



# OLYMPIC COACH SPORT PERFORMANCE DIVISION

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Message from the  
**Director of Coaching**  
**Chris Snyder**



Welcome back *Olympic Coach* readers! Thanks for taking the opportunity to learn what Team USA is doing as we prepare along the Road to Tokyo 2020.

As always, we have been very busy with all things USOC, including the Olympic and Paralympic Assembly which allows us to engage with our constituents in meaningful meetings around operations, membership and high performance. While we see each other at different points throughout the year at different events, this is the one time when everyone is in one place and we can focus on specific business to improve Team USA. I want to personally thank those of you who participated and for your energy and commitment to Team USA. Together we are stronger, and at this point in time – ensuring athletes everywhere are training and competing in safe environments, and are empowered to succeed is our primary goal.

In our continuous pursuit of excellence, we offer this issue of *Olympic Coach* which includes the following topics: optimization model, the role of national standards in coach learning, reverse engineering coaching, and the mechanics of movement preparation.

We are fortunate to have world class professionals contributing to *Olympic Coach* and we're happy to share this information with you. We hope you'll get as much out of these articles as possible to improve your coach development and athlete performance.

Thanks again for your continued support.

Chris Snyder  
Director, USOC Coaching Education

P.S.: If you are interested in contributing to a future issue of *Olympic Coach*, please reach out to Christine Bolger directly ([Christine.bolger@usoc.org](mailto:Christine.bolger@usoc.org)). We love to share best practices in coach and athlete development.

## The Role of the National Standards for Sport Coaches in Coach Learning

Lori Gano-Overway, Bridgewater College

Coaching is an ever-evolving profession informed by the latest scientific research and best practices of effective coaches. Therefore, for a coach to achieve and maintain effectiveness and achieve sustainability requires staying up to date with the profession. When defining coaching effectiveness, Côté and Gilbert (2009) further document the importance of coach knowledge by noting that to be an effective coach requires “the consistent application of integrated professional, interpersonal, and intrapersonal knowledge” (p. 319). More recently, Rynne and Mallett (2014) make the case that coaches, particularly high-performance coaches, must learn in order to achieve sustainability, which they view as being able to develop and maintain the “environments and behaviours that make efficient and ethical use of resources” (p. 12). Specifically, they contend, “Without engaging in continued and quality learning practices, coaches will condemn themselves to a future where they repeat past mistakes. They also risk opting for uninformed, short-term gains that jeopardize their own and their athletes’ futures” (Rynne & Mallett, 2014, p. 15). Thus, coaches face a call to action, that is, engage in the pursuit of lifelong learning. However, the questions facing coaches are:

1. What do I need to learn to help myself and my athletes develop?
2. How do I go about learning it?

The purpose of this article is to discuss how the National Standards for Sport Coaches can contribute to answering these questions and support the coach learning process.

### The National Standards for Sport Coaches

Recognizing the need to help sport coaches adequately prepare to work with athletes, the National Association for Sport and Physical Education (NASPE), a former association within the American Alliance for Health, Physical Education, Recreation and Dance (now SHAPE America) developed a task force to identify the knowledge and skills sport coaches should possess to provide a quality sport experience for amateur athