many peoples' knowing together and this requires creative agency from the athlete as well as from others. As a result of collaboration several expert growing processes often develop side by side, reinforcing each other.

This study shows that creativity has an important role in forming the unique insight and this insight affects the quantum leap to exceptional expertise. In such a non-linear system, it is difficult to find any single creator or a simple explanation for success such as an athlete or coach's creativity. However, it is important to identify creative mechanisms that affect the progression to peak success. Until now, the role of creativity in becoming exceptional in sports has gained little attention in academic research.

This study brings new viewpoints to building excellence in sports. Furthermore, the study sheds light on this thorny concept, providing insight for any experts, teams and organizations also in other domains searching for a winning edge and the way to become exceptional experts.

Keywords expertise, collective creativity, sports, success, development, Olympic athlete

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Tiivistelmä

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Tekijä
Susanna Rahkamo

Väitöskirjan nimi
Tie menestyksekkääksi huippuasiantuntijaksi – Tutkimus viiden moninkertaisen suomalaisen olympiavoittajan kollektiivisesta luovuudesta

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Tiivistelmä

Tutkimus käsittelee menestykseen johtavaa huippuosaamisen kehittymistä ja luovaa ongelman ratkaisua, ja tuottaa uutta tietoa huippuasiantuntijaluovuudesta sekä menestymisen ja luovuuden kytkeytymisestä toisiinsa. Grounded theory –metodin avulla se pureutuu moninkertaisten suomalaisten olympiavoittajien dynaamiseen, vuorovaikutteiseen ja systeemiseen kehitysprosessiin. Tutkimus osoittaa, että luovuus on tärkeässä roolissa ainutlaatuisen osaamisen kehittymisessä ja vaikuttaa kuuden kriittisen osatekijän kanssa poikkeuksellisen menestyksekkään asiantuntemuksen kypsymiseen.

Tutkimuksen keskeisenä johtopäätöksenä hahmottui luovan ongelmaratkaisun synnyttämä kipinöinti sekä huippuosaajaksi kehittymisen kumulatiivinen ja spiraalinen malli. Mallin osatekijät ovat: 1) Kysyminen ja ajatusten pallottelu 2) näkemyksen muodostaminen 3) soveltaminen 4) usko omaan tekemiseen 5) sisäinen palo ja 6) periksiantamaton työ. Spiraalin pyöriessä, dynaamisessa vuorovaikutuksessa toisten ihmisten, kulttuurin, välineiden ja ympäristön kanssa syntyy kipinöitä, pieniä oivalluksia, jotka vaikuttavat osaamisen kehittämisen suuntaan ja painotuksiin. Kipinät syntyvät yhdessä tekemisen ja miettimisen, näkemisen, lukemisen, kokeilemisen sekä reflektoinnin seurauksena, avaten uusia näkökulmia, luoden ymmärrystä, sovellusideoita ja muokaten kokonaisnäkemystä.

Vaikka tällaisessa systeemisessä kehitysprosessissa on vaikea löytää yksittäisiä tekijöitä tai yksinkertaista selitystä menestykseen ja erityisyyteen, kuten urheilijan tai valmentajan luovuus, tutkimus hahmottaa kriittisiä tekijöitä ja luovia mekanismeja, jotka vaikuttavat huippuasiantuntijaksi kehittymiseen ja menestymiseen. Huippuosaamisen synnyttäminen on kollektiivista toiminta, jossa yhdistetään monien ihmisten tietämystä. Tämä vaatii luovuutta sekä urheilijalta että muilta. Tällainen toiminta tarjoaa samalla aineksia kunkin osallistujan henkilökohtaisen asiantuntemuksen kasvuun, kuten tässä tutkimuksessa sekä urheilijoiden että valmennustiimin jäsenten erityisosaaminen kehittyi yhteistyön seurauksena.

Viiden suomalalaisen moninkertaisen olympiavoittajan kehitysprosessin tarkastelu tarjosi lähes laboraoriomaiset olosuhteet huippuosaajaksi kasvamisprosessin tutkimiseen, sillä urheilussa sekä suoritus, että lopputulos ovat tarkasti määriteltyjä ja kriteeristö kaikkien tiedossa. Näin menestystä tavoittelevat ovat lähtökohtaisesti samassa asemassa.

Tutkimus osaltaan valottaa luovuuden abstraktia käsitettä, tarjoaa uutta näkökulmaa edistää paitsi yksilöllistä potentiaalia niin myös organisaatioiden voimavaroja sekä auttaa löytämään väyliä ylivoimaisen osaamisen ja poikkeuksellisen asiantuntemuksen saavuttamiseen.

Avainsanat asiantuntijuus, luovuus, kollektiivinen luovuus, urheilu, menestyminen, kehittyminen, Olympiaurheilu

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It is hard to believe that this long process has come to an end. Making a scientific contribution has been an extraordinary effort and, at the same time, I have enjoyed being a student again with the opportunity to explore and learn. Now, when the journey is over I can appreciate the trouble and be amazed by the learning I have gained. Preparing this work has truly expanded my own thinking and confirmed to me both in the results as well as in the process the importance of being surrounded by extraordinary people. As I state with this study, this work has also been a collective creation combining many peoples' wisdom and creativity. I thank collectively all the lecturers and researchers who I have had a privilege to study with as well as those whose written text has contributed to my thinking. I have learned from so many. However, I wish to extend my special gratefulness to a few people who have invested their time in the aim of helping me with this specific work.

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My colleagues at Pertec Consulting have shown tolerance towards me in regards to being absent from work from time to time. I am especially grateful for the intellectual friendship with Pentti Sydänmaanlakka for his encouragement, great support and devotion to helping me in this project. I greatly value the advice and mentoring as well as his effort of reading the half ready text over and over again.

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The findings of this study are built on the careers of great Finnish athletes together

with their coaches. I wish to thank them all for engaging in deep discussion and allowing me access their world. I am extremely grateful for their time and helpfulness. They were all making a great effort in trying to help me to understand their thinking, approach, the path, the choices and to clarify the feelings they were carrying inside. The coaches' input was truly valuable as they opened their philosophy and methods to me. I wish I could have had the change to present my results to the great coach, Matti Pulli, but, unfortunately, he passed away during the process. I am lucky though to have been able to capture some of his thinking in this work.

I wish to thank professor Kai Hakkarainen who firstly, opened his virtual library of expert literature and guided me to quickly capture the streams of discussions in that area. Secondly, he let me attend the collective creativity seminars at the University of Helsinki, get sparring and ideas from the group of researcher for my work. Thirdly, I am thankful for him for pre-examining this work, giving the deep analysis, encouraging feedback and final hints for polishing.

My sincere thanks goes also to professor Cliff Mallet, from The University of Queensland, who acted as the other pre-examiner of my dissertation. Getting a monographic dissertation evaluated at the other side of the world by an esteemed specialist in the field of sport science, felt exciting and also slightly scary. Therefore, the uplifting statements felt extremely good. Especially gratifying was his positive view of the usefulness of the models in practice.

I will also thank in advance professor Erno Lehtinen, who will act as an opponent of this dissertation. I hope that we will build an interesting and exciting discussion of the topics in the defense.

For Aalto University, I am grateful for offering the superb academic home for my work providing tools and the necessary guidance. For the Finnish society, I am extremely thankful for the outstanding education system that offers excellent education and provides the possibility for researchers like myself to explore. Personally, it has been a true privilege to be able to access the university once more, join the intellectual trip and take part in academic knowledge building. I am extremely thankful that I got the opportunity to make this expedition. For the Finnish Work Environment Fund, I am thankful for investing in the project.

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Finally and extremely deeply I thank my dear family for their love and support. I cannot emphasize enough the meaning of their influence in this process. A special note of gratitude goes to my husband Petri, for extensive discussions and sense making together, as well as having a tremendously positive attitude and giving encouragement to my work. As throughout the sporting years he still gets more out of

me than I myself believe, I am fortunate to have him on my side. I also want to praise my parents for all the support through my life and also in this process. My mother Auli took the effort to read through the drafts of my work and gave valuable feedback, even though the research area was quite different to hers. With this work, I am proud to join the chain of doctors already in the third generation in our family. To my father Kari, I am grateful for the unconditional support during my sporting career. I do not think that without those wise philosophical remarks when growing up, I would ever have become a champion in sports. It is these subtle comments that started the thinking process that has refined over the years to this theory building work.

By looking forward, I am dedicating the work to the bright future of our lovely children, Max and Camilla.

Vantaa, 13 November, 2016

Susanna Rahkamo

Contents

List of figures

List of tables

1. Introduction

1.1 Background

Competition has become increasingly global in many fields of life. Often the winner clears the table and the others are left with the crumbs. Therefore, to become the best in the world is highly important for a growing amount of people and organizations. For this reason, the vigorous search for improvement is increasing as individuals, teams and organizations are constantly seeking ways to perform in a unique manner and to use the resources available to gain a competitive advantage.

This study was started from the empirical observation that some experts seem to become sovereign in their field, coming up with winning strategies over and over again whereas many hardworking people do not distinguish themselves from the mass even with discipline and devotion. A similar observation struck me in an area with which I am very familiar, sports; some athletes become exceptional, unique and unbeatable in global competition. They seem to be able to better adjust their training and performance through slightly altering their approach. It appears that these individuals, teams and sometimes the whole systems are better and more inventive in solving the problems coming their way and creating own ways of doing.

When I was looking more closely at extremely successful individuals, teams and organizations, it appeared that on the way to success people had made many unique decisions that triggered them in somewhat new directions. These sometimes tiny incidents affected minor changes in their paths that, in the end, appeared to lead to decisive turning points and further, to new dimensions in their performance.

When I started this research I was very curious as to how these ideas, visions, minor changes and following an own route comes about. I was after what Frank Sinatra sings about in the famous song: “I did it my way”, asking myself could this research identify such catalyst moments and patterns that led to own ways.

I had a hunch that creativity plays a part in the process of becoming exceptional. This hunch is based on my own career in sports. Looking back on my own career as an athlete, I can see that it was not a straight line or a ready path but a series of situations, collaborations and decisions paving the way to becoming the European Champions and World Silver Medalists in ice dance with my ice dance partner Petri Kokko, my coach Martin Skotnicky, and the rest of the coaching team. Reflecting on my path and career as a professional figure skater “from within” (Shotter 2006), I noticed how seemingly minor incidents were crucial in changing the path and affecting the future decisions in a systemic way. I wrote my thoughts (Rahkamo 2008, p.117):

> "To become a professional athlete and become the best in a sport, requires hard work, imagination, courage and the support of other people, as well as happy coincidences that make the overall system work."

Already, in my sporting career we were, with my team, always asking the question "why" and looking for a way to challenge the common pattern as we understood, very early in our collaboration, that the great athletes from the Soviet Union could not be beaten by emulating their ways of working. We did not have, as at that time the dominant Soviet skaters did, the privilege of ten coaches at every practice and a whole sporting system as a resource. However, we found many possibilities that we could use. Looking back on our career, taking advantage of these possibilities was also decisive and had great impact on speeding up our way to the top. This reminds me of the observations Hämäläinen and Saarinen (2007, p.63) describe as sensibilities in their system intelligent framework:

> "It might emerge from something incremental, marginal, even trivial. And yet it amounts to a huge restructuring of the fundamental aspect of an entire system – because of the leverage created by
>
> - change in the way people perceive other agents of the system as a result of a small change in other people's behavior
>
> - change in the way people perceive their own possibilities of acting with the system as a result of a small change in the system…"

Since my active sporting career concluded, I have had the honor of leading the Finnish sport system in many different positions, as the Vice-President of the Finnish Olympic Committee, the President of the Finnish Figure Skating Association and Chair of the Olympic Culture and Legacy Commission in European Olympic Committees, to mention a few. As a sport leader, my perspective has changed from being within to be more that of an external observer. However, being aware that small path openings in the right place can change the future for those who are currently trying to master their performance to win in global competitions in sport motivated me to reflect on what I might be able to add to the existing wisdom.

My mind has been racing in trying to put a finger on the details of what makes a substantial difference to the outcome of years of practice and the deliberate search to become unbeatable and exceptional. Simultaneously, with my voluntary work in the field of sports, I have worked as a leadership coach and consultant in helping individuals, teams, and companies as well as other organizations in their transformation to adjust to the rapidly changing environment of global competition, and the renewal process in finding their competitive edge. I have found a lot in common in the search for exceptionality in the seemingly disparate areas of life, business and sports. This leads me to think that building success requires similar behavior regardless of the field. To understand the distance from good to great is fundamental and decisive for success. The leadership guru Jim Collins (2006, p.128) describes the mentality between good and great in the same named book:

> "Much of the answer to the question of good to great lies in the discipline to do whatever it takes to become the best within carefully selected arenas and then to seek continual improvement from there."

Reaching the ultimate success in sport and the level of an Olympic gold medalist requires a competitive advantage and therefore athletes, coaches and sporting systems are constantly searching for and developing new ways of doing, going beyond existing and adapting the available resources to their advantage. The motivation for this study was this observation and wondering if perhaps the secret of success lies in the fact that those who become exceptional are better at identifying problems and finding solutions to them.

After a brief overview of the research it seemed that differences in the paths of experts' outcomes have not been researched thoroughly. There was very little depth given to the ways in which exceptional experts in sports built their wisdom. What appeared to be totally missing was the discussion of how new ideas of what needs to be developed, come about. As a finding from this overview, the following conclusions could be drawn; we do not adequately know how the combination of seeking for improvement and practicing in a disciplined way really function together or how new ideas develop.

The literature on sports does not pay attention to insightful thinking but rather concentrates on such areas as exercise, motivation, physical and mental abilities, circles of acquaintances and environmental issues. Across studies in sports explaining success there was very little discussion about creative thinking, with only a few exceptions that will be presented in the literature. In other words, the idea of creative thinking in building knowing and insight in sports is almost non-existent in current literature. To my mind, there seemed to be a considerable lack of theories concerning expertise: how creativity comes about in such areas as sports where the end product is rather well defined and regulated.

I felt that this study could identify the difference in the development process by asking questions in order to ascertain what role creativity plays in becoming superior in a field of sport. Therefore, this study seeks to find out how to learn to know what kind of improvement is needed and what should be done to get an upswing; what happens before and how can this enhancement be transformed into action.

I got excited and decided to dive in to look for creativity by evaluating the myriad developmental stages of multi times Olympic Champions on their arduous path to glory. With the practical notions as well as my own experiments and thoughts, I wanted to look more closely at what is involved in building the exclusivity, at how and through which processes experts become exceptional, paying special attention to those incidents that significantly impacted on the way**.**

The job itself felt like looking for a needle in a haystack but I believed I could find something interesting if I looked close enough, being alert to statistically infrequent ideas, as Csikszentmihalyi (1994, p. 299) explains:

> "Creativity is an attribute of ideas or products that are original or statistically infrequent, and therefore unpredictable, in a given culture."

My concrete aim with this study is to identify how to catalyze the process and, as a leader, how to find what kind of mechanisms of creativity should be reinforced. With this research I hope to shed some light on the phenomena of success, by looking at the process that leads to it as well as the elements that are involved. My underlying hope is that the findings as to how to create excellence in sports might be successfully applied in other walks of life too.

1.2 Research questions

Creativity is seldom associated with sports, and maybe as a natural consequence, the researchers studying creativity have not been looking at the field of top sport. Often, creativity is defined as the goal-directed production of novelty (Weisberg 1993), although; it seems evident that creativity is essential whilst on the way to a well-defined goal that only a few in the world reach. I noticed that little is known about how and through which processes athletes and their teams make decisions that finally led to extreme success, beating opponents over and over again. Therefore, this study was motivated by the questions of how some individuals became superior in their field, and still more specifically how did they choose their unique approach.

This research is about the process of building excellence and the main objectives are to unfold the creative mechanisms that work in the system. To study this, the empirical work was done in a specific area of expertise; Olympic sports by asking two questions:

1. **Which factors and processes built multi-times Olympic Champions to become uniquely successful?**

2. **What role does creativity play in becoming an exceptional expert?**

These questions also have a pragmatic foundation. With this research I will unfold the ways and means of enhancing excellence, to find better ways for coaches and leaders to lead individuals, teams, organizations and even to assist societies towards winning in global competition.

1.3 Research lenses

My background and experience played a big role in the collecting and analysis of the data. Firstly, my position as a former athlete and current leader gave me access to interview Finnish sporting heroes. I believe that my knowledge and knowing play an important role in understanding the nuances of the data and give me the tools to look deeper, and more richly explain the meanings of what had happened.

Also, my work as a senior partner and consultant in a leadership consultant company, Pertec Consulting, gives me the perspective to explain the phenomena in larger contexts, what the findings mean from an organizational developer's perspective. Figure 1 shows the personal lenses through which I have viewed the data. With

these personal lenses I bring my own interpretation into this research, which is both the strength and a weakness of the study.

In addition to a scientific interest, this study is motivated by the practical interest of how to lead people, teams, organizations and systems towards success; therefore, the tone of the research is pragmatic. Even if the phenomena could be studied from different angles, I chose to look at it from an individual perspective. However, at the same time I have tried to capture the surrounding contributors to the process and understand the systemic dimension, which brings some complexity and systemic tilt to the picture.

This study views development of excellence from a fresh angle and offers the ongoing discussion on expertise research a new dimension. In order to do this, I have searched for explanations from such areas as creativity and knowing to find additions to what is already known.

To be able to say something about the phenomena of creativity in becoming an exceptional expert, I first had to define and identify exceptional experts in real life contexts. I also needed to be able to extract a process in real life situation that was clear and pure enough to enable me to pinpoint the relations leading to it. In sport, the end result is well regulated and therefore gives the possibility of focusing on the process. Because the most valued result in sports is winning at the Olympic Games, I decided to look at the Olympic winners and more specifically at those who had won Olympic gold medals repeatedly, as recurring success could not be explained away as mere coincidence.

My native country Finland has had a great history of outstanding athletes, but only a small amount of them, five athletes, fitted into my criteria of multiple Olympic Champions after the year 1970. In history, the Olympic Champions from Finland have been created through intense work by a small team rather than a sporting system. This offered me an excellent opportunity to focus on individuals in almost laboratory settings.

I could capture micro systems that were only weakly affected by the meso

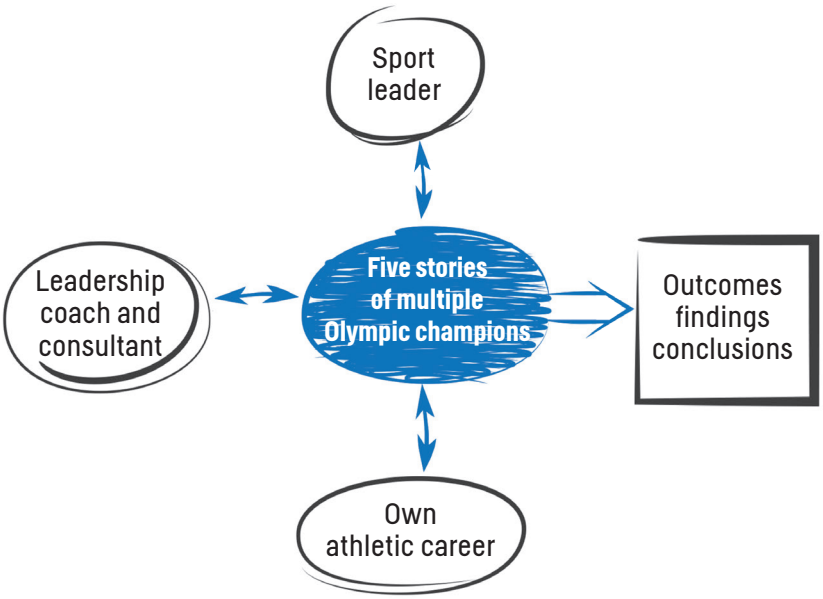

Figure 1. The personal lenses of analyzing the data.

level, the Finnish sporting system. On the macro level, the atmosphere for sports in Finland was positive, portraying athletes as national heroes. But neither sporting systems nor the Finnish society greatly affected the development of the Olympic Champions and they could offer only limited financial support to athletic careers. This leaves these micro systems as fairly remote, self-sufficient and a great target for research.

To answer the question of how creativity affects the process of building excellence, and to be able to understand the really outstanding performers' growing process, this research looks closely at individuals who reached excellence. The study is retrospective in nature and uses biographies and interviews as the data, in order to capture the voice of the doers and create a picture of their whole career. In an attempt to comprehend the process and understand the phenomena the study is conducted by qualitative methods using grounded theory principles to let the data lead in the right direction but in a structured way. This study presents five careers of five winners and tries to identify similarities in the processes of reaching the success.

Topics relevant to this research include such areas as expertise, creativity, knowing, sense making, drive and sports.

1.4 Preliminary explanations

In earlier work, scientists working on creativity believed that creativity depends on the special qualities of unusual persons (Amabile, Pillemer 2012, Sternberg 2012). However, the famous citation from Thomas Edison tries to point out the less mysterious process of excellence and inventiveness:

> "Genius is one percent inspiration and ninety-nine percent perspiration."

Csikszentmihalyi (1996, p. 1) came to the same kind of conclusion pointing out the process of getting to insightful ideas:

> "Genuinely creative accomplishment is almost never the result of a sudden insight, a light bulb in the dark, but comes after years of hard work."

In sports, people like to explain exceptionality as talent, inherited ability to perform better than others. Even if some inherited elements would give some benefit and give a great starting point in life and for the development of expertise, it does not seem to predict greatness (Ericsson 2013b) or creativity later in life (Sternberg 2012). The famous writer John Irving who suffers from dyslexia puts the matter well (Amabile 2001, p. 333): "Talent is overrated."

Looking at talent scientifically, studies are inconsistent, and there is no agreement on what part our inherited genes plays in becoming great (Johnson 2013, Kaufman 2013, Ericsson 2013b). As it is hard to predict talent from traits early in life, it leaves the question open, if such thing as talent exists.

Already more than twenty years ago, Ericsson et al. (1993a) stated that expertise is due to extensive time spent in deliberate practice for at least ten years, pointing to the quality of the activity and concentration on improvement. However, Ericsson (2009, p. 423) noted the following:

> "Experience in a domain of activity appears to be necessary to perform adequately, but extensive experience does not invariably lead people to attain superior performance".

Creative innovations are the highest levels of achievement in many domains because the creative individuals go beyond the boundaries of the domain and redefine them (Ericsson 1998). By only following the existing patterns one can get as good and as far as others. To become superior, one needs to build beyond the existing experts, blend a unique cocktail of knowledge and put that into practice. Maybe the answer to the mysterious achievement of superiority then, lies in a combination of perspiration and insightful thinking, with both elements being of equal importance.

Some other scholars (Ward, Kolomyts 2010, Kozbelt, Beghetto & Runco 2010, Kaufman, Beghetto 2009, Weisberg 2006, Gardner 1993) have come to the same conclusion that exceptional expertise and creativity might be closely associated and noticed that many variables appear to separate those who merely master domain-specific skills and knowledge from those who actually make creative contributions (Simonton 2000, Sternberg, Lubart 1996, Sternberg, Lubart 1995) and excel. Despite this, expert studies have covered creativity only slightly and conversely creativity studies experts (Weisberg 2006). Ericsson (2009, p.423) noted:

> "We still inadequately know why professionals differ so greatly in their achievements."

The explanations are still dominated by the idea theory that this is due to the amount of effort and time a person devotes to domain mastery (Ericsson, Krampe & Tesch-Römer 1993a) the ”99 percent ”described by Edison.

Often, athletic performance, performance of classical music, and medical diagnosis, are considered as uncreative fields, as performing in these areas requires high automaticity, but as Weisberg (2006, p. 767) notes:

> "These fields are more open for creative thinking than many realize."

Some athletes have left a notable mark in history, like Fosbury in high jumping or Tsukahara in gymnastics. In many cases, creativity has been subtler and appeared in development of equipment, training and testing methods or embedding knowledge used in other fields into own field of sports. This has often gone unnoticed. It is much better known and regoniced that mastery in sports needs practice, years of repetition and improvement, the “99 percent”, but it does not mean that the “one percent” would not be necessary, and even crucial for winning. The instinct and intuition, the vision and finding the solutions seems to be mandatory to become overwhelmingly great in sports. If we think about players like Messi, Maradona or Gretzky they appeared to just know what to do in each situation.

Maybe Jimi Hendrix’s words lead our thinking as he explains, after developing significant mastery:

> "Blues is easy to play, but hard to feel. It all has to come from inside, though, I guess."

The mysterious ”inspiration” by Edison, ”my way” by Sinatra or ”feeling from inside” by Hendrix hints at the role of a personal view and insight. We might all agree that these individuals were all superior experts in their fields but it seems hard to deny that each gave something of themselves to the process.

Still another aspect remains cloudy, how does the “inspiration” come about? Can it have its origins from within or is there some, as yet unsuspected element, which provides the vital spark? Often researchers studying mastery in sports, focus on individuals, however, looking at the bigger picture it appears that establishing mastery is a longer process of interaction with coaches and many others. In top sports, many people affect the growing process where the athlete can be regarded as an object and is the focus of others' actions while being the subject of their own doing.

Maybe extremely exceptional individuals engage with, and throw themselves into something that Hämäläinen and Saarinen (2007, p.15) describe in this way:

> "Systems create possibilities for self-supporting spirals of uplift in which people generate positive energy, excitement, encouragement and excellence through connectivity of the kind that sparks human flourishment."

Therefore, the questions remain, is the building of exceptional expertise an individual endeavor or a collective effort, and whose input and creativity is needed on the way to superior expertise, the surrounding people or a developing expert.

Literature on creativity is broad and the findings reflect a lack of consistency in how creativity functions, and what we really mean with the expression creativity (Runco, Acar 2012). Therefore, the starting point for this research is to narrow the scope and define what is meant by creativity and expertise. Kozbelt, Beghetto and Runco (2010) present several ways of grouping. One way to group is a four level categorization to distinguish the different nature of creativity: little-c, for everyday creativity; mini-c, happening in the learning process; Pro-c, representing progression from little-c to Big-C, and finally Big-C, meaning creativity that changes the world. The Big-C we can only refer to later when it has been acknowledged that the world has actually changed. With this categorizing in mind, this study will concentrate on the Pro-c-level, looking at both the development of expertise and creativity in this process.

It seems that lots of pieces of the puzzle of how to become exceptional have been identified so far, but many are still missing, and the pieces we have assembled up to this point are far from seamlessly linked leaving us with an as yet incomplete picture.

With these thoughts and observations regarding previous research and my pre-understanding of the phenomena, I started to think about how to initiate a research agenda that would enable me

to identify those moments that make a change in the pattern and to answer the question; what happenings lead to those changes? Following this, I will explain how I moved forward to examine it.

1.5 Structure of the thesis

Chapter 2, reviews the previous relevant literature and the terminology used in the empirical study starting from a wider angle and narrowing it to be more specific. This general structure stays similar throughout the chapter meaning that to begin with both areas, expertise and creativity, are explained separately, then, how they link together, and finally, how both of these areas relate to sports. In other words, the topic and angle changes in different paragraphs in chapter 2, but this main structure remains.

In accordance with the previous paragraph, 2.1. overviews the expertise and creativity literature encapsulating the general themes and discussion. 2.2. examines the literature related to talent and individual characteristics related to creativity and expertise. 2.3 taps into the development of expertise and creativity to find relevant explanations of the phenomena that will be used in this research. 2.4. observes how expertise and creativity can be influenced both externally and internally. Finally, chapter 2.5 draws conclusions from the current literature and introduces the viewpoint used in this study, which looks at an individual as part of a system.

In chapter 3, I explain my theoretical approach and orientation as well as elaborating on the research methods and collection of the data. This chapter should help the reader to understand my perspective, methodology and help to provide a way to follow my path of decision-making.

In chapter 4, the data, the five cases, the life stories of the Olympic champions are presented in brief. From chapter 5 onwards, my interpretation of the data starts and the research questions will be answered by first explaining the factors in the process of exceptional expertise and then moving to describe how creativity appears in that process. In this chapter the voices of the extraordinary achievers are presented through many original quotations. In this chapter, the reader can also follow how the abstractions have been formed and why I have brought certain elements to the fore.

Chapter 6 will conclude and unite the elements presented earlier in chapter 5 into a process, explaining what leads to what. It introduces the “six-factor model”, and how creativity links to it. It also links the findings to previous research. The second part of chapter 6 opens the discussion about the practical use of the model and the ideas presented in this study. It will also discuss the reliability of the research methods and the strengths and weaknesses of this work to make it easier for the readers to put the findings into the right context and allow them to judge the usability of the outcomes. In the end of the chapter some ideas for future research possibilities are presented, which have emerged while doing this research.

2. Literature

> "A central problem with identifying the exceptional achievements often associated with giftedness is that many of them require creativity and innovation, such that exceptional products reflect ideas that go beyond the current ideas of society (Ericsson, Roring & Nandagopal 2013, loc. 4318) ."

The purpose of this study is to increase the understanding of how excellence comes about and how the idea of what needs to be done emerges. In this chapter, an overview is created of the previous research done both in expertise research, looking specifically at what is understood about becoming excellent, and creativity studies to build a view of what is understood about how creativity works. This literature review focuses on the discussions on these topics in general but pays special attention to the research conducted in sports. This two-sided examination is used to help to build the understanding of the phenomena rising from the empirical data.

The body of work regarding expertise is approached iteratively; starting from Ericsson's et al. (1993a) groundbreaking insight into how expertise is gained through deliberate practice. The creativity theory, on the other hand, has been examined from a very broad level. For getting an overview of the creativity theory, a meta-synthesis was executed, roughly following the protocols outlined by Tranfield et al. (2003), which consisted of two processes: first, defining search protocols and second, reporting the findings. The search process is presented in Appendix 1. The remarks about creativity in this literature section are based mostly but not exclusively on these findings. Some literature concerning collective creativity has been included, as this did not come through very strongly in the meta-analysis, however, collectivity and collaboration appeared to be important elements in building superiority.

In addition to these two very closely related fields of theories, some relevant literature has been included from such areas as motivation, collective knowledge gathering and mental toughness as these areas are helpful in explaining breakthrough success, creativity and excellence. Also literature from sports is reviewed to capture the discussion going on in this specific domain about the process of becoming exceptional.

In section 2.1 and its segments, I will go through some of the debates, views and explanations of expertise, and creativity at a general level, at first separately then together and finally specifically in sports. Section 2.2. concentrates on talent and individual characteristics, and 2.3. on the development of the areas, expertise and creativity: first coming from the broad perspective and then narrowing it down

to be more specific about the process of development in sports. There I have also included some literature about the development of mental toughness, as becoming superior seems to involve psychological strength, capability to get over disappointments and an ability to stay resilient for a lengthy period of time. In section 2.4, I will focus on matters that affect excellence building, both internal and external influencers. This section describes how environment and other people's, especially coaches', input influences expertise creation and how a person's own mental toughness affects the process. Section 2.5. draws conclusions from the literature presented here. At the end, the chapter closes by enlarging the view from an individual to a system view.

2.1 Expertise and Creativity

Throughout human history, people have been constantly pushing the human race forward. However, defining what creates greatness seems to be hard to distinguish and a complex phenomenon to capture. Individual differences in professional achievement are huge but we still do not adequately understand the sources of these differences (Ericsson 2009). Weisberg (2006) explains that deliberate training is the foundation of expertise, which, in turn, is responsible for consistent high-class performance that is creative. It appears that expertise and creativity are intimately connected and I have a basic assumption that expertise and creativity are both needed in excellence. These two seem to be bound together. The same people are not excellent in many fields and also creativity seems to be very domain specific (Baer 2012).

The attempts to define greatness have created debate, research explanations and different conceptualizations. In the next part, some discussions going on are reviewed both in expertise and creative research in order to form a foundation to show what is known and what is not known in these two areas. Research findings are also shown in order to explain what is known about excellence in sports and how creativity is considered in the process of becoming superb in sports.

2.1.1 Expertise as excellence

From a traditional cognitive perspective, expertise is an exceptional competence, based on acquired knowledge structures, which are mentally processed (Hakkarainen et al. 2011). Weissensteiner, Abernethy and Farrow (2009) defined expertise as an emergence of the successful interaction of biological, psychological, and socio-developmental factors in a process of practice carried out over a (long) period of time, which leads to adaptation and growth, both psychologically and physiologically.

Excellence goes beyond expertise and very few people reach this level. Good and great are therefore different but sometimes hard to distinguish as different routes and abilities seem to affect reaching them. Various explanations for the phenomena have been given in research looking at individual differences, development and influencers of personal growth as well as living, learning and working environments. Some inborn personality traits might have an impact in attaining excellence, however a human being is very raw when born and the cells are dynamically open to change.

The nature/ nurture debate has been strong in explaining greatness, and in the past more weight was put to inborn differences. In contrast, Ericsson et al. (1993) argue that greatness is largely due to large amounts of domain-specific knowledge acquired through many thousands of hours of deliberate practice where one pushes beyond one's own limits and constantly strives to be better.

Studies of resilience have shown that staying involved for lengthy periods of time, from youth to adulthood, appears to be important in explaining greatness. Many findings strongly support the supposition that deliberate practice is the major determinant in the development of expertise (Baker, Young 2014, Ford, Hodges & Williams 2013) for healthy individuals (Ericsson et al 2013) and being part of a community of experts powerfully strengthens the process (Hakkarainen 2014, Stoeger, Gruber 2014). However, training can have many dimensions. It can be very creative when individuals explore, push the limits, and use the resources available in forming decisive training. Excellence is an evolution. However, some researchers have questioned the role of practice as being the only explanation, putting also weight on the combination of genes interaction and inborn requirements like intelligence (Rindermann, Ceci & Williams 2013).

Lately, research done to emphasize the importance of living, working and training environments is also gaining popularity to explain the development of expertise. Development seems to require complex processes where training, the surrounding people and environments affect the way genes develop. Excellence does not arise alone or by chance, but in dynamic interaction, as Stoeger and Gruber (2014, p. 5) explain:

> "People cannot single-handedly turn themselves into geniuses. Excellence is not about isolation, rather, excellence begets excellence."

Hatano and Inagaki (1986) also point out that although unchanging environments and cultures offer reasonable resources for learning and achieving routine expertise, by following well-guided paths these experts sometimes lack variability. Knowledge is clustered in domains (Csikszentmihalyi 1996) and elements for creativity therefore scattered around in many fields. To develop further and to levels beyond previous, people need to have possibilities for adaptation, to seek out places to produce the necessary variability and pay visits to other fields. Elements for fresh and creative notions can often be found from other domains and the seeds for new ideas are usually scattered around in many fields.

Sometimes when facing demanding surroundings disruption or change the need for modification or invention of new skills becomes forced and the exploration to overcome possible constraints also turn out to become motivated. People can also actively experiment with their environments and in doing so new ideas for variation can appear instinctively and serendipitously. In this way, adaptive experts differ from ordinary experts significantly.

Hatano explains how some experts are searching for different challenges as well as constantly reaching to the upper limit

of their own expertise thus making their expert zone grow bigger (Hakkarainen 2014, Hatano, Inagaki 1986).

Being among others and especially among more advanced performers positively affects development. Several researchers have studied knowledge and tried to define it as something people have (possess) or do (practice)(Newell et al. 2009). A lot of interest has been directed to how knowledge is transferred and how new knowledge is being built (Nicolini 2011, Cook, Brown 1999, Tsoukas 1996, Nonaka 1994). From the knowledge creation perspective, expertise involves a collective effort as knowledge does not emerge from the depths of an individual's mind but is internalized in a process of participating in social communities, mediated by complex knowledge artifacts and this takes place within collective knowledge networks (Hakkarainen et al. 2011). This perspective also takes into account the transformation process of knowledge, evolution and the creation of new knowledge and expertise, instead of a perspective where expertise involves acquiring already existing knowledge. Collaboration and thinking together are ways of making the mind more creative as other people give additional, supplementary and unexpected concepts to work on. Cultural immersion and the formation of centers of excellence where people come together to share, affect and promote the system of producing elite performances and expertise (Stoeger, Gruber 2014). Also Hodges and Coppola (2015) points out that people become more confident in their own abilities to perform a skill when they are observing a skilled performance. Our environment and the people around constantly affect us positively and negatively.

Kaufman (2014) summarizes the research findings on greatness from several researchers in seven claims about the development of excellence, which also form the definition of excellence used in this study:

1. Innate talent does not exist; all skill requires rehearsal and support.
2. The quantity of hours spent on a domain is not as important as the quality of deliberate practice.
3. 10 000 hours practice is only the average time needed for excellence. There is great variance between domains, within domain and between individuals.
4. Deliberate practice does not explain all variance.
5. Other traits are also vital for expert performance and not only deliberate practice.
6. Human capability develops in a complex interplay between genes and environment.
7. Individual differences influence but do not necessarily constrain the level of performance.

Excellence in this study is a term used for exceptional competence, which is acquired in a process of practice done over a prolonged period of time, and which goes beyond the previous knowledge and abilities of experts in the same field. The focus is placed on sporting excellence and success, and then on the individual athlete

producing this success, however, this study takes a wider perspective of looking at the process of creating new sporting strategies. This perspective includes the impact of the surrounding team and environmental aspects.

2.1.2 Creativity as a term

The term "creativity" is broad and each researcher seems to have a personal interpretation of it. Some refer to it as a way of thinking whereas, others perceive it as the way the brain functions, an attitude, a process or a product.

Discussion gets wider when we take innovations into focus. Creativity is needed to make innovations but the definitions of how these two concepts, creativity and innovations, are linked together have often been unclear. Often creativity has been considered as the generation of novel and useful ideas whereas innovations also include their implementation (Anderson, Potocnik & Zhou 2014).

This research concentrates on the term creativity, with the full awareness that the term innovation could still offer some additional explanations to the phenomena. I make this distinction, as I am not looking to ascertain if some innovations are made but firmly believe that creative thinking is required in the process of acquiring excellence. This process can, but does not necessarily, lead to innovation. However, I do consider creativity as something that changes the way previously taken, and therefore the implementation of a new strategy or a way of working, is affected also by creativity.

To catch the multifaceted discussion going around concerning creativity, a very systematic search protocol was followed and the meta-synthesis method used in order to provide a view of the creative process (Appendix 1). The central idea of concentrating on these review articles, contracted from the search, was to clarify what is known and what assumptions can be appropriately drawn from previous research, and to make sense of the growing and scattered research around creativity in psychology and social sciences.

In general, the findings still highlight the lack of consistency in how creativity functions and what we really mean when we refer to creativity (Runco, Acar 2012). Sternberg (2012) suggests that creativity is merely an approach towards living, a habit and acquired behavior to generate ideas or products that are original in a certain domain. There still seems to be many open questions left like; are creative traits genetic, how much does creativity develop when fostered, and how should people be stimulated to be more creative? One conclusion seems to be that creativity might be a combination of some personal traits (Chávez-Eakle, Eakle & Cruz-Fuentes 2012, Kim 2008a, Kim 2008b), attitude (Baer 2012), and the reinforcement of creative behavior (Sternberg 2012, Amabile, Pillemer 2012, Baer, Kaufman 2008, Scott, Leritz & Mumford 2004).

What we do know is that creativity as a concept combines a broad selection of cognitive processes, where the brain activates in certain ways (Runco, Acar 2012, Sawyer 2011b). Neuroscience has also shown that creative thinking is not something mystical as believed earlier but an interaction of cognitive abilities such as reasoning, representation,

association, working memory, and self-reflection. Contrary to earlier beliefs, the whole brain seems to be active when people engage in creative tasks, and not only the right hemisphere as thought earlier (Sawyer 2011b). In creative thinking, ideas, knowledge and past experiences are combined in the mind in new ways thus bringing new possibilities and solutions into consideration (López- González & Limb 2012). However, when carrying out creative tasks the same brain areas are active, which are active in many everyday tasks but resulting in behavior that is characterized as creative (Baer 2012, Runco, Acar 2012, Sawyer 2011b, Scott, Leritz & Mumford 2004).

Scott et al. (2004, p. 362) described creativity by citing earlier researchers in this way:

> "Creativity ultimately involves the production of original, potentially workable, solutions to novel, ill-defined problems of relatively high complexity".

According to them creativity can be understood in terms of (Scott, Leritz & Mumford 2004, p. 362) :

1. cognitive processes,
2. associational and affective mechanisms,
3. dispositional and motivational characteristics that prompt people towards creative efforts, or
4. outcome of strategies and successful exploitation of various environmental opportunities.

Sternberg and Lubart (1991) made an attempt to capture the essence of creativity by building an investment theory of creativity, a union of six distinct and interrelated resources that are required in creative thinking: intellectual abilities, knowledge, style of thinking, personality, motivation, and environment. In addition to this, Sawyer (Sawyer, DeZutter 2009, Sawyer 2008) as well as Hakkarainen (2014, 2011) brought collective nature and emergent perspective to the study of creativity.

In the light of recent research, several researchers have been concerned and been critical of the fact that ideas concerning creativity have been over-generalized, and these ideas have lacked validating research with strong research evidence (Runco, Acar 2012, Baer 2012, Dietrich, Kanso 2010). For example, Runco et al. (2012) mentioned that divergent thinking tests have occasionally been regarded as tests of creativity, but at best the tests are only indicators. Also Baer (2012) declared that as creativity seems to be very domain specific, it cannot be identified through all-purpose tests. Furthermore, creativity is not something that can be done whenever challenged with a standardized test (Sternberg 2012). It is a complex phenomenon.

Creative thinking has much in common with insightful learning and knowledge gathering, and if we assume that creativity is a learned habit it builds the questions, what kind of habits do we need in relation to growing to become expert and how do we develop them, what is the process and how can it be fostered.

In conclusion and for clarification, in this research, I use Sydämaanlakka's (2009, p. 111) approach when he summarized creativity as follows:

> "Creativity is the ability to see things from new perspectives and build from it something new, original and functional."

Creativity is therefore linked to the ability to put things into practice; in other words, it must be able to produce concrete results. It can be considered from many viewpoints: the individual or collective, product and end result or process or even a system. I concentrate, in this research, on the emergence of ideas and new approaches that are linked to the process of becoming excellent. To get closer to that, I will next explain what is understood about the process of creativity as it sheds some light also on explaining the progression towards excellence.

2.1.3 Process of creativity

25 years ago Amabile (Amabile, Pillemer 2012) structured the Componential Theory of Creativity in order to integrate the research findings of many scientists in the field of creativity and outline the creative process. The theory was first published in 1983 but has been built on ever since. It consists of three intra-individual components that influence creativity: domain-relevant skills, creativity-relevant skills, intrinsic task motivation, and one external component: the social environment. According to Amabile and Pillemer (2012), the external component (the social environment) stimulates intra-individual components and affects motivation. Domain-relevant and creativity-relevant skills on the other hand, can be trained, modelled, and experienced with the help of the social environment.

According to the Componential Theory of Creativity, in the first stage of the process, "**problem or task presentation**", the need or possibility to solve a problem or take on a new task arises. In this stage, task motivation is dominant as it defines if the person will continue to the second stage "**preparation**". In this second stage, domain-relevant skills are crucial in order to find the relevant information and often learn the new skills necessary to work on the task. Attention at this point is focused and deliberate. In the third stage, "**response generation**", possibilities are produced. This requires creativity-relevant skills and task motivation. The stage has two different steps: incubation and illumination.

Already, a long time ago, people had noticed that a period of unconscious incubation occurs just before getting an idea (Sawyer 2011b). When evaluating the novelty and usefulness of the possibilities a person has moved to the fourth stage, "**response validation**". In this phase, a person again uses domain-relevant skills in order to evaluate the feasibility of the solution. In the final, fifth stage, "**outcome**," is reached, used and communicated. Before this last step, when creative expression is formed and used often has a big time gap to the first stages. To reach the final stage requires persistence and tolerance to rejection, because society mostly sees attempts to alter the status quo as annoying (Sternberg 2012).

Amabile et al. (2012) point out that, in reality, the process of creativity is much messier than when neatly presented linearly in five-steps. This might be due to learning that happens between. This study tries to explain how this kind of creative thinking process occurs in the process of becoming excellent in sports, taking the whole athletes career into consideration in addition to learning and training, which are obvious factors in becoming successful in sports.

Many researchers present the creative process or creative problem solving as a cyclical endeavor coming back to previous stages or starting all over again (Vessey, Mumford 2012, Amabile, Pillemer 2012, Walinga 2010). Walinga (2010) states that unlocking insight (Dietrich, Srinivasan 2007) actually happens at the question end after restructuring or redefining the problem and not at the solution end. In the flash of insight or the 'aha' moment, a certain shift in thinking or letting go of assumptions happens, suddenly, as the problem and its potential solutions appear clearly, and comes through to the conscious mind (Dietrich, Srinivasan 2007). Dietrich et al. (2007) suggest that deliberate insight might be quite different to spontaneous insights in that two different types of information (emotional and cognitive) contribute to creativity. Vessey and Mumfort (2012) also propose that problems from different domains might also have special demands for the process. Being aware of these various ways of reaching and feeling insightful thought, this study is sensitive to the different mechanisms in play whilst reaching original ideas.

Ideas of unlocking insight gets support from experiments in neuroscience indicating that immediately prior to an insight solution there is a certain pattern of neuronal activation (Sawyer 2011b). Sawyer suggests that the feeling of insight might be merely a subjective feeling of emotional intensity or excitement when one has discovered the core problem, instead of when finding the solution to it. The process is still unclear and some researchers see this "aha" moment as critical while others do not. This study looks for those moments that the interviewees feel important, in other words they themselves point them out as having affected the way they think and then changed their future approaches.

> "Insight solutions seem to require distant or remote associations (Sawyer 2011b, p. 143)".

Different frequencies of the brain's electromagnetic field indicate different sorts of brain activity: The frequency bands of these active neurons are alpha type, which are associated with cognitive inhibition and occur, for example, while daydreaming (Sawyer 2011b). When daydreaming, thoughts are unguided and normative guidelines do not hinder the associative task (Dietrich, Srinivasan 2007). Dietrich et al. (2007, p. 58) explains that:

> "This time new ideas can be assembled unconsciously and then represented in working memory in their finished form."

These notions about daydreaming and insightful thinking leads to consider that before the "aha" moment there needs to

be input that triggers the mind to work, and after this specific "aha" moment, actions that change the future thinking patterns and freedom of thoughts in the way of letting the mind play with the task.

Sawyer (2011a) further theorizes that insight seems to come from the temporal, occipital, and parietal (TOP) areas of the brain, which receive many neuronal axon signals from the lower, sensory brain systems. Perception and long-term memory are located in these top areas. The front lobe, on the other hand, is active when thinking creatively. This notion is interesting and relevant for this study as firstly, the use of the front lobe seems to require extra energy, and therefore motivation to be used, and secondly, TOP areas are linked with acquired expertise, where the previous knowledge is already stored, suggesting that learning and knowledge acquisition needs to take place.

The process of becoming an Olympic champion takes years. This study looks at this process in a holistic way in order to find the cycles of creativity, inventing and learning on the way to excellence.

2.1.4 Thoughts about expertise and creativity

One of the leading creative researchers, Simonton (2000) argues that there are still many individual differences that cannot be explained only by expertise gathering, even if creative geniuses may have worked harder than their colleagues. There are three factors of concern according to Simonton in regard to the theories of experts attempting to explain superiority.

The first factor, creative geniuses have some character traits that distinguish them from the experts who have made less remarkable outcomes in that they are more unconventional, risk taking and open to experience. A possible reason for this might be that the ones asking more questions and not taking answers as truths, invest time in thinking and in daydreaming, and therefore are the ones finding new answers and ways of doing. Maybe these individuals have created some habits of working and thinking, or maybe they are working in such uplifting collaboration that it produces this kind of behavior. This study tries to probe into this.

The second factor, the more creative persons in Simonton's study spent less time in formal training than their colleagues. Formal training often aids the pupil to adapt to the teacher's way but does not usually promote seeking for alternative ways. Simonton (2000) hypothesized that even if some traits of creativity might be also inherited it is probable that the environment has a tremendous effect on creativity whether developing or suppressing it. In the belief that both social and physical environment mold the formation of habits and ways of facing obstacles and finding solutions, in studying excellence, focus needs to extend from individual to their social contacts and interaction with environment. This study is looking looks more widely at the interactions the Olympic champions had both with people, artifacts and to environment.

The third factor, creative productivity increases to its highest point often quite early in a career and then stops increasing. So, even with deliberate training, creativity does not often peak in the later

stages of a career. This might indicate that people are most flexible early in life and then become stuck with a certain thinking process and style as well as the expertise learned. This study pays attention to Simonton's point that the seeds for thinking styles are planted young, however, this study does not try to find and point out the genius creator as such but rather tries to display the unique thinking, acting and combination of crucial factors, which produces excellence. This study examines the potential collective form of creativity that manifests itself in the success over other athletes in the same domain.

There are still quite many questions to be answered and Simonton pointed out a few good directions for looking at them: what is the role of individual characteristics, how does the adaptive development process and the growth phases come about, when and how are new ideas established, and how are ideas adopted?

2.1.5 Expertise and creativity in sports

Human capabilities come close to their limits in elite athletes' outstanding performances especially in physical, psychological, motor and perceptual- cognitive dimensions (Ford, Hodges & Williams 2013). Despite this, the limits are constantly being pushed further. Motivated athletes and their teams are searching for new ways to practice and perform in order to win, master the opponent and break records.

The sporting genius has been defined as being an exceptional innovator, a highly creative athlete, a performer of novel moves and tactics, and a producer of imaginative strategies that tend toward competitive success by responding to the physical challenges encountered in the practice of sport in spontaneous and imaginative ways (Hopsicker 2011, Lacerda, Mumford 2010). The most puzzling questions that arose when making this study were, how are these geniuses made, and how are these strategies invented?

Smith (2003) pointed out that elite sport performance requires an athlete to integrate many factors, some trainable (psychology, physiology and skill), some teachable (tactics) and others outside the control of the athletes and coach (genetics and age). Pekkala (2011) compared the top athletes to entrepreneurs in business pointing out the similar capital that both career options generate. Therefore, what we often think about the abilities needed in becoming a top athlete are far greater than only the skill of athletic performance in a certain sport. This study tries to capture how and through which process these different elements integrate and come together to form an extraordinary athlete.

Despite the inventive aspect of becoming superior, researchers have shown little interest in studying creativity associated with sports. Maybe this is due to how the researchers see sports. For example, Simonton (2000) argues that an athletic performance is not creative as there is not a significant new product. This is partly true as the end product is well defined, however, the way to achieve the goal might still be quite creative. Creativity and creative thinking can be thought of in much wider terms than that of a basic product. In many areas of life, including sports, creativity is not the goal but a tool. The reason is not to be creative for the

sake of being creative but to act creatively in order to get to the goal, which, in sports, is to win. It might also be that because inventions in processes have given competitive advantage to the athletes, they and their teams have not actively shared details of their procedures and, therefore, these inventions have not been notified widely and publicly as being creative contributions. But Anderson (2001, p. 144) pointed out:

> "The athletic world is full of exemplary cases in which a sport or practice is openly transformed by an athlete who takes up the sense of possibility and goes to work on realizing novel ways of participating or performing."

An athlete or the team around the athlete might be extremely creative in finding a solution or using the environment and their own strengths, adapting to new situations, developing equipment and finding improvement. In this process of winning, some well-known athletes have ended up also leaving their mark on their sport, Biellmann inventing a spin and Salchow a jump in figure skating, Comaneci a specific somersault in gymnastics, Graf first and Boklöf later jumping with the V-style in ski jumping, and Siitonen applying freestyle to Nordic skiing, to mention just a few. However, others then followed these creators along with many other inventors, and incorporated these new moves and inspirations into their performances pushing the limits again further.

Even with such inventions, only a few studies have studied creativity in sports, but those who have, brought some ideas to consideration. Bar –Eli et al. (2008) studied two great inventions in sports, Tsukahara's Vault and Fosbury's Flop, and found that forming them were due to evolutionary, rigorous and a continuous development processes of solving a personal challenge or a problem in order to improve their own performance. Lacerada et al. (2010) described genius in sports, pointing out the strategic innovations, and especially to the beauty and excitement of these inventive movements. Memmert (2010, 2009) studied attention orientation, Hristovski et al. (2011) adaptive movement and Weissensteiner (2009) creative play. Hopsicker (2011) makes detailed description of benchmarks in developing creative behavior on the way to sporting genius and Campos (2014) explained creativity, spontaneity, habit, and the continuity in development of body and mind.

Araújo et al. (2010) reported that in unstructured street football, Brazilian elite football players tried many skills in different conditions without fear of ridicule or recrimination from observing coaches and, therefore, learned a unique palette of skills that were afterwards, and continue to be, valued around the world. Lacerada et al. (2010) explained how Argentinian footballer Maradona, for example, turned his "disadvantage" of being small to his strengths using his center of gravity to shrug off tackles. Hristovski and his colleagues (2011) on the other hand, found when studying sports in laboratory settings, exploring such activities, where an athlete needs to adapt and seek her own way, led to the creation of new opportunities for action. These examples show some benefits of adaptivity and the freedom to adapt that seems to generate new strategies in sport performance (Lacerda, Mumford 2010). Lacerada et al (2010, p. 187) explained that creativity and freedom interrelate:

> "Creativity is the product of freedom but also freedom is the product of creativity."

Memmert et al. (2010, 2009) experimented with attention orientation with different athletes in different sports and noticed how training makes them specialists in making creative decisions typical for the discipline. They found, for example, that some players act more creatively in complex game situations than others and can better regulate the span of attention and/or adapt their moves after internal signals. In this way, they could better make split second decisions than others (Memmert 2009).

More specifically, these researchers noticed that an expert in an open skill sport, like ball games or combat sports, pays more attention to less easily anticipated events when compared with a novice or an expert in closed skill sports like swimming, gymnastics, or figure skating. These expert ball-players are able to execute skillful play without using the limited cognitive brain functions (Diamond 2013), in other words, they use automated functions for most of the moves. In this way they save space for noticing anything that is new, unusual and not expected.

For example, a hockey player takes in all the relevant information. Additionally, he can also make sense of the set up behind his back from the positions, speed and directions of the other players with just one look. However, he only focuses attention to less expected actions and clues, to make quick decisions before passing the puck further. Sometimes this might look almost magical as a player can make a pass to a player behind through just knowing from cues that he is there.

If we look still deeper into the Memmert's (2009) findings, we can find that stimuli cues that orientate attention can be divided into four sub-processes: Orienting attention, selective attention, divided attention, and sustained attention. Each of these is specific to some sports and an expert in that sport outperforms a novice in that ability and can put it into action.

For example, a long distance skier learns to pay attention to the reactions in his body, knows how hard he can push and how a change in the terrain will affect the agony and recovery. A ski jumper, on the other hand, learns to read the wind and make changes in his jump accordingly. Engaging in these kind of reflections gives the ability to make unique plans and ways of adapting. To outsiders, they appear secret, but for an athlete the skill gives a tool to gather relevant information to be creatively applied to new situations. Learning distinctive type of skills and special creative thinking styles are specific in each domain of sports, and learning to use them seems to be a part of growing to be an expert. Memmert's studies point to the direction that there is not one single explanation as to how creativity is used in sports, however, by looking at some specific cases we might find common mechanisms that build excellence. This study focuses on finding such mechanisms.

This research seeks to find ways in which patterns of winning may be employed, systemised and performed repeatedly across the board; giving special attention to unique approaches and strategies. In this way, the research focuses on the process rather than the end product as an innovation. This type of creativity

has gone largely unnoticed by researchers. Anderson et al (2012) present, in their state-of-the-science review, that there has been quite a notable pause of research exploring the creative process compared with the excess of studies evaluating antecedent factors to innovation. This study will continue to study the process of excellence and creativity in it in an attempt to unfold the connection between creativity, expertise and excellence in sports. A central question in this research is – what is the role of creativity in building excellence.

2.2 Individual characteristics and resources for expertise and creativity

Tales about born greatness as well as stories of self-made excellence have always fascinated people, and lots of debate has been going on as to which line of these sagas is closer to the truth. The nature/nurture debate has been strong in explaining greatness, and in the past, more weight was put on inborn differences. In contrast, Coyle's (2010) research suggests that genius is a quality that can be taught, developed and relies mostly on deliberate practice rather than genetic hard wiring. Further to this, Ericsson et al. (1993a) argue that greatness is largely due to large amounts of domain-specific knowledge acquired through many thousands of hours of deliberate practice where one pushes beyond one's own limits and constantly strives to be better. In order to do those hours, one needs extensive motivation.

In this chapter, some more depth is added to the nature/nurture debate as well as to the individual characteristics and traits often found to be dominant in exceptional experts.

2.2.1 Individuals' functions in creative work

While many researchers have tried to explain capability as being largely connected to talent, others have tried to discover ways to prove the specific genetic traits of highly creative individuals. Research shows that highly creative individuals seem to have certain ways that their brain activates. For example, Chávez-Eakle et al. (2012) stated that specific personality characteristics and traits have been found in research of highly creative individuals, and that personality can have an impact on the realization of the creative potential. However, they state that vice versa the creative potential might have lifelong implications for personality development by offering possibilities for personality recognition, and re-organization of life. In other words, it is clear that, in creativity, certain personal traits are needed, but what is unclear; are people born with the traits or are they the result of development?

Stenberg (2012) writes that creative people have a habit of looking for ways to see problems from a new angle, overcome obstacles, take sensible risks, stand up for their own beliefs, tolerate ambiguity, act autonomously and persist when facing resistance. Chávez-Eakle et al. (2012) reported some dimensions of the specific personality traits of highly creative and currently productive individuals as being: high exploratory excitability and novelty seeking, low harm avoidance, high persistence, high self-directedness and high cooperativeness. They further state that

people achieving highly creative accomplishment have provided evidence to the predictions that these people have a tendency to be physiologically more responsive to internal and external stimulation. They explain that this over excitability leads to a richness in feelings, thoughts, vivid imagination, and moral and emotional sensitivity.

Researchers in many fields have tried to understand what goes on in the human body when engaged in creative tasks or different kinds of people involved with creativity. Even if some of these are beyond the scope of this study, there are a few interesting findings that help to understand certain kinds of behavior such as engagement and motivation.

Some genes seem to have links to creative personality traits. According to Chávez-Eakle et al. (2012) the dopamine reporter gene is found to have associations to cognition and motor functioning as well as links to personal traits such as exploratory behavior and novelty seeking. Dopamine is central to stimulating euphoria, emotions and feelings of reward. Novelty seeking and harm avoidance have also been associated with the serotonin transporter gene.

According to Sawyer (2011) what we call creative behavior might be a result of many different neural pathways connecting in the brain. The front of the brain, the prefrontal areas, are associated with thinking and the highest and most developed human abilities (Sawyer 2011b), however it is very limited in capacity, holding only a maximum of four items at a time in the mind (Dietrich, Srinivasan 2007). This area is mainly in charge of top down mental processes called executive functions (EF) also called cognitive control, which takes the lead when concentration is needed (Diamond 2013). It seems to have a role in creativity. According to Diamond (2013) EF consist of such functions as inhibition (including self-control and selective attention), working memory and cognitive flexibility.

The most demanding EF, cognitive flexibility, builds on two others and comes much later in human development. It is in charge of letting the mind play with different ideas one by one, changing perspectives back and forth and handling unexpected opportunities from different angles (Diamond 2013). The other two functions support cognitive flexibility, for example, by inhibiting already thought ideas and letting the mind switch to other ideas without losing the ideas already thought. Revolutionary ideas seem to need utmost cognitive flexibility. In order to find creativity, these moments of juggling alternative ideas and directing attention might be the cues to discovering the creative processes in sports.

