Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Social and Educational Sciences
Department of Psychology

Eline Lillegård

Psychological factors and rifle shooting performance

Exploring grit, passion, flow and self-efficacy's effect on rifle shooting performance in national level athletes

Master's thesis in Psychology - Specialization in learning, brain, behaviour, environment

Supervisor: Hermundur Sigmundsson

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Abstract

Purpose – The present study investigated the relationship between psychological factors (passion, grit, self-efficacy and flow) and performance in rifle shooting, as well as discussing in which way these factors may lead to good performance.

Method – Rifle shooters on a national level (N = 49) responded to four questionnaires during the winter season, reporting their subjective experience during a competitive setting (Oslo Open 2019).

Results – Grit was significantly related to results during Oslo Open (r = -.259). Passion was significantly related to rifle shooting performance, both overall ranking for the summer season 2019 (r = -.244) and results during Oslo Open (r = -.296). Self-Efficacy was significantly related to both overall ranking for the summer season 2019 (r = -.325) and results during Oslo Open (r = -.305) and explained approximately 11% of the variance in the overall ranking. Flow was significantly related to both overall ranking for the summer season 2019 (r = -.297) and results during Oslo Open (r = -.520) and explained approximately 27% of the variance in the results during Oslo Open.

Conclusion – These results indicates that psychological factors may be of essential importance for rifle shooting performance on a national level, and that the best rifle shooters in Norway possess high levels of the four psychological factors tested.

Originality/value – To my knowledge, this is the first study on psychological factors and performance in rifle shooting. The study adds important information about some of the psychological mechanisms involved during rifle shooting, and the information provided by the study can be transferred to other domains as well.

Keywords – psychological factors, passion, grit, self-efficacy, flow, rifle shooting, performance

Preface and acknowledgements

The motivation behind my master's thesis comes from a personal interest for sports and a great fascination by successful athletes and their performances. I have always wondered how these athletes are able to perform on such high levels, especially under great pressure. When I was taking my bachelor's degree in psychology, we had a guest lecturer in one of our classes, Vegard Haukø Sklett, who talked about his master's thesis that focused on psychological factors effect on ski jumping performance. Ever since this lecture, I had a dream to write a similar master's thesis being given the chance. My master thesis is therefore inspired by Sklett's thesis from 2017. The reason I choose to look at rifle shooting is that I am a rifle shooter myself and have been my whole life. I therefore have a great passion for the sport and have experienced the differences between good and bad performance, and how this is dependent on different psychological factors. The factors grit, passion, flow and self-efficacy are therefore factors that I have experienced myself multiple times – or during my worse performances, the lack of these factors. Because of this, this thesis is based on the search to get a more complementing understanding of the most prominent psychological factors in rifle shooting performance.

The work on this thesis, have at times been very demanding and challenging. But the process has more than anything been very rewarding, educational and enjoyable. I found it extremely motivating to be given the chance to write my master's thesis about a subject that I am so interested and passionate about. I am therefor very grateful for my supervisor, Hermundur Sigmundsson, who has been very supportive of my work and has made it possible for me to write about this subject. His contributions and enthusiasm have been very appreciated.

I would also like to thank Det frivillige Skyttervesen (DFS) for allowing the research project to be executed, Nordstrand Skytterlag for their invaluable help during my data collection and Leif Gravem for his contribution during the development of the self-efficacy scale.

My biggest gratitude goes out to the 49 shooters that chose to participate in this study – without them there would be no thesis. Their interest for the project and exclusively positivity has meant a lot to me during the process.

Eline Lillegård

Bøfjorden, April 2017

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1. Introduction

I have always had a great interest in sports and admired the people that become successful athletes. I have especially wondered a about what is going on in these extraordinary athletes' minds – both in their daily lives, during practice and under big and stressful competitions. What separates the mediocre athletes from the great athletes?

The field of sports psychology seek to answer this question. Sport can broadly be defined as physical activity for the purpose of exercise and recreation or for the purpose of competition and for reaching the best possible results (Bryhn, 2018). Psychology is often defined as the science of mind and behaviour (Gross, 2005). Sports psychology is therefore a broad field which mainly focuses on applying psychology to enhance athletic performance (Cox, 2001).

To achieve great performance in sports, a person must possess a high level of a variety of different skills. A skill is defined as an action or a task that is executed and that has a defined goal or purpose (Sigmundsson & Haga, 2005). Skills must not be confused with abilities, that are a more general capacity of the individual that is related to the performance of a variety of skills or task (Fleishman, 1972). Abilities are often linked up against the very disputed term talent. Skills in contrast to abilities are not innate and can be acquired and learned through practice (Sigmundsson & Haga, 2005). In sports the skills that first come to mind are probably the motoric, physical and technical skills. These terms are also related to physical fitness. Physical fitness can be defined as innate or acquired personal attributes that are related to a person's capacity to perform physical activities (Gísladóttir, Haga, & Sigmundsson, 2014).

In addition to the motoric skills mentioned above, physical fitness also consists of endurance, strength, flexibility, speed, reaction time, suppleness and so on. Practice is necessary to improve an athletes motorical skills, technical skills and physical fitness, and therefore also the overall performance. Deliberate practice seems to be the most effective and important in this case (Ericsson & Pool, 2016). Deliberate practice is highly structured practice, with a clear goal to improve a specific skill or a set of specific skills. This type of practice can often be perceived as boring and little rewarding (Filion, Vallerand, Amiot, & Mocanu, 2017).

Ericcson et al (1993), found that at 20 years old, experts in different domains, had about 8000 hours deliberate practice more than amateurs the same age. Experts can be defined as people that perform consequently better than their peers, produce concrete results and their expertise can often be replicated and reproduced.

In addition to this expert also have in common that they have practiced intensively (deliberate practice) and with clear goals, they have had dedicated and enthusiastic coaches, and have received support from their family along the way. Experts are also often recognised by having a so-called inner motivation. Ericsson have argued that it takes 10 years, or at least 10 000 hours of practice to become an expert (Ericsson, Prietula, & Cokley, 2007). Experts therefore possess a superior level of the skills that are needed to perform in their specific domain, and they seem to have in common a great level of perception-action coupling (Warren, 1990). Perception and action are coupled by laws of control that relate informational variables to parameters of the action system so as to regulate behaviour in an adaptive way. Action-relevant information is both generated by and reciprocally used to regulate our movements. This insight originates from Gibson (1979), who claimed that: "We must perceive in order to move, but we must also move in order to perceive" (p.223). Studies indicate that visuomotor processes can differentiate experts and novices, and that performance can be explained by the temporal adaptations to rebounds and the number of movement adaptations. The most skilled athletes can control precisely timed visuomotor behaviours under tightly constrained spatiotemporal conditions. This has been showed e.g. in different kinds of ball sports (Mallek, Benguigui, Dicks & Thouvarecq, 2017).

To reach a level of expertise, you will have to engage in deliberate practice. When you develop your skills, that being technical or mental, you go through a learning process. One theory for learning and the learning process, is Edelman's (1993) theory on neural group selection. The learning process is according to Edelman an experience-based selection, where your nervous system changes and adapts to development and experience. Practice strengthens the neural connections that are used in the specific actions. It could be argued that Edelman's theory supports the perspective of specific training; each skill is specific and should be specifically trained (Edelman, 1993). The actual learning process consist of four phases, and where we are in the learning process depends on how much training and experience, we have in relation to what we should learn (Sigmundsson, Trana, Polman & Haga, 2017). In skill development, both quantitative and qualitative changes occur. Quantitative changes involve the development of new skills. The first stage of skill development involves quantitative changes and obtaining a general understanding of the skill. In the acquiring and refining the skill stage, qualitative changes occur, which are improvements of the skill you have acquired. For example, you become able to control the skill better, to make it more efficient, reducing inaccuracies and large variations in performance.

The individual will then reach the automation stage. At this point, the skill is highly learned, requiring little attention for its actual execution. To achieve this level of motor skill proficiency, intensity and the number of repetitions of practice is central. In the fourth phase, skills may be applied or transferred to other situations or different contexts. This will only happen if the skill has been well learned and maintained. This is consistent with the brain's ability for plasticity, and if you do not maintain specific brain functions, these areas could degrade (Sigmundsson et al, 2017).

In addition to the skills mentioned above, e.g the motorical and technical skills, there are also a variety of psychological factors that are crucial for performance. Sports psychology is an old and comprehensive field that provides us with an arena to explore the interactions in human performance, thoughts and emotions (Singh, Bhardwaj & Bhardwaj, 2009). Psychological factors are important for motivation, coping with resistance and maintaining the energy level that is necessary to put down the effort that is needed to achieve excellent results and performance in sport (Duckworth, 2017, Duckworth, Matthews & Kelley, 2007, Filion et al, 2017). But psychological factors can also be crucial for performing under pressure, to best cope with nervousness and negative thoughts, regulate tension, presence during the competition and keeping the focus where it should be. Numerous studies have explored psychological factors in elite athletes, and it has been found that the level of the different psychological factors that the athletes possess, is what separates the successful athletes from the less successful athletes (Krane & Williams, 2015). The most successful athletes will therefore possess some psychological factors that enhance their performance. The most important psychological factors for performance highlighted by Krane and Williams are a bigger total engagement, clear and defined long-term and short-term goals, confidence, visualisation, ability for self-regulation, high standards to themselves and an ability for planning. In addition to these factors, Orlick and Partington (1988) highlights focus as another essential factor.

Mental practice is used to improve your psychological skills. Mental practice is procedures and exercises that increases an athletes ability to be effective and better prepared when he or she attempts reach their goals, and is a tool to develop psychological skills so that you in the best possible way can utilize your physical resources (Pensgaard & Hollingen, 2006).

The psychological factors, the motorical skills, technical skills and the physical fitness seem to be in reciprocal relationship with each other, and together they create the foundation for great performances in sports (Sklett, Lorås & Sigmundsson, 2018).

In my master thesis I am going to take a closer look at shooting sports, specifically rifle shooting, and some psychological factors that I believe may have an effect on performance in rifle shooting. The factors I will explore are grit, passion, flow and self-efficacy. I have chosen to look at rifle shooting because of a personal interest for the sport, being a shooter myself. But I also chose this sport because rifle shooting is a very mentally demanding sport. Focusing on your tasks, keeping your concentration on a high level, regulating your emotions and having your head in the game is crucial for performance in the sport (Jeppesen & Pensgaard, (2006). Rifle shooting is also a technically difficult sport, and it takes years of practice to get the shooting positions technically correct and stable – but in the heat of the moment, it is your mental skills that initially will decide your result.

I will therefore in this study explore the relationship between psychological factors, and performance in rifle shooting. My research question is therefore: are the participants score on the psychological factors related to their ranking and results in the individual shooting competition?

2. Theory

2.1 Rifle shooting

"A passion for precision"

-Unknown

Shooting sports is a collective group of competitive and recreational sporting activities involving proficiency tests of accuracy, precision and speed in shooting. In this Master's thesis the focus will be on bullseye shooting, using a rifle. Here the goal is to hit a round shooting target as close to the middle as possible with a precision rifle. These disciplines place a large emphasis on precision and accuracy through sight picture, breath and trigger control. In addition to this, several mental aspects like focus and emotion regulation are seen as important for performance (Jeppesen & Pensgaard, 2006). In Norway Det Frivillige Skyttervesen (DFS) or the National Rifle Association of Norway, is the largest organization for shooting sports (Bryhn & Tosterud, 2016). DFS has over 138 000 members which makes it one of the biggest sport organizations in the country. Every year DFS arranges «Landsskytterstevnet» which is the Norwegian championship in rifle shooting. This is the biggest sporting event for rifle shooting in Norway, and it is also one of the biggest sporting events in the country independent of the sport, with between 4000 and 7000 participants each year (Bryhn & Tosterud, 2016). After the initial shooting, the 15 best shooters get to shoot at «Kongelaget» or «Kings Team», which is the finale at «Landsskytterstevnet», and the «shooter queen» or «shooter king» of the year is crowned (Bryhn & Tosterud, 2017).

DFS contributes to develop Norwegian athletes that are amongst the best in the world. For example, did shooter Gudbrand Gudbrandsen Skatteboe win Norway's first individual Olympic gold medal at the Olympic Games in Athen 1906 (Det Frivillige Skyttervesen, n.d.). Competitions in rifle shooting are arranged the whole year around, and there are many different disciplines you can compete in. The focus in this thesis will be on the standard program for bullseye shooting in DFS. In the summer, this program is shot outdoors on a range with a shooting distance of 200 or 300 meters, using a large bore rifle. In the winter this program is shot indoors, with a shooting distance of either 15 or 50 meters, using a small-bore rifle. The rifle most used in Norway is the Sig Sauer STR 200 (STR: Scandinavian Target Rifle) (Bryhn & Tosterud, 2016). The standard program for bullseye shooting in DFS consists of 35 competition shots where the shooter switches between three positions; prone (see Figure 1), kneeling (see Figure 2) and standing (see Figure 3). The program consists of different series, with different time limits and different levels of difficulty.

