Examining the Psychological Skills Used by Elite Canadian Military Pilots

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Abstract

The purpose of this research was to better understand how elite military pilots use psychological skills to enhance the quality and consistency of their performance. Elite high performance athletes have used psychological skills training to enhance the quality and consistency of their performances for many years (e.g., Mahoney, Gabriel & Perkins, 1987, Orlick and Partington, 1988, Orlick, 2008). For the purposes of this study fifteen elite Canadian pilots were interviewed at a Royal Canadian Air Force base in Canada. Results indicated these elite level pilots utilized all seven elements of Orlick's (2008) Wheel of Excellence over three phases of flight: pre-flight preparation, mission execution, and post-flight debriefs. One striking performance difference in the world of military pilots is the extreme deployment conditions to which they are sometimes exposed and the extreme consequences of mission failure, which may include loss of life.

Introduction

Research has repeatedly demonstrated that psychological or mental skills training (MST) can effectively enhance the quality and consistency of sport performance (e.g., Fournier, Calmels, Durand-Bush, & Salmela, 2005; Vealey, 1994). Focused MST programs empower athletes to exercise a greater degree of control over performances through the acquisition and utilization of skills and strategies such as distraction control, arousal/activation management, and effective competition focusing. Orlick (2008) summarized the key mental skills necessary for high-level performance in any high performance domain in the *Wheel of Excellence* model: focus, commitment, mental readiness, positive images, confidence, distraction control, and ongoing learning. Focus is described as the

driving force from which the remaining 6 elements of excellence develop and grow. This fundamental requirement of a full focus has been supported by research with performers of many different high peformance domains (e.g., Cohn, 1991; Orlick & Partington, 1986; Talbot-Honeck & Orlick, 1998; Werthner 2002).

In recent years, the growing popularity of extreme sports has shed light on the use of MST to enhance performance in high-risk contexts. Burke and Orlick (2003) explored the mental strategies used by successful Mount Everest climbers. The researchers reported that climbers employed mental skills in three distinct temporal phases: the preparation phase, the ascent phase, and the descent phase. The authors noted that a positive mindset and effective focus were

frequently cited by climbers as important components of success. Coleman and Orlick (2006) examined the use of mental skills in the high-risk sport of big mountain freeskiing. In this study the researchers also noted the importance of a preparation phase, performance execution phase, and post-performance phase. The major success elements common to all freeskiers were a fully focused connection with the task, love for the sport, and the ability to remain calm and focused in very challenging situations. Given this existing support for the extensive use of relevant focusing and other psychological skills in elite and high-risk sport contexts, it is surprising that there is an absence of applied research with respect to the use of mental skills and MST in military flying training and performance.

Roth and Andre (2004) produced what may be the first published investigation of an MST strategy for military aviation. Using 60 participants with no previous flying experience, the researchers attempted to ascertain the value of "chair flying" as a pilot training activity. Chair flying was defined as a preparation technique in which a pilot sits in a chair and mentally rehearses each sequence of the impending mission, including movements and props. Participants were assigned to a Memorization group, Simulator group, or Chair Flying group to be compared in a simulated (i.e., computer based) flying task. In preparation for the task, the Memorization group studied an Operating Handbook, the Simulator group practiced the mission with a computerized simulator, and the Chair Flying group received instructions and practiced with the chair flying (mental imagery) method. Results showed no statistical differences between the performances of the Chair Flying group and the Simulator group, and a marked decline in performance by the Memorization group. It was concluded that chair flying can be equally as effective as computer based simulator training in preparation for a simulator mission.

Toong and Koh (2005) investigated the effects of an MST intervention on the performance of 127 novice military parachutists by assigning participants to either a Mental Skills group or a Control group. Trainees in the Mental Skills group received a brief instructional program on relaxation, visualization/imagery, and mental focus. Using self-report measures of confidence and anxiety levels, in combination with other objective measures such as instructor assessment, the researchers reported that significantly more trainees in the Mental Skills group successfully performed a jump from a three story tower when compared with trainees in the Control group. They concluded that MST "can potentially have a positive impact on military performance, especially on tasks that are performed under stressful conditions" (p. 6). They further suggested that a taxonomy of mental skills, appropriate for specific military tasks, would add value to the current technical focus of training.

Purpose

The present investigation was undertaken as part of a collaborative effort with Canada's Department of National Defense (DND) and the Royal Canadian Air Force (RCAF) to examine the psychological underpinnings of Canadian military aviation excellence. The purpose of this study was to explore the following question: What psychological skills are used by elite Canadian military pilots and how are these skills used throughout their highly demanding aviation careers? This investigation also provided the groundwork for the development of a relevant and focused MST program specific to the needs of Canada's Air Force.