Studies show that people with a large working memory capacity can concentrate more intently when a task requires, but when the task demands are low their minds start to wander (Sawyer 2011b). Such mind wandering seems to be important for creativity. Sawyer (2011b) presents the idea that “some neuroscientists assume that people prone to mind wandering may score higher on tests of creativity.” He also states it the other way around that “creative people show higher levels of alpha wave activity when engaged in creative tasks like the Alternate Uses Test and the RAT, compared to medium- and low-creative

groups." Alpha waves are known to occur during daydreaming (Sawyer 2011b). Therefore, mind wandering and daydreaming are also processes that are of core interest to this line of research.

However, the results that can be drawn from individual characteristics are general and often contradictory (Sawyer 2011b, Dietrich, Kanso 2010), and might occur because of a broad definition of creativity. Alternatively, some hypotheses have been proposed, such as that both sides of the brain are working and not only the right side as often thought. This might correlate with multimodal processing and cognitive activities such as thoughts, imagery, working memory, linguistic processing, attention, processing of emotions, and volition (Chávez-Eakle, Eakle & Cruz-Fuentes 2012, Sawyer 2011b). Chávez-Eakle et al. (2012) further suggest that this kind of activation might explain creative people's ability to translate their experiences into creative works fluently, originally, and flexibly.

In conclusion, a creative individual uses the brain in a variety of ways and creativity requires both active thinking and daydreaming. This indicates that a person has to have motivation towards the task in order to use the limited space for thinking, and to let the mind flow freely with certain ideas when not concentrating. The limited space in comparing options, points out that most brain functions need to become automatic in order to leave space for deliberate thinking and solving tricky questions, this again needs expertise. Additionally, it seems that a human brain can only solve one or two questions at a time, which points in the direction that building a new way might be time consuming and a process with many steps.

2.2.2 Talent

Starting from Guilford (1950), there has been a growing interest in finding the traits in talent of those who have changed the world. Still now, policy makers, teachers, coaches in arts and sports believe strongly that talent can be predicted and found at an early age, and special education should be given to those possessing the raw material for talent.

However, there are many examples of how extreme creativity or talent have not been recognized early in life, instead individuals have liked an activity, kept on doing it, and found their own route to excellence because of their strong drive and ability to use their own faults to provide benefit.

Amabile (2001) wanted to point out exactly that, when she questioned the whole idea of talent explaining creativity and expertise in her story of the world-renowned writer John Irwing. Irwing suffered from dyslexia and perceptual inabilities and therefore was seen as a non-talent as a writer. Still, he found his way to becoming a master of storytelling and has had an extremely successful career in book writing.

More recently, Simonton (2013) presented the concept that excellence requires interplay between nature and nurture, and therefore is dependent on environmental factors and gene endowment. Johnson (2013), on the other hand, debates that the nature-nurture dichotomy does not focus on the right points when studying the development of extreme expertise. She offers a person's "drive" as a more appropriate focus point to explain the difference in

achievements and explains that certain genes drive people to seek such experiences that power expert attainment and creativity.

Irrespective of this though, defining excellence is demanding and complex. It seems that too much gained expertise might hinder creativity and therefore hinder greatness (Kaufman 2013), but too little will limit possibilities. Simonton (2000) offers some advice to overcome this problem by advising the acquisition of expertise in diverse domains, which gives more alternative viewpoints with which to examine the world. Therefore, the ability to learn the right things might be extremely important, to see the right things as well as have access to the right teachers. This study does not try to solve this problem of talent, but is aware of the existing discussion and the contradictory views.

2.2.3 Motivation – An inner requirement of excellence

In reaching excellence, motivation is a vital concept in order to boost the action, and is required in looking for new solutions, engaging in thinking and reflecting (Deci, Ryan 2014, Amabile, Pillemer 2012, Ryan, Deci 2001). Motivation is a complex phenomenon and influenced by many extrinsic and intrinsic factors. Motivation has been studied frantically and research in psychology has assessed the relationship between motivation and the various consequences, from using at least three different approaches: cognitive, affective and behavioral (Vallerand 1997), all of them important for the purpose of this study.

Without motivation, a person does not even start an action, nor engages in the thinking process required for linking discrete elements of knowledge. Deep thinking takes time, effort, and energy and the capacity for mental energy expenditure per day is limited as explained by (Kahneman 2003), and therefore the use of this capacity is a choice. Without strong motivation towards the task many keep on only copying existing patterns from others, and also repeating their own, already acquired ways of doing.

Intrinsic motivation evolves from inside, from the sheer enjoyment of the activity itself, as extrinsic motivation does from outside in the attempt to attain some separate outcome like rewards, or when avoiding punishment (Amabile, Pillemer 2012, Ryan, Deci 2000). Intrinsic motivation is a meta-concept, and seems to apply in many domains (Baer 2012), but intrinsic motivation cannot be transferred from one area to another, so it is very domain specific.

Self-Determination Theory (SDT) (Ryan, Deci 2000) identifies three needs linked to intrinsic motivation, autonomy, competence and relatedness. These needs are gratified in the best way when the task is intrinsically motivating leading a person towards thriving, well-being and growth. Conditions that support wellness also support commitment, productivity, and creativity (Deci, Ryan 2014). Mahoney et al. (2014b) proposed that the self-determination theory also provides a sound basis for understanding the motivational antecedents of mental toughness bridging mental toughness and the self-determination theory, specifically striving, surviving, and thriving. These all seem to be vital in becoming expert.

Even if intrinsic motivation emerges from inside it can be reinforced by environment and positively strengthen, for example, by coaching. A key assumption of SDT is that energy can be enhanced but controlling, especially from the outside, drains it (Spreitzer, Porath 2014). Amabile and Pillemer (2012) noticed that while doing creative tasks intrinsic motivation increases when developmental feedback is given but often decreases when creative tasks are closely monitored.

Many researchers see that motivation is one of the powers behind creative work (Amabile, Stanley 1987, Runco 2004). A person might have expertise, skills and even a strategy to gain creative outcome, but without strong motivation these abilities are hardly ever put into action (Vessey, Mumford 2012). Openness to new ideas and a willingness to play with them for a long time are vital elements for creativity, however they are also very task- and domain-specific as mentioned before. Baer (2012) clears this thought:

> "One might be extremely open to new ideas in one area, either cosmology or cosmetology, but have no interest in new ideas in the other."

Therefore, people rarely do creative work in an area unless they really love what they are doing. The intrinsically motivated focus on the work than on the potential rewards (Sternberg 2012, Ryan, Deci 2000, Sternberg, Lubart 1996).

"Harmonious passion" is a strong and stable form of intrinsic motivation and affects creativity more than intrinsic motivation alone (Amabile, Pillemer 2012). Harmonious passion engages autonomy and creativity, bringing personal enjoyment through pursuing an activity through one's free choice. It internalizes the activity as part of the identity and being able to work and progress in it is highly motivating. It might be good to point out that working autonomously does not mean working alone or in a selfish way but in connection with collaborators on an equal footing.

Motivation in sports

In sports, developing into a top expert and a performer takes years and along the way to success, there are lots of constraints to navigate through. In this, motivation is crucial, and it affects in many ways are both intrinsic and extrinsic. Many studies show that self-determined motivation leads to positive consequences, like athletes' investment of effort (Pelletier et al. 1995), and persistence in sports (Pelletier et al. 2001). However, social factors such as success and failure, competition, co-operation with coaches as well as other athlete's behaviour can also affect motivation (Vallerand, Losier 1999).

As might be expected, Gillet et al. (2013) found that a non-self-determined profile characterized by low levels of autonomous motivation and high levels of controlled motivation predicted low levels of performance. However, they also found that performances in competition were good even if the level of outside control was high during competition, if at the same time the athlete's overall intrinsic motivation of the sports was high.

They explain the finding with situational motivation and the characteristic of sports competition. The reason for (elite) athletes to participate in competition is often to win, and by winning one obtains extrinsic rewards such as recognition, fame, and trophies, which the athletes sees as tempting and motivating. However, these researchers point out that this kind of positive effect of high level of outside control on performance seems to apply only when the athlete embodies also intrinsic motivation towards the own sport.

Chantal et al. (1996) conducted an interesting study with Bulgarian top athletes shortly after the collapse of communism, and found that non-self-determined types of motivations and amotivation were more prominent among the best performing athletes compared to the less successful. This finding shows that motivation is bound to cultural backgrounds as well as situations. In some situations, incentives to win are extremely high and pave the way to a privileged life. This fosters winning at all costs and non-self-determined types of motivations.

Motivation is also tricky and bears a risk, as the same kind of motivation can in different moments elevate or decrease a performance. Curran (2011) found that harmonious passion offered elite junior soccer players some protection against burnout due to high levels of self-determined motivation. However, Lemyre et al. (2007) found that sometimes self-determined motivation leads to overtraining and burnout. A good coach seems to be in a key role in facilitating adaptive forms of motivation to enhance the quality of sport performance (Mallett 2005).

In this study, motivation is believed to be part of becoming successful. The study tries to identify how motivation appeared in the five cases and how it affected the other factors development and creativity. Motivation might be a driver for the whole process as presented by Johanson (2013) and especially harmonious passion that leads individuals to choose to engage in the activity that they like (Vallerand et al. 2003).

2.2.4 Individual characteristics in sports

Fletcher and Sarkar (2012) found that Olympic gold medallists possessed numerous positive personality characteristics similar to the ones found in highly creative individuals (Simonton 2000) such as openness to new experiences, conscientiousness, being innovative, proactive, and risk taking. This symmetry between Olympic Champions and highly creative individuals might well predict that creative personality characteristics are necessities for athletes.

However, identifying the right talent beforehand is difficult and complex. In spite of the thousands of research hours devoted to the question of psychological and physiological profiling of successful sports performers, there is little to show how to identify adult elite or junior talents (Morris 2000). Up to today, no conclusive proof has been found that talent or other born attributes, excluding body size and structure, play a significant role in becoming great in sports (O'Keefe 2013). Quite to the contrary, choosing young athletes for intensive training groups based on identification of physical characteristics often seems to lead to early dropout instead of long term success (Burgess,

Naughton 2010). Talent is a multidimensional construct, but often simplified in some characters, which are easy to identify ignoring those that are harder to notice. Often picking out "the right talent" is based on the early signs of visible physical capabilities, rather than spotting those possessing potential for development and psychological resilience. Talent identification is therefore tricky, and we still only partly know what that means and no uniformly accepted theoretical framework to guide current practices has been found (Vaeyens et al. 2008).

According to Ford et al. (2013) even though height, stature and to some extent muscle and bone structure tends to lead individuals towards specific sports there is no clear evidence that, after years of practice, these inherited characteristics advance or limit expert performance in sports. Despite the fact that athletes from certain countries seem to dominate in certain sports, like East Africans in endurance running and Jamaican sprinters, the optimal learning environment and culture might be the core reasons for the development of expertise rather than genes.

Hundreds of autosomal genes, tens of multiple mitochondrial genes and genes in X- and Y-chromosomes have been shown to influence fitness and performance phenotypes (Bray et al. 2008). This advancement in genomic studies has led to overestimating their advancement, and is questionably used by some practitioners (Davids, Baker 2007). We still know too little about how the network of genes interact with each other and with the environment, and further to this, many other genes have not yet been studied for their potential influences or to their potential impact on human difference in performance or trainability (Bray et al. 2008).

This example shows the difficulty: Ford et al. (2013) explain the difficulty encountered in research attempting to study gender effect on swimmers and triathletes. The results were confused by the effect of body size and reach. Gender seemed to affect more in short distance than long but it was unclear what caused the difference: body size and the better reach or the gender.

Other research areas on body structure include muscle fiber type, bone structure and cardiac hypertrophy. For example, even if it is found that the distribution of muscle fiber type (slow and quick) differs from person to person at birth, it seems that this distribution can be developed towards the optimum with extended training (Ford, Hodges & Williams 2013).

Research has been done on the hormonal characteristics of individuals, for example Ford et al. (2013) describe the research conducted on inherent testosterone levels, which have been shown to indicate greater prowess later in endurance sport. They also portrayed studies, which examine the interaction between genetic polymorphisms and their response to training. These studies suggest that some individuals might be quicker learners and therefore gain advantages, however, the tests have only been carried out for the short skill acquisition phase to demonstrate the association between the genes and learning. Elite athletes engage in years of learning and therefore quickness of learning might even out in the long run. The athletes learning more slowly might catch up and also learn to use some other special strengths where they get an advantage over the others, for

example, this kind of slowly developing strength was found in the studies when a large sample of athletic biographies from the German national team athletes across all Olympic sports were analyzed (Güllich, Emrich 2014).

In conclusion, individual characteristics and the critical factors required to succeed in sports are pointing towards social context, motivation to learn and resilience rather than talent. Individuals have differences but there are many processes that can be cultivated to become excellent. Rather than searching for and explaining some inherent ability, this study tries to find the processes through which individual strengths are found and what successful athletes do to develop towards excellence.

2.3 Development of expertise and creativity

Development happens throughout life. People learn consciously and unconsciously as they engage with the world around and, more specifically, when concentrating on improvement, practicing, staying involved and focusing. Different stages and development patterns have been identified both in becoming expert and using creativity as well as activities that are core to development. This part presents some findings and presents discussions about development.

2.3.1 Deliberate practice, play and work in developing expertise

In their paper Ericsson et al. (1993a) presented a concept, deliberate practice, to explain the domain-specific knowledge acquisition, which systematically builds the way to attaining expertise. Exceptional performance, according to them, was not reached without deliberate practice, which has particular features of optimized improvement and some constraints that hinder achievements.

Ericsson et al. divided activities into three general categories, work, play, and deliberate practice, according to their goals, costs and rewards. In their definition, work and play were not targeted at improving performance but for different goals, such as delivering current level performance or pleasure. Later, many researchers have proved the impact of deliberate practice as well as further defining its role in the attainment of expertise (Baker, Young 2014, Araújo et al. 2010, Côté, Baker & Abernethy 2007) for healthy individuals (Ericsson et al 2013), but several researchers have also questioned some dimensions of the propositions (Gagné 2013, Simonton 1999). However, hours added in deliberate practice seem to closely relate to performers accomplished level of performance (Ford, Hodges & Williams 2013) .

According to Ericsson et al. (1993a) deliberate practice, work and free play utilize different processes in the mind. Deliberate practice is a cognitive process, where individuals are constantly striving to learn from feedback, and push beyond their own limits. Conversely, in work the task is not improvement and one executes the reached level of abilities as the brain uses knowledge stored in the long-term memory without the need for much activation of the prefrontal cortex, like in deliberate practice. In play, one can just let go, and enjoy the activity and let the mind freely wander.

Deliberate practice

In deliberate practice, one purposefully searches for the weaknesses that limit the performance and invents ways of eliminating them in a very structured manner. Questioning the current way and making changes additionally requires a highly sophisticated understanding of the critical factors needed and the nature of the skills required becoming expert (Hodges, Starkes & MacMachon 2007). In a well-designed practice, the tasks to optimize performance have immediate informative feedback as well as providing an overall comprehension of performance results. These kinds of tasks are performed repeatedly to gain the automation of a skill.

In their groundbreaking study, Ericsson et al. (1993a) compared the daily routines of four different groups of musicians. The first group was the best violin students in The Music Academy in West Berlin who had the highest expectations of becoming world-class soloists. The second group consisted of the same aged students who were likely to become members of one of the best symphony orchestras in Germany, and the third group was made up of the students who were on the preparatory program to become music teachers. The fourth group consisted of the musicians who had already achieved the level and status of world-class violin soloists.

As a result of the study, Ericsson et al. (1993a) found that deliberate practice was only possible for limited hours a day, not more than four. Longer attempts to introduce new abilities led to exhaustion. Interestingly, this four-hour limit correlates with the findings of Kahneman (2013). Kahneman stated that people could engage in deep thinking, in other words, conscious thinking that builds new pathways in the brain, for only a limited amount of time, four hours at most during one day. The rest of the day, people are using already built connections that are quick and spontaneous. A well-learned task needs little or no top-down controlling from the brain and when a task becomes automatic there is no need to activate the prefrontal cortex that is functioning when consciously thinking. In this way, executive functions are not involved when the task is passed on to the subcortical regions of the brain (Diamond 2013). In other words, automated tasks can be performed without using cognition. More automated abilities mean a bigger repertoire, saving the cognitive capacity for practicing deliberately.

In the conclusion of the Ericsson et al. (1993a) study, it was stated that deliberate practice, which was different from other types of activities done in the same domain, such as playing alone or with others, required effort and was not inherently enjoyable. During this process of deliberate practice, a pupil gains skills gradually through many hours of solitary practice. Therefore, according to Ericsson et al., only practice of which the purpose is to improve performance in a specific domain and requires effort and engagement should be considered deliberate practice (Hodges et al. 2004). The nature of experiences during practice has been defined more precisely to be domain specific, containing explicit constraints in a typical performance environment (Ford, Hodges & Williams 2013).

Ericsson et al. describe the need for deliberate practice as a necessity for

acquiring high-level expertise. However, the importance, or non-importance, of competition, play or enjoyment, and their role in the process have raised thoughts. For example, Hodges et al. (2004, p. 236) have questioned the lack of pleasure connected with the significance of practice and write this way:

> "Correlations between enjoyment and relevance of the activity to improving performance have not been proved. The periods of intense pleasure or "flow" (Csikszentmihalyi 1996) might be unpredictable and independent of the relevance of the activity to improving performance."

Free play

In Ericsson's et al. (1993a) definitions, free play or competing did not constitute deliberate practice and are not the determining factor between good and great. However, some research (Côté, Baker & Abernethy 2007, Memmert, Baker & Bertsch 2010) has shown that these activities might play an essential role in the process. Play reinforces exploratory and cognitive flexibility "experimenting, combining and generating new possibilities" (Chávez-Eakle, Eakle & Cruz-Fuentes 2012). These skills might be extremely important and useful on the way becoming extraordinary, but they require using in order to become abilities one can use, and also use when required.

For example, during musical improvisation, which is considered an endeavor where creative enhancement is constantly sought, the activity in almost the entire lateral prefrontal cortices decreases. This area in the brain is associated with goal-directed behaviors and conscious monitoring (Sawyer 2011b). A conclusion can be drawn that deliberate practice and improvisation uses totally different areas and functions in the brain. Improvisation is linked with letting go of focus whereas deliberate practice requires focusing and the full use of cognitive capacity. However, both of these processes are important and certainly play a vital role in becoming excellent. This raises questions such as: does deliberate practice only produce experts, or are such activities as improvisation and play important in becoming great. This study goes some way to shedding light on both these processes.

Furthermore, play is done for the activity itself. It is enjoyable and can lead to effortless mastery and feelings of flow. Motivational theories (Ryan, Deci 2001) emphasize the power of intrinsic motivation; meaningfulness, intentions and enjoyment as being stronger than goals set by environment. Free play might trigger deep motivation, which again helps an individual to dive into deep thinking (Kahneman 2003). Free play also contributes to the total hours that constitute the activity that build expertise as well as helping to stay focused on the task long enough to gain mastery. In summary, play is not deliberate practice but it might be a piece of the puzzle of becoming superior.

Work

According to Ericsson et al. (1993a), work includes public performance, competitions and a service provided for pay. Work maximizes current abilities or delivers a sufficient standard, whereas deliberate

practice is designed to maximize learning. In other words, work, competition and performance do not qualify as deliberate practice because they are not purposely designed to improve specific aspects of performance but merely to show what one can do at a given time. However, learning to perform is also crucial for musical or theatrical artists. Being able to win is one dimension of becoming superior in sport.

A competition situation is often seen as training to cope with the stress and demanding conditions. Therefore, learning to perform is one part of building up to becoming a successful athlete or a performer. Coping strategies to overcome stress might be learnt only when facing up to such circumstances, as these situations are hard to simulate in trainings. Mental training can be purposefully designed to practice competing or performing, and, therefore, can become also a part of the deliberate practice. These examples show that what is deliberate practice might be very domain specific and task specific, however the concept of deliberate practice is very useful in understanding the cognitive contribution required for attaining excellence.

Deliberate recovery

Measuring the amount of hours does not provide any information about the quality of the training nor about the lifestyle. The question of how to become an expert is not only about an activity but also about balancing one's resources. For example, Young and Salmela (2010) noticed that achievers have a better ability to balance training and rest than non-achievers. They labelled this as "deliberate recovery". This is also in line with remarks by Ericsson et al. (1993a) on constraints of efforts. Deliberate practice can be sustained only for a limited time each day, as one must avoid exhaustion. By 1993, Ericsson et al. had already formulated the notion that top performers sleep more and nap more often. This was found when the research compared the different groups in the study precisely, a need to concentrate on the next training, or it might be necessary to let the mind wonder and build new associations.

2.3.2 Knowledge and knowing

Many researchers have tried to identify different forms of knowledge, how they are organized in people's minds and what kind of processes people use to exchange knowledge (Nicolini 2011, Cook, Brown 1999, Tsoukas 1996, Nonaka 1994). Cook and Brown suggest that we have four distinct forms of knowledge and explain how, explicit, tacit, individual and group knowledge interplay when we are engaged in activity with others. They argue that these four forms should all be treated as four distinct and co-equal forms of knowledge (each doing work the others cannot). They also put forward the argument that the differences, between these four types of knowledge, are relevant, both theoretically and practically. In their words, a process of knowing connects these four forms of knowledge with each other.

Cook and Brown (1999) make a distinction between knowledge and knowing and their relationship: "knowledge" is possessed and "knowing" is part of action. Knowledge is commonly thought of as something we use in action but it is not understood to be an action (Cook,

Brown 1999). Knowledge is then, a tool for knowing and knowing is an aspect of our interaction with the social and physical world. Knowledge is used in action or circulated in a community, whereas knowing is inherently tied to the pursuit of an activity, and is constituted or renovated as actors engage with the world in practice (Nicolini 2011), for example, in sports. Knowing is then about interaction between a knower(s) and the world, being dynamic, concrete, and relational. It requires present activity and collaboration. This perspective avoids the idea that knowledge describes an entity, or a substance, that pre-exists before its utilization. This idea is presented in Figure 2. To understand how knowledge is distributed in practice helps to build an understanding of how knowledge and knowing contribute to excellence.

Interplay of knowledge and knowing can generate new knowledge and new ways of knowing. This practice brings participants' knowing to others' use and, as a result, knowing manifests itself in practice like Nicolini (2011) says. From this point of view, improved practice may not always be the product of acquiring more knowledge; at times it may be the result of developing innovative ways of using knowledge already possessed (Cook and Brown 1999).

In new knowledge building, incorporating knowledge from other fields is usually essential. Other experts are also important as they constantly and collaboratively build on each other's knowledge and knowing further and this serves as pre-knowledge for new knowledge and new ways of using it. The ways of building new knowledge and knowing is important in this study as these processes can show how people learn to know what they need to do to become excellent.

2.3.3 Development of creativity

Studies on artists' working processes and the development of artistic expressions show that a unique style is a result of a developmental process with many loops of focusing, problem identification and defining as well as solution searching and finding (Locher 2010, Weisberg 2004). Therefore, becoming great might be a process of searching, finding new

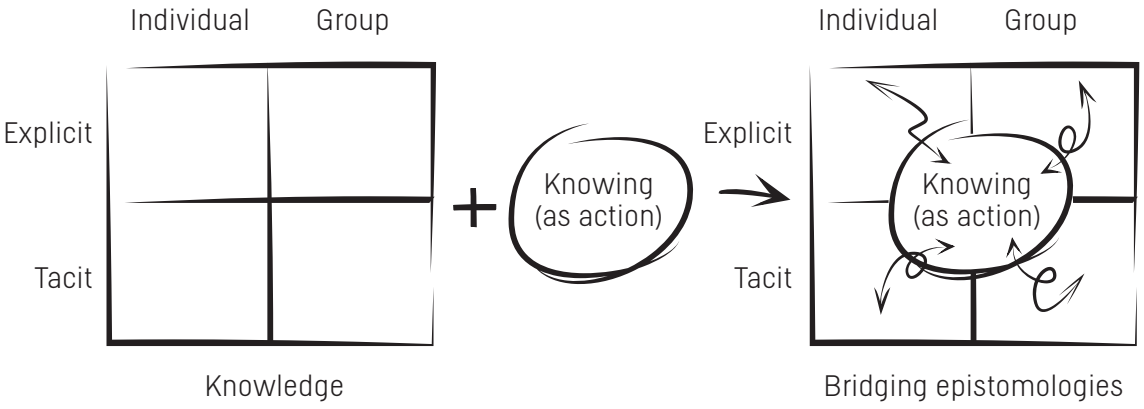

Figure 2. Process of knowing bridges four forms of knowledge (Cook, Brown 1999, p.383).

connections and working them further. Sawyer (2011b, p. 150) explains:

> "Imagine a writer composing a poem; each selection of a single word is likely to result from multiple events of association and insight. And after a first draft is completed, the process of editing and revising will involve hundreds more such mental events."

Visual artists seem to have a kernel idea, a "skeleton" that they gradually develop in a creative process: experimenting, thinking and crafting (Kozbelt, Beghetto & Runco 2010, Weisberg 2004). "Pictorial elements," and details are added one by one in a process of idea-development and art making. In the process, little by little, the perspective changes due to personality, work, personal history, the artistic process as well as technique and skills.

This study tries to unfold how the Olympic Champions and their teams built uniqueness. It remains conjectural to an extent but this study asserts that, as with artists, excellence is the construct of many loops.

Developmental phases during a human life affect how we use creativity. Also developing creativity is sensible. Already a small baby learns what kinds of actions are rewarded. If trying new things are fostered and acknowledged, a baby is encouraged to continue to explore. However, if a baby feels that an exploration is not supported or gets negative feedback, the interest to continue usually diminishes (Chávez-Eakle, Eakle & Cruz-Fuentes 2012).

Similar reactions also seem to happen later in life. Kim (2008b) found that the traditional school environment in the US can be very difficult for extremely creative children as many teachers see children's characteristics of thinking outside the box as disruptive. This kind of outside the box thinking is for a teacher a sign of unfocused and uncooperative actions and differs from the receptive mode of behavior that is preferred. Teachers sometimes see boundary expanding traits as unwanted in the school environment, favoring model answers and punishing creative ones making it less likely that a student will try a creative approach (Sternberg 2012). Sadly, Kim (2008b) noticed that creative potential could be misinterpreted and many highly creative students as well as gifted students are actually underachievers due to that.

Creative children are often very sensitive to negative feedback and therefore disapproval of exploratory characteristics can cause unhappiness and emotional distress (Kim 2008). These two findings, when taken together, suggest that social environments have a role in the development of getting to use the creative potential as Kim (2008) describes and additionally help to build self-courage and personality.

Diamond's (2013) studies on executive functions provide an interesting aspect. Executive functions are our brain's abilities to top down direct our brain functions and thinking. If we are constantly punished for our explorations and sensitivity to stimulus or for using our cognitive flexibility (change perspectives and thinking out of the box), the other two executive functions that focus attention and inhibit external and internal stimulus will dominate and the ability to take another viewpoint is shut down. Also

very strict sporting environments might hinder a child's sensibility in finding an own personal style and sporting strategy. Lacerada et al. (2010, p. 189) define:

> "Creativity is of particular importance to success in sports… sport is the voluntary attempt to overcome unnecessary obstacles."

Therefore, a supportive environment and coaching is important in finding ways to overcome obstacles and also to develop the use of one's own personal potential to its maximum.

2.3.4 Factors in expertise and creativity development

Interestingly, Amabile et al. (2012) identified similar components as being included in the Componential Theory of Creativity as was proposed by researchers studying expertise in sports (Fletcher, Sarkar 2012, Crust, Clough 2011, Jones, Hanton & Connaughton 2002). The Componential Theory of Creativity consists of one external element, social environment, and three intra-individual components: domain-relevant skills, creativity-relevant skills and intrinsic task motivation. This might mean that the ways to become what we call a creative genius or an ultimate expert are not so different.

Creative outcome builds in a series of many small moments and an array of worked solutions. These kinds of events happen throughout life in interaction with others, seeing, and learning as the brain processes these happenings involving many distinct neural groups that are scattered throughout the brain (Smith 2008).

However, these mental moments, or creative insights, do not come from nowhere but depend on the amount of pertinent elements stored in long-term memory of, the TOP (temporal, occupational, parietal) areas of the brain. Dietrich et al. explain (2007, p. 70):

> "The more knowledge that is readily available in memory, the more relevant items can be superimposed in working memory to form new combinations."

Similarly, López-González et al. (2012) explain the discoveries in neuroscientific studies of how creativity works:

> "Creativity is far from a magical event of unexpected random inspiration. Instead, it is a mental occurrence that results from the application of ordinary cognitive processes."

> "In creative thinking ideas or past experiences are combined in novel and significant ways via interaction of such cognitive capacities as reasoning, representation, association, working memory, and self-reflection."

In this way, both research groups, Dietrich et al. and López-González et al., explain that elements that are stored in the brain due to learning and other experiences can be retrieved for further use. This makes the connection between gained expertise and creativity, and shows how closely they are connected.

The solution to a particular challenge can be worked on deliberately in the conscious mind or the idea might emerge in an intuitive way, come to the surface after the connection is made. Dane and Pratt (2007) clarify the concept that intuition is affectively charged judgments that arise through rapid, non-conscious, and holistic associations.

But there is also another side of the coin concerning expertise. Even if a broad range of creativity research shows the important role of domain-specific knowledge, sometimes a large amount of domain knowledge may confine an expert to searching for the solution where it does not actually reside (Walinga 2010, Simonton 2000). Creativity requires knowledge but at the same time, previously built knowledge should not hinder looking at the world in new ways (Sternberg 2012) and exploring other domains for new ways of solving personal challenges.

Diamond (2013) explained how repeated practice makes changes in how the brain activates thus affecting automation but at the same time, hindering possible new connections. In other words, with deliberate practice automation is built, and due to automation in doing some tasks the need for activation in the lateral prefrontal cortex decreases as its steering is passed on to the subcortical regions of the brain and stored for further use in long-term memory (LTM). When learned tasks are executed, top-down controlling, such as executive functions (EF), are not active. During the long evolution time LTM has developed so that it can perform repeated tasks more efficiently (Diamond 2013), and without using much energy. This is why, a well-structured knowledge base activates very efficiently, in an automated way, allowing performance even when a situation is inconsistent, which is good for example in a competitive situation. But automation also restricts the possibility to see the challenge from other perspectives, which is, of course, a challenge to the notion of being creative in a well-learned task.

For example, musical training seems to lead towards less stimulus-driven attention, and allows more room for a goal-directed performance (Sawyer 2011b). This is good in the way that a performer can maintain focus on a performance despite there being distractions.

However, something else needs to happen in order for an expert to be creative. Even though this study does not looking at how the brain functions, a little understanding of the processes involved might help to understand the patterns, which experts might need to follow to become creative.

The way attention is focused predicts the solution. Focus on obstacles narrows the attention, as focusing on possibilities facilitates the opening of fresh viewpoints. Some personal features and learned ways of engaging with new stimulus also affect the focus. The characteristics and quality of an insight in a certain domain vary depending on expertise (Dietrich, Srinivasan 2007) and personality. Walinga (2010) found that myriad personality, temperament, socio-cultural, and genetic factors may be influencing the mechanism of cognitive appraisal and therefore also affect the focus, but, narrowing and widening focus can be also learned and used.

New insight is only a start for creative output as getting a novel idea established still requires lots of effort. In order to execute creative ideas, the development of new expertise and therefore stamina, willpower, and persistent work is usually required. Therefore, also in this way, creativity and expertise are closely connected.

2.3.5 Development of expertise and creativity in sports

> "It is however almost impossible from results of matches to identify the mechanism that mediates the superior performance of the top competitor. Each match is developing differently and it may be impossible to compare different individual behaviour (Ericsson 2013b, loc. 4291)."

Hopsicker (2011) states that habituation cannot substitute for spontaneity and proposes three experiential benchmarks of creative behavior while an athlete develops towards sport genius: preparation, risk-taking, and dwelling. He writes (Hopsicker 2011, p. 114):

> "The sporting genius possesses richer propositional and practical knowledge of her specific sporting activity, and can draw from this knowledge to create and perform innovative actions winning space and time on the field unavailable to less skilled players."

Development to sport genius requires the virtues of patience and persistence, self-discipline and self-mastery.

Developmental stages in sport

Bloom (1985) studied 120 outstanding achievers and presented three distinct phases in development: romance, precision, and integration. According to later studies done in sports, similar stages can be found and named such as the sampling years (childhood; 5–12 years), the specializing years (early-adolescence; 13– 15 years) and the investment years (late adolescence; 16+ years) (Weissensteiner, Abernethy & Farrow 2009, Côté, Baker & Abernethy 2007).

During the first phase, the sampling years, children typically participate in a wide range of activities with the focus being primarily on play activities, with a little introduction to discipline training. During the second phase, specializing years, a more systematic approach and specialization takes place. In the third phase, an individual commits full time to an elite level activity and, at this time, the ability becomes more complete. Many activities vary greatly as to when these phases occur; in some high skill sports, specialization appears very early but in endurance sports and sports that rely largely on physiological capacity, specialization might occur still after reaching adulthood (Ford, Hodges & Williams 2013).

Ericsson et al. (1993) introduced still a fourth phase where individuals go beyond the knowledge of their teacher. According to Ericsson et al., at this phase, individuals make a unique innovative contribution to the domain, but there still seems to be uncertainty in explaining how such giant steps are made. Even if the research on expertise sheds light on the requirements of becoming a specialist, it still lacks the

power to explain how to become excellent. Some more knowledge needs to be added to further illuminate this.

Practice in sports

Growing to be an athlete happens in a relatively brief and sensitive moment of human life and it requires, compared to many other areas of life, a more linear progression and in this way differs significantly, for example, from many artists' careers (Salasuo, Piispa & Huhta 2015). Despite this being the case, early specialization and a high intensity in specific practice does not predict long-term success though sometimes brings quick wins (Güllich, Emrich 2014). It seems that early specialization more often leads to early dropout than to being active over the long term and therefore makes the process complex and dynamic.

Becoming excellent in sports is therefore much more complicated than only engaging in specified high intensity practice. During their career, athletes need to learn many different kinds of skills, turn obstacles into advantages, use their own strengths for benefit, overcome constraints and be prepared and able to perform when a performance is required. Hopsicker (2011) identified four different kinds of technical skills that athletes must cultivate in order to be prepared for adaptation, to be able to embellish on a set structure and improvise, adding movement to their vocabulary. The skills are: basic strengths and capacities, sport specific skills, intimate integration between equipment, space and the body specific to the sport, and, finally, learning the rules, traditions and constraints of the sport. These skills lay a foundation for creative actions and risk-taking but require continuous rehearsal and upkeep.

Practice is at the core of developing sporting performance. High-level athletes reported that they felt the most enjoyable practices were the ones, which brought the biggest progress (Baker, Young 2014, Côté, Baker & Abernethy 2007). They often gained great pleasure even when receiving deliberate corrections.

In Coughlan's et al. (Baker and Young 2014) study, set in the laboratory, football players were given a choice to select their training. The expert players more often chose to spend time developing areas of weakness than did the intermediate-level players. Other studies in sports have also reported that a willingness to identify and work on weaknesses is important on the pathway to excellence (Crust, Clough 2011). Ericsson's et al. statement of deliberate training being not so enjoyable might still be true in the sense that some deliberate training might be in itself not so enjoyable but the consideration that it is crucial for learning makes it meaningful and therefore enjoyable.

Results in a study by Toering (2011, p. 59) with football players show that higher-level performance was not only associated with effort, but also with better ability for reflecting on what they are doing:

> "Elite players may be more aware of their strong and weak points and the translation of knowledge into action. They may be also more willing to invest effort in practice and competition. Elite players might learn more effectively, and benefit

> more from practice and competition and develop their performance faster than non-elite player."

This aspect seems to make superior performers different from the ones that became just good. This heightened awareness might lead to a more complete picture of perfect performance in the minds of these athletes and then provide the necessary tools to enable them to build up their performance better. Fletcher and Sarkar (2012, p. 673) quote Baker et al. (2005):

> "Expert triathletes were more proactive in their approach with a greater emphasis placed on thoughts related to their performance, whereas non-experts reported more passive thoughts unrelated to performance."

The human brain is remarkably plastic to integrate different types of physical and perceptual experiences (Cross et al. 2013), which build new connections, however, not everyone uses the ability fully. This is the point Ericsson et al. (1993a) make, that through deliberate practice one is pushing those limits rather than using the already existing capacity.

Despite this being the case, repeated tasks without receiving feedback, and redesigning the task, do not lead to maximal improvement even for highly motivated individuals (Ericsson, Krampe & Tesch-Römer 1993a). In sports, knowledge is mostly transformed in practice situations, where demonstration is one part of transforming knowledge. Therefore, feedback comes in many forms, also by training with others and comparing the performance to others, by watching and mimicking.

In their study about the resilience of Olympic gold medalists, Fletcher and Sarkar (2012) found that Olympic champions appeared to be very proactive in their sporting careers, which came to the fore in their ability to identify opportunities in the environment and act on them to bring about meaningful change. This implies that with constant internal reflection and interaction with (certain) environments some athletes are able to adapt and vary the training, leading to a wider usable repertoire than of those who are not at such a level of expertise.

Working on weaknesses is mandatory but the route to expertise follows idiosyncratic pathways (Araújo 2010). The needs are unique and patterns of practice in different societies vary greatly. Araújo et al. (2010) came to the conclusion that on the Brazilian world-class football players' development path, aversive environmental constraints had exerted a powerful influence on the acquisition of expertise.

The key to success might be the interpretation of the available constraints and feedback from tasks worked further in deliberate practice. This cyclic process leads to a unique performance and the athlete, the surrounding team and the ecosystem all play a role in the development. For the superior, the interaction goes beyond coaches and grand masters; it stretches to anything that is available for knowledge gathering and it might be used very creatively.

Deliberate play

It is not only practice that is important. Play is a condition for creativity (Anderson 2001). Athletes' unstructured play or 'deliberate play' (Côté, Baker & Abernethy 2007) done for its own sake and for pleasure, might be crucial in influencing the motivation to stay involved in sport and the later ability to process information in various sporting situations (Baker, Young 2014b). Study with team sports shows that the players who were more creative had spent time additionally with free play compared to those who had only taken part in deliberate practice (Memmert, Baker & Bertsch 2010, Côté, Baker & Abernethy 2007).

Deliberate play lets the players try out new moves and tactics, and improvise (Côté, Baker & Abernethy 2007). Flexibility and the ability to combine learned skills in more open ways seem to develop better in not fully structured practice and, therefore, foster players' creativity (Côté, Baker & Abernethy 2007). Sawyer (2011b) suggests that this might be because the default network in the brain is more active in free play than when engaged in a novel task in deliberate practice. This daydreaming like mode might let the mind wander, flow freely and provide it with moments of "mini incubations", which contribute to creative thoughts. In other words, taking conscious attention temporarily away provides the mind with brief opportunities for insights to occur.

The study with Brazilian world-class footballers (Araújo et al. 2010) showed how expertise could be achieved with little formal coaching and without material facilities, but with early specialization and involvement in football type experiences and activities. The researchers proposed that in these practice environments, skill acquisition emerged from the athletes' continuous adaptation to uncertain constraints. Improvising created possibilities spontaneously and broadened the range of skills, which then developed to become a part of the repertoire. These findings contrast with the perspectives on the development of expertise through deliberate practice of Ericsson and colleagues. It is beyond doubt that deliberate practice is important in the development of expertise but alone it is not sufficient to explain the further flourishment to greatness.

Creativity is a habit (Sternberg 2012) and also a learned skill in sports. In Memmert's et al. (2010) study, creative team ball players spent more time in free play in their early lives than less creative players who spent their time almost only in structured training. The more creative ones used as much time, or more, in doing sports but had a richer variety of activities, which also contained free play. The players created their own playing style due to this richness of training compared to the ones who only followed the learned pattern in formal training and did not learn to develop new ways. This study suggests that creativity contributes to finding an own way of performing and that the way in which practice is approached contributes to using creativity, spontaneity and novelty.

Competition

Another aspect specific to sports is the ability to compete and perform at a

specific time under stress (Baker, Young 2014b) and therefore, competition could be considered as a combination of deliberate practice, play and work, (1993a).

However, the need to practice in competitive situations varies greatly between disciplines. For example, some very tactical sports like ball games require situations where players must make quick decisions. Consequently, in that kind of sporting activity, the time spent in competing is actually crucial and distinguishes expert decision-makers from non-experts (Baker, Young 2014b). Spontaneity and taking risks endorse novel solutions. The speed and quality of decision-making by a genius significantly contrasts to that of lesser-skilled performer as a genius identifies and interprets challenges faster as well as sees more solutions to the challenge (Hopsicker 2011).

Winning is the ultimate goal in elite sports and superiority is measured in competition. Competitions can be an enormously stressful and emotional experience (Hanin 2000). Through the years of competing and performing, athletes as well as other experts create many strategies to cope with these stressful situations (Fletcher, Sarkar 2012, Crust, Clough 2011). These strategies are very often unique and almost always creative.

Mental toughness in sports

It seems that in order to cope with motivational constrains one must crave to become excellent and believe that finding a way is possible. O´Keefe (2013) argues that one of the most substantial contributors to greatness is maintaining development and making improvements after setbacks. In general, mentally tough athletes cope better than their opponents with the many demands they face (competition, training, lifestyle) (Jones, Hanton & Connaughton 2002) and still keep on going. Mental toughness is a label for a pool of psychological features and has been associated both with positive effect to high performance and lower levels of negative effects (Mahoney et al. 2014a). Mental toughness is a personal capacity to produce consistently high levels of subjective (e.g., personal goal achievement) or objective (e.g., race times) performance despite everyday challenges and stressors as well as significant adversities (Gucciardi et al. 2015).

Growing and nurturing mental toughness is a complex and often very long, goal-oriented process, but is necessary for many reasons, for example, it is related to the higher levels of sporting achievement and pain tolerance (Crust, Clough 2011). It helps to overcome obstacles, to keep going for long periods of time, to keep one's own view regardless of others' opinions, to fight when under stress and to take hundred percent out of oneself. Studies in sports show that to overcome constraints, requires mental toughness (Baker and Young 2014).

This is in line with Dweck (2007b, 1988) who pointed out that high achievers have a strong belief that they can affect their own development and the results they will gain. These open-minded (Dweck 2007b) persons trust that people, and the world, are malleable, instead of fixed. Outcomes can be affected by one's own determination and through making remedial efforts after setbacks. In contrast, those having a

"closed mind" (Dweck, 2007), predict that abilities are set and inherited, and therefore any measurement or competition is only a proof of their talent or no-talent. To become excellent requires open mind thinking thus allowing a person to believe that modification is possible and will finally pay off. Therefore, mental toughness and resilience is vital for high achievers in order to stay focused even when experiencing setbacks, pain and competition pressure (Jones et al. 2002).

Jones, Hanton and Connaughton (2002) as well Galli and Vealey (2008) identified five general categories of mental toughness, (1) self-belief, (2) desire and motivation, (3) focus (performance-related and lifestyle-related), (4) dealing with competition related pressure (external) and anxiety (internal), and (5) dealing with pain (physical and emotional). These focus-related attributes require self-discipline and focusing skills along with the ability to switch sports focus on and off (Jones, Hanton & Connaughton 2002).

It seems that one way to separate those who succeed from those who do not quite make it, is the way they can handle threats and use them to make them stronger. According to studies, mentally tough individuals seem to be using multiple psychological strategies and different ways that were outside physical activity, for example the imagination and goal setting (Crust, Clough 2011).

Galli and Vealey (2008) interviewed college and professional athletes about their perceptions and experiences of resilience. They found five general dimensions for resilience experience (2008, p. 670): "**adversity** (e.g., injury, performance slump, and the transition to college), **sociocultural influences** (e.g., social support and cultural factors), and **personal resources** (e.g., determination, competitiveness, and a love of sport)" were factors at the center of the resilience process ('agitation'), which directed them to positive outcomes such as **learning** and **new perspective,** and also provided the motivation to help others.

Self-belief, and the characteristic, "unshakable", seemed to be the most fundamental qualities for mental resilience. Self -belief has two extents: the belief in one's ability to achieve goals and the confidence to be different and, therefore, better than opponents. Motivation is also particularly important in forming a strong desire and the determination to achieve the goals (Jones, Hanton & Connaughton 2002).

Studies with mentally tough individuals have also shown potential brain-structure differences when compared with the less tough. Crust and Clough (2011) found that mentally tough individuals seem to have more grey-matter tissue volume in the right frontal lobe. Other research has shown that this area in the brain has a role in reality assessment, monitoring, and strategic thinking (Crust, Clough 2011). It is still not certain if this is a developed or inherited dissimilarity, however, it seems that mental toughness is open to manipulation through mental skills training (Crust, Clough 2011) and the crucial abilities to to perceive the current situation as well as to think strategically can be learned.

2.4 Influencing developing – internal and external

As neurologist Sebastian Seung's (2008) research shows, the linkages in our brains created through countless experiences, determine what we do and even what we think. He gives an example:

> "For example, although identical twins have identical genes, one may play the piano and the other may play the flute. Much as muscles can be changed by weight lifting, brains can be changed by practice."

Knowledge gathering and creation is central to becoming an expert. Working together with other people lets an individual gain from others' knowledge and also assists in finding the ways to use their own acquired capabilities. Good teachers and coaches are able to bring a person quickly to an expert level by bringing new information to be digested, as well as helping a person to find and shape and reorganize the already existing knowledge.

Environment, surroundings, culture and people around are important in how people's knowledge grows and what they learn to know. Nicolini (2011) presents the idea of "site" to demonstrate the place, moment, happenings and artifacts that act as intermediaries in knowledge transfer. The idea of "site" brings to the fore the wider relational scene and gives the possibility of going beyond the traditional idea where the context is some kind of passive background or surrounding.

Through this concept, the systemic view can be seen as the interaction with the environment and artifacts as well as having wider context thus dynamically fostering development.

The idea of "site" suggests that all human phenomena are situated and have a specific "location" (place, history, field of organized interests). This study tries to capture those moments when creative ideas emerge and in this way tries to find a pattern and the mechanism for it. Following Hemlin's et al. (2008) notion that innovative activities tend to cluster and be located in cue-rich environments suggest this way. This study tries to capture the cues through individual's stories to find what led to unique approaches.

Different events in life can have a strong influence on how creativity and excellence comes about. The work in this research goes some way to recognizing those which affect events in becoming superior in sports as well as shedding light on what happened in these events that shaped the future actions.

2.4.1 Building knowledge and knowing

Some individuals and teams are constantly looking for solutions to further their performance. Visits to other fields can help to develop understanding and sometimes even lead to the finding of solutions that are original, new and consequently may be successfully transposed to their own domain.

Cohen's et al. (1972) "garbage can model" plays with the thought that good solutions are looking for problems to be solved and not the other way around by stating that many challenges one faces might have

been solved already elsewhere. Therefore, these existing solutions in other domains needs to be seen and found, and then mixed and matched to existing knowledge in the particular field of relevance.

Cook and Brown (1999) called this kind of knowledge investigation "productive inquiry", where one deliberately, though not always consciously, seeks the missing elements in order to improve. "Productive inquiry" and looking for solutions are central to creativity as well as having the ability to exploit external knowledge (Cohen, Levinthal 1990).

However, to know what to look for is not quite so clear or simple. It requires that one does not take knowledge or ways of working as given but is ready to question the existing ways of doing and constantly reframing and renewing the questions one is asking. When being open, sometimes "serendipitous" (Merton, Mongardini & Tabboni 1998), not planned intentions, lead to unique and successful answers and productive events. This though requires an open mind and readiness to change and adjust. These not planned intentions often go unnoticed without productive inquiry, openness to stimuli, a capacity to absorb as well as the ability and willingness to reflect.

To be able to absorb, see what is missing or what could be possible, a person has to have a pre-understanding in the matter. It is hard to see relevant information if a person does not have enough expertise to interpret and link. Cohen and Levinthal (1990) state that one's absorptive capacity, digestion of new stimuli, is largely a function of the actor's prior related knowledge. Absorptive capacity is the ability to make use of external knowledge. In explanation they (Cohen, Levinthal 1990, p.128) say:

> "Prior related knowledge confers an ability to recognize the value of new information, assimilate it, and apply it."

This means that not just anyone can absorb any knowledge and use it. Timing is crucial both because of the amount of prior knowledge and learning, as well as the level of motivation at the time. Experience in a variety of fields may help to elevate the problem identification and cast a new light on a personal view. As Walinga (2010) suggests, manipulating focus facilitates the ways to get insights, as for receiving new awareness, one needs to be ready to let go of previous ideas and fixed pathways of solving problems.

2.4.2 Affecting creativity and creative thinking

Personality develops throughout life (Chávez-Eakle, Eakle & Cruz-Fuentes 2012) and developmental reinforcement is possible at many stages but particularly during childhood. Human connections, societal context, environment, and many incidents are important both for personality formation and the development of the creative potential (Chávez-Eakle, Eakle & Cruz-Fuentes 2012). Social surroundings matter as to how well a person learns to use creativity relevant skills and how freely their own ideas can be expressed.

The crucial three things that promote creative habits according to Stenberg (2012) are: (a) to offer people opportunities to

engage in creative actions, (b) encouragement when people use these opportunities, and (c) rewards when people think and behave creatively. Often, a domain and its culture as well as an individual's motivation, experience, and abilities influence how much freedom is given and what kinds of strategies are used in learning and guiding. Allowing space and time for trials and free association is grounded in the ways of working and the learned mindset. For example, mind wandering (Sawyer 2013), contributes to insight and appreciating those seemingly ineffective moments might aid creativity as the mind processes, little by little, the scattered information from the memory and external representations making new interpretations of it.

A social environment that is open for new experiences, and accepts new and also crazy ideas can facilitate and increase the positive impact of affecting creativity and trust to use one's own ideas for developing and performing. Hemlin et al. (2008) pointed out that particularly in turbulent, high-pressure, competitive environments a climate for creativity, such as support and autonomy could predict creative performance.

In elite sport, the reinforcement of creativity has not been regarded as a priority. Sporting success is believed to be best gained under the strict supervision of a master coach. However, encouraging atmospheres foster the possibilities for questioning the status quo and the exploration of new ideas. Whereas, established routines and favoring status quo hinders creativity and narrows the interest in looking for new ways (Hunter, Bedell & Mumford 2007).

Stress, negative emotions, and distractions further constrain creativity whereas encouragement boosts creative performance, and risk taking. Both training and competing might benefit from the ability and the freedom to use flexibility and creative thinking in sports. Studies (Mahoney et al. 2014a, Fletcher, Sarkar 2012, Crust, Clough 2011, Jones, Hanton & Connaughton 2002) explicate the wide use of flexibility in the competition situation of top athletes and also mention the appliance of creativity.

Many researchers point out that encouraging play reinforces exploratory and cognitive flexibility (Hemlin, Allwood & Martin 2008, Hunter, Bedell & Mumford 2007). It seems that creativity is a combination of processes and traits and the way in which they are channeled. If pathways used for creativity are strengthened it will lead to more creative outcomes. If people are helped to use their capabilities and put into suitable environments they can become highly productive and flourish throughout their life.

Focusing on assumed threats distracts attention from the goal and reduces performance. Therefore, to break the impasse and to actively relax cognitive constraints helps to focus on core challenges. However, this is often difficult as constraints are complex and sub-cognitive and thusly require determination and the ability to reflect. The ability for deep reflection is one-core capability necessary to becoming expert and developing beyond the competence of other experts in particular field (Sydänmaanlakka 2003, 2007). The better a person can understand and be conscious of self, discover their own strengths and weaknesses, the

better one can master their own "tool", self. The process involved in reflection might be thought to be individualistic yet it can be learned and, more relevantly, it can be taught.

2.4.3 Teams, organizations and resources affecting excellence

The people around affect how we are and what we can become. It seems that superior experts have had people around nearby to adjust and provide resources for their use, they have been able to adapt their environment to their needs, and also overcome any lack of resources. These resources are financial, environmental, cultural on a large (country) and small scale (family), they include access to, teachers, knowledge training material, training facilities and expert culture, as well as support, time and energy available. The resources allow concentration on practice and development offers a climate for knowledge sharing and the possibility for personality development. However, lack of a supportive environment might restrict the potential and the capacity to grow and flourish (Kim 2008b).

In order to study the interaction between people, teams and environments in different organizations, Hemlin et al. (2008) formed a framework of a creative knowledge environment (CKE). The framework is useful as it outlines the dimensions concerning how environments interact and affect people as well as teams thereby encouraging creativity at micro-, meso- and macro-levels, even if their framework was built with the main aim being to help at an organizational level.

The framework included two aspects, social and cognitive as well as eight components of environment: 1) individuals, 2) group characteristics, 3) general work situations for individuals, 4) task characteristics, 5) field, 6) physical environment, 7) organization, and 8) extra-organizational environments.

Coaching human beings to become excellent

Coaching is an active attempt to help another to find and unleash their potential, achieve greatness and to flourish. The presence (or absence) of the appropriate "persons in the shadow" (Gruber et al. 2008) can influence an individual in development in many ways including guiding, teaching, resource and knowledge acquiring. The coach can greatly affect a person to become and stay motivated as well as engage in deliberate practice for an extensive period within a domain.

Designing appropriate practices and providing feedback usually requires this kind of a teacher and a coach who is more knowledgeable in the specific field. Through a coach, during deliberate practice, a trainee takes advantage of the accumulated knowledge of the previous generations concerning optimal training (Weisberg 2006, Hodges, Starkes & MacMachon 2007, Ericsson 1999). A coach interacts, directs the pupil's development, designs and monitors practice and facilitates the acquisition as well as the application of knowledge and skills. It is in this way that a novice more rapidly learns from earlier experts and this collaboration catalyzes the process and frees time to go beyond the levels of previous performers.

Coaching creativity requires the facilitation of cognitive, personality, motivational, social interactional and environmental approaches; in other words affecting the elements of the Componential Theory of Creativity as presented by Amabile et al. (2012). Scott et al. (2004) found that the most successful creative training programs focused on developing cognitive skills involving heuristics combined with skill application in realistic exercises, which were appropriate to the domain where creativity was needed. They concluded that creativity training works for all kinds of people, not just children or the unusually gifted. In sports coaching, much more weight has been put on advising and automatizing than developing heuristic dimensions of cognition.

To maximize learning, the feedback from the coach and from the coachee is crucial in order to constantly keep pushing forward beyond the comfort zone. Through feedback a wider repertoire becomes possible and through training, automated. Automation gives the brain the capacity to develop even further leaving the possibility of using the knowledge in more advanced ways. Training is then not just automating or heuristics but a combination of both, pushing expertise further using creativity for new knowledge building and heuristics. Furthermore, maximum training is not the same as optimal training; the amount of learning needs to be optimized, not the amount of training. This requires agency from both the coachee and the coach, where together in a two-way, dyadic system both are widening and co-constructing their abilities by influencing and being influenced by the other's words and actions, as described by Beebe and Lachmann (2002).

In sports, the role of a coach has been regarded as being very important (Mallett 2005, Bloom 1985), often a coach and the athlete form a kind of a specific dyadic team. Keeping this very much in mind this study includes views from both the athletes and their coaches in order to better understand the interaction in the creation of excellence.

2.4.4 Affecting creativity and development in sports

Studies show that there is a considerable variation in the quantity of accumulative training, which suggests that there are other factors explaining excellence. Such differences are in lifestyle and supportive culture, environment, access to knowledge and equipment. Salasuo et al. (2015) concluded that to attain sporting success one must be in the right place at the right time and incorporate just the right kind of tangible and intangible capital.

Ericsson et al. (1993) had already pointed out the need for early support. Often the parents play a crucial role in supplying sufficient resources, encouragement and instilling hard-work ethics, especially in the early stages of development (Crust, Clough 2011). However, the study with Brazilian world-class footballers showed that expertise could also be achieved with little parental support (Araújo et al. 2010). Teachers and childhood background (e.g. sibling rivalry) play a further, vital role in building self-image and -confidence that help to proceed (Csikszentmihalyi 1996, Bloom 1985). In developing expertise in sport, a coach is in the central position (Mallett 2005).

Durand-Bush et al. (2002) who studied champions winning two or more gold medals in the Olympic Games and World Championships found that all of these champions had lots of similarities: all had very supportive parents, a great coach, good self-confidence and motivation as well as all of them having set long and short term goals and trained a lot. They emphasized development and creativity. Each of them had strategies to overcome stress factors, with most of them having had an extensive support network and almost all studied while doing sport.

Weissensteiner, Abernethy and Farrow (2009) found in the study done on batting in cricket that a favorable socio-developmental environment provided the athletes with technical skill mastery and superior visual-perceptual skill but also with the essential foundation for the development of positive psychological attributes, which are mental toughness, self-belief and confidence, the ability to cope with adversity, and the adoption of individualized routines and rituals.

Building self-confidence and mental toughness seems to be extremely important for success, but makes affecting training tricky. Lang (2010) pointed out in a study with competitive swimmers and their coaches how constant supervision and applying a disciplinary mechanism of surveillance, actually produced embodied conformity to normative behavior and obedient, docile bodies. Therefore, coaching cannot merely be a mechanical knowledge transformation but needs to scale up to become a dynamic interaction. However, to holistically understand individual differences is complex as Coultier et al. (2016) pointed out and requires skills from coaches. Mallett (2005) proposed that an autonomy-supportive coaching approach might develop a positive learning environment in which athletes can both enjoy their participation as well as seek optimal performance.

Pensgaard et al. (2002) reported that everyone, including athletes already at the elite level, benefited from a climate of mastery and the athletes emphasized the importance of the coach as the creator of such a motivational, supportive and caring climate. Balaguer (2002) explained the factors of this kind of mastery climate in more detail.

In sports, some environmental factors seem to be necessary (Ford, Hodges & Williams 2013), and they are often deliberately built to enhance goal-directed activity. This kind of environment can consist of such things as: having access to physical training facilities, equipment, and equipment adjustment, being part of a community with the latest knowhow and research, time and place reserved for thinking, concentrating, relaxing and napping. What is an optimal training facility is not clear cut, but is a matter of need and an ability to adapt and use the multi-faceted ingredients as provided by an archetypal training circumstance for one's own benefit.

Araújo et al. (2010) suggest that environmental constraints might sometimes play a determining role in the development of creativity and unique skills. The stories of great Brazilian footballers told how they learned to adapt their rhythm when jumping over holes and seeking

to avoid roots, or playing with different sizes of balls in differently shaped fields (Araújo et al. 2010). As Wallinga (2010) presented, barriers might act as facilitators to activate ways of finding new solutions. This effect is still little understood and focused on even less but seems to have an influence on the acquisition of specific skills.

The other constraints might act in similar ways and the needed components can act as constraint or as building blocks. This might leave behind the possibility that too optimized a training environment could dull creativity. Some modification is needed to activate teams and individuals in search of optional ways of using materials, equipment and surroundings among other aspects. Influencing expertise development requires then a very holistic approach, which takes the whole athlete along with the multifarious personal characteristics into consideration thereby leaving a freedom for the athlete to flourish leaving such everyday considerations as discipline and rule conformity to be internalized by the individual performer.

