

**Technologies of sportification – Practice, Theory and Co-Production of Training  
Knowledge in Cross-Country Skiing Since the 1950s**

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## **Abstract**

Elite athletes of today use specialized, scientific training methods and the increasing role of science in sports is undeniable. The scientization process started in endurance sports (e.g. Yttergren 2012, Bourne 2008, Krüger 2006, Svensson 2014, Heggie 2011, Johnson 2009), among them cross-country skiing. This article analyzes how Swedish physiologists and cross-country skiers interacted in the scientization of training methods, focusing on the *technologies of sportification* that were used. Examples of such technologies are scientific testing, training logs, training camps and training manuals. Material from archives, interviews and earlier research will be studied using theories of *bio-power* (Foucault 1998) and sportification (e.g. Yttergren 2006, Guttmann 1978). The article concludes that while *technologies of sportification* could not ensure a rapid rationalization of training methods, these technologies over time became standard features in the training and sportification of cross-country skiing.

## **Keywords**

Training, skiing, sportification, technologies of sportification, bio-power

## **Introduction**

According to sportification theory, all sports tend to develop along similar patterns towards increased specialization, standardization and rationalization (Guttmann 1978, Elias, Dunning and Hopf 1982, Elias 1986, Maguire 1999, Yttergren 1996, Goksöyr 1988, Collinet, Delalandre, Schut & Lessard 2013, Pfister 2003). This has meant that elite athletes of today use specialized scientific training methods. Over time, the increasing role of science in sports is undeniable. Cross-country skiing is

one of the sports that have a well-established co-operation with physiologists and other scientific experts. But how and why did scientists and educated coaches gain power? Scientization of training methods accelerated around the world in the 1950s and cross-country skiing was an early adopter, even if not all skiers were (Svensson 2014). Still, the experiential, local knowledge of skiers remain an important ingredient in modern day training. How have these different knowledge traditions merged? How did scientists try to convince skiers to adapt their training to the latest scientific results? This article will answer these questions, using the interactions between skiers and physiologists in the Swedish cross-country skiing team during the years 1950-1980 as the case.

The development of scientific training for cross-country skiing in Sweden was not an isolated phenomenon. On the contrary, it was part of a larger rationalization process in the Swedish society, as well as a scientization of training in other nations and sports. The ambitions were greater than to contribute to elite sports – the goal in Sweden and elsewhere were to get the broader population to exercise based on scientific knowledge (Svensson 2013, Schantz 2015, Latham 2015). The Swedish case will therefore be analyzed with reference to international developments.

### **Theory and method – *bio-power and technologies of sportification***

To study developments in training during the 20<sup>th</sup> century is to a large extent to analyze the interaction between sport and science. The developments of the last century have transformed training from a private, experiential endeavor to something much more systematic and scientific. Therefore the training of Swedish cross-country skiers will be related to the wider research on training history and sportification, in order to understand the role of rationalization and scientization of bodies in relation to training and sports.

The history of sports and how they develop has been studied with increasing interest since at least the 1970s, with one of the classics of this emerging research field being *Sport im Zivilisationsprozess* (Elias, Dunning and Hopf, 1982). The first theory of sportification was outlined separately by Allen Guttmann (1978) and Norbert Elias, and the latter coined the term sportization (Elias, 1986, 128-129). Other important developments of the theory have been done by Joseph Maguire (1999), Matti Goksøyr (1988), Gertrud Pfister (2003) and Leif Yttergren (1996, 2015). This theory has been used to analyze developments in sports and physical education both in regional, national and international contexts (e.g. McIntosh 2007, Collinet, Delalandre, Schut & Lessard 2013, Sjöblom and Fahlén 2010, Horton 2012, Bromber, Krawietz and Petrov 2014, Groenen 2014, Yttergren 2012). The theory of sportification argues that all sports develop along similar lines, towards increased specialization, rationalization, standardization, regimentation, organization, equalization and quantification, on national scale (Yttergren, 1996, 21-22) and global scale (Horton, 2012, 512-514). While some lifestyle/extreme sports such as surfing and climbing do not easily fit into this model (e.g. Wheaton 2013, Dumont 2014), the general validity of sportification is harder to question.