Method
Participants

Participants were selected using purposive sampling. Senior commanding officers within DND recommended suitable participants for this study, with the guidance of preferred criteria provided by the researchers. These criteria included high level performers and combat or deployment experience if possible. A sample of 15 elite military pilots was selected from the 15 Wing Moose Jaw base, where the RCAF conducts the majority of its pilot training. A 16th interview, with a top commanding officer, was

not included in the data analysis. Of the 15 participants, several were training to become instructor pilots, others were high ranking instructor pilots, and two occupied top supervisory positions. Seven participants had flown multiple aircraft types (jet, helicopter, multiengine) and two participants had flown the CF-18 Hornet, the RCAF's frontline fighter jet capable of speeds up to Mach 1.8. Four participants had been deployed to combat zones for one or more tours and one participant spent a substantial amount of time serving with Joint Task Force Two, Canada's Special Operations Forces unit.

Data Collection and Analysis

Data was collected through one-on-one, semi-structured interviews. An interview guide was created based on Orlick's (2008) *Wheel of Excellence*. The interview guide was independently reviewed by key RCAF personnel, the DND Social Science Research Review Board, and peers within the performance psychology community. Interviews lasted from 45 to 90 minutes and took place over a period of four days at 15 Wing Moose Jaw. Interviews were recorded, transcribed and analyzed both inductively and deductively. Both phases of analysis were conducted manually, without the use of computer coding programs.

Throughout the course of the interviews and analysis it became apparent that the use of psychological skills coincided with three distinct temporal phases, as was noted in previous studies (e.g., Coleman & Orlick, 2006). Thus the results were categorized within the following temporal groups: pre-flight, mission execution, and post-flight. The pre-flight phase refers to the time leading up to the flight and in-between flights; this includes the pre-flight briefing. The mission execution phase begins when the pilot steps onto the flight line and ends when the pilot exits the aircraft. The post-flight phase refers to all of the time following the flight, before the pilot begins to prepare for the next flight; this includes the post-flight debrief. The element of commitment to the task or mission was clearly evident beyond the confines of any one phase of

flight, and in most cases was evident even prior to employment in the military. Based on the pilots' extensive and ongoing high level of commitment, this element of excellence was analyzed and presented as a unique component of performance excellence.

Results
Commitment

All 15 pilots spoke of the importance of dedication, perseverance, and focus in the pursuit of their objectives. This commitment was clearly present prior to the participants' employment in the military. Pilots maintained a focus on their ultimate goal of becoming a military pilot and acted in specific and positive ways to achieve that goal, even when faced with barriers.

> *I was seven or eight. . .from that point on, that's exactly what I wanted to do the whole time. So going to school I had that idea in my mind: I knew I had to have good marks, be dynamic and so on, because those were all the things the Forces were looking for in officers. (Participant 14)*

Participants described a strong commitment to learning and preparing themselves for flight, wanting to know that if they failed it would not be for lack of preparation or effort. Many also felt that they had made a deliberate choice to achieve their own personal best as a pilot.

> *I think you can choose to perform well. . .I think you can choose to at least set yourself up for success. You can't control everything, but you can at least put yourself in the best state of mind or emotionally and physically ready to perform. (Participant 8)*

Fun and enjoyment seemed to strengthen the level of commitment felt by participants. For all pilots, evidence of this enjoyment could be seen and heard in the way they spoke when recalling certain events or discussing various aspects of their jobs.

> *I remember we had a blast. [The training exercise] was very successful . . .it was very exhilarating, knowing that you made it work, and it's fun. It's very challenging. We still talk about it. (Participant 4)*

At times, participants felt that they could make a choice to feel positively about flying, which was especially important during challenging situations such as a difficult course. Many pilots stated that if they ever stopped having fun, they would know their time in the military was up.

Pre-Flight
Focus

An important part of the pre-flight phase for all pilots was bringing an effective and connected focus into the preparation routine. A key characteristic of an effective focus was being in the moment: Participants were not thinking about irrelevant events of the past or the future, but were totally absorbed in the task at hand. The pre-flight preparation focus was described as being of the same quality as a performance focus.

> *There's no way to simulate [an engine fire] in real life, but in the simulator. . .I'll do the maneuvers. And I exercise myself in the same way: I don't take it nonchalantly. . .I try and keep it as close to as if I would do it in real life. (Participant 11)*

Participants were aware of what they needed to do to effectively achieve this type of focus (their best focus) and would actively take steps to ensure that the correct conditions were in place (e.g., removing themselves from a distracting environment).

Mental Readiness

A key component for all pilots during the pre-flight preparation was ensuring that they were mentally ready to execute their mission. All 15 pilots discussed the concept of mental readiness through ideas such as capacity building, studying, and anticipating various aspects of the flight.

> *If I know I'm not going to fly for a week I will always go back to the books that the students use, and I will re-read the books. Because, even though my day is predominantly running the [flight] school, never can I go to a cockpit and not be prepared. (Participant 1)*

Participants described several important elements of mental readiness: reviewing written material (e.g., flight procedures, maneuvers), building capacity (the ability to attend to multiple stimuli), learning from others, planning for unplanned events, and engaging in mental imagery. Pilots emphasized the importance of planning for possible emergencies before a flight by thinking about potential circumstances they may encounter (informed by textbooks or other pilots' experiences); determining how they would respond; and often visualizing their preferred responses or a number of possible responses.

Mental Imagery

All 15 participants described the use of mental imagery or chair flying as part of their preparation for flight. An important characteristic of chair flying was the inclusion of clear and realistic details. Pilots specifically noted that they "put themselves in the cockpit" or use a first person perspective in which they saw the cockpit and the horizon through their own eyes. For many participants, chair flying was largely a visual experience. Several participants also described the use of kinesthetic components, such as reaching to flick switches or pulling back on the throttle, and some participants described using auditory elements in their chair flying.

> *I visualize everything from what I see outside to controls in the cockpit. I even go over what ATC [Air Traffic Control] will say/ask and what I will verbalize to myself when I need to do checks in the cockpit. (Participant 5)*

While differences between participants were obvious in the chair flying methodology, it was clear that all participants attempted to engage in a realistic replication of potential flight events and their preferred responses, any way they knew how.

Chair flying encompassed a large portion of many participants' pre-flight preparation, especially as students. Every participant was familiar with chair flying and had practiced it at some point. It is worth noting, however, that even though chair flying is a recommended training exercise, formal instruction in the method of chair flying was not being provided at the time these interviews were conducted. Participant 8 noted this discrepancy: "It's interesting because everybody says 'chair flying', but nobody really teaches anybody how to do it". Participants described learning their own methods of chair flying in a self-directed manner or through dialogue with other students and pilots.

Stress Management
13 of the 15 pilots interviewed discussed their experiences with stress in pre-flight preparation and their personal management techniques. Sources of stress and anxiety during the pre-flight phase included general workload (long hours, high task load) and upcoming tests (the thought of having an examiner in the plane, the possibility of failure). Pilots varied widely in the way that they perceived stress and in their coping methods. Participants discussed the use of cognitive restructuring, visualization, shifting focus, exercise, music, socializing at the mess or with family, and breathing as methods of controlling their feelings of anxiety or stress.

> *The fact is, rather than be nervous [before a test] I would tell myself 'what do you have to lose?'. . .And if I don't care as much, I find I'm more relaxed and I perform way better. (Participant 11)*

> *I would just sit in a room for about five, 10 minutes just to think about the flight and just to try to relax a little bit - especially before an airborne test, because those are stressful. It would help me relax and get more in control. Just think positive. (Participant 7)*

These participants recognized that their control over the situation was limited. By shifting their perspective and focusing on constructive activities that were under their control, these pilots were actively creating improved conditions for success.

Mission Execution
The mission execution phase begins when the pilot arrives on the flight line to conduct the pre-flight checks and strap in to the aircraft.

Focus
Participants described an effective mission execution focus as being in the moment. This involved shutting out all other irrelevant or unnecessary stimuli and being able to broaden or narrow their focus, as required by the task. Being in the moment also included an element of anticipation and an ongoing connection with the aircraft and the flow of tasks.

> *Your focus narrows and you're not thinking about other stuff. I can have outside stresses at home and it won't affect me. . .as soon as I get into the plane I don't think about it anymore until I'm on the ground. (Participant 12)*

Participants were constantly thinking ahead to what would happen next and preparing themselves before they needed to act. In this way, the pilots were able to move fluidly and effectively from one task to the next, without hesitation.

Participants also described themselves as high in situational awareness [SA], which was defined as a working knowledge of the environment, including air traffic, weather conditions, aircraft status, and task demands. This awareness can be either temporal or spatial. A broad SA allows a

pilot to direct his/her focus appropriately and avoid being caught off guard.

> *You can have a plan, but the plan can change very, very quickly. So having situational awareness throughout changing environments would probably be the number one thing. Everybody [can learn] the hands and feet, but it's the thinking part that's the most important. (Participant 15)*

As participants became more experienced as pilots, they increased their SA through greater familiarity with the possible situations they could encounter in flight. The ability to perform routine procedures without conscious thought also allowed pilots to focus more on their surroundings and other SA relevant stimuli.

When fully focused, participants were connected with their task and the mission in a natural, organic, or free flowing way. Participants described completing tasks without consciously thinking about them, by trusting in their abilities and simply allowing their bodies to perform the movements that they have trained them to do.

> *[Do I] get into a groove and do it? Yeah; especially when you get very comfortable with it. The more time you have in the airplane, you know that feel of the aircraft – or muscle memory, brain memory or whatever it is – if something feels a little weird you'll just go 'okay something's off here' and you'll be able to anticipate or change. (Participant 8)*

Participants described feeling connected to the airplanes, as if the aircraft was an extension of their human body. Many participants found that when they attempted to consciously think about familiar maneuvers or actions they inhibited their own performance.

When faced with an emergency situation, many participants noted that their responses seemed to occur almost automatically. They recalled not having to think about what they were doing, but

simply allowing their training and instinct to take over.

> *Everything changed at that point. Everything we'd been training for, because we always simulate [losing engine thrust], and at that time I knew it wasn't simulated. So I just took control from him [student pilot] and brought the airplane back. I just did my drill. (Participant 4)*

Before going up in an aircraft pilots were well aware of what their priorities were in an emergency; thus, they knew which tasks needed to be completed first. Knowing or establishing priorities in an emergency was a key factor in decisive action. In addition, the ability to recall relevant past experiences and responses and adapt those to the current situation was an important performance and survival skill.

Distraction Control and Refocusing
When participants were aware that they could become distracted during flight, they often used verbal cues to prevent their focus from shifting away from where it needed to be. For example, when attempting to complete a maneuver that had been difficult in the past, participants sometimes spoke out loud the various steps they needed to follow as they progressed through the maneuver.

> *On one trip, I was just all over the place. I wasn't settling in. And I was flying with this guy, he told me 'just talk yourself through it'. And I started to do that, and I'd say 'plane, line, hinge', and those are the three references that we use, and I was forcing myself, as I said it, to look at those different spots on the airplane. (Participant 10)*

Participants found this strategy to be useful during slower maneuvers to ensure that they did not overlook anything important and to guide their focus to the appropriate steps in the sequence.

As soon as a pilot found that s/he was distracted, the immediate response was to attempt to refocus on the task at hand as quickly as possible. Refocusing generally involved three components: compartmentalization of the distractor (blocking it out of one's mind and moving forward), prioritization of the remaining tasks, and shifting focus to the new priority.

> *I just tell myself, or the rest of the crew, 'okay, that happened. We can't fix it now; it's too late. We now have to concentrate on the next thing'. And it's either tell them that too bad, that's a fail point if it was a test, or it's a thing that we're gonna have to talk about later. (Participant 9)*

For the majority of pilots, the second step of prioritization was simply a matter of returning to standard procedure. This prioritization component was especially important when participants experienced task saturation (being distracted by an overload of tasks).

> *That took personal training to tell myself if that's happening to me [task saturation], I need to figure out if there's a red ball that's the most important ball. And if you see four balls coming at you, I don't care about the other ones, just catch that red ball. And just use that as the how to get yourself out [of the task saturation]. (Participant 2)*

After determining the order of tasks pilots focused on the top priority first, eventually working through most or all of the remaining tasks on the list. When attending to the most urgent priority, pilots were able to refocus and quickly re-engage in what was most important at that point in the flight.

Confidence
Pilots described three major sources of confidence: personal abilities, fellow pilots, and safety precautions. Participants used various psychological skills to strengthen or enhance their personal confidence. Participant 11 discussed the use of positive self-talk when he was unsure or hesitant in a flight situation:

I was pretty nervous going through [flight school] and as I progressed I began to learn that this nervousness was hampering me. And if I just told myself that I knew what I was doing, I found I calmed down a little more and I was able to see a little more; the horse blinders came off a bit.

Many other participants realized that being less than perfect was acceptable and used their less-than-best performances as learning experiences. Participants also felt that their confidence was affected by their pre-flight preparation.

> *It's almost like you worry about it up until the moment [of the flight], but then when the moment's there you kind of go 'you know what, I just have to go and do what I've been taught to do' or 'do what I've trained to do'. (Participant 8)*

These pilots trusted that the RCAF instructors and training program had given them all the tools that they would require to fly safely and perform at the highest level.

The importance of having a high level of trust in one's fellow pilots was implicit in many of the comments made by participants.

> *Trust is very important. I have flown with people I didn't trust. You pay closer attention to what the individual is doing and double check all his or her switch selections. I would even ask questions to clarify their intentions prior to doing a maneuver. The trust is initiated in the training environment but must be continuously maintained throughout your flying career. We have a saying in the Air Force: You are only as good as your last flight. (Participant 5)*

When a pilot is able to trust his/her fellow pilots, it becomes easier to focus on the task at hand and

all the other important elements in his/her broad situational awareness.

Due to the high risks involved in military flying, personal safety was a top priority for all participants. Some participants gained confidence from the knowledge that they had taken precautions to ensure their safety through pre-flight preparation and also by avoiding unnecessary risks. Participant 13 stated, "I'm always thinking about 'what if this happens; what will I do?' And the minute I don't have any more options, I'd rather be on the ground". Participants maintained their confidence through the knowledge that they were aware of their own personal limits (the point at which they could not safely recover the aircraft). Participants learned their personal limits gradually, over years of flight experience. Once they had pieced together a firm understanding of their limits, pilots respected these boundaries as absolutes.