Developing mental toughness in sport

Mentally tough athletes are more competitive, committed, self-motivated, better able to maintain concentration, control, are generally more confident and therefore often more successful than those who have not peaked and reached the upper levels in their field.

They also persist longer under pressure, are more consistent and believe in themselves even after setbacks (Crust, Clough 2011, Jones, Hanton & Connaughton 2002). High sport confidence facilitates performance through its positive effect on athletes' thoughts, feelings, and behaviors, however each athlete's sources of confidence are unique, therefore strengthening confidence requires identifying the individual needs of the athlete (Hays et al. 2009). Mental toughness can be developed through the provision of particular coach-mediated learning environments (Mahoney et al. in press).

Literature both in mental toughness and talent development demonstrates that setbacks have an important role in becoming an elite performer (Crust, Clough 2011). In the Sarkar and Fletcher research (2012), Olympic champions managed to recognize stressors as opportunities for growth and engaged with challenging situations to learn to cope in them. Walinga, who studied creative problem solving, found that barriers act as enablers and might aid shifting one's thinking. She writes (2010, p. 158):

> "It appears that threat appraisal plays a role in how strongly an individual clings to constrained representation and barrier focus."

In sport, the perceived threat can lead to paralysis and strategies that 'unpack' the barrier are necessary to better understand what problems it poses to the original goal. By this, one can find ways of changing the focus, which opens other questions to be solved and also ways to solve them.

Research has defined some features of how successful individuals have found many strategies to overcome constraints

and become resilient and mentally tough by effectively avoiding or negotiating their restraints across a number of situations and practices. These strategies are sometimes very creative and take advantage of the available resources, as well as adapting to the specific environment. Gould, Finch and Jackson (1993) identified eight groups of strategies that the US national champions in figure skating applied to overcome stress factors during their career:

1. rational thinking and self-talk,
2. positive focus and orientation,
3. social support (coach, parents and extended family, friends, psychologists),
4. time management and prioritization,
5. precompetitive mental preparation,
6. training hard and smart,
7. isolation and deflection,
8. ignoring and postponing the stressors.

During a sporting career, the stressors vary considerably in frequency, intensity and duration and can come from everywhere. Particularly at the peak of sporting careers, athletes appeared to engage with higher-level meta-cognitive processes that involve reflecting on one's initial reaction to stressors. This reflecting process plays a crucial role in highly demanding performance environments, like competing when injured or when being under constant media attention. Fletcher and Sarkar (2012) found that among many other things, even sport politics and organizational issues added stress to Olympic Champions' lives. In these kinds of situations an athlete appraises stressors, often negatively, therefore, further evaluating one's own thoughts about the stressors might aid towards facilitating performance and the situation in a positive way and maintain efficient and resilience in stressful situations (Sarkar & Fletcher 2012).

Mental toughness is an interesting phenomenon. It is strongly tied to success and motivation, but also positive stubbornness and free spirit. It has some similarities to the creative traits discussed before. This research seeks to come closer to explaining how these different factors affect becoming excellent.

2.5 Conclusions

General literature shows that the excellence requires uniqueness (Kaufman 2014, Simonton 2000). Unique contribution is usually pictured as being creative. After searching through the literature on how expertise emerges in sports, thus allowing for elite performances, it became apparent that there is a lack of understanding as to what role creativity, plays in it. In sports literature, creativity has only been moderately studied as only a few researchers have touched on the area.

A question arises: is sport seen as only a domain of repetition where simply training produces excellence, and where creativity is not required. The challenge could be that sports is considered to consist only of redefined products and therefore has not been investigated by researchers studying creativity, as these two quotations from

a researcher studying creativity explains sports, music performance and games:

> "It is relatively easy for an aspiring expert in these domains to learn precisely what is necessary to attain world-class mastery of the skill (Simonton 1999, p. 320)."

> "A gymnast who repeats the same flawless performance in competition after competition will be considered remarkable, whereas a writer who writes the same novel over and over would be considered less than a hack. By definition, creative products must be original, novel, or surprising. Mere repetition of previous work is necessarily disqualified as creativity [Martindale, 1990] Simonton (2000, p.286)."

Although sporting performance is well defined, repetition does not explain how to become unbeatable. We know that deliberate practice is the biggest reason for acquiring expertise but practice fails to explain excellence in sports. For example Baker et al. (2014a) noticed the weakness in many statistical approaches used in researching deliberate practice as they are based on assumed linearity between practice and performance improvement over time.

Ericsson (2013b, 2013, 2010, 1999, 1993a), with his extensive work, has pointed out the need for deliberate practice, but hinted that there might be something more behind it. Also Baker and Young (2014, p. 142) implied:

> "The studies indicate that experts may not always do more of everything but they seem to be doing lots of little things."

However, research up to this point in time inadequately explains what these little things actually are. We have still only unsatisfactorily identified how individuals and their teams come to know what activities lead an individual to superiority and how they produce this knowledge.

Throughout history, there have been attempts to explain superiority with talent, but the nature –nurture debate is still unsolved (Kaufman 2014). What we do know is that becoming expert in sports develops in stages (Weissensteiner, Abernethy & Farrow 2009, Jones, Hanton & Connaughton 2002, Bloom 1985) and that development depends on many external and internal factors. Based on previous studies Durand-Bush (2001) outlined these factors in sports. The external factors are, for example, culture and society, physical and social environment, access of knowledge, resources and support. The internal factors include such issues as motivation, self-confidence, goal setting, commitment, concentration and skills related to coping with stress. We also know that mental toughness and resilience is needed to win Olympic Gold medals (Fletcher, Sarkar 2012). Smith (2003) made an effort to unite factors leading to elite performance making a framework for understanding the training process. However, it did not tell how the different factors influence each other and the study did not address the question of where new knowledge comes from and how this knowledge is constructed. Previously, researchers in sports have not presented a comprehensive process of becoming excellent, and findings still lack the understanding of how creativity contributes to this process.

Research in creativity (Hakkarainen 2014, Amabile, Pillemer 2012, Baer 2012, Runco, Acar 2012, Sternberg 2012, Sawyer 2008, John-Steiner 1985, Scott, Leritz & Mumford 2004) has produced some visions concerning how new knowing is formed, but there have been no attempts to link creativity to excellence in sport. Interestingly though, Fletcher and Sarkar (2012) pointed out very similar personality characteristics in Olympic gold medalists that Simonton (2000) had found present in highly creative individuals.

We know that through being in a community of experts and having an expert as a teacher, a novice learns quicker (Hakkarainen 2014, Weisberg 2006, Ericsson 1999). However, this does not explain how certain exceptional experts are able to surpass the achievements of those who have gone before them.

Hakkarainen (2014) presented the notion that creativity is a collective phenomenon and Sawyer and DeZutter (2009) explained how, in Improvisation Theater, ideas emerge and mold the performed play. This empirical study attempts to find mechanisms to explain how creativity appears in the process of becoming excellent in sports by answering the second research question: "What is the role of creativity in becoming an exceptional expert?"

As a summary:

- In sports, we do not know what mechanisms new knowledge production uses.
- Excellence in sports has been mainly explained as being due to deliberate practice, however the need for other forms of activity has been noticed as well as external and internal factors, which clearly influence the process. How these all link together and intertwine with each other has not been presented as a development process.
- Sports and creativity have not been linked together.
- Creativity is not a clear concept. However, creativity research has shed some light on the process of how ideas are developed, proposing some affecting elements.

The question of which processes build multi-times Olympic Champions to become uniquely successful has not been answered. This study outlines, studying five cases in Finland, what factors lead teams to learn how to become excellent in their sports and how creativity contributes to this process.

Using Olympic champions as examples, this study outlines process in becoming excellent in sports, and how creativity impacts on it.

2.5.1 System view

The study will examine a larger entity, which is not attributable to one actor. To explain the process of excellence in sport needs a wider concept therefore I use a concept of system as a way to explain the interaction between different actors, objects and environment.

With the concept of a system, I mean "a set of interrelated objects that can be characterized by elements with an essential influence structures between them" as defined by Bossel (2007, p. 5). Bossel points out how all systems are dynamic and change over time. I am especially interested in how systems act creatively and support development to become excellent and for this the system intelligence concept presented by Saarinen and Hämäläinen (2010) is also helpful. The duo defines System Intelligence this way (2010, p. 16):

> "System Intelligence (SI) involves the ability to use the human sensibilities of systems and reasoning about systems in order to adaptively carry out productive actions within and with respect to systems."

Systems intelligence combines many aspects of creative environment and the development of greatness. Hämäläinen et al. (2014) presented eight dimensions of it:

- Systems perception
- Attunement
- Reflection
- Positive engagement
- Spirited discovery
- Effective responsiveness
- Wise action
- Positive attitude.

All living systems are open for energy and information (Beebe, Lachmann 2002). Individuals create systems but are also affected by them. In this study, In order to understand the two-way dyadic system of coach and an athlete in building the athlete's mastery I use the Beebe and Lachmann's (2002) descriptions of dyadic system, as a dynamic interactive process and co-construction of knowing. By concentrating on them I have tried to find how they together built knowing by influencing and being influenced by the other's words and actions as well as the world around them affecting both of them separately and together.

Sawyer (2005) also offers a useful approach with the concept of "social emergence" in trying to get a wider systemic view explaining the individual agency in a system and vice versa. This study uses the concept of emergence to describe an individual growing process being a part of a system and affecting it, dyadic system to describe the intense bonds between an athlete and a coach. When affecting the systems positively I refer to the system intelligence framework.

3. Research design and methods

This chapter gives an overview of this research. To begin with, chapter 3.1 orients the reader philosophically and methodologically followed by chapter 3.2 which gives more information about the research design. Then chapter 3.3 introduces the data and chapter 3.4 adds detail as to how it was collected. Finally, chapter 3.5 shows the readers how the different kinds of data is analyzed.

3.1 Philosophical and methodological orientation

The underlying motivation behind this work was the wish to conceptualize the process involved in gaining ”the missing bit”, which has thus far eluded researchers, when making the transition from expert to excellence in order to help to push human capability to new dimensions. The philosophical view of this study follows the ideas espoused by positive psychologists, as described by Seligman and Csiksenmihalyi’s (2000), who in their research, attempted to identify the dimensions and factors that allow individuals and teams to flourish and human creativity to come to full fruition.

In general, science is an approach, a way to describe, understand and explain a particular phenomenon in depth as objectively as possible (experts widely accepted). Science produces new knowledge linking new predictions with previous ones to form an understanding of the existence of different kinds of phenomena. But science does not provide a complete or final answer, it proceeds by hypotheses that question and cast doubts on previous knowledge. The scientific approach is a continuous renewal process of developing, organizing and predicting. This research tried to help to further develop, and to take a part in, the discussion as to where greatness comes from.

Epistemologically and ontologically, researchers move between the positivist and interpretive axel. This study is positioned at the interpretive end of the axis. It follows epistemologically and ontologically constructivist ideas, being pragmatic in nature.

Traditional research has taken an ontologically positivistic view stating that there is an objective reality and owning an epistemological belief that science is able to explain it (Martela 2012). The interpretative view however rejects the notions of objectivity (Charmaz 2000, Tsoukas 1993) and builds on a constructivist epistemology. According to this view, many realities exist and a phenomenon is a reflection of a subjective construction ”built from a variety of symbolic constructs” (Tsoukas 1993, p. 323). A constructivist starts from the idea that we can only interpret what we see and by constructing our knowledge we can gain a better understanding of what it is (Weed

2009, Charmaz 2006). With this study I was looking closely at the development process of excellence to see, understand and construct ideas to build further on the findings previous researchers have made.

Pragmatism has been explored and developed by many philosophers, for example Pierce and Dewey, but its roots go back to Aristotle's way of logical thinking. As the speed of producing knowledge has risen and the amount of information is mounting, practicality in science is becoming more important than earlier. The idea of science is more and more to try to understand and conceptualize real life phenomena by finding effective explanations and predictions for them in order to improve our ability to master our practices. New knowledge is needed in order to build usable solutions immediately. Pragmatism is, in general, ready to accept the best explanation available at a given time knowing that at some point the picture might become still clearer. Therefore, the tone and purpose of this study is to be useful for current practitioners, at the same time being aware that the ideas need to be developed further in the future.

As I was aiming to find the role of creativity in building exceptional expertise I was entering into phenomena that have been collaboratively created by individuals, but might be difficult to reduce to individual actions (Sawyer 2005). This brought challenges to the viewing angle; how to balance and explain an individual contribution and a collective effort. Systems theories give an approach to demonstrate the dynamism of the system by bringing actions and interactions into the picture. Emergence rejects both reductionism and holism giving an approach to explain collective creative action that emerges from interaction between people and their environment (Sawyer 2005). Emergence seemed to be a suitable philosophical approach in viewing this study. The process of excellence is a process of individuals, which develops in interplay with people and environments.

3.2 Forming research design — Grounded theory principles and methodology

Up to the time of writing, research has not been able to detect beforehand the ones that become superior in their lives therefore it is only retrospectively we can follow the path these brilliant achievers took (Côté, Baker & Abernethy 2007). Gruber (1982, p.15) suggested:

> "If we want to know how people become extraordinary adults, we could start by looking at those who have succeeded and work back to find out how they came to do it."

I decided to focus on people who have made extraordinary achievements and asked those who have succeeded, how they became better than others, and which factors led to them "doing things differently".

Edmonson and McManus (2007) suggested carefully choosing a sufficient strategy and design for research. They (2007, p.1158) quoted Bouchard saying:

> "The key to good research lies not in choosing the right method, but rather in asking the right question and picking the most powerful method for answering that particular question."

Nascent theory, proposes tentative answers to novel questions of how and why, often merely suggesting new connections among phenomena. As we have only a limited understanding of the creative thinking patterns of people growing to be superior experts, especially in sports, emerging theorizing methods (the nascent theory) were the best fits. To these kinds of research situations Edmonson and McManus (2007) suggest the usage of qualitative methods. This study fitted into the nascent theory class and the research questions for this study are best answered by a qualitative method.

I looked for the qualitative method that could best being adapted to my research problem and got acquainted with grounded theory and analyzing with codes. Edmondson and McManus (2007) explained that grounded theory fits well as a method to identify patterns from the data with interviews and observations being employed as the main data collecting methods. This method seemed to be suitable for me to carry out interpretive research and build a hypothesis.

Grounded theory is based on two researchers Glaser and Strauss (Charmaz 2006). Because of their different research backgrounds, both of the inventors of the method brought a specific aspect to the theory. On the one hand, Glaser brought to the study a systematic approach, which was due to his rigorous training with quantitative research. Strauss, on the other hand, brought to the method notions of human agency, emergent processes, social and subjective meanings, and problem solving practices.

Later the two of them developed the method in different directions. Glaser moved the method toward verification and Strauss teamed up with Juliet M. Corbin. The new team, Corbin and Strauss created a renewed version of grounded theory, which has been the guideline for researchers and graduate students throughout the world ever since (Charmaz 2006).

The Grounded theory method also seemed suitable for me because of its widespread use. The method has been largely accepted and researchers doing qualitative research in social sciences and organizational research have regularly been using it (Bryant, Charmaz 2007, Rynes, Gephart Jr. 2004). Furthermore, as several researchers at my university were using the method, I thought I could easily get support and guidance in the proper use of the method.

The original grounded theory had previously stressed the mechanical progression of analyzing, but Strauss and Gorbin (1998) introduced flexibility and creativity to the tools used in analysis, which was appealing to me. In their opinion, even if a study tries to follow a very systematic protocol of research the results are still constructed by the researcher as well as the persons being interviewed. Other researchers also rejected the objectivity of theorizing that Glaser had strictly trusted. For example, Charmaz who is a social constructivist, an ontological relativist and an epistemological subjectivist noted: “Data does not provide a window on reality. Rather, the ‘discovered’ reality arises from the interactive process and its temporal, cultural, and structural contexts” (Charmaz 2000, p. 524). Each individual builds their own understanding of how

things are, based on their previous knowledge, culture, society and experiences. I liked the idea of detecting the patterns and using my understanding in the process. I felt I had the ability to understand the context, spot the irregularities and to interpret what the interviewees were saying because of my background as an elite sportsperson.

Suddaby (2006) pointed out that a researcher with previous knowledge takes part in building the data. The participants and the researcher produce the data in interviews and therefore the meanings that the researcher observes and defines. The data and the results are therefore also related to the world in which the participants in the research live, this being true for both the researcher and the interviewees. With grounded theory, some patterns of reality can be produced but they are researchers' and interviewees' compositions. The end result is therefore, at best, an assumption of what could be.

Additionally, contemporary grounded theorists, like Suddaby and Charmaz, emphasize the idea that researchers should examine the data without any contact with scientific literature and try to explain the data with the help of it as it might shift their view and explanations in the direction of that literature (Mills, Bonner & Francis 2006). Strauss and Corbin, however, took another approach. They saw that viewing literature hand in hand with data analyzing increases theoretical sensitivity and stimulates thinking (Strauss, Corbin 1998). Both Dubois and Gadde (2002), and Edmonson and McManus (2007) pointed out that learning is an important part of the process. Learning happens when scholars constantly make a match between the empirical findings and theoretical frameworks. However, in this lies also the limitation of using grounded theory as it distinguish the embeddedness of the researcher's considerable agency in data construction and interpretation like explained by Bryant and Charmaz (2007). For minimizing this I followed carefully Strauss and Corbin's approach in theorizing, going back and forth with literature and building on the ideas of previous researchers. It felt that visiting literature on the field also helped to widen the source of interpretation rather than only relying on my own experience.

3.2.1 Abductive reasoning

Following in the footsteps of the pragmatic philosophers, I have used abductive reasoning in this study. The abductive reasoning model (Mantere, Ketokivi 2013, Niiniluoto 1999), where empirical observation and theoretical explanations are in constant dialog, seemed to be a suitable way to build an understanding of this phenomenon. In abduction, the process progresses from a general picture to following the path of some elements to see and define it more precisely. I started with a pre-study that gave me a rough idea of what I could be looking at in the main analyzing process. Additionally, my first research question related to capturing a comprehensive picture of the process to excellence. Whereas with my second question, I focused on a specific aspect of this process. This approach is explained in more detail in chapters 3.2.4. and 3.2.5.

Abductive reasoning lies between induction and deduction. With abduction

we can form explanations and likely hypotheses from observations with the help of cognitive reasoning as with deduction we can explicate these hypothesis. The role of induction, on the other hand, is to find the problem to be studied. All these three different approaches, deduction, abduction and induction, are necessary in order to make a scientific analysis but only deduction is exact and the other two are unavoidably approximate. As Mantere and Ketokivi (2013) state, science looking for absolute rationality in organizational research is unrealistic and beyond the capacity of human capability to reason. Therefore, the three different approaches are all needed for different purposes.

In this study, my aim was to outline the main elements of the process of becoming unbeatable in sports but also to see what role creativity plays in the process. I had some pre-ideas of this, however, the explanation to how this all comes together and where the creativity fits were still cloudy. This research offers an explanation to these questions. The way in which I have approached the data has been to remain open to any possible solution, yet upon spotting any features that bear a similarity to the literature on creativity and idea formation I have used them as the foundation for a second analysis.

This study started from a gut feeling and a hunch, in other words I knew what I was looking for when entering the empirical field. However, I also knew that researchers had overlooked what I was looking for. It seemed there was not really an explanation to it in literature. Therefore, the concept, the missing bit, needed to be constructed with the help of empirical data, together with the indications of previous researchers. The way in which I started to construct an understanding of the transitory phenomena can be likened to opening a mussel in order to reveal a pearl.

To begin with, I had to concentrate to understand how thinking and new knowledge building and knowing in sports builds and only then could I get to spot the pearl, and see how creativity works in this system. That being the case, analyzing by coding had two stages: Firstly, the process of building excellence, and secondly, I looked more closely at those codes which speak about forming an understanding and a view of becoming excellent in order to explain the creative thinking in the process.

3.2.2 Data

Baer (2012) suggested that creativity is very domain specific and it could only be studied in context. I chose the field of my empirical study to be elite sports and more specifically, Olympic sports. Studying Olympic champions provided me, as a researcher, with extreme cases (Yin 2009) as striving to be unbeatable is at the foundation of elite sports. In sports, uniqueness in global competition is measured in an established way, which provides this study with “a ready process for identifying the specific people by relying on other experts’ judgment (Sosniak 2006, p. 293)”. In this way, many aspects of expertise attainment are standardized in sports giving the possibility to focus on the variables in the process. This gave the study almost a laboratory type of setting.

I turned to some exceptional athletes in my native country and focused on the Finnish multi-time Olympic Champions

and their teams. I believed that winning multiple Olympic gold medals is definitely infrequent but not a coincidence. Through looking more closely at the process, I believed that I would be able to bring additional aspects and considerations to the study of gaining superiority.

In addition to a rigorous training routine, discipline and determination, I wondered what role creativity played in attaining elite levels of excellence. I thought it would be interesting to look at the process and systems of these exceptional achievers to learn if creativity plays a part, what kind and whose creativity might be needed. In Finland, the number of multi-time Olympic Champions in the past 45 years was only five, and therefore I could include them all in this study. With these thoughts in mind I wanted to track infrequent ideas that, with lots of work, come to make a distinctive contribution to success.

Grounded theory uses interviews and observation as the main data collecting methods. Observations were out of the question because of the retrospective nature of this study. However, I thought interviewing would be good in order to hear the individual stories and their nuances as the individuals, through having been in the process, interpret them.

However, I was aware of some restrictions in the data collected in this retrospective way. Retrospective interviews (Sosniak 2006) have their limits as it is hard to remember the thoughts from 30 years ago, especially to recall the steps and thinking patterns of the time. For this reason, I felt it was important to include more people than just the athletes in "the remembering process" as suggested by Sosniak (2006, p.294). I decided to interview the closest collaborators, the coaches.

These people who qualified for the study had such recognition that four out of the five had at least one biography written about them, and two of the coaches had written books describing the way to success. Eleven biographies have been included in my data. Furthermore, as these people were of public interest, the press had been actively reporting about their careers. Some press articles as well as Wikipedia were useful in writing the athletes' stories. The multiple resources for the data helped in the triangulation of the information as the same events were repeated, but the nuances sometimes changed depending on whom the source was and when the stories were told. The articles and a few of the biographies were written whilst the particular athlete was still active in their career.

In a theoretical study, very often a control group is formed to help to point out the distinctive differences that are the focus of theorizing. However, as Sosniak (2006, p.294) points out:

> "A random sample control group makes no sense for a purposefully chosen elite study group."

Also a carefully chosen control group was difficult to form properly, ruling out all the possibilities that could have affected during the life span of some other athlete not quite peaking.

Even if there was no control group the interviewees were asked to make

comparisons by asking the question of why did these athletes became better than others. To some extent it is self-evident that all the interviewees and biographers made their own interpretation of why they succeeded and were also aware of the actions and performances of others. Especially the coaches were asked to compare the champions with other athletes they had been following closely. The coaches had several athletes in coaching and that gave some perspective to this study, but did not give enough building blocks for forming a control group that would have brought particular value in answering the research questions in this study. Some explanations of not developing to become champion in Finland, have been given also already by Salasuo et al. (2015).

Rather than try to identify the differences between these exceptional individuals and others not quite reaching the top, my aim with this study was to find similarities between the five cases and identify any patterns they follow. Therefore, I used my own expertise to try to understand what was important and specific in these cases. But of course, the absence of a focus group is a limitation to this study and consequently the tone of the results is more about suggesting and theorizing rather than exact and proving.

Retrospectively, the study also has other limitation as it gathers data from earlier times, when the cultural and social setup differed from that of today. Therefore, there is "a risk of confusing the circumstances of the times" with the elements important to the development of expertise as warned by Sosniak (2006, p.296). However, I was more after the thinking process of the team and therefore trusted that individual abilities have not changed to such an extent that I could not get a basic grasp of the patterns of thinking based on incidents from the past. Also, the somewhat self-sufficient small teams typical for that time gave possibilities to follow the complex process of an individual's growth as well as their knowledge creation compared to the environment of today. The small self-sufficient teams gave this study an advantage of accessing and following the growth process in almost a laboratory type of set up.

3.3 Data collection

Three kinds of data was collected for this study. Firstly, biographies, articles, Wikipedia and other written material were used to form the life stories of the five multi-times Olympic Champions. These careers are presented in the chapter four. Four out of the five athletes had at least one biography written about them. Details about the one that did not could be collated from other sources including the information gained from interviews. Several biographies had been written about two of the athletes including their coach's autobiographies and these were extremely valuable in understanding the training philosophy and approach, explaining their own journey to realization. A further advantage to this was that the coaches gave an action research type of view of the growing process as they had been following their athletes from when they were young to the point of them becoming multi-time champions.

The second set of data was collected for the pre-study. This was done in order to gain some pre-understanding of

the phenomena. One Olympic Champion and two world championship medalists in different Olympic disciplines were interviewed. This gave the possibility to test the idea and the interview questions. Analyzing the data helped to form the preliminary picture of the phenomena and gave the first stepping-stone when starting to analyze the main data. This pre-study was carried out in spring 2011 as part of the qualitative research method course arranged at my university.

The third, and the main data collection method and stage was interviews with the five Finnish multi-time Olympic Champions and members of their coaching team. I interviewed all the athletes and also several coaches in their team. The interviews started in 2012 and were conducted in many phases. The first phase I carried out while taking part in a specific grounded theory course at my university. During this phase, I followed very precisely the procedures described by the lecturing professor. I wrote memos and drew some connections using the process described by Corbin and Strauss (cop. 2008). I also visited literature to be able to interpret what I was hearing and seeing. Later, I also attended an Atlas.ti computer method course to learn to use the specific program, which helped to systematically work through and analyze the interview data. By this time I had conducted all the interviews and I restarted to analyze from the beginning using the analysis and memos done before as checkup materials. In this way, I could also see if my own way of coding and noticing some ideas had stayed the same.

These three types of ways of collecting the data helped to triangulate the information gathered and gave a more credible way of forming a comprehensive picture of what had really happened in the past.

3.3.1 Biographies and other written data

There were eleven biographies to analyze, many articles, Wikipedia sites and official sites of competitions to prove the competition results. From the written materials, the biographies were the most useful. Some of them were written during the athletes' career and some after. The coach was the author of three of the books and two of them took a very analytical point of view describing the learning curve they had been both witness to and part of.

The biographies were very valuable for writing the athletes stories presented in chapter four. They also offered descriptive, though interpreted reviews of what had happened and many of the same events that came out in the interviews were presented in the books. As the books were written closer to the actual happenings, they had more details whereas in interviews the same events were presented in a more abstract, analyzed and sometimes even in slightly different light. The tone of the story had sometimes changed during the years, which might have been due to the changes in relations between these people, however, most of the aspects of the development of the career remained as presented in interviews as they had been presented in biographies. I could still remember following most of the Olympic victories on television at the time. To refresh my memory, I watched some of the competitions from video collections.

The biographies were important in forming a comprehensive picture of events, which were important in understanding what was the unique in their approach. Biographies helped in the search for sparking moments that happened and lead to innovations.

3.3.2 Pre-Study

The purpose of the pre-study was to test my research questions, my interview questions, the appropriateness of the grounded theory as a method and the grounded theory as the approach as well as to learn to analyze the collected data. The pre-study was carried out in spring 2011 bringing understanding of the phenomena, helping to focus from a theoretical angle and giving the possibility to test grounded theory as the overall analyzing approach.

For the pre-study, I conducted three interviews with one Olympic Champion and two-world medalists in different sport disciplines to see, if by interviewing them, I would be able to find answers to my research question and also whether my instinct was correct. I asked the interviewees if they could tell me how had they become better than others and whether or not they felt that creativity had played a part in this.

The pre-study made me trust my intuition and encouraged me to proceed. I had a feeling that I could find some pattern if I looked close. The approach felt sufficient, though I had some reservations. The question I asked was not easy to answers as it is hard to remember the thoughts from the past objectively.

Additionally, some decisions were made quite early in the athletes' careers,

	Name	Discipline	Olympic gold medal
1	Pertti Karppinen	Rowing	1984 individual gold 1980 individual gold 1976 individual gold
2	Matti Nykänen	Ski jumping	1984 individual gold 1988 two individual golds 1988 a team gold medal
3	Samppa Lajunen	Nordic combine	2002 two individual golds 2002 a team gold medal
4	Lasse Viren	5000 m and 10 000 m running	1972 two individual golds 1976 two individual golds
5	Marja-Liisa Kirvesniemi	Nordic Skiing	1984 three individual gold

Table 1. The Finnish Olympic Champions that have won several individual gold medals after 1970.

and recalling childhood memories clearly, especially what one was thinking at that point was not so easy. Life for these individuals had obviously changed with success and interpretations could have changed and altered over time. For this reason, and as suggested by Sosniak (2006, p.294), I saw that it was important to design the study to include more people from around these athletes in the remembering process to help triangulate the information provided by the successful individuals themselves.

3.3.3 The interviews

After the pre-study I continued to ask the same questions from a defined group of people; the Finnish multi time Olympic Champions and their circle of acquaintances. Multitime Olympic Champions, qualified for this study, were those who had won more than one individual gold medal at the Olympics. It would have been interesting to have a team sport included but there were no team sport Olympic gold medallists from Finland. In some sports in the Olympic program there are also so called team events. These teams were formed from a collection of individuals performing to make a joint result rather than teams who combine their actions to make joint performances. Therefore, for this study only individual gold medals were taken into consideration.

From the beginning of the 1970's, there have been five such athletes from Finland who have gained two individual medals. These athletes are presented in Table 1.

I interviewed four of the athletes between March 2012 and June 2013 and the final one in November 2015. During the same period, I also conducted eight

		Date	Time
1. athlete	Athlete	3.3.2012	2 h 15 min
	Wife	3.3.2012	15 min
	Late coach	27.2.2013	1 h
2. athlete	Athlete	12.3.2012	1 h 30 minutes
	Coach from development stage	2.3.2012	1 h
	Coach at the later state of the career		2 h
3. athlete	Athlete	19.3.2012	1h 30 minutes
	Coach and the father	9.4.2013	2h
4. athlete	Athlete	29.2.2012	2 h
	Coach	6.5.2013	2 h
5. athlete	National team coach	25.8.2015	1 h 10 minutes

Table 2. Interviews, time and duration.

interviews with coaches and people involved with the athletes. The interviews were life story interviews (Atkinson 1998) conducted to explore the participants' experiences gained during their sporting careers, their thoughts and ideas on the way to excellence.

The interviewees (except one) chose the place to be interviewed, and were then in a familiar surrounding for them. Only two of the interviewees were women, one athlete and a wife. All the coaches around an athlete were men. This was rather eye opening though out of the scope of this study. Each of the interviews was one to two hours long, and altogether added up to 19 h 40 minutes (see Table 2). All the interviews were recorded.

In these deep semi-structured interviews (Kvale 1996), I used "opening the locks" type of questions (Rubin, Rubin 2005). Then applied a laddering technique (Reynolds, Gutman 1988) going deeper and deeper into any topic that felt interesting and relevant to my research question. Because I wanted the interviewees to orient to the topic before, in order to start thinking, I sent the three main questions to them beforehand, which were:

1. **What made you (the athlete) better than others?**

2. **Was there something you could call innovation behind the doing or something you or the athlete did in a new way, in your (athlete's) career?**

3. **Who or what affected you or the athlete to do it that way?**

With these questions I wanted to find out what the triggers were that made the athlete different and more successful than others, what happened during their career, who or what helped to form their thinking, who were the biggest connectors and contributors to paving the collective thinking on the way to success.

At the same time as the interviewees talked I was looking for the cues to see what was unique in their career. I wrote memos after each interview in order to grasp the immediate thoughts and the feeling I had in the interviews. At the time, the memos did not feel so important but later helped me to understand the intensity and the feelings the interviewed person had. After the first three athletes' interviews I started coding in order to define if the questions I asked were getting me closer to answering my research question.

All the interviews were conducted in the native language of the interviewees, who were Finnish, also my native language. The interviews were recorded and then transcribed or audio coded. I started by transcribing but later found the feature in the Atlas.ti program that allowed audio coding which was more practical for me.

The data was translated only for the quotations and questions used in this paper as the purpose was to keep the data as original as possible for as long as possible. The author completed the translations.

At the end of each interview I let the athlete name and draw a map of key persons in their circle of acquaintances during their career in order to be sure to include the key players in the study. In this way I lightly followed the snowball technique

described by Goodman (1961) and named the additional important persons in the athlete's career. In doing this I felt I had a better chance of getting to the roots of building expertise.

3.4 Data analysis

3.4.1 Analyzing the biographies

Based on all the collected data, the biographies, articles and interviews, I formed the five narratives of the athletes' careers, focusing on the stories, which, in my opinion, seemed to be important in contributing to the research questions. The narratives shortly introduce the athletes' careers, the members of the team, the special insightful events and innovations they used. These five stories that outlines the five cases used in this study are presented in chapter 4 and they help the reader to understand the context and the kinds of events on which I have based my results.

3.4.2 Analyzing the pre-study data

I started analyzing the pre study data by giving in vivo codes to any statement that I found interesting, keeping in mind my research topic. I was looking at the creative thinking as well as elements and processes involved in becoming superior in a certain field. I started with athlete number one and followed up with athlete number two and so on. I put the 72 in vivo codes onto an excel sheet still saving the original text connected to the vivo codes. In the next stage, I gave the in vivo codes a more abstract label, a "code". I had altogether 40 codes. Following this, I grouped these codes according to what each label represented to seven further sub-categories. This time I tried to understand what the groups meant in the way Corbin (cop. 2008, p. 261) explains:

> "The patterns are emerging in the data but have to be recognized by researcher. A researcher needs to search how the main issues or problems of the research are handled or managed over time. Once analysts have uncovered process in the data, they are able to paint conceptual pictures that add to the understanding of the experience."

I started to draw a picture to clarify how my abstracted elements could flow together. I was asking my data, through which process and ongoing flow of action /interaction /emotion had an athlete created his or her own way, and, more specifically, how did the insight grow to the point that it resulted in a unique approach and new and unique ways of doing.

I tried to identify processes that were strategic, routine, random, novel, automatic, and /or thoughtful like pointed out by Corbin and Strauss (cop. 2008). I disciplined followed the instructions to contract the labels to three to four core categories that would answer the research question. I did this, however slightly too rigorously. At this stage, my aim was to see if the method worked and was I able to find elements of creativity when I asked the athletes to describe use of creativity during their careers. The process that I followed is described in Table 3.

Categorizing stages	Description of the categorization stage	Amount
1. Stage	Giving in vivo codes to quotations	72
2. Stage	Making abstractions and forming codes	40
3. Stage	Forming of subcategories	7
4. Stage	Forming of core categories	4

Table 3. The process of analyzing the pre-study interviews.

As I had a great deal of pre-knowledge of the area I needed a very structured way of analyzing in order to separate my own thoughts from the data. I was aware that I had to understand and interpret what I was hearing and be sincere to the data, as Tracy (2010) had pointed out. The analyzing technique of grounded theory provided me with a suitable tool to move systematically from data to abstract constructs, creating concepts, and relationships between them.

3.4.3 Analyzing the interview data

In an effort to answer the research questions, I started to analyze the interview data very systematically based on the procedures and practical guidelines described by Corbin and Strauss (cop. 2008) and tested in the pre-study. I used Atlas.ti program to help to organize the codes and to work on the process.

I decided to make two phases of analyzing the interview data; the first phase to answer the research question one, and the second phase to answer the research question two. In this way I could first concentrate on the whole process and then look more closely at creativity. The first phase also served as the foundation for phase two by providing the reduced data based on the specific quotations speaking about creativity or similar phenomena.

Analyzing factors of the process

In analysis phase one, the aim was to define, identify and outline why and through which process multi-times Olympic Champions built to be uniquely successful. I did not have ready categories or decided themes in advance, however, my pre-study and pre-understanding was directing me to be sensitive to expressions that indicated that they were linked to uniqueness, creativity and exposure to stimulation. The pre-study also helped to get going with grouping but was not revisited thereafter. The process is described in Table 4.

To get going with coding, I started to identify any statement that I felt interesting. Keeping my research topic in mind, I simultaneously gave the quotation a code or several codes that described the quotation. I coded everything that I felt was describing elements and processes involved in becoming superior, remarking especially on the events and explanations the interviewees were putting weight on. Listening over and over to the recordings, paying attention to nuances I tried to follow their path of thinking and develop an understanding.

Categorizing stages	Description of the categorization stage	Details
REPARATORY WORK: Determining the unit of analysis	Listening the tapes and reading the text several times.	
STAGE 1: Identification of interesting quotations and their coding	1. Identifying and highlighting expressions from the authentic interviews. 2. Transcribing the quotations from audiotapes. 3. Creating reduced expressions from initial expressions	95 codes were given to 759 quotations
STAGE 2: Linking codes to each other	Using terms: “is property of”; ”is part of”; ”is cause of”; ”is associated with”; ”is a”; ”contradicts”	204 code-code links where created
STAGE 3 A: Categorizing and reducing expressions to form **subcategories** and **core categories**	Forming categories of grouped codes that were linked to each other with statements: ”is a”; ”is part of” or; ”is property of ”	27 subcategories and 11 main categories were produced.
STAGE 3 B: Building code link chains	Code links were formed from all statements linked with: ”is a cause of”	From 50 ”is a cause of” association to one having 11 categories
STAGE 4: Reduction of **main categories** to **core categories**	Final six categories were made	Final core categories, which were systematically related to other lower level categories, were formed.

Table 4. Different categorizing process stages in the first analysis phase.

Figure 3. Tag cloud of codes.

I decided to have the quotations as sentences or even having longer paragraphs linked to the code to help me to come back to the original quotation when progressing to linking the codes. I treated all the interviews similarly, athletes and the coaching team, coding what I was hearing and what was important to my research question. After finishing coding the last interview, I went back to the first ones to see if my coding was consistent.

As a note about the way I was handling my recorded interview data. I had recorded all the interviews and transcribed four athlete interviews and three of the coaches. As I noticed I could code audiotapes with the Atlas.ti program I stopped transcribing the interview audiotapes and started coding the tapes directly. This I did with the remaining interviews. In audio coding, I transcribed each quotation and added them to the comment section of the code in the Atlas.ti -program. In doing this I could keep the quotation and the code link together thus enabling quick identification in order to continue with the process similarly as with the written documents.

After coding, I started to form groups and give the codes group colors. To get a feel for my used codes I printed out a tag cloud produced from my used codes highlighted with the group color Figure 3. This time the codes were all in Finnish as all the data was as well.

Using Atlas.ti's network tool, I started creating a network with all my codes. I at first clustered the codes according to their color to get some order to the sea of codes. Then I started to make connections between the individual codes using the

code link tool and statements therein. The tool offers a few different statements that specify the way the codes link to another, like code A "is a part of "code B or code A "is cause of "code B.

At this stage, I went back and forth between groups and networks; I changed the color of the code if the code fitted better to another group in order to start to visualize the cloud of codes. I also went back to the original quotations to prove that the statements were right. When I felt that the statements made sense, I read all my 204 code-code links to my colleague to verify my sense making. Any statement that was unclear we, with my colleague went back to the original quotations and discussed together what the interviewees may have meant. After these discussions I made some adjustments to the links. Examples of the statements and original expressions are in Table 5.

After this, I exported all the links to Excel and formed a line of links using "is cause of" – statements. One longer chain emerged and the shorter chains also started to make sense and find their place in the main chain. This time, I formed the first sub-categories by giving a more abstract label to the group of codes that were linked to each other with the statements "is part of", "is property of" and "is a". In other words, some codes were descriptions of other codes and this way I could form 27 sub-categories that had many codes describing them. At this point, I went back and re-read the quotations in order that I could interpret them and thus put them into unifying groups. Then, I moved to group the 27 sub-categories into 11 main categories. I still linked some of the main categories together in order to arrive at the final six core categories. Now each core category was formed of codes from the same part of

Statement	Code	Expression
Code	Drive	
Is part of	Motivation is part of drive	"I really enjoy running."
Is property of	Desire to develop is a property of drive	"My driving force was the desire to develop it more and make things a little better all the time."
Is cause of	Self -imposed is a cause of drive	"Often is thought that happiness is something which cannot be affected, I disagree. These kinds of risks can be minimized with creative thinking."
Is cause of	Drive is a case of training	"If you have been in the gym doing a leg workout, and your legs are tired, then you can in the afternoon to restore the legs and then do something for the upper part."

Table 5. Code-relations and an example of statements in stage 2.

the process chain Table 6. The table shows how main category A is formed from code A. There the first box describes how "code A" is linked with different statements to other codes and forming the sub-category A+. The second box and the third box show how categories were subtracted from sub-categories to main categories and still to six core categories.

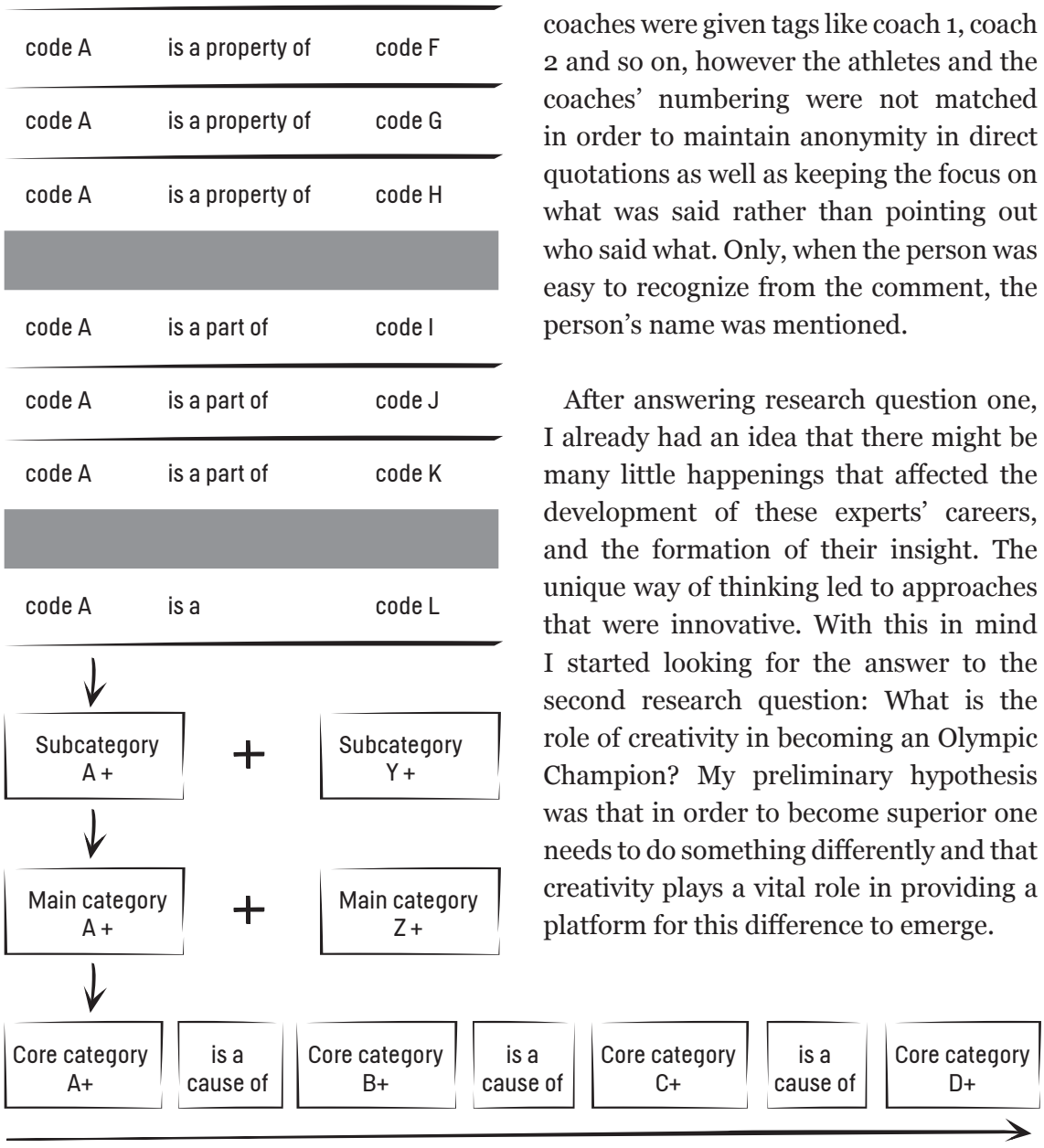

Table 6. Linking code A to other code other in stage 2, 3 A, 3 B and 4 to form sub, main and core categories with explanatory codes linking codes to each other.

Examples of formed abstractions from reducing data from authentic expressions in different stages are shown in Table 7. The further categorizing is presented in the chapter 5.1.

When presenting the quotations in the result section, I have done it as anonym as possible. Therefore, the interviewed persons' quotations have been tagged like athlete 1, athlete 2 and so on. Also, the coaches were given tags like coach 1, coach 2 and so on, however the athletes and the coaches' numbering were not matched in order to maintain anonymity in direct quotations as well as keeping the focus on what was said rather than pointing out who said what. Only, when the person was easy to recognize from the comment, the person's name was mentioned.

After answering research question one, I already had an idea that there might be many little happenings that affected the development of these experts' careers, and the formation of their insight. The unique way of thinking led to approaches that were innovative. With this in mind I started looking for the answer to the second research question: What is the role of creativity in becoming an Olympic Champion? My preliminary hypothesis was that in order to become superior one needs to do something differently and that creativity plays a vital role in providing a platform for this difference to emerge.

Expression	Code	Sub category	Main category	Core category
“I have trained and trained until exhaustion and even then I have trained.”	Persistence	Endurance	Endurance	Persistent work
“In my view, it is precisely that that you are not giving up so easily. Many are looking out of the window and seeing that it is a bad weather out there and don’t bother to go out and row. They think that oh, I will instead do a little exercise cycle or go for a little run. But you know that going there exactly then makes the workout twice as demanding.”	Determination			
“Despite the fact that the results did not improve, he believed the exercise would bring results later.”	Persistence			
“When I got the training program, I executed it to the last detail.”	Execution	Physical work	Deliberate practice	
”I did millions of these bounces on ground.”	Amount of training	Deliberate training		
”I have always tried to develop myself in something at these basic exercises.”	Training			
“Every situation had been made familiar with training.“	All familiar with training			
“The coach feeds the ideas and considers how they are received.”	Coaching			
”In the evenings I went the race through my mind.”	Concen-tration and mental training			
”I was so committed to the sport compared to these others, they had also other things to do. I either rested, trained or I was at work.”	Lifestyle	Life-style	Life-style, plan and setting for training	
“Skiing was my profession. I was bound to leave all outside things. I was forced to forget some of the friends. All outside things stayed. Those back at home hired a outside help to make the work I had done.”	Lifestyle			
“Such solutions were made to the exercise conditions that it made it possible to develop.”	Ensuring conditions	Training conditions		
“The coaches role is to make the training programs.”	Training plan	Working roles		
“The coach’s first goal is to know and examined the athlete with all the individual characteristics, abilities and stress factors as well as his way of han-dling the information after failure.”	Knowing the athlete			

Table 7. Examples of formed abstractions from reducing data from authentic expressions.

Analyzing creative expressions

In analysis phase 2, I went back to the codes and picked out the ones, which related to the categories of ”insight” and ”systemic application”. I read the quotations and tried to identify ideas that were original and affected the way the team or an individual in that team acted before and after the idea was born. I also looked at the happenings that I had heard of in the interviews and read about in biographies. I put these happenings, one after another to see how those features evolved over a period of time.

I had two theoretical approaches helping me when analyzing the data: the Event System Theory (EST) by Morgenson et al. (2015) and the group creative process presented by Sawyer and DeZutter (2009).

The Event System Theory (EST) was constructed in order to explain how an event could affect an organization, a team, individuals or a whole environment to change, or create new behaviors and features that affect future activities or events. This kind of triggering event typically has a specific time and place. It can be a major event affecting everyone, such as a war or a small event, like a discussion with a person affecting an individual, however having a big impact for the future activities and actions. The EST was used in this study to explain how individual's ideas grew, mainly to point out the separate moments and collaborations that affected the formation of personal insight that was special for the individual and the team and contributed to the approaches the individual and the team were taking thereafter.

The other approach, was based on Sawyer and DeZutter's theorizing on social emergence to explain how creativity emerges in interaction in a system way. The duo introduced a frame to review collaborative creativity, which gives the possibility to study creativity as a group's interactional processes and its improvisational nature, instead of just one individual's mental process. With the help of this frame, I am going to explain the little incidents, the intellectual insights, which generate and grow in interactions with people, environments and surroundings, and shape new ways and approaches. In this way, I widen Sawyer and DeZutter's frame to include the interaction also with environment, conditions and equipment. Following Sawyer's (2008) terminology I call these intellectual insights; sparks.

The sparks come one by one or as a burst. A burst of sparks might emerge, for example, when collaborating intensively with others. Sparks and burst of sparks have a time and space. I call these moments sparking moments that are small events. These sparking moments follow each other in a chain as they build on person's thinking in an additional manner. However, I make a distinction of the major sparking moment, an event when the main insight occurs. This major event includes spark or sparks, and therefore is a sparking moment, however, it has the biggest transforming effect on future training or/and an approach in the specific chain of sparks. To further clarify, each spark slightly changes the way a person or persons think but during the major event such a shift of thinking happens, which leads to a decision of future action or approach that is very distinct from the way it was done before.

The two theories have a slightly different purpose and approach in the attempt to describe creativity in the cases of this study. I used these two theoretical approaches to find and explain how such sparks and the burst of sparks followed each other as time passed, and how they emerged, evolved, and transformed the future development. These two approaches gave me a theoretical approach and explanation to describe what I found. One the one hand, I had a way to point out those events that had time and place, as described in EST, and on the other hand, I had a frame to describe the systems of scattered and insightful thoughts the "sparks" like presented by Sawyer and DeZutter. Sawyers approach puts emphasis on the emergent nature of sparks, ideas and insight, whereas the EST concentrates on the triggering events that are temporally determined. EST also helps to track down the place and the time for the sparks, the burst of sparks as well as for the actions that follow, allowing a chain of sparks to form that explains how the thinking grows in the process. The actions that follow these transforming events when a major spark happens also usually include sparks as putting an idea into practice requires modification.

In other words, my attempt is to find, follow and present different kinds of chains of sparks that developed to a "major spark" and changed the future actions. I also follow thereafter what kind of changes these sparks brought. In this way, I am trying to track a chain of many little sparks, burst of sparks leading to transformation and change of insight. The example of the chain is presented in Figure 4.

From each team, I collected an example of a chain of sparks and sparking moments, but I tried to find different types of chains to describe the different volumes these chains can have. In this way, my aim was to discover the process and mechanism of creativity rather than to point out the events themselves. By doing this, I have tried to understand how and through which processes new ideas are generated. This forming of a chain of sparks and sparking moments over time is presented in chapter 5.3.

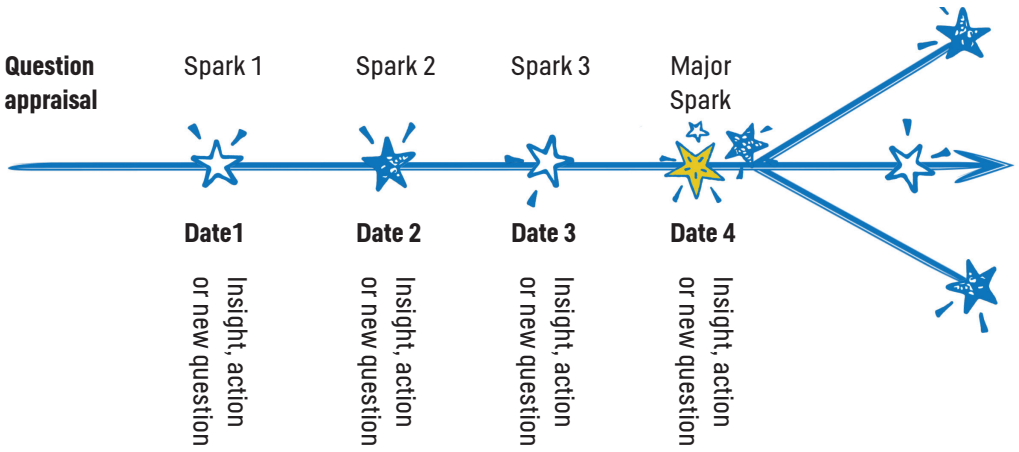

Figure 4. The chain of emerging sparks leading to major spark that is an event changing behavior, features or following events in a decisive way.

4. The journey to extraordinary — Five athlete's cases

The athletes in this study are all from Finland, a fairly large country with only a few people very north of the globe. Finland has long snowy winters, which makes winter sport possible and also three of the Olympic Champions in this study were competing at winter Olympics. However, the winter also affected the two other athletes who competed against athletes from quite different environments. The climate, place on the map, as well the history of the country affects the way culture has developed. Next, the five athlete's careers are formed to narratives in order to give a reader the possibility to understand the link between the athlete's career and the results. In the end of each athlete narrative some innovative sparks relevant to this study are outlined.

4.1 Lasse Viren, runner

Born		22.7.1949		
Olympic games	Participation in 3 Olympics 4 medals	1972–1980		
Olympic results	Munich	1972	10 km	1st
	Munich	1972	5 km	1st
	Montreal	1976	10 km	1st
	Montreal	1976	5 km	1st
	Montreal	1976	Marathon	5th
	Moscow	1980	10 km	5th
European Championships medals	Rome	1974	5 km	3rd

4.1.1 Introduction

Lasse Viren continued the Finnish long distance runner's legacy as the "Flying Finn" following in the footsteps of multi -times Olympic Champions Hannes Kolehmainen and Paavo Nurmi in the early 20th century. Viren recaptured the nickname after winning in two consecutive Olympic games, Munich 1972 and Montreal 1976, in both the 5000 and 10 000 meters races.

4.1.2 Growing to be athlete

Viren enjoyed a happy childhood in the little village of Myrskylä with his family consisting of a truck driver father, mother and three brothers, two of them older than him. The neighbourhood of the small city, Myrskylä offered a solid place to grow up. The atmosphere at home was caring and also offered, for a bigger group of boys, a place to meet and play. The village boys used to do all kinds of sport; ski jumping, cross-country skiing and running. Lasse Viren was an ordinary boy and nothing out of the ordinary was anticipated in any way concerning his future success, and that one day, he would become a Finnish sporting legend. Viren won his first medal in a local skiing competition at the age of 6, but that was the best result he had for a long time. Even at the age of 17 his results in all sports were far from the top even in local events.

However, at the age of 16, Viren recalls an event that changed his destiny. On the 5th of September in 1965 he was following the radio broadcast of the traditional track and field contest between Finland and Sweden. The legacy of the Finnish tradition in long distance running had totally faded and the Finnish long distance runners were beaten thoroughly by the Swedish. Viren remembers thinking in that moment that maybe he should do something about it.

This event changed his life and approach to running. He started systematic training. He built his training based on his own knowledge and intuition. Luckily, he was not aware of the interval-training trend in Finland then, but started doing quite long runs building a good base for later practice. At the age of 17 he started to keep a training diary to be more systematic. He had no doubts that long distance was his thing, as he had no abilities for anything else. He was too slow for a sprinter and too weak to become a thrower (Haikkola, Vuorio 1973).

Viren enjoyed running, and the amount of yearly kilometers accumulated and his results improved. In 1967, he won a medal for the first time competing in the 17-18 years category in cross-country running in the district championships, and was determined to break into the team going to the Finnish national championships. On a hot day in May he came second at the Nationals in boy's cross-country running. The same season, on the track Viren won the boys Nationals in 3000 meters and was chosen for the international competition between Finland and Estonia. The cumulative effect of years of systematic training paid off as in September Viren broke the Finnish A-boy's record in both the 3000 and 5000 meters. It was at this time that he left the mechanical trade school he had started and decided to concentrate on running. As he did not really know what to do next, he applied for military service as a volunteer. After two weeks in service he was accepted to the sport troops.

In the sport troops he got assistance from the running coach Hannu Posti and began training using Posti's burdensome methods, which proved to be too hard for Viren. The following season the results dipped. After eleven months, finishing with the troops, he was free to start training using his own methods again. However, a notable result of his stint in the forces was that it had improved his stamina and laid

the foundation for extensive training. The next season was successful. Viren won the National Championships in the 5000 m race in men's category, which got him, for the first time, into the national team.

The news of Viren's good results had traveled overseas and he got an invitation to go to study, and run, the following winter in Utah Brigham Young University, where some Finnish runners were already practicing. The half year training there was athletically not very good. His legs got sore after running on asphalt in the USA. Notwithstanding this, the experience brought some language skill and helped Viren to develop the self-confidence so that he could manage to live abroad.

That summer, in June 1970, Viren asked Rolf Haikkola, an experienced trainer to train him. Haikkola studied Viren's training diary and came to the conclusion that Viren had motivation and spirit in place but his condition level was quite modest. Through their collaboration, Viren started comprehensive training, the times in all distances improved next summer and that was what Viren was after, not particular results.

The results were good enough for Viren to be granted a full scholarship from the Olympic Committee for the next winter, which meant that he could take a leave of absence from his profession as a Policeman and train in warmer weather.

4.1.3 Reaching the top level

Viren was a very disciplined trainer, running every single day of the year and frequently, three training sessions a day. With the precise training method, "Total Training", developed by Haikkola. The training was proportioned in a very thought out way, ensuring that variety was a key factor, allowing for gains in terms of quality as well as quantity.

The training method, Total Training**,** formed the foundation for practice and was done very thoroughly. It also took into account mental as well as nutritional aspects of training and was divided into months, weeks and finally days. Haikkola outlined it, but together they fine-tuned the plan to fit perfectly to Viren's life in order to be applicable. Haikkola (Raevuori, Haikkola 1978, p. 97-98) explained:

> "An athlete must know the reason for each individual workout. He must know how and why he ticks. When a runner helps to build a schedule and approves it, it is much easier to carry out even in the absence of the coach."

After finalizing the plan, Viren followed it a hundred percent. Haikkola constantly received feedback of the practice, in order that he could monitor the effect of the training.

To be sure of progress, they used several test runs. Haikkola points out that the tests were very important to see how the training was affecting and to understand what needed to be done. Tests were often done in competitions where they tried different kinds of tactics in real life situations to which_special test runs were also added. Testing in competitions needs strong self-courage from an athlete to be able to go to competitions and not try to win even

if the crowd and media are expecting it. One aspect of the plan was to build belief and the ability to use clear tactics and be mindful during the run.

After the second year of working with Haikkola the amount of training had increased by 31% and the results improved in all distances. By the time of the Munich Olympics, Viren was in peak condition. His preparation had gone as planned with no setbacks, he had systematically built up his condition, was enjoying his running and had greatly improved his stamina.

In media speculation, Viren was portrayed as a dark horse at the 1972 Olympics in Munich. He had already shown signs of his capabilities but he was not really among the true favorites. However, Viren won his first gold medal in the 10,000-meter race with a world record time despite him falling down and being left far behind the main group of runners. The unbelievable run was a result of great preparation where the training duo had calculated possible rivals and trained to outperform them. When on the track, he was a fighter, alert to competitors' moves, sharpened like that of a hunting animal. The unexpected events in the race could only have occurred as a direct result of his strong mental power. His doctor described Viren's exceptional mental strength (Raevuori, Haikkola 1978, p. 93):

> "He not only runs, but senses, thinks, and maneuvers so cold-bloodedly that it is almost unbelievable."