So, how is sportification done in practice, on the ground so to speak, within individual sports? I argue that within the rationalization aspect of sportification, the development of scientific training is an important aspect and I have previously shown how sportification theory could be nuanced by framing rationalization of training as one of the later stages of sportification (Svensson 2014). Perhaps also one of the hardest to achieve, since it deals with individual athletes and their training setup rather than issues that can be resolved by central organizations (e.g. regimentation, equalization, standardization). The difficulties in making skiers adapt to scientific advice led to the use of innovative technologies in order to succeed.

The aim of this article is to show *how* and *why* training has become more scientific, using Swedish cross-country skiing 1950-1980 as the case. I will argue that a number

of *technologies of sportification* were used to increase the role of science in training. Mainly four such technologies were used: scientific testing, training logs, training camps and training manuals.

These *technologies of sportification* will be further analyzed through Foucauldian concepts of *bio-power* and disciplining to show how scientists, backed by the Swedish Ski Association, tried to increase the role of science in training among elite skiers. Foucault's theories on *bio-power*, technologies of power and disciplining have been used to analyze power relations within sports (Markula and Pringle 2006, Kimura 2003).

The article sets out to answer the following questions: How did the scientists work with *technologies of sportification*? How did the athletes react to the respective technologies?

The empirical material is mainly interviews with elite skiers active during the 1950s, 1960s and 1970s, as well as scientists involved with the Swedish national team during those decades. The interviews have been semi-structured (Wengraf 2001), meaning that a set of prepared questions about training that was used as a starting point for all the interviews, while allowing for the discussion to divert from the questions based on what the interviewed person says. 20 elite skiers (thirteen men and seven women) that have represented the Swedish national team were interviewed. The results in this article build on all interviews, even if not each skier is referenced individually. The gender unbalance represents an actual gender unbalance in the national team during the period 1950-1980. Given that the skiers and physiologists were interviewed about events that took place up to 60 years ago, there is reason to be cautious with drawing far-reaching conclusions. I have used additional sources, such as the Swedish Ski Association archives and official training instructions as well as autobiographies of individual skiers, to get a broader understanding of the role of science in training 1950-1980. In addition, five physiologists (all male, since there

were no female physiologists working with the skiers at the time) involved in the testing and training of elite skiers has also been interviewed.

The article starts with a short background as to how and why the co-operation between physiologists from the Royal Central Institute of Gymnastics (GCI) in Stockholm and the Swedish Ski Association was initiated. The following section studies details from the introduction of *technologies of sportification* in the Swedish national cross-country skiing team, with special focus on the interaction between scientists and skiers. Finally, the article is concluded with a discussion of how the power-relations between different knowledge traditions (science and experience) affected training, and how the Swedish case relates to similar developments in other nations and sports during the same period.

### **The scientific turn in Swedish cross-country skiing**

After a very successful 1940s, where Swedish skiers dominated the international scene, the 1952 Winter Olympics in Oslo ended in disappointment. Swedish skiers won only one medal, a bronze in the relay race. That was far below expectations, and such failures have historically resulted in extensive reconsideration of training and other preparations, such as in Norway after the failure in the 1958 FIS World Championships after which Kristen Kvello was handed the task to re-model the training setup in Norwegian cross-country skiing (Gotaas, 2003, 277-281). In the hardening international competition of the Cold War era, poor results could not be ignored or blamed on temporary bad luck. There was a genuine fear already ahead of the games that increasing international competition would require increased focus on rational training methods. Therefore the Swedish Ski Association, represented by its newly elected chairman and former GCI student Sigge Bergman, contacted GCI and their professor in physiology, Eric Hohwü-Christensen, to get scientific assistance in order to improve the results (Swedish Ski Association, 1951, 208).

Hohwü-Christensen agreed to help out, and soon the collaboration was up and running. Physiologists began testing skiers and used the results for basic physiological research, which could then be used to increase the knowledge about certain aspects of the skiing body. The Swedish Ski Association gave far-reaching authority to the physiologists, allowing them to test skiers, design training manuals and influence preparations for Olympic Games and World Championships.

Gradually, the previous model of experiential, natural and individual training as the base for elite skiers was replaced by a scientific, rational and universal approach as the official way of training. It was seen by the Swedish Ski Association as a necessary measure to remain competitive on the international level (Svensson, 2014, 12-13). In practice, many of the skiers resisted this development, and the introduction of scientific training methods is in many ways a story of how scientists and skiers interacted to agree on what kind of training was most efficient, and whether theoretical or experiential knowledge was the most important ingredient. There were a few major issues where scientists and skiers had different ideas about training: the role of landscape and place, the need for and usefulness of follow-up, testing and planning, and the importance of personal experience. These issues were discussed with focus on a number of *technologies of sportification* that the Swedish Ski Association together with scientists from GCI wanted to implement to establish scientific training.

The Swedish scientific interest in elite sports was not unique at the time. In several other nations, physiologists had begun to take an interest in testing and analyzing athletes. Sport historians from around the world have shown that there has been a growing scientific interest in sports during the 20th century, and that scientists have had a massive impact on the training theory of many sports. It is also clear that scientists often had larger ambitions than to contribute to elite sports – the testing of athletes was part of a wider examination of the human body at work (e.g. Johnson

2009, Heggie 2011, Park 2011, Hoberman 1992, Krüger 1997, Rabinbach 1990, Wrynn 2010, Howe 2006, Carter 2010, Tipton 2014, Bassett 2002, Park 2014, Carter 2012).

I will now turn my attention to the *technologies of sportification* used in the scientization process, starting with the scientific testing that began in the early 1950s.

### **Scientific testing of skiers**

The first *technology of sportification* that scientists introduced or re-interpreted in their interaction with Swedish elite skiers was scientific testing.

The start of the direct interaction between national team skiers and physiologists started is marked by an event in 1954, when physiologist Per-Olof Åstrand showed up at a training camp, bringing with him some lab equipment, testing apparatus and a bicycle ergometer. He was asked by the skiers if he had been engaged by the Swedish Cycling Association (Åstrand, 1988, 230). This remark was a sign of the widespread skepticism towards scientific testing among the elite skiers, which remained even though the Swedish Ski Association firmly supported the scientific turn.

The skiers protested in various ways, e.g. during the Winter Olympics in Squaw Valley in 1960. The gold-winning Swedish team in the women's relay race was selected by a test on bicycle ergometer (Åstrand, 1988, 230). But when physiologists wanted the male skiers to follow the same procedure, they refused to participate (Stefansson 2013).

During the first years of co-operation between GCI and the Swedish Ski Association, scientists most often visited training camps, but soon skiers had to visit the lab as well (Swedish Ski Association, 1957, 24-25). Once there, they were put on special diets and sleeping routine, in order to eliminate factors perceived as irrelevant for the experiments. In the lab, the scientists could set the agenda. A typical example can be

found in a 1957 article by GCI physiologist Rune Hedman about possible connections between oxygen uptake and carbohydrate usage. Hedman brought the skiers (and himself) into the lab, where their diet, muscular activity and sleep were controlled during the day before the actual experiment. They were also monitored and tested at several times during the set-up stage (Hedman, 1957, 306-307). During the test, the subjects skied around a 750 m track, after fasting for 12 hours. Scientifically, this set-up enabled some interesting conclusions about glycogen storage in the training body (Hedman, 1957, 307-309), but skiing on an empty stomach would never have been accepted on a regular training camp. So, from a skier's point of view, this was not really skiing but science, because it took place in the lab. And the skiers' attitudes towards this type of activity were hesitant. Several say that they felt like Guinea pigs or lab rats, and that it was mainly the physiologists that benefited from the interaction (Stefansson 2013, S. Larsson 2013).

Skiers were critical towards the testing, but even more so towards the lack of follow-up or translation of what the results meant. Britt Strandberg (born 1934, medalist in the Winter Olympics of 1960, 1964 and 1968) recalls that the tests seemed rather pointless from the skier's point of view, because "we got no explanation of the result, what and how to compare with" (Strandberg 2015).

This illustrates quite well how many of the skiers (especially the female) responded to scientific testing. They did what they were asked, but remained unconvinced that they would gain anything from it. Some of the men were more explicit in their opposition, especially against what they perceived to be a lack of respect for their traditions and experiential knowledge. I interpret this as a testament to the higher confidence and status of male skiers at the time.

The scientists, however, were confident that their findings could improve training (e.g. Hedman, 1957, 305). Similar claims are made in other articles by GCI physiologists, and there were skiers in the national team who supported such claims,

especially regarding lactic acid threshold, rest periods and the importance of drinking water during exercise (Asph 2013, Rämgård 2013).