Stress Management
Stress management during a mission execution was most evident when participants were in test situations or completing new or unfamiliar maneuvers. Flight tests often created the highest levels of perceived stress for students and professional pilots. During tests, many participants found that their desire to do well and please the examiner hampered their ability to focus and act automatically. Participants described trying various approaches to deal with their feelings of stress in test flights. For some, approaching the flight with the mentality that there was nothing to lose helped to alleviate the symptoms of anxiety. One participant reported that he would consider the possible outcomes of a failed flight and ask himself whether he could accept or live with those consequences. Once he had accepted the worst possible outcome, he resolved to simply do his best. Several pilots described putting aside or compartmentalizing their thoughts of the examiner and refocusing their attention on the task at hand, as they would do in a routine flight.

Ongoing Learning
For all participants, ongoing learning was an extremely important facet of optimal performance. Flying was often described as a continuous adjustment to the ideal. Participant 12 stated, "Flying is just a constant correction of errors, that's all it is. You're always fixing something that's going wrong". Because pilots have many decisions to make and little time in which to consider them, they accepted the fact that a portion of these decisions would be incorrect, or not ideal. What was important was not the correctness or incorrectness of their decisions, but rather the ability to analyze those decisions, recognize the errors, and adjust if necessary.

> *[The most important skill is] the ability to make a decision and to rationally think out different options; not just making a decision and sticking with it, but being able to continually assess that decision and update it and make the proper decision at the end of the day. (Participant 1)*

During flight, participants constantly analyzed their decisions to determine whether they had selected the most ideal course of action. In-flight analysis was completed as quickly as possible and once a pilot recognized an error or identified a more appropriate action, there was no hesitation before the new plan was implemented.

Post-Flight
Ongoing Learning
Following every flight, pilots engaged in a detailed debrief in which the various segments of the flight were analyzed, mistakes were pinpointed, and corrective measures were suggested. Many participants noted that the tools or strategies for "how to improve" were the most valuable product of the debrief, as they were frequently well aware of their mistakes as soon as they had made them. The idea of owning one's mistakes was also very important to all participants.

I look at what happened, what I did, what could I have done better so that I can learn something. But I also take into consideration that it's always easier after the fact to analyze because I also think about what I had, the information that I had at the time, and the time that I had [to respond or react]. (Participant 13)

Pilots accepted responsibility for their actions while also recognizing that they are acting within certain situational parameters. Participants analyzed their actions, the information they used to arrive at those actions, the environmental factors, and their frame of reference (i.e., what they believed to be true) going into that flight or maneuver.

Pilots described engaging in personal and group debriefs as well as one-on-one debriefs with the flight instructor or examiner. Participant 15 shared the lessons from post-flight debriefs with others: "There's always lessons that you learn from it . . .I usually share them, because everyone can always learn from other peoples' experiences". Group debriefs presented pilots with a valuable opportunity to learn from others, as they were prompted to consider possible events and responses that they may not have previously regarded as important, or even plausible. Participants were especially concerned with and committed to learning from their debrief following a less-than-best performance.

You don't want to be afraid of failure. It may happen from time to time - none of us are perfect - so the guys who can bounce back from that, actually use that to feed on, they tend to be quite successful. (Participant 2)

Many participants took this opportunity to recognize their imperfections and accept that making mistakes and growing from them are part of the learning process.

Stress Management
Pilots discussed the importance of dealing effectively with criticism, as it remains a large

part of the pilot training system. To deal with criticism in a constructive way, participants attempted to extract the most useful information from the comments and disregard the negative aspects (for example, something that may be perceived as a personal put down).

Some guys just like to destroy you, so you just kind of sit there and suck it up. And then you have to be strong mentally when you go out the door, and take everything he said and put that in perspective and say 'Whatever. Yeah, I agree with this and this, but I don't agree with that. And I'll show you next time, I can do it'. (Participant 7)

Participants tried to prevent any internalization of the critical remarks, reminding themselves that the instructors were not attacking them as people but were trying to help them to become better pilots.

Discussion
The purpose of this study was to explore the use of psychological skills by elite Canadian military pilots. This investigation was conducted within the framework of Orlick's (2008) *Wheel of Excellence*. The results of this research reveal that Canada's elite military pilots incorporate all seven elements of Orlick's *Wheel of Excellence* into one or more of the three flight phases (pre-flight, mission execution, post-flight). These findings are consistent with the conclusions of previous investigations in elite sport such as Fournier et al (2005) and Gould, Eklund and Jackson (1992). This research is also consistent with findings in other high-risk activity performance domains (Burke & Orlick, 2003; Coleman & Orlick, 2006) and supports the validity and relevance of Orlick's *Wheel of Excellence* within the context of elite military aviation.