The amazing 10,000-meter race was followed by the second gold medal victory in the 5,000 meters only a few days later. Viren won it even though the race was run at a totally different pace and with different tactics to the one some days before. No one could imagine that Viren, who was known as a endurance runner, could fight back in a slow paced race decided only in the final spurt. In that competition he proved his diversity, and that he could outperform his competitors in many different ways.

Viren's goal as an athlete was clear: to win at the Olympics. Other victories and records were secondary to him and only served towards the purpose of winning at the Olympics. Mentally tough, physically prepared and with a clear goal in mind, he could outperform his rivals in the moment, on which he had concentrated all his efforts. Viren (Raevuori, Haikkola 1978, p.108) said:

> "For me breaking records does not mean so much. It is easy. You just train yourself into top shape, and then get some timekeeper alongside the track to time you. To aim at records is like shooting carrion; the shooter has no outside challenge, but to win at Olympics is quite another thing. You have to time yourself exactly; you must not err by as much as a week. To aim to Olympic victory is a risky game; you are not alone on the track with the idea of winning."

Viren did beat world records but that was not what he was after. It did not serve the goal he had. Winning a race on a certain day, in a certain place with rivals trying to outperform each other needs other qualities than being the fastest. Viren trained the capabilities required to beat his expected rivals in order to outdo them

tactically. He approached decisive races with two tactics in mind; these being that, as one might expect, he planned to use his abilities but further to this he had also developed the capability to respond to rivals' possible attacks. His training had provided him with a relatively wide range of capabilities and therefore, he could win despite the quite different tactics used in the races.

4.1.4 Staying at the top

The road to the Montreal Summer Olympics 1976 was quite different to the path, which had led Viren to victory in Munich. Injury shaded his training, since May 1974 Viren had suffered from a leg injury that interfered with his training and competing for almost a year. Finally, after many periods of rehabilitation, doctors suggested surgery, the leg was operated on and recovery only started one and a half years before the big event. It was evident that Viren's training needs were changed and the training method was suitably fine-tuned towards a more holistic approach, tailor-made to build him mentally as well as physically thus ensuring peak performance. They also introduced training periods in the thin air in the mountains of Kenya into the program.

Even if the way to the games was rocky and overshadowed by pain, the closer the Olympics came the more the results improved, but his shape was not quite as good in Montreal as it had been in Munich. A noteworthy aspect was that during the four year period between the Olympic games Viren did not win any international competitions and consequently was again not the actual front-runner of the games in Montreal despite his previous medals.

The Olympics in Montreal was another incredible event where, against all odds, Viren triumphed in two races that were quite different to each other. In the 10.000 meters, Viren won in sovereign style. He came to the finishing line alone after a high tempo run where Carlos Lopez was accelerating the pace lap-by-lap dropping the runners one by one. Finally, there were two men left, Lopez and Viren in a cat and mouse kind of chase. Lopez was not a kicker and as he could not drop Viren by adding speed, he had no gear with which to answer when Viren kicked just before the last lap and sealed his third Olympic gold.

Speculation started immediately. After the victory, Viren had taken off his running shoes and lifted them high in the air, to do a lap of honor. Celebrating the victory with the shoes raised above his head was judged to be a commercial maneuver and almost led to his disqualification. Viren was ordered to a one-hour hearing in front of the International Olympic Committee to explain his actions. The procedure lasted until eight hours prior to the running of the 5,000 meters final before he was, to some extent, cleared and given permission to run. "The commercial purpose of the maneuver could not be proved." The gold medal was sealed but Viren was furious with the wording of the committee statement, which, clearly, still left doubt about the intent behind his actions. It takes a mentally tough athlete to get through such days of uncertainty whilst at the same time preparing for the next competition.

Anger might have helped to get the last bit of fighting spirit up. It was needed, as in the 5,000 meters Viren won by the

smallest of margins after an agonizing finish. Four runners passed the finishing line within four seconds after sprinting the last 100 meters in less than 13 seconds. Viren recalls that at the long jump pit he found an extra gear after accelerating the speed over the last four laps gradually dulling the sprint edge from his rivals. His tactic came as a surprise for the 13 other runners who were in hunt for his scalp. Speculation had been rife as to how Viren could win but still he was able to surprise all with his calculative approach. What was amazing was his ability to disarm each of his rival runners of their different individual strengths. He could kill each competitor's winning edge one after the other.

After this victory, speculation started again, now his superiority raised suspiciousness with media conjecture related to accusations of doping. Viren had to face the dark side of excellence: mistrust, jealousy and potential discredit. It is not easy to be preponderant.

In Montreal, Viren still ran the Marathon, but it was too much for him after four competitions in the same week (two pre-heats and two finals). He finished fifth after using all the remaining energy left in him.

Shortly before the Olympics, Viren had finished his bachelor's life and got married. When Viren decided to train for another four years for the Moscow Olympics the training plan needed to be tailored to include other people's needs as well. His motivation had been, and still was, to win at the Olympics, in order to be like Paavo Nurmi who won five gold medals at three Olympics.

In Moscow, Viren concentrated on winning the Marathon allowing him to achieve his goal of winning gold medals in three separate Olympics like Nurmi, but he also participated in the 10,000 meters race coming fifth. After the 10,000 meters run he recalls having a momentary flashback to five rounds before the end.

He had flashbacks linked to the preliminary rounds, when he had been exhausted, at the moment he was supposed to accelerate. He hesitated and did not accelerate as he had planned to do in such situations. It is speculation, but this momentary flashback and hesitation might have cost him a medal. His coach analyzed it after and drew the conclusion that Viren would have had the capacity to win, but such a minor episode showed how margins of winning are small. Everything has to come together exactly at the moment of the race.

The marathon started well for Viren but after 30 kilometers he had to drop out because of stomach problems. He retired from his athletic career after the Moscow Olympics.

4.1.5 Collaboration with coaches and the team

Viren's training consisted, more or less, of self-coaching until he was 19 years old. After that he started a ten-year collaboration with Rolf Haikkola. The duo was the core of the team but his masseur Ema Ukkola, who was always available for Viren, was an important part of helping in the recovery from the drill. Another, and very important, member of the team was doctor Peltokallio who played a vital role in keeping Viren healthy, operating

on him when Viren got a mysterious leg injury which did not heal.

The coach, Rolf Haikkola

The collaboration between Viren and his coach Haikkola was tight. To Haikkola's way of thinking, the athlete with his necessities always came first but the trainer's role was not only to follow, but to regulate, motivate and find a balance especially in difficult situations. Therefore, Haikkola wanted to learn to know his athletes well, with all their personal abilities, capabilities, stress factors and the way each athlete needed to be handled when facing failure. Haikkola says that he could only affect an athlete if they were on the same wavelength and that cooperation was built on mutual trust. Individuality was the backbone of his coaching.

When the two of them, Viren and Haikkola, met they spent time in making it perfectly clear as to what each of them wanted. Haikkola was interested in the physiological and psychological abilities of the young athlete and made sure that Viren was suitable for his training methods. The working rules needed to be clear and simple on both sides, because the collaboration and dialog between the athlete and his coach was fundamental to information flow and for fine-tuning the training.

Haikkola had created his training principles and philosophy gradually over the years, first as a runner and then as a coach. As a coach he started out in a small village and then continued on to work in the biggest athletic club in Finland. Before Viren, Haikkola had a group of runners called "Rolf's gang" with whom he experimented using different types of training methods to systematically develop runners. When Viren came in 1970 to ask Haikkola to train him, Haikkola had already done many trials and learned what worked and what did not. He had even quit as a trainer in 1966 after several setbacks with his runners. However, in Haikkola's eyes Viren had potential and he was again eager to enter the fray. The time off had washed away the earlier disappointments and given him time to analyze the Finnish running system as well as his own coaching.

The problem with Finnish running, which was then at its lowest ebb, was that it did not build peak performances, only very consistent runners. The quality and quantity was very similar throughout the season. Haikkola had also learned this from his own career as a runner.

Haikkola's training provided a holistic framework, which ensured that Viren developed physiologically, and psychologically. Psychologically, an athlete needs to be sure about his capabilities and have the courage to take risks and to trust in his own ability to succeed. Physiologically, he needed to have a solid basic condition, the ability to use the available energy resources effectively and to have the capacity to perform using many different tactics.

4.1.6 The Innovative sparks

Haikkola's Total Training was a holistic training method, a philosophy, which consisted of physiological, anatomical and psychological training, as well as a very discipline approach to nutrition. Training was aimed at simultaneously building these areas, which they calculated as

being needed to win in competitions. The philosophy contained a strategy for training and a tactical plan for competing. Very simple and clear in retrospect but required years of development and thinking to reach the well-defined view. Haikkola recalls the foundation of his coaching system as being made up of a mixture of Arthur Lydiard, Mihaly Igloi, Percy Cerutty and Paavo Nurmi, the four legendary coaches and runners, as well as his own experience as a runner and a coach. He also developed and fine-tuned the coaching method and his own thinking by collaborating with athletes and in weekly discussions with other trainers.

Total Training was finally compressed into a Four Level Training System, which prepared an athlete mentally and physically to win in competition. Haikkola (2003, p.73) wrote:

> "The four-stage training approach contained in a very significant way four mental elements: attitude, will or goals, positivity, as well as resistance to stress."

The principal idea of the developed system was to provide frequent stimuli to the body through a variety of activities, thus producing systemic responses affecting both physiological and psychological change. A critical element of the system was to develop the energy supply and energy transportation in the body in order to provide a way in which it could be tapped into and maximized for performance enhancement. The approach was unique.

Each level of the four level training had its own purpose and all of them were needed to steadily build the athlete towards winning. Essential for the method was the simultaneous strengthening of the athlete's attitude, will, positivity and ability to cope with stress. Haikkola noted that many trainers concentrated on a single aspect and area of the training and did not see that helping an athlete to develop is a holistic growing process, where intrinsic motivation is at the core. This four level training system was what Haikkola regards as having been decisive to success (Haikkola 2003).

The system did not differ so dramatically from the knowledge and practices of Finnish training in general but was quite different in the way it was implemented. The problem with Finnish running, which was in its lowest ebb then, was that it did not build peaks, the training remained very similar throughout the season.

The second difference was the rhythm of training. At the time, according to the knowledge in Finnish duration sports, the trainings were built on three-week intervals. There was a natural evolution to the Four Level System with a daily rhythm, which ensured that the body got lots of constant variations. The days were planned to differ in effectivity, for example one day the level of stress to the body was a half from the maximum level, the next at three quarters, the third at one quarters, the fourth on 1/1 and so on.

The third distinguishing issue was the exact proportioning of the training, both in terms of quality and quantity. The level of stress in each training was defined and exactly calculated using percentages from the maximum heart rate level.

Haikkola was training other runners and they even practiced together at times, but each of them had their own individual plan that was based on the individual heartbeat, way and time to recover, condition just to mention a few variables. When the plan was made, each athlete was expected to monitor their own pulse rate and balance the training accordingly.

It was also important that practice was to be taken as practice and not as competition. Even though these do not seem to be such huge considerations, following those principles every day of the year requires a very disciplined approach. According to Haikkola, one decisive difference between some other athletes he was training and Viren was that Viren followed the plan a hundred percent whereas others liked to push slightly more when the feeling was good. This pushing on easy days dulled the edge of the real hard training and these athletes never pushed their body to peak levels.

The duo was concentrating on winning and therefore Haikkola was analyzing the possible competitors thoroughly. He took this knowledge into account when planning the training to peak at the Olympics. After the base work had been done, the duo made sure that Viren had sufficient means to win races run at various speed and the tools to take advantage of competitors' weaknesses. Before each competitive run, after knowing exactly who were the co-runners, Haikkola made two tactics; the preferred and a back-up plan. In the actual event, Viren was a cold-blooded competitor, alert to any moves aware of his own strengths and able to disarm others.

4.1.7 Summary and conclusions

Team Viren–Haikkola had two conspicuous methods: the total training system and a tactical approach to each race. Both of them produced the competitive edge and were unique at the time. However, becoming to see clearly had been a process of many sparks.

What was striking when listening to the duo was the self-courage, the simplicity of the plan and the route to success. Each detail had been thought out in minute detail and the duo was able to execute this plan. It was astonishing, how they could become so sure beforehand that total training would lead them to success.

The total training system, disciplined following the plan, self-discipline, and complete management of the body and mind were finally Viren's resources for victory. Viren had the ability to manage his nerves in moments of stress, be alert to signals from the body discarding other stimulus whilst keeping his functionality at the maximum level. The amount of work and dedication was outstanding but so was the courage and self-assurance. It is evident that the total training system was a culmination of the long, over decades, process of knowledge gathering and sense making: collaborating, studying, reflecting, trialing and erring. Finally, with years of constant cogitation they also trusted their own gut feelings and executed the plan.

4.2 Matti Nykänen, ski jumper

Born		17.7.1963		
Olympic games	Participation in 2 Olympics 4 medals /2 games	1976-1994		
Olympic medals	Sarajevo	1984	Large Hill	1st
	Sarajevo	1984	Normal Hill	2nd
	Calgary	1988	Large Hill	1st
	Calgary	1988	Normal Hill	1st
	Calgary	1988	Team	1st
World Championships medals	Oslo	1982	Large Hill	1st
	Oslo	1982	Team	3rd
	Engelberg	1984	Team	1st
	Seefeld	1985	Team	1st
	Seefeld	1985	Large Hill	3rd
	Oberstdorf	1987	Team	1st
	Oberstdorf	1987	Normal Hill	2nd
	Lahti	1989	Team	1st
	Lahti	1989	Large Hill	3rd
World Championships medals in Ski flying	Harrachov	1983	Ski flying	3rd
	Planica	1985		1st
	Kulm	1986		3rd
	Oberstdorf	1988		3rd
	Vikersund	1990		2nd
Ski world cup		1983		1st
		1985		1st
		1986		1st
		1988		1st

4.2.1 Introduction

In Sarajevo 1984, Matti Nykänen won his first Olympic gold medal in large hill after gaining silver on normal hill a few days earlier. Four years later in Calgary, he cleared the table when winning all the three ski jumping events: normal, large hill and team competition, being the first ever jumper to win both individual competitions in ski jumping (Wikipedia accessed 2nd of March 2, 2015). He was crowned five times world champion and achieved nine medals in the World Championships. He won 46 World Cup races and the overall cup four times. For nine years he was the king of the hills. He did not win all the time but over the years he won everything there is to win in ski jumping including the non-Olympic "sky-flying". He was a phenomenon. Nykänen analyzed his success this way (Theiner 2003, p. 55):

> "If I should point out the reasons for my success my answer would be: relentless nature, a huge eagerness to practice, competitiveness, physical characteristics (skinny legs, not too massive musculature, slim but wide upper part and light bone structure) and flying skills."

Nykänen had essential people around him to help him to find his winning formula and surroundings that made it possible to ski jump. The collaboration between Nykänen and the coaches as well as the collaboration among the coaches and different stakeholders like scientists, developers of equipment and the actual training conditions was crucial for creating an overall competitive advantage.

4.2.2 Growing to be an athlete

Nykänen was born on July 17, 1963 in Jyväskylä as the third child and the only boy. Matti's father worked as a taxi and lorry driver and his mother was a salesperson in a co-op. The family, which grew further with one more girl being born, lived fairly modestly and Matti's childhood was carefree and happy. Three sisters, grandma and his parents surrounded him, but the father was his hero and Matti spent a lot of time with him when he was little. Matti was a sensitive and restless kid with lots of energy. A lively boy who liked to play all kinds of pranks and sometimes they were dangerous and got him in trouble. He pushed feelings and situations that were difficult to handle to the side including school. He suffered from hyperactivity that nowadays would be diagnosed as ADHD (attention deficit hyperactivity disorder) but at that time such diagnoses were still rare (Theiner 2003). These symptoms have influenced his whole life.

At the beginning of 1970's Jyväskylä city built a 35-meter ski jumping hill. On an ordinary skiing trip with his father they once passed the new hill, his father asked if Matti would dare to jump from it. The answer changed his life. He became the most enthusiastic jumper in the beginners group. Despite his eagerness he did not show any specific talent. He was very small, the smallest of the lot, and he needed to struggle to keep up with friends of the same age. Occasionally, he won some little competitions but mainly not, however he was already good at self-motivating. There is a story which tells about Matti once coming second last in a competition and being comforted by his coach Taisto Jussilainen being able to find the positive side of the event saying at home: "I was not last." (Theiner 2003, p. 24). He hated losing but even if he sulked at the moment of defeat, he had the ability to turn each experience to the positive and not let negative ones bother him for long. For him the sensation of winning was instant joy and sign of progress, but not instrumental, at least during the growing process, to him becoming a champion.

"Matti never tried to show off victories and the means to get to the center", stated his fellow competitor friend Joel Piilola with whom Nykänen trained daily as a child, when interviewed for the book (Arve 1988, p. 26).

In winter 1975/76, being 12 years old, jumping became the center of his life and engaged Nykänen so much that he started to train daily. Until then, he had trained only twice a week, but now jumping filled his

days. If the weather was good he left school after the lunch break and went jumping instead of school. Nykänen was not fond of school and he constantly got in trouble there. He repeated the first grade and in the third grade he was moved to an observation class. His parents, as well as his coach Jussilainen, tried to push him to attend school but Nykänen could not see the point in learning subjects at school, as he only wanted to be a ski jumper and jump. Jussilainen advised the over energetic Nykänen that it would be better that he came to the jumping hill rather than go hanging around in the city square. That was what Nykänen did. In the years to come he often spent the whole day on the hill, from eleven until eight at night jumping, at his best, 60 jumps a day and on average days 30-40.

Nykänen developed late. At 14 he still looked like a ten years old, was very light and therefore gained only a little speed from the downhill part of the hill. In trying to compete with his friends he had to compensate for the lack of speed by stretching the length of time in the air before bringing the jump to the end and by timing his takeoff better than the others. In both of the skills he later became exceptional. He also had the courage to steer in the air. He never regarded lightness as a problem, instead he accepted it as a fact and knew that it simply meant that he needed to practice more with increased determination. Gradually, the training started to take effect and the jumps started to gain length but competing was challenging as the excitement brought about anxiety and the timing of his takeoff suffered. He was better in training than in competitions.

In 1979, Nykänen was chosen to be part of a group that was training towards the Junior World Championships. However, he was not chosen to compete in the championships even though in the national championships he left behind the other jumpers in the junior national team. He might have suffered from prejudice against jumpers from Jyväskylä as, at that time, it was unheard of that a real jumper would come from there.

The concrete hill in Jyväskylä actually offered exceptional training facilities for jumping. It was unique as it had the slalom slope with a ski lift next to the ski jumping hill that also served the jumpers. This allowed jumpers to execute more jumps per day than most places in the world. Matti jumped roughly 3000 jumps during his career; about 2000 before he was 17. This amount was about double that of his competitors, who had to walk up the hill, which limited the amount of jumps.

In the spring of 1981, Nykänen was chosen to represent the Finnish team at the Junior World Championships in Schonach. To everyone's surprise, even his own, Nykänen dominated the competition from the very first practice jump and won the whole competition. He came from out of the blue for everyone but after that victory he stayed at the top of the ski jumping ranking for the next ten years.

At the end of 1981, Nykänen won his first World Cup competition. Two months later he attended the World Championships for the first time. He was quite unsure of himself and not used to the "normal hill" profile in Holmenkollen, Norway. However, with each jump he improved and by the end of the competition he had familiarized himself with it so well that he

finished the competition in fourth. The large hill had a more regular profile for Nykänen and he felt comfortable in spite of the thick fog that was bothering most of the jumpers. The judges had a hard time seeing the jumpers; therefore, the length of the jumps became decisive. Nykänen showed his iron nerve and fearlessness stretching the furthest and won his first world championship gold medal. In the years to come he often won competitions by the biggest margin when the conditions were most challenging.

Nykänen understood that only jump after jump could bring him the needed skills. He jumped in all kind of weathers on all kinds of hills. He also divided the jumps into parts to rehearse certain parts of the jumps.

4.2.3 Preparation for the Olympic Games

The preparation for Sarajevo was not without difficulty. In May 1983, Nykänen underwent a knee operation. He lost a month of valuable preparation time. With a huge effort he worked his condition up but he struggled in competitions at the beginning of the season whereas East German Jens Weissflog dominated the early season. Nykänen suffered with a technical problem in his jump and thought it was due to a hand mistake, however video pictures showed that the balance was missing due to the bindings that were set too far behind. After agreeing to correct the position of the bindings, the problem of the jump was solved. With this correction Nykänen found his jump and the last competitions in the World Cup series were already successful. But with such an unstable preparation season, Nykänen did not expect himself to be competing for gold in Sarajevo Olympics.

In Sarajevo, the night before the "normal hill" competition, Nykänen suffered from food poisoning, vomiting the whole night. Adding to this, the weather conditions were not the best for him and the ski trail was too soft, causing his skis to slip twice in the first jump. Despite the adversity he took the lead after the first round but in the second round his skis slipped again from the trail, he also hesitated a bit, and the jump was not long enough to win. He finished his first appearance at the Olympics in second place. After the competition he commented (Thiener 2003, p. 84): "The skis will not slip again." The victory in the "big hill" competition made Nykänen an Olympic Champion and a star.

4.2.4 Staying at the top

The victories motivated him and Nykänen kept on training hard. He replied (Theiner 2003, p.82):

> "I think, that for the period 1984/85 I was in the best condition. I was then technically and physically better than in Calgary later. I could jump, how I wanted to, no matter, if takeoff was delayed a little or I jumped too much to the right or left. Jumping went always really well. Also then the coaches did not have too much to correct."

In the four years between the Olympic games Nykänen was a public hero. The young boy was suddenly the center of attention and intense scrutiny. The stardom

brought many nuances to his life some of which were negative. Alcohol came into the picture and it brought problems. Also short marriages, becoming a father with two different women created challenges. The general public accepted his bungles but collaboration between the people working with him became perplexing. As he was as good as he was, bad behavior was accepted more than for others. Sometimes though, the tolerance was overwhelmed, for example he was sent home from the Four Hills Tournament in 1986-87.

Nykänen got into conflict with coaches. The collaboration with his coach Pulli broke down in 1987 after a turbulent year and the disagreements following it. Nykänen trained alone until the late summer executing the training programs from previous years. At the end of the summer, Pulli contacted Nykänen and they agreed on the best way to get to the Olympics.

Nykänen had been using painkillers for his knees since 1982 and in the summer of 1987 his knee was operated on with arthroscopy. The operation was already his fourth (Theiner 2003). The Arthroscopy went well and he recovered from it with strong will, self-discipline and great physical condition. He recalled (Theiner 2003, p. 82):

> "I never doubted that I will still jump at the top level, but each operation, of course, has its risks. If the Olympics were a year later I do not know if I would have been able to participate in them at all."

Even with all the turbulence in his life he had been preparing towards Calgary since Sarajevo, and therefore, to recover and to close the gap of lost time, he was training harder than ever. The Olympic season of 1987/88 started well, Nykänen won seven world cup competitions out of ten making him the favorite in Calgary. The Calgary Olympics went like a dream he won everything. He was a legend.

In 1989 his knees were troubling him so much that his training became really difficult. The great jumping years were over and his life went in another direction.

4.2.5 Collaboration

Looking back, Nykänen was lucky to have excellent and enthusiastic coaches around him at the right time in his career. Two of the closest ones were his first coach Taisto Jussilainen who coached Nykänen until the first Olympic medals. The second important coach was Matti Pulli who joined the team when Nykänen was thirteen and took over the main responsibility for the training. Pulli coached him through all his successful years. There were also other coaches who helped to cut the diamond; Risto Pirttimäki came to the team after Jussilainen retired in 1984 and the head coaches of the national team were valuable during the long competition tours, for example Kari Ylianttila helped in analyzing the jumps especially in the year of the Calgary Olympics.

Nykänen gave most credit to his trainer Pulli (Theiner 2003, p. 36 and p. 41):

> "He was an important person in my career."
>
> "Without him I would never have become what I did (Thiener p. 41. 2003)."

Between 1960 and 1970 it was still rare to use scientific methods and only a few researchers were trying to explain what happened during takeoff or the air flight scientifically. Therefore, most of the training was done based on trial and error.

Nykänen benefited from the research activity Pulli was conducting on ski jumping. Pulli said in interview:

"Nykänen was built with the help of science."

The first coach Taisto Jussilainen

Nykänen's first coach Taisto Jussilainen had also been a jumper himself but after his military service he started to coach his brother, Harri, a national team member. In the 1960's, coaching knowhow in ski jumping was poor in Finland and Taisto Jussilainen started to familiarize himself with jumping techniques and training methods. Ski jumping was not very popular in Jyväskylä and to build enthusiasm Jussilainen started to coach young children. Jussilainen had already established his coaching routines when Nykänen came to try out and then started in the beginners group. Young Nykänen did not stand out in the group as a ski jumping talent but from the start he was very enthusiastic.

Jussilainen was pragmatic but also analytical. He had a good eye for ski jumping technique and pointed Nykänen in the technical right direction when preparing the foundation for an excellent jump. He was also careful to not let Nykänen hurry but to follow the development phases, thus perfecting the jumping style. For example, even though Nykänen suffered from a lack of power Jussilainen was patient in building the technique even if other boys were already training with weights. He also advised Matti to stay and practice on smaller hills to really learn to use power in the take offs even if Nykänen could use his flying squirrel like gliding skills better on bigger hills and therefore compete on an equal footing with his friends.

Nykänen eagerly sought feedback and worked hard to improve based on the suggested corrections. Jussilainen recalls the moments when he was transporting the boys from the training and Nykänen was in the back seat bombarding him with questions about how to improve the jumps. Being silent for a while and coming up with ever deeper question, Nykänen was analyzing his jumping, whereas the other boys where chatting about other things.

At first, Nykänen kept on practicing in order to be able to beat his ski jumping friends who were slightly better than he was at that time. He was an underdog and worked hard to stretch his jumps further. Jussilainen helped Nykänen by creating all kinds of metaphors and artifacts to picture the corrections and the features of a good jump. For example, Nykänen was supposed to try to fly on the surface of a big balloon without breaking it with the skis (Arve 1988). Together Jussilainen and Nykänen polished the jump trying to fight back the forces throwing the position off but still staying relaxed and sensitive to the exact timing for take off.

In his calm style, Jussilainen seems to have had a psychological eye on Nykänen. Through his unruffled approach he could motivate and trigger Nykänen to turn disappointments into building blocks for the future and to strengthen his belief.

For example, he managed to turn the depression over poor performances and the frustration of being left out of the 1980-81 Four Hills Tournament into the energy he needed to practice even harder.

The coach, Matti Pulli

Matti Pulli started coaching Nykänen in 1977 when Nykänen returned to the Jyväskylä skiing club from his two-year move to a neighbouring club, which was not all that competitive. In the meanwhile, Pulli had started working together with Jussilainen in Nykänen's original club in1976. Collaboration and friendship worked well between the two coaches. They complemented each other; Pulli was in charge of the theory and Jussilainen was the practical coach. Pulli and Jussilainen trained Nykänen together until 1984, when Jussilainen stepped aside.

Pulli was multi-talented with a repertoire ranging from Opera singing to swimming and football. He was also a part of the junior national team of gymnastics. Getting interested in ski jumping characterizes Pulli well (Arve 1988). Ski jumping was one of the only sports Pulli had never done himself but he became fascinated by it after Veikko Kankkonen won Olympic gold in 1964. The victory started a public debate in Finland about the mystery of ski jumping; why some fly further than others. Pulli was a very curious and innovative person and he was very much drawn to the contradictory theories concerning the importance of speed, aerodynamics, the power and direction of takeoff, which he saw as an intellectual challenge.

He had already completed his studies as a physical education teacher and it was while he was teaching that subject at the University of Jyväskylä, in addition to statistics and mathematics, that he began pondering the secrets of ski jumping. Being in the research culture, it was natural for him to contact the two researchers in Central Europe who had worked on theories of ski jumping: a Swiss engineer, Reinhard Straumann who had published his study in 1957 about aerodynamics and his DDR college Gerhard Hochmuth who defended his doctoral thesis in 1958 about take off. From these two viewpoints Pulli started to build his theory of ski jumping. Over the years he worked closely with many researchers to solve the mystery.

However, he needed athletes to try out his ideas and therefore he looked for suitably open-minded athletes to develop and prove his theories. In 1964, he found Harri Jussilainen, the little brother of Taisto Jussilainen. In this way the two future colleagues, and friends, Pulli and Taisto Jussilainen, started to collaborate. Harri Jussilainen improved, quickly rising to the podium at the national championship the following winter after one year of Pulli's intensive training program and focus on developing power for takeoff. In the following years Pulli's training team grew to approximately twenty jumpers, but among established ski jumping circles his ideas met high resistance as he was seen as an outsider and therefore had no credibility. Gradually, as his pupils improved, he started to gain respect for his ideas. However, sometimes even his pupils, even if they were very open for trying out new things, were skeptical of his extravagant ideas.

Pulli first laid his eyes on Nykänen when Nykänen was 13 years old. He did not consider Nykänen to be anything special but instead saw potential in his friend Joel Piilola who had started three years later but already jumped much further. To Pulli's surprise the head coach of the Finnish ski jumping team, Eino Kirjonen, who once visited Jyväskylä, saw Nykänen as a potential future jumper rather than Piilola. Kirjonen had already noticed Nykänen's ability to glide and was not distracted by the small weight and powerless takeoff, which caused a lack of results at that time. Kirjonen also pointed out that Nykänen, as described by Pulli, seemed to have just right personality for a winner: an enthusiastic trainer doing an unprecedented amount of jumping, feisty in trying hard with a huge urge to compete. As Nykänen heard about this prophesy from Kirjonen his training got extra boost.

It took a year for Pulli but when he first saw the 14-year-old Nykänen jumping on the big hill he remembered the words from Kirjonen and recognized the skill Nykänen had developed. Pulli was impressed by the courage the little boy had and his ability to stretch extra length floating in the air. Pulli recalled thinking when Nykänen did his first jumps from the big hill (Theiner 2003, p. 34):

> "This boy will be the future world champion."

As important as it was to build up his own understanding of the discipline, Pulli had to work to widen other people's knowledge in order to get them to co-operate. For example, learning to use and experiment with new kinds of equipment required the bringing together of people from different areas of expertise. This did not always prove easy as he often met with reluctance, resistance and a lack of desire and excitement to innovate. Nonetheless, Pulli was energetic and persistent in finding the alleys through which to push his ideas forward and inspire people to trial his ideas. Pulli also saw being active in the International Skiing Federation as helpful in order to be on top of developments and to affect rulemaking and judging. He needed to sell ideas to judges, collaborators and sometimes also to athletes.

In 1977-78 he persuaded the Finnish Skiing Federation to get all year training facilities as was common in Middle Europe. It was not enough to only go on camps once or twice a summer to do ski jumping, to have year around training in ski jumping was required. As there had already been some unsuccessful trials, the federation did not warm to the idea of a plastic hill with the result that Pulli and certain other experts involved in Finnish ski-jumping were willing to take a loan to invest in it themselves. Upon seeing this enthusiasm, the federation relented and agreed to the proposal, a move, which began Pulli's development on ice trails with a refrigerator producer.

Over the years Pulli created his philosophy of ski jumping, which was to become the guiding light of his strategic approach. The most important factors, and the basis of the strategy, were the training conditions, finding suitably motivated athletes and the core competence of coaching.

4.2.6 Innovative sparks

> "It is most crucial to know what to do as that lays the foundation for success. The secondly most important aspect is to practice (Theiner 2003, p. 36)."

Nykänen was extreme in practicing and trained mindfully, developing his ideas about jumping with the help of his team**.** He had Finland's best research forces behind him in that his coach, Pulli, was a vivid collaborator, knowledge gatherer as well as having the functional ability to put the science into practice. Additionally, as he was not a ski-jumper himself, Pulli formed a highly effective team with the equally pragmatic Jussilainen who understood the ski-jumping technique from his own experience.

Collaboration with coaches was crucial for Nykänen but he was also his own teacher, reflecting constantly. Nykänen learned to use his senses in ski jumping and he became excellent in jumping in all kinds of conditions. Learning from his own jumps and experimenting with ways, jumping from different size hills, constantly reflecting, he built a picture of his great jump in his head. He said he never really corrected mistakes but aimed to jump in the optimal way. This visualization was his self-learning process, which was guided by great coaches.

In ski jumping, it is a challenge to transform the body from the sliding position into the flight position without losing speed. Nykänen understood and learned to know how to accelerate optimally during the takeoff stage and then get the body in the best possible position whilst in flight (Theiner 2003). He built his jump with the help of bits of knowledge collected over the years. Sometimes, he made deliberate mistakes to see how they affected the jump and he also challenged his coaches during practice to see if they could identify mistakes.

Solving the mystery of take off

Even though Matti Pulli believed in doctor Hochmund's studies about takeoff in ski jumping, he wanted to expand on the theory and his own understanding. Therefore, he dived into analyzing the secret of take off with full energy. He teamed up with researchers from around the world to solve the mystery. It took him ten years to figure it out.

For example, he borrowed a high-speed camera from the Jyväskylä University in 1965 and filmed his jumpers. When analyzing the material he came up with many improvements; for instance he figured out that moving the hands from back to front and up was not good for aerodynamics. His jumpers started to swing their hands the other way around, from forward to back, which he had seen one Norwegian jumper do. The skiers adapted to this very quickly as it was a more natural way than the then commonly used one. The style soon became the norm (Kujala 1999).

Concerns over takeoff continued to be an issue for him and the analysis went on. He inspired others with his open questions and teamed up with Professor Paavo Komi and Professor Richard Nelson from the University of Pennsylvania. Nelson had acquired hyper-speed cameras, developed

during the Vietnam War to analyze why missiles were not finding their targets. The three men decided to use these cameras to film the ski world cup race in Lahti, Finland. In 1969, three filming towers were built in order to capture the right angles of the jumps from the world best jumpers. The following summer Pulli spent the summer in Pennsylvania University studio analyzing the films track by track, made some observations, however he could still not solve the mystery. Despite failing to find an actual solution, in his mind he made an illogical observation: it looked like the speed of some jumpers increased before takeoff even as the slope flattens. He could not understand the reason for this, even after the same material was further analyzed a couple of times in Finland. Pulli ended up by conjecturing that it might have been an illusion created by the filming process (Kujala 1999, Arve 1988).

In 1976, under the leadership of Professor Bauman from the University of Cologne in Germany, filming was repeated again at the Four Hills Tournament in Oberstdorf. This time Professor Komi, Professor Nelson and Pulli were part of the filming team. Nothing new emerged from Bauman's analysis. Neither could Pulli find anything even if he, along with other researchers, spent hundreds of hours analyzing the films. Only the earlier finding was there again: the speed of the best jumpers seemed to increase when on the hill table (in other words when the curve flattens). Physics experts said that it was impossible and the research team could find no explanation as to why that happened. It seemed that the mystery was to remain impenetrable (Kujala 1999).

Accidentally, Pulli saw a TV program about Einstein's theory of the planets' elliptical orbits, which explained how the speed of planets increases when in curve. The insight was instant, as Pulli understood how Einstein's theory could also explain the mystery of ski jumping. Pulli, with the help of his friend Pekka Luhtanen, went back to the films and found that the world's best ski jumpers naturally started their take off much earlier than the less-accomplished jumpers. Their power generation began earlier than those of less skilled and they reached the maximum speed one and a half meters before the nose of the hill. Later Luhtanen based his doctoral dissertation on this finding, describing how the forces impacted on different segments of the body (Kujala 1999).

Training innovations

In summer 1980, scientific findings related to take off were put into practice. The guiding thread was to keep Nykänen's explosive ascent but to gain power. To do that Pulli contacted his previous pupil, the Italian born specialist in power training, Carmelo Bosco and together they came up with an exerciser made from elastic, rubber bands that were attached to the ceiling. Using this, Nykänen exercised his total power in output speed. He jumped from high up and the rubber bands slowed down the landing but speeded up the instant new takeoff. This kind of training was quite different from any other previously used and the other Finnish ski jumpers continued with more traditional methods such as lifting heavy weights. During his career, Nykänen used only small weights to keep his muscle weight down and explosiveness up.

The summer prior to the Sarajevo Olympics the team, Pulli and Bosco,

introduced a weight vest for Nykänen to recover quickly from the knee operation after the competition season. The idea was that Nykänen used this first four-kilogram and later up to 12-kilogram vest 8-10 hours a day. For years, Nykänen wore the vest under his shirt and took it off only for sleeping.

When going to the Olympics in Sarajevo, the Finnish ski jumping team traveled there three weeks prior to the start of the games. A problem arose when the organizers did not let the jumpers use the hill for more than a couple of jumps a day. Nykänen was used to jumping at least ten jumps a day from a ski jumping hill. To keep the muscles active Pulli introduced strength training in competition. This power workout during the competition caused raised eyebrows from co-competitors and their teams. It was unheard of that anyone would do weight training during competition as it was believed to interfere with the sensibility of jumping.

Nykänen himself, doubted the wisdom of the heavy training close to competition and was afraid of losing the finesse of the jumps, but Pulli was convinced that it would be helpful and would stimulate the muscles when there was only a limited amount of jumping possibilities. Four years later in Calgary, they used the same program to keep up the jump momentum during a long event with limited possibility to jump from the hill.

Aerodynamics

Despite the fact that in ski jumping the judges award the points it is a simple fact that the one who jumps the furthest wins, therefore Nykänen and his team tried to find the way to stretch the jump. The jumping style of Nykänen was aggressive rather than sophisticated and he was often criticized for it as he held his skis slightly to one side rather than laying on top of them. He had discovered that he could add length to his jumps by doing so and could greatly enhance the airfoil surface and thus fly better.

Later, Doctor Hohmund proved in his studies in wind tunnels that holding the skis to the side is the second best option after the V-style adopted by Jan Boklöv in 1985 (Kujala 1999, Anonymous 2015). At that point, the V-style had already been introduced and many jumpers would have wanted to use a wider ski position, however, the judges marked the jumps down. In that period the rule was that the skis needed to be together and under the jumper.

As judges subtracted lots of points from Nykänen for holding his skis to the side his team needed to change the flying style. Nykänen could jump with extremely tight bindings, which allowed him to move his skis during the jump. Pulli and Nykänen experimented with opening the skis. In Calgary, he jumped moving his skis in the air to both sides of his body after coming to such an angle that the judges could no longer see it from the side. In the longest jumps in Calgary, the skis were quite far apart on both sides of the body. This was the third best style in the air according to Doctor Hohmund in later experiments (Kujala 1999).

Pulli's experiments with materials

In Pulli's philosophy, it was crucial to make constant development in order to stay ahead (Kujala 1999). He was active

in developing equipment and facilities for jumping. For example, in the beginning of the 1980's, winter sport changed in that it became an all year sport due to the innovations in hill technology and as plastic hills became more common also in Finland. To overcome the fact that some jumpers succeeded on plastic and others on snow, Pulli started investigations with iced trails with refrigerator producers in order to better the friction on the plastic trail. This trial with the artificial trail led to the development of adopting artificial trails not only in summer but also in winter. At that time, in ski-jumping the trail in the upper part of the hill was skied for the first time by a jumper.

The idea for iced trails came in 1977 during a fishing trip with Nykänen's other coach Taisto Jussilainen, who worked as a pipefitter outside his hobby of being a ski jumping coach. The two came to the conclusion that the friction on plastic was unlikely to be developed to match that of snow. Pulli contacted a refrigerator manufacturer, Porkka Oy with his idea. As the iced trails were noticed to work well, the other ski jumping facilities followed up quickly. Porkka installed the same systems in many places in the world.

As early as 1973, Pulli was trying to change stocking caps to helmets and loose garment to tight ones even though these innovations were rejected in Finland and adapted first by skiers abroad. He introduced helmets to ski jumping not for safety but for aerodynamics. For example, he contacted an experienced pilot who commented that the stocking caps are the worst for aerodynamics. The first helmet Pulli experimented with was made of leather, like motorcyclists had with the next model being like the ones worn by downhill skiers only stripped of all the weight. For this development he got assistance from the speed skier, Kalevi "Häkä" Häkkinen, with whom he also started to experiment with the ski jumping materials.

Pulli also experimented with skis, their materials and bindings. This research got a special boost after remarks from the Austrian, Max Golcher whose pupils had risen to the top of the rankings in a short time. Golcher diplomatically hinted that the Finns are good at jumping but that their traditional approach limits them and that they do not see where the development is going.

Pulli was forcefully struck by these words and escalated his experimentation with the jumping gear with various levels of success and at his own expense. Some of his innovations failed, such as adding Teflon to the bottom of the skis but others worked. His openness to trying new things meant that the whole team was quick to adjust to improvements from elsewhere.

4.2.7 Conclusions

In his teen-age years, Matti Nykänen almost lived on the ski hill. At the age of 12, while still at school, he would leave at midday to go jumping. After he finished grammar school he went there already in the morning and left in the evening. He was training far more than anyone else in the world and also thinking about jumping constantly. He had the courage to make all kinds of trials in all kinds of weather, widening his capacity to handle changing conditions as well as building in his mind a picture of the optimal jump. He

was restlessly trying to jump like the picture in his mind's eye.

Nykänen had excellent conditions for training, great coaching with the Finnish sport research center next door. With constant development the team made big breakthroughs taking advantage of science and many practical findings to develop the sport and training that were used in practice. With the existence of scientific research, pragmatic knowing and deliberate practice, Nykänen gained superiority that was almost impossible to beat. Nykänen cultivated his kinesthetic and intrapersonal intelligence learning to trust his gut feeling that helped him also when conditions were harsh.

Nykänen could win with the biggest margin when the weather conditions were challenging as when winning his first World Championships jumping in fog. Through his observations and experiments in all kinds of weather conditions he learned to read the nuances of wind and trust himself even when he could not rely on visibility. Nykänen used his other senses feeling familiarity in the conditions where others felt fear.

In retrospect, it was the combination of raw skill, determination, world class coaching, innovation and, most relevantly to this paper, fearlessness in embracing and recognizing the role of creativity which powered building Nykänen the phenomenon.

4.3 Pertti Karppinen, rower

Born		17.2.1953		
Olympic games	Participation in 5 Olympics 3 medals /3 games	1976–1992		
Olympic medals	Montreal	1976	Single	1st
	Moscow	1980	Single	1 st
	Los Angeles	1984	Single	1 st
World Championships medals	Amsterdam	1977	Single	2 st
	Bled	1979	Single	1 nd
	Munich	1981	Double	2 nd
	Hazewinkel	1985	Single	1 st
	Nottingham	1986	Single	1 st
	Copenhagen	1987	Single	3 rd

4.3.1 Introduction

Montreal 1976, Moscow 1980, Los Angeles 1984, legendary rower, Pertti Karppinen brought home three gold medals in three consecutive Olympic games in single scull rowing. After his gold medals, he went on to compete twice more in the Olympic games but did not make it to the finals. His career was flavored by his duel with the great German sculler Peter-Michael Kolbe. Even though Kolbe won more overall medals than any other single sculler in history, he was never to

succeed in winning the Olympic gold medal (Anonymous2016). Twice in Olympic finals, Montreal and in Los Angeles, Kolbe led almost the whole race but both times Karppinen was able to fight his way to victory at the finishing line leaving Kolbe in second place.

4.3.2 Growing to be an athlete

While still a young boy, Pertti Karppinen was already a strong athlete, the best in many disciplines in his native village (Väätäinen 1979). He mastered a variety of sports ranging from running to ice hockey. He especially liked javelin in which he was inspired by his idol, the Olympic Champion in Tokyo in 1964, Pauli Nevala. When he was fourteen, his family moved to Raisio next to the sea and soon Pertti had followed his bigger brothers in joining a rowing club. He grew rapidly, becoming more than two meters tall and noticed that in rowing he could benefit from his body size.

From his stonemason father, Karppinen had learned to work hard and respect physically tough labor. Living in farmhouse surroundings he, with his five siblings, joined his father in cutting down trees, in hayfields and doing whatever needed to be done to keep the big family going. Centermost of the flock, he did not have the privileges of the older or the indulgence of the younger siblings and this, combined with the arduous farm work, was already beginning to form the basis of his physical strength. Building on this strong base continued when, after finishing comprehensive school, Karppinen got a job as a multifunctional man. The physically demanding post consisted mainly of loading, assembling, disassembling, carrying and warehousing which built the young boy's muscles. Despite often being exhausted in the evenings after such tiring labor, sport continued to attract him.

Inspired by the success of his older brothers, Karppinen tried to hang after the more experienced rowers and started dreaming of winning a competition. At first, training with older rowers was difficult but as the years passed the task got easier. When Karppinen started as a rower he was rowed double scull with Harri Virtanen. As Virtanen was slightly more experienced he acted as a coach for the two. The community of rowers was small but very tight and the older rowers helped the younger ones in technique and in building the programs. Virtanen's bigger brother gave some hints for the doublet. Heikki Virtanen was the leader of the rowers, and built the first training program for Karppinen (Väätäinen 1979).

In 1970, being 17 years old Karppinen won his first national medal in juniors with his rowing partner Harri Virtanen. The duo was successful but after Virtanen left Raisio to study in Helsinki, Karppinen tried his hand at many different combinations: duos, fourths and eights. Around the time of these events, Karppinen's training intensity had already tightened up when a coxswain, Eino Ketonen started designing the training programs. With Ketonen, the training became more systematic and Ketonen challenged Karppinen to train more. Due to this, Karppinen started to rise towards the rowing elite in Finland.

Despite being rather successful and winning many medals in different rowing events, the summer 1972 went by with

mixed and confused feelings. His father, who had noticed Pertti's training, will and determined personality encouraged him to try singles even though his older brother had announced that Pertti's success would lie in bigger teams. At the end of the summer 1972, he decided to take part in an ultra long single race in Nuijamaa. After a two-week intensive training period he won the race by a long distance. This event started his intense focus on singles as well as heralding the period when he became unbeatable in Finland. During his career no Finnish rower could beat him in single scull.

Already by 1973, only one year after switching totally to singles, Pertti gave a storm warning to the international rowing community by winning the B-final in his first European Championships. His rowing speed increased competition by competition and by the end of the following season, at the World Championships, Karppinen rowed already in the A-finals finishing sixth. With that result, he was elevated to the highest funding category of the Finnish Olympic Committee. With the money Karppinen could address the biggest weaknesses in his training, namely the limited training time on open waters. Rowing in Finland was a marginal sport and the federation was one of the poorest. With the money starved federation and moderate family funds he could not have afforded the camps abroad, but in the beginning of the 1975 season he was able to start the rowing period already in March with a three-week camp in Italy and then in Germany.

This investment paid off when Karppinen came fourth at the World Championships in Nottingham, England. The success did not come easily but as a result of the intensive training. However, there were still obstacles, one of them being a lack of time. In Finland, sport is not an employment and the money for living had to be earned like any other Finn, by working.

Another obstacle, despite the funding, was coaching. At that time the head coach of the Finnish Rowing Federation, Juhani Julku, was in charge of Pertti's training program, but the duo's cooperation was difficult because of the long distance between them. Pertti lived on the west coast of Finland and Juhani close to the Eastern border of the country. Therefore, Pertti practiced mostly alone following the plan made by Julku.

4.3.3 Preparation to Olympic Games

The goal for the training had become very clear - the Montreal Olympics. Pertti's employer was flexible and allowed morning and evening trainings. The other improvement for preparations towards the Olympics happened in the area of equipment. The old wooden boat which was approximately ten seconds slower than those of his competitors was left behind as Pertti got two new and competitive boats for the Olympic season, one for Europe and the other for the Olympics. The new boats were the same that Kolbe had. He also got two sets of oars, one specifically designed for tailwinds. Pertti recalls:

> "The boat in Montreal was good and competitive. It was the same boat Kolbe had, but before Montreal older boats that could not endure my powers."

The competition season of the Olympic year started promisingly as the Moscow regatta brought third place for Karppinen. Even after several victories that summer, he did not qualify for the semi-finals directly but had to fight his way there in repechage. The repechage opened the door to the semi-finals and third place there took him to the finals. This was quite usual for him to improve his performance over the races. The finalists were the familiar top rowers but no one anticipated that the tallest of the bunch, Pertti Karppinen would cross the finishing line as the winner.

In Montreal, the 2000 meters race started with a sprint by the favorite German Peter Kolbe. Karppinen's diesel motor began slowly and after 500 meters he was the second last. Despite this, Karppinen felt that his start was good and tried to just stabilize his stroke rhythm. Halfway through the race the competition seemed clear; Kolbe was engaged in a solo race with all the others being left far behind. When the last quarter of the race started, Karppinen had pulled his boat into second place, Kolbe was still leading but his quick start was getting to him. Karppinen was gaining on him with the fastest 500 meters time of the race. The last 10 strokes from Karppinen were so strong that Kolbe could not fight back. Karppinen's victory was a big surprise to everyone, even himself.

4.3.4 Staying at the top

The year after the Olympics was a kind of gap year. Being a celebrated champion distracted concentration, preparation and training. Even if he practiced a lot, the concentration was not so total after Olympics. At the world championships the following summer Kolbe was better prepared and won.

Two years after Olympic victory the world championships 1978 in New Zealand was disappointing even though Karppinen was second. He had won every race in that season before the Worlds.

The falling flat was due to overtraining and, therefore, after the season Karppinen felt drained and depressed. Further to this, his coach sensed that he had failed to prepare Karppinen for the season's peak and due to this the co-operation dissolved. Karppinen coached himself for a while.

In the winter 1979, however, Jarkko Raninen started coaching Karppinen and the training experienced a change of rhythm as intensity rose. Raninen was a specialist in strength training and started to concentrate especially on power development. He figured out that as Karppinen had already rowed for over ten years, the rowing technique was at an acceptable level. The assumption seemed to be correct as during the next two-year period Karppinen was unbeatable.

The summer of 1980, before the Olympics in Moscow, Karppinen competed against Kolbe six times and beat him in every race. But because West Germany boycotted the Moscow Olympics Kolbe had to stay home and could not attend the games. Karppinen recalls that he had almost an obsessive idea of beating Kolbe in each race that summer so as to not let anyone be able to say that Kolbe could have won the Olympics if he had attended. The Moscow games brought a clear victory to

Karppinen even though he suffered from food poisoning two days prior to the start.

Collaboration with the coach Raninen ended in Moscow as they had previously agreed. Karppinen continued to practice, coaching himself and building training programs mainly on his own. However, Nesteen Soutajat (Neste's Rowers), the club Karppinen was representing made contact with the Norwegian rowing coach Tor Nielsen in an effort to bring in expert help for Karppinen.

The period between Moscow and Los Angeles was flavored by constant experimentation. Kolbe had developed a new type of boat, "a bump boat" with a German manufacturer where the rower is in place and the oarlocks move on rails instead of a moving seat. Karppinen also experimented; he decided to start rowing doubles with his little brother Reima Karppinen with the 1981 world championships being set as a goal. Despite some injuries and other hindrances in preparations, the doublet came second and continued to practice together, though meeting with only variable success. After not making the podium in the Worlds Final in Luzern 1982, Karppinen was facing a choice: quit, continue with his brother or go back to singles. As he still felt the spark for rowing and to continue towards the Olympics in Los Angeles, during the next season, he continued training both singles and doubles with his brother.

But single rowing did not work out with the "pump boats". Only two weeks into the training the boat broke. After four boats it was clear that the equipment was not at the level of the Germans (east and west) nor of what the Americans had. Neither did the doubles work out as expected. The Duisburg World Championships 1983 left the duo Karppinen-Karppinen, outside the medals.

However, an opportunity to win opened once more as "the pump boats" were banned after the 1983 World Championships. There had been considerable dissonance in the rowing community over the availability of equal equipment. When the ban came into force, there was only one year to go to the Los Angeles Olympics. He decided to concentrate fully on singles where he would now have an advantage. Being an experienced rower and used to the "normal boat", gave him an advantage over youngest rowers who had only limited experience with them after a few years' trial with "bump boats".

But the decision was hard, as returning to single rowing meant turning his back on his brother. He recalls the period before he made the decision to return to single rowing to be the hardest and most depressing for him as a rower. But he felt, making this decision was necessary for him and brought hope back to his rowing even if his brother lost his strong rowing partner through that decision.

In 1983, Karppinen was in a good form, however coming back to singles came with pressure since he was defending Olympic Champion. He also had new challenges not the least of being a family man with a young son but also he was training whilst also working first as a fireman and then as fire marshal. Rowing in doubles also required a different technique and that needed to be polished. However, when the rowing season started Karppinen was already on the right track. In his first duel

with Kolbe he could see that he was getting back in the race; he slightly lost the first start and won the other.

Before the Olympics he trained really hard and recalls (Katavisto 1984, p. 141):

> "I must admit that I took out everything that there was and got the feeling that I could not train harder. It gave me a certain tranquillity and self-confidence."

Pertti Karppinen won all the heats in Los Angeles, but victory did not come easy. Kolbe was leading the race as in Montreal and as Karppinen accelerated in the same way as in Montreal when the last quarter started, this time Kolbe was able to fight back and follow. When there was only 250 meters left of the race Karppinen accelerated a second time putting everything in to the play. He recalls:

> "150 meters before the goal I went alongside and past Kolbe. At that moment I knew that I could keep the pace to the finish line."

4.3.5 Collaboration

> "According to his rowing buddies Karppinen has been so uncompromising coachee that any coach would have got the same results with him (Katavisto 1984, p. 96)."

Throughout his career he had pretty much taken care of his own coaching, though he had had many coaches to help him. In general, the problem in coaching rowing in Finland was that there was very little tradition and no written material or tested methods for it. There were not ready coaching systems, no coaches in place and only a handful of rowers, therefore, all the advance knowledge and knowing needed to be built piece-by-piece. To find a balanced training, that took into consideration the strain, rest and nutrition was not so simple. Karppinen needed an outside coach but to find a knowledgeable coach was hard. Some coaches ended up making too light training programs and some too hard. Even though the coaches changed he was thankful to all of them saying that he got something valuable from each of them.

The First Real Coach

In 1975 the training accelerated when Karppinen got his first real coach, the head coach of Rowing Federation, Juhana Julku. Until then, older rowers had helped Karppinen in building the training programs. By that time Karppinen was already fully committed to rowing, focusing on Olympics.

At that time that Juhani Julku came into the picture, Karppinen was already fully committed to rowing, focusing on the Olympics. The new coach was of the opinion that it was impossible to work full time and prepare for the Olympics as a side project.

Julku introduced skiing as an important part of winter training. He was of the opinion that skiing was better than running because it has similar elements to rowing. In rowing as well as in skiing the body, back and arms are all working in

similar kinds of moves and both of them involve sliding on a surface and require balance as well as having a cyclic rhythm.

Even if Julku was of the opinion that skiing could not replace rowing, he found it very useful for condition training. However, the coaches after Julku replaced skiing with other methods.

The Norwegian coach Tor Nielsen

The collaboration with Tor Nielsen started after the Moscow Olympics. Nielsen was excellent in rowing technique and helped Karppinen to stylise his rowing style. The challenge was that Nielsen coached in Italy and therefore, collaboration was sometimes hard as Karppinen mainly trained in Finland besides the rowing camps. This probably led to mistake on a high altitude camp just prior to the World Championships in Luzern 1982. The too heavy camp spoiled the chances of success. Nielsen had been decisive that there was no need to test how the body would react to the high altitude training, and executed the training plan as intended, unable to notice the signs of fatigue. Even though Nielsen was an expert in rowing he miscalculated the bodily reactions of the athletes preparing for events.

The tests after the Worlds showed that training towards the peak of the season had been done in such a way that positive effect was not gained. The disappointment and frustration ended the tight collaboration, mainly though because of Nielsen's time limits and the long distance between the two. In addition, there were also new coaches in Finland that could help Karppinen. However, Nielsen remained, as a technical coach for Karppinen and that was very helpful in the years to come.

Nitti Nuuttila

Nitti Nuutila took over the responsibility of training from Nielsen and led the preparations towards the Los Angeles Olympics. Nuuttila's knowledge was grounded in track and field and he gained experience in rowing only when working with Karppinen. It was important that Nielsen was still in the team bringing the know how in rowing technique.

4.3.6 Innovative sparks

Karppinen was very much in charge of his own coaching even though most of the time he had a coach by his side, taking a role in designing the overall training. He learned from each of the collaborations, forming his own view. He was a thinker, constantly trying to find improvement and even though he was something of an introvert, he was not shy in asking questions when he needed help. Karppinen was excellent in removing obstacles and handicaps he encountered, he was determined, precise and concentrated on what he had set his mind to. But even after his great victories, he never lost his humble attitude towards practicing and he was grateful for the help of others.

Overall for a rower, the winter conditions in Finland are challenging and to overcome these challenges Karppinen invented many compensatory training. For example, he started using an ergometer for training even though, at the time, it was only used for testing. For example, he

combined ergometer training with training in the pool to lessen the repetitiveness of the long training sessions.

Another invention for winter he came up with was the training method that imitated the rowing move. Using cables, he structured an exercise to be analogical with a 2500 meters' race. The race consisted of 240 pulls, so he made a sequence of the same amount of pulls with the arms combined with the same amount of squats while creating the image that he was rowing. In other words, he used mental training together with imitative rowing moves to substitute the lack of rowing possibilities. He speculates that maybe his characteristic rowing style also developed because of these exercises.

Karppinen's style was economical. He constantly streamlined his moves to row as efficiently as possible but always divided the distance into parts. He constantly calculated his moves to get a better understanding of the strokes needed in a certain strip or distance. He calculated the rowing strokes when rowing in the pool, partly to fight against boredom, to avoid fatigue and to stay focused, but also to row steadily and economically. He was very systematic and he added the same approach to everything he did, for example when running he counted the steps required in certain distance, measured the time and kept diaries. In doing so he became very aware of his inner feeling and, especially, the timing, rhythm and capacity of his strokes.

4.3.7 Conclusions

Consistent in his way of living, Karpinen was hard working, consequent in training, ascetic and somewhat of a loner, leaving all the extras away from life. He was inventive in building his training, finding compensatory ways of substituting methods while keeping the focus on the aim of the exercise. He built his way of practicing over many years starting in being part of the rowing community, but expanding it with the help of various experts. He was very analytical and gradually molded the conditions, exercises and training system to fit his needs to the Finnish conditions. This all made his way of training quite unique and different from others.

He was demanding and hard on himself, knew what he wanted and had high morals towards practicing. He was humble in learning but very precise, analytical, challenging and bold. Everybody working with him was given an opportunity, but needed to perform. Some coaches trained him too little and he looked for a new one. Some of them could not balance the training to get the results and he kept on searching for a new trainer. He comments: "An athlete does not have time to wait." But he was a respectful learner and learned something from each of the coaches as well as many other sources. He kept on listening, observing and analyzing as he was constantly seeking for improvement. He affected his own career the most and kept it under his steering, maybe not because he wanted to but because there was no one who really met his needs and high standards.