Figure 1. Prone Position

Sourced from: https://www.dfs.no/skyttertidende/aktuelt-na/nyheter-fra-nst/2015/liggende-stilling/

Figure 2. Kneeling position

Sourced from: https://www.dfs.no/opplaring/oktarkiv/basis-skyting/avtrekksokt-2/

Figure 3. Standing position

Sourced from: https://www.aftenposten.no/sport/i/jd3WEn/halv-million-skudd-blir-avfyrt-i-loepet-av-landsskytterstevnet

As a senior you get divided into different classes depending on your skill level. (Bryhn & Tosterud, 2016). What is unique about shooting in DFS, is that men and women shoot in the same classes; there is no division between the sexes. Both men and women shoot the same programs, with the same time limits, and they also shoot at the same distances and use the same rifles and ammunition. Therefore, at for exampel «Landsskytterstevnet», it is crowned either a shooter queen or a shooter king, and not one female champion and one male champion. There are however a greater proportion of men that shoot in DFS, and since the first «Landsskytterstevnet» in 1893, there has only been crowned three shooter queens; in 2006, 2015 and in 2017 (Bryhn & Tosterud, 2017).

As a senior in DFS you also compete across different ages. Therefore 18-year olds often compete with people that are over 70 years old.

Rifle shooting research

The field of rifle shooting research is small; however, some research has been published. For example there has been done research on the aiming process in rifle shooting (Zatsiorsky & Aktov, 1990), preparatory heart rate patterns in competitive rifle shooting (Konttinen, Lyytinen & Viitasalo, 1998), psychophysiological processes during rifle shooting (Bird, 1987) and brain activation during shooting in novices and experts (Janelle et al, 2000).

A very interesting study on rifle shooting has also been done at NTNU. This study looked at rifle shooting practice and the positive effects this can have on children with ADHD and other concentration difficulties. It was concluded that the practice led to an increase in concentration in the children, and that the children experienced great self-efficacy, well-being and a calmness at the shooting range. Some of the children also said in interviews that the shooting practice gave them techniques for controlling their behaviour outside the shooting range as well (Østerlie, Vedul-Kjelsås, Buaas, & Løhre, 2018).

To my knowledge there is done very little to no research on the psychological aspects of performance in bullseye shooting using a rifle. This study will, therefore, explain some important theories of psychological factors and the impact these factors could have on national level rifle shooters performance.

2.2 Grit

«Grit is not falling in love, but staying in love.»

-Angela Duckworth, psychologist

It may not come as a surprise to anybody that great effort and endurance is necessary if you are going to accomplish anything in life. Grit is a term that very well summarises these factors. Grit can be defined as the tendency to go for long term goals with passion and perseverance (Duckworth, Peterson, Matthews, & Kelley, 2007). Grit is about having a goal you care about so much that it organizes and gives meaning to almost everything you do in your life. Grit is holding on to that goal, even when you fail (Duckworth et al, 2007). Gritty people are people with great stamina, who never give up and seem to have an unlimited amount of motivation. The interest in grit has increased greatly these past few years, maybe especially in fields like sports, education and learning, because of grits ability to predict success. Studies have for example found that grit seems to correlate with academic performance at elite universities (Duckworth et al 2007) and time spent at the US Military Academy, West Point (Duckworth & Quinn, 2009). Grit seems to predict success and performance in demanding domains, and surpasses predictions based on for example talent. Talent and grit are therefore two unrelated terms, and Duckworth have stated that talent in no way guarantees that a person has a lot of grit. Actually, it seems like grit and talent more often are negatively correlated, and that people with great talent, on the average are less gritty. People with both great talent and a lot of grit are therefore very rare (Duckworth & Winkler, 2013).

Grit consists of two subscales: maintaining interest and perseverance in effort (Duckworth et al, 2007). It has been concluded that grit leads to success because gritty people are more likely to engage in deliberate practice, possibly the most important factor for success and performance. Deliberate practise is not necessarily a very positive and giving activity for the individual, but people with a great amount of grit looks past this and focuses in all the advantages deliberate practice will give in the long run. Because of gritty people's persistent interest and endurance, they will continue this deliberate practice day after day, and year after year. In addition to this gritty people will choose more challenging and difficult tasks when given the option. It therefor seems like gritty people likes being challenged more than less gritty people (Duckworth, Kirby, Tsukayama, Bernstein & Ericsson, 2011).

Grit may also lead to success because people with a lot of grit seem to be more motivated, more aware of what they want to accomplish, and because they are more resilient and

therefore handle adversity better than people with less grit (Duckworth, 2017). In many ways grit is what makes you continue to work hard towards your goals, when all you feel like is giving up.

Grit seems to be related to self-control, and the amount of grit increases with age. Studies have also found that grit is correlated to self-efficacy (Rojas, Reser, Toland & Usher, 2012). It also seems like people with a growth mindset to a larger extent possesses grit, than people with a fixed mindset (Duckworth, 2017). Grit and Big Five conscientiousness seem to be somewhat the same trait both phenotypically and genetically, and grit also seems to be highly similar to other personality traits (Rimfeld, Kovas, Dale & Plomin, 2016).

Whether grit can be "learned" or trained is debatable. Some people claim that grit is an innate ability, but Duckworth (2017) however is not of this opinion. She says that a person can increase his or her level of grit, or at least indirectly by training factors that are related to grit. For example, she claims that participating in gritty cultures and being around gritty people could increase a person's own level of grit. She also says that finishing the tasks that you have started will make you grittier, but that this also demands a certain amount of grit. There is some empirical evidence that grit can be learned. Rimfield et al (2016) found in their twin analyses that grit yielded a heritability estimate of 37%, with 20% for consistency of interest. This indicates that environment may account for the remaining percentage of grit level, and that the environment you surround yourself with and the actions that you do, can increase or decrease your own grittiness.

2.3 Passion

«Do what you love, and you will never work a day in your life»

-Confucius, philopsopher

Passion is a factor that is considered to be a part of grit. To work towards your long-term goals with passion and perseverance is the very definition of grit, and gritty people will therefore also most lightly be very passionate people, it least in their specific domains. But passion can also be considered an important psychological factor itself. Passion is defined by Vallerand as «a strong inclination and desire towards an activity that one likes, finds important, and in which one invests time and energy» (Vallerand, Blanchard, Mageau, Koestner, Ratelle, Léonard & Marsolais, 2003, s.1). Jachimowicz defines passion as "a strong

feeling toward a personally important value/preference that motivates intentions and behaviours to express that value/preference" (Jachimowicz, Wihlerb, Baileya, & Galinskya, 2018, p.9981).

For an activity to be a passion to someone, the activity must be considered significant and important to the person's life. The activity must be something you like, or may even love doing, and therefore something you also spend a lot of your time doing. Passion for a sport, for example, is something you either have or don't have. It is therefore not a skill that can be trained or learned.

Passion is a very old term, yet it has received very little attention by psychology. Until recently there has only been done research on romantic passion (Vallerand et al, 2003), but philosophers have always been interested in the term. Aristotle and Rene Descartes argued that passions are positive if reason underlies behaviours. In this perspective passion is a necessary ingredient for all achievements (Mageu, et al, 2009). Hegel also shares this view and argues that passion generates potentially important adaptive and beneficial outcomes, and he goes so far as to say that passion is the subjective aspect of energy, will and activity in general (Sparknotes, 2020). Others, e.g. Lagache and Spinoza, have argued that passion can lead to negative outcomes when people lose control over their activity engagement. Today passion has received more attention in the field of psychology, and the present research also mirrors these two perspectives.

Vallerand, one of the most influential people in the area, claim that passion is strongly related to identity. Great passion for an activity, for example a sport, will cause this sport to become an important part of the person's identity, and the sport will be a part of defining the person. For example, will a person that is very passionate about football, not only play football but **be** a football player (Vallerand et al, 2003). But passion being so connected to identity, can according to Vallerands perspective cause some problems.

Vallerand therefore takes a dualistic approach to passion: he divides passion into harmonic passion and obsessive passion. In the case of harmonic passion, the activity is internalized autonomously into the person's identity. This means that the person will accept the activity to be very important to them, but that it is not related to for example their value as a human being or their self-esteem. There will be a clear separation between the activity and the self. Harmonic passion will give increased motivation and cause a person to voluntarily engage in the activity. This will also give the person confirmation. In the case of harmonic passion, the

activity, for example a sport, will harmonize with the other aspects of a person's life (Vallerand et al, 2003).

An obsessive passion will in contrast arise if the activity is controlled internalized in the person's identity. This type of internalization will come from an interpersonal or intrapersonal pressure. This pressure occurs either because certain emotions is linked to the activity, for instance the feeling of being socially accepted or your self-esteem, or because the joy that arises when you engage in the activity becomes uncontrollable. This will lead to the person feeling forced to engage in the activity, and the activity will therefore not any longer be something that the person does voluntarily. The person will no longer be in control, but be controlled by the passion, and therefore the activity can end up taking over big parts of the person's life. This will lead to a conflict between the activity and the other aspects in the person's life (Vallerand et al, 2003). Those who experience obsessive passion, will be more likely to quit the activity than people who experience harmonic passion.

In contrast to Vallerand, some present research takes on a different and more positive perspective on passion. In more recent times the "positive psychology" has become a more popular direction within psychology. The positive psychology focuses on optimal human functioning, and how people's lives can be most worth living (Seligman & Csikszentmihalyi, 2000). Seligman and Csikszentmihalyi is of the opinion that passion is one of several answers to the question above. They claim that the people that wake up with a smile because they are looking forward to practice or a competition, and who work hour after hour to achieve exceptional results, will have a passion that makes their lives worth living. Passion gives meaning to the everyday life and gives motivation and a feeling of wellbeing. This perspective has more focus on passion for achievement, and not so much on the possible negative outcomes of passion. According to Jachimowicz (2018) passion produces beneficial effects on performance through a key mechanism called immersion, or a deep involvement in something. Passion is in this case something that drives us. Jachimowicz also underlines passion as an important underlying dimension of grit. This master thesis follows Jachimowicz definition of passion and therefore focuses on passion for achievement. The scale used in my questionnaire is therefore also based on this perspective (Sigmundsson, Haga & Hermundsdottir 2019).

Passion have shown to lead to increased performance within several domains. For example, have studies shown that passion leads to better performance in football (Filion et al 2017), basketball, synchronized swimming, waterpolo (Vallerand et al, 2008), and increased

performance in musicians (Roussy, Lavigne & Vallerand, 2010). Both harmonic and obsessive passion lead to better performance, the difference however was that only harmonic passion also led to wellbeing and positive emotions. Obsessive passion often led to more negative emotions.

Passion can lead to performance in several ways. First of all, you need to have a fundamental passion for an activity, for example a sport, to actually want to start doing that activity. This resembles Jachimowicz's immersion: a deep involvement in the activity. From there on passion will lead to increased motivation and give the person energy. This energy and motivation will give the person the necessary resources to engage in deliberate practice (Filion et al, 2017).

Passion, together with grit, does so that you choose to engage in deliberate practice, even if this may be boring and not very enjoyable. If you are passionate about for example a sport, you will therefore dedicate yourself completely to this sport, something that will help you endure in the face of adversity, which in the end will lead to success.

2.4 Flow

"A typical day is full of anxiety and boredom. Flow experiences provide the flashes of intense living against this dull background."

-Mihaly Csikszentmihalyi, psychologist

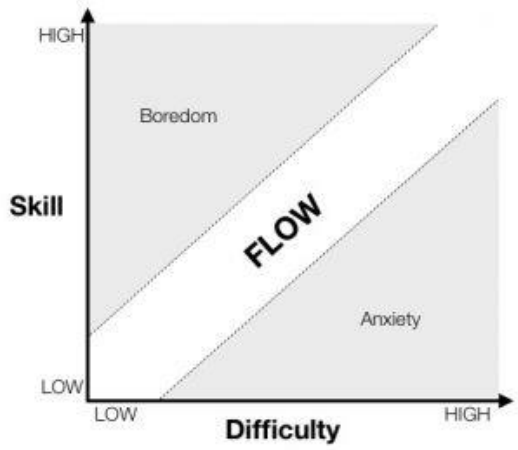
The term flow is important within the domains of learning, performance and expertise. This concept, developed by Mihaly Csikszentmihalyi, is just like passion a central term within the positive psychology perspective. Flow is also considered to be one of the answers to what makes life most worth living and is one of the hallmarks of optimal human functioning (Seligman & Csikszentmihalyi, 2000).

Flow can be defined as an optimal psychological state of consciousness where you are completely present in the moment and engrossed in the activity that you are doing. Further the state of flow can be recognised by having clear goals, confidence in your skills, full concentration, and full focus on the activity. You will experience a feeling of control, and often have a distorted apprehension of time. The activity will seem rewarding, unaffected by the outcome of it. And an inner motivation will occur (Nakamura & Csikszentmihalyi, 2014). Athletes will often not call this state flow, but rather refer to it as «being in the zone" or

“running on autopilot”. Under this state the individual will be working up towards is full capacity, without this being experienced as tiring. Being in this state will rather be experienced as very positive and joyful for the individual (Nakamura & Csikszentmihalyi, 2014).

Flow has been reported across different domains. For example have the state been found in artists, scientists (Csikszentmihalyi, 1996), authors (Perry, 1999) and in athletes (Jackson & Csikszentmihalyi, 1999). The state of flow seems to be universal.

According to Csikszentmihalyi, an optimal balance between skill level and challenges is the most important precondition to achieve flow (See Figure 4). If a person feels that there are too little challenges compared to his or her skills, the person will be bored, and therefor quit the activity. On the other hand, if a person feels that there are too much challenges compared to his or her skills, the person will become frustrated, and therefore also quit the activity. Preferably the task should be so challenging that the person must work up to its full capacity and do their very best to be able to solve it. This is similar to Vygotsky’s «zone of proximal development» (Nakamura & Csikszentmihalyi, 2014). By this means flow is not a skill that someone has, but a state that can be achieved if the mentioned conditions are met. It is still assumed that this state is easier to achieve, if you have experienced the state earlier (Jackson & Csikszentmihalyi, 1999).