Most skiers claim scientific testing did not have any effect at all on their training practice (e.g. Stefansson 2013, Strandberg 2015, Tano 2013, Gustafsson Rönnlund 2013, Martinsson Grahn 2013), at least not for the generation of skiers active during the 1950s and 1960s (Lestander 2013). Experimenting with different conditions while examining athletes was something common at GCI, and done in several studies (e.g. Karlsson, Åstrand and Ekblom 1967, Karlsson and Hermansen 1966.) For the skiers these scientific interventions could compromise their ability to perform. Assar Rönnlund (b. 1935, medalist in the Winter Olympics in 1964 and 1968) agreed to conduct testing right before the 1962 Vasa Race, because he saw physiologist Bengt Saltin as a friend. Nevertheless, in his autobiography (Rönnlund, 1967, 51-53) he suggests that the scientific experiment and testing may have decreased his chances of winning the race.

The testing conducted in the lab at GCI in Stockholm was often oriented towards maximal oxygen uptake. In cross-country skiing and other endurance sports, the  $VO_2$  max number is crucial for performance. This is not the same as saying that those who are best at performing in the lab will also be the best in the skiing tracks. From a scientific point of view, however, there was no major difference. A large study published in 1967 presented stats for 95 male and 38 female athletes at national team level from different sports. The physiologists established a “correlation” between high  $VO_2$  max and good results at competitions for some sports, including cross-country skiing (Saltin and Åstrand, 1967, 353). Being a successful skier was reduced to oxygen uptake. Even if cross-country skiing is an endurance sport, other factors (technique, psyche, pain threshold etcetera) are also important. By studying the effects of different training methods (e.g. Saltin 1964, Saltin and Åstrand 1967, Ekblom 1969) the physiologists framed the athlete as a  $VO_2$  max phenomenon, and based on that reconfigured the understanding of what training a skier should

conduct. In summary, there were both positive and negative attitudes towards scientific testing among the national team skiers. Scientific testing built a basic knowledge about the physiology of elite athletes, a knowledge used to adjust training methods. However, the impact of scientific testing on actual training setup was limited until the mid-1970s.

### **Training logs**

Training logs have been used throughout the 20<sup>th</sup> century among athletes in various sports. However, early training logs of well-known athletes like Sweden's Gunder Hägg or Germany's Rudolf Harbig in the 1930s and 1940s were written more or less on the athlete's own initiative, had no scientific function at the time and attracted external interest only decades later (Bourne, 2008, 154). The type of training log introduced by physiologists in the 1950s was different. It can be seen as a form of *bio-power*, which promotes a form of self-monitoring in the name of productivity and improvement, which governs through "continuous regulatory and corrective mechanisms" to the point where these mechanisms have been internalized in the athlete (Foucault, 1998, 144). In the case of cross-country skiing, physiologists wanted the national team skiers to write detailed training logs, but many neglected to do so or did write but refused to show them to scientists (e.g. Johansson Öberg 2015, Stefansson 2013, Persson 2013 Åslund 2013, Sandström 2013). The arguments against training journals were based in a utility perspective rather than a fear of surveillance. None of the skiers I have interviewed express any obvious ideological stance behind their reluctance to supply the scientists with detailed training logs. Therefore I argue that it was rather because scientists failed to convince skiers of the usefulness of registering and comparing training sessions. Even if a skier was convinced of the potential benefits of a training log, physiologists did not automatically gain access to this material.

A tendency among the 20 skiers is that those who were positive (or at least not negative) towards the scientific testing also embraced a detailed planning of their training (Rämgård 2013, Asph 2013, L. Larsson 2013, Grahn 2013, Tano 2013). The training log had epistemological implications, as it transformed tacit, personal knowledge (Polanyi 1958) into written records. Scientists transformed local knowledge into data that they could collect and accumulate. Concepts such as lactic acid or VO<sub>2</sub> max were introduced as important factors for success in cross-country skiing. The skiers reacted differently towards this new vocabulary. Some used it to formulate what they had previously lacked words for (e.g. L. Larsson 2013), others to check that your perceived fitness was right (Rämgård 2013). Different strategies were available. A skier could either reject the scientific language and training set-up, or adapt it for their own purposes. The role of training logs was to enable a more detailed planning and follow-up of training, and this ambition was evident also in other scientific methods introduced by physiologists around the world, such as the scientific periodization model introduced in the Soviet Union in the 1960s (Matveyev 1965). Managing the temporality of training was increasingly important.