The element of commitment was an integral component of success for pilots in all phases of flight training and flight performance in the military. In their research with National Hockey League players, Barbour and Orlick (1999)

found that NHL players rated commitment highest in terms of importance as well as their own perceived proficiency. Pilots also identified commitment as an essential component of success in military aviation; however pilots seemed to vary markedly in their perceptions of the most important mental skill. Barbour and Orlick further noted the integral role of fun and enjoyment in the enhancement of player commitment and retention. They suggested that fun and enjoyment be recognized as a distinct element of success in the pursuit of excellence. Every pilot in the present study also indicated that some aspect of flying consistently brought him/her enjoyment or positive, uplifting feelings. Pilots cited various sources of positive feelings, including the challenge of the occupation, the camaraderie of the RCAF, their roles as instructor pilots, and the unrivaled freedom of being in the air.

Participants felt that an extremely critical component of their mental readiness was the extent to which they had prepared for potential incidents or other unforeseen events that occurred during that flight. Pilots accomplished this mental readiness task by anticipating possible circumstances drawn from their own knowledge and experiences, as well as by engaging other pilots in discussions of their past experiences in similar missions or contexts. High risk performers in studies by Coleman and Orlick (2006) and Burke and Orlick (2003) also reported detailed planning in the pre-performance phase of high-risk activities; however neither big mountain free skiers nor successful Mount Everest climbers engaged in this type of consultation with their peers. The military pilots' reliance on peer discussion is a unique aspect of flight preparation that is not noted in past research in high-risk sport. While it was impossible for pilots to plan for every possible circumstance, it was important for them to enter each mission knowing that they had had done all they could to prepare themselves for expected and unplanned incidents.

Mental imagery, or chair flying, was an integral component of the pre-flight preparation phase for every pilot in this study. Roth and Andre (2004) suggested that chair flying could be equally effective as simulator based training in preparation for a simulator flying task, but that further research was required to determine whether chair flying is effective in preparation for real missions. For the elite military pilots who participated in this study, chair flying was an essential and effective component of preparation for real missions. Orlick (2008) stated that the world's top performers use mental imagery every day to prepare themselves for training, to perfect or make corrections to technical skills, to overcome challenges, to see themselves achieving their best, and to improve their confidence in their abilities. Pilots in this study utilized imagery in a similar way, with an emphasis placed on skill acquisition, skill refinement and error correction. Pilots incorporated mainly visual and kinesthetic (i.e., physical movements) modalities into their chair flying practice. Some pilots also included auditory elements, such as hearing radio calls, and one participant reported that he could feel the sensations of being under G (the force of gravity). Munroe, Giacobbi, Hall, and Weinberg (2000) found similar results in their investigation with 14 varsity athletes. Results showed that athletes incorporated visual, auditory, olfactory and kinesthetic elements into their mental imagery. The pilots in this study reported using mainly visual and kinesthetic components with limited usage of auditory elements and no mention of olfactory elements. This presents a possible avenue for improved performance by enhancing both the quality and diversity of this part of current pilot and student preparatory routines.

Past research has questioned whether the amount of deliberate practice or mental imagery required for excellent performance decreases once a performer attains an expert level of performance (Durand-Bush & Salmela, 2002; Krampe & Ericsson, 1996). The current research conducted with elite military pilots supports this theory. Pilots reported that the majority of their chair flying was performed during their training in flight school when they were frequently learning

new and challenging procedures and techniques. As they became increasingly familiar with the aircraft and the various maneuvers, they reported a decrease in the amount of time spent chair flying. Later in their careers, pilots would return to chair flying when preparing for important tests or missions, when transferring to a new aircraft, when on deployment, or when returning after time away from flying.

In their work with big mountain freeskiers, Coleman and Orlick (2006) reported that confidence was linked to sufficient and effective preparation, including safety measures such as back-up plans and safe zones. The present research involving military pilots supports the importance of this finding. One pilot stated that the only instances in which she felt a lack of confidence were those for which she felt that she was insufficiently prepared. RCAF pilots also placed a great emphasis on personal safety measures, as they were aware that many preventative steps could be taken to execute the mission in the safest way possible. McDonald, Orlick and Letts (1995) reported that elite surgeons enhanced their self-confidence by controlling their situation through positive thinking, selecting their own team members, and postponing surgery if necessary. Pilots devised similar methods of gaining control over their physical selves and the environment to enhance their self-confidence. The methods used by pilots included positive thinking and positive self-talk; maintenance of physical health and fitness levels; and planning flights according to weather conditions. Pilots recognized what they could control and actively attempted to manipulate those variables in positive ways. In addition, pilots deliberately cultivated a keen awareness of their own abilities and limitations. If their abilities to successfully complete a mission or a maneuver were in any way compromised or questionable, in the same way that surgeons would postpone surgery, pilots would simply not fly.

All pilots interviewed for this study reported that a connected focus was essential in order to excel in flights and missions. Pilots described their

best focus as one in which they were in the moment, connected to their tasks, thinking positively, maintaining a broad SA (situational awareness), and using their capacity effectively. Werthner (2002) identified trust as a specific component of an effective 'in the moment' focus. Werthner reported that elite athletes strive to balance the cognitive aspect of monitoring performance with the more instinctual or trusting aspect of simply allowing one's body to perform what it has done many times before. The pilots in this study also seemed to maintain such a balance of focus and trust as most of the routine mechanics of flight were performed without deliberate or conscious thought. The countless hours spent engaged in missions, chair flying, and other preparatory activities allowed pilots to carry out these actions with minimal attention while simultaneously processing other inputs and prioritizing tasks.