Figur 4. Flow model

Sourced from: https://www.psychologytoday.com/us/blog/one-among-many/201502/flow-and-happiness

Flow is associated with «peak performance in sport. Elite athletes that have achieved extraordinary results have an increased probability for having experienced flow, and it is therefore assumed that flow is the underlying psychological process for «peak performance» in sports (Jackson & Roberts, 1992). This means that an athlete must be in a state of flow, if he or she is going to be able to achieve great results. There has been found evidence for this in several studies. For example, did Jackson and Marsh (1996) analyse athletes' description of their biggest achievements and self-reports collected by the Flow State Scale (FSS). They found that their descriptions matched the hallmarks of flow. Because flow seem to be the underlying psychological process for «peak performance» in sports, it is important that athletes and coaches seek to reach this state, and plan practices and competitions with this in mind. This state should not only try to be achieved because of its positive effect on performance, but also because if the well-being and positive emotions it gives the individual.

Flow is assumed to lead to superior performance in sports in several ways. Primarily it seems like flow encourages the athlete to return to and continue the sport, because of the positive experience flow gives. Flow is therefore associated with motivation, dedication, perseverance and commitment to the activity (Nakamura, 1988).

A person that is dedicated and committed to an activity will put in a lot of effort in that activity over a long period of time. And this is the very fundament of performance within any area. A study examined the relationship between experience and perseverance in activities within high school students. This study showed that students that still were committed to their talent at 17 years old, compared to students that have quit their talent, four years earlier had experienced a larger degree of flow, and lesser degrees of anxiety. These students had also to a larger extent identified their talent as a source of flow (Csikszentmihalyi & Rathunde, 1993).

It is also assumed that the self grows with the experience of flow, and that flow therefor contributes to increasing people's self-esteem. It is therefore natural to believe that flow may lead to increased self-efficacy and therefore also indirectly lead to better performance in sports. Flow is also characterized by increased concentration, focus and presence in the moment, which also are important factors of performance, maybe particular when someone is under a lot of pressure.

2.5 Self – efficacy

"Peoples level of motivation, affective states, and actions are based more on what they believe, than what is objectively the case"

-Albert Bandura, psychologist

The best athletes are confident, believe in themselves and the things that they do (Gould, Greenleaf, Lauer & Chung, 1999, Martin & Gill, 1991, Moritz et al, 2000). The term self – efficacy sums up these qualities in an athlete. This is the most studied psychological factor in sports, and many claims that having a high degree of self – efficacy is the most crucial element for performance. Self-efficacy can be defined as the belief one has in being able to execute a specific task to obtain a certain outcome (Bandura, 1977). Self – efficacy is not necessarily related to the persons actual ability to execute a specific task, but rather the persons subjective perception of his or her ability to execute the task. Self – efficacy can therefore be seen as a situation specific confidence. This means that a person can possess a high degree of self – efficacy in one area in life, for example in relation to a sport, but possess a lower degree of self – efficacy in other areas.

This concept was developed by Albert Bandura (1977) and plays a central role in social cognitive theory (SCT). SCT claims that behaviour does not only depend on external motivation, as is claimed by for example behaviourism. Instead SCT believes that people are proactively engaged in our own development, and that we actively control our own behaviour. Here our actions will be influenced by for example our degree of self – efficacy (Bandura, 1977).

Explained, this means that a person will assume that a given behaviour will lead to a certain outcome. Self – efficacy is the belief a person has that he or she can execute the action that is needed to achieve the expected result. The degree of a person's self – efficacy determines whether the person will even try to perform a specific action. Because of this Bandura claims that self – efficacy is what to a large degree control our lives, because if a person doesn't believe that he or she can achieve a specific result, they will also have little motivation to act (Bandura, 1977).

Self – efficacy varies over three dimensions: level, strength and generality. Level is related to a persons expected performance over different levels of difficulty. For example has it been found that football players with different degrees of self – efficacy, judges how many

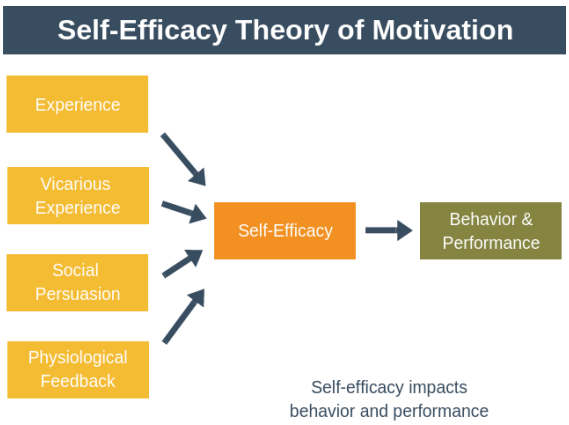
penalties they will be able to score differently (Feltz, Short & Sullivan, 2008). Strength is related to how certain a person is that he or she can execute a specific action or achieve a specific result. Strength can vary from being a 100% certain that you can execute the action, to being a 100% certain that you won't be able to execute the action. This means for example that two football players can both believe that they will be able to score on 6 out of ten penalties, but that one of them will be more certain at this than the other (Feltz et al, 2008). Generality concerns how general this self – efficacy is, that is over how many domains or situations a person will have a high degree of self-efficacy. For example, will a football players self-efficacy be very general if it is high across all skills related to football, and doesn't vary depending on different contexts (Feltz et al, 2008).

Self-efficacy can affect performance in several ways. This is a cognitive mechanism that among other things mediates your self-assessment, thought patterns, emotional reactions, motivation and behaviour; all important factors in sports performance (Feltz, et al, 2008). As mentioned, we know that self-efficacy effect which activities you choose to participate in. In other words, you will choose to participate in the activities you assume you will be able to master. This also means that we will not act if we do not believe that this can lead to getting what we want. Self-efficacy also seems to affect how much effort you are willing to invest in an activity, and how consistent and persevering you will be in your effort, especially in the face of obstacles. This will off course be of great importance for performance (Moritz, Feltz, Fahrback & Mack, 2000). More specifically this means that the more self-efficacy a person has, the more likely the person will be to seek challenges, and the desired goal achievement will also be greater. Athletes with a high degree of self-efficacy will therefore not be afraid to set big and challenging goals for themselves, and they will be enduring in the face of adversity. Athletes with a lesser degree of self-efficacy on the other hand will avoid challenging goals, worry about failure, put in less effort and easier give up when faced with obstacles.

It is also assumed that self-efficacy is related to emotion regulation, which can also affect performance. It is believed that athletes with a high degree of self-efficacy, also will have a higher degree of positive emotions, such as joy, happiness and satisfaction, while athletes with a lesser degree of self-efficacy will have a higher degree of negative emotions, such as sadness, anxiety and depression (Treasure, Monson & Lox, 1996). Further it is assumed that these negative emotions, in particularly anxiety, can be interpreted by the athlete as a consequence of not possessing the skills that are needed to execute the action, which further

affects the self-efficacy beliefs and therefore also the performance. People with positive self-efficacy beliefs seem to be better at regulating themselves to an optimal condition, which increases their chances to perform well.

It has been found that if you believe that you can master a task, you will normally perform better than if you do not believe that you can master the task. This seem to be the case in all areas in life, not only in sports. There are countless studies that prove this, and it has been published over 60 research papers related specifically to self-efficacy and sports performance (Moritz et al, 2000). For example, in a study on American Olympians during the Olympics in Nagano, self-efficacy was reported as the most influential factor for performance (Gould, Greenleaf, Lauer & Chung, 1999). A study done by Martin & Gill (1991) found that self-efficacy was e good predictor for performance in long distance runners. A metanalysis done by Moritz et al (2000) compared correlations from 45 different studies that all focused on different sports and found a positive relationship between self-efficacy and performance in sports. When it comes to different domains, Bouffard-Bouchard (1991) have shown that self-efficacy also influences performance in students. In this study they raised or lowered students' level of self-efficacy. It was found that the students that got their levels of self-efficacy raised, set larger goals for themselves and to a larger degree used effective strategies to solve their tasks or problems. This study is also evidence that the of level self-efficacy can be trained and improved. Bandura (1997) mentions four sources to the construction of self-efficacy: *previous experience, verbal persuasion, vicarious experience* and *physiological feedback* (See Figure 5).



Figur 5. Self efficacy

Sourced from: https://expertprogrammanagement.com/2018/10/self-efficacy-theory-of-motivation/

3. Method

3.1 Ethical considerations

No ethics committee were involved prior to this research project as no sensitive information is required from the participants. However, the project was carried out in accordance with the declaration of Helsinki and follows the ethical recommendations from the Norwegian Centre for Research Data (NSD) as far as possible.

The participants were informed about the purpose and execution of the study, and they had to sign a written declaration of consent (See Appendix A). prior to the study. The participation in the project was voluntarily, and the participants were given the opportunity to withdraw from the study at any time, without further questions.

The participants anonymity was emphasized, however the researcher in this study identified the respondents by writing their names on their envelopes during the data collection, in order to separate them by results on the ranking list and so that it would be easy for the participants to pick up their specific questionnaire. The questionnaires did however not have the participants name written on them, only their ranking and a random number. After all the data had been plotted into SPSS, it was impossible to identify the respondents and all the questionnaires were deleted, and only their numbers were used in further analyses.

3.2 Participants

The final sample consisted of 49 of the best shooters among the 100 best ranked shooters for the summer season 2019 (N=49). 38 (77.6%) of the subjects were men, and 11 (22.4%) of the subjects were women. The uneven number of men and women in the sample is not surprising and reflects the fact that shooting sports in Norway is dominated by men. For example, during Landsskytterstevnet in 2018, only 20.8% of the participants were women (Landsskytterstevnet 2018, 2018). This sample therefore seem to be representative of the population. The mean age of the subjects was 34.67 (ranging from 16 – 61 years; SD = 12.29). Descriptive statistics for the sample are shown in table 1.

Table 1. Descriptive statistics for the sample (*N*). Minimum (Min). Maximum (Max). Means (*M*) and standard deviations (*SD*).

Variable	*N*	Min	Max	*M*	*SD*
Age (years)	49	16	61	34.67	12.29

The sample represents some of the best DFS shooters in Norway, ranging from 1th place in the 2019 summer season, down to the 98th place (*M* = 43.24, *SD* = 29.87). If we look at the results from the Oslo Open competition, the sample ranges from the 1th place, down to the 304th place (*M* = 68.80, *SD* = 64.61). Descriptive statistics of the results from the performances measured in this study can be found in table 2.

Table 2. Descriptive statistics of the results from the performances. Means (*M*) and standard deviations (*SD*).

Variable	*N*	Min	Max	*M*	*SD*
Overall ranking summer season 2019	49	1	98	43.24	29.87
Oslo Open placement (before finals)	49	1	304	68.80	64.61

The sample can be expected to be homogenous to a certain degree, especially in regard to their skills for shooting (e.g. stability in the shooting positions, aiming ability and trigger technique). Other than this, the sample varies greatly when it comes to age, shooting experience, and demographic factors.

3.3 Procedure

I wanted to hand out my questionnaires during a competitive setting. This has several advantages; the flow and self-efficacy questionnaires are more directly linked to a specific situation and is therefore best used in relation to a specific situation. Testing the participants in relation to a specific competition also gave me the opportunity to compare the participants scores on the factors to their results in the competition as well as to their overall ranking. This gave me more options when it came to my analyses. Choosing to do my data collecting during an important competition may also increase the chance that the participants will experience the factors tested. As my data collection situation, I choose Oslo Open; a competition held every year the last weekend of November/first weekend of December. This is a big competition that gathers over 1000 contestants each year. It is also considered as an unofficial

Norwegian championship, and most of the best shooters travel to Oslo to compete in this competition.

After ended summer season 2019, I checked the ranking of the 100 best shooters. I contacted DFS and asked for permission to conduct my study, and after getting permission I contacted these 100 shooters mainly by email or messenger. In my email/messenger text I informed them about the study and asked if they planned attending Oslo Open later that year, and in that case if they wanted to participate in the study. 62 of the shooters said that they were planning to compete in the Oslo Open competition, and all of them were interested in participating in the study. A big portion of them however ended up not competing that weekend after all. 13 of 62 (21%) of the shooters therefore did not answer, and the final sample had a total of 49 participants ($N = 49$). As mentioned, the main lack of responses was caused by the fact that not all the people interested in participating in the study, could compete in the Oslo Open competition after all. The response rate can therefore be considered as good.

The people who planned attending Oslo Open and who wanted to participate in the study, received another email/messenger text about a week prior to the competition to be reminded about the study.

I put all the questionnaires in envelopes, together with the declaration of consent. I wrote the participants name on the envelope, but the questionnaire only had their ranging and a random number for identification written on it. I organized all the envelopes alphabetically in a box, that I put next to the registration site at Nordstrand, the competition organizer. Every shooter that is going to compete in the competition have to go to the registration to pay a fee. I therefore felt that this was a good place for the participants to pick up their envelope

3.4 Design

To find out to which degree psychological factors are related to performance among the best shooters in Norway, and whether these factors can explain some of the variance in performances, this study employed a correlational research design. A correlational design provides empirical evidence suggesting two or more variables are, or are not, related to each other (Field, 2016). It is important however, to note that this evidence does not establish causal relationships. Still it does contribute to a deeper understanding of the variables being

studied and their relationship. Correlational research gives a natural view of research questions because there is no influence of what happens, but rather observations of what naturally goes on. Secondly a regression analysis was used, as it is a natural extension of a correlational analysis. A regression analysis is a statistical procedure for developing a mathematical equation that describes how variables in the data are related and use it to predict values of outcome variables from one or more predictor variables (Field, 2016). A regression analysis therefore provides us with some additional information about the variables and their possible relation. The questionnaire used in this study consist of four different scales based upon four different psychological theories: The passion 8-items scale developed by Sigmundsson, Haga & Hermundsdottir (2019), the grit 8-items scale developed by Duckworth & Quinn (2009), the Flow State Scale – FSS by Jackson & Marsh (1996) and Self- Efficacy (adapted by Sklett 2017).