4.4 Samppa Lajunen, nordic combined athlete

Born		23.4.1979		
Olympic games	Participation in 2 Olympics	1998–2002		
	5 medals /2 games			
Olympic medals	Nagano	1998	15 km	2 nd
	Nagano	1998	4 x 5 km	2 nd
	Salt Lake City	2002	15 km	1 st
	Salt Lake City	2002	7,5 km	1 st
	Salt Lake City	2002	4 x 5 km	1 st
World Championships medals	Trondheim	1997	4 x 5 km	2 nd
	Ramsau	1999	15 km	2 nd
	Ramsau	1999	4 x 5 km	1 st
	Lahti	2001	15 km	2 nd
	Lahti	2001	7,5 km	2 nd
	Lahti	2001	4 x 5 km	3 rd
	Val di Femme	2003	15 km	3 rd
	Val di Femme	2003	4 x 5 km	3rd

4.4.1 Introduction

Samppa Lajunen (I will call him Samppa, so as not to get confused with his father with the same surname) won three Olympic gold medals in the nordic combined in his second Olympics, in Salt Lake City 2002. Four years before he had twice won silver in Nagano 1998. In his career, he won the combined World Cup twice (1997 and 2000) and the team World Championship once (in Ramsau, 1999). Samppa finished his sporting career in the spring of 2004, being only 24 years old.

4.4.2 Growing to be an athlete

Samppa spent his childhood in the small town of Lieksa where skiing was a popular sport. His father was a very active outdoorsman and he took Samppa, as a baby, everywhere with him. Samppa got his first taste of life as a skier while still in a baby backpack and when he learned to walk he got his first skis. His father recalls that the two-year-old Samppa liked to make his own trails in the snow, skiing round the house and the nearby woods, a big smile on his face, as he planned his own routes. He enjoyed skiing and was very skillful on them. From a very early age his father encouraged him to have a try and praised him attempts; in this way the father was building Samppa's self-confidence and his joy of exercise. By the time Samppa was four he had already done a fair amount of skiing and won local ski competitions in the six year olds' category.

Once, while visiting his grandparents at the age of nine Samppa, who had liked to jump from all little bumps, got to try different sizes of take off ramps. This started his interest in jumping with skis. Samppa did all kinds of sports but the small town

in which he lived could not offer so many possibilities, especially in team sports. There were not enough children for that. Gradually, skiing and ski jumping became his chosen sports.

When Samppa was 12 years old the family moved to Jyväskylä, which is next to a ski jumping hill. The parents had an option to get work in two different cities; they chose Jyväskylä as it offered better possibilities for Samppa to continue the hobbies he had started and the city was already famous for ski jumping through the successes of Matti Nykänen. Other sporting facilities were also excellent. However, the family did not have any goals as such in sports other than to improve in it as much as possible and enjoy doing it. Samppa's father recalls that his goal was to spend time with his three sons and as he himself enjoyed sport that was what he did. He exercised and coached them. But there were no big goals, none of them were dreaming about the Olympics. Samppa recalls that it never even crossed his mind, as it was such a far removed and impossible idea.

4.4.3 Reaching the top level and staying there

Samppa began competitive skiing at an early age and in 1996, at just 16, he placed 11th in the last World Cup race of the season, at which point he realized that the top of the world was achievable. The following year he catapulted to the top of the rankings when he was the youngest ever winner of the Nordic Combined World cup being only 17 years old.

During the same season, he participated for the first time in the World championships in Trondheim finishing 17th in the individual race. However, he won his first medal at those championships in the team competition being one of four team members.

In the Nagano Olympics in 1998, Lajunen won his first Olympic medal by coming second both in the individual race and in the team competition. The next year at the Ramsau World Skiing Championships, Lajunen won silver in the "normal hill" competition and gold in the team event.

The 1999-2000 season was a gap year from major competitions, however Lajunen dominated the Nordic Combined World Cup winning eight races and the overall competition. At the Lahti World Championship, held the following year, Lajunen won two individual silver medals, and bronze in the team competition.

After a difficult start to the Olympic season 2001-2002, Lajunen got his jumping technique in place just in time for the Games. Lajunen won Olympic gold medals in all three Nordic combined competitions including the team competition. In that season's World Cup, he came third and in the next season's World Skiing Championships in Val di Fiemme he got the bronze medal in normal competition and the team competition. During his last competitive season, 2003-2004, Lajunen medalled again being third at the World Cup. At this point, though only 24, he decided to end his competitive skiing career.

Despite his great success, the driving force for Samppa was to improve rather than to win even though he was very competitive by nature. He was good at

balancing his life and included other aspects than sports in it as well. For example, he was studying economics at the University of Jyväskylä.

4.4.4 Collaboration with coaches and the team

Father as a coach

Samppa's father and coach Heimo Lajunen was an active man, a doctor by profession working in hospitals and private clinics. After his working day he had the energy, the personal interest and inner value to spend time doing sport with his sons and other active boys. He liked to do sports and shared a similar interest to the boys of wishing to improve the practice activities and their common skills. He was playful and innovative in designing training plans and practices. The guideline was to keep it fun whilst still developing the boys' skills and abilities. Consequently, the training had lots of variation from which he made options for the athletes to choose from. He often made a few options for the athletes to choose from.

In this way, he also wanted to build the athlete's own ability to think and take responsibility, which he saw as crucial. He points out that an athlete must understand the reason why he is doing an exercise and what is he trying to improve with it. The athletes had to think how to vary the training in order to put weight to different parts, develop in balance, have fun and avoid exhaustion. There were also no planned days off as, to his way of thinking, life brings days off naturally. Both the trainer and the boys learned to be flexible and be imaginative in adjusting the training plan. They could combine school, studies, traveling and family vacations in training and most importantly, have fun. Fun and variation was crucial in Heimo's opinion as only that way was there enough pull for training. However, the training was to be done mindfully with the utmost concentration on quality. Often he took part in the extra long trainings as well, to keep company and to keep the concentration focused on the training instead of listening only to music and training without concentrating on the task.

As Heimo was a doctor by profession he had very good sense of physiology. He understood what kind of effects training brings to the body. He could make use of this knowledge when seeking to develop the performance of the athletes due to his being aware of the changes it made in the body and cells. His education in physics helped him to understand the forces involved in ski jumping. He filmed all the jumps and analyzed them, read about training and collaborated with coaches, debating about the best approach. He wanted to be sure to train in the right way and was constantly pushing himself to consider his choices.

Heimo describes himself more as a preacher that sportsman. He was the soul and jack-of-all-trades in a small community of Nordic combined in a local club. He arranged the training facilities, cleared the snow from the jumping tower, arranged competitions, waxed skis and, of course, coached. He did not count the hours in making it possible for the boys to do the sport as he felt an obligation to do well in what had been started. Often, after his work on Fridays, he hurried with the boys to Lapland for snow training. Driving five

hours in order for the boys to get training on snow still on the same evening and before the lights went out. He spent half of the night fixing equipment to prepare for the morning training. He describes it as sometimes being close to insanity. He told (in interview):

> "On Christmas Eve in the season of the Salt Lake City Olympics I was shovelling snow off the ski tower in darkness, so that the boys could jump on Christmas morning. Well, why they had to jump on Christmas morning? Because the boys were leaving to World Cup tour on the Boxing Day, it was snowing and Christmas day was the only day to jump. Yes, it goes close to madness, but it is not otherwise possible."

Another example:

> " If we would not have still taken time to test the last pair of skis the day before Samppa left to Salt Lake City, all the jumps would have lacked five meters. Again we were making six hours the skis to be ready for testing. This way we, after many testing days, finally found the pair that was far better than the others. Probably, without that last bit of testing, still thinking in last minute what can we do, the jumps would have been five meters shorter, and Samppa had not become Olympic gold medalist. Anything that would have been left undone had ruined the Olympic success."

Jukka Kalso and other coaches

Later in his career Samppa also had another ski jump coach, Jukka Kalso, who had been a ski jumper himself. Kalso's impact was really important because he strengthened the team and brought to training knowledge and experience that Heimo did not have especially in ski jumping and physical training. Also the national team coaches and being on national camps, had influence on training but most of the training was still done at home.

During Samppa's last competitive season, the national team coaches brought a scientific and analytical approach to training. In cooperation with research centers (KIHU and Likes) new testing methods were used to evaluate the takeoff technique, the production of power and pressure. Jyri Pelkonen, a former Nordic combined skier, also brought new influences to ski training from Norway, and Jarkko Saapunki, a ski-jumping coach, developed ideas for power and speed development.

4.4.5 Innovative sparks

The father/coach was coaching the boys to make their own decisions, take responsibility for their training and be mindful about the quality. The coach thought the boys to select the most suitable exercises for themselves and ask themselves: "what will develop me the most today?" The training was target oriented but was designed to use imagination in order to keep the exercise playful and fun. The coach provided three options for training.

In order to rehearse the push offs, Samppa's father invented a specific training method, their "secret weapon" that was built of the parent's worn out mattresses in the living room. The idea was that the stack of mattress was so high that

the jumper needed to push off in the right direction as well as it being so soft that he did not need to be afraid of hurting himself. Being in the living room allowed extensive amount of jumps. Often the father videotaped the attempts and in this way Samppa could see, correct and fine tune the jumps as well as increase the amount of training jumps. His father explained that the mistakes were the same when jumping in the living room on to the stack of mattress as they were on the hill. In the living room however, they were more quickly corrected.

Samppa's team was small but purposely selected to supply what Samppa needed for his life and practice. They were very specific what they needed, and actively and systematically built the team to include the best Finnish professionals for example in ski service, communication, marketing and, at the same time, Samppa was able to concentrate on training full-time. In the professional approach he stood out from his rivals. At first, Samppa's uncle, a businessman Jarmo Lajunen was taking care of the economical arrangements, but after the workload got bigger Samppa's other uncle Raimo Lajunen took over as a personal manager.

This systematic approach to the career created a competitive advantage for Samppa as not many of his competitors had thought about all these aspects before. They mainly took the help they received but were not actively building their team and condition specifically to suit themselves. A good and concrete example of this was that Samppa had already then many pairs of skis for use in testing, which was not common in ski jumping at that time.

4.4.6 Summary and Conclusions

The Olympic gold medals were the result of the years of work, where the foundation had been constructed since childhood. His father brought his active lifestyle to his three sons and they jointly improved the performance over time, trying to be better and better. In 1996, six years before the Olympic gold medals, Samppa competed in the World Cup coming 11th and from that moment on, by following the training plan, choosing an ideal path for himself with the guidance of his Father whilst still enjoying his skiing he realized that he could reach the pinnacle of the skiing world. Two years later he won his first gold medal.

Samppa and his father were "self-made men". With a small, energetic and capable team they built the surroundings and the knowhow for constant improvement. They were innovative in solving problems and hands on to make them work. Samppa's uncle extended the family project by taking care of finding financial support.

Samppa's mother balanced the family of four men. She was educated as a psychologist, family therapist and psychotherapist who specialized in working with children. She brought balance to Samppa's goal-oriented life and softness on the side, offering a contrast to the more challenging and demanding father/coach. But overall, Samppa was active in making his own plans with the help of his team, establishing balance in his life between training and activities outside sport. He felt it was important to have a backup plan and not to overstress the athletic career.

It can be concluded that it was this complex, yet relatively basic in terms of do-ability, blend of personal motivation, guided activities, playfulness, variability, wealth of ideas and rest along with flexibility and familial support that ultimately led to Samppa's success. It leaves the broader question of how to develop this particular mixture.

4.5 Marja-Liisa Kirvesniemi (Hämäläinen), skier

Born		10.9.1955		
Olympic games	Participation in 6 Olympics	1976—1994		
	7 medals /3 games			
Olympic medals	Sarajevo	1984	5 km	1 st
	Sarajevo	1984	10 km	1 st
	Sarajevo	1984	20 km	1 st
	Sarajevo	1984	4 x 5 km	3 rd
	Calgary	1988	4 x 5 km	3 rd
	Lillehammer	1994	5 km	3 rd
	Lillehammer	1994	30 km	3 rd
World Championships medals	Lahti	1978	4 x 5 km	1 st
	Seefeld	1985	5 km	2 nd
	Seefeld	1985	10 km	2 nd
	Lahti	1989	10 km	1 st
	Lahti	1989	4 x 5 km	1 st
	Lahti	1989	15 km (c)	2 nd
	Val di Fiemme	1991	5 km (c)	2 nd
	Falun	1993	15 km (c)	2 nd

4.5.1 Introduction

In Sarajevo 1984, in her third Olympic games, Marja-Liisa Kirvesniemi won all three individual cross-country skiing races, as well as a bronze medal in the relay. In the next ten years, she achieved a further three Olympic medals accompanied by eight World Championship medals. She took part in six Olympic games altogether and still, in her last games in Lillehammer 1994 won two bronze medals.

4.5.2 Growing to be athlete

Marja-Liisa Hämäläinen grew up in a farmhouse in South Karelia about six kilometres from the Russian border being born in a house that had been occupied by the Hämäläinen family for 300 years. Since childhood she had been used to taking responsibility for the work on the farm and waking up during the school years before six to milk the cows with her mother. Despite it not being intentionally aimed at the target to which it later

became essential, the work on the farm established the base for her physical condition and mental discipline.

Hämäläinen started skiing at the age of eight after seeing the Innsbruck Olympic Winter Games on television in 1964. She wrote on a paper (Teider 2015) : “I want to be a Olympic Champion.” At the junior age, she was known as a talent who also won in the older age categories. While the other kids took competitions as a leisure time activity Hämäläinen took skiing and each race seriously competing always to the finish line to the fullest of her ability. Her four year older brother and nearby boys were her biggest challengers. “I always tried to be faster than the boys. I have always been incredibly spunky“ (Teider 2015). She was part of the local sport club and it was there that she started the long career together with her coach Sulo Repo.

In 1971, being only 15 years old, she participated in the junior championships and placed seventh in the individual race and won gold in the relay team. Due to the great result she was accepted to the national team. However, even though it had been a promising start, her career did not take off.

She participated in the Olympic games for the first time in 1976. Expectations were high but the toughness of the world elite was a harsh reality for Hämäläinen. She underperformed in competitions. The stress she felt created a mental stoppage, which prevented her body from functioning; in other words, she froze.

The nervousness and seeing the other skiers in competition brought a total block for her. Even though she was part of the relay team which won the gold medal in 1978, the other members of the team especially Hilkka Riihivuori and Helena Takalo covered for Marja-Liisa’s weak part. Tired, Hämäläinen came eventually to hand over more than a minute behind the leaders. Despite Hämäläinen underperforming, the team managed to win.

Hämäläinen experienced merciless judgment in the shadow of the gold medal celebrations. She was nicknamed the weakest link and the press denounced her as a “permanent loser”. Outside opinions hurt her feelings, as she was a sensitive person growing under the wing of her father, coach and older brother.

After the two Olympic games, Innsbruck and Lake Placid, and Lahti’s and Oslo’s World Championships she almost stopped. She was a good skier but constantly buckled under pressure and many believed, herself included, that it was difficult to change” the loser’s brain” to one of a winner. However, Hämäläinen’s career took a new direction after Oslo once she learned not to be afraid of losing.

4.5.3 Reaching the top level

Little things happened. The game changer was the relationship with her husband to be, Harri Kirvesniemi, who transformed Hämäläinen from an obedient girl to a woman with her own will. She grew to let go of the sorrow over her father’s death and her dependence on her older brother and the coach. The coach, who had become almost like a second father to her, noted later that he had not understood what was missing in Marja-Liisa’s life and that he should have understood to train a

woman differently to a man. He had not seen what was lacking in her life and what was holding her back.

The relationship brought happiness to Hämäläinen and made her trust herself, plan her own life, set her own goals, and take personal responsibility. During that time, she learned to notice that she had previously followed and accepted the goals and programs others had created for her without deeply internalizing them herself. Now she saw her life differently, which released her from the compulsion to win and the fear of losing. She started to steer her own life, understanding the meaning of each training and step she was taking.

With the influence of Harri Kirvesniemi, she started to practice harder. Nothing significant changed, but she started to push slightly more, stretch further taking more out of her knowing how each practice helped. Also on the ski camps she did not feel homesick any more but enjoyed being there. The coach Repo recalls the change: "I was slow seeing the difference."

Two years before Sarajevo, after the Oslo World Championships, all the training including the basic condition season was designed to train the specific ability needed for progressing with skis. There was less running but more roller skiing, and all the jumping exercises were done aiming forward instead of upwards imitating the gallop done in skiing. The goal was to get skiing natural in every condition, and still leaving capacity for her mind to be prepared for monitoring and managing of situation.

The target in skiing is to use the least amount of time on track but in practical terms it means to find optimal progress on each bit of the track, being sure that the struggle uphill does not eat up the energy resources and curve the speed. Thus, the downhills allow for recovery and when approaching the goal line all energy is used. The skier needs to balance the resources during the way but use them to the maximum. This way each part of the trail needs to prepare for the next one.

Skiing is a combination of style, rhythm, motorics and control. Marja-Liisa was a tall skier and her natural wide limbs had to be made to move in the right direction in variation of styles and landscapes, and to swallow meters effectively. The team found the optimal style by trial and error, getting feedback by watching closely, applying Marja-Liisa's deep reflection and using a stopwatch. Her optimal rhythm was so sluggish that many thought it was impossible to progress fast with such style, however the stopwatch gave the prove. Her pushes needed to have tremendous power to go in the right direction in order to move her tall body rapidly onwards.

It took time to find the way and the style, but the effort finally paid off and it became apparent in the year before Sarajevo that Marja-Liisa had learned the lesson and that a more effective movement now came automatically.

In early spring of 1983 in Lahti, Kirvesniemi won her first Ski World Cup event and this victory was a game changer for her. It was clearly the case that her body had started to work the way it should and listen to orders she was giving to it.

Marja-Liisa's whole life had prepared her to become a champion but the mental

preparations to win on the specific 10 kilometers track in Sarajevo started in summer 1982 when the skiers visited the coming Olympic site. At that point the foundation for the tracks had already been made. The team walked the trails taking pictures and making meticulous notes of the landscape, studying the terrain meter by meter, each curve, and bump. Coming back home the track maps and the memos were analyzed in detail and a great deal of consideration was given as to what effect it would have on the body. With this information, the team, Marja-Liisa, Harri and the coach Repo, made decisions and a detailed plan regarding how each section was to be skied with the knowledge being swiftly transformed into practices. The team analyzed the track and planned the to train the specific bits on that particular track. They searched for similar landscape to accustom the body for the coming event and designed the training program to build the ability to use and change the skiing style seamlessly as the landscape altered as well as to adapt the body to tolerate the cumulative stress and exhaustion this specific track would cause the body.

The closer Sarajevo came, the more focus was put on the exact 10-kilometer opening race for the ladies. The explored information from scouting and from pre-Olympic games was translated to mental training. Marja-Liisa skied in her mind the 10-kilometer track over an over both during the training and when lying relaxed in her bed. In the end, the track was like a video in her head that she had replayed countlessly. The head coach Immo Kuutsa's insight was that if the 10-kilometer race was an even game it would be solved in the difficult downhill section only a kilometer from the finish line. As a tall skier, with long limbs; Marja-Liisa was not at her best in the fine motoric downhill parts.

Marja-Liisa started to prepare her mind for this downhill section. With the coaches they had created a slogan: "impressively to victory or shockingly to bushes." The idea was to be prepared to not hesitate but to go with full speed and take all the risk on this downhill part, not to start braking even if the brain would shout so. The coaches took all the responsibility for this decision to ease the fear of losing. Only this message for the brain, for that specific moment was rehearsed in 70 -90 separate mental training periods.

In the Sarajevo starting race, in her third Olympic games, she actually got to this downhill section, she had been seeing in her mind's eye, in the lead but with her rival Soviet skier Raisa Smetanina only six seconds behind closing up the gap with each kilometer. With blurred eyes, exhausted muscles and the brain not thinking straight, she came to the top of the hill and she gave the command to the brain it had received in the same situation many times in her mind: "impressively to victory or shockingly to bushes". Her brain responded automatically to the order and her muscles moved the legs and body to accelerate the speed as the slope changed direction. In this hill Marja-Liisa escaped Smetatina's reach, who needed to slow down in the curves. In the last two kilometers Smetanina lost altogether 11 seconds and Marja-Liisa won her first Olympic gold medal.

She repeated the victory in two other individual races, as well as getting a bronze medal in the relay. Kirvesniemi did not

realize when crossing the finish line that she had become a queen of skiing in Sarajevo and made history. The Finnish people went wild. Only on returning home did she realize the value of her achievements and the importance to the Finnish people.

Even if the Sarajevo was well planned and the result great. The preparations were not without problems and backtrack. The season started well, but during the fall, Marja-Liisa's condition overheated. In November, a hundred days before Sarajevo, Marja-Liisa was diagnosed with overtraining and had to take a break from training. The Finnish doctors, who had invented a diagnostic method during the preparation towards the Moscow Olympics, gave Marja-Liisa a precise diagnosis that she was facing overtraining, fatigue, and imbalance and that her body could not recover. In the next 60 days she trained only lightly, sleeping and trying to recover meaning the earlier plans had to be removed. Only fourteen days before the start in Sarajevo she finally started to feel her body was ready to ski. The lay-off had worked.

In August 1984, being 28-years-old, Marja-Liisa's hometown, Simpele and the whole of Finland celebrated Marja-Liisa and Harri's wedding. Hardly anyone could have foreseen that Marja-Liisa's career at the top would go on for another ten years.

4.5.4 Staying at the top

The next winter in Seefeld's World Championships, Kirvesniemi's medal collection grew with two individual silvers. Less than a year later, in December 1985 Kirvesniemi's first child was born. She transformed from skier to mother and finished her skiing career.

However, staying at home when her husband left for ski camps and competitions started to bring desolation. Her competitive instinct and desire to be successful on the ski tracks was still burning and the idea of a comeback started to grow.

In spring 1987 after deep discussions with her family and with their supportiveness, she decided to head towards the World Championships in 1989. At that point the Calgary Olympics were less than a year away and the task to get back into competition shape in such a short time was extremely challenging. Despite this, she was craving to get back and ready for the challenge. Many people were skeptical that she could make a comeback but she had huge hunger to train and the urge to show that she could make it. The skeptics proved to be wrong as in Calgary she skied in the 5 kilometers to 5th place and won a bronze medal with the relay team. In the World Championships in 1989 in Lahti, it was again Kirvesniemi's show. She won two gold medals and silver.

After her second daughter was born Kirvesniemi returned to the 1991 World Championships again skiing quickly, in medal shape, winning silver in the five kilometers individual race. This time the return was done under the supervision of the Ski Association's physician Seppo Rehunen to avoid any potential health risks caused by such a quick return.

During the next years' training camps and championships, the entire four-person family, added to with a babysitter,

travelled with the national team. The family had made it clear to the Ski Federation that without children and the caregiver with them, Marja-Liisa could not continue. The children's involvement in the training camps and competitions was important for her wellbeing.

The Olympics in Albertville left Marja-Liisa slightly outside the medals. She was sixth in the 15 kilometers and 4th in the relay. However, the family Kirvesniemi still celebrated an Olympic medal after Harri skied in the bronze winning medal team.

The medal rain continued in 1993 in Falun when Marja-Liisa won her eighth world champion medal, silver in the 15 kilometers. A year later, ten years after her first Olympic medal, 38-year old Marja-Liisa won two bronze medals at the Lillehammer Olympics in 1994. This concluded her 30 years as a competitive skier.

4.5.5 Collaboration with coaches and the team

The individual coach, Sulo Repo

In the Simpele region, United Paper Mills (UPM) was the big employer and an active player in the community. The company representative, called Sulo Repo who was a physical education teacher in a nearby city to take the job in the Simpele joint school and to activate the local sports club. Repo had graduated from Pajulahti as a sport instructor and had done his own competitive career as a runner. Despite his having a background in athletics, rather than skiing, he set out to launch a skiing department for the club to activate local children in winter. He recognized young Marja-Liisa very early as having the winner's traits almost twenty years before the Olympic victory. The duo worked together for the whole of Marja-Liisa's career from the beginning to the end.

The head coach of the ski team, Immo Kuutsa

Kuutsa served the Finnish Ski Association as the cross-country head coach in the years 1972-85, the years when Marja-Liisa transformed from two times Olympian to winner in Sarajevo. He was elected as coach of the year in 1978 when the ladies relay team in which Marja-Liisa was also skiing won the World Championships. He was also the personal coach of Olympic Champion Helena Takalo. By education Kuutsa is a gymnastics teacher and he served as a physical education teacher in Iisalmi grammar school and high school between 1963-2001, however, during those years he was absent a total of 19 years on coaching duties (Anonymous2007).

Kuutsa was a highly competitive coach and strived to get results. He saw Marja-Liisa had the potential to win in Sarajevo and fought to make it happen. As one of his colleague's said: "Kuutsa was quite a wizard." Collaboration with Sulo Repo was intense, Kuutsa followed the trainings on camps and Repo prepared the plans for the year and followed the trainings at home.

The boyfriend and husband, Harri Kirvesniemi

Harri was a deep thinker, analyzing skiing thoroughly. He brought the needed

security to Marja-Liisa, living by her side through the competitive years. The love story started in the training camp and it transformed the insecure girl into a self-confident and determined woman. The relationship also brought an analytical thinker to the team.

1980 in Lake Placid, Harri Kirvesniemi became an Olympic medalist himself in winning the bronze medal in the relay. Between 1980 and 1997 he collected six bronze medals in the Olympics: one individual medal from the 15 kilometers in Sarajevo 1984 and five with the relay team. He also won eight World championship medals all together. During his career Harri studied in the University of Jyväskylä and therefore the family moved to live in Jyväskylä. With this contact to the university Marja-Liisa also formed a close connection there and became a regular visitor to the university's testing lab.

Jyväskylä University's sport research center

Jyväskylä University's sport research center was behind many trials done with Marja-Liisa. Paavo Komi ran the center and had transformed it into a world-recognized research unit. Just as the team was behind many innovative measurements in ski jumping, as explained in Nykänen case, Komi's research team was very much involved in testing and developing ways to improve Marja-Liisa's performance as well.

One example of testing was muscle synopsis analysis that showed Marja-Liisa's body was divided, half and a half of muscle structure; the hands were quick but the legs were slow. The researchers and practitioners together figured a way to train endurance for arms without losing their quickness and vice versa. The researchers also developed all kinds of gadgets to be used to improve training and Marja-Liisa was eager to make trials with them. One example was the so-called "cask", which reduced the oxygen from breathing air giving a similar kind of effect to training to that of training in thin air.

4.5.6 Innovative sparks

After the scouting trip to Sarajevo in 1982 Marja-Liisa's team found that even though the profile of the track and trails on the map looked rather harmless, there were often hidden hazards. During the last year and a half before the Sarajevo Olympics, Marja-Liisa's team dig into the details of the track, broke the task down and found a way to rehearse each detail and prepared the mind and the body for winning the first competition.

By only looking at the ski plan, one might not have noted the traps set by the trail planner, for example, that the long downhill parts did not give much rest as they were cut with quick curves and bumps or that the speed was swallowed by an immediate upswing. In order to ensure the adaptation to this specific track in Sarajevo, a similar track profile was built in Marja-Liisa's neighborhood. This allowed Marja-Liisa to accustom to the own reactions when skiing the trail. They found specific training to overcome any difficulties, and invented methods to stimulate and rehearsed the problematic places.

For the preparation for Sarajevo, the Finnish national team introduced mental training to be part of the practicing.

Systematic mental training was still quite rare in Finnish sport with, at that time, only a few psychologists using it with athletes. Marja-Liisa got from psychologists many tips on how to relax during the skiing and also learned to reflect constantly, a method Japanese marathoners had used successfully. She used mental training in preparation in many ways but also in getting ready for the first event of the Sarajevo. Before getting to the race she had skied the 10 000 race in her mind over and over again for months, adding all the details of the track and reflecting on her reactions to them. She entered what she called "the tube", a mental mode of preparing and concentrating to win. During this time, everything else in life faded away as she got mentally and physically ready to fight at Sarajevo.

For the event itself, triggers were planned for the specific track and each detail was thought through. Marja-Liisa had placed the track plan on top of her bed in order to erode it in to her mind and get her mentally prepared to face each of the tricks on the trail, including the critical last downhill part.

It was not only with mental training but also training with the speed skier Hakkinen, which helped to build Marja-Liisa to have the courage in the downhill part where she had previously struggled.

Marja-Liisa was tall skier and her pushes with tremendous power needed to be directed in the right way in order to move her body rapidly onwards. The team found the optimal style and rhythm for her by trial and error, getting feedback by watching closely, feeling and with the help of the stopwatch. To outside, the rhythm appeared so sluggish that many thought it was impossible to progress fast with such style, but the watch was telling another story.

Also the researchers in Jyväskylä University's sport research center were behind many trials that helped to prepare Marja-Liisa's body towards winning. Marja-Liisa was open and eager for trials. There were a team of researchers with her testing and thinking how to measure, interpret the measurements and how to adapt the results to training. This interaction produced many sparks and ideas that affected training and developing training methods.

4.5.7 Summary and conclusions

In a way Marja-Liisa's story reminds us of a Cinderella story, after finding her prince her career took another course. She recalled: "Without Harri, I would not have become an Olympic winner." Harri brought happiness and security, and affected how Marja-Liisa saw her own career. He helped her to take another perspective, which again sharpened her view and opened ways for little changes that had not been evident before. This transformed a permanent loser as she was called into a repetitive winner and a hero in Finland.

Strategic planning, harder training and mental training prepared her bodily and mentally to win. It was a collaborative effort to become aware of many small nuances and how to prepare Marja-Liisa to be stronger and to enable her to win. The Marja-Liisa case was a collective creative effort that Marja-Liisa could bring together. She said:

> "I have had enough setbacks, so I became a humble Olympic champion."

4.6 Conclusion about five stories

The five stories of the Finnish multi-time Olympic Champions are each unique, however they also have many similarities. All of these champions trained very hard and were dedicating their life to sports, but they were also brave in trying out things in new ways as well as making their own choices. They were competitive, resilient and uncompromising, but at the same time adaptive, curious and experimental. Even if each of them could be described, at least to some degree, as a loner none of them rose to the top alone. The success was a result of the contribution of many influencers, the most important being the coach, as well as the family in the background. However, there was a wider team, whose impact helped to gradually add elements to their expertise, widen the understanding and the perspective. This enlargement of thinking was collaborative and therefore a much larger system than only an athlete's improvement or even an athlete's and a coach's collaboration.

Each of these five athletes had a balanced and encouraging childhood with a close relationship with the family and with their other siblings. They all started doing sports with local clubs or followed the siblings to the hobby close by. In this way, doing sport, these future champions were no different from the way the local kids spent their time. The club that each of these athletes entered already had a tradition in the discipline they later came to excel in. In this way each of the five multi-time Olympic champions were entering an existing sporting culture with know-how, equipment and facilities.

These young athletes became familiar with the sport, were able to access the sport specific facilities and built a solid and sport specific base during their childhood and youth.

These athletes were resilient already as children, staying involved for a long time and also later staying at the top of the world rankings for years. Furthermore, despite the fact that they were at the top for a long time it did not mean that the years were similar and the periods repetitive. The process brought new challenges throughout their careers. Staying on top did not follow a one "winning formula", but each game had to be approached with a refreshed attitude. There were many changes and things that happened between the Olympic games bringing new obstacles to be overcome and new ideas to be implemented. However, through the years, the accumulated experience and expertise helped the teams.

Each of the teams seemed to have created a highly individualistic philosophy, view, and logic about the sport and the training they followed. It had been gradually developed over a number of years and it was very particular and unique in the way it had been internalized. They had some ideas concerning specific details they were determined to master while at the same time they were working on the whole and building a comprehensive ability. This was the unique philosophy that the teams were trying to master in order to win. Through repetition they acquired data that they could process further in each training. This mindful repetition and constant reflection was similar between the individual athletes and was also a recognizable trait of these coaches.

Another interesting similarity between these athletes was the dutiful following of their coaches' guidance. Four out of five athlete had the same trainer during the most intense years, although one had to search for a trainer more frequently. Even in that case, once the collaboration was formed, it was close, symbiotic and based on mutual respect. Reciprocal trust was based on the same goal, and the determination to achieve it.

In addition to the dutiful following, the coaches consciously encouraged the athletes to take responsibility and ownership. The coaches were building the athlete's self-esteem and giving them room to take their own initiative. So even under coaches' leadership, these athletes were very self-sufficient and did not take orders from outside their core team and did not allow themselves to be led blindly. They were sometimes seen as stubborn and intractable towards others including the head coaches, national teams and other organizations. Some of them indeed, ran into trouble with this but some could find their way without too much confrontation.

Further similarities between these five cases were that all the athletes and their teams were active internationally. They were very aware of the international level and demand of their discipline, analyzed the competitors and were rather quick in responding to any development taken by them even if they were by no means followers of their competitors. It is astonishing how well they were on top of the knowledge and aware of where the competitors were. They were good in observing, but so were their coaches who used their networking skills to get the knowledge they needed. They were also very quick and ready in experimenting. They all took part in experimental trials and were often the first to adopt new features into their training.

Looking at the career afterwards, the journeys appear clear, linear and logical. However, considering the process retrospectively blurs our view, as we simplify the process. When we know the outcome, it is easy to predict that the team knew what they were doing at the time and the decisions were obvious and easy to make. But, looking more closely at the stories, the teams groped their way to the top and the way was rich with details, daily decisions and moments when difficult choices had to be made. These choices required insight, and also determination in execution, especially, when their views went against the mainstream or beyond the understanding of the community. The beauty seemed to be in the collaboration where everyone, especially the coach and the athlete, had their specific roles and between them built mutual respect.

Theses moments and choices offered an interesting target to be reviewed, to understand how these athletes and their teams built their path, their insight and how they became so sure they were doing the right things; as there was no way to be sure that their choices would bring success, even if they believed they would.

5. Findings

This study had two research questions. In chapter 5.1, firstly, the conclusions from the pre-study are drawn suggesting that persistent work, drive and stimulation of creative thinking have a role in becoming a champion in sports. In chapter 5.2, the results and findings are presented for the first question showing that six-core factors affect, in a cyclic way, in becoming an exceptional expert in sports. In chapter 5.3 the findings for the second research question I are described showing that the athletes and the teams, together and separately, got creative sparks, which affected the way they approached the training and thinking about the sport thereafter.

5.1 Findings in pre-study

The pre-study suggests that success is a result of persistent work, drive as well as stimulation and creative thinking. These factors affect when there is a supportive foundation and environment for a development process to happen. This finding was drawn from three interviews with two World Championship medallists and one Olympic Champion. Table 8 collects the paths involved in making these findings from sub-categories to the core categories.

Through the interviews, it became apparent that these three athletes came many times to crossroad situations during their

Sub categories	Amount of codes	Core categories	Amount of codes
Drive	9	Drive	9
Persistent work	7	Persistent work	7
Exposure	3	Stimulation and creative thinking	21
Interpretation	5		
Interaction	7		
Creative thinking	6		
Foundation	3	Foundation	3
Total	**40**		**40**

Table 8. Codes in sub and core categories of the pre-study.

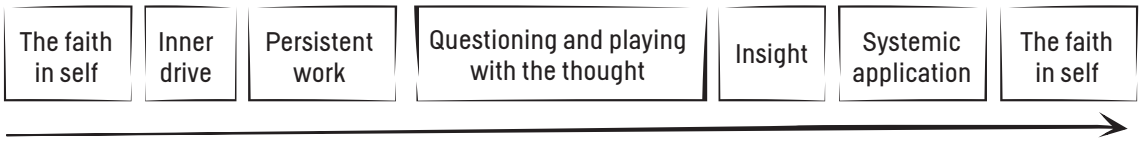

Figure 5. A process of developing expertise.

career and their choices made a significant impact on the direction their careers took. They came to face problems and questions to which they had to find solutions. This solution finding and reasoning proved to be very interesting as it appeared to sometimes lead to unique solutions as well as a clearer vision and understanding of what needed to be done. Execution of these ideas helped them on their way to success.

This pre-study was made with limited data and therefore wide conclusions could not be drawn from the results but it gave some directions and encouraged a closer look at the sport. Exposure to stimulation featured as an especially important factor in creating a unique approach. The pre-study provided a good stepping-stone to access the main study, and paved the way for collecting the data and analyzing it.

5.2 The cycle of developing expertise

The aim of the first research question was to define, identify and outline, which factors and processes built multi-times Olympic Champions to become uniquely successful.

As illustrated in chapter 3.4.3, in the first analysis phase, all the interviews were coded and divided into sub-, main and core categories according to their content. Simultaneously, the codes were linked to each other with the statement "is a cause of". In this way, a process started to appear and six core categories were identified, which were: 1) questioning and playing with the thought, 2) insight, 3) systemic applications, 4) faith in self, 5) inner drive and 6) persistent work. The process is presented in Figure 5. These six core categories had their own characteristics that followed on from each other as the former gave input to the next forming a cycle (Figure 6).

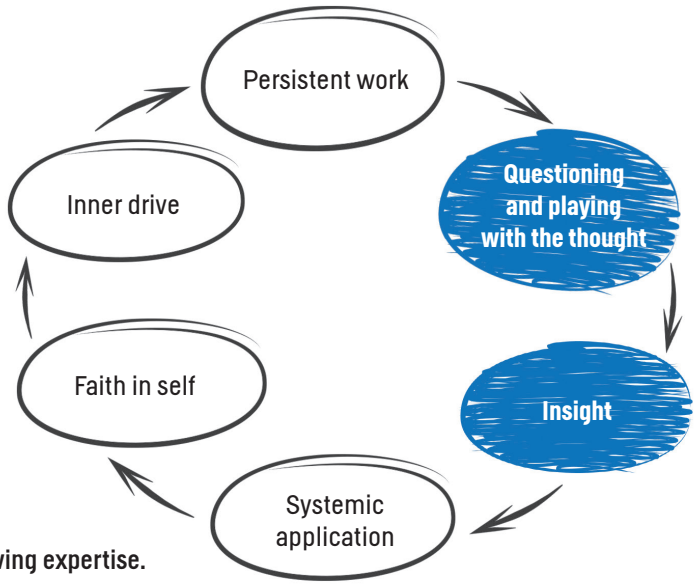

Figure 6. Cycle of growing expertise.

The cycle rotated over and over again building layers on the knowing, own way of doing and reinforcing bit by bit the individual's unique expertise. As the process was cyclic, it is hard to distinguish where it actually started. This research concentrates on the development to become exceptional, therefore, the starting point is not really relevant as after the ten to twenty years that it took for these experts to develop to the top level, the cycle had rotated any number of times. That is to say then that the starting point could actually be any given point of the cycle.

The process of analyzing started with coding the original expressions. The codes were formed into 27 sub-categories then to eleven main categories and finally merged to form six core categories. Table 9 shows how the codes were divided into core and sub-categories. There were three to four sub-categories per core category describing the dimension of it. The extended examples of forming categories from the original expressions are presented in Appendix 2, codes linked to core categories are collected in table in Appendix 3 and the codes in Appendix 4.

Next, each of the formed core categories with their sub-categories is described in more detail. The explanation starts from "questioning and playing with thought" as it got most quotations. Obviously, this was also due to the interview questions, which were emphasizing creativity.

5.2.1 Questioning and playing with the thought

> "As an athlete you must realize that you need to develop your knowledge about the sport all the time in order to know what to do." Athlete 1

The core category "questioning and playing with the thought" had four features: questioning, interaction, trial and sense making (Figure 7). These four features were formed from the sub-categories. There were altogether 320 quotations and 17 codes linked to this core category and they are presented in Appedix 3.

The teams studied had a special feature in that they constantly questioned what

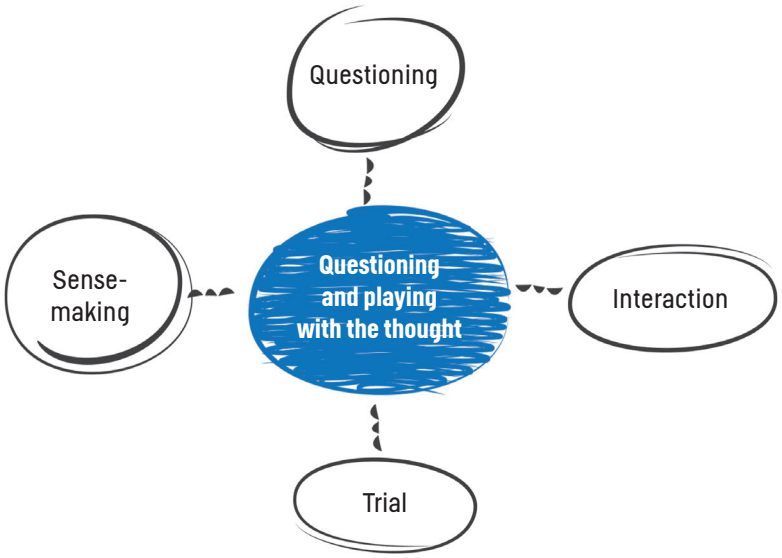

Figure 7. Characteristic of questioning and playing with the thought.

Questioning and playing with the thought		Insight		Systemic application	
Questioning		**Understanding**		**Own choices**	
Looking for a solution	16	Understanding	72	Risk management	8
Adversity	6	Idea of holistic training	72	Choice	7
Coincidence	5			Goal	7
Listening to own body	4			Decision making	6
Total	**31**	**Total**	**144**	**Total**	**28**
Interaction with outside		**Image building**		**Executing the own idea**	
Data collection	47	Vision	51	Development	57
Interaction	45			Differed from the others	17
Rivals	21			Development of self-confidence	16
Observation	9			Construction of tactics	17
Interplay with environment	7			Implementation	3
Training mates	7			Know-how	3
Total	**136**	**Total**	**51**	**Total**	**113**
Trial		**Differentiation**		**Self-imposed**	
Experimentation	26	Development of own idea	26	Self-imposed	47
Testing	16	Differed in thinking	20	Taking own actions	17
Total	**42**	Competitive advantage	11		
Sense making		Innovation	5		
Analyzing	36	Learning and adaptation	4		
Reflecting	31	New creation	3		
Learning to know the athlete	26	Creativity	3		
Feedback	10				
Imagination	8				
Total	**111**	**Total**	**72**	**Total**	**64**
Faith in self		**Inner drive**		**Persistent work**	
Self-confidence		**Motivation**		**Deliberate Practice**	
Mental strength	28	Motivation	28	Training	58
Trust in oneself	7	Drive	2	Coaching	30
Resistance to stress	7	Others desire	2	Concentration	20
Fear	4	Will	2	Mental training	20
Humor and relaxing the mind	1			Amount of training	10
Total	**47**	**Total**	**34**	**Total**	**138**
Own way		**Growth mindset**		**Life-style, plan and setting for training**	
Put ones soul into	33	The desire to develop	26	Lifestyle	20
Philosophy	23	Approach	13	Ensuring conditions	16
Mental toughness	22	Curious	5	Training plan	14
Belief in own idea	19			Predicting	13
Identity	6			Control	9
Isolation	3			Investment	6
Success	2				
Total	**103**	**Total**	**44**	**Total**	**78**
Integrity and ownership		**Competitive instinct**		**Endurance**	
Consent of the athlete	6	The desire to win	17	Persistence	10
Identity	6	Ambition	2	Determination	3
Importance of sport for athlete	4				
Total	**16**	**Total**	**19**	**Total**	**13**
Balance and security		**Positive feelings**			
Life management	23	Enjoyment of training	7		
		Enthusiasm	4		
Total	**23**	**Total**	**11**		

Table 9. The forming of core categories and subcategories from the codes.

could be improved and where was the problem that needed to be solved. The athletes, coaches and other close team members intensively engaged in this problem finding and problem-solving activity sometimes very consciously as the problem arose but many times the seeds of the idea or open question had been sown much earlier and an idea or a specific question appeared when seeing, collaborating or interacting with the people and environment around.

> "It was one crucial factor that biopsies were taken from my muscles, and I knew that I had fast arms and slow legs. The research team was pondering, how I should practice my arms so that the speed does not disappear but would gain sufficient endurance and how I should train my legs to become fast and not too slow. I am divided in the middle." Athlete 5

The search process went also to inside one's own mind and feeling the body. When reflecting, the previous knowledge was brought into the conscious mind, linking the inner process with outside knowledge. Intense analyzing structured the information. Trying out and experimenting helped the teams to further refine practical ideas. The searching process often lasted a long time with subconscious progressions constantly being a part of the improvement. Questioning and sense making were continuous.

> "I concentrated. It is not conscious - it comes day by day over time." Athlete 3

> "You have to use imagination all the time." Athlete 2

The deep knowing grew with profound thinking, reflection and interpretation after getting input via all of the senses. The searching went outside, but also inside by reflecting: being aware of own competencies and abilities, knowing own strengths and weaknesses. Sometimes, constraints and setbacks facilitated the search and impasse forced a reframing of the question over and over again.

The better these athletes and coaches became, the better their capacity to see and understand grew, and it became clearer what needed to be done and which details needed more digging. When they could master the previous task it created an opening for further development. The questions were critical for information searches and often rose from observing, thinking or collaborating as new information affected question appraisal.

The core teams had a sense of urgency to improve and actively inquired and tried to find new angles to look at the task as well as to find answers to emerging questions. Knowing and insights did not grow in a vacuum but by being with fellow athletes and coaches, surrounded with the domain culture, using environmental possibilities and being in interaction with people near and far. These interactions brought new building blocks and seeds for growing the ideas. The teams also followed competitors and were aware of new means, equipment and training methods and were deeply engaged with their work using time for reflecting and thinking.

Questioning

Practicing, pushing forward and engaging with the task raised questions. The main

force for question appraisal was the drive to improve and it pushed the teams to constantly explore the current way, and search for new solutions. The questions arose from the play with equipment and environment, discussion with others people, practicing and finding own limits and strengths.

> "It is necessary to keep the training fresh. It is also important to be mindful of what you do. That you constantly question why am I doing this in order to improve." Athlete 2

> "He was bombarding me with questions, and that is one feature I have not seen with anyone else… He analysed all the time and was cross (laughing) if I could not supply answers for his questions." Coach 3

> As an athlete I found it easy to go to talk with the coaches and ask questions when I visited Vierumäki (a training centre)." Athlete 1

Sometimes thoughts popped up by accident and sometimes through frustration, for example, the question of how to compensate for the winter weather led to finding substitute training methods. As Karppinen said about this:

> "Some people think that you need to row all the time but I thought that I'll try other exercises as I could not row during the winter. I was trying to develop the things I felt were important in sports so that I could compete against those who had better conditions. I think you have to be so interested in your discipline that you want to find out what you need to do."

The teams pointed out that mindful training, analyzing and constant critical thinking were the keys for finding new angles to explore, and to answer questions: why am I doing this the way I am, is there another way, or how do I overcome this obstacle? These questions were asked over and over again and affected data gathering, experimenting, monitoring and interaction with self and the outside world.

> "We monitored others. Especially when jumping is a technique sport, so you are able to learn quite a lot when you are looking at the others jump. Viewing how do they do that thing, you can copy the suitable elements and try to do the same. Of course, I was interested in all who performed well, and at the same time wondered why did they do so well." Athlete 2

The coaches were very attentive to the detail, and used time for exploring and planning how to search for answers to their burning questions.

Interaction with outside

Information gathering happened gradually and from everywhere in bits and pieces during the progressing career of the athletes and coaches. The teams collected building blocks for understanding and knowing in interaction with people and the surrounding world. The team actively sought collaboration with those who could enlarge their vision, offer some guidance and they constantly searched for solutions screening for hints and ideas.

For example, all the interviewed athletes and their coaches were highly aware of what the competitors' level was and what their abilities were. They had had a chance to see and observe on their way to the top, how the world's best at the time practiced and competed. At the same time, they pointed out that they were focusing on finding their own winning formula. Karppinen explains:

> "I learned when racing long distance with stronger rowers or against a faster boat. I had to begin to think economically, to do every stroke precisely. I tried to row as economically as possible. With these rivals, we might have rowed twenty kilometers side by side, and I tried to row economically and accurately. You know, you cannot lose even a one cent in twenty kilometre stretch."

Collaboration with relevant people helped and was crucial both for the athletes and the coaches in order to add applicable knowledge to their somewhat unpolished views. For example, for the athletes, there were many influential people with whom they collaborated: other athletes, rivals, training friends, the family, doctors, managers, psychologists, physiotherapists and other team members and sometimes even some almost random contributors. However, the most important collaborators were the coaches.

> "During my career I had these different coaches and I always learned something from each of them. It is difficult to distinguish, how much weight each contact and coach from Finland and abroad had and which was the most important. I think it was a strong rope of many strands." Athlete 1

The coach and the team brought many more contact points to the collaboration and the search for knowledge: other coaches, scientists, developers, advisors and other athletes. They all brought pieces of insight to the whole. For athletes, bridging the gaps between the discrete information happened everywhere but especially when in competitions, training camps, or when actively searching for new information.

The coaches were attentive to other areas of knowledge such as entering into discussions with scientists, meeting with coaches from a variety of disciplines and reading as much relevant material as possible.

They were also coaching other athletes and therefore actively observing, collaborating and adjusting. In this way, they were finding new angles, widening their knowing and building their own view. Often, there was also more than one coach involved in comprehensive coaching and more athletes in the same coaching situations.

The coaches were actively involved with other coaches making coaching a collective action where everyone gained from this process. Also the coaching situation itself was a collaborative accomplishment where knowledge was built and transformed. In coaching, the athlete gets building blocks through instruction but the coaches also got information from the athlete as the dialog moved in two directions. In this kind of collaboration, both partners constantly grew, as they were able to solve problems at a continuously high level of human ability. Experimenting with good athletes gave the coach and coaches great

opportunities to observe in extreme cases, sense and use the information again for further knowledge creation. They used the situation in working with top athlete to build their own knowledge further.

> "It is a swap also from coach's side. That is, if I get from him something I must give something back. One Norwegian coach arranged for us a good campsite in Spain. All together eight weeks in the camp during the winter and spring, then he helped us out there. For doing this, he got our test results and he got our biomechanics, which were very valuable for him." Athlete1

The athletes and the coaches had their own roles in the process; however, the line between the roles was blurry. The coach had the weight on being an outside knowledge seeker and an editor, whereas the athlete was using the inner feeling, the inside knowledge being the reflector and the linker of the body consciousness with the outside knowledge. Broadly speaking, the roles were such that the coach forms an idea and "sells" it, and the athlete uses what fits into his picture.

The coaches were very open and investigated the world for cues for information, took part in research and attended educational workshops that could be applied to the training, whereas the athletes read, observed and played with environments and conditions working on their sensibilities with environmental cues, being both open and closed to the surrounding world. For example, Viren ran in many competitions abroad sensing the changes of rhythms, pushing and jostling, learning to adjust his own moves and reactions to any possible constraints during the event. Nykänen and Karppinen say how they trained in all kinds of winds and weather and learned the effects of natural forces.

Even if the athletes lived more in their own world and sometimes in "a bubble", they were also open to relevant information as this athlete describes:

> "I read all the information about training and also from the radio you can get lots of coaching knowledge. In many places you can find information related to training and health. I was one of the first customers for Dr Tolonen (famous doctor specialized in nutrition and health). He asked me to list on a paper all the drinking, eating and supplements I used. He wondered how could I eat so correctly. I said that I have read all his books. I read constantly these books on health and training as well as other related materials." Athlete 1

Different parties in collaboration had their own, specific and important roles in data collection.

Trials

By making trials, the teams and individuals learned to recognize what worked and what did not, what could be put into practice and what not. Some trials ended in rejection, some took years to mature to the "ahaa" -point, and some became second nature without big, visible happening, like Nykänen's ability to make his biggest winning margins in bad weather conditions, which was due to practicing in

harsh conditions and learning how to act when the wind was blowing.

> "I went to the little hill when there was a terribly strong wind."

Nykänen was also purposely making mistakes in search of the optimal take off, as his coach says:

> "Nykänen deliberately made mistakes to develop greater sensitivity. Sometimes, he decided to dive forward over the ramp, or took off too late. Little by little he put together, a particular kind of image, and trained his motoric skills and coordination. Others just went into the (ski) jump and jumped with lots of tension."

Nykänen also found ways to test his effort in jumping as he describes:

> "I went back to a small hill, 20 meters, to see if I made any effort at all at the take off. In a large hill you can go along with the speed and forget the effort in take offs."

The trials and experiments brought new angles and information and better variability.

> "It was good that I have been able to try out different things. Through these experiments with different disciplines, I became aware of what excites me. After a little practice I found out also where I am good at and where not." Athlete 2

Sense making

These interviewed athletes and coaches were very strong about their views and had a strong vision that had been growing through the years. They were also excellent in reflecting on their own feelings and competences, aware of their own thoughts and capacities and good in combining outside knowledge with their inner resources. The ability to adapt and to customize specific knowledge was the result of years of thinking and collaborating with many people. Through this process and after internalizing it, the athlete was able to put the knowledge into action and the coach to optimize the training and competing. This way, the athletes as well as coaches' understanding gradually grew in what was needed to make the specific sporting performance better.

These superior athletes I interviewed had the ability and were engaging in deep reflection. They had trained this ability through their careers. This kind of reflecting on their doings from the perspective of sports happened not only when they were doing the sport, but also when spending time off, thinking deeply what is and what could be, looking at their activity from many points of view. In this way the ability of specific knowledge adaptation and customizing it for own use, were results of years of thinking and collaborating with many people but also interacting with the environment and sporting equipment. They learned to trust their feelings and the information from inside and in their own ways they were each analytical. It might further be termed mindful in modern parlance.

It seemed that the athletes were constantly growing their understanding of

what they needed to be doing, through thinking, trying out and collaboration. They felt collaborating was important but felt strongly the ownership and responsibility of actively building the comprehension, as one athlete commented on the set up and athlete's role:

> "Athletes are responsible for themselves. The coach cannot know what the jumper's really feel and what is happening inside the body." Athlete 3

The coaches' role was also to be the with-thinkers with athlete. They concentrated on understanding the athletes' inner world and feelings, gave feedback and helped to conceptualize the desired vision of the future. The athletes were very demanding and active in the process as one coach reflects:

> "He was grilling me about his jumps all the time. He demanded feedback and was angry if you didn't give it. He apparently built some kind of image from the gathered feedback. I would assume that he was searching for the ideal jump with the help of the corrections. He was constantly analyzing what's happening in his performance putting an image together like having video equipment inside his head. That is a feature, which I haven't still seen with anyone else, although I have been closely involved with this sport since the 60's." Coach 3

Most of the coaches had a strong philosophical stand to stimulate the athletes to take the initiative themselves, and were pushing the athletes to increase their reflection capability by pushing the choice to them and strengthening their inner awareness. Even though that was the case, the coaches themselves, like the athletes, analyzed, reflected, asked for feedback and were deeply engaging in thinking. The coaches spent hours analyzing videos and different kinds of metrics trying to comprehend what could improve and what could be essential with the specific athlete.

With the help of scientists and other specialists the coaches and also the athletes tried to enlarge their expertise about understanding the perfect performance, the idea of how to do it better, how to enhance the awareness of strengths and weaknesses and how to translate their view into practice. They used extensive time to create their understanding and refused to take ready answers without explanations:

> "I strongly debated when I did not understand." Coach 4

The coaches used other contacts to clarify their own thinking and build understanding.

> "We sat four coaches once a week and we were thinking about the past and what should be done. In these discussions, we went through all pretty thoroughly, what we need to do. It was useful. It captured from others comments ideas that I thought I should take into account." Coach 1

When the athlete's team collaborated together, they tried out, tested new ideas

and ways of doing, reflected, and applied the new information to practice, all the time trying to understand what was it all about. And they kept on going until the understanding came as one coach says:

> "It took me 16 years to develop the view and understand." Coach 2

5.2.2 Insight

Insight and the view generated gradually as new elements were applied to previous knowledge. Each person's developed insight was like an endless spiral that started early in the career and developed over time adding pieces to it like in a puzzle. The team members looked for explanations, sometimes for years, and fixed it one detail at a time. When they found answers to these specific aspects, the overall idea and vision started to form and became clearer and clearer over the years. Their expertise deepened and expanded. The unique features appeared to the view after the team focused on some specific area of the discipline and formed deeper knowing into that.

Insightful knowing did not grow in a vacuum but as a result of being with fellow athletes and coaches, surrounded with the domain culture, using environmental possibilities, and in interaction with people near and far. The view formed often gradually and with rigorous search to answer the questions they had been asking sometimes many times and for many years.

Even though the team was focusing on the same goal, each had their own vision in their mind. There are no two minds alike. Even with very deep collaboration, the coach and the athlete had their own visualization. The coach created his expertise as a coach and the athlete as a doer having the perspective of being the subject of doing. Then the insight included sensing with their body, and feelings. This difference was visible. The coaches had more words and they were able to communicate with the outsider whereas the athletes tried to translate their inner feeling into words.

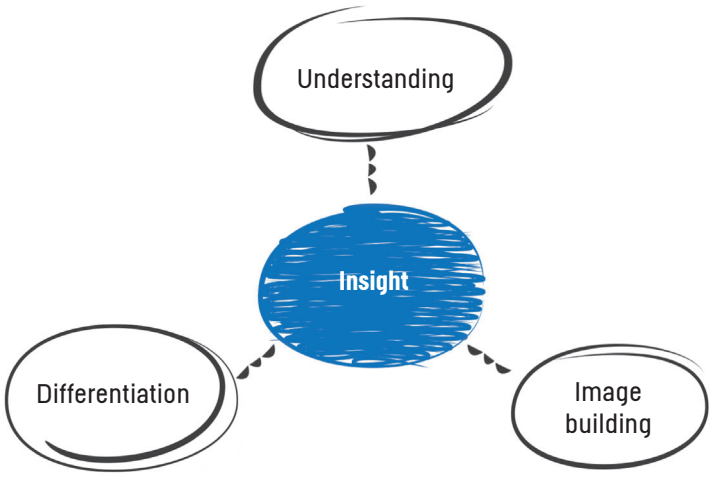

Figure 8. Insight and its subcategories.

The core category, "insight" was formed from 197 coded quotations, 10 codes, and based on these features the codes were formed to three subcategories: understanding, image building and differentiation (Figure 8).

Understanding

The better these athletes and coaches got, the clearer it became what they needed to do in order to improve to become expert and beyond. This clear visualization was the result of spending time and investing effort in thinking. The previously learned abilities opened views to new ideas that again directed them towards further plans, practice and search, which, again, led to new knowledge.

This understanding was the holistic knowing, connecting all the details, experiences, knowledge, trials and errors. It was the sensational feeling of comprehension, having gathered the pieces together and just knowing how the whole system works. But there was no endpoint to this knowing. As the athlete got injured or older, there were new questions to be solved. Also, when the competitors improved it forced the teams to develop still further. There was always a next question to be solved. Solving one bit at a time and spending years in doing so, these individuals developed an all-inclusive understanding of what they were doing. With this knowing, the team also became more knowledgeable about information and could judge what was relevant and what was not. With this understanding, they could see better and in more detail what needed to be developed next.

The deep understanding came through profound thinking, reflection and interpretation after getting stimulation via all senses as described with the factor "questioning and looking for answers". All the collaboration, seeing, reading, reflecting, doing trials and making errors, contributed building blocks that finally emerged as deep understanding.

Image building

> "I had my own picture of how I jump. The view must be all the time with. Motoric comes from this view. I was always looking for the right performance. I never corrected mistakes. I only tried to jump far."

Each athlete had produced a specific and very clear picture in their own head as to how the performance was supposed to be done to maximize their own abilities and to win. These athletes could see their own perfect performance and what elements were crucial to it. As Nykänen explained during the interview, when asked about how he knew what a good jump was like:

> "When we are now talking, I have been jumping constantly in my mind. In my head is the correct image of my jump. The mental-image-training is continuous."

During the active years Nykänen said he thought of jumping all the time and he constantly saw the correct jump, the jump he was striving for in his head. The detailed picture in the mind's eye of this athlete combined the crucial elements of his perfect jump.