### **Training camps**

The method of going away on camps to exercise has a long history within the military sector, but the first sport training camps that I have found any record of were initiated by British football clubs in the early 1880s (Taylor, 2008, 44). In Swedish and Norwegian cross-country skiing, training camps quite early (1930s) became an opportunity for athletes to get away from work and train for a week or two, sometimes in combination with forestry work (Gotaas 2003, Sandbakk and Tønnesen, 2012, 24). In Sweden, training camps were only loosely organized by the Swedish Ski Association and much of the planning and training setup was done by the athletes themselves. This gradually changed during the 1950s and 1960s. Training

camps became more common, more important and more centrally planned, as part of the ambition of the Swedish Ski Association to control training.<sup>i</sup> At training camps, scientists could monitor the skiers and perform different tests on them, but the camps also offered skiers the opportunity to compare themselves with their colleagues and discuss training methods at a time when other opportunities to exchange training knowledge were few (Bourne, 2005, 153-155, Gotaas, 2003, 297-298). Two thirds of the skiers I interviewed underline the importance of training camp for exchange of experiential training knowledge, but it was also a way for scientists to gather their test subjects and see them in action. Scientists packed a minibus with treadmill and other equipment and drove from Stockholm to relatively remote places like Vålådalen and Rättvik (Bergh 2013). Once there, they conducted tests on skiers that were not always positive. In general, skiers were more interested in scientific advice in their early career. Physiologist Ulf Bergh argues that this could be due to that it was more interesting to see a constant increase in performance and numbers, while it was less rewarding to get scientific stats showing decline (Bergh 2013).

### **Training manuals**

The development of the official training manuals published or endorsed by the Swedish Ski Association is an interesting case that clearly shows how training was transformed by a scientific, rationalist ideology. In the 1940s, training manuals were written by the legendary Swedish training ideologist Gösta Olander, manager of the Vålådalen alpine station in the mountain range west of Östersund. He described mountain training camps in a non-scientific tone. He had a naturalistic view on training and propagated a holistic method that built on practical experience rather than science. He was inspired by the movements of the Sami and of mountain wildlife. Using the natural variations of the mountain landscape was also important. Olander recommended running in moors and slopes during the summer, while

running in deep snow or skiing during the winter (Olander, 1948, 4-6). The landscape itself was important, and Olander had colleagues who already in the 1930s advocated training in mountain landscapes (Yttergren, 2012, 85-89).

When physiologists took over the duty of writing these manuals, the advice on training changed. In the 1962 edition, Olander's naturalistic training was replaced by a focus on intervals, scientific testing and detailed planning (Briandt 1962). These manuals were distributed among elite skiers and junior skiers, who could follow the changes in training ideology (Lestander 2013). The scientific turn was in line with earlier international changes in training for elite runners during the 1940s and 1950s, when coaches such as Franz Stampfl, Herbert Reindell and scientists like Woldemar Gerschler argued for more high-intensity training based on scientific arguments (Magness 2010, Krüger 2006, Yttergren 2012, Bourne 2008). In 1970, the physiologist Sune Wehlin had full responsibility for writing the official Swedish training theory for cross-country skiing, which he did using a scientific vocabulary and stressing the importance of measuring bodies during training (Swedish Ski Association, 1970, 18-23). Wehlin was optimistic about the possibilities of new methods, and predicted Swedish success due to increasingly scientific training setup (Swedish Ski Association, 1970, 7). The training manual even included charts with oxygen uptake and other data on test subjects (Swedish Ski Association, 1970, 11, 13). The role of physiology continued to increase during the 1970s. In 1974 the training manual included a chapter on scientific testing as an important tool for skiers who otherwise could not compare performances from training sessions in different landscapes (Bergh, 1974, 55). Between 1948 and 1974, training manuals were transformed from an almost poetic account with romantic connotations to a scientific *technology of sportification*. Their importance declined as skiers in the 1970s increasingly received training advice from coaches at specialized educations for talented skiers (e.g. Ottosson 2013, Wassberg 2013).