3.5 Instruments

Three of the instruments used in this study were based on previously developed standardised scales; Passion (Sigmundsson, Haga & Hermundsdottir, 2019), Grit (Duckworth & Quinn, 2009) and Flow (Jackson & Marsh, 1996). The instrument for Self – Efficacy was based on a scale developed for a similar master thesis (Sklett, 2017). The three standardized scales used a five-point Likert scale, ranging either from "strongly disagree" (1), to "strongly agree" (5), from "not at all typical of me" to "very typical of me". The self – efficacy scale used a seven-point Likert scale, ranging from a small degree of certainty (1) to a high degree of certainty (7).

Grit

Duckworth, Peterson, Matthews, and Kelly (2007) defined grit as perseverance and passion for long-term goals. Grit S, short grit scale (Duckworth & Quinn, 2009) and the Norwegian translation of the scale (Sending, 2014) were used to assess the participants' level of grit (See Appendix B). The participants rated eight items, using a 5-point Likert scale with items rated in terms of how much the item was "true" for the respondent (1 = not like me at all and 5 = very much like me). The measure included two subscales of four items each: Consistency of Interest (COI) and Perseverance of Effort (POE). An example item for COI is 'I often set a goal but later choose to pursue a different one' (reverse-scored) and for POE, 'I finish whatever I begin'. Mean score for all the answers was used and the maximum score on this

scale is 5 (showing extreme grit), and the lowest score 1 (no grit at all). Cronbach's alpha for the passion scale was α = .63.

Passion

The passion 8-items scale developed by Sigmundsson, Haga & Hermundsdottir (2019), was used to assess passion score (See Appendix B). This scale focuses on the passion for achievement or becoming good in some area/theme/skill. The scale is a self-reported questionnaire with 8 items focusing on the passion a person has for an area/theme/skill, for example: *'I have an area/theme/skill I am really passionate about'.* The items are rated on a Likert scale, ranging from 1 to 5 (1 = not at all like me, 5 = very much like me). The scale is based on Jachimowicz et al.'s (2018) definition of passion as a strong feeling towards a personally important value/preference that motivates intentions and behaviours to express that value/preference. Mean score for all the answers was used, and the maximum score on this scale is 5 (extremely passionate) and the lowest is 1 (not at all passionate). Cronbach's alpha for the passion scale was α = .82.

Flow

To assess the participants level of flow – experience, the Flow State Scale – FSS developed by Jackson & Marsh (1996) was used (See Appendix B). The FSS consists 36 items and nine dimensions with four subscales (emotion, focus, arousal and time). In this study however I choose to use a total score for flow, instead of using a separate score for each of the subscales. The participants were asked to respond to the flow items using a five-point Likert type response format as previously described. For example, (Emotion): "*I loved the feeling of that performance and want to capture it again,"* (Focus): "*My attention was focused entirely on what I was doing,"* (Arousal): "*I was not worried about my performance during the event,"* or (Time): "*The way time passed seemed to be different from normal."* Higher scores reflected higher levels of flow experience, and the highest achievable flow score was 180. Cronbach's alpha for the passion scale was α = .92.

Self-Efficacy

Lastly, self – efficacy score was measured using a costumed questionnaire. The original questionnaire was developed by a former master student at NTNU, to assess self – efficacy in ski jumping (See Appendix C) (Sklett, 2017). Some minor adjustments therefore had to be made to make the questionnaire more fit to assess self – efficacy scores in rifle shooting. This

is because scales of perceived self-efficacy must be adjusted to the particular domain of functioning and the object of interest (Bandura, 2006). These changes were made by me, but I also sent the self – efficacy questionnaire (both the original and the adjusted) to a former shooter on the Norwegian national team, who has experience both as a shooter on a national level, and as an instructor for shooting. This expert feedback ensured the quality of my adjustments and contributed to the validity of my scale. The Self – efficacy scale was developed in line with Bandura's (2006) "Guide for constructing self-efficacy scales".

An 11 item scale was developed (See Appendix B) to measure self – efficacy related to specific rifle shooting capabilities, which are seen as essential for performance. These specific capabilities involve efficacy believes concerning the "cycle of shooting" – from firing one shot, to firing the next shot. These items focused on three different areas representing relevant challenges in performing the sport, and efficacy believes toward the equipment (rifle and suit), technique (positions, trigger control, focus and knowledge) and stress management. Example on phrases from the scale are *"How certain are you that your suit is good enough to reach the highest national level of performance", "How sure are you that you can performe your best under pressure"* and *"How sure are you that today you are capable to be amongst the best rifle shooters (DFS) in the country".*

Participants were asked to subjectively consider how sure they were about managing these challenges and situations on the previously described seven-point Likert scale. Higher scores reflected higher levels of self-efficacy believes, and the highest achievable score on self-efficacy was 77. Cronbach's alpha for the passion scale was $\alpha = .84$.

3.6 Statistical Analysis

Two types of analyses were done: a bivariate correlational analysis and a stepwise multiple regression analysis. The correlational analysis was conducted on all constructs to demonstrate the relationship between the psychological factors and rifle shooting performance, both from the overall ranking and from the individual competition. Lastly a stepwise multiple regression analysis was done to find whether the rifle shooting performances could significantly be predicted by the psychological factors. Both from the overall ranking and from the individual competition. To conduct the statistical analysis SPSS Version 26.0.0.0 was used.

The data from all the variables was checked for missing values. There were three participants with missing values. According to Pallant (2007) missing values is normal in quantitative research. The missing values on the variables were therefore replaced with the mean of the available cases. This method maintains the sample size and is easy to use. This is a recommended method for preventing the exclusion of many participants and a decrease of an already small variance in the sample by replacing the missing value by the mean (Pallant, 2007). This is therefore a good method to use in a study like this, where the sample size is relatively small. There can be several reasons why some of the participants did not answer all the questions in the questionnaire. It could be that they just did not bother, or that they forgot to answer some of the questions. In this case however, I think the reason for two of the three cases simply was that two of the pages in the questionnaires had stuck together and that the questions in between these pages were "hidden" for the participants and they therefore did not see them. In the third case I believe that the participant just forgot to check if the questionnaire had a backside, as only the last questions of the questionnaire (all the questions on the last page), were not answered.

In these questionnaires there are no right or wrong answers, which leaves multiple individual combinations within all constructs. However, it is essential to have a certain degree of internal consistency. All scales should measure Cronbach's alpha, and in the domain of psychology an $\alpha = .70$ should be the limit (Field, 2016). Alpha values lover than this should be considered as questionable. There were calculated Cronbach's alpha coefficients on all scales in this study. All values were above .70, except from the grit scale that had a Cronbach's alpha $\alpha = .63$. The other alpha values can be seen in table 3.

After the correlation analyses was performed, further implementation of the results was done, more closely studying the relationship between psychological factors from the indexes and rifle shooting performance, with a bivariate correlation using the coefficient *r* of Pearson. Pearson's correlation coefficient tells us something about the covariance between two measured variables (Field, 2016). According to Cohen (1992) *r*- values below .10 is considered a small effect, or a low correlation, values above .30 as a moderate effect or correlation, and values above .50 is considered as a large effect or correlation. Lastly a stepwise multiple regression was done. The goal of multiple regression is to enable researchers to assess the relationship between a dependent variable and several independent variables (Field, 2016). Stepwise multiple regression is hence used to find which combination of independent, or predictor variables that can predict the dependent, or predicted variable,

e.g. rifle shooting performance. The significance level (*p*-value) for correlations in this study was set at the $p < .05$ level. The analyses showed a negative correlation between performances/results and the psychological factors. This can be misleading, because it really shows that higher scores on the scales means that the participants are higher up on the ranking or result list. Obviously the lower the number the shooter has on the ranking or result list, the better are the shooters performances, e.g is number 1 on the ranking better than number 2.

4. Results

In order to investigate psychological factors on performance in rifle shooting, the following hypothesis were formulated: (1) There are significant correlations between score on psychological factors and performance amongst the best rifle shooters in Norway. (2) Some variance in performance in rifle shooting can be significantly explained by the effect of psychological factors. Therefore, a bivariate correlation analysis and a stepwise multiple regression analysis was deemed appropriate for the study.

The factors and their internal consistency (Cronbach's alpha) are summarized in table 3, and Pearson's product-moment correlations between the rifle shooting results and the scores from the questionnaires of psychological factors in rifle shooting are depicted in table 4.

Table 3. Descriptive statistics of psychological factors for performance in rifle shooting.

Factor	Valid *N*	Cronbach's α	Min	Max	*M*	*SD*
Passion	49	.82	3	5	4.18	.54
Grit	49	.63	2.63	4.50	3.81	.47
Self-Efficacy	49	.84	42	76	63.57	7.5
Flow	49	.92	88	169	133.27	17.7

4.1 Correlational analysis

Psychological factors and overall ranking summer season 2019

The scores from the correlational analysis indicate significant correlations between overall ranking for the summer season 2019 and Passion (r = -.244, p = .046), Self-efficacy (r = -.325, p = .011) and Flow (r = -.297, p = .019). There was no significant correlation between overall ranking for the summer season 2019 and grit (p>.05).

Psychological factors and Oslo Open placement

There were significant correlations between all the psychological factors and placement in the Oslo Open competition: Grit (r = -.259, p = .036), Passion (r = -.296, p = .019), Self-efficacy (r = -.305, p = .016) and Flow (r = -.52, p = .000).

The correlation analyses also found that there were moderate to high correlations between the different factors.

Table 4. Correlations (Pearson) between the rifle shooting performances/results, and scores form the psychological factors (rifle shooters on a national level, *N* = 49)

Indexes	1	2	3	4	5	6
1. Overall ranking	1	**.479****	**-.244***	-.159	**-.325***	**-.297***
2. Result Oslo Open		1	**-.296***	**-.259***	**-.305***	**-.520****
3. Passion			1	**.384****	**.467****	**.442****
4. Grit				1	**.407****	**.432****
5. Self-Efficacy					1	**.631****
6. Flow						1

Note. **. Correlation significant at the .01 level (1-tailed).
*. Correlation is significant at the .05 level (1-tailed).

4.2 Regression analysis

Psychological factors and overall ranking summer season 2019

A stepwise multiple regression analysis was conducted to test whether the psychological factors significantly predicted participant's overall results in the summer season 2019. The regression analysis revealed that self-efficacy (β= -.325; *p*=0.001) significantly contribute to the model, explaining approximately 11% of the variation in the ranking variable. The R^2 (0.106) and significant F-value (5.549, *p*=0.023) support medium fit of the model. All of the other variables' score were not included into the equation at step 2 of the analysis (*p*>.05 Passion, grit and flow).

Psychological factors and Oslo Open placement

As for the overall ranking, a stepwise multiple regression was conducted to test whether the psychological factors could significantly predict the participants individual results from the Oslo Open competition; in other words to find out if the factors can predict individual results for a certain competition during the season. The regression analysis revealed that flow (β= -.520; *p*=.000) significantly contribute to the model, explaining 27% of the variation in the

individual competition/Oslo Open variable. The R^2 (0.27) and significant F-value (17.392, p=0.000) support good fit of the model. All of the other variables' score were not included into the equation at step 2 of the analysis (p> .05: Passion, Grit and self-efficacy).

Regarding multicollinearity between the psychological factors and rifle shooting performance, it was found that the variance inflation factors (VIF), was not large enough to cause concern. This is because they were all smaller than the suggested cut of point, that according to field (2016) lays between 5 and 10.

In terms of autocorrelation, the Durbin-Watson test was used, which tests for serial correlations between errors (Field, 2016). This test statistics varies between 0 and 4, where a value of 2 means that the residuals are uncorrelated. The Durbin-Watson value for the regression analysis investigating the overall ranking, was .258, and values under 1 are according to Durbin and Watson (1951), a cause for concern. The Durbin-Watson value for the regression analysis investigating Oslo Open placement, however, was 1.795, a value very close two 2, and that therefor indicates a lack of autocorrelation.

5. Discussion

The goal of this research was to explore and direct theoretical and empirical attention to psychological factors and the impact they can have on performance. In this study the focus was on the four factors self-efficacy, flow, grit and passion, their function and effect on performance in the sport rifle shooting. My hypotheses were (1) There are significant correlations between score on psychological factors and performance amongst the best rifle shooters in Norway. (2) Some variance in performance in rifle shooting can significantly be explained by the effect of psychological factors.

The findings from this study supports both hypothesis and suggests that there are moderate correlations between some of the psychological factors and rifle shooting performance, both when in it comes to overall ranking and results in individual competitions. Especially the factors self-efficacy and flow seemed to play a central role in performance. My findings are also in line with current theories and previous findings in the area of sports psychology. There is however very little to no research studying the way psychological factors may have an impact on rifle shooting performance.

On a general basis this study supports the belief that sports performance depends on the level of skill, abilities and qualities that a person possess, and that the psychological skills often is what separates the most successful athletes from the less successful athletes (Krane & Williams, 2015).