Pilots use the term capacity to refer to the ability to monitor multiple stimuli and shift attention to what is most important. Pilots tried to build and strengthen their capacity during their pre-flight preparation by attempting to replicate the multi-input, dynamic environment of the cockpit when studying or chair flying. Some pilots believed they could create a similar effect on the ground by engaging in a secondary activity, such as juggling or bouncing a ball, while focusing on their flight-related preparation (mental imagery or reviewing written material). These pilots felt that by using this technique they could improve their ability to monitor multiple variables (some subconsciously) without becoming overwhelmed or losing focus on the most important task. This strategy of intentionally incorporating multiple stimuli into preparatory activities is a simple one; however it is not specifically addressed in aviation research or other high performance research to date. This technique might provide a valuable contribution to the field of sport and performance psychology. The effectiveness of such a practical activity is worthy of further exploration for performers engaged in fast paced, multifaceted performance environments, especially those with the potential for extreme outcomes.

If pilots did become distracted in flight, for example by an error or an unexpected event, the typical refocusing process for these elite pilots seemed to follow a distinct set of five steps: (1) identification of distractor, (2) recognition of degree of control over distractor (3) compartmentalization of distractor, (4) reprioritization of tasks, and (5) execution of top priority task. Many pilots reported using cue words or phrases such as "what's next?" to prompt their rapid refocusing. Performers in other domains have reported using compartmentalization or thought stopping strategies to block out unwanted or harmful distractions (e.g., Orlick & Partington, 1988; Zinsser, Bunker & Williams, 2001).

One aspect of distraction control and refocusing that does not to appear to have been addressed in sport psychology literature is a pilot's conscious thought process of task prioritization that often follows compartmentalization. This may be due in part to the unique performance requirements in military aviation (i.e., there are many tasks to attend to within a very short period of time, given the high speed at which they are flying). The complexities of flying an aircraft in a busy or dangerous airspace require that a pilot must be prepared to organize a multitude of tasks before attempting to complete them. As students, pilots often relied on a pre-planned RCAF prioritization scheme of "aviate, navigate, communicate". In any situation, pilots knew that their first priority was always to aviate (i.e., keep the aircraft from hitting the ground). As simple as it sounds, this gave pilots a starting point on which they could refocus and proceed with determining the necessary steps to gain control of a complicated or overwhelming situation.

Orlick (2008) stated that personal excellence arises from stretching one's limits, engaging in thorough post-performance evaluations, looking for positive elements as well as areas for improvement, and acting on the lessons learned from one's experiences. These elements of ongoing learning and self-reflection were a consistent component of excellence for all pilots interviewed. Upon the conclusion of every

mission, pilots analyzed both good and bad elements of the flight, drawing out specific learning opportunities and lessons for ongoing improvement. Student pilots and experienced pilots focused on finding the tools to address any mistakes that had been made. Pilots often referred to their toolboxes, which they continually stocked with tips and bits of information gathered from debriefs, personal studies or experiences, and discussion with peers. Once an appropriate tool or lesson was discovered for a specific error or opportunity for improvement, pilots immediately attempted to put that tool into use and focus on performing that maneuver correctly during the next flight.

Many pilots reported that they engaged in personal debriefs during their own time, following the formal flight debrief. Contrary to the findings of Orlick and Partington (1988) – that Olympic athletes used reflection and personal debriefs to continue to improve their mental skills – the pilots in this study seemed to focus almost exclusively on mechanical aspects of the flight during debriefs without directly addressing the role of their own psychological skills or their best focusing and refocusing skills. Only occasionally in this study did pilots mention reflecting or debriefing on their own focus, for example if the flight or part of the flight was exceptionally poor or if an error was made needlessly. It appeared that emotions that were experienced during the flight were also rarely discussed.

Hogg (2002) stated that a successful debrief requires "a desire to reflect on all aspects of performance with the intention to make changes" (p. 184). We would add that a successful debrief should help pilots and other performers reflect on their own best focus (when things are going best) and to find ways to respect that best focus consistently. This research has shown that psychological skills are a critical aspect of optimal performance in military aviation, so these skills should become a normal or structured component of debriefs in military aviation. Because these mental skills play such an integral role in quality or optimal

performance, it would be of immense value in the future for military pilots to include psychological skills training for student pilots as well as include normal ongoing focus reflections in both formal and personal debriefs.