Olander's ideas place him in a tradition that is far from the scientific, physiological approach developed by scientists like Åstrand and Saltin. The attitudes of the skiers were highly individualized, with some leaning towards the natural methods of Olander and some towards the scientific approach. Even those who were among the more positive towards scientific influence warned that a too far-reaching rationalization of training risked taking away the joy and reducing performance (Rönnlund, 1967, 43). The skiers were reluctant, to say the least.

### **Additional technologies**

In addition to the four *technologies of sportification* that presented above, there are others that need further attention. For example, the introduction of professional, educated and specialized coaches, beginning in the early 1970s with the first "ski gymnasiums", i.e. special high schools for elite ski talents, further underlined the scientific turn in training (Svensson 2014). The role of coaches in the process of rationalizing training methods has been increasing for more than a century (e.g. Day 2012), and earlier research indicate that the role of such coaches as facilitators of scientific training knowledge have been massive in many sports, such as athletics (Yttergren 2015, 2012) and football (Carter 2010).

Technology in its more literal form (equipment, clothes, skis, etcetera) have also greatly influenced sport and continue to do so today (Haake 2009, Fuss, Subic and Ujihashi 2008, Tenner 1996). However, the study of such technologies lies outside the scope of this article. For the purposes of this article it is sufficient to note that technological innovations as well as specialization and professionalization has continued and accelerated through the use of GPS, pulse watches, scientific testing, high-tech sportswear, machine-made tracks and so on.

Doping is another example of how science has influenced training (e.g. Rosen 2008, Woodland 1980). This extreme end of scientific preparation of the athletic body has

also been influenced by Swedish physiologists. Björn Ekblom discovered the basis for blood doping (Ekblom and Huot 1972, Ekblom, Goldbarg and Gullbring 1972). He had no ambition to provide a means for athletes to cheat, but that is how the basic scientific knowledge has been used by some. Ekblom's research was basic physiology, while from a sport perspective it opened up for cheating. Ekblom himself realized the potential problems with his discovery (Ekblom 1972), but the results indicate that the role of physiology in sports have not only been beneficial. In other countries than Sweden, scientific knowledge has purposely been used for doping of athletes (Hoberman 1992, Carter 2012) with the blessing of the state, as just recently in Russia according to the World Anti-Doping Agency (McLaren 2016).

Doping can be seen in this light as an extreme example of *bio-power* (Foucault 1998), and there have been attempts to frame doping using Foucauldian theories on power (Kimura 2003). While doping is an extreme form of scientization and has been characterized as a technology similar to others used in sport, like high-altitude pressure chambers (Kimura, 2003, 225), it also goes against many of the fundamental aspects of sportification, such as (current versions of) regimentation and equalization. Therefore I do not include doping as a *technology of sportification* in this article.

### ***Technologies of sportification and power relations – universal science vs. local experience?***

The Foucauldian theories on discipline focus on how bodies are controlled in a productive way, made to increase their performance (Foucault 1998). This is done through the use of organized time, space and activity (Markula and Pringle, 2006, 74). In the area of sports, this translates to elements of the sportification theory such as regimentation, rationalization and equalization. Training is moved from nature to controlled spaces, from the athlete's home environment to a test lab, from the forest

trail to the treadmill. Increased focus on time (intervals, training logs, planning and periodization) limits the individual freedom of the athlete. Training activities themselves are re-organized to fit scientific, productive discourse and theory. In cross-country skiing, this has meant less general strength training (like manual forestry work), more specialized training with focus on muscles most frequently used in skiing (Svensson 2014, Sandbakk and Tønnesen, 2012, 25-30). The declining importance of forestry in skiing challenged the experiential knowledge of skiers. Physiologists argued for increasing interval training on scientific base, but such questioning of individual skier's expertise was not easily accepted (Åslund 2013, Stefansson 2013). At a training camp in Rättvik in the 1960s, the national team skiers were told to run intervals up and down the skiing slope. Lars Olsson, forestry worker and skier from Värmland, made two runs and then walked away, explaining: "there are never more than two slopes like that in a race" (Oppenheim, 2004, 94-95). There are also examples of how skiers refused to participate in scientific testing (Stefansson 2013). These protests should not be seen as an expression of ignorance towards the effects of the interval training recommended by scientists, but rather as a frustration over losing control over one's own skill. It was a matter of expertise, and who could claim to have it.