5.1 Self – Efficacy and performance in rifle shooting

My correlational and regression analyses in this study support my hypotheses that self-efficacy is correlated to and could be influential on rifle shooting performance both in the terms of overall ranking (r = -.325, p = .011) and in the individual competition(r = -.305, p = .016). Self-efficacy could explain 11% of the variance in the overall ranking the 2019 summer season. These findings are not surprising as they are in line with previous research that has concluded that self-efficacy is one of, if not the most, influential psychological factors for sports performance (Feltz et al, 2008; Gould et al, 2009; Martin & Gill, 1991; Moritz et al, 2000).

Self-efficacy was found to be the most influential factor on overall ranking during the season. Self-efficacy may influence the shooters ranking in several ways. For example, the shooters with the high levels of self-efficacy may try harder, be more motivated, endure longer, get

over obstacles better and seek challenges to a higher degree than shooters with lesser degrees of the factor (Bandura, 1997; Feltz et al, 2008; Moritz et al, 2000). Summarized, the positive effect mentioned above, may cause athletes, in this case the shooters, to put in great amounts of effort over a long period of time; which is what characterizes a high overall ranking for a whole entire season.

My thoughts are that high self-efficacy beliefs and great performances, live in a very close and interacting relationship, where they end up creating a very positive pattern or a "positive spiral" for the athlete (in this case the shooter). If we look at Banduras (1997) four sources of the construction of self-efficacy, it is natural to assume that these four sources are more easily accessible for greater athletes. *Previous experience* is the first of these four sources. Successful shooters will have more positive previous experiences that they can use as a source to construct higher levels of self-efficacy in the future – and higher levels of self-efficacy will again lead to new great performances and therefore maybe a further increase in the persons efficacy beliefs. The other sources may show a similar pattern. Great rifle shooter performances will likely lead to *verbal persuasion,* that is positive feedback from coaches, competitors, friends, family and etc. Great shooters will also most likely hang out with and get to know other great shooters, e.g through national teams, training camps, competitions and so on, and therefore be more exposed to *vicarious experiences.* Seeing others succeed will according to Bandura increase your own levels of self-efficacy. The greatest shooters will also maybe be able to use their high efficacy beliefs to perceive the *physiological feedback,* the last source to self-efficacy, in the most advantageous way possible, as self-efficacy is assumed to be related to emotion regulation (Feltz et al, 2008; Gould et al, 2009; Martin & Gill, 1991; Moritz et al, 2000; Treasure, Monson & Lox, 1996). This is how high levels of self-efficacy may lead to performance, which again can lead to an increase in efficacy believes, that again can lead to even greater performances in the future. Self-efficacy and performance do possibly lead to a positive spiral for the athletes.

The results also indicate significant correlations between self-efficacy and performance in the individual rifle shooting competition. This can be explained by self-efficacy's effect on emotion regulation that I briefly mentioned above (Treasure, Monson & Lox, 1996). Under the pressure of the relatively big and important competition that Oslo Open is, the shooters with the highest levels of self-efficacy were probably able to regulate their emotions and reach an optimal level of arousal for performance. In the face of the pressure experienced during Oslo Open, these shooters also most likely experienced a set of positive emotions like

happiness and satisfaction, while shooters with more negative efficacy beliefs also most likely experienced more negative emotions, like sadness and anxiety.

5.2 Flow and performance in rifle shooting

The results from this study show that flow influences rifle shooting performance: both in the overall ranking (r = -.297, p = .019) and when it comes to the individual rifle shooting competition (r = -.52, p = .000). Flow could explain 27% of the variance in the individual Oslo Open results. This is in line with both the hypotheses and previous research on flow and sport psychology. The study therefore supports flow as an optimal psychological state for human functioning and as one of the hallmarks of "peak performances" in sport (Jackson & Roberts, 1992).

Maybe not surprising, this study found flow to be more influential on results in the individual competition than on the overall ranking, even though the correlations between flow and overall ranking also was significant. Flow was actually found to be the most influential factor on performance during Oslo open of all the factors tested.

In other words, the shooters that performed the best during Oslo Open, also experienced the highest levels of flow. The flow state may have contributed to the performance through an increase in confidence in yourself and your skills; closely related to self-efficacy. Flow probably also effected the level of performance through an increase in concentration and focus, as well as a feeling of control during the competition (Nakamura & Csikszentmihalyi, 2014). Concentration and focus are crucial for performance in any sport, but maybe especially in a such a mentally demanding sport as shooting, where the margins are minimal – here focus is a key element (Jeppesen & Pensgaard, 2006). The shooters that reported low levels of flow on the other hand probably experienced being unfocused and not in control, as well as feeling insecure about themselves and their skills.

As mentioned, flow was also significantly correlated to the overall ranking of the shooters. This can likely be explained through that flow is experienced as such a positive feeling for the individual that it encourages the person to return to, end spend much time on the activity. Flow is therefore also associated with dedication, motivation, endurance and commitment to the specific activity – in this case rifle shooting (Nakamura, 1988). This explains the relationship between flow and performance over a longer period, e.g a season or even over several years. It is also assumed that the experience of flow increases one's feelings of self,

and that flow also therefore can lead to increased levels of self-efficacy (Nakamura & Csikszentmihalyi, 2014).

The results show that the shooters with the best results during Oslo Open was also the shooters that reported experiencing the highest levels of flow. Flow therefore seemed to affect the shooters performance in a positive direction. It could be argued that the best shooters in this case also had the best preconditions to be able to reach this state. A condition to achieve flow is that there is a perfect balance between the persons skill level and the tasks level of difficulty (Nakamura & Csikszentmihalyi, 2014). Oslo Open, being the big competition that it is, leads to a greater pressure and more nerves among the shooters, and is therefore a quite difficult competition to succeed at. The level of difficulty may be too high for the more novice shooters to reach the state of flow – but the best shooters skill level will be more in line with the level of difficulty of the competition. Therefore, the best shooters could have had a better chance at reaching the flow state. The shooters with the best performances during the competition, and that experienced the highest levels of flow, was therefore probably also the shooters with the best balance between their skill level and the level of difficulty of the Oslo Open competition.

5.3 Grit and performance in rifle shooting

This study found no significant correlations between grit and overall ranking, but it was found a significant correlation between grit and performance at Oslo Open (r = -.259, p = .036). This is maybe a bit contradicting to previous findings and the hypotheses that was formed, and it may have been more natural to assume an opposite effect where grit was correlated to overall ranking as the very definition of grit is "to go for long term goals with passion and perseverance" (Duckworth, Peterson, Matthews, & Kelley, 2007, s.1087). But this was not the case in this study. There may be several reasons to my contradicting findings, and I will take a closer look at the possible reasons in the methodological reflection's sections of the discussion.

Even though the findings are contradicting, it was only found significant correlations for one of the conditions for grit – the findings do support that grit influences performance in rifle shooting. Grit may affect performance in rifle shooting through deliberate practice, as it appears that gritty people are more likely to engage in deliberate practice than less gritty people. In this case the grittiest of the shooters, probably are the shooters that have had the most deliberate practice and therefore able to perform on such a high level. This could also

explain the significant effect that grit had on performance during Oslo open: deliberate practice is defined as highly structured practice, with a clear goal to improve a specific skill or a set of specific skills (Filion et al, 2017). The shooters that performed the best during Oslo Open probably practiced very specifically towards this competition, and had a clear goal related to Oslo Open.

It also seems to be the case that gritty people, better like to be challenged (Duckworth, Kirby, Tsukayama, Bernstein & Ericsson, 2011). Therefore, gritty people may find the Oslo Open situation to be more positive and pleasant than less gritty people, and therefor indirectly be able to perform better. Studies have also found grit to be related to self-efficacy (Rojas, Reser, Toland & Usher, 2012), and knowing that self-efficacy is significantly correlated to performance, it is only natural to believe that grit also is related to performance, and that the two factors may work in similar manners.

Duckworth (2017) argued that you can develop your level of grit through several mechanisms, and more recent studies also supports this argument (Rimfield et al, 2016). One way Duckworth claims that grit can be trained is through finishing what you started and overcoming obstacles. It is natural to assume that the best shooters have had to overcome a few obstacles along the way and have had to get through challenging times. This may again have led to an increase in their level of grit. Duckworth also believe that you can increase your level of grit through participating in gritty cultures. In a similar way that I argued that the best shooters are more exposed to *vicarious experiences* (which can affect your efficacy believes), I argue that the best shooters also are more exposed to gritty cultures, e.g through national teams, training camps, competitions and so on, and are therefore able to increase their level of grit through this.

5.4 Passion and performance in rifle shooting

This study found significant correlations both between passion score and overall ranking (r = -.244, p = .046), and passion score and the individual Oslo Open result (r = -.296, p = .019). This supports the hypotheses and is in line with previous findings.

Passion being a part of grit, the mechanisms in which it increases performance may be highly related or very similar. It is therefore natural to assume that passion, just as grit, through an increased engagement in deliberate practice will affect performance (Filion et al, 2017). This engagement in deliberate practice comes from the increase in energy level and motivation that passion gives.

If we look at passion as a factor itself, a passion for an activity will lead you to spend a lot of time on this activity (Vallerand et al, 2003). The most passionate shooters therefore may become the best shooters, because they also spend the most time shooting – both when it comes to practice and choosing to participate in many competitions. Passion is also related to dedication, which means that the most passionate shooters dedicate themselves almost fully to the sport, and will stick to it in the face of adversity and continue with shooting for years – and in the end this dedication will lead to success.

Even though I have not explored this, it could be reasonable to believe that not only the best shooters are the most passionate, but maybe also the oldest shooters in my study, and in general, may be the most passionate. Shooting is in theory a sport you can participate in until you are over 100 years old, and many shooters never quit the sport but participate in it their whole lives. This requires great amounts of passion for the sport, and shooting must because of this be perceived as a very meaningful part of their life and identity. The oldest shooter in my study was 61 years old and had the very impressive ranking 10 place for the summer season 2019. Having been a shooter for so long, and still holding such a high level of performance would in my opinion indicate that this is a shooter very passionate about the sport. Passion for an activity will in other words lead you to start participating in the activity – and to continue with it over a long period of time. This is a good prerequisite for success.

5.5 General discussion

The psychological factors grit, passion, flow and self-efficacy do seem to have a significant effect on performance in rifle shooting, based on the theoretical and empirical literature reviewed and the results from this study. Self-efficacy proved to be the most important factor for predicting performance in the overall ranking for the summer season 2019. Flow proved to be the most important factor for predicting performance in the individual Oslo Open competition. The findings in my study therefore mostly support my hypotheses and the previous research and the main theories in sports psychology. The findings are also supported by, and very similar to the results from the Sklett (2017) master thesis on psychological factors and ski jumping performance, which this study was inspired by.

The best athletes, and in this case the best shooters, are therefore most likely gritty people, that does not give up faced with challenges, but stays motivated and committed to their goals. They possess a great passion for the things they do, and love and commit to this activity. They will have great faith in themselves and believe that they can do absolutely anything they set

their mind to. In addition to this, the best shooters are prone to experience states of flow, both during practice and competition.

The less successful athletes, or less successful shooters, will become unmotivated and apathetic faced with adversity and setbacks. A lack of passion makes them unwilling to put in the effort that is required to become the best, and the level of commitment to the activity will be lower. Quitting will therefor maybe seem as an easy option, when the activity may seem tiring in the long run. They may also be missing faith in themselves, and never really believe that they can succeed, and therefor may never seriously attempt to do so either, in line with Banduras SCT. Less successful athletes may also struggle to reach the state of flow, and therefore never get to experience this optimal condition for learning and performance.

But are the most successful athletes, in this case shooters, born to be successful? Are the mental skills that are necessary to succeed innate, and people are therefore born gritty, passionate, with great self-efficacy and a proneness to the experience of flow and like that also "born winners"? Ericsson et al (2007) claims that experts are always made, and not born, and from the theories reviewed above this assumption seems to be correct, at least to a certain extent.

The factors tested in this study do to a large extent seem to be factors that can be learned and trained, except for maybe passion and flow. Passion is not so much a skill, as it is a feeling towards something. And passion for something, for example a sport is therefore something you either have or don't have (Jachimowicz et al, 2018). You can for example don't force your child to be passionate and interested in football just because you are. You are therefore maybe born with a passion for something, and therefore have good preconditions to both engage in your passion and continue engaging in that passion over a longer period of time. The best shooters are therefor probably born with a passion for shooting. Shooting is, in Norway at least, a family sport where the interest and passion for the sport in many ways inherits from generation to generation – so in the case of shooting, it is very likely that the best shooters are born with a passion for the sport.

Flow is like passion, not really a skill, but a state a person can experience. Flow can therefore not be trained, but you can intentionally try to reach this state. This is most effectively done making sure that the persons skill level perfectly matches the difficulty of the task. However, the flow state may be easier to reach, having experienced it before (Jackson & Csikszentmihalyi, 1999). Experiencing flow therefore may lead to great performance and in

the case of this study make you a better shooter, but the best shooters may therefore also have greater chance to experience this state later.

Grit and self-efficacy do on the other hand have empirical evidence that support that these factors can be learned and trained (Duckworth & Winkler, 2013; Rimfield et al, 2016; Bouffard-Bouchard, T, 1991). These are therefore maybe not just psychological factors, but mental skills. Your level of grit can as mentioned be trained by being in gritty environments and finishing what you started (Duckworth, 2017). As mentioned, people with both great talent, and high levels of grit are very rare (Duckworth & Winkler, 2013). This can be because grit is also developed in the face of challenges, and very talented people don't get to develop their grit because they rarely face great challenges. Less talented people on the other hand, meet greater challenges and therefore also develop greater levels of grit to overcome these challenges. The best rifle shooters may therefore be the shooters that have experienced the greatest obstacles, and maybe contradicting to popular beliefs – maybe not the people with the greatest talent for shooting in the first place.