Stress management, or activation control, was an important aspect of successful performance for all pilots in all phases of flight in this study. Orlick (2008) discussed stress control and positive recovery from setbacks as components of distraction control. Pilots reported widely varying strategies for stress management or reduction such as exercise, positive self-talk, meditation, time off, compartmentalizing, and socializing. Some pilots felt that stress was simply a part of the job and should be accepted as such. When stressed, these pilots reported simply focusing on the task and doing whatever was required to complete their goal. While it is possible that the considerable variation in stress management tactics may be the result of a lack of formal training in such techniques, research in sport has indicated that the use of diverse arousal management techniques is common among elite performers (e.g., Gould, Finch, & Jackson, 1993; Lazarus & Folkman, 1984; Nicholls & Polman, 2007). Different performers may simply prefer different strategies, depending on the nature of the stressor.

It is interesting to note that during routine flights, pilots generally did not experience anxiety or fear. In the rare event that a pilot felt anxious leading up to a flight, these feelings were dispelled in the moments prior to take-off when the pilot narrowed his/her focus to complete the routine checks. Similar patterns of activation have been identified in Olympic gymnasts (Mahoney & Avener, 1977) and sport parachutists (Fenz & Jones, 1972). These performers recorded elevated levels of anxiety (physiological indicators) up to some trigger point (e.g., for sport parachutists, this trigger was the starting of the plane engine). After the trigger point, anxiety levels decreased substantially and remained low for the duration of the performance. For many pilots, this trigger point appeared to be the act of strapping in or taking

their seat in the cockpit. Researchers seem to agree that in these circumstances performers exert some type of control over their arousal levels prior to performance; however, the nature of how arousal levels are controlled has been relatively unexplored. Coleman and Orlick (2006) reported that the big mountain freeskiers attempted to control their pre-performance activation by deliberately taking deep breaths, calming themselves and clearing their minds at the top of the hill just before executing the run. Some pilots in this study felt that a certain level of activation was good for optimal performance. Their shift to a calm and fully connected focus seemed to occur naturally, when they immersed themselves in fully connecting to their normal take-off routines.

The pilots interviewed for this study demonstrated a strong desire to take responsibility for their errors and to find ways to continue to make improvements, for example by acting on the lessons learned from post-flight debriefs. During debriefs, errors made during the flight were reviewed and analyzed, and tools or suggestions to improve future performances were discussed. This was a humbling experience for many pilots. Student pilots sometimes received frequent and targeted critiques of their actions, however experienced pilots also received this type of criticism at times during tests, important missions, or when flying with the Snowbirds (formation aerobatic flying). Anshel and Gregory (1990) suggested that skilled athletes cope with acute stress (e.g., criticism) by blocking out negative or harmful elements and assimilating and implementing information that will benefit future performances. The present research supports this finding: To cope with the potential negative effects of receiving criticism (e.g., distraction, decreased self-confidence) many pilots made a conscious effort to adopt a positive perspective. Pilots reported taking ownership of their mistakes, looking for tips they could use, blocking the negative components, staying focused on their goal (of becoming an excellent pilot), putting the experience in perspective and acting on the lessons learned.

Thompson and McCreary (2006) suggested that stress management techniques should not be taught as unique or dissimilar from other typical responses to military situations (i.e., to be used only in special circumstances involving stress). Rather, these mental skills should be thoroughly "integrated into all relevant training opportunities so that they become reflexive in the same way that technical proficiencies are reflexive" (p. 3). Interestingly, the pilots who reported experiencing little or no stress on a day-to-day basis were those who saw stress management techniques as natural and automatic. While others might consider these techniques to be specific tools to cope with stress, these pilots saw them as normal reactions to normal (stress enhancing) situations. Thus, the strategy proposed by Thompson and McCreary is supported by this research and may be an effective way for the RCAF to begin introducing and sustaining stress management training.

Conclusion

The purpose of this investigation was to gain an understanding of how elite Canadian military pilots use psychological skills to perform successfully in this highly demanding occupation. Results showed that Orlick's (2008) *Wheel of Excellence* is highly applicable as a model of performance psychology for military pilots. Pilots used elements of the model in three temporal phases of flight: pre-flight, mission execution, and post-flight. Commitment was an integral element of successful performance for all pilots and was evident through all stages of flight and, in many cases, prior to enrollment in flight school. Looking forward towards the future, this research has highlighted several important elements that could be effective in an MST program within the RCAF or other military aviation programs.

The pilots of Canada's Air Force who participated in this research are a unique group of men and women who possess incredible talents and an inspiring level of commitment. These pilots train with a level of focus and commitment that, to many, may seem unsustainable. Driven by a love of flying and a desire to achieve personal excellence, these pilots understand that high quality training leads to high quality performance; and when these pilots are called to truly perform, there are no second tries. The elite performers of the RCAF possess many psychological skills that enable them to perform consistently in their highly demanding roles. In an environment where circumstances can change at a moment's notice, where decisions must be made instantly, and where every action has a consequence, effective psychological skills can empower pilots to gain their wings, execute missions, recover from emergencies, save lives, and contribute to a better and safer world.

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