Comments like: “I just tried to jump as long as possible”, sound very simplistic but I sensed the words meant fine motoric sensation and detailed images from inside and outside. It combined all the little parts and feelings of an impeccable jump also being aware of the slight differences between a great and almost great jump.

There was this big picture of making a perfect performance but it had developed through adding small details one by one. The teams were very aware of the crucial details needed, focusing and working them to perfection. The holistic picture formed from interplay with these details and the big picture. The development of the holistic view was then like building a puzzle, adding pieces to it one by one, but at the same time not losing sight of the overall mission. In this way the whole image appeared and got constantly sharper.

However, what is noteworthy is that no two people saw the same view; despite the fact that the coach and the athlete were looking at the same picture their visualization was different from each other due to the viewpoint. The picture for athletes was from inside as they were the doers and for coaches from the outside. This is shown in a coach’s comment about an athlete’s specific style:

> “I don’t know where the style came from. He probably just figured it out.” Coach 3

Despite the fact that an athlete’s style and learnings are built together by many people, the athlete constructs a personalized visual image, which includes his own feelings, reflections and understanding of all the details. In the process, the athletes’ and their teams’ search generated a deep and holistic understanding and knowing about the discipline and specifically how the specific individual athlete could win the competitors that the athlete was about to face in the exact competitions that the team were preparing the athlete for. The image became specific for each as it integrated the understanding about individual strengths and the answer to the question: “What do I need to do to win?”

Each of the close collaborators brought their specific view and understanding to the collaboration. These views crossed but were not the same as indicated by the comment from an athlete who states that each trainer brought something and that the knowing is a rope with lots of knots.

What was also interesting, the athletes did not spend time pondering what other athletes needed to do, but they seemed to know exactly what a perfect performance for themselves was. They were striving towards this perfect image of their performance. The coaches, on the other hand, had other athletes and they were building a more generic philosophy of training and then adjusting it to specific athletes. This adjustment was very thorough.

Differentiation

These people lived for their mission. They spent lots of time deeply considering what they could do to further improve. Issues were sometimes small and looked like minor things for outsider but were important for them. Often they focused on specific detail areas to find progress, like team Lajunen who

understood that they needed to take care of Samppa's economy so that they could build the team and actions they wanted. They did not wait what was offered and addapted to that but seeked to define self what was required and solve it. Economically team Lajunen was active and, therefore, quite different from his competitors.

The deepening understanding and unique insight was like a spiral that started early in the career and developed over time. Finding new questions to be answered and solving them, brought specific features to their performance. Interplaying with certain environments and conditions led the teams to adjust and find suitable solutions that were then specific for them. Solving detail after detail in this way resulted in a highly individual, unique way. Each of them developed their specific philosophy. For example one coach explained:

> "Many jumpers, they don't even know how they are in the air. I would say that 90 percent of the world top jumpers fly the first 30 meters in the dark… you know 100 kilometers an hour in squat…there is this dark space. … And my idea was that the one who is capable of shortening this dark space in the beginning would fly further." Coach 3

Another coach who worked with the same athlete says:

> "All my training focused on improving the right way of producing effort in takeoff." Coach 2

The teams deep understanding and philosophy was built over time in collaboration with many people. They formed their experience through years of thinking, finding solutions to the arising questions and collaborating. Finally, the athlete picked the suitable elements from the information as well as collaborations and made the final assembly.

In interviews, not all the athletes could put their knowing into words very well. It seems that athletes' brains were coded with movements and deep knowing but not necessarily with words. That had been in their interest and motivation; not to talk about their performance but to execute it.

The image was also not static but evolved and got new features through time. For example, injuries needed time to recover from, consequently bringing new angles to the image and forcing adaptation. Getting older and being pushed to adjust the training also had to be taken into account bringing new requirements. This stimulated the search but also brought new features as time passed, with the result being that the image building was constant.

5.2.3 Systemic application

> "After the years pause in coaching I started to coach again, and I was now able to carry out my own four-step process for the training. I did not change anything on anyone's command; I did only what I believed to produce results." Coach 1

The view formed over a period of years but only the implementation of the developed

view brought results. One can train extensively but if the training does not have a comprehensive idea behind it, it is hard to become unique. Only implementing the view produces results one has thought of.

> "The coach's job is to try to understand, what is the red thread of the training, the core of the discipline, and how it should be implemented." Coach 1

The core category "systemic application" was produced from 205 quotations and 12 different codes. The codes were first grouped into three subcategories before being abstracted to one core category (Figure 9).

Own choice

A large proportion of a coach's job consists of making choices and decisions. As an individual's energy and time have limits, selecting and planning what to do and how to practice is crucial. Having a view of what needs to be done also frees time from secondary things. As one coach says:

> "The purpose of each practice is to improve." Coach 1

For this reason, it is crucial to be doing those practices that bring the most benefit for this specific athlete.

Some of the coaches were also pushing athletes to make decisions in order to develop them to become stronger and to teach them to take responsibility for their own training and choices. However, this varied between the athletes and the coaches, depending on their philosophy and personalities. For example, one coach had a clear systemic idea of producing stimulation to the body and to get the maximum effects from this idea required following the calculated plan. On the other hand, another coach pointed out the importance of flexibility and adaptation to situations and, therefore, constantly gave the options for daily practice. The idea was to encourage an athlete to reflect and think about how to balance the training. In

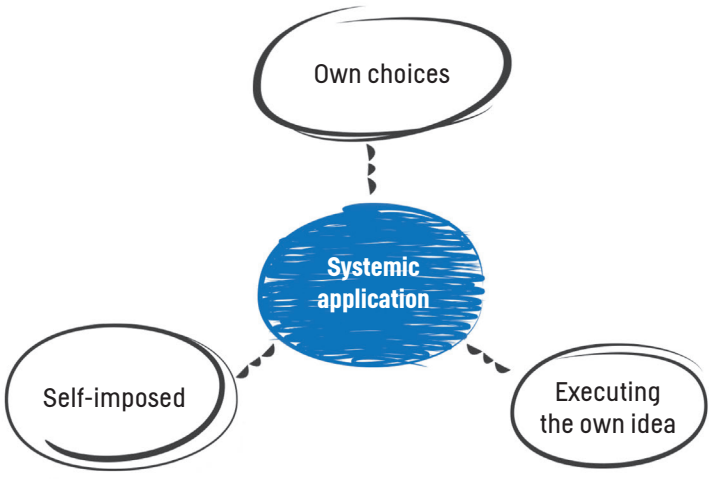

Figure 9. The core category: "Systemic application" and the subcategories.

some of these cases the athlete appeared to be very independent while in other cases the coach had the lead and the athlete was the absorbing side of information. Even in these cases, I felt that the athlete had quite clear vision of what and what not to do, but trusted in the leadership of the coach for information and the formation of a comprehensive training method.

It seems that there was no, one winning formula that all of these teams found but they each formed their own philosophical view about training and they were strong and persistent in executing it. The teams were then active in making their own choices and putting their developed ideas into action.

Doing sport, setting goals, focusing on improvements and questioning are choices these athletes and their teams deliberately made. They decided to focus on sports and formed their life accordingly. For example, some of these athletes spent extensive periods of time in camps as they could improve their practicing conditions this way. They chose employment, which enabled this. Their choices affected their whole life and their families' lives as well.

Trying to win in an Olympic sport is a risky business but after taking this risk with their lives they were cautiously trying to affect any risks that could stand in the way of their peaking at the moment they had chosen.

> "I put a lot of thought to the risks: what could be detrimental to my development, how could these risks be removed completely or at least reduced." Athlete 2

It seems that both the athletes and coaches had made deliberate choices; the philosophy had been thought through many times over and over again. The insight had become clear and they made choices in their life to make execution possible.

Executing the own ideas

As the new understanding grew, the need for doing things in a new way got motivated. By following their instincts and ingenuity as their own understanding indicated, the athletes and their teams shifted to new ways of doing. Through these ways, they began to adapt the training to what they thought to be most productive.

> "The aim of my methods was to stimulate often enough. This affected a number of physiological and psychological changes in the body." Coach 1

It took a lot of thinking and undertaking to develop new methods and transform them to be of use in training. All the collaboration, seeing, reading, reflecting, doing trials and making errors contributed building blocks to the athletes' own ideas but only when they were put into action did they make a decisive difference. Both the athlete and the coach had their own internalized view and role in the process.

It requires determination to execute one's own ideas and to resist the doubts, both internal and external and which may compromise the view.

As this coach said:

> "I did not change anything on anyone's command; I did only what I believed to produce results." Coach 1

> "I made my own plan based on my own decisions, based on what I felt would be crucial to find the competitive edge." Coach 4

An athlete commented on keeping his view clear and resisting other counsellors trying to influence:

> "Then some of these coaches on training camps wanted their fingerprints somewhere, but I always followed my own program. My program was made so that today was something and then tomorrow is something else. Sometimes a camp leader wanted that everyone is doing something together. I never fell to that trap. I always did my main practice according my plan. On the camps there was always some athlete who wanted to provoke you to compete. I was lazy to follow." Athlete 4

One coach compares his other pupil to the champion and said that he did not always follow the plan, but might have done heavier training than planned because he had a good feeling. But due to that he dulled the peak trainings, where he was supposed to go to his limits, which he never did. He, like many others, did not understand that the body needs different kinds of stimulus and the peak trainings need to be prepared for. The training is a holistic process. The coach explains:

> "He did not have the patience to follow the thought-out logic. The output remained moderate, not excellent; even though he trained as much but was not following the idea. " Coach 1

A coach explained how important it was that what was being done was actually understood:

> "If a athlete trains three times a day, how many overlong practices can be executed, or powered training to fit in. It might turn out that the wrong dosage of a recovery between the daily exercises makes the runner and coach's job to be void." Coach 1

> "You must see that if you do this way you will achieve these benefits or opportunities. In order for you to be analytical, you should have background information of the future. You need to know when you do this year this it will lead to that." Coach 1

And another coach about the execution:

> "His effort technique was developed such that he already started the effort very early. The methods to stimulate this were simple but effective. There were actually five jumping exercises to stimulate what we were after." Coach 2

I would argue that these athletes and their teams had their own ideas and strategic views of how to make their performance work. In order to execute this, and to rehearse specific details, they invented

quite personal ways of rehearsing, as Karppinen was to explain:

> "During the winter I could not train outside but something had to be done, so I did and I thought that as in rowing I had 240 strokes to do at competition, so I did 240 squats and as many pulls. I thought that 240 was good number and there was not anything else I could do. I repeated this over and over while watching TV."

In the big perspective, success is a web that builds from many little ideas and realizations.

Self-imposed

> "For two years, I had practiced with rowing ergonomics and they (the device distributers) heard about it. They said that it was not intended for exercising, but made to be a testing tool. I was probably the first who practiced with it." Karppinen

The athletes and coaches were taking their own –initiatives, did not wait for someone to give orders but were themselves leading the way. They chose to follow their way, as one team put it:

> "As the others left to competitions, we continue practicing and testing at home. The winter season was otherwise so fragmented, but this way we could continue testing and finalizing before the competition." Coach 4

They were not trapped by the problems but found possibilities. For example, Pulli designed a weight lifting period while at the Olympics to overcome the risk of loosing the sensibility of takeoff due to the long time spent at the games without enough possibilities for jump training. This raised skepticism in others.

Also the others found ways of compensating for training when it was impossible to do what had been planned. For example, Karppinen spent lots of time rowing in the rowing hall (a pool with a counter-current device), used a rowing ergometer or even did squats to imitate rowing moves at home. There were no excuses to give up.

The teams around athletes were very small, which was typical in Finland then. Even if there were national teams and camps arranged for them the whole system centered around some enthusiastic individuals who built the system more or less themselves.

At the time that the five featured athletes were active there was fairly weak central support system in sports in Finland which meant that the athletes as well as coaches could not wait for opportunities to present themselves but had to be active themselves. The teams were often gathered around eager coaches who were also very good at persuading people to help and in providing the necessary assistance.

In this the athletes and their coaches were acting like entrepreneurs and very little crucial decision-making concerning their training happened outside these teams. These athletes as well as their teams took control of their own actions.

They lived according to their own decisions and actions.

> "I started to actively seek partners and also the other people whom I needed in order to have the sufficient competence in the team." Athlete 2

For example, Viren got in contact with Haikkola after coaching himself to become the Finnish champion. He wanted to get to the next level and sought help from an experienced coach. After getting the coach, the duo made tight co-operation and followed the plan 100 percent.

Karppinen also took the lead in his career and kept on looking for coaches throughout his career, someone who could challenge him. Karppinen was solid in making decisions and was also criticized for having changed coaches so often. He had the problem that there were not much knowhow in rowing in Finland. He was the one who was thinking deepest about his career and he soon surpassed the coaches' level of comprehension thus enforcing change.

However, despite the fact that Karppinen changed the coach, he almost always had someone to work with. He was grateful for the help and says that he learned something from everyone. Karppinen said:

> "You must be able to choose your partners. It is bad if someone from outside begins to determine who is coaching you and what you should be doing." Athlete I

And another athlete commented on building the team:

> "Partners have been really important for me and I have pretty much searched and got them myself." Athlete 2

5.2.4 Faith in self

These athletes and their teams believed in what they were doing. They were strong-minded and had faith in their own actions.

> "There is always more than just the common sense. There is this feeling included. If I had a strong feeling that I am doing this correctly, then I cannot do things in other way. If I had done in another way that I was actually thinking, and had coached following some other line of thought, I would have been dishonest to myself as well as to the world. This was kind of stubbornness, which had a lots of feelings involved. At that time, in advance, I did not know yet that this would end pretty well." Coach 4

> "Development of ideas needed time to mature. Work and will are not enough the view came gradually and needed self-courage as well as the trust to keep the own view." Coach 1

All together 18 codes formed the core category, "faith in self". Based on quotations the codes were divided into four subcategories: self-confidence, own way, integrity and ownership and balance and security (Figure 10).

Self-confidence

The coaches were very aware that one aspect of training was to build the athletes self-confidence, the ability to trust themselves.

> "Dozens of times he hears his father praising him: 'Good, Samppa, that goes well'."

Strong will and solid views, ambition as well as judgment to one's own decisions and power could be recognized in all of the athletes and the coaches. The athletes and their coaches in this study were, in many ways, mentally tough having the confidence and the persistence in finding and navigating their way towards their goal past constraints and obstacles, as well as in their determination to win and be the best. They made their own decisions and followed their own path being autonomous and not letting anything or anyone get in their way. However, toughness was directed mostly towards themselves and somewhat to their team and surrounding people.

> "I never wanted to make a career in that way too selfish. When I succeeded I was hoping that the others succeeded too." Athlete 5

The coaches built the athlete self-confidence, emphasizing the psychological preparation for competitions of physical exercises. Like on coach said, each training was meant to build self-confidence and it went hand in hand with the physical training. Self-confidence did not come always as given like this athlete told:

> "I was afraid of everything. I was afraid of the losing, and I was afraid of success. I was afraid of conditions. That is where we started the modification." Athlete 5

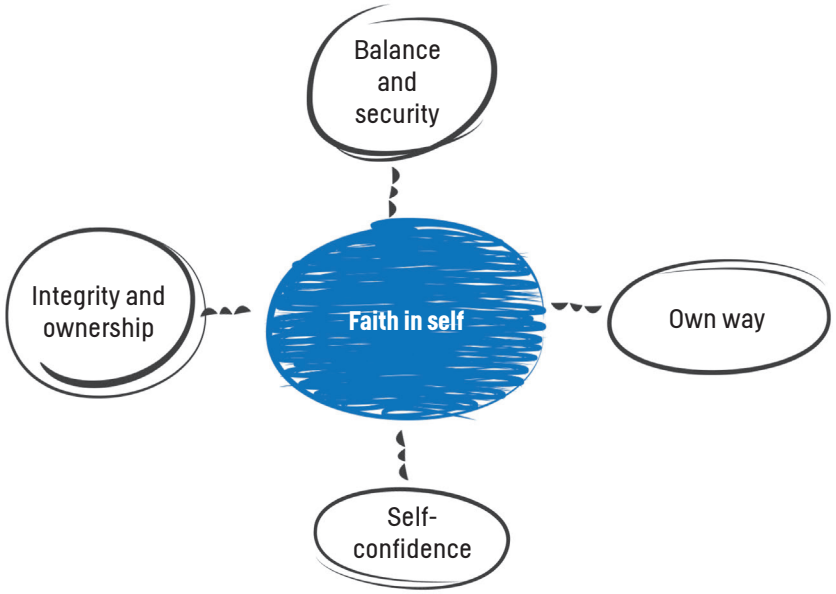

Figure 10. Core category: "Faith in self" and the subcategories.

Being successful was important in building the belief in self and confidence in own actions.

> "I was an avid skier, and I skied, and I improved. When the competition took place I was doing well and a taste of success brought me more enthusiasm to practice." Athlete 2

Own way

Using lots of thinking, trying and preparing these teams were very sure of what they were doing and they dared to stand behind their idea. Like this athlete was saying:

> "I probably did thinks unlike any other, but I was pretty sure that I did right." Athlete 3

> "I had to dare to be different from others, and to keep my mind." Athlete 4

These teams had many similarities but at the same time they each had their own philosophy that they followed. The different philosophies were also due to the different disciplines involved as well as differing personalities. Despite being open to change and to variation there were some details, in the case of each team, to which they held fast.

For example, Lajunen's team was constantly trying to look for fun and diversity in training to kill the boredom and build initiative whereas Karppinen tried to be as economical as possible and Viren followed the calculative four stage plan hundred percent in order to get the maximum effect of the peak trainings. Like Viren told he was not provoked by fellow runners or the luring of federation head coaches to digress from his plan. With all of the teams the path to excellence demanded clear own vision and the stripping away of that which was safe and customary.

> "One international reporter asked me afterwards how did we have the courage to go and train on the mountains, when the high altitude training had not yet been proved with research. I answered: "If you do not dare to try, you do not reach anything." Coach 1

Having the guts to follow the own instincts is perhaps one of the most undervalued qualities, which epitomized the athletes who reached elite levels. The teams were very aware of what they wanted and refused to be talked into doing things differently.

However, the strong mind, the biggest opponent to their own view was their own doubts. To remain true to their insight required courage. When there were little obvious results it required bravery to keep on going and trusting that the results will come. Like this coach explained:

> "The training volume was increased by 33% during our first year working together, however the results did not improve. He did not doubt that the results would come later. The following year, the amount of training was increased with another 31% and the results improved in all the distances." Coach 1

The uncompromising lifestyle had its faults and becoming a hero had it consequences. Even if these experts were extremely strong, individualistic personalities, they sometimes felt misunderstood and isolated, lonely and sad. Doing things their own way was seen as an attack against group culture and unspoken rules. The athletes were seen as difficult and stubborn.

Autonomy was not always given but taken, leading to social remoteness. The action of following their own instincts sometimes led to isolation. Isolation worked in two ways; the athlete broke away from the existing way of doing, but also the other athletes ostracized them for not belonging to the group. This required mental toughness.

Sometimes, the athlete's ability or interest in communicating his or her way was not the best. Even if the tough attitude was not directed towards anyone but themselves, the people around was feeling uncomfortable. The purposeful and disciplined attitude as well as progress was sometimes too much for their peers and as a group tried to break it or then just let out of the group. Even some national coaches and team leaders tried to force these athletes to adapt.

Regarding their personalities, this kind of following own path sometimes led to different kinds of consequences such as open conflicts, isolation (voluntary and involuntary), causing stress, loneliness and reservation. I heard a little sadness in the voices of the athletes I interviewed at being left out of the group.

> "Other athletes in rowing circles are friends with each other and engage for a beer. I was never called to any of these. They are better friends with each other. I have no idea whether it's the envy when I was always the one who was the strongest or is it the single rowing that made me a little different." Karppinen

Nykänen walked his own paths and when in training camps or competitions he preferred to train alone rather than with the team. During the competition years he had no real friend in the national team. Often, the others followed what Nykänen was doing but Nykänen did not follow others. He concentrated alone and only on his own jumps. He was deliberately turning off everything around him not being interested in what happened nearby. He was excellent in shutting out any distractions and surroundings when concentrating on a jump.

The better the results of the athletes became more outside requirements and obligations started to come some of which were helpful whereas others had more to do with demonstrating power and authority rather than representing a valid viewpoint. There had been occasions where the teams had fought their way through resistance and the coaches had supported the athlete in their decisions against the leaders who did not accept those. Sometimes also the coaches protected the athletes from knowing all that was going on.

What helped the teams to do choices in their own ways without need to compromise to group decisions were the rather weak leadership structures in Finland at the end of last century, which did not force

them to set in some outside, ordered mold. This being said, the athletes' perceived individualism was socially challenging with impacts on many levels.

Despite the passing of years both the athletes, and their coaches, remained passionate in their recollection of the determination they had needed to remain true to their initial plan. The memories of events from the past were still able to bring strong feelings to the surface. Clearly, the notion of struggling to maintain the integrity of their beliefs had been troublesome on some occasions and required determination to remain uncompromised.

Integrity and ownership

The featured careers were based on the athletes' free will, choice and self-determination. The athletes felt that training was rewarding and fun thus encouraging them to work towards the goal. The biggest challenge for them came from inside. They were humble and honest but demanding towards themselves.

> "I am in my opinion a goody-goody, but also when needed extremely strict to myself. I would not let myself easy. I set the bar high." Athlete 5

They did not wait for someone to take the lead but led their own decisions in taking responsibilities and facing the challenges of their own actions. A guideline that Haikkola followed in his training philosophy came from his previous coach:

> "Do not wait for someone to make something for you, start with the idea of what you can do yourself."

Strong identity, integrity, truthfulness to oneself and a humble attitude towards the work was very present in all the interviews.

> "I said to my coach, that I have a feeling that I have not practiced enough. The coach said: 'I have these test results. If you have done all this, what you put here plus your own workouts on top of this then, yes, you're practicing enough.' But I had a feeling that I had practiced too little even though I trained from morning seven to eight at night." Athlete 3

Viren stated that there were occasions when he lacked drive and had to wait it out until the feeling passed, eventually though he always went to train. Karppinen recalls his mother saying: "please do not go", as he was leaving to row alone on the lake when it was just opening from the winter ice. Karppinen recalled answering before going:

> "If I do not go now, I will always give in."

The individuals had a strong feeling what they needed to do and they executed that. They led their own life taking responsibility of their actions and even happiness.

> "It is often thought that happiness is something which can not be affected, but I disagree. Risks can be minimized with creative thinking. They can be removed completely or reduced and that is what we did." Athlete 2

Planning of training was mostly the coaches' job but some coaches built the programs to be adjustable. This was to strengthen the feel of ownership and mental strength of the athlete.

> "The ultimate outcome is always better if a person decides himself and thinks why do I do this and why I do exactly this today. It must be justified to oneself." Coach 4

Balance and security

Each of the five cases pointed out how their lives were balanced and their family important in providing relaxed and secure surroundings for them. This brought warmth and stability to an otherwise unsure and somewhat lonely life. The families were also strong supporters and enablers for the athletes all the way through their careers, first valuing and accepting the athletic life-style and also making it possible to have apply full focus to sports. The family was the athlete's mental backbone, giving support during the career's ups and downs and the unit to turn to in times of stress. The family was often also helping to make important decisions.

> "It was wonderful to go home. It is important that the feeling of security is found at home." Athlete 3

> "The family things need to be okay, the financial affairs must be in order, and there should not be any other things stressing and disturbing." Athlete 3

> "I also have a tendency to over excitement, so a balanced life and other interests were also a way to deal with it." Athlete 2

For example, when Marja-Liisa's coach fine-tuned the training so that it made working on the farm not possible, she felt that she was not carrying out her responsibility towards the family. The whole family approved the arrangement, wanted to support the training and made a decision to hire outside help to allow Marja-Liisa to fully concentrate on training. In general, the families helped these athletes to carry out their specific life-styles, which was quite different from the Finnish standards. They helped to create an atmosphere that supported training, and allowed space for afternoon napping, preparing specific meals and other training related activities.

After getting married the support and understanding from the childhood home was transferred, becoming the responsibility of the spouse.

> "When I came back home, often ten a clock in the evening, my bag was taken from me, clothes put to dry, the laundry taken care of and the food was on the table ready. From early morning the same thing, the service was worked. These are some things, which were important then." Athlete 1

> "The spouse brought stability." Coach 6

Coach and an athlete formed a very intimate relationship, where especially the athlete was extremely open for affecting and therefore also vulnerable. The work required mutual respect in order to function. A coach commented on his role:

> "If the coach behaves shamelessly, confidence will disappear immediately." Coach 1

It is interesting to note how the coaches saw their role in the athlete's life. A coach commented:

> "The coach only supports the athlete's efforts, thoughts and makings. He can never be a priority. He must always be in the background to support." Coach 1

5.2.5 Inner Drive

Taisto Jussilainen, the first trainer of Matti Nykänen described inner drive well (Arve 1988, p. 24):

> "I do not remember to have seen any other 12-year-old boy who had such willpower, who is trying so hard, desire to practice and hunger for winning."

In an interview in a national newspaper, Helsingin Sanomat, the year before his first Olympic gold medal Matti Nykänen also gave an example of how strong drive directed his whole life (Theiner 2003, p. 78, quoting interview in Helsingin Sanomat 16.1.1983):

> **HS:** What is important in your life?
> **Nykänen:** Ski jumping, nothing else interests me.
> **HS:** What is the meaning of life?
> **Nykänen:** To try to get forward.
> **HS:** How to get over the failure in the sport?
> **Nykänen:** Failure means that you have been working out too little. In that case I rest a couple of days and then I train harder.
> **HS:** What ski jumping gives you?
> **Nykänen:** A peace of mind.
> **HS:** Who are the role models in your life?
> **Nykänen:** Jouko Törmänen (Olympic Gold medalist 1980) and Matti Pulli (the trainer), outside the sport I do not have role models - I have never been outside of sport.

Inner drive was a power and an essential force in activating behavior. Without drive neither thinking nor action, reached the level required for superior performances. Drive helped in moving away obstacles, directed the focus into training and also towards any question or problem that arose. Often it meant rigorous searching or even fighting to find the right avenue to eventual solutions.

On the other hand, the love of the sport and enjoyment of training were pulling towards practicing and the lifestyle required for improving. Even if each of the interviewees were not dreaming of winning the Olympic gold medal when they were children, all of them were very competitive by nature. Already as children, they were competing against their siblings or neighbors, and moved towards more challenging rivals as time passed.

The question was not about the athletes' drive but also the deep desire, motivation and passion from all of the team. The coaches I interviewed were all fully dedicated to their work. Like the mental trainer of the ski team said, it was quite normal that the head coach called at six in the morning thinking that everyone was already fully engaged with improvement in skiing.

Pulli, Nykänen's coach, screened all the aspects that could be advanced. He

fervently developed equipment, took part in research, pushed other people to get involved and challenged the International Ski Federation. He also passionately pursued the city authorities to build elevators next to ski jumping hills in order to get the athletes to increase their training jumps.

Lajunen's father and coach explains how on autumn Fridays after his work as a doctor, the group of athlete and himself packed the car and drove eight hours north to jump on snow on weekend camps. Then if it was snowing there he spent, along with the other adults, the night hours clearing the jumping hill from snow in order to have it ready for the morning practice.

"Inner drive" could be described as having four dimensions: internal motivation, growth mindset (Dweck 2007a), competitive instinct and positive feelings (Figure 11). These formed a subcategory made up of 107 statements and 11 codes.

Internal motivation

Doing sports was mostly self-rewarding. "I really enjoy running" or "my enthusiasm for sport, was absolutely huge", were typical comments from the athletes. The athletes really liked what they were doing, the enjoyment of the activity itself. It was central to the life and work of all the Olympic Champions and their coaches I interviewed.

The fact that internal motivation was present was a decisive factor in building excellence as finding joy in being disciplined and dedicated helped the athletes to keep going, to search for answers to nagging questions as well as establishing training and the desire to improve as the center of their lives thus avoiding potential distractions.

In some cases, ultimate success came almost as a surprise as their focus had

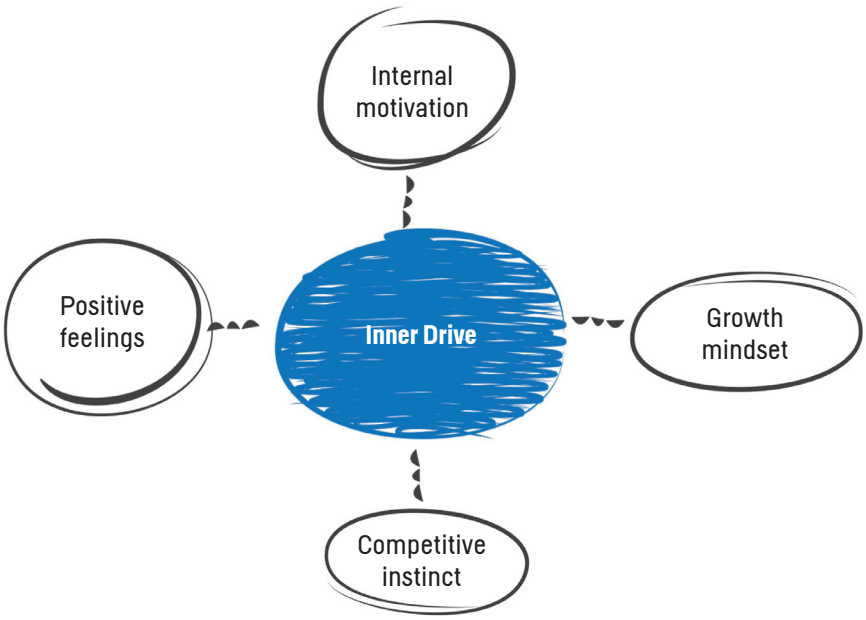

Figure 11. Inner drive.

always been on their own enjoyment and on concentrating on improvement, whereas some had very clear goals from early in their lives.

These athletes who succeeded in more than one Olympics seem to be fairly resistant to outside goals even in situations where the expectations around them rose after them having experienced success. For me it felt that others' expectations were not as important as their own. The joy of activity was very grounded and the awareness of their motives for doing competitive sport was deeply internalized. However, the process of internalizing took time to develop. For the athletes in my study, the internal motivation was strong and stayed strong even if other motivators existed. Motivators sometimes varied from internal reward and punishment, to personal importance, synthesis with self and satisfaction but in the background there was always the enjoyment of the action itself.

> "It was the work of my life, I loved it."
> Athlete 3

Sometimes though it took a while to really internalize the personal determination to win at the Championships. This awakening was crucial, for example in Marja-Liisa's case. She added another gear to her training after truly forming her own desire and not only accepting the goals other people suggested for her.

Even if the age of choosing one discipline differed from eight years to twenty, the route finding process was steered by experiencing enjoyment of the activity itself. The goal of winning at the Olympics often came later during the career, step by step, even if some of the athletes I interviewed had the vision of being an Olympic Champion already as a child stating after seeing the Olympic Winter Games in TV:

> "I want to be an Olympic Champion."
> Athlete 5

Another athlete understood his change of attitude towards winning when the reigning World Champion was within reach in the Olympic final. Up to that point, he had concentrated on development even though he was very competitive by nature.

Growth mindset

Competing against oneself, improving one's own performance appears to have been a big driver for the teams I interviewed. The main focus was on improvement and learning. Planning and thinking of the way to improve was a gratifying activity in itself. One coach explained that for a long time they did not have any set performance goals, their motivation was only to do as well as they could and to improve. He said that winning an Olympic gold never even entered their mind, as it was an absurd idea. At some point they then realized that the top was not very far. Another athlete said:

> "When I talked with other athletes they had decided already at school that they would someday become Olympic champions. I have never thought so I have only developed myself and tried to improve." Athlete 1

With a growth mindset, athletes were constantly looking for improvement. It was the driving force, the inner voice that said, "I can do better". It stimulated the urge for constant search and looking for places to improve, asking questions how and why: "How can I improve, and why do I do things like I do? Can I do it differently?" It catalyzed the search for the answer in the process, of seeing, interaction with others and deep reflection, resulting in a understanding. They were exceptionally receptive and had humble desires to learn and to have training.

> "My driving force was the desire to develop more, and to make things a little better all the time. It has been in everything I do, the feeling that I can always do better, as well as a desire to make things better. For me this has been the motivation. For some athletes it is that they must win competitions and they have a desire to succeed. For me the success is the outcome. It has become or not." Athlete 3

Small victories were necessary though to see the improvement and be motivated to keep going and train more. The athletes got pleasant feelings from winning as it showed they had done something successfully. The results were often an echo of the true motive, competition offered a metric and showed if the athlete and the team had found a way to optimally progress. The journey was then more important than the results even if the results were rewarding as they showed that the way to mastery had been found. The importance of winning was temporary in nature not instrumental and only linked to that competitive situation.

The coaches were also looking everywhere for hints for improvement in a very holistic way trying to constantly improve their own know how, training conditions and facilitate the possibility for success.

Competitive instinct

The Finnish Olympic Champions had a competitive instinct and the desire to win. Even if these athletes really enjoyed training and improving, they were also very competitive by nature. This characteristic was already evident when they were children. Some wanted to show off for the neighborhood kids and some competed against their older siblings.

> "I always tried to be faster than the boys. I have always been incredibly spunky." Athlete 5

They were humble in training but learned to be tough in competition. They liked competing, which does not mean that they were good at it. They fought fiercely to win, when in competition though.

> "I had an urge to compete." Athlete 1

They learned to win, some quicker some slower. Marja-Liisa was even deemed to be a "permanent loser" by the press before she found the winning form. They all had the urge to improve and beat their rivals and they cultivated the skill of winning with decisive practices, which focused building winners. One biography describes Marja-Liisa (Saari 1985):

”She was frenetic in winning and hated losing.”

> “There were no limits. I had the desires of a winner.“ Athlete 3

However, the desire to win was also related to a growth mindset. Competing against others gave opportunities to measure themselves in terms of personal improvement, to put themselves on the line and push themselves to the edge of their abilities. This is what Karppinen said:

> “I did not have an Olympic gold as a goal until after Montreal. I wanted only to succeed there but was not dreaming of Olympic gold. But every night I thought of rowing, and I had gone through the competition in my thoughts many times before Montreal.”

Some had and some did not have clear goals from the beginning. The most important factor seemed to be a combination of the desire to improve and an urge to win.

The coaches were also very competitive and had a huge drive to win. Often it seems that they had a desire to prove their visions had substance and they fought to demonstrate them.

Positive feelings

The activity and engagement brought enjoyment. Although there were moments and times of frustration and letdowns the overall tone towards the action was satisfaction and fulfilment. They felt good and balanced in training and when doing sports.

> “It is so natural to me, a wonderful feeling.” Athlete 3

However, there were two different directions of feelings. The athletes and the coaches really loved to be active with sport but sometimes felt a lack of support and understanding of their needs. They felt harmonious inside their training world but were often frustrated about the steering and being dependent on the administrational part of the sport, needing to adjust to others’ requirements, schedules and decisions which felt, at times, irrelevant and not deeply thought through.

Little victories triggered feelings of success and improvement and further positive feelings were stimulated by positive comments although sometimes crushed by negative. Family members and people around were important in building a positive and relaxed atmosphere and in creating a balance in life.

5.2.6 Persistent work

Practicing deliberately and working intensively for an extensive duration of time is the most important single contributing factor in making someone an expert. The first response of each athlete was “determined practice” when asked: “Why did you become the best?” In interviews, all the interviewees, both athletes and the team members, pointed out that

disciplined work, dedication and endless rehearsals were the most crucial reasons for success.

These athletes practiced technical abilities, mental capacity and also formed their life to make it possible to fully concentrate and devote time and energy to training. In other words, the work was physical and mental, for the purpose of making changes to both the body and the brain. The work included a lifestyle that supported the training, searching for knowledge and often, also places for practicing. This kind of focused work lasted for years, all year round. One of the athletes put it this way:

> "…with hard work and knowhow." Athlete 1

There were altogether 229 quotations and 13 codes linked to the core category "Persistent work". Accordingly, I grouped the codes and formed the three subcategories based on the qualities of the codes. The sub-categories are: deliberate practice (Ericsson, Krampe & Tesch-Römer 1993b), endurance and, thirdly, lifestyle, plan and settings for training (Figure 12).

Deliberate practice

It was clear that it takes years of deliberate practice to become a champion. Deliberate practice could be pictured in three dimensions: amount of training, quality of training and mental training. The coaches' job was to train, teach and supervise the training. They drafted the overall plan for the athlete to train all the needed areas and monitored the progress.

The amount of practice was the first thing each of the athletes and the coaches mentioned in the interviews. It is the first hurdle and even if training smart is crucial, the actual amount of workouts just needed to be done as one of the athletes' commented:

> "The first thing is that you put volume in order. In top-class sport the question is who is able to train more and on the other hand who is able to recover from the

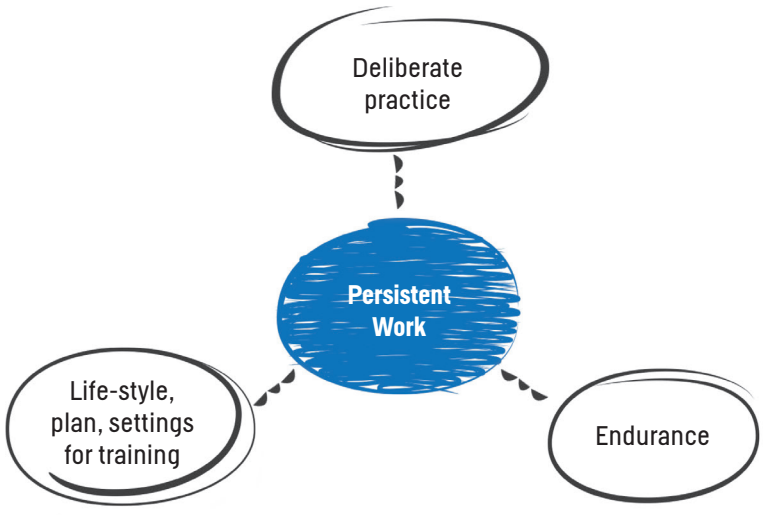

Figure 12. Elements of persistent work.

workout. The one who is able to do this the best gets a competitive advantage over others." Athlete 2

"For instance I have done these jumps on dry millions and millions. These are things that you have to do a lot." Athlete 3

"In principle, already from pretty early age, I have worked out more than my Finnish contestants. My amount of hours has been much more. It has not even been a question of recovery, but the question pretty much about commitment and diligence that you are able to work out a lot. Another thing is that there is no need to take any doping, you can train and recover. When you work out smartly, then you will be able to train almost how much ever." Athlete 2

The training programs were tough. For example, in the Soviet training literature it was stated that a ski jumper is able to do a specific number of jumps, that being 15,000 a year. Nykänen did 30 000 of those (Kujala 1999).

Someone might do lots of training but without focusing on development and quality, being mindful in training, the work is not pushing maximally forward and the time is not used wisely. This kind of training gives the competitive advantage to someone else.

The athletes and the coaches were concentrating on what they were doing having their mind constantly with them:

"I have always tried to develop myself in something at these basic exercises." Athlete 1

"I went to the 20-meter hill, the small hill, and I did jumps there. There I went to see if I make an effort at all. Jumping on a big hill you can be lulling on speed and the final effort lacking." Athlete 3

"Especially on the long, over two hours, ski trainings I went often with him as a company so that he would not just be listening to the radio with his earphones without thinking about anything. You must all time be concentrating on what you are doing." Coach 4

"On the national team camps, he took care of implementing the own program, not to be provoked to be competing with others if it did not serve the purpose." Coach 1

The idea was to constantly improve and be expanding their own abilities. To do that and stimulate the body optimally required not only understanding but also good planning. Breaking down the routine helped to fix the faults and concentrate on betterment. What to train came from the plan. These athletes also followed the plan and were able to go to their limits when the plan said so, but could also resist of doing so when the plan required recovery or was designed to rehearse some special feature.

"The whole idea of training is to develop. Exercise should never be too hard, continuously hard, if you want to get good results." Coach 1

Despite the fact that the mind and concentration was on the physical aspect of

the training there was also a great deal of attention given to special, mental training.

> "I did these compensating trainings and at the same time I had the rowing motion in my mind." Athlete 1

> "I concentrated very well in exercises already before doing them." Athlete 3

> "I was three years in Yuri Hanin's mental coaching. It was very crucial." Athlete 2

> "We prepared to face each of the competitor and we made two tactics in each race." Coach 1

> "I went through the 10 kilometre race in my mind each day many time. I knew the track profiles. I knew in advance how I would feel in each point." Athlete 5

> "Our competitions are long and you have to know yourself be comfortable with yourself. It is self-identification during the race. Everything is as familiar to you - like eating bread." Athlete 3

The coaches' role was to make sure that all the aspects of the training was in the plan as well as to help the athlete in finding the best possible technique. Monitoring and giving feedback and corrections were then the daily work for coaches. In coaching, an athlete is prepared through instruction, through experimenting with different thought processes and through using the potential and being able to perform at the highest level of ability.

Coaching is a holistic process of developing an athlete mentally and physically. It requires knowing what to do as well as communicating it in such a way that the athlete can take in the information and act upon it.

> "The coach needs to know the coachee and consider how and what ideas you can plant." Coach 4

Coaching then, requires knowledge, respect and caring and between the coach and coachee there must be mutual respect. As one coach said:

> "We had a mutual respect for each other." Coach 1

The coach needs to know the coachee thoroughly and not only the substance as, in the end, the coachee lets or does not let the coach, train. This requires dedication from the coach working the way to be on the same wavelength with the coachee. These athletes bought the philosophy of their coaches and if they did change the coach.

> "He was a realist and was listening very carefully. I had to be thoughtful what I said: If I had spoken complete rubbish, he would have exploded immediately." Coach 1

With communication and dialog, a coach helps the coachee to go to their own limits and push beyond what they had previously thought was possible. Going to, and exceeding, limits needs persistence and the

coach can help in getting there, to build the mind and mental toughness, to prepare and to stimulate. However, coaching is not always rosy and without emotion. Samppa's father-coach describes the disagreements and the coaches' ability to push. He described:

> "The question was, can he swallow the anger and put up, in this case with the father as a coach, even if wanting to walk away and say that we can no longer do this together. We both could swallow our anger as we saw that this cooperation produced results. I think you are tougher with your own son and say things harder even if you love him."

Life-style, plan and setting for training

These athletes and team members had to decide where to invest their energy and followed a sport-centred lifestyle. This lifestyle included practice and excluded other time and energy-consuming activities, sometimes even friends. Therefore, it was not only about the practice but also about holistically dedicating their whole life to support training and competing. People very close, the coaches and the circle of acquaintances were building or helping in building the environment and conditions in such a way that the practice was possible. Especially early on but also later, this included the training mates who were important, in creating a pull towards sport and training. The athletes commented of this kind of life-style:

> "My profession was jumping. I was training all the time. My life was just jumping and family. I invested a lot more than anyone else. From the age of 16 onwards I went at seven in the morning to the hill, and I left it at seven to eight o'clock in the evening. I've lived over there … I've done a lot of work. No one else was doing it in the same way. This is it, or what divides me from other athletes. I had nothing else but focusing on the performance. I missed school and studying, but I knew that I was doing right." Athlete 3

> "It was a lifestyle." Athlete 3

> "I believe that most crucial was the regular life, and investing in the sport." Athlete 4

> "Time was money. You cannot do sports at an advanced age, I had to do it then." Athlete 1

The coaches searched for the best possible environments or helped in developing them to maximize practice. The coaches were driving, preparing the equipment and taking the conditions into consideration. For example, Viren was living some periods at Haikkola in Helsinki to be close to the training environment and trainer. Marja-Liisa's team built a similar profile ski trail close to her home in order for her to rehearse the exact capacities needed in Sarajevo. Samppa´s father recalls one Christmas Eve when he was preparing the ski jumping hill to be ready for the morning training. He admits with some irony in his voice that sometimes the stretching went to such extremes that it resembled madness. However, with a more serious voice he admits that if these adjustments had not been met he does not believe that the success would have come. There was no system in place that would have done it.

Additionally, the families were adjusting and supporting the maximal training. For example, Samppa's family took the training conditions into consideration when moving and applying for jobs in other regions.

Some of these athletes worked in professions outside sports or studied. Their employers or universities were flexible and gave room for long training camps as well as adjusting the working hours to fit around training routines. The work was then well planned to fit into the disciplined training schedule.

Endurance

The third aspect of persistent work was endurance. These athletes could maintain intense training for a long time without giving in before and after they reached the top. They were determined to keep going and executed the plans they had made. This kind of persistence in training was already noticeable long before they came to the top.

Becoming a champion then is not for the faint-hearted or to be achieved after only a few years of tough effort, it is years of dedication and execution. These athletes, the multi-times Olympic champions, were able to sustain their careers for a long time Marja-Liisa competed in six Olympics and only from her third did she start to be successful, Karppinen won at his first Olympics but competed in five. Viren competed in three Olympics, Nykänen in two Olympics but stayed on top for nine years. Lajunen also won everything there is to win in his second Olympics five years after his first World cup victory and during those years he picked up medals from each championships, medalled in four world cups, winning the whole tournament two times.

Although some of these athletes did not succeed for a long time, they kept on going. For example, Nykänen as a child was weaker than his friends and was not successful from the beginning. At first he was too light and lacked the power and then when the jumps started to gain length in practice, he could not manage his nerves in competitions. However, he never made his weight a problem for himself, instead he accepted it as a fact, and knew that therefore he needed to practice more than others.

> "I trained up to fatigue and even after being tired. Those are the core elements that I have had. And I think that when the other athletes in my sport were recovering their bodies from practice, I have still trained even if I felt tired."

It was not only a question of the amount of training but also of having the discipline to execute what was planned and to stay tuned to practice deliberately. Unless there was a very strong reason these athletes did what was planned. They shaped their lives around practicing and not the other way around. They did not give themselves any possibility to back off from what they have planned to do. Karppinen said:

> "In my view, it is precisely that that you are not giving up so easily. Many are looking out of the window and seeing that it is a bad weather out there and don't bother

to go out and row. They think that oh, I will instead do a little exercise cycle or go for a little run. But you know that going there exactly then makes the workout twice as demanding. Sometimes it was so windy that a place to row had to be searched. You have to investigate where to row. It is so that some will look for the places, and others are doing something else. You rather take the effort to go to this place, even though it is, many kilometres away."

Persistent work is made up and consists of the ability to execute the plan, and to train also when it is not so tempting.

"You go and you do not just think of going." Athlete 4

Even Viren's wedding ceremony was planned so that he had time to train the whole day before the ceremony in the afternoon, the day after he competed.

But they also found ways of compensating for lost training when it was impossible to do what was planned. Karppinen spent lots of time rowing in the rowing hall (a pool with a counter-current device), used a rowing ergometer or even did squats to imitate rowing moves at home as his father watched TV beside him. There were no excuses to give up.

It seems that the top athletes had the biggest challenger inside themselves, integrity, the truthfulness to oneself and a humble attitude towards the work was very visible in all the interviews.

"I had an indeed terrible "moral hangover" if I left a training out. Then I went at nine or even eleven o'clock in the evening to make it. For me it was very important that I always did the exercises." Athlete 3

One interesting aspect was that most of these athletes did not have days off. They said, "life will bring the days off". The training was planned so that there was enough variation so that the body did not overload.

The coaches had the same kind of endurance as the athletes. Pulli says he was 16 years developing his idea before Nykänen came. He thoroughly investigated the science of ski jumping and especially the take off. He spent a summer in the State University of Pennsylvania to analyze the video material collected from the World Championship. He repeated the same research three times with several professors to come up with the idea. He was also determinedly pushing conditions and equipment development forward. Similarly, Haikkola spent years in developing his idea before Viren appeared.

5.3 Creative sparks

"Sure the most important insight is that there is no single magic trick, which leads to winning Olympic gold medals." Athlete 2

After searching for insightful moments I found many different kinds of micro events that I call creative sparks. The sparking moments can be tracked to temporally determined events when sparks were formed. The sparks are small

intellectual comprehensions that affect reorganizing the mind and influence the way one thinks and acts thereafter. In these critical moments, sparks appeared due to the interaction with people, environment or facilities. The sparks that were revealed in this study were followed by a series of new sparks. Then one spark led to the next. Due to the effect of these cumulative sparking moments, the training and practice changed.

The sparks were different in size and effect. Some of them were big philosophical ideas about the whole approach, some ideas to develop technique, or training methods and some to approach a specific competition. The nature of the sparks could be described as having the following qualities: unconventional, experimental, answer detective, correcting deficiencies, and discovering own strengths.

Sometimes, a tiny spark started a development, which led to behavior that was unique, new features or further developments. I also found some bigger sparking moments that changed the whole vision. Before this bigger spark, the smaller sparks usually happened thus paving the way towards a pivotal event, the major spark. In the empirical study, I looked how the specific idea and point of view had started to generate and where it led thereafter. I tracked the chain of small sparks to explain how the development of insight was gradual. I comprehended from the earlier mentioning of the problem how the spark came about then I explained how the new insightful thought affected the future actions. In this way, I have created a picture of the emerging nature of insight and small creative ideas that led to the future development.

I could follow many different chains of sparks that led to innovative solutions that were also adapted in training, but there were many more sparking moments. There were also some chains of sparks and trials that did not lead to benefits to the training.

The general feeling was that the teams were curious about the latest knowledge and quick in making trials.

In the following, I present one example of such a series of sparks from each of the teams, in order to demonstrate their nature and the process. These examples are: forming an understanding of takeoff by Pulli; creating additional training methods by team Lajunen; creating a personalized training philosophy by team Viren; analyzing the coming event by team Kirvesniemi; and finding one's own competitive strength by Karppinen.

These examples do not explain why these champions won, but rather show how the chain of sparks developed. In some of these cases, the thinking of the coaches is followed and in some more the athletes. But one should not draw the conclusion that all creative thinking was done by the people in the team. I chose these examples to demonstrate the different kinds of chains of sparks, and the mechanism through which they emerge, rather than their importance.

As I explained in the method section of this thesis, I used two theoretical approaches to explain the nature of these sparks. With the help of the Event System Theory (EST) (Morgeson, Mitchell & Liu 2015) I used a tool to explain the physical place and specific moments of some

triggering events. The idea of emerging explained by Sawyer and De Zutter (2009) offered a way to understand the systemic nature of collaboration and the generative nature of cognition.

5.3.1 Clearer image, deeper understanding – Einstein paves the way to effort in take off

This chain of small sparking moments helped the members of team Nykänen to understand the effort required in take off in ski jumping. The sparks led to insights that changed the focus in training and affected further development. This chain of thought and experiments led to developments in the strength Nykänen had in specific ways he could then use in the takeoffs of the jumps. This chain that is presented in Figure 13 follows the thoughts growing in Pulli's mind. This chain of thought led to the development that made Nykänen become unique when it came to takeoffs.

The series of events started in 1964 after Pulli had familiarized himself with Dr Hochmud's (East German researcher) doctoral thesis that studied the effort in takeoffs in ski jumping. Pulli shared Hochmud's view presented in the study but felt it incomplete and had the urge to study the topic further. In this way, Hochmund's ideas initiated a series of thoughts and actions that led to major spark years later.

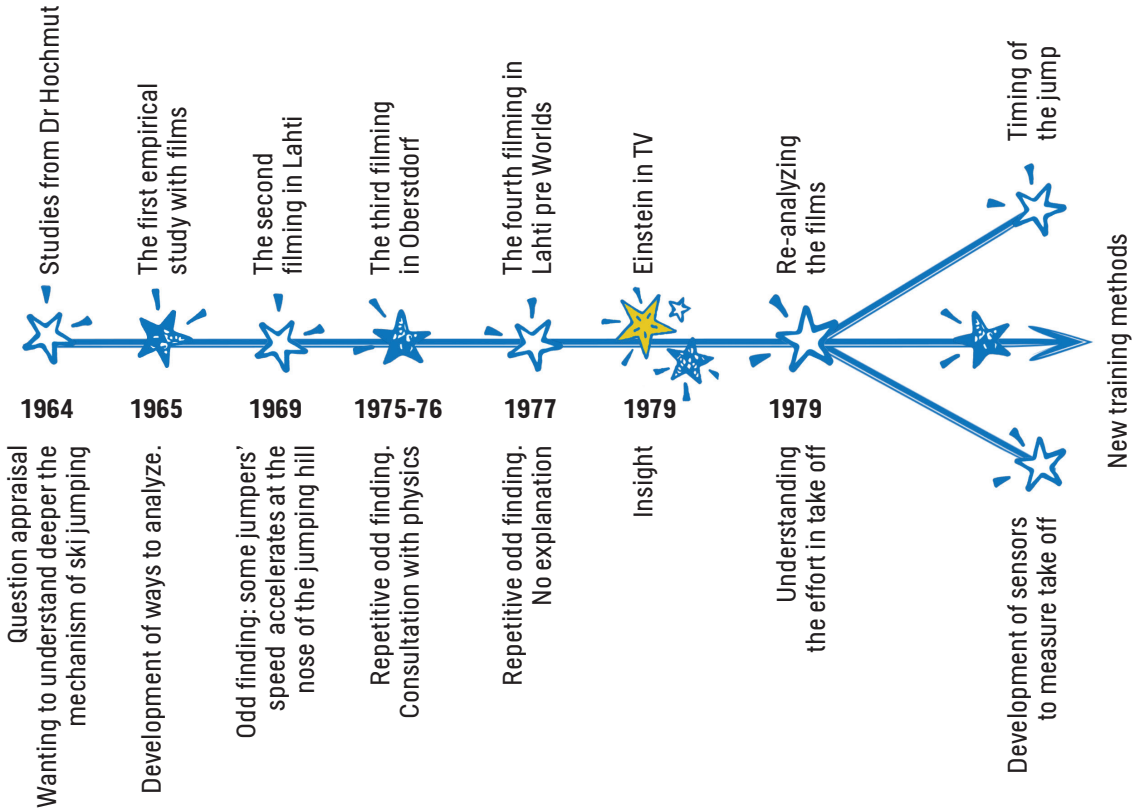

Figure 13. Timeline of sparking moments in Pulli's developing understanding of the use of effort in ski jumping take off.

In 1965, Pulli started to prepare an empirical study of ski jumping technique and borrowed a high-speed movie camera from university and filmed ski jumpers in an international event. Pulli was fascinated by the mystery of the take off in ski jumping and was sure he could explain it with rigorous research even if the first analyzing round had not brought much success. However, in his early experiments even if he could not explain the takeoff mystery he learned another valuable wisdom: a jumper's hands should go down from the takeoff instead of up and back like the jumpers were doing at that time.

Pulli, an active and driven practitioner, continued his search to understand what happens during a takeoff. He repeated the filming again in 1969 at the ski world cup in Lahti. In the meantime, Pulli had made friends with Professor Komi who was doing his research at that time in Pennsylvania. The University of Pennsylvania had acquired super speed cameras that had been originally developed for the Vietnam War in order to see why the missiles did not always find their target. Professor Nelson from the University of Pennsylvania and Professor Komi arranged so that Pulli could borrow these special cameras to film the takeoffs in ski jumping and then come to Pennsylvania to analyze the filmed material. To do the filming, particular towers were built to be able to film the right angles of the jumps. The following summer, Pulli spent in Pennsylvania calculating the speed and forces of the jumps.

Despite the rigorous study, he gained only small insights and was unable to make any major innovations but he did make one finding that struck him as odd. It seemed that the speed for some jumpers accelerated when coming to the nose of the jumping hill. He kept on pondering the phenomenon, but could not find a solution as to how speed could accelerate on the flat part. Finally, he buried the idea as having been a fault in filming. But again something good came from the study, the analysis of the film and its findings was published with the title "Biomechanics in Ski jumping" in The University of Jyväskylä publication series as the first study of ski jumping made in Finland.

During New Year 1975-76, at the Four Hill Tournament in Oberstdorf, Germany the same kind of study was repeated for the third time. The film technology had improved and the super quick filming was developed, giving new equipment to be employed and utilized. The material was now analyzed in three different universities: in Cologne, Germany by Professor Baumann, in Pennsylvania by Professor Nelson and in Jyväskylä by Professor Komi and Pulli.

Again, Professor Komi and Pulli faced the same phenomenon as they had years before. The speed of some jumpers accelerated when coming to the hill nose. There were lots of guesses why that could happen, and the problem was also shown to experts in physics, but the physicists were also unable to find any physical phenomena that would support that finding. Again, the result was put aside as a mistake in film technology as there were no answers to it. But the matter kept disturbing Pulli's mind.

In 1977, Professors Komi, Nelson, and Baumann along with Pulli planned a new empirical study and decided to film the jumps at the pre-games of the World

Championship in Lahti. The same phenomeon occurred, the speed of the best jumpers accelerated when the curve bent upwards. No solution was found for another two years.

Finally, the insight came by coincidence when Pulli saw a TV-program about Einstein's worldview. Einstein's idea about the elliptical orbits suddenly explained why coming to a curve could accelerate a skier's speed. Pulli turned to his fellow physicist, Pekka Luhtanen, and together they started to analyze the videos one more time now with Einstein's explanation in mind.

The two of them came to the conclusion that in the ski jumping takeoff, the initial acceleration was the most crucial aspect. It is at that point that the power generation begins and the speed reaches its maximum already long before the nose of the hill. Even though it is hard to recognize with the eye, they found that some good jumpers started the production of the take off earlier by pushing against the surface. The early takeoff maneuvers affected to catapult forward instead of upwards, in other words, the direction of the jump. This finding was transformational.

After this discovery, the idea was transferred to the training methods to determine the optimal moment for the production of the jump. The team also developed supportive exercises to improve the abilities required to master the idea.

Pulli commented on the whole process:

> "All in all, it was a huge undertaking to detect the mechanism of the effort."

Pulli recalled the exploration of the right take off moment with Nykänen:

> "I said to him that there is still a need to start the pushing even earlier. He replied that if he starts, even two centimetres earlier he would land on his nose. But eventually, he began to find the moment."

This innovation brought many kinds of other sparks and consequent events other than winning the Olympic gold medal. The main idea of Pekka Luhtanen's doctoral dissertation was based on this insight, and also, the idea of effort led to further the development of sensors to measure takeoff in ski jumping, to mention some.

These sparking moments that paved the way forward followed a timeline and could be tracked to some events, as explained in EST. Even the main spark, when the solution to a puzzling question was found, can be traced to a certain moment. It could be described as an "aha" moment, a supercharged or heightened moment.

Even though the precise breakthrough moment was special, the idea had grown through interaction with many people and a great deal of experimentation with a variety of equipment. These interactions involved for example, universities, development of filming technology, many ski jumpers' performances, co-researchers, the team making the filming production and of course the jumpers. This example perfectly highlights the emergent nature of ideation and the co-construction of understanding.

5.3.2 Unconventional training conditions - Stack of mattresses in living room

This example is about developing an innovative, additional training method by team Lajunen. This insightful supplement to training was a practical solution to improve jumping technique and increase the amount of jumps. The growing idea is presented in Figure 14.

The Lajunen team was very flexible, imaginative and innovative in the way of rehearsing and building training conditions. They found creative ways to adjust conditions and make them suitable for their needs. As a team, they were extremely active, self-sufficient and self-confident.