Self-efficacy beliefs can be constructed through Banduras (1997) four sources to self-efficacy. Ambitious athletes should therefore try to seek these four sources. The best shooters therefore seem to have high self-efficacy beliefs, probably because they actively think about and evaluate their previous accomplishments, gets positive feedback, observe their competitors succeed and interprets their physiological responses in a positive and constructive way, and are therefore able to regulate their emotions.

The most successful shooters therefore may have some underlying abilities to help them on the way, for example a great passion for the sport and being more susceptible to the experience of flow. But at the same time, they have been shaped by their environment and their actions and because of this developed a grittiness through e.g overcoming the obstacles in their way and gained positive efficacy beliefs through Banduras four sources to self-efficacy. The best shooters therefore seem to be born with some prerequisites that give them a potential, but primarily the best shooters are made through their environment, experience, actions and most importantly great amounts of practice – both physical/ technical and mental practice.

Grit, passion, flow and self-efficacy do seem, based on both my study and previous research, to have a positive effect on performance in sport. The research also suggests a close relationship and great similarities between the factors. I argue that the factors live in a

reciprocal relationship. For example, is passion a part of the very definition of grit. Because of this, very gritty people are likely also very passionate people and this passion might be the reason why gritty people are so preserving in the face of obstacles. Passion is therefore some of what gives increased grit through an increase in motivation and increased energy level (Filion et al, 2017).

Self-efficacy is also related to grit, and there is empirical evidence that these two factors correlate (Rojas, Reser, Toland & Usher, 2012). My study also supports this. Grit and self-efficacy are two very similar terms, but it can be argued that the terms can be separated by the fact that grit is somewhat more stable over time. Similarities include that both people with high levels of grit, and people with high levels of self-efficacy try harder to successfully complete difficult tasks, set high goals for themselves and continue to be committed to that goal. They respond to negative feedback with an increased level of effort and they seem to be of the opinion that failure is due to a lack of effort, skills or knowledge which all are factors in yourself that you can do something about (Bandura, 1994). There are also similarities between self-efficacy and flow, it is assumed that the experience of flow could give an increase in the levels of self-efficacy. This is partly because the flow state is recognized by a great confidence in one's skills (Nakamura & Csikszentmihalyi, 2014).

Flow and passion also have several common characteristics. For example, can both flow and passion lead to a person being completely engrossed in an activity, loosing a sense of time and place, both factors makes the activity feel rewarding in itself independent of the outcome, and they arise a feeling of inner motivation (Nakamura & Csikszentmihalyi, 2014; Seligman & Csikszentmihalyi, 2000; Vallerand et al, 2003). Does this also mean that the people that are passionate about something, easier reach the state of flow? Flow is however also associated with an increase in motivation, dedication, perseverance and commitment to the activity. These are some of the hallmarks of grit (Duckworth, Peterson. Matthews & Kelley, 2007). Maybe is there also a close relationship between these two factors, by for example that the state of flow can lead to more grittiness, or that gritty people more easily experience flow?

These four psychological factors therefore live in a reciprocal relationship, where they are all related to each other and all affect each other. But the factors do not only affect each other, but also other factors and emotions.

Despite the factor's similarities and reciprocal relationship, it could be argued that they can be divided into two groups depending on the mechanisms which they affect performance. I do in

fact believe that they lead to performance in different ways – some of the factors lead to performance in a short-term perspective (e.g. under pressure and specific situations), while other factors lead to performance in a more long-term perspective.

I suggest that the first group consists of passion, grit and self-efficacy, while the second group consists of self-efficacy and flow. Self-efficacy may belong to both groups because it seems to contribute to performance in both a long term and a more short-term perspective. This is contrary to my previous beliefs, as I thought that self-efficacy mostly contributed to performance in a short-term perspective. But from the results in my study and from a close look at previous research, this factor also seem to play an important role in a long-term perspective.

Passion, grit and self-efficacy seem to belong to the "long-term group". This thesis do not support grit being a part of this group, but previous research however does. These factors lead to performance through dedication and commitment to the sport. The factors also affect which goals you set for yourself, the standard you have for yourself, and gives you energy and motivation to engage in deliberate practice, which may be the best predictor for success (Duckworth et al, 2007; Duckworth, 2017; Filion et al, 2017; Moritz, Feltz, Fahrback & Mack, 2000). Like that, these factors can affect long-term performance, and the shooters that have been stable at a high level of performance over many years, probably possess high levels of these factors, and have therefore been willing to put in the large amount of effort that is needed to keep performing on such a high level over time.

But by only possessing these factors, the really great performances e.g. in individual competitions and championships, may be absent. Here the factors in the "short-term group" are necessary – flow, and again self-efficacy. These factors are in my opinion necessary to get out your full potential under pressure. Flow and self-efficacy are most likely connected to confidence, control over anxiety, visualisation, focus, high standards to oneself, and emotion regulation (Nakamura & Csikszentmihalyi, 2014; Moritz, Feltz, Fahrback & Mack, 2000; Treasure, Monson & Lox, 1996). It is important to be confident and keep focused under pressure, and this contributes to not feeling stressed and anxious. Still, it may be the ability of emotion regulation that is the most interesting in this case, and also the most favourable. Without the ability to regulate your emotions, nerves may take over. As an athlete, nerves can lead to negative thoughts, stress, feeling uneasy, and you may assume that these feelings come as a consequence of a lack of the skills necessary. This makes it nearly impossible to perform. If you are able to regulate your emotions on the other hand, you still might get nervous, but

these nerves may actually be advantageous to the athlete. A certain amount of nerves actually seems to be necessary to perform, because this leads the body to mobilize and you become "fit for fight" (Treasure, Monson & Lox, 1996). The nerves and other feelings that occur, will also be attributed to more constructive causes if you have high levels of self-efficacy. For example, instead of feeling nervous because you believe you don't have the skills necessary to succeed, you may feel more excited because you look forward to the situation you are about to encounter, and because you have such a great desire to succeed. Athletes with great amounts of self-efficacy and an ability to experience flow, will therefore often perform under the big and important championships, and other pressuring situations. These athletes are often what you typically consider to be people with a with a winning mentality. In the example of shooting, these are the very merited shooters and the shooters that give us the biggest sports moments. But if you possess only the "short-term" factors, you will probably be very unstable and have problem with performing over time. In rifle shooting we also have example of these kind of people, shooters that you can never write off in a competition, and that despite uneven results during the season, still almost every year make it to the "Kings team".

The very best athletes, shooters as well, of course possess all the factors described above. They are therefore gritty and passionate enough, have enough self-efficacy and a proneness to flow, and do therefore perform on a high level over time, as well as under pressure. In this study, these are probably the people that both were ranked high during the summer season and did well at the Oslo Open competition.

It needs however to be pointed out, that the shooters performance outcome in this study could be associated by a number of other influential factors.

5.6 Methodological reflections

A weakness to the study is it's relatively small sample size. My goal was to collect data from up to the 100 best ranked shooters in 2019. But wanting to do my data collection in a competitive setting, this was not possible as not all of these 100 shooters could compete in this specific competition. My sample would have been bigger if I aimed at testing the 100 best ranked shooters independent of them competing in a specific competition, and if I maybe conducted my data collection digitally. This is the disadvantage by wanting to do my data collection during a competition, but at the same time I really wanted to have the opportunity to investigate the psychological factors effect on performance in an individual shooting

competition. This again has advantages and gave me the opportunity to look at psychological factors effect on performance in both a long term, and more short-term perspective.

When you want to test experts in a field, this also naturally limits how big of a sample you are going to be able to get.

I also have some remarks regarding the grit scale. I noticed that many of the participants had very contradicting responses on this specific scale. For example, could they claim that it is very typical of them to "*finish what they started"* but that they also "*often decide on one goal, but later decide on another goal".* This is a quite peculiar answer, and very many of the participants showed this pattern in their responses. I believe that these contradicting responses is due to some of the questions in the grit scale being reversed, and that many of the participants did not notice this, and therefore responded the opposite of what they actually meant to. It could therefore be that the scores on the grit scale does not reflect the participants actual level of grit. This argument can be supported by the fact that the grit scale showed a low Cronbach's alpha ($\alpha = .63$). If this is the case, this could explain why the correlational analysis did not show any significant correlations between grit and overall ranking – a somewhat surprising result, especially considering I found significant correlations between grit and the individual competition. However, I cannot know for certain that this is the case. Still, I struggle to understand why the scale is constructed this way.

The fact that I was not able to control exactly when the participants answered the questionnaire, is also a potential problem. I had clear instructions on how to answer the questionnaire at the first page of the questionnaires. Here I stated that the flow state scale should be answered short time after the competition, the self-efficacy scale should be answered either short time before, or short time after the competition, while the grit and passion scale could be answered at any time during the competition weekend. Self-efficacy and flow however are quite situation specific factors, in contrast to grit and passion that are more permanent, and it is therefore important that the participants answered the scales at the specified times. For example, does it make little sense if some of the participants answers the flow state scale before the actual competition – and therefore reported feelings and experiences from a situation that had yet to happen. There were also other competitions happening in the same area during that weekend, in addition to Oslo Open. Say that some of the participants answered the self-efficacy scale after a different competition than Oslo Open, in that case their efficacy beliefs would probably be effected by their performance in this competition – and not reflect their efficacy beliefs in relation to Oslo open. Not being able to

control when the participants answered the questionnaire could therefore have negative effects the results, and because of this be a potential weakness of the study.

This reflects another possible problem. The factors could all be affected by the context, and it is therefore difficult, if not impossible to be certain that the measured factors actually reflect the participants actual levels of the different factors. Even passion and grit being more permanent factors, could be affected by having a bad day, or having overperformed at a competition. The emotions that could arise because of different events, could affect the participants responses in a way that they do not reflect their average level of the factors. Having been able to control for context would because of this have been preferable.

Further studies should focus on getting a larger sample. As mentioned, wanting to study experts does often naturally limits the sample size. Further studies should maybe therefore study successful athletes over several sports, and also over larger geographic locations, to try to get a larger sample and therefore also get more reliable results.

I would also consider improving the grit scale or use a different grit scale to asses grit in future studies. This is to avoid misinterpretations of the questions and potential errors in the participants responses.

I also suggest doing the data collection over several periods during the season. This is to avoid random responses and control for different contexts. As I mentioned the factors can be influenced by different situations, and you can score high or low on the factors depending on how you feel at the time you answer the scales. Getting the participants to answer the scales at different times during the season would therefore ensure getting a more accurate reflection of their actual factor scores. Future studies should also try to control when the participants answer the different scales, to even further control for context.

Combining a qualitative approach with quantitative data in order to get an even more comprehensive understanding of the psychological impact on rifle shooting performance could also be recommended.

6. Conclusion

"It is not the mountain we conquer, but ourselves"

-Edmund Hillary, first man to climb Mount Everest.

From this study it can be concluded that psychological factors can be of great importance for rifle shooting performance on a national level. It could there for be assumed, like Krane & Williams (2015) suggested, that the different psychological factors that the athletes possess, could be what separates the successful athletes from the less successful athletes.

The findings from this study, along with theory and previous empirical findings have shown how the factors may effect performance, it has shown both the similarities and differences between these four psychological factors – as well as identifying some central characteristics of the most successful rifle shooters. It can be assumed that that the best rifle shooters already had or have developed these factors. As a consequence of this they are motivated, energized, and choose to engage in deliberate practice, in addition to being confident and persevering, and to a large degree they experience positive emotions and has a great capability to regulate their emotions (Duckworth et al, 2007; Duckworth, 2017; Filion et al, 2017; Moritz, Feltz, Fahrback & Mack, 2000, Nakamura & Csikszentmihalyi, 2014; Treasure, Monson & Lox, 1996). This all in addition to having acquired the physical, motorical and technical skills that rifle shooting requires. Everything suggests that the psychological factors, the motorical skills, technical skills and physical skills live in a reciprocal relationship with each other, and together they create the foundation for great performances in sports (Sklett, Lorås & Sigmundsson, 2018).

Seeing the importance of the mental factors described above and the positive effect they can have on rifle shooting performance, the benefits that mental practice are made clear. Mental practice is in other words a tool that all athletes with ambitions should make use of. In rifle shooting it seems like most of the athletes agree that mentality is crucial for performance, yet few of the shooters seem to be training mentally as deliberate and structured as they do their physical skills, motorical and technical skills. Studies like this are therefore important, and could possibly increase awareness of the importance of psychological factors in rifle shooting as well as in other achievement environments. A more complementary understanding around the factors will possibly lead to a prioritization and emphasis on psychological aspects as a separate skill – equal to the physical, motorical and technical skills.

References

Bandura, A. (1977). Self-Efficacy: The Exercise of Control. New York: W. H. Freeman.

Bandura, A. (2006). Guide for constructing Self – Efficacy scales. In F. Pajeras., & T. Urdan. (Eds.). Self- Efficacy Beliefs of Adolecents (pp.307-337). Connecticut: Greenwich.

Bird, E. I. (1987). Psychophysiological processes during rifle shooting. *International Journal of Sport Psychology*, *18*(1), pp. 9-18.

Bouffard-Bouchard, T. (1991) Influence of Self-Efficacy on Self-Regulation and Performance among Junior and Senior High-School Age Students. *International Journal of Behavioral Development, 14*, pp. 153-164.