There is also a gender aspect to this meeting between scientists and skiers. All the scientists were male, as were most of the officials representing the Swedish Ski Federation. This could have had an effect on how male and female skiers adapted to scientific advice. Did female skiers, lacking the tradition and connection to forestry that shaped male skiers, more easily adapt to scientific training? From the material studied here, the answer is no. Female skiers active during the 1960s did not change their training much because of new scientific knowledge (e.g. Gustafsson Rönnlund 2013, Martinsson Grahn 2013, Johansson Öberg 2015).

The scientific impact transformed cultural background, personal experiences, free will and plain stubbornness to calculations of  $VO_2$  max and pulse rates. In the

scientific articles, the skier became a replaceable object representing a certain scientific result. The value of personal experience was diminished when things like the sugar balance of glucose water was controlled by scientists, causing problems in the relations between skiers and physiologists (Stefansson 2013).

Attempts to quantify and analyze skiing performance in the 1950s, 1960s and 1970s were an aspect of the strong rationalization movement in Sweden at that time (Svensson 2013, Bolling 2005). This is in line with earlier research on other nations and regions of different cultural and political traditions, where sport science more often than not has been tied to a broader political agenda to strengthen and educate the population for nationalist, military, economic and medical reasons (e.g. Latham 2015, Krüger 1999, Berg and König 2002, Beamish and Ritchie 2005, Johnson 2009, Hale 2008, Heggie 2011, Hoberman 1992, Howe 2006). The *technologies of sportification* were employed to further scientific training knowledge, and the strategy proved successful. Science has contributed directly to the sportification process and the ambition of constant improvement of performance advocated by international federations such as the IOC. Still the scientific influence had to fit within existing ethics of international sport, and certain technologies for improved performance were banned or heavily regulated (Kimura, 2003, 225-226). Why is doping different than other scientific contributions? At least in the Swedish case, there was an ambition to spread the new scientific training methods to the broader population (Svensson 2013), for reasons of public health. Doping does not (yet) have a similar potential, and as it also breaks with basic aspects of sportification (regimentation, equalization) it is only logic that it is fought with such intensity.

Through the scientific logics of effectivity, comparability and rationality, scientists used *technologies of sportification* such as training manuals, testing, training camps and training logs as tools. They accessed the data needed, compared it over time and with results on international level, and finally designed training advice based on their findings. In a sense, *technologies of sportification* stood against what Michel Foucault

has labelled *technologies of the self*, i.e. strategies or practices used by the individual to change the self (Martin, Gutman and Hutton 1988). The role of such technologies in sport has been framed as something that can give a certain freedom to act within the existing discourse, rather than to change that discourse altogether (Markula and Pringle, 2006, 152-153). Foucault has been rightly criticized for underestimating the individual agency and the difference of social normativity in different subgroups of society, such as elite athletes (Pylypa, 1998, 33-34). Athlete's responses to *technologies of sportification* show that while in some cases the technologies of self and of sportification coincided, the responses and motivations were quite personal. For example, some skiers used training logs as a technology of the self to design and evaluate their training based on personal experience, while the physiologists could use the same technology to build a scientific base for training.

In the case of cross-country skiing, *technologies of sportification* did not have an immediate effect. Most skiers continued to rely on their experiential, personal knowledge regarding training. However, the *technologies of sportification* which were introduced in the 1950s gradually became standard features for coming generations of skiers. By the late 1970s, training logs, training camps, scientific testing and training manuals built on scientific knowledge were standard, and an important way to translate science into practical, usable methods for athletes. If sportification in its early stages during the late-19<sup>th</sup> century was more about regimentation and equalization (Yttergren, 1996, 210-211) then my conclusion from studying sports development from the mid-20<sup>th</sup> century onwards is that rationalization, in the form of scientization of training, has been the most important factor. Given the vital role that *technologies of sportification* played in cross-country skiing, I argue that this theoretical approach could be a fruitful addition to the general theory of sportification, especially when it comes to the study of training. The role of these technologies in other sports deserves more attention from sport historians.

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### **Interviews (by Daniel Svensson)**

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## **Endnotes**

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<sup>i</sup> Swedish Ski Association archives, ref code SE/RA/730603.