In general, ski jumpers train by doing lots of different kinds of jumps on the floor. One of these kinds of practices is where a jumper jumps to the flying position and the coach catches the jumper underneath the jumper's hips. To do this training the trainer needs to be on the spot and involved. To increase the amount of jumps, and to free the coach from catching the jumper, Team Lajunen invented a landing space formed from old sofas and the parent's worn out mattresses. They built this stack of mattresses in their home in the living room corner. This practical innovation not only increased the amount of jumps but also made it possible to improve the jumping technique. In this way, the coach could be on the side analyzing the jump instead of under catching the jumper.

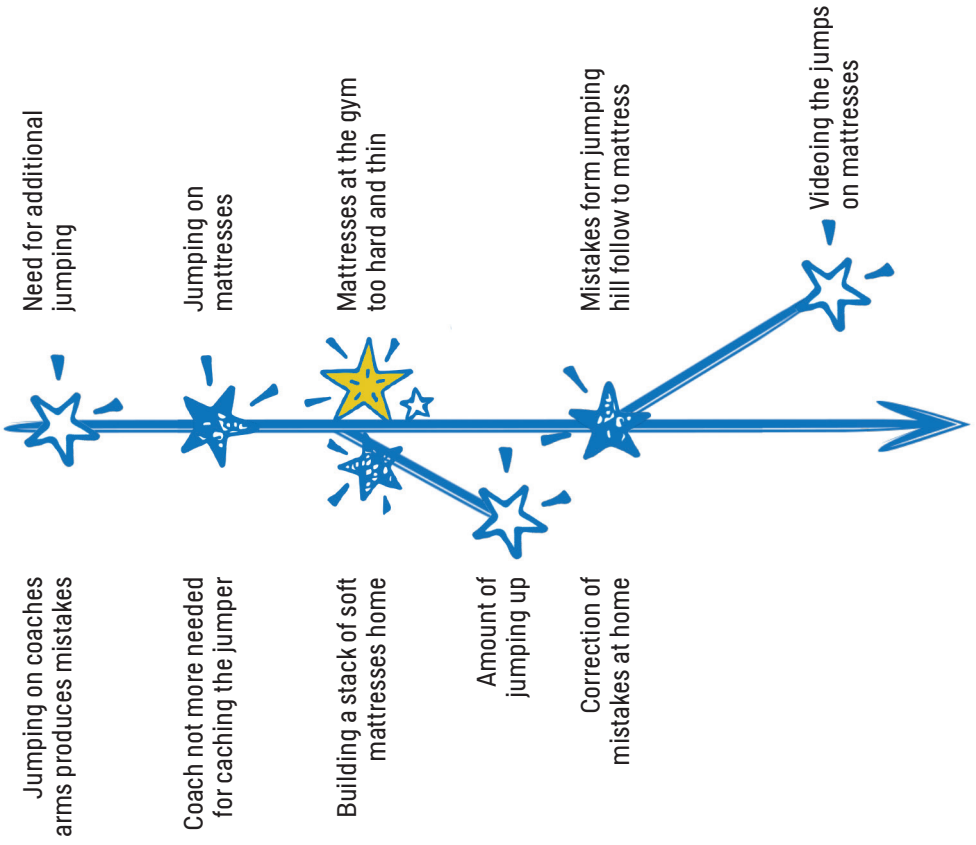

Figure 14. Sparking moments in team Lajunen's in creating a substituting training method and its insightful use.

This invention does not seem such a huge innovation as such as each gym has thick mattresses. However, the mattresses there are usually too thin and too hard and therefore a jumper is often slightly careful of jumping onto them and therefore starts to prepare himself for making a soft landing. On the contrary to the situation at home, the pile was made out of extremely soft mattresses and the jumper could fly freely without fear of injury.

With the mattresses the team also got rid of the problem that came when jumping into the coach's arms. In this exercise a jumper tends to open his body a bit further in order to leave room for the coach's hands, but a stack of mattresses neither seeks the jumper nor the hands. A soft stack of mattresses lets the jumper execute the jump correctly and fly freely.

Samppa could use this specific stack of mattresses whenever he wanted or needed it and it gave him an opportunity to execute lots of jumps one after another. These two things were not possible on the jumping hill or at gyms. They also learned to notice when practicing with the stack that the same mistakes that Samppa made on the jumping hill followed to the home mattress simulation.

Despite seeming to be only a small innovation, it turned out to be an absolutely crucial tool in adding to the amount of jumps and increase their quality. They could always correct the technique when they felt that the ski jumping was not working out for one reason or another, the jumps did not fly in the right direction or there was insufficient power in them. It was possible to repeat the jumps twenty, thirty or even a hundred times. Already, in one night, they could concentrate on correcting even a significant mistake in style. The coach could look at the jump from the side and videotape it. Coach Lajunen videoed the jumps in their living room, examined them frame-by-frame to identify the mistakes and which way the effort was being directed.

Lajunen team's example is about practical innovation that helped to improve the training. It started from the need to practice more high quality jumps and, at the same time, to free a jumper from dependency on the trainer being present during each practice. Furthermore, this practical solution freed the coach to coach. Ordinary mattresses produced mistakes to a jumper's position but these soft mattresses did not do that. In the interplay with the mattresses they learned to notice that the same mistakes that take place on the jumping hill follow to the mattresses and vice versa.

The sparks happened when the need to find a solution emerged. Then trials followed with mattresses. The trials required interaction between the coach, the jumper and the artifacts. The idea of improvement and finding a solution emerged when analyzing the situations, finding the problems and probing the possible solutions. When the solution was found and the stack of mattresses was built at home, further benefits for their use were found.

The sparking moments had place and time and these moments followed each other, influencing each collaborator's mind and developed their further interaction and usage of the kind of training method.

5.3.3 The development of philosophy – Four stage training program

The example of team Viren is about building the whole training philosophy by Haikkola. This example shows how the insight builds gradually in collaboration. Haikkola described the Four Level Training System in this way:

> "My coaching system is a mixture of Arthur Lydiard, Mihaly Igloi, Percy Cerutty and Paavo Nurmi. The marathon type of running, that is, long aerobic runs I owe to Lydiard. From Igloi I took the so-called wind sprints. One runs a fifty meters burst, then jogs for fifty meters, runs hard for fifty meters and jogs again – and so on from two to five kilometers. To Percy Cerutty I am in depth of mostly uphill running. It is true that Cerutty used sand dunes, but there is excellent terrain for uphill sessions near Lasse's home. Cerutty also wanted his runners to train three times a day; that was very import to him. From Nurmi I took the technique of continuous runs at a steady pace."

This chain of small sparking moments led to the development of the whole training philosophy (Figure 15). The philosophy was based on the idea that each practice needs to develop the body and the mind towards becoming a winner. Therefore, the training was built with many variations of impulses to the system in order to

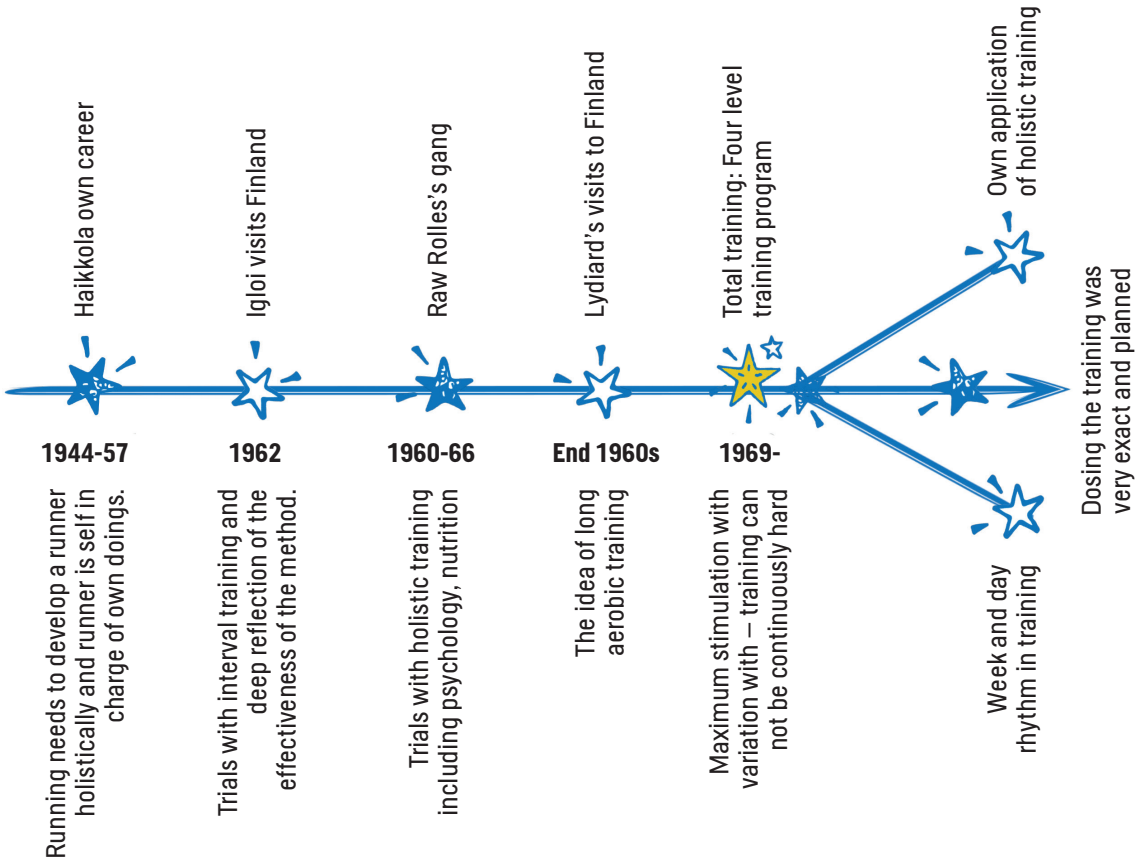

Figure 15. Timeline of sparking moments in forming Haikkola's training method.

maximize the effect of total training. The training was handled as a holistic process but each detail was thoroughly considered. The steps towards building peak performance required letting go of the earlier assumptions, including the prevailing beliefs of that only hard training would bring the winning results.

The series of events leading to the holistic philosophy and the training system started, as Haikkola was an athlete himself. In his career Haikkola competed nationally at the top level gaining some creditable, international results. From his early coach, a philosopher Eino Leino, he developed a strong foundation for his training method:

> "Do not wait that someone does something for you, but start with the idea that you have to do it yourself."

Leino pointed out as well that each athlete needs a trusted person at the side to be able to perform at the highest level. As an athlete then and as a coach later, Haikkola adopted Leino's ideas: an athlete needs to take personal responsibility and the coach is the trusted person working in the assisting role, supporting alongside the athlete.

From his later coach, Armas Valste, Haikkola learned that a winning runner needs ability and preparedness to perform, intellectual capability, knowledge and experience. He understood that all these areas linked together and needed to be improved in tandem with each other, and, therefore, there were never two similar training days a week in order to constantly stimulate the body and the mind.

From his own experiments, Haikkola also learned that tiredness cannot be avoided in long distance running, but if the runner learns to go past the feeling of tiredness, there is still another stage when running becomes light. To get to this stage, the runner needs a strong, it may be termed iron, will and a high tolerance to pain.

These areas needed to be included in the training as it was of the utmost importance that the athletes' minds had been prepared, almost constructed, in such a way that they could tolerate the demands of reaching this stage.

With these learning in mind, after his own career in 1960, he started coaching at club and national level and formed the so-called Raw Rolle's Gang, the team of seven Finnish long distance runners training purposefully, systematically and with lots of humor. Haikkola tried, with the runners, his ideas using his own learnings as a foundation, and understood already then that the first task for a trainer was to learn to know the athletes well, and build mutual respect. Only in that way the collaboration could work.

In 1962, the world-famous Hungarian coach Mihaly Igloi, was at Vierumaki for a couple of weeks to teach Finnish runners. Haikkola also went there for a week, and thereafter tried out Igloi's learning in practice. He followed Igloi's training schedule and ideas for two years. Every day, he stood on the backstretch of a track, when "Rolle's Gang" was training, and every day was interval training.

The experiment revealed that Igloi's method was good, but not suited to

Finnish conditions, for the cold weather and slippery roads of winter. After this trial Haikkola decided to take the good parts of the training method and adapt them to Finnish conditions. Igloi's ideas produced, however, one of the backbones of Haikkola's four step training method.

With Rolle's gang, Haikkola reached a good national level, but none of the athletes reached the international top level. Slightly disappointed, Haikkola took a break from training in 1966 but restarted again in 1969 with Viren. During his pause, Haikkola had learned that training hard, continuously hard would not bring the best results. He needed to adapt his philosophy again.

In the meantime, New Zealand coach, Arthur Lydiard, came to Finland to work in helping to raise Finnish running from its lowest point. Lyrian added to the Finnish coaches' know-how and awareness the need for long aerobic runs. This was also an important addition to Haikkola's knowledge. He understood and learned that anaerobic training eats up the resources 19 times quicker than aerobic training, and therefore aerobic training needs to be set as the foundation for a training program. Another corner of the method was added.

The pause from coaching matured Haikkola's idea of the Four Level Training System. Total Training, as it was called, was a holistic training approach, a philosophy, which consisted of physiological, anatomical and psychological training as well as a very discipline approach to nutrition. One leading idea of the system was to give very often stimulus to the body to affect the physiological and psychological changes in it. It was built with the aim of preparing an athlete mentally and physically to win in competition.

In general, the Four Level Training System did not so distinctively differ from the knowledge of the contemporary Finnish training of the period, but was still quite different in the way it was implemented. It followed a daily rhythm instead of the training being planned and organized in three-week intervals, which was the trend at the time in Finnish duration sports.

Proportioning the training was very exact and planned, both in terms of quality and quantity, using exactly calculated percentages from the maximum heart rate level to be sure to use the resources optimally.

The philosophy contained a strategy for training and a tactical plan for competing. Each level of the four-level training system had its own purpose and all of them were needed to steadily build the athlete towards winning. Essential for the method was strengthening simultaneously the athlete's attitude, will, positivity and ability to cope with stress. Haikkola noted that many trainers concentrated on a single aspect and area of the training and did not see that developing an athlete is a holistic growing process, where intrinsic motivation is at the core.

When Viren started with Haikkola, he had already trained systematically for a few years and won the Finnish nationals. In the beginning, the two agreed on the system and the way of training. To start the collaboration, Haikkola worked for three months to outline an exact plan.

Then the plan was modified together with Viren to fit with Viren's life. Finally, they together agreed on the execution. After these preparatory steps, the execution was closely monitored and followed, as they were both aware that only with exact information could they build the training further and learn exactly how Viren's body functioned.

Looking back to forming the philosophy, the creation of this system had many triggering events of collaboration that developed Haikkola's thinking. Experimenting with his ideas with various athletes helped to transform knowledge to knowing. However, the creation of the Four Level Training System emerged from bits and pieces gleaned over the years and required many peoples' creative ideas to merge. In this way the chain of sparks constructed the idea and organized the mind to see the complete process. The trials and interaction with various athletes as well as interaction with fellow coaches offered windows of opportunity for idea construction.

After forming his Four Level Training System, putting philosophy into practice required courage to execute it without compromising when meeting resistance. Haikkola trusted his view and did not let anyone or anything interfere with the idea. He recalls the obstacles and resistance at the time:

> "I had sports medical science against me saying that that could not be done. It was challenging for me. Luckily, Viren was ready to try his limits."

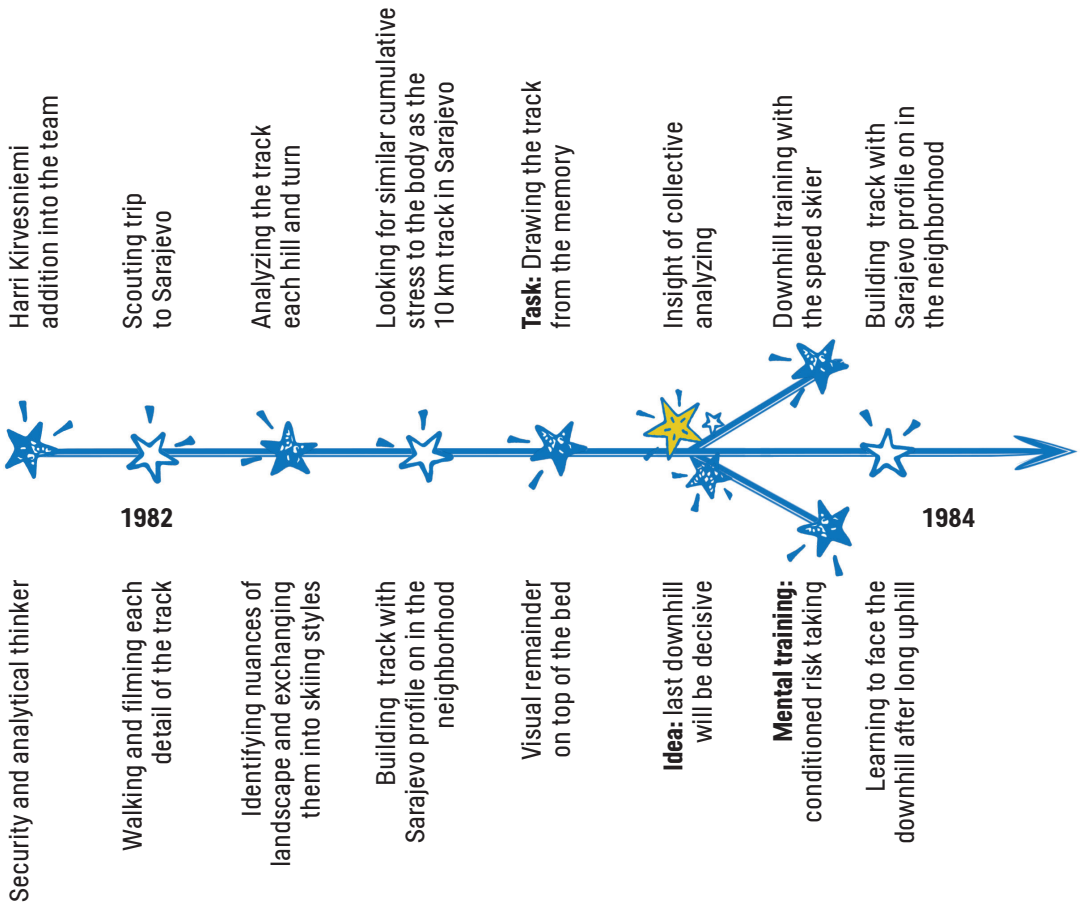

Figure 16. Timeline of sparking moments in Marja-Liisa Kirvesniemi's preparation to Sarajevo Olympics.

5.3.4 Predicting the future – Finding a unique preparation process

Long before the Sarajevo Olympics, Marja-Liisa started the preparations for winning the first competition, the 10-kilometer race. Of course, her whole career had prepared her to win, but when the track plan was published one and a half years before the games, the mental preparation and focus to this specific games started.

Prior to the extensive preparation, which started in summer 1982, Marja-Liisa had started to take more responsibility for her training, and attended a trainer's course to understand better her own coaching. She also got a helpful addition to her training team as Harri Kirvesniemi, a fellow national team member had entered her life as a boyfriend and this relationship brought to the team one more analytical brain, a thorough thinker and a close person to collaborate and trust. The thinking process preparing for the Sarajevo Olympic games is presented in Figure 16 starting from this stage.

In summer 1982, the Finnish National Team skiers visited the Olympic site where the foundation for the tracks had already been prepared. The team had found a slogan: "All out in Sarajevo" and were now hiking the trails and making detailed notes in a manner similar to how rally drivers prepare in advance for the complexity of the course. Harri and Marja-Liisa took photos and made exact notes of the landscape carefully taking note of each little feature.

Back home the track maps, the memos and pictures were analyzed in detail, and the team got the first sparking moment when they found that the 10-kilometer track even, which looked harmless on the trail plan was actually tricky. What looked like a recovering downhill, in fact had two difficult ninety-degree turns not allowing a skier time to rest. Harri with Marja-Liisa and her coach Repo interpreted each change in the course layout, and how they might affect recovery and the style needed in each part. The notes were translated into physical training focusing on how to change the skiing rhythm and style effortlessly when the landscape altered. They planned how to train the specific bits, and designed the training program to prepare the body to tolerate the cumulative stress this track would produce.

The second spark came when the track was analyzed and they decided to duplicate track near their home. They searched for suitable landscapes in their neighborhood and prepared a track that simulated the Sarajevo 10 kilometer trail. The first trainings were done on it a year before to accustom the body for the coming event.

The special mental training was designed to take advantage of the explored information from the scouting trip and pre-Olympic games. Marja-Liisa skied, in her mind, the 10-kilometer track over an over both during the training and when lying relaxed in her bed. In the end, the track was like a video in her head that she had replayed countless times. The track was burnt into her mind with the help of special mental training, one more spark on the way.

At a camp for skiers, the head coach of the national team Immo Kuutsa, gave them an assignment to draw a detailed plan of the Sarajevo track from memory.

Marja-Liisa got a school score 10+for this assignment. She hung the drawing over her bed with the official trail plan to give her mind visual stimulation.

The next spark, being the major spark, happened when Kuutsa got an insight after analyzing the track repeatedly. The difficult downhill part, only a kilometer before the finishing line would be decisive for winning the gold medal if the 10-kilometer race was tight. The downhill was planned straight after a long uphill part that had created a tremendous build-up of lactate acid.

As a tall skier, with long limbs, Marja-Liisa was hesitant and not exactly at her freest on the downhill parts. Special trainings were planned for this part on the home trail. This included technical skill trainings, condition training as well as mental training.

A further spark came when the coaches and the mental trainers tried to find a way to make sure that the mind was ready to give orders to the body if the race was tight. A triggering slogan was created in order to not hesitate but to go downhill with full speed regardless of the head being blurred by the accumulated toxins.

The slogan was: “Impressively to victory or shockingly to the bushes.” One idea of this plan was also to take the responsibility for this decision and also the possible media blame of Marja-Liisa if she fell down while taking the risk. The coaches promised to take the blame if she fell. To automate the mind with the slogan, Marja-Liisa was daily in her mind’s eye going through the command saying to herself the keywords, and skiing the hill with full speed. Only this message for the mind in this specific moment was rehearsed in approximately 90 separate mental training periods.

The preparation for the last downhill also included training with the Finnish speed skier Häkkinen. Together the duo went through how to move the skies and maintain balance at full speed. At the end of these rehearsals, Marja-Liisa gained more courage, and gained experience in the downhill sections.

In Sarajevo, in the actual race the Soviet skier, Smetanina, was only two seconds after Marja-Liisa, and closing the gap in the uphill before this decisive downhill. As planned before, if the race was tight, the coach who was giving the last interval time said the trigger words to stimulate the blurry brain to take the risk in the way practiced many times.

Marja-Liisa skied the whole downhill slope without braking and mastered the turn, whereas Smetanina came down the hill in a more cautious skiing style and Marja-Liisa finally sealed the victory by over 18 seconds.

This preparation needed reflection, collaboration, observing the terrain and knowledge of the other competitors. This all affected the knowing as to how each part needed to be trained. The training program was crafted with all this knowledge and then ambitiously executed in a way that was only possible for a highly motivated athlete.

The sparking moments happened in the chain one after the other. With constantly seeing more and more new, insights

became possible. They appeared through interaction with people, environments and equipment in a systemic way where the solutions were found collectively but could also be tracked back to certain specific moments that had place and time.

5.3.5 Creating an own approach – Finding the own strengths

Karppinen started to find his personal style early in his career. The idea of economical movement was the guiding light throughout his career. The insight how that was reached came together piece by piece when applying training methods innovatively. The innovative application with the sparks is presented in Figure 17.

Already as a boy, Karppinen was very competitive in whatever he did. Competing against older boys and faster and, pushed him to his limits and to figure out how to win. He got the idea to try to row as economically as possible and save energy with each stroke in order to keep up. This started the way he approached rowing ever after, focusing on being strong and steady. He was trying to stylize each stroke to gain those centimeters needed to win at the finishing line. The major spark early in his career was seemed somewhat insignificant at the time, but decisive in everything he did thereafter. After winning gold medals his rowing was analyzed in detail East German training literature and pictured Karppinen as the ideal of rowing with an economical style.

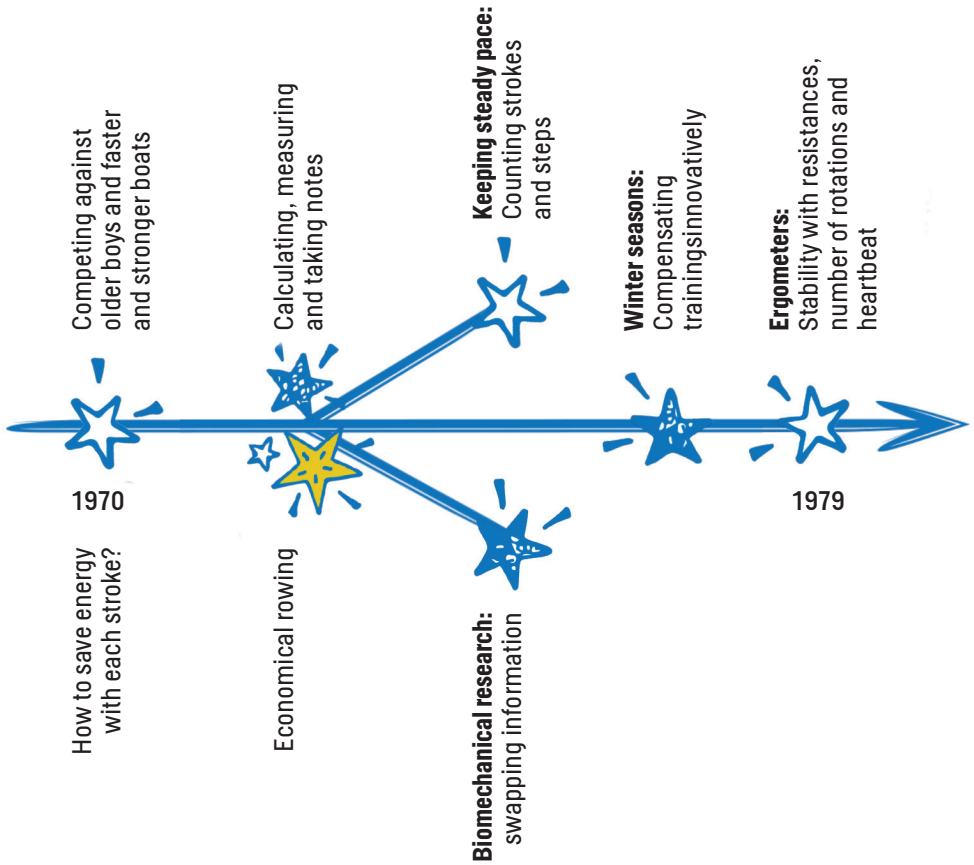

Figure 17. Timeline of sparking moments in Karppinen's way to be the most economical rower of the world.

The better he became, the fewer good sparring partners were available to compete with him equally and stimulate him to push harder. After rowing, against duplets, he needed to invent opponents for himself. He started to use counting to become consistent. He counted his steps when running and strokes when rowing. He used landmarks to measure how many steps or strokes there were, and tried to keep a steady pace regardless of the wind or storms. Even if counting the steps is not such an unusual activity, Karppinen used this as the way to compete against himself and pushed himself systematically towards economical rowing. To keep a consistent pace and to stimulate each training, he calculated time and distance of all his training tracks, counted moves, measured his heartbeat, and used diaries to mark all the information down, even his daily weight.

> "I had a place where I measured the speed and heart rate. I tried to get a certain heart rate zone and slide the boat so that it takes 20 minutes to the goal, which was a church. I had to apply these kinds of things as I rowed alone."

During the winter he had a chance to row in a pool three times a week. He was staring at the clock on the wall, calculating the strokes and estimating when the clock's arm would make a move again. Concentrating on the rhythm, he learned to have a very good feeling of how long each stroke lasted. Calculating also helped to get over the exhaustion and keep on focusing.

As the winters are long in Finland and Karppinen was competing against the rowers from the countries that had a possibility for year round rowing he needed to figure out substitute training methods. Not letting this constraint slow him down he got a sparking idea. In order to imitate the rowing moves, he invented squats combined with pulls that he could do at home. He did these moves in intervals of 240 as that was the amount of strokes he used in 2000 meters. At the same time as he performed these moves he thought about rowing combining in this way the moves with mental training. This series he repeated again and again and said that this exercises probably also left a mark on his style of rowing.

With calculating, measuring and concentrating, Karppinen learned to know exactly how his body reacted when rowing and he sought the same with other tools as he needed to find a substitute for actual rowing.

For example, Karppinen adopted an ergometer as a training tool. Ergometers were new then and used mainly for testing and not for training. Again, a spark appeared and he decided to re-apply the testing equipment to his needs in training using different resistances to reach a certain level of heartbeat and then calculated how many rotations he could do. He scribbled down each measure to adapt the equipment to his needs. Also, by measuring and exactly recording he could follow the development of his condition, year after year.

In Montreal, winning for the first time, his calculations in trainings also came in use in competition. He had calculated that from a certain landmark there was 250 meters to the goal and at that point

he could add one more gear. He also knew the point at which the 10 last strokes to the goal started and there everything left was put into action. In the final, he accelerated past the West German, Kolbe with those last strokes by keeping each stroke steady and economical, concentrating on his own rowing rhythm but adding an extra gear to power production as he had done in training for years and in his head each evening.

In Finland, rowing know-how was limited and therefore Karppinen needed to build the knowing in bits, adjusting training methods to his needs. The major spark of rowing economically lasted throughout his career and he got many other sparks when inventing substitute training methods specially to overcome the long winter when rowing was not possible. As he himself said, hints for improvement were everywhere. He got help from several coaches, for example the Norwegian rowing coach Tor Nielsen did biomechanical research and gave Karppinen valuable information to stylize the strokes. Also, several other coaches helped him making the training programs and building the foundation for the powerhouse. Throughout his career he continued to strive to make his strokes more economical and to make his body stronger to do steady strokes. He was also determined and creative in finding ways to compensate the lack of sparring. Focusing on calculating and training mindfully, Karppinen became the world's best in economical rowing and also a master in concentration.

6. Discussions and conclusions

In this part, using the results of my empirical study, I will discuss how the findings contribute to current understanding of becoming excellent in sports and how creativity affects this process. I also discuss how these findings contribute to other areas of life where excellence is sought and creativity is necessary.

Based on the empirical study, I formed two propositions as answers to my research questions that were presented in chapter 1.5. and were as follows:

1. **Which factors and processes built multi-times Olympic Champions to become uniquely successful?**

2. **What role does creativity play in becoming an exceptional expert in sports?**

To begin with, in chapter 6.1., I will show the theoretical contributions of the study. Chapter 6.1.1 will give the answer to the first research question with proposition one. The first proposition brings the whole developmental process together as a spiral that evolves through the athletes' whole careers. Chapter 6.1.2. will answer the second research question with proposition two describing the collective nature of the creativity and the creative sparks.

Chapter 6.2., moves to discuss the practical implementations of the study for coaching and leadership. Chapter 6.3. looks back to this study and reflects on the validity of the results. In chapter 6.4. some ideas for further research are suggested.

6.1 The way to become an exceptional expertise of Olympic Gold Medallist

This research studies the long-term development of exceptional expertise in sports and states that it is a cumulative cyclical spiral that has six factors linked to each other. These factors are: 1) questioning and playing with the thought, 2) insight, 3) systemic applications, 4) faith in self, 5) inner drive and 6) persistent work. The factors have been studied separately, some more intensively some less so. How they all link together has not been presented before.

This study also states that the development of exceptional expertise in sports requires creativity. Until now, researchers have hardly paid attention to how creativity links to the long-term development of expertise in sports. This study shows that creativity has an important role in forming a unique insight and this insight affects the quantum leap necessary in making the transition from ordinary expert to extraordinary. This insight is crucial,

however, the other factors of the cycle are all needed both in developing an insight and in putting it to practice creating a system with many affecting aspects.

6.1.1 The cumulative cyclic spiral of six factors and sparking moments

This study shows that the process of becoming excellent in sports evolves when a cumulative cycle of six factors spiral reinforcing the other factors. During this process, collaboration with significant others and the world around gives fuel to creativity. Creative sparks occur in interaction with other people, equipment and environments, bringing new thoughts and angles into the process of development and furthering the construction of thoughts and reorganization of the collaborators' minds.

This study argues that creativity manifests in sparks that contribute to building a unique insight. The sparks disrupt and slightly change the future actions and development affecting the process of becoming exceptional. These kinds of moments of sparks, or burst of sparks, follow in the chain and therefore the idea formation is a process, rather than ideas appearing out of the blue. During the development to become excellent, chains of sparks emerge when ideas are elaborated on, building the comprehension of what needs to be done and what is crucial. The dynamic process evolves thinking as new knowledge and understanding brings new viewpoints and builds the picture constantly further and further. Sparks might be small, when a new element gets added into the previous thinking or a major disruption that changes the point of view from which one sees the whole. A major disruption is a series of a little sparks flickering before this happens.

In other words, the deepening understanding, forming an insight and building knowing is a cyclic process that is creative, and the result of years' puzzle-like work. In this mindful process, or rather a system with many contributors, the teams and their members construct their thinking both alone and together, constantly reorganizing their inner as well as interactive processes. Due to the reorganization of the mind, disruptions happen and new ideas become available forming insights in a continuous process. Each disruption, a little spark, affects the further approaches individuals and the team are taking on the path to excellence. Therefore, the sparks occur in a process where knowing is built, when outside input triggers the knowledge previously stored in the mind and emerges forming progressively, bit by bit, a person's insight and vision. Putting this insight into action affects the development in such a way, which leads gradually towards excellence. I argue that these small sparks make the difference between good and great, in combination with the six factors spiraling.

This study shows that in sports, creative thinking helps in finding and building unique ways to develop and use resources available and is crucial in the development towards greatness. As a result of these findings new aspects are brought into the research into expertise in sports, as creative thinking has not been linked adequately with the process of sporting excellence before. The findings also offer new insights that can be relevant and applicable to development of excellence

in other areas of life outside of sports. In combining the process of development and creative thinking, this research also sheds light on the connection of the physical and mental aspects of training with knowledge creation and building of unique insight.

Proposition 1: To become excellent is a cumulative cyclic spiral of six factors: questioning and playing with the thought, insight, systemic applications, faith in self, inner drive and persistent work. In the course of spiralling, sparks occur and lead to innovative practices. These innovative practices lead to exceptionality.

The gradual development process of expertise

In this study, the athletes' process of reaching greatness was gradual rather than instantaneous. The deep understanding of how to become a champion was for the athletes' teams, a learning and searching process that flickered little ideas that shaped the direction, view and training. These little ideas were like small waves that affected the system to change, creating new approaches, new knowledge and knowing thus enlarging the collaborators' personal view and insight.

When the cycle of six factors spiraled, new questions arose, learning happened, and little sparks of insight twinkled (Figure 18). These sparks that got birth from unanswered questions or constraints, and

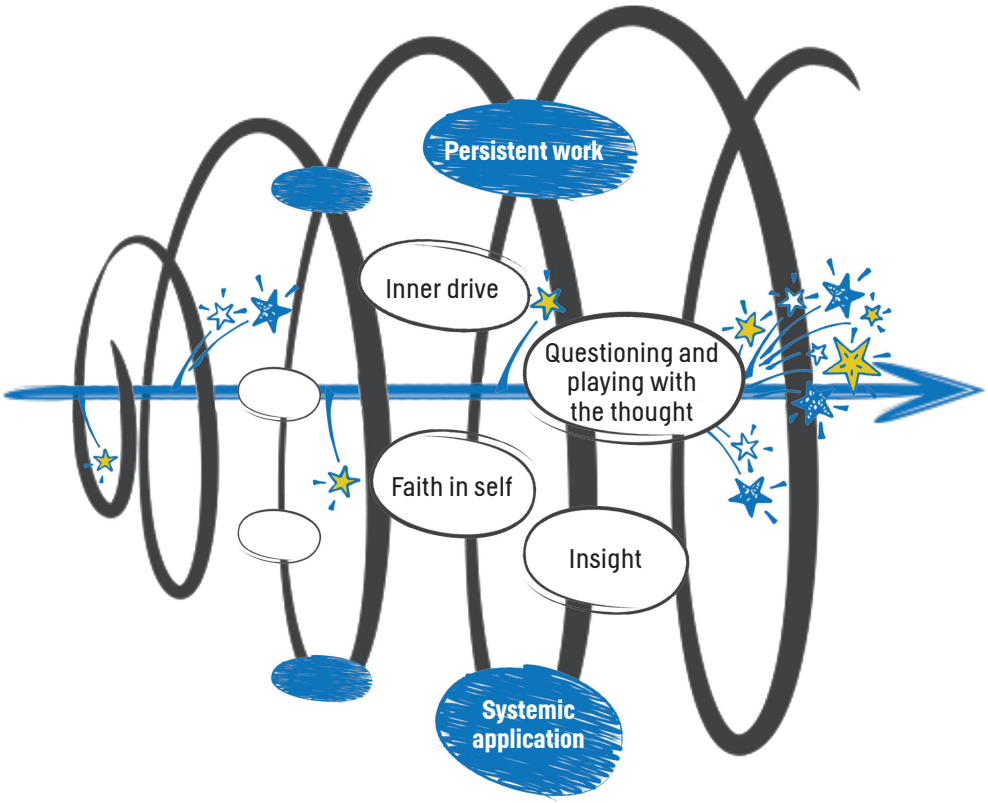

Figure 18. The cyclic six factor process producing sparks and building excellence.

were affected outside or/and inside stimulus, were the game changers, that led to innovations in training and competing, and further to the development from ordinary expert to becoming great. In other words, in the cumulative cyclic spiral the six crucial factors reinforced each other affecting the Olympic athletes' development enabling them to become outstandingly successful. This is in line with Hopsicker (2011) who found that becoming a genius in sports requires extensive skill, risk taking and dwelling. Dwelling meaning that an expert, based on experience gained, intentionality and in the split of a second knows what to do next as well as has more solutions to the challenge. This study presents an additional way of looking at the same phenomena of building excellence in sports and presents a cycle or six factors. As a result of these six cyclic factors spiraling, collaborators moved year after year deeper and deeper in knowing with the sparks shifting the way in a unique direction.

When describing the process in general, searching for answers to emerging and unanswered questions pushed individuals and their teams towards productive inquiry that in turn built blocks, which helped in solving the questions which had arisen and otherwise strengthen their, and their teams', views.

In this search for answers to the puzzling questions, little sparks flickered bringing fresh thought to the fore when both the conscious and subconscious minds were working, building a more detailed picture, a clearer insight, and a more individual view of how to excel. This picture evolved like a puzzle that came together over the years, one piece at a time when being actively involved with the task constructing one detail after another whilst at the same time keeping the big picture clearly in sight.

On the way to excellence, the evolving insight acted as a guideline for decisions, knowing what to do, transforming the insight into actions, being able to structure the steps required into the training programs, making individual plans as well as helping to keep the personal vision clear. In order to execute the plan, it required trust in self and own abilities not to compromise the vision regardless of the inner doubts or resistance from outside. Individual's inner drive produced the will and determination that energized the persistent work to improve, develop and progress towards mastery. When inner drive and persistent work combined, they pushed towards new heights, producing new questions and the urge to explore and to reach further competence.

Questioning and playing with the thought

The athletes and their team members in this study spent lots of time and effort in thinking and in creating understanding of what they needed to be doing. This required the ability to deeply reflect on their own movements as well as realize their own strengths and weaknesses. But it also required being knowledgeable of all the details and aspects of their routine and competition. This understanding grew over the years through experimenting and in active knowledge seeking, which was similar to what Cook and Brown (1999) called productive inquiry. The search happened in the specific areas and topics the teams felt they needed additional

information in, to fill the gaps in their existing mental model. This kind of search happened actively but also serendipitously. They were constantly searching for answers and sometimes things that seemed to be irrelevant or minor also linked and added the missing bit and cleared the picture in the mind. Because of productive inquiry, the odds for serendipity were greatly increased.

This kind of serendipity is reminiscent of Cohen et al.'s (1972) "Garbage can theory" in which ready solutions are looking for answers to be solved. When the right "garbage" is found, the question gets answered. As in Marja-Liisa's case the team looked for other domains, speed skiing, for solutions when the downhill part was seen as decisive for winning at the Sarajevo Olympics or when Pulli, Nykänen's coach, developed ski trails with refrigerator manufacturer to ensure summer training, or when he figured out the mystery of take off in ski jumping with the help of Einstein's theory of planets.

Reframing a problem led sometimes to a sparking moment, which brings to mind Walinga's finding that the innovations often happen "in the question end" (Walinga 2010). Often, experiencing an impasse assisted in the reframing of the original question and from this differently phrased approach came sparks which cast new light onto previously held knowledge.

For example, Lajunen's old mattress –solution was developed to rehearse the flying position in off-hill-trainings of ski jumping. The mattresses allowed the athlete to not be afraid of hurting himself in landing and therefore allowed the position to be kept unmoved. Questioning the training method and seeing its faults aided in developing a more suitable way for practicing take off and flying.

Sparks – a link between the questions and insight

The little sparks that contributed to insightful and unique thinking occurred unexpectedly when the mind linked stored but not previously connected thoughts with each other or when a new idea was connected to previous thoughts. These kinds of sparks were the result of a conscious thinking process or/and when letting the mind wander as explained by Sawyer (2011b). In this process, the mind reorganized the thoughts in a way that comes close to the explanations given by Beebe and Lachmann (2002) when studying infants' development. Stimulations, like collaboration and interaction with other people, conditions, equipment and environment, influenced the constructing and reorganizing of the mind, creating sparks that affected further thoughts, actions and interaction.

In this way, the little sparks slightly influenced the learning and knowledge formation in a special way, gradually moving and shifting the teams to their particular and unique direction, towards their own way of practicing and performing. Sometimes, the changes at the time were so minor that they went unnoticed as such, however, these sparks were pivotal and became visible in performance, even if their birth process was sometimes hard to distinguish from the whole.

Insight

Csikszentmihalyi (1996) pointed out that it is a skill to see what is a good idea and what is not. Not just any solution brings success. Kahneman (2003) found that experts make better intuitive decisions than non-experts and with training they come to see more than the rest of us. In this way, the training and becoming constantly better enabled these teams to see more and solve such problems that others were not even aware of. Therefore, the spiral of six factors moved constantly forward and the teams and individuals got to see more and more aspects to be improved, and insight was then gradually moulded.

With the developed expertise these individuals had access to information that others did not have and they also trusted themselves to use this information being sometimes even resolute in their view. Simon (1992. pp.155) described:

> "The situation has provided a cue; this cue has given expert access to information stored in memory and the information provides the answer. Intuition is nothing more and nothing less than recognition."

The development of a unique style as explained by Locher (2010) and Weisberg (2004) helps to explain the gradual process of forming the exclusive insight. Both Locker and Weisberg described how the crafting of a painting by a pictorial artist was the result of many loops of solution searching and finding. In these studies, the artists were focusing with their eyes on one part and detail at a time pausing every now and then step back to look at the whole picture but returning to perfect the details. The athletes and their teams, in this study, worked in a similar way keeping the big picture in sight and training holistically but concentrating at certain times, specifically on perfecting some parts, or even details, of a performance while enhancing the whole.

Systemic applications

The experts in this study trusted their intuitions, which were developed through practice as well as the years spent strengthening themselves with the six factors. They could apply their vision into their actions, practices and training programs. Insight, which was in mind, was transformed to practical steps, rather than being a theoretical construct solely contained on an abstract level.

The systematic application in training was demonstrated in all of the cases. For example, after Marja-Liisa's team got the insight that the last downhill section would be decisive, extensive trainings were designed to make sure that in the actual race she could realize the knowing. Viren's case demonstrated how the comprehensive philosophy was applied in detailed training plans and systematically applied and followed. Team Lajunen had quite a different approach to training than team Viren, pointing out the individual choice in order to nurture the self-efficacy. This philosophy, although quite different, was again systematically applied, followed and adjusted as the insight developed.

In competitions, the holistic insight gave the ability to use, access and in a split second put the knowing into action. These

kinds of examples of intuition applied in actions were, for example, Viren's fall in the Olympic final when he without further thought rose and won the race in a world record time, or Nykänen's unbelievable ability to jump in all kinds of weathers, including heavy fog. In the World Championships in Oslo, Nykänen was able to use his instinct and to improvise, as well as make decisions using reflective thinking, exploiting knowledge and the information available at that moment, the situation to hand and within him. What looked like magic or even mad to outsiders was actually deliberately worked on over the years to become second nature.

In this way, these champions and their teams were far ahead and had solved problems the others did not even know existed and furthermore were able to put them into practice.

This is in line with what Hopsicker (2011) described about how genius in sports could use intuition and imagination and tap spontaneously into the highly developed knowledge base to find different solutions to the task at hand. He explains how, in a split second, one resolution stands apart as the "best" course of action. The capacity to be sure of their own view was then the result of extensive knowing and a wide "database" contained in the mind.

Faith in self

Together with insight and systematic application came faith in self which allowed these athletes, as well as their teams, to trust themselves and to follow their insight, intuition and apply them without deviation in any detail, across the board.

Even if each of these teams had drawbacks as well as outsiders trying to affect their way of living and training, they remained true to themselves not giving in and compromising their view. This kind of behavior, however, sometimes led to negative consequences, like social remoteness, resistance from others, or feelings of distress. The findings in this study resonate with the studies of mental toughness (Mahoney et al. 2014a, Crust, Clough 2011), where mental toughness is the ability to keep on going for a long time regardless of setbacks, being able to take oneself continuously to one's own limits and in the ability to follow one's own plan a hundred percent.

Even if these athletes appeared stubborn at times, they were humble towards their task, productively inquiring and listening to advice, while at the same time, listening critically and mindfully, choosing whom they trusted and what they applied. As Haikkola said about Viren: "He would not have accepted any nonsense."

Inner drive

Inner drive was the motor for all, for practicing, for thinking and for daring to trust themselves. The inner drive strengthened the training, was the fuel for pondering, getting sparks and developing personal insight. It also pushed towards having faith in applying own ideas into the practice.

Motivation was deeply internalized, giving pleasure, positive feelings and peace of mind. For some, sport was also a motivation to connect and find their place in society, to feel related to others. The theories of intrinsic motivation and

harmonious passion (Deci, Ryan 2014, Amabile, Pillemer 2012, Ryan, Deci 2000), and the need for autonomy, relentlessness and competence explaining the human energizing force, are in line with this study.

Persistent work

Persistent work is the obvious and the most discussed element in building a champion in sports. This study also shows that persistent work is mandatory and these athletes, as well as the team members, demonstrate this vital part of the cycle involved in becoming the best. To produce habits, repetition and deliberate practice was needed (Ericsson 2013a, Ericsson, Krampe & Tesch-Römer 1993a) to make changes in the body, the cells and even the genes as explained by Johnson (2013). Persistent training included a holistic approach to entire life in its entirety and, therefore, it contained a whole lifestyle with sleeping, eating, resting, studying or working as well as creating a balance in life, everything to support the training.

Each team was very aware of the quality of the training and the necessity to continuously search for a better understanding of themselves as well as possible ways of improving the training, which again led to searching for new questions and answers, the coaches being impassionate about exploration.

The cyclic process

The cyclic process was somewhat similar to Bateson's (2000) deuteron-learning or triple-loop learning as the experts learned to learn over time, and learned capabilities acted as the foundation for new learnings. However, the questioning and searching for answers, through wondering and inquiry in building an individual insight seemed similar to Kolb's (1984) experiential learning; where understanding was built through exploring, and where exploration, analyzing, decision-making and acting formed a cycle. In a way, this study demonstrates two types of learning, learning new habits, and learning new views and insights. The first was done by practice where the body is habituated, and stressed to be able to work in many situations automatically and to its maximum. This work is the result of years of work when new aspects are assembled bit by bit and automated into previous capabilities. Automation freed time for further deliberate thinking, active exploration of new aspects and experimentation in the way Kolbe describes.

It is important to stress that each of the six spiraling factors were equally valid. Even if the sparks of insight facilitated new knowledge creation, the innovative knowledge had to be implemented and worked on so that it became a habit. An enormous amount of time spent in practicing, was powered by inner drive and passion, the motor that kept the cycle spiraling for at least ten years as noticed already by Simon et al. (1973). Determination to win and to be the best, as well as finding and navigating the way towards the goal past constraints and difficulties, required mental toughness.

6.1.2 Collective creativity process in building breakthrough success

Despite the growing process of becoming expert being an individual process it is constantly affected by the sociocultural stimulation and involvedness. In interaction with different people, the participants get stimuli from each other that induce thinking and construct the interaction. This collective effort brings to the individual's creation of knowing a systemic nature and makes the lean specialization process complex and collaborative as explained by Hakkarainen, Sawyer as well as Beebe and Lachmann (Hakkarainen 2014, Sawyer 2005, Beebe, Lachmann 2002).

In this study, it became evident that many minds contributed to insightful thinking on the way to building an Olympic winner: the athlete, coaches, other athletes, doctors, psychologists, and scientists to mention just a few. Through collaboration, these significant others offered new viewpoints and added features to others' insights. In this way, the collaborators ideas and vision grew when interacting with each other. When the ideas were bounced between different people in a manner that Cook and Brown (1999) called generative dance, pieces of new information were added and linked thus, bit by bit, creating new knowledge and knowing as described by many researchers (Nicolini 2011, Newell et al. 2009, Cook, Brown 1999).

This study shows that the process of becoming an exceptional expert is inductive, where the cycle of six factors constantly built the foundation for the next bit to be added. When the collaborators become better and better they have the ability both to see the new seeds for sparks and to be able to exploit them.

> **Proposition 2: The creative sparks emerge through collective influence but contribute to the individual insight. Developed insight guides the way to excellence.**

Creative sparks in collaboration

Idea pitching happens in all kinds of interaction, in conversations but also when people work side-by-side or when they observe. Stimulation further induces novel associations, meanings, connections, and hunches that each individual adds to their own previous knowledge and knowing, which, again, induces further happenings and interactions. In this way, interaction offers building blocks for others involved in collaboration allowing them to construct their own vision. Accordingly, a scientist, a coach and an athlete built their own view further, at the same time as they offered others ingredients for their mind to process. Beebe and Lachmann (2002) describe in their study how the dyadic interactive process reorganizes inner as well as relational processes. The relational processes are co-constructed and reciprocal. In interaction, multiple ways of collecting information is used and some of that is beyond conscious awareness. In collaboration with different people, a person may find access to a very different portion of their own self (Beebe, Lachmann 2002).

During the back-and-forth exchange of knowledge and knowing, ideas are built further and further producing little sparking moments, the thoughts that are new to us. The

view is then a construction of our thinking and thoughts, a series rather than a single idea and a result of a chain of many collaborative events that form the representation we create in our mind. The events when sparking moments happen might be spatially and timewise remote, have pauses in between and often require additional work in order to be able to see further. Beebe and Lachmann (2002, p. 148) wrote:

> "Basic to representation is the capacity to order and recognize patterns, to expect what is predictable and invariant, and to create categories of these invariants."

From an individual's perspective, these sparks might include short or long collaboration phases, organizing and reorganizing the mind. The sparks happen in interplay with other people but also in interplay with environments and artifacts. In this way, these chains of collaborative events develop a system that continuously affects and is many sided in terms of both the collaboration and self-organization.

The chains of sparking moments were described in chapter 5.3. in more detail. A system of collaborations with sparking moments is presented in Figure 19.

Some collaborators are closer to each other than others, involving the implementation of new knowledge whereas some are more remote and occasional. Newell (2009) made a distinction between these two types of collaboration: bridging and bonding. Both of these ways can produce sparks and expand thinking, however, in bonding the collaborators work closely together to also execute the new ideas, whereas in bridging the collaborators contribute only to ideation. The athlete and the coach or several coaches usually form a tight execution team whereas, for example, scientists might bring some piece of knowledge to the team thereby

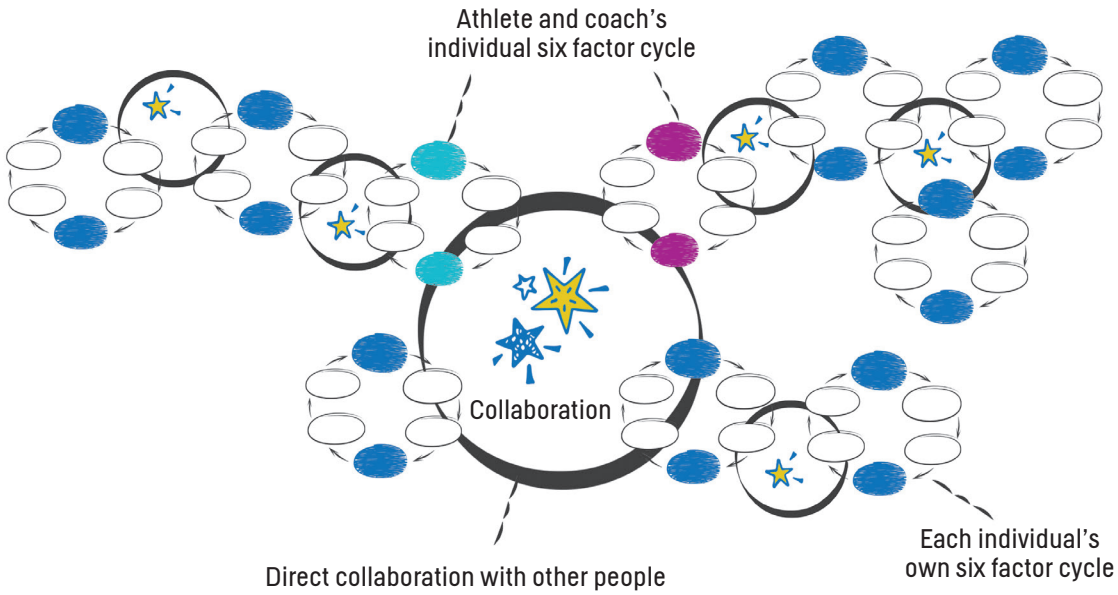

Figure 19. An example of a system of many individuals' collaborations with sparking moments.

creating sparks but would not take part in making the idea work on a day to day basis. For example, when Pulli was watching the program of Einstein it created sparks. The research team transformed the idea to further concepts that could work in practice, and finally, the intense work with Nykänen produced the final sparks in the chain.

In this study, the athletes and coaches could recall many situations, discussions and people who contributed to their thinking. The interviewees said that when working and discussing with other people they saw and learned many new things, got ideas, then reflected, tried them out and transformed them to fit into their own vision and way. After collaborating with these people, or being on camps and competitions, it changed and widened the way the team members thought as well as opened totally new viewpoints which gave additional components to enhance their further training.

Looking at the system from an individual's perspective, due to these sparking moments the further development took on a somewhat new angle affecting slight systemic changes. Following these chains of sparks, we can understand and follow how the thinking formed towards a unique perspective and how a new approach developed forming an exclusive way. In the presence of the other factors in the cycle of six factor-model presented in 6.1.1, the unique approach is gradually molded which progressively transforms an expert towards being exceptional.

To clarify, even if the sparking moments are collective, each collaborator brings their own expertise to the collaboration, works towards shared or/and individual goals and due to collaboration constructs their own individual expertise. This way the sparking moments build an individual's unique insight that is a distinctive combination of all the experience and knowledge the individual has combined

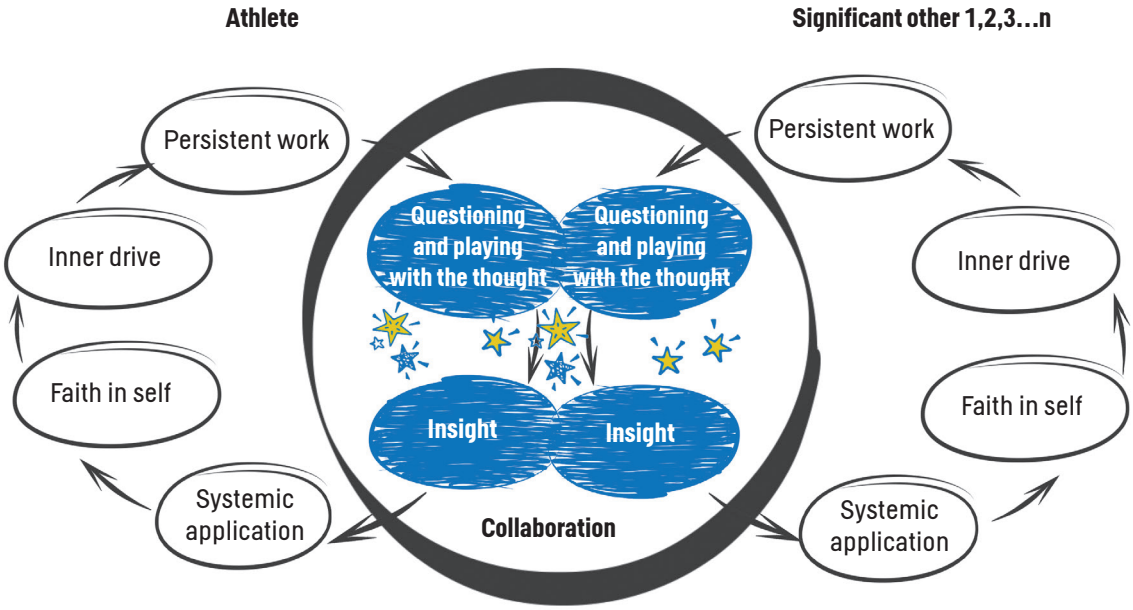

Figure 20. Collective creativity to build individual's insight.

in the own mind throughout their life. As Beebe and Lachmann (2002) mentioned, two processes happen simultaneously: reorganization of inner as well as relational processes. In other words, at the same time there is a collective transformation going on in addition to the individual transformational process. Each collaborator has a unique process in their own mind linking the previously stored knowledge and knowing to new information.

This points to the importance, quality and richness of collaborators in directing the development towards exclusive expertise, which is a result of collective influences. This individual process in collaboration is presented in Figure 20.

The picture distinguishes the collaborator's separate, yet, collective growing process pictured from the athlete's perspective. These separate processes do not dim the fact that the athlete's and the coach's insight of training and its philosophy had to be shared and similar, but two peoples' insight can never be the same. Even though a coach and an athlete worked very intensively and shared the philosophy, the coach was not able to execute the performance like the athlete nor could the athlete fulfill the role that the coach was performing.

To further explain, the studied individuals, athletes and coaches, had their own processes of building excellence. The seeds for sparks came from many places but required productive inquiry to sparkle. Small sparks affected slight changes in the direction of the learning process and the holistic insight the person gained. These, sometimes, minor changes of direction got started from questions that motivated exploration for solutions when new situations, improvements and viewpoints caused new questions to arise which, naturally, required answering.

Collective creativity

This study shows that creativity in sporting teams is a collective effort and being part of the culture of constant development accelerates participants' growth. In such a non-linear system, it is difficult to find any single creator or a simple explanation for creativity. As a result of this several expert growing processes often develop side by side, reinforcing each other. This is in line with what Hakkarainen et al. (2011) pointed out, in that how being part of a community of experts, with all that implies, and the expert culture acts as a source of elevation for individuals' development as learning happens in many ways: formal, informal and latent.