Bryhn, R. (2018, March 6 th). Idrett. Sourced from: https://snl.no/idrett

Bryhn, R., & Tosterud, S.E. (2016, December 26th). Det Frivillige Skyttervesen. Sourced from: https://snl.no/Det_frivillige_Skyttervesen

Bryhn, R., & Tosterud, S.E. (2017, August 30th). Landsskytterstevnet. Sourced from: https://snl.no/landsskytterstevnet

Cohen, J. (1992). A Power Primer. *Psychological Bulletin, 112*, pp.155-159.

Cox R. (2001). *Sport psychology*. New York, McGraw-Hill.

Csikszentmihalyi, M. (1996). *Creativity*. New York: HarperCollins.

Csikszentmihalyi, M., & Rathunde, K. (1993). The measurement of flow in everyday life. *Nebraska Symposium on Motivation*, *40*, pp. 57–97.

Det Frivillige Skyttervesen. (n.d.). Hva er Det Frivillige Skyttervesen? Sourced from: https://www.dfs.no/om-dfs/dfs/

Duckworth, A.L. (2017). *Grit: Lidenskapen og standhaftighetens kraft.* Oslo: Cappelen Damm.

Duckworth, A. L., Kirby, T. A., Tsukayama, E., Berstein, H., & Anders Ericsson, K. (2011). Deliberate Practice Spells Success: Why Grittier Competitors Triumph at the National Spelling Bee. *Social Psychological and Personality Science*, *2*(2), pp. 174–181.

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology*, *92*(6), pp. 1087-1101.

Duckworth, A. L., & Quinn, P.D. (2009) Development and Validation of the Short Grit Scale (Grit–S), *Journal of Personality Assessment, 91*(2), pp. 166-174.

Duckworth, A. L., & Winkler, L.E. (2013, April). True grit. Sourced from: https://www.psychologicalscience.org/observer/true-grit

Durbin, J. & Watson, G. S. (1951). *Biometrika, 38*, pp. 159-178.

Edelman, G.M. (1993). Neural Darwinism: Selection and Reentrant Signaling in Higher Brain Function. *Neuron, 10*(2), 115-125.

Ericsson, A., Krampe, R., T., & Tesch-Romer, C. (1993). The Role of Deliberate Practice in the Acquisition of Expert Performance. *Psychological Review, 3,* pp. 363-406.

Ericsson, A., & Pool, R. (2016). *PEAK: secrets from the new sicience of expertise.* Boston New York: Houghton Mifflin Harcourt.

Ericsson, A., Prietula, M.J, & Cokely, E.T. (2007). The Making of an Expert. *Harvard Buisiness Review, 85*(7), s. 114-121.

Feltz, D.L, Short, S.E., & Sullivan, P.J. (2008). *Self – efficacy in sport.* Illinois: Human Kinetics.

Field, A. (2016). *Discovering statistics using IBM SPSS statistics* (4. Ed). London: Sage.

Filion, J.V., Vallerand, R.J., Amiot, C.E, & Mocanu, I. (2017). The two roads from passion to sport performance and psychological well being: The mediating role of need satisfaction, deliberate practice, and achivement goals. *Psychology of Sport and Exercise, 30,* pp.19-29.

Fleishman, E.A. (1972). On the relationship between abilities, learning and human performance. *American Psychologist, 27*(11), pp. 1017-1032.

Flow model: Sourced from: https://www.psychologytoday.com/us/blog/one-among-many/201502/flow-and-happiness

Gibson, J.J. (1979). *The ecological approach to visual perception*. Boston: Houghton Mifflin.

Gísladóttir, ó., Haga, M., & Sigmundsson, H. (2014). Motor Competence and Physical Fitness in Adolescents. *Pediatric Physical Therapy, 26*(1), pp. 69-74.

Gould, D., Greenleaf, C., Lauer, L., & Chung, Y. (1999). Lessons from Nagano. *Olympic Coach, 9*(3), pp.2-5.

Gross, R. (2005). *Psychology, the science of mind and behaviour*. London: Hodder & Stoughton.

Jachimowicz, J.M., Wihler, A., Bailey, E.R. & Galinsky, A.D. (2018). Why grit requires perseverance and passion to positively predict performance *Proceedings of the National Academy of Sciences, 115* (40), pp.1-6.

Jackson, S. & Csikszentmihalyi, M. (1999). *Flow in sports*. Champaign: Human Kinetics.

Jackson, S.A., & Marsh, H.W. (1996) Development and validation of a scale to measure optimal experience: the flow state scale. *Journal of Sport and Exercise Psychology, 18,* pp. 17–35.

Jackson, S.A., & Roberts, G.C. (1992). Positive performance states of athletes: Toward a conceptual understanding of peak performance. *The Sport Psychologist, 6,* pp. 156- 171.

Janelle, C. M., Hillman, C. H., Apparies, R. J., Murray, N. P., Meili, L., Fallon, E. A., & Hatfield, B. D. (2000). Expertise Differences in Cortical Activation and Gaze Behavior during Rifle Shooting, *Journal of Sport and Exercise Psychology*, *22*(2), pp. 167-182.

Jeppesen, A.G., & Pensgaard, A.M. (2006). *Mental trening i skyting* (1.edt). Asker.

Kneeling Position: Sourced from: https://www.dfs.no/opplaring/oktarkiv/basis-skyting/avtrekksokt-2/

Konttinen, N., Lyytinen, H., & Viitasalo, J. (1998) Preparatory heart rate patterns in competitive rifle shooting, *Journal of Sports Sciences*, *16*(3), pp.235-242.

Krane, V., & Williams, J. M. (2015). Psychological Characteristics of Peak Performance. *Applied Sport Psychology: Personal Growth to Peak Performance, 7,* pp. 159-176.

Landsskytterstevnet 2018. (2018, July[23]). Deltagerstatistikk LS 2018 Stjørdal. Sourced from: http://2018.landsskytterstevnet.no/wp-content/uploads/2018/07/Deltakerstatistikk-31-7-18.pdf

Mageau, G.A., Vallerand, R.J., Charest, J., Salvy, S.J., Lacaille, N., Bouffard, T., & Koestner, R. (2009). On the Development of Harmonious and Obsessive Passion: The Role of Autonomy Support, Activity Specialization, and Identification with the Activity, *Journal of Personality 77* (3), pp. 602-646.

Mallek, M., Benguigui, N., Dicks, M., & Thouvarecq, R. (2017) Sport expertise in perception–action coupling revealed in a visuomotor tracking task. *European Journal of Sport Science, 17*(10), pp. 1270-1278.

Martin J.J., & Gill D.L. (1991). The Relationships Among Competitive Orientation, Sport-Confidence, Self-Efficacy, Anxiety, and Performance. *Journal of Sport and Exercise Psychology,13*(2), pp.149-159.

Moritz, E., Feltz, D.L, Fahrbach, K.R., & Mack, D.E. (2000) The Relation of Self-Efficacy Measures to Sport Performance: A Meta-Analytic Review, *Research Quarterly for Exercise and Sport, 71*(3), pp. 280-294.

Nakamura, J. (1988). Optimal experience and the uses of talent. In M. Csikszentmihalyi & I. Csikszentmihalyi (Eds.), *Optimal experience* (s. 319–326). Cambridge: Cambridge University Press.

Nakamura J., & Csikszentmihalyi M. (2014) *The Concept of Flow. In: Flow and the Foundations of Positive Psychology*. Dordrecht: Springer.

Orlick, T., & Partington, J. (1988). Mental links to excellence. *The sport psychologist, 2*(2), pp.105-130.

Pallant, J. (2007). *SPSS A Survival Manual*, Crows Nest, N.S.W., Australia: Allen & Unwin.

Pensgaard, A.P. & Hollingen, E. (2006). *Idrettens mentale treningslære.* (2.edt). Oslo: Gyldendal.

Perry, S. K. (1999). *Writing in flow*. Cincinnati: Writer's Digest Books.

Prone Position: Sourced from: https://www.dfs.no/skyttertidende/aktuelt-na/nyheter-fra-nst/2015/liggende-stilling/

Rimfeld, K., Kovas, Y., Dale, P. S., & Plomin, R. (2016). True grit and genetics: Predicting academic achievement from personality. *Journal of Personality and Social Psychology, 111*(5), pp. 780-789.

Rojas, J.P., Reser, J.A., Toland, M.D., & Usher, E.L. (2012). *Psychometrics of the Grit scale.* Paper presented at the P20 Motivation and Learning Lab, Luisville, KY. https://sites.education.uky.edu/motivation/files/2013/08/PojasPeserTolandUsher.pdf

Roussy, A.B., Lavigne, G.L., & Vallerand, R.J. (2010). When passion leads to excellence: the case of musicians. *Psychology & Music, 39*(1), pp.123-138.

Schmidt, R.A., & Wrisberg, C.A. (2008) *Motor learning and performance.* (4.edt). Champaign, III.: Human Kinetics Books.

Self-efficacy model: Sourced from: https://expertprogrammanagement.com/2018/10/self-efficacy-theory-of-motivation/

Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist*, *55*, pp. 5–14.

Sigmundsson, H. & Haga, M. (2005). *Ferdighetsutvikling: Utvikling av grunnleggende ferdigheter hos barn.* Oslo: Universitetsforlaget.

Sigmundsson, H., Haga, M., & Hermundsdottir, F. (2019). The passion scale: Aspects of reliability and validity of a new 8-item scale assessing passion. *New ideas in psychology, 56*, pp. 1-6.

Sigmundsson, H., Trana, L., Polman, R., & Haga, M. (2017). What is Trained Develops! Theoretical Perspective on Skill Learning. *Sports, 5*(38), pp.1-11.

Singh, T. D., Bhardwaj, G., and Bhardwaj, V. (2009). Effect of self-efficacy on the performanceof athletes. *J. Exerc Sci. Physiother. 5*, pp. 110–114.

Sklett, V. (2017) *Psychological Factors of Performance in Ski Jumping* (Master thesis). Norges Teknisk-vitenskapelige universitet (NTNU), Trondheim.

Sklett, V.H., Lorås, H.W., & Sigmundsson, H. (2018). Self-Efficacy, Flow, Affect, Worry and Performance in Elite World Cup Ski Jumping. *Frontiers in Psychology, 9* (1215), pp. 1-9.

Sparknotes. (2020). Philosophy of History: Section 4. Sourced from: https://www.sparknotes.com/philosophy/hegelphilhist/section4/

Standing position: Sourced from: https://www.aftenposten.no/sport/i/jd3WEn/halv-million-skudd-blir-avfyrt-i-loepet-av-landsskytterstevnet

Treasure, D.C., Monson, J., & Lox, C.L. (1996). Relationship between Self-Efficacy, Wrestling Performance, and Affect Prior to Competition. *Human Kinetics, 10*(1), pp. 73-83.

Vallerand, R. J., Blanchard, C., Mageau, Elliot, A.J., Dumais, A., Demers, M.A., & Rousseau, F. (2008). Passion and performance attainment in sport. *Psychology of Sport and Exercise, 9*(3), pp. 373-392.

Vallerand, R. J., Blanchard, C., Mageau, G. A., Koestner, R., Ratelle, C., Léonard, M., & Marsolais, J. (2003). Les passions de l'âme: On obsessive and harmonious passion. *Journal of Personality and Social Psychology, 85*(4), pp. 756-767.

Warren W.H. (1990) The Perception-Action Coupling. In: Bloch H., Bertenthal B.I. (eds) *Sensory-Motor Organizations and Development in Infancy and Early Childhood. NATO ASI Series (Series D: Behavioural and Social Sciences)*. Dordrecht: Springer, pp. 23-37.

Zatsiorsky, V.M., & Atkov A. V. (1990). Biomechanics of highly precise movements: The aiming process in air rifle shooting. *Journal of Biomechanics 23*(1), pp. 35-41.

Østerlie, O., Vedul-Kjelsås, V., Buaas, I. Ø., & Løhre, A. (2018). Skytetrening for elever med konsentrasjonsvansker; Evaluering av et tiltak i skolen. Sourced from: https://brage.bibsys.no/xmlui/bitstream/handle/11250/2478346/2018.01.18+Rapport+Rennebu+-+digital.pdf?sequence=1

Appendicies

Appendix A

Samtykkeskjema

Norges teknisk-naturvitenskapelige universitet (NTNU)

Psykologisk institutt

NTNU – Trondheim

Ønsker din deltagelse i dette forskningsprosjektet:

Psykologiske faktorer i skyting (DFS).

I forbindelse med min masteroppgave i psykologi, ønsker jeg å samle inn data fra toppskyttere i Norge, både kvinner og menn, for å kunne undersøke noen psykologiske faktorer og deres effekt på prestasjon. Jeg ønsker å finne ut hvilke psykologiske faktorer som har størst effekt på prestasjon.

Disse skårene måles ved hjelp av standardiserte spørreskjema, og de vil omhandle dine subjektive opplevelser av en konkurranse situasjon. Å utfylle spørreskjemaet vil ta ca. 10 minutter. All behandlingen av data vil utføres av meg. All data vil selvfølgelig også være anonymt, behandles konfidensielt, og alle som ønsker vil få tilgang til resultatene når prosjektet er ferdig.

Dette prosjektet er basert på frivillig deltagelse og du kan derfor trekke deg fra prosjektet når du måtte ønske. Du kan også be om å få dine data slettet uten noe spørsmål, så lenge dataene ikke allerede er analysert eller publisert. Innsamlet data vil behandles konfidensielt, og kun av dem involvert i prosjektet.