The teams in the study actively searched for expert communities and places that would encourage growth and generate ideas. Even though the teams were small, the team members vigorously looked for places for knowledge transformation with other experts, and also chances to become part of groups aiming to provide improvement, for example researchers or experts from neighboring disciplines. They accessed these communities intentionally and were not scared of visiting unfamiliar areas of expertise in order to grow. Sometimes they were lucky "being in the right place at the right time". After gaining access to such communities, the teams in this study did not hesitate to use their opportunities.

A person can have an access to many expert communities, like the examples in this study show. A sporting club may form such a community, a group of individuals may cluster around an excellent coach to share training and thinking, as well as competitions, both national and international at which experts gather together. The athletes and the coaches were not frightened or at least did not hold back from competing in tough competition with the best in the world as they recognized that competing with superior opponents pushed them further and away from their comfort zone offering enriching lessons about themselves, others and competitive situations. Being among such communities greatly advanced the process of building awareness and understanding of what others were doing, and what was needed to master the discipline.

At first these kinds of competitive communities were nearby and the rivals were local children, however, when these children could not no longer compete with or provide a challenge for them they actively looked for places to get stimulation. When there was no one around to spar with, they created challenges for themselves as explained by Karppinen who, for example, searched purposely for stormy weather conditions to provide a form of sparring partner.

All of the athletes in this study began to compete at a fairly early age at an international level and were therefore aware of what was required in the quest to become the best in the world. They enjoyed being in competitions, but beyond enjoyment they used contests, formal or informal, as places for learning. These shared moments with co-competitors collectively offered seeds for sparks to flourish. Collaborative moments occurred in expert communities, both on purpose and unintentionally, in which sparking moments were shared, in what might be termed, a dynamic symbiosis. For instance, an example of sharing sparks unintentionally happened in competitions when observing competitors' actions boosted the ideation.

The Olympic Champions in this study did not become excellent alone even if they performed individually. Nor did the coaches become experts as coaches without other people being around especially the athlete trying out and performing the collective ideas. The athletes and the coaches needed each other and also other people around to push their abilities further and enable them to grow to become exceptional. Whilst we can see the tangible end product in the success of the elite athlete, this study seeks to place emphasis on the fact that achieving exceptional levels requires other people's agency.

The chain of sparks presented in this study, looks at the forming of an insight from one person's point of view, however, at the same time sparking happened in many peoples' minds in a systemic way enriching the collaboration and affecting the group to flourish together. Even if, in the end, a person's expertise is a unique combination of knowledge put into practice, the building of excellence is collaborative, merging many people's knowing together in a manner that afterwards makes it difficult to distinguish whose input affected whose. In the studied teams when at their best, both the coaching team and the athlete took part in the co-creation process, where everyone's knowing grew and sparks of insight were generated.

An example of the specific roles in collaborative and collective creativity – an athlete and a coach

This study shows that athletes and other influencers have significantly different roles in the creation of exceptional expertise. To enhance an athlete's career is the objective of a team's actions and the athlete is the object of these actions. However, the athlete has a different role in his career to everyone else. The athlete is always the subject in his own career and the one executing the results of collaboratively created knowledge. Therefore, the athlete always plays a crucial role in the collaboration in assembling the final product and performing it.

In other words, the athlete, the coaches as well as other significant collaborators work towards the same goal to get the athlete to excel in their sport. In this process, coaches and the athletes have distinctive roles and viewpoints; the athlete views it from the inside and the coach from outside (Figure 21). In the athlete's development process, the athlete is a subject, the doer but also an object for his own corrections. For the coach, the athlete is always the object, however, simultaneously to helping the athlete, the coaches have their own expert growing process, namely becoming expert in coaching. In this process they are subjects, as was presented in Figure 20. However, this study is specifically geared towards researching the process of becoming exceptional in an athletic performance with the demonstrable proof of exceptionality being the winning of an Olympic gold medal, therefore the athlete is considered here as the subject.

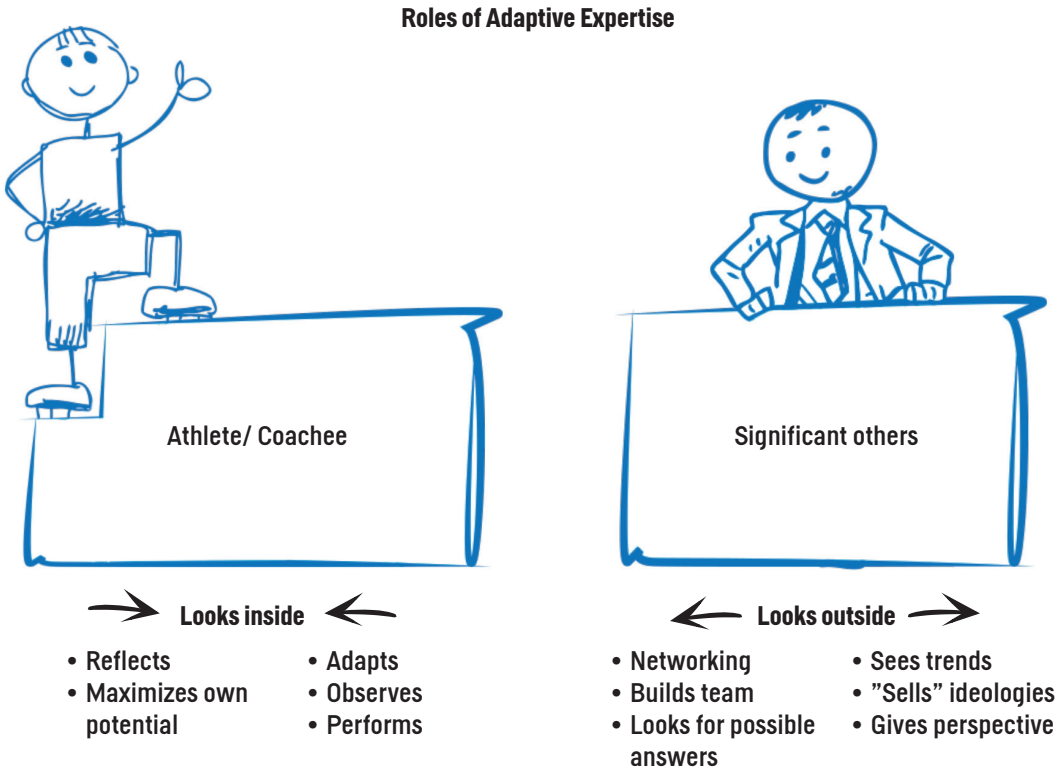

Figure 21. The roles of the athlete and coaches.

Even if an experienced athlete is extremely knowledgeable, the coach is highly important for the coachee. To be the ultimate best in the global race requires being at the cutting edge of existing knowledge and to have a great ability to handle new information. The amount of data that needs to be processed and analyzed as well as transferred into practice is so demanding that using only one person's thinking and an athlete's capacity is usually not enough in reaching success at a world level.

The internal communication, the mindful and deliberate training as well as the assembly of the new knowledge with existing performance, the main jobs for the athlete, demands deliberate thinking. At best humans have only the capacity of using deliberate thinking, in other words system-2-thinking for four hours a day (Kahneman 2013). As Ericsson et al. (1993a) noticed, the best experts daily spent four hours in deliberate practice for years and this apparently uses the same capacity that is needed for the new knowledge acquisition process, therefore the acquisition and processing of external knowledge, the search for the right building blocks and information, remains the job of the coach and coaching team. Reflecting and collecting information from inside as well as transforming the information from the coaching team to physical actions remains the work of the athlete even though many devices and methods are constantly being developed to help in that process.

In the task of coaching an athlete to become an Olympic champion, a coach's role is to help to build the process, influence and catalyze the outcome. But in the same process, the coach grows as a coach. In this way the coach and the coachee form together a two-way, dyadic system where both influence and are being influenced by the other's words and actions as explained by Beebe and Lachmann (2002). This dyad offers an interactive field for growth to each collaborator as discussed before.

6.2 Practical implications of the study

In many areas of life, the speed of transformation has increased due to globalization and digitalization, and therefore, competitiveness of businesses, organizations, governments and communities are increasingly dependent on exceptional expertise and the production of new insights. Exceptional expertise is especially crucial for rapidly developing industries where competition is fierce and where creativity helps to build competitive advantages for companies and individuals working in them.

Becoming excellent is a complex process with divergent variables that interact with each other. The cyclic six-factor model helps to identify these elements. In this cyclic process, creativity is needed, contributing to unique development, interpretation and continuous renewal. Therefore, understanding how the creative mechanisms work can be used to stimulate learning and constant renewal.

My aim, with this study and particularly with this chapter, is to suggest some concepts that would help to understand how to facilitate development of both experts and their creativity. In this chapter, I concentrate on the practical findings of this research. I discuss how the model could

help leaders, coaches and anyone wanting to enhance growing to become excellent, in enabling individuals, teams, organizations and even societies to notice the crucial factors and qualities which play a part in building breakthrough success, and to recognize the right kind of stubbornness and path finding procedures that support individuals and teams in growing to become exceptional experts. I will also present an additional model of three qualities, which is grouped from the six factors in order to help leaders in practice on a day-to-day basis. Constantly balancing these three qualities offers a leader a way to take care, on a daily basis, of the leadership areas critical in competing to win in the global race.

Moving on from this, I go through how each of the six factor and the three qualities can be stimulated, the process fuelled and the possibility for sparks enhanced.

6.2.1 Leading the cycle of six factors

Leading people is a holistic undertaking and, therefore, anyone wanting to systematically lead or assist individuals or teams to the top needs to understand and see how the systems affecting development function and then act system intelligently to catalyse the process (Hämäläinen, Jones & Saarinen 2014). Using coaching as a leadership tool is a powerful mode of operating, but it requires extensive knowledge and great sensibility to meet the points where triggering is required and where not. Even if the concept of coaching and leading are not the same, it is interesting to note that a coach is often like a leader and conversely a leader very often displays the traits of a coach.

Coaching elite athletes does not differ greatly from coaching anyone highly motivated in other areas of life who wants to challenge themselves physically or intellectually and push towards developing greatness. To be able to approach, trigger and mobilize the potential inside an individual requires learning to know the person thoroughly. It also demands seeing the whole path, which includes the ability to recognize the most important and relevant aspects along the way.

For this reason, the coach needs to actively seek and construct dyadic interaction with the coachee in order to be able to impact on the growing process of the coachee and to build understanding of the crucial elements required in a specific field. By doing so, the coach grows as the coachee reciprocally affects the growing of the coach like explained by Beebe and Lachmann (2002).

In order to foster growth and development from good to great, a coach or a leader needs to stimulate the six factors and has accordingly six important roles to fulfill: an inspirer, an enabler, a facilitator, a sense maker, a strategist and a supporter. An inspirer boosts the spirit and helps to keep the flame burning. An enabler makes the persistent work possible removing obstacles from the way as well as assisting in the building of a supportive and beneficial environment. A facilitator is a connecter helping and aiding ideation, bringing stimulation, finding and drawing together inspiring collaborators. A sense maker helps to form a common vision and aids in linking the disparate bits in an individual's mind. A strategist builds and assists in further constructing the plan and the stepping-stones towards realizing

the planned view and showing the direction. Finally, a supporter builds people's self-confidence and courage to proceed in realizing their plans.

Next, I will present how the six-factor model can help a leader and, how each of the six factors can be stimulated. The cyclic process of the six factors with strengthening activities are illustrated in Figure 22 and explained one by one in this chapter.

Inner drive

The first challenge of coaching is to maintain and increase individuals' inner drive, stimulate intrinsic motivation and help them to stay focused and enthusiastic over a lengthy period of time, often more than ten years. A coach or a leader is an inspirer and motivator.

The infusing of extra strength to individuals' inner drive is especially needed whenever faith is put to the test or volition is fading. Sometimes a (sports) career may last for over twenty years, before success comes. Therefore, exceptional expertise requires resilience. Cherishing and nurturing the internal flame is highly important. Occasionally, the coach needs to keep the flame alive by blowing on it, but caution needs to be taken so that the flame does not blaze out of control and burn the future potential thereby killing the progression. The coach must constantly remember and be aware of a person's total wellbeing in order to progress optimally. Even if the end target is high and hard to

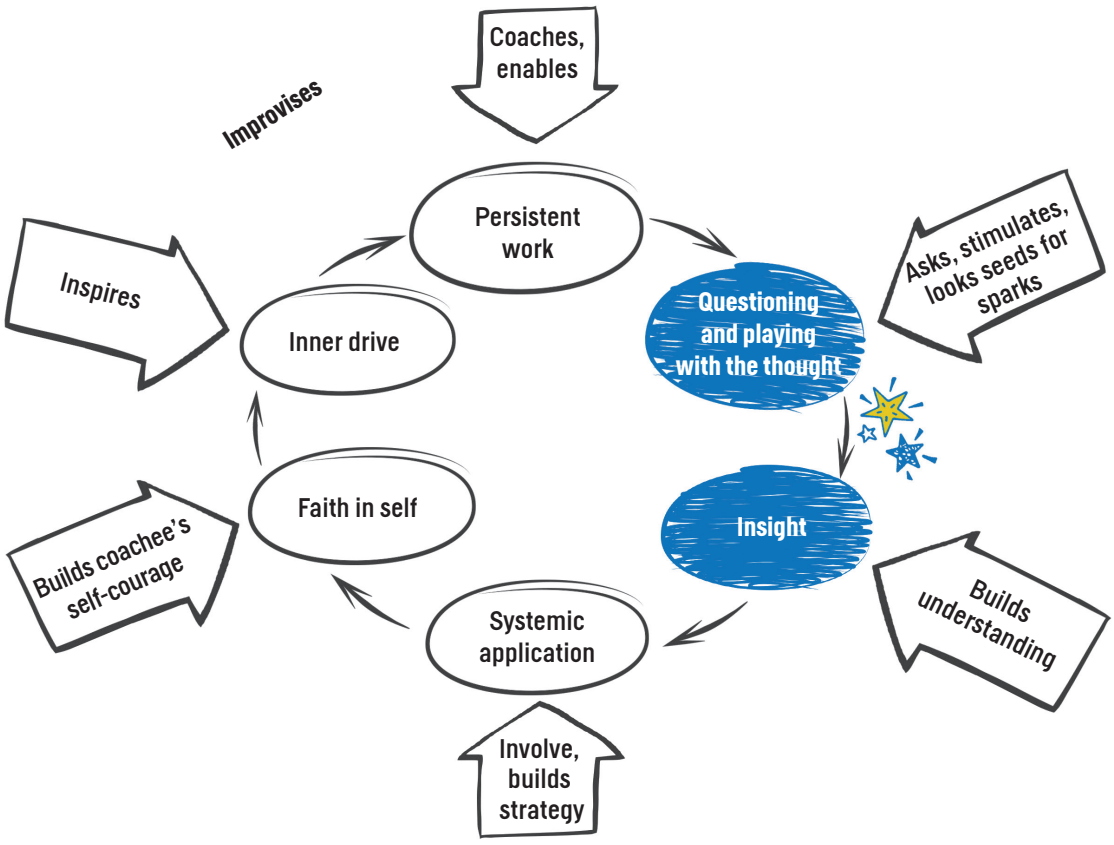

Figure 22. **A leader or a coach affecting the six-factor process.**

reach, without balance and life being in order, the capacity to go to the individual limits and the athlete to go over the pain threshold is jeopardized.

Persistent work

The second challenge for a coach or a leader is to make persistent work possible. What needs to be done has to be made possible to do. Therefore, removing obstacles from work and the developing surroundings in order to support blossoming is vital.

A coach or a leader can help in designing work to be versatile, variable and inspiring, and at the same time the most progressing and productive. But only by knowing the individuals thoroughly, with all their strengths and weaknesses, can a leader learn to help these individuals use all their abilities in a specific domain in an optimal way, in order to avoid boredom. Work must be meaningful, rewarding and most of the time comfortable. A human being is not a machine and, therefore, maximum is not an optimum, but optimum is the maximum. The work of a coach and a leader is to enable others to succeed and to do that the selection of coaching tools must be broad, flexible and innovative.

Questioning and playing with the thought

The third challenge of leading is to contribute to the collection, processing and creation of knowledge. A leader is an ideator, a facilitator, a connector and a builder of understanding together with others. All this a leader does together with others meaning that each expert has their own process of building knowledge and knowing, however, the leader usually has the role of orchestrating the whole process and then the main responsibility for opening new doors and views as well as collecting and compiling external information to be used by the people in the team.

A leader needs to be able to hear people, to be able to observe environments, to anticipate the development of the field, to collaborate with other knowers in the domain and beyond and to see what information and assistance could be useful for development. For this to occur, good communication skills as well as the ability to observe, listen, link, use and adapt many people's knowing are vital. The coach in sport or a leader in business is usually a link in a network, which amalgamates different types of information into a whole.

In this study, the athletes pointed out the importance of experiencing and seeing, and the coaches' knowledge sharing. This sharing of knowledge happened in collaboration and through other interactions. For example, all the interviewed athletes had had a chance to see, on their way to the top, how the world's best at the time practiced and competed. In elite sport, the teams are constantly pushing the field further. What is done today will no longer be sufficient tomorrow. The teams needed to see beyond the current practices, adapt and add something that they believed would bring them success in the future. Remaining constantly aware of the competition, being convinced of, and being convincing in one's own actions naturally feed into all areas of life. Only being at the heart of the actions helps to find the right answers and most importantly to ask the right questions. To win in the system,

requires understanding the system extremely well.

Insight

The role of a leader is to identify and collate understanding in order to ascertain which elements best contribute to an overall system of doing; how it is affected, as well as to realize what will promote becoming great in a specific domain. A leader, leading self or others, needs to have a vision of the whole but see also the key details that cannot be compromised. A generalist leader often cannot make a distinction between the central features and less important ones. It is also rare, or impossible, that a single person can comprehend all the aspects, therefore it is crucial to have a well-structured team and to know who can take a leadership role in a specific area.

In the case of sport, the roles are often quite clear. The coach adapts and packages the information and then suggests improvements to the athlete. The athlete extracts and adjusts the information to fit with his inner knowledge. For a coach to be successful and be able to bring exactly the right information in an easily digestible form requires knowing the athlete well: his personality, temperament, strengths and weaknesses, trainability and learning styles. As an outsider to the athlete's internal world, it is essential for the coach to be close to the athlete to be able to draw the right conclusions from the information that emanates from the athlete. The coach needs to have a very holistic understanding of coaching and to take into account the athlete's whole life to be able to succeed in building an athlete to greatness. The coach has to have the sensibility to notice changes in the athlete and the environment but also the capability to react accordingly. The coach is acting most of the time in the shadows as described by Grüber (2008) when the athlete takes the place in the limelight. The coach closely follows the athlete's trip to expertise, but is secondary in the process. A coaching leadership style does not differ from coaching elite athletes.

Having insight into all, seeing the system, is challenging and requires expertise and cognitive capability. A good leader has to have a huge amount of understanding and knowledge to form a comprehensive view, and also know that all the details are seen, taken care of and mastered in the team.

Systemic applications

After having an insight, the insight needs to be transferred systematically to actual doing. Strategic and tactical planning is about making choices as to where to put the scarce resources like time, energy, human effort, as well as which capital investments are required and worth fighting for. Efficiency in application needs decision-making skills, focus and strength of will to be sure to apply the comprehended insight instead of a compromised view.

In this way, the work must be uncompromising, but adaptable, disciplined but not boring or exhausting. It should be clear and assertive, but leave room for flexibility. Life is complex and unpredictable things happen: changes of circumstances, illnesses and other variables. Designing work requires extensive information,

innovativeness, sensitivity and the ability to adjusting the plans if required. It is clear that a leader or a coach must have a basic grasp of what to do, the nuts and bolts of the task, but it is willingness to improvise, to learn from the unexpected and seize the sparks of creativity that are the essence of making it work.

When focusing on an individual, it is fascinating to see how malleable the human body and mind is. Therefore the training of an athlete or the work designed to form excellence must contain the elements that will cause the individual's cells and genes (Johnson 2013) to make the necessary changes. The trick is to know what is needed, how to do it, and to design the work, that combines exactly these aspects in the right dosage and which the individual's physical and mental capacity can tolerate. Designing the future is abstract but need to be put into day to day proportion in a way that implements the insight and takes into account the whole holistic picture. Therefore, a coach or a coaching leader must know how the particular individual, a team or organization functions while still considering the individual's psyche, physical characteristics, team dynamic and culture in addition to knowing what changes to the mind, body and environment should be made and, more relevantly, how to make them.

Faith in self

Setbacks are critical, as in those moments thoughts of giving up often start to surface in the mind, and then the decision of whether to quit or continue is at stake. It is at these moments that a coachee needs most support and understanding from the circle of his acquaintances. The coach supports an individual's self-efficacy (Bandura 2006), faith in self, and thoughts about own capabilities. A good leader and a coach constantly build each individual's self-confidence alone and as a team. Furthermore, a good leader can build an optimistic future regardless of the current situation. Giving up will not lead to excellence but banging one's head against a brick wall does not either.

Accepting and confronting the brutal facts, being absolutely true to self is fundamental while pursuing the vision for greatness. Building faith, confidence and courage are the fundamental necessities to overcome obstacles. Collins (2006, p.86) in his study with good and great companies presented "The Stockdale Paradox" which excellently describes what faith in self is:

> "Retain faith that you will prevail in the end, regardless of the difficulties, and at the same time, confront the most brutal facts of your current reality, whatever they might be."

Coaches and leaders have a difficult role to play in finding a balance between empathy and hardness. In this study, the coaches described their relationship with the coachee as very close, almost like being a father to the athlete. On the other hand, the coaches had to have the hardness to push and help the athlete to get over the difficult exercises as well as steering them through disappointments, not to pity or give in. This pushing through the hard times was based on the common agreement and the desire to win. Both

understood what they were after and the athlete had given permission for the coach to coach and push her/him to the limits. a good coach uses a huge variety of different ways of leading in order to get results that have been previously agreed upon and, from time to time, the athlete or coachee gives their own self-determination away to be led by the coach, voluntarily, in order to be pushed to own/their absolute limits.

In this way, a coachee opens up, letting the coach see all the weaknesses as well as strengths, being bare and without guards to be steered. This requires a hundred percent trust. A good coach understands the vulnerability and respects others opening for molding. A good coach is sensible, constructive and able to use the knowledge wisely. The work towards greatness requires ownership and self-reliance and the feel of self-efficacy. A good coach respects the coachee's self-determination and constantly builds the self-courage and faith in self, one of the six essential factors is generating greatness.

6.2.2 Leadership in three qualities of the process

Simplifying for practical implications, "the six factors" could be grouped further to three human qualities that are labelled

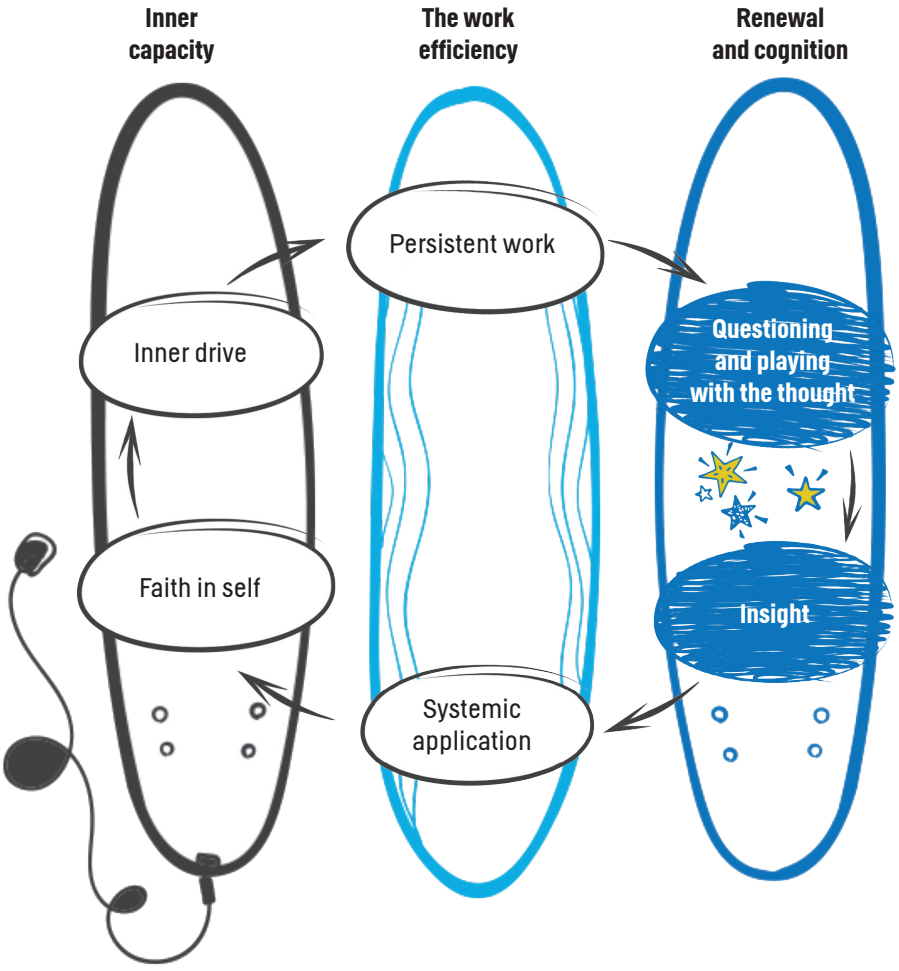

Figure 23. Three qualities of the cyclic process.

as “inner capacity”, “efficient work” and “renewal and learning”. These three qualities in the process are shown in Figure 23. The six-factor model as well as the three qualities could be applied in leading organizations, teams and individuals in various fields of life.

By taking care of all three qualities and balancing them, every leader can improve their leadership in driving value in different kinds of organizations. Balance between these dimensions and qualities is important, as only mastering two out of three does not lead to greatness. Excelling in just one quality could be described as poor leadership. The three qualities are in line with statements made by Sydänmaanlakka (2003) who pointed out in his intelligent leadership model, how it is crucial for a leader of one self, team or an organization to find the balance between efficiency, renewal and well-being.

The first quality, “inner capacity”, includes among others, motivation, mental strength and wellbeing. These deeply grounded human inner qualities contain our needs and desires. “Faith in self” is founded on security and self-confidence whereas “inner drive” typically arises from an urgent basic need pressing to move forward. Maslow (1943) already presented how drive, high motivation is a power that is essential for activating behavior. Self-determination-theory (Deci, Ryan 2014, Ryan, Deci 2001, Ryan, Deci 2000) on the other hand described how internally motivated people strongly enjoy what they are doing, and therefore are happier and more productive. The two factors, “inner drive” and “faith in self” form a person’s wellbeing base and the powerhouse that is a fundamental resource for action.

Directing “inner capacity” is the ability to lead people’s inner resources by strengthening and channeling them. Stimulating the internal motivation pushes people to reach their potential and gives the personnel and the team members the feeling that they can achieve their life mission.

When inner drive is not found, work feels less rewarding than when fully motivated and can cause boredom or even feelings of unworthiness. Encouragement builds self-confidence and self–efficacy, enabling a person team or the whole organization to trust themselves and execute their plans. Self-confidence and self–containment can be learned and strengthened by positive feedback and through experiencing success. Therefore, each little step of success should be acknowledged as they build trust and faith in self. However, learning to cope with negative feelings and fear creates mental toughness and courage in other ways. The hard facts need to be seen and understood, but they should be always expressed combined with hope. Accepting fear but seeing choices and accepting delayed gratification are ways to overcome negative feelings as expressed by Kohlrieser (2006).

Without stimulating these people’s inner capacities, the personnel in the workplaces or the athletes striving for improvement, are not pushed to their maximum potential and what they could be capable to becoming. But no-one can be a master in another’s life and the outsider can only be an inspirer and leave room for others to take the initiative. Highly motivated people can also burn the candle too fast and therefore, constant steering and nurturing is needed. Cultivating the inner capacities

and balancing life creates wellbeing, which is the foundation for shining at work.

In this study, the drive was pushing the teams to use their capacity in reasoning, reflection and conscious thinking, cognitive and deliberate thinking systems. They had a strong desire to develop as Dweck describes (Dweck 2007a, Dweck, Leggett 1988) when explaining the growth mindset.

"Work efficiency and action" is about making things happen and managing the progress. It requires good strategy and virtuoso planning as well as taking care of the work conditions, removing any obstacles in creating fluency and allowing for the possibility to push forward. Putting energy into the right things, and only to those, creates progress.

For the athlete, as in business, global competition is quick and demanding where the global winner dominates and sets the pace for others. Therefore, efficient execution is the key. Efficiency forces the stripping down of extra energy suckers, meaning that full focus and concentration can be given to the task.

The third quality, "continuous renewal" is about invention and transformation; of being on the edge and creating breakthroughs. Questioning and playing with the thought" lays the foundation for the formation of "insight", the understanding. Leading this quality requires stimulating the search, facilitating collaboration within a variety of fields, enabling seeing, empowering constant questioning and wondering as well as problem finding and solving. Nurturing this quality involves trials and allowing for the possibility to err.

In general, diversity increases the exchange of experiences and varied viewpoints. Building diverse teams, making visits to inspiring targets and supporting participation in different networks are examples of the ways a leader can stimulate thinking in an organization. However, by only concentrating on this quality, "renewal of cognition", people may become frustrated and little gets done in the end, as new invention will be trampled underfoot by the discipline of doing.

In this study, each practice brought fresh questions, additional trials and a furthering of, what might be termed, sense making through this process of inquiry. In this way, questions arose due to the constant inquisitiveness and the search for how to make things better.

The three qualities are equally important and need to be in balance although it is usual that people may excel in some whilst be lacking in others. Keeping this in mind, it is essential to understand one's own strengths when building a team in order that all areas are nurtured thus pushing individuals, teams or organizations forward with full force towards excellence. Leadership that neglects one area and concentrates on only two ends up handicapped. If a leader fails to enhance "inner capacity" the atmosphere declines, if leadership fails to stimulate "work efficiency", the execution is poor, if leadership is not targeted towards "renewal of cognition", the results will be ordinary.

The "inner capacity" gives a bigger meaning for a person, team or organization to engage with the task and answer the question "why". "Work efficiency" is

the answer to the question “what” to do as “renewal of cognition” finds answers to the question “how”. In this way, this finding resonates with what Simon Sinek (2011) found when observing successful companies. These successful companies clearly understood the three power questions and always started with the question “why” as a logical starting point giving meaningful activity engage with.

6.2.3 Leading creative sparks

Creative sparks happen when people get outside stimulation that collides with the previous thoughts, learning and experiments stored in the mind. Sparking moments are connections happening in the brain and pumping into the conscious mind. For creative sparks to happen requires investment of attention, wondering and the preparedness to question the status quo. It also requires risk-taking and improvisation as presented by Hopsicher (2011). It is this searching, the collaborative restlessness and openness to the new that lays the foundation for the development of fresh ideas.

A leader can facilitate the possibility for minds to meet, viewpoints to bump into each other and ideas to grow in a generative way. Expanding the possibility to see different concepts, value new openings, being exposed for serendipitous ideas and fostering creative abilities, accelerates the likelihood of creative sparks to happen and be worked forward. An individual’s brain needs to build new interventions in order to make changes on a cellular and behavioral level. Without new connections in the brain the learning curve levels off and may even atrophy.

Sparking moments require pre-knowledge and knowing and therefore, wide-ranging learning and education gives both food for thought and lenses to look through. Also, the ability to use and change viewpoints can be learned. A leader can foster or diminish the use of the lenses. The diminishing brings efficiency and fosters the possibility for renewal and innovation. Balancing the exploration and exploitation is a skill, a choice of strategy and one of the most difficult decision to make for a leader as pointed out by March (1991) and remains so to this day with researchers having yet to find a definitive, applicable, useful piece of advice which may be of help to leaders.

Creativity is a skill, a habit and a way of approaching life; consequently, it needs to be cultivated and encouraged. Being creative requires capturing many experiences and stimulations, letting them float in the mind, in a daydreaming way as described by Sawyer (2011b), as well as the ability to consider alternatives as described by Diamond (2013). Due to an excess of haste and a deficit of encouragement, new openings and questions often go unnoticed meaning that the status quo remains undisturbed. Sometimes awareness of the nurturing time required for flourishing and implementation remains modest. However, curiosity combined with analyzing and sense making abilities brings new openings into consideration.

In this cycle of becoming excellent, collective creativity is needed, contributing to unique development and interpretation of the world. Understanding how the creative mechanisms work can be used to stimulate learning and continuous renewal.

6.3 Evaluation of the study

Choosing the research method depends on what the study is about, how good a previous understanding there is about the phenomena and also what is the researchers contact and distance to the subject. In this part, I will evaluate my choices of the method and approach, as well as the credibility of conducting the research in order for the reader to make their judgment of the appropriateness of my choices and plausibility of making sense of the findings.

I chose an approach that was exploratory rather than proving an explanatory research approach. According to Patton (2014), qualitative study needs to answer three questions to be credible. The first question assesses as to whether the researcher is trustworthy to carry out the study, is qualified and has the necessary ability to provide their own perspective. The second question is about how the methods and techniques were applied to ensure integrity in the findings. The third question Patton (2014) raised is about the credibility of the underlying research paradigm, the question between qualitative and quantitative methodology. I will begin my evaluation of these three questions with the research paradigm.

6.3.1 About the paradigm

Reliability, validity, and objectivity are the traditional criteria for evaluating quantitative research but that criteria is not always the best way to analyse the excellence of qualitative research. The eight criteria of excellent qualitative research mentioned by Tracy (2010) are: sincerity, a worthy topic, rich rigor, credibility, resonance, significance, contribution and ethical as well as meaningful coherence.

In the methodological part, I presented the logic behind seeking a suitable research design that seemed the best fit for the phenomena at hand. I argued that creativity in sports has been mostly overlooked and that there is little understanding of how the process of becoming excellent happens in sports. Creativity is an abstract phenomenon and even the scientists are not clear what we mean when talking about it. To be able to capture and make some sense out of this kind of unclear phenomena requires interpretation. For this kind of research question and phenomena that has only little or no research, Edmondson and McMagnus (2007, p.1158) suggested the nascent theory approach, which “proposes tentative answers to novel questions of how and why, often merely suggesting new connections among phenomena”.

Creativity is not a popular topic in sports studies with only a few studies having been carried out; in fact, creative studies have touched only lightly on sports and the first reaction from the interviewees when discussing innovativeness and creativity was one of surprise. There was no established existing concept as to where and how creativity exists in sport. Explanations were needed to open up the right kind of stories. Through the process of using laddering techniques, interviewees were encouraged to reveal the kinds of stories and specific moments that could be described as creative. In my opinion, choosing the design that gave sufficient room and an approach to being open to any direction was suitable for researching this kind of phenomena.

To understand the expert creativity and where it could be found required an understanding of the process of developing exceptional expertise. Even if ideas exist regarding the factors of what affects expert development, there was still very little understanding of the process and what affects what. I chose an abductive approach. This research design gave the possibility to suggest a process and then further find how creativity works within it.

Now, when the study is ready, I feel that the choice of the research design was suitable for answering the research questions presented in chapter 1.2., and the two propositions provide possibilities and thought streams.

As a comment on this study, it is to be hoped that researchers will work further and evaluate the appropriateness of the propositions in relation to a wider group of athletes and that experts in other fields will also benefit thus, helping us gain a better understanding of achieving excellence.

6.3.2 About methods and techniques

I made a pre-study to test the method and the interviews questions to find out if the method was suitable for this kind of phenomena. With the pre-study I had the possibility to discuss about the appropriateness of the method and the approach before starting the study.

For the data in the actual study, I chose all the living Finnish Olympic Champions, who had achieved at least two individual Olympic gold medals and also members from these athletes' coaching teams. There were five cases altogether. These five cases do not provide sufficient information about how things work in general and in all situations but they can give hints to how things might be. Choosing the multitimes Olympic champions was an easy and clear way of producing a group to be studied. As I took all the Finnish athletes after the year 1972 into this group, there is no questioning needed for why someone was not in the group. It was unfortunate though, that there were no athletes from any team sport in this group as it would have been interesting to see if the process and creativity had other nuances in a team context. Additionally, the studied individuals were all Finns and of course it would have been of some interest to see if the same findings applied to other nationalities.

In this research, the voice was given to the athletes and their teams. To bring the data richness I collected the data via different channels. I conducted a pre-study with different top athletes, following the same analyzing method and questions used later in the main study. I used biographies and interviewed the athletes and several of their coaches to hear the stories from many angles. I wanted to hear the growing up stories and establish how the stories complemented each other leading to a more comprehensive view of the episodes.

There was a time gap and, of course, remembering happenings from long ago is difficult. Stories told, after a long time, are not always remembered exactly as they occurred and were the stories the storyteller wanted to tell as pointed out by McAdams(2001). When many individuals told the same story from a slightly diverse angle, it helped to form a picture of how the events evolved at the time. The same

events told by several individuals enabled me to triangulate the data. But it is good to point out that a retrospective story is always an interpretation of what has happened and therefore not the full picture, even when carefully constructed. The biographies were useful sources of information as they were written close to the happenings and relied on extensive interviews then or were written by the coaches. The coaches were in many ways helpful for this study. They were all very analytical and, as they had been so closely involved in the life of these Olympic Champions, they were a great source of information. While the coaches were intrinsically linked to the athlete and their career they could also compare them with other athletes with whom they had worked.

I had the temptation to have a bigger group of interviewees describing one athlete to provide an even fuller picture. However, after trying a few interviews with some collaborators I felt that, as there was too much time in between the happenings and the interviews, they were unreliable and did not offer much additional information and value to this study. This was probably because these collaborators were not in regular contact with the team at the time in question and therefore, did not have a full picture of the happenings. With the long duration between, the stories had too many holes and I could not judge what was erroneous and what was true. Consequently, I decided to stick with close collaborators and with the biographies written at the time the athletes were still active.

Unfortunately, since 2000, Finland has not had such all-conquering athletes as the ones interviewed for this study. All the athletes interviewed for this study had been active in their sport quite a long time ago. Some of the stories are from almost 40 years ago and world and Olympic sports has changed a lot since. After the success of the Olympic hero's interviewed for this study, the competition has become more global and increasingly competitive. Previously, African athletes were not strongly involved in the Olympic games and countries like China entered the Olympic scene on a big scale only after hosting the Olympics in Peking in 2008. On the other hand, the huge visibility and TV coverage has brought more money into sports and made it possible for an extensive number of athletes to become professional leading to a more competitive field. These two developments have had a huge impact on the development of sports and made competition tighter moreover bringing bigger support teams to work with the athletes.

It would have been interesting to have athletes from today, even if I do not think it would have changed the results all that much, as the way a person function has not changed that much over the years. At any given time, the actions are planned to win against the contemporary competition of precisely that time. This set-up has not changed over time. But that is something that remains for future studies to prove.

This study did not have a comparison group. The existence of that kind of group would have brought great benefit when evaluating the stories. However, it made no sense to create such a group of Non-Olympic Champions, as there was no way to regulate all the other aspects of life that could have affected the success.

Another issue of credibility concerns the integrity and the dependability of the study. This is related to how the data analysis was conducted (Patton 2014) and if, regardless of the researcher, the same results would be reached from the data answering the same research questions. In grounded theory, validation is built into the research process by continual checking of the credibility, plausibility and trustworthiness of the actual strategies used for coding, analyzing and presenting data (Kvale 1989). I carefully followed the grounded theory approach and the guidelines described by Corbin and Strauss (cop. 2008). To be transparent and to make it easier for the reader to follow the analyzing process, I have tried to show how I came to the results step by step. Thus, the steps were first described thoroughly in the methodology section and then assiduously followed in the result section. The process was described and illustrated with tables and pictures.

I constantly went back and forth between the data and the previous research results to find further options. I used the Atlas.ti program to help analyze and interpret the data. In order to learn to use all the helpful features of the program I attended a course dedicated to the use of the multiple features of the program. After making sense of my data myself, I read all my code linking statements that I had made to my colleague. I wanted to make sure that my logic could be followed and my conclusions confirmed. Together with my colleague, we discussed each link that was unclear, read the original quotations and confirmed together the meaning and how it was linked to other quotations and codes. I had conversations and sometimes mini-interviews with active athletes and coaches preparing for the Olympics in order to test my statements.

I also lectured on several occasions about my results to coaches and coaching developers from Finland and abroad getting feedback from them. For example, I was a keynote speaker at the ICCE (International Council for Coaching Excellence) sport coaching conference, presenting my results and having discussions thereafter with both coaching practitioners and researchers from around the world asking them to find weak spots in my interpretation, categorizations and findings. These discussions helped me to further develop my model and to triangulate the accuracy of my findings.

Even with the steps that I made, this research remains interpretative. The data in this study is already an explanation of what has happened and, by default, has the individual's intuitive view intrinsically embedded. Furthermore, the results remain my construction and therefore are a subjective interpretation of the phenomena. The results and the logic presented in this study put forward tentative answers as described by Edmondson and McManus (2007) and need to be further proved by other researchers, in other countries and using data collected on athletes active at other periods.

Grounded theory was a demanding and laborious method of analyzing the data. It was like stepping into the unknown. The benefit however, was the systematic process and I think with the help of the method and Atlas.ti program I have been able to handle the data. Atlas.ti had many useful tools to offer and I used fairly many

features of it, which assisted in grouping and sorting the codes and ideas.

6.3.3 About researcher as qualified to do the study

In qualitative studies, the researcher is the main research instrument. Therefore, the question of how credible the researcher is, is at the heart of the validation of qualitative study.

The curiosity to start to investigate creativity in sports came from my own experiments in sports and from the many choices I had made with my team during my athletic career. Even if my experience in a relatively creative sport, figure skating, may have directed me towards researching expressive creativity, I decided to start searching the individual decision-making processes during the sporting careers of exceptional, successful individuals and their teams and wanted to identify the unique aspect in the process.

I felt that having pre-knowledge of the field of sport both as an athlete and as a sport leader helped me to form the questions and look for the events in Olympic Champions' careers that were unconventional. Digging into sports that were quite different from my own, gave me enough distance and unfamiliarity that in order to find out what was relevant to my research I had to throw myself into these individuals' life stories to experience how their processes evolved. However, my background gave me the sounding board and the possibility to notice the unique nuances in the stories.

As a sport leader and consultant I was aware of decision-making patterns from the viewpoint of the upper levels of an organization but as an athlete had felt that the understanding of the personal approach and its important nuances often go unnoticed at an executive level. They are sometimes interpreted as being trivial, and planning one's own career and executing the training in "the own way" are perceived as being odd and difficult. I had a feeling that a better understanding of these nuances would give the possibility for more quality decisions at an executive level and that motivated me in making this research. My aim with this study was to get close to the athletes and the teams in order to recognize the creative and decisive decision making processes to be able, in the future, to help leaders strengthen them in sports as well as other areas of life through my work as a consultant.

After finishing this work, I am going to develop the six-factor model into a questionnaire to provide a method through which organizations can be assessed, weaknesses identified thus providing a way to strengthen them in the process of becoming excellent.

My intent is also to use my model to help leaders to become sensitive to the mechanisms for fostering creativity and, through balancing the three qualities and leading through the six factors, to unleash the potential in people and succeed. I feel that through this process I have learned a lot and reorganized my mind.

6.4 Future research challenges

The study could be worked further and further and there are many interesting

corollary offshoots that would be interesting to explore. It would be fascinating to see how this cyclic six-factor model works in different areas of life and ascertain as to whether the nurturing of renewal of cognition leads to creative explosions and sparks. A natural extension would be to study entrepreneurs and globally competing small companies and it would also be especially interesting to see how different kinds of communities and organizations could use the model to boost development towards exceptionality.

As described in the evaluation of the research design, this study was made only with individual sports and in Finland, working with athletes whose careers were quite some time ago. It would be interesting to prove, or otherwise assess and further clarify, the models presented here with today's athletes, team athletes and athletes from other countries and continents. It would be of great interest to find out that if a leader stimulated a team, using action learning, in the manner described in this study whether it would produce more innovations, sparks and enhanced expertise, and this could be proved by measuring.

Another interesting area of experimentation might be carried out in the development of the use of artificial intelligence in accelerating exceptional expertise and learning. It would be exciting to find out whether machine learning could be used to help development in sport. The questions for studying could be: How millions of repetitions could be done with machine learning to find the optimal position and performance for each athlete or how an athlete's performance could be improved after each execution, with the help of machine learning.

6.5 Postscript

As a matter of fact, as I reflect back to doing this dissertation I realize that I actually followed the six –factor model as well. It required constant questioning and looking for answers by collaborating, reading, making sense of the data searching and trialling for models that could explain the phenomena. Small sparks emerged during this search and gradually built the insight and vision of how things evolved, however converting my vision into this dissertation required systematic application, planning the work and progress in stages.

Sometimes there were doubts that this would ever come together and maybe my logic has holes. However, reflecting on what I knew as well as encouragement from the people around helped me to trust that I had a point that is worth presenting. This gave a boost and added drive to continue and push forward, stage-by-stage, adding layers and details to the work. Finally, making this kind of work requires persistent work, stamina to do what it takes to do a doctoral dissertation, sit down and keep on focusing.

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Appendixes

Appendix 1: Meta-Synthesis

For getting an overview of the creativity theory, I executed a meta-synthesis roughly following the protocols outlined by Tranfield et al. (2003), which consisted of two processes: first, defining search protocols and second, reporting the findings. The term "creativity" is broad and each researcher seems to have a personal interpretation of it. To catch the discussion going around concerning creativity I followed a very systematic search protocol and used the meta-synthesis method in order to "provide a broad ranging descriptive account of the field with specific exemplars and an audit trail". (Macpherson, Holt 2007, p.176) .

I started with a broad perspective and looked at the review papers from creativity research between 1996 and 2013. I used search words creative* and review. The Scopus database found 6674 articles. At first, I narrowed the search down to psychology, social science, decision-making, neuroscience and arts. I was aware that neuroscience might lead my research towards too specific areas but I wanted to have it with the reviews, as there seems to be many insights explaining creativity.

I limited the search to specific journals and picked magazines that talked about learning, thinking, psychology, arts and excluded magazines that talked about psychiatry, mental health, therapy, disorder.

Search term	Hits	Date	Search term
creativ* and rev*	6674	17.11.2013	
	4778	17.11.2013	limited to psychology and social science
	462	17.11.2013	limited to some journals
	440	17.11.2013	*- psycoanalytical theory
	89	17.11.2013	limited to reviews
	56	17.11.2013	limited to2004-2013
	40	17.11.2013	*-"Psychoanalysis", "Psychoanalytic theory", "Pathophysiology", "Perception disorder", "Psychoanalytic Therapy"
	20		after abstracts read

Table 10. Search from Scopus data base.

		Personal traits	Testing	Process	Environ-ment	Nero-science	Training in sports
Diamond, A.	2013			1	1	3	
Pang, W., Plucker, J.A.	2012						
Baer, J.	2012	1	1				
Amabile, T.M., Pillemer, J.	2012	1	1	3	1		
Chávez-Eakle, R.A., Eakle, A.J., Cruz-Fuentes, C.	2012	1	1			1	
Vessey, W.B., Mumford, M.D.	2012		1	1			
Runco, M.A., Acar, S.	2012	1	1				
Sternberg, R.J.	2012	3	3	2	1		
Sawyer, K.	2011		1			3	
Walinga, J.	2010			1			
Smith, G.J.W.	2008	1					
Baer, J., Kaufman, J.C.	2008	3	2		1		
Kim, K.H.	2008	1	1				
Kim, K.H.	2008	1	1		1		
Hemlin, S., Allwood, C.M., Martin, B.R.	2008				2		
Hunter, S.T., Bedell, K.E., Mumford, M.D.	2007				2		
Dietrich, A., Srinivasan, N.	2007	2				3	
McCoy, J.M.	2005				1		
Scott, G., Leritz, L.E., Mumford, M.D.	2004						2
Mathisen, G.E., Einarsen, S.	2004		1		1		
Hao, N.	2010		3	3			
Memmert, D., Baker, J., Bertsch, C.	2010			3	3		3
Weissensteiner, J., Abernethy, B., Farrow, D.	2009				3		3
Memmert, D.	2009		3			2	3
Simonton, D.K.	2000	3					1
Hany, E.A.	1996			2			2

Table 11. Area of the articles and their contribution to the resarch topic on the scale 1-3 (3 being high impact).

My idea was not to get towards disorders and illnesses but to development and excellence. Therefore, I further narrowed the search by excluding the terms: “Psychoanalysis”, “Psychoanalytic theory”, “Pathophysiology”, “Perception disorder”, “Psychoanalytic Therapy”.

I read abstracts of 40 review articles that I had got through this process and came finally to 20 articles that specifically covered my research area and questions. I also ran another search process with search words: creativity, expert and sport (including the word athlete). From this search, I found eight articles of which six were relevant to my topic. I also used search words: creative* and success (including winning, goal, sport achievement, innovation and sports), however, when refining the search to articles that talked about process I again found eight articles but those that were relevant I had already got when using the previous search. I used excel-sheets to sort and evaluate the area of creativity the articles covered and contribution to my research topic.

This synthesis broadly sums up the key findings in creativity research in psychology and social sciences according to these reviews. However, when reviewing I kept my research question in mind and limited the explanations to those that were relevant to this study. The articles in sport were different in nature, most of them were empirical studies and more specific and detailed with some exceptions. I present my findings starting from a broad view of creativity and move towards creativity in sports.

Appendix 2: Examples of forming categories from original expressions

Expression	Code	Sub category	Main category	Core category
When something was unclear, I started digging information.	Data collection	Questioning and information collection	Questioning and data collection	Questioning and playing with the thought
I demand justification, why I did something. Not just that somebody was giving orders.	Feedback	Questioning and pressure to develop		
It was important that we did not remain just follow what Igloi or Lydiard or anyone else in the world did.	Finding a solution	Trying to understand		
I jumped with the good ones. I could see what is their level.	Observing	Seeing	Interaction	
There was a large group of researchers from the back when I was working in college at the time. There I was able to make an investigation and he trusted everything that was done then.	Collaboration	Collaboration		
He deliberately made mistakes to develop a view. He sometimes decided to dive into the jump too early, or too late.	Trial	Questioning and trial	Trial	
We sat four coaches once a week and we were thinking about the past and what should be done. In these discussions, we went through all pretty thoroughly, what we need to do. It was useful. It captured from others comments ideas that I thought I should take into account.	Analyzing	Analyzing	Sense making	
The idea was rotating in my head	Reflecting	Sense making and knowledge building		
I listened to my own body, that where it bends.	Reflecting	Reflecting		
Before I could do him individualized exercise program, it took me about three months, rummaging through all the things he had done over the years.	Analyzing	Data collection and analyzing and knowledge development	Systematic enhancement	

Expression	Code	Sub category	Main category	Core category
It was the kind of idea that skis must be different. (insight)	Vision	Pre knowledge and thinking	Image building	Insight
He built little by little to a certain image for himself, motor skills and coordination. He deliberately made mistakes to try out …	Development of own idea	Insightful knowing		
The critical element of Four-stage training is the development of energy systems, with good performance depends on a sufficient supply of energy.	View	Image building		
In sports competitions, all do not realize what is a reserve, the forces inside of you. If you are not accustomed to go to 100 % level, you will not be able to move there in competition.	Understanding	Understanding	Understanding	
I understood what was the most crucial in effort of jumping.	Understanding			
He jumped with fierce slings, and that allowed to move the skis in his sides.	Innovation	Innovation	Differentiation	
Preparations were made to face each and every individual in competition	Predicting	Own choices	Own choice	Systemic application
I've been thinking about the risks that have been detrimental to my development, that they can be removed completely or reduced.	Risk management	Risk management		
If you don't dare to try, you do not reach anything.	Loyalty to own ideas	Risk handling		
His flight technique differenced from the others as he jumped so that his skis were on the side. It made it possible that the body was carried much better than if the skis had been below.	Differed from the others	Choice		
We turned over the training programs.	Application	Finding an own way	Executing the own idea	
After the years pause in coaching I started to coach again, and I was now able to carry out my own four-step process for the training. I did not change anything on anyone's command; I did only what I believed to produce results.	Implementation			
We always agreed on two tactics in advance. One of the main tactics and one deputy tactics.	Construction of tactics	Tactics		

Expression	Code	Sub category	Main category	Core category
I started to actively seek partners and also the other people whom I needed in order to have the sufficient competence in the team	Self-imposed	Self-imposed	Self-imposed	Systemic application
One of the most important thing in the Olympic medals that they are not even able to overcome is the fact that your life is in balance.	Life management	Life management	Balance and security	Faith in self
It was wonderful to go home. It is important that the feeling of security is found at home.	Security	Balance		
The family things need to be okay, the financial affairs must be in order, and there should not be any other things stressing and disturbing.	Balance			
I was afraid of everything. I was afraid of the losing, and I was afraid of success. I was afraid of conditions. That is where we started the modification.	Fear	Building self-confidence	Self-confidence	
I was an avid skier, and I skied, and I improved, and when the competition took place and I was doing well and a taste of success brought me more enthusiasm to practice.	Improvement	Self-confidence		
It is often thought that happiness is something which cannot be affected, even if I disagree. Risks can be minimizing with creative thinking. They can be removed completely or reduced. That has been done.	Ownership	Integrity	Integrity and ownership	
Do not wait for someone to make something for you, start with the idea of what you can do yourself.	Spontaneity			
If an athlete has the burn to practice, he should be trusted and not constantly be interfered. The athlete should be given a peace and quiet to do the sport and not to fight with federation, that want to mix up with everything.	Consent of the athlete	Ownership		
If you as an athlete start to listen to external advisors then you no longer know who to listen to.	Trust in own thinking	Belief in self	Own way	
Development of ideas needed time to mature. Work and will are not enough the view came gradually and needed self-courage as well as the trust to keep the own view.	Trust in own thinking	Own view		

Expression	Code	Sub category	Main category	Core category
My driving force was the desire to develop it more and make things a little better all the time.	Desire to develop	Growth mindset	Growith mindset	Inner drive
I have trained more than my Finnish competitors. It's not even a question of recovery, but the question pretty diligence that I was able to work out.	Approach			
I always tried to be faster than the boys	Desire to win	Competitive instinct	Competitive instinct	
I really liked running.	Motivation	Motivation	Motivation	
The enthusiasm for the sport, it was absolutely huge.	Enthusiasm	Joyful development		
I liked to practice and it was really nice to compete.	Enjoyment of practice			
I have trained and trained until exhaustion and even then I have trained.	Persistence	Endurance	Endurance	Persistent work
In my view, it is precisely that that you are not giving up so easily. Many are looking out of the window and seeing that it is a bad weather out there and don't bother to go out and row. They think that oh, I will instead do a little exercise cycle or go for a little run. But you know that going there exactly then makes the workout twice as demanding.	Determination			
Despite the fact that the results did not improve, he believed the exercise would bring results later	Persistence			
When I got the training program, I executed it to the last detail.	Execution	Physical work	Deliberate practice	
I did millions of these bounces on ground.	Amount of training	Deliberate training		
I have always tried to develop myself in something at these basic exercises.	Training			
Every situation had been made familiar with training.	All familiar with training			
The coach feeds the ideas and considers how they are received.	Coaching			
In the evenings I went the race through my mind.	Concentration and mental training			

Expression	Code	Sub category	Main category	Core category
I was so committed to the sport compared to these others, they had also other things to do. I either rested, trained or I was at work.	Lifestyle	Life-style	Life-style, plan and setting for training	Persistent work
Skiing was my profession. I was bound to leave all outside things. I was forced to for-get some of the friends. All outside things stayed. Those back at home hired a outside help to make the work I had done.	Lifestyle			
Such solutions were made to the exercise conditions that it made it possible to develop.	Ensuring conditions	Training conditions		
The coaches role is to make the training programs.	Training plan	Working roles		
The coach's first goal is to know and exam-ined the athlete with all the individual characteristics, abilities and stress factors as well as his way of handling the informati-on after failure.	Knowing the athlete			

Appendix 3: Codes in core categories

Questioning and playing with the thought		Insight		Systemic application	
Codes	**Amount**	**Codes**	**Amount**	**Codes**	**Amount**
Data collection	47	Understanding	72	Development	57
Interaction	45	Vision	51	Self-imposed	47
Analysis	36	Development of own idea	26	Taking own actions	17
Reflecting	31	Differed in thinking	20	Construction of tactics	17
Experiment	26	Competitive advantage	11	Differed from the others	17
Knowing the athlete	26	Innovation	5	Development of self-confidence	16
Rivals	21	Learning and adaptation	4	Risk management	8
Looking for a solution	18	New creation	3	Choice	7
Testing	16	Creativity	3	Goal	7
Feedback	10	Idea of holistic training	2	Decision making	6
Observation	9			Implementation	3
Imagination	8			Know-how	3
Interplay with environment	7				
Adversity	6				
Coincidence	5				
Training mates	5				
Listening to own body	4				
Total	**320**	**Total**	**197**	**Total**	**205**

Faith in self		Persistent work		Inner drive	
Codes	**Amount**	**Codes**	**Amount**	**Codes**	**Amount**
Put ones soul into	33	Training	58	Motivation	28
Mental strength	28	Coaching	30	The desire to develop	26
Life management	23	Concentration	20	The desire to win	16
Philosophy	23	Mental training	20	Attitude	13
Mental toughness	22	Life style	20	Enjoyiment of training	7
Loyalty to own ideas	19	Ensuring conditions	16	Curious	5
Faith in oneself	7	Training plan	14	Enthusiasm	4
Resistance to stress	7	Predicting	13	Drive	2
Consent of the athlete	6	Endurance	10	Ambition	2
Identity	6	Amount of training	10	Others desire	2
Importance of sport for athlete	4	Control	9	Will	2
Fear	4	Investment	6		
Isolation	3	Determination	3		
Success	2				
Humor and mental relaxation	1				
Total	**188**	**Total**	**229**	**Total**	**107**

Appendix 4: Codes

adopted	differed from the others	intrinsic property	resistance to stress
adversity	drive	invest	resources
ambition	education, philosophy,	Isolation	risk management
amount of training	enabler	know-how	rivals
analysis	endurance	knowing the athlete	role of parents
application	enjoying training	learning	self-imposed
athlete type	Ensuring conditions	life management	sparring partner
attitude	enthusiasm	life style	success
choice	environment	liked competing	talent
coaching	experiment	listening to own body	team
coincidence	familiar with training	love of sports	testing,
collaboration	family culture	loyalty to his own idea	the desire to develop
competitive advantage	fear	mental strength	the desire to win
concentration	feedback	mental toughness	training and hard work
confidence	finding a solution	motivation	training friends
consent of the athlete	goal	new creation	training plan
construction of tactics	good feeling	observation	trustworthy person
control	hard work	others desire	understanding
creativity	holidays	positivity, faith in oneself	view
curious	humor and mental relaxation	practice	will
data collection	idea of holistic training	put ones soul into	
decision-making	identity	recalling	
development	imagination	reflection	
development of own idea	importance of sport for athlete	relentless work	
development of self-confidence	innovation	research	

In today's world extraordinary expertise is required to succeed. This research unfolded how exceptional experts found their way to excellence and as the result of the study built a model explaining this development process. Researching five multiple Olympic champions gave this study almost laboratory type settings to analyze the process towards greatness. In the process towards excellence, creativity had an important role and aided in forming the unique insight that affected the quantum leap necessary in making the transition from ordinary expert to extraordinary. Collaboration with significant others fuelled creativity and from the effect of interactions, new opportunities emerged as activities evolved. This study offers new insight for any experts, teams and organizations also in other domains searching for a winning edge and sustaining advantages.

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