Du har frem til 1.Desember (siste dag av Oslo Open helgen), på å utfylle spørreskjemaet. Spørreskjemaet vil deles ut i løpet av helgen, og dere kan levere det tilbake til påmeldingen hos Nordstrand skl (sammen med samtykkeskjemaet) eller til meg personlig i løpet av helgen. Passer ikke dette kan dere sende det til meg i posten. Adresse står i spørreskjemaet.

Har du noen spørsmål er det bare å ta kontakt!

Jeg har lest informasjonen, og ønsker å delta i dette forskningsprosjektet:

Signatur og dato:

Eline Lillegård

NTNU: Norges teknisk-vitenskapelige universitet

Tlf: 45 20 19 17

lillegard.eline@gmail.com

Appendix B

Psykologiske faktorer for prestasjoner i skyting (DFS)

I forbindelse med min masteroppgave i psykologi, ønsker jeg å samle inn data fra toppskyttere i Norge, både kvinner og menn. Jeg skal se på fire psykologiske faktorer, og om det er en sammenheng mellom skår på disse faktorene og rangering på Norgestoppen 100 på topp. Dette vil si noe om hvor viktig disse faktorene er for prestasjon. Jeg har også som mål å undersøke om det finnes forskjeller mellom kjønnene i skår på de psykologiske faktorene.

Det skal ikke skrives navn på spørreskjemaet!

Nummer (tilfeldig valgt nummer for identifikasjon):

Rangering:

Alder:

Spørreskjemaene skal besvares i løpet av Oslo Open helgen, og leveres helst tilbake til påmeldingen hos Nordstrand skl, eller til meg personlig. Passer ikke dette for deg, kan du også sende det til meg i posten.

Adresse:

Bøkleppvegen 29

6643 Bøfjorden

Når du besvarer spørsmålene, skal det være med Oslo Open stevnet i tankene, det er altså dette stevnet du skal referere til. Passionskalaen og Gritskalaen kan besvares når det måtte passe deg i løpet av helgen. Flytskalaen bør besvares **etter** du har skutt Oslo Open stevnet, og helst i kort tid etter endt skyting (senest samme dag). Mestringstroskalaen bør besvares enten kort tid før eller kort tid etter skytingen på Oslo Open stevnet.

Det tar ca.10 minutter å besvare spørreskjemaet. Besvar alle spørsmålene så ærlig som mulig og etter hva som passer best for deg. Det finnes ingen gale eller riktige svar.

Passion 8-items scale (Sigmundsson, Haga og Hermundsdottir, 2019)

Passion (8-items):

Nå kommer det noen enkle spørsmål hvor du skal vurdere om det er ´typisk deg´ eller ´ikke i det hele tatt´. Sett kun et kryss på det som beskriver deg best.

1 Jeg har et område/tema/ferdighet som jeg virkelig brenner for.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

2 Jeg kunne tenkt meg å bruke mye tid til å bli god innen et område/emne/ferdighet.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

3 Jeg tror jeg kan bli ekspert i et område/emne/ferdighet.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

4 Jeg har lidenskap nok til å bli ekspert i det området/temaet/ferdigheten jeg liker.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

5 Jeg er arbeidsom nok til å oppfylle mine mål.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

6 Jeg har brennende lidenskap for noen områder/tema/ferdigheter.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

7 Jeg bruker mye tid på de prosjekter jeg liker.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

8 Min lidenskap er viktig for meg.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

Grit 8-items scale (Duckworth & Quinn, 2009)

Grit –S (8-items):

Nå kommer det noen enkle spørsmål hvor du skal vurdere om det er ´typisk deg´ eller ´ikke i det hele tatt´. Sett kun et kryss på det som beskriver deg best.

1 Noen ganger distraherer nye ideer og prosjekter meg fra tidligere prosjekter.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

2 Jeg mister ikke motet ved tilbakegang/motgang.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

3 Jeg har vært besatt av en bestemt ide eller prosjekt i en kort periode, men har seinere mistet interessen.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

4 Jeg er arbeidsom.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

5 Jeg setter meg ofte et mål, men bestemmer meg så for et annet isteden.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

6 Jeg har vansker med å beholde fokus på prosjekter som tar mer enn et par måneder å fullføre.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

7 Jeg fullfører alt jeg påbegynner.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

8 Jeg er flittig.

◯ Veldig typisk meg

◯ Ganske typisk meg

◯ Litt typisk meg

◯ Ikke typisk meg

◯ Ikke meg i det hele tatt

Flow State Scale – FSS (Jackson & Marsh, 1996)

Vennligst svar på de følgende spørsmålene i forhold til den konkurransen du nettopp har gjennomført (Oslo Open). Disse spørsmålene er relatert til de tankene og følelsene som du kan ha opplevd under konkurransen. Det finnes ingen gale eller riktige svar. Tenk på hvordan du følte deg og hadde det under konkurransen og svar på spørsmålene ved hjelp av skalaen under. Sett en sirkel rundt det nummeret som best passer din opplevelse fra alternativene til høyre fra hvert spørsmål.

Skala:

Svært uenig	Uenig	Hverken enig eller uenig	Enig	Svært enig
1	2	3	4	5

	Svært uenig				Svært enig
1. Jeg ble utfordret, men jeg hadde tro på at mine ferdigheter ville gjøre meg i stand til å overkomme utfordringene.	1	2	3	4	5
2. Jeg utførte de riktige bevegelsene, uten å måtte tenke for mye eller prøve for hardt på dette.	1	2	3	4	5
3. Jeg visste tydelig hva jeg ville gjøre.	1	2	3	4	5
4. Det var helt tydelig for meg at jeg gjorde det bra.	1	2	3	4	5
5. Oppmerksomheten min var fokusert utelukkende på det jeg holdt på med.	1	2	3	4	5
6. Jeg følte at jeg hadde full kontroll over det jeg holdt på med.	1	2	3	4	5
7. Jeg var ikke bekymret over hva andre kanskje tenkte om meg.	1	2	3	4	5
8. Det virket som om tiden endret seg (den gikk enten saktere eller raskere).	1	2	3	4	5

9. Jeg nøt virkelig opplevelsen.	1	2	3	4	5
10. Mine evner matchet de store utfordringene i situasjonen.	1	2	3	4	5
11. Det virket som om ting skjedde automatisk.	1	2	3	4	5
12. Jeg hadde en sterk følelse av hva jeg ville gjøre.	1	2	3	4	5
13. Jeg var klar over hvor bra jeg presterte.	1	2	3	4	5
14. Det krevde ikke mye innsats å beholde fokuset på hva som skjedde (der og da).	1	2	3	4	5
15. Jeg følte at jeg kunne kontrollere hva jeg gjorde.	1	2	3	4	5
16. Jeg var ikke bekymret for min egen prestasjon under konkurransen.	1	2	3	4	5
17. Måten tiden passerte på virket annerledes enn normalt.	1	2	3	4	5
18. Jeg elsket følelsen prestasjonen ga meg, og jeg ønsker å oppleve det igjen.	1	2	3	4	5
19. Jeg følte meg kompetent nok til å møte de høye kravene i situasjonen.	1	2	3	4	5
20. Jeg handlet automatisk.	1	2	3	4	5
21. Jeg visste hva jeg ønsket å oppnå.	1	2	3	4	5
22. Jeg hadde en sterk anelse underveis i konkurransen om hvor bra jeg gjorde det.	1	2	3	4	5
23. Jeg var fullt konsentrert.	1	2	3	4	5
24. Jeg hadde en følelse av total kontroll.	1	2	3	4	5
25. Jeg brydde meg ikke om hvordan jeg fremstod.	1	2	3	4	5

26. Det føltes som om tiden stoppet opp under konkurransen.	1	2	3	4	5
27. Opplevelsen fikk meg til å føle meg bra.	1	2	3	4	5
28. Ferdighetene mine hadde et like høyt nivå som de utfordringene jeg møtte.	1	2	3	4	5
29. Jeg handlet spontant og automatisk uten å måtte tenke.	1	2	3	4	5
30. Målene mine var tydelig definert.	1	2	3	4	5
31. Jeg skjønte på måten jeg utførte handlingene hvor bra jeg gjorde det underveis.	1	2	3	4	5
32. Jeg var fullstendig fokusert på arbeidsoppgavene mine.	1	2	3	4	5
33. Jeg følte at jeg hadde full kontroll over kroppen min.	1	2	3	4	5
34. Jeg var ikke bekymret over hva andre kanskje tenkte om meg.	1	2	3	4	5
35. På noen tidspunkt, virket det som om ting skjedde i sakte film.	1	2	3	4	5
36. Opplevelsen var ekstremt givende for meg.	1	2	3	4	5

Mestringstro og prestasjoner i skyting (DFS) (Tilpasset fra Sklett, 2017)

Introduksjon: En idrettsutøvers rolle er kompleks og består av en rekke oppgaver og utfordringer. De følgende spørsmålene er utformet for å identifisere i hvor stor grad du, som DFS-skytter på nasjonalt nivå, tror på at du vil mestre de mange utfordringene du møter.

Hvert spørsmål omhandler hvor sikker du er på utstyret eller utførelsen av ulike oppgaver eller håndteringen av ulike situasjoner under skyting.

Instruksjon: Besvar spørreskjemaet enten før eller etter en konkurranse som du føler er veldig viktig for deg (Oslo Open 2019).

Les hvert spørsmål nøye, tenk på hvor sikker du er på det som er beskrevet, og sett sirkel rundt det nummeret som best angir hvordan du føler deg akkurat nå i dette øyeblikk.

Svært usikker = 1, og svært sikker = 7

Svært usikker			Hverken sikker eller usikker			Svært sikker
1	2	3	4	5	6	7

Det finnes ingen gale eller riktige svar.

Ikke bruk for lang tid på noen av spørsmålene.

<u>Del 1: Utstyr</u>

Hvor sikker er du på…:

1. …at i dag, er skytterutstyret ditt godt nok til at 1 2 3 4 5 6 7
   du kan prestere på høyeste nivå i nasjonale konkurranser?
2. …at skytterdressen din er optimal, slik at du er 1 2 3 4 5 6 7
   i stand til å konkurrere med de beste i landet?
3. …at utstyret ditt gir deg tryggheten/troen som 1 2 3 4 5 6 7
   trengs for å prestere på høyeste nivå i nasjonale konkurranser?

<u>Del 2: Tekniske ferdigheter</u>

Hvor sikker er du på…:

4. …at skytestillingene dine er gode og stabile nok til å 1 2 3 4 5 6 7

kunne prestere på høyeste nivå i nasjonale konkurranser?

5. …at avtrekksteknikken din er god og robust 1 2 3 4 5 6 7

nok til å kunne prestere på høyeste nivå i nasjonale konkurranser?

6. …at fokuset utover i konkurransen vil være 1 2 3 4 5 6 7

optimalt uavhengig av utfallet av tidligere avfyrte skudd?

7. …at din kunnskap om skyting er god nok 1 2 3 4 5 6 7

til å kunne oppnå store prestasjoner (på nasjonalt nivå)?

Del 3: Stress

Hvor sikker er du på…:

8. …at du føler deg rolig og selvsikker under 1 2 3 4 5 6 7

press, slik at du kan prestere på høyeste nivå i nasjonale konkurranser?

9. …at du kan prestere på ditt beste under press? 1 2 3 4 5 6 7

(for eksempel når du leder før finalen i en av de største nasjonale konkurransene)

10. …at du kan bruke stressende situasjoner til å 1 2 3 4 5 6 7

prestere bedre?

11. …at i dag, er du i stand til å være blant de 1 2 3 4 5 6 7

beste skytterne (DFS) i landet?

Appendix C

Original self-efficacy scale developed for ski jumping performance (Sklett, 2017)

Self-efficacy and ski jumping performance

Introduction: The role of an athlete is complex and holds many different tasks and challenges. The following questions are designed to identify to which degree you, as a world cup ski jumper, strongly believe to master the many challenges you face. Each question involves how sure you are in performing certain tasks and certain situations during ski jumping.

Instructions: Complete the following scale either before or after a competitive situation that you feel is highly important to you.

Read each question thoroughly and consider how sure you are in managing the tasks in the conditions described and circle the appropriate number to indicate how you feel right now, at this moment. Small degree of certainty = 1, and high degree of certainty = 7

There are no right or wrong answers. Do not spend too much time on any one of the questions.

Small degree of certainty			Moderately degree of certainty			High degree of certainty
1	2	3	4	5	6	7

Equipment

How sure are you...:

1. …that today, your equipment is good enough to reach the highest level of performance in world cup competitions? 1 2 3 4 5 6 7

2. …that your suit is optimal, so you are able to compete with the best in the world? 1 2 3 4 5 6 7

3. …that your equipment gives you confidence in performing at the highest level in world cup? 1 2 3 4 5 6 7

Technique

How sure are you…:

4. …that your in-run position is good enough to reach the highest level of performance in world cup competitions? 1 2 3 4 5 6 7

5. …that your take-off technique is stable, and on a very high level in the world cup? 1 2 3 4 5 6 7

6. …that you are capable to fly effectively no matter what the outcome from the table is? 1 2 3 4 5 6 7

7. …that your knowledge about ski jumping is good enough for high level performance (world class)? 1 2 3 4 5 6 7

Stress

How sure are you…:

8. …that you feel calm and confident under pressure so you can perform on the highest level in world cup? 1 2 3 4 5 6 7

9. …that you can perform at your best under pressure (e.g. leading after first round in a world cup competition)? 1 2 3 4 5 6 7

10. …that you can use stressful situations to perform better? 1 2 3 4 5 6 7

11. …that today, you are capable to be among the best ski jumpers in the world? 1 2 3 4 5 6 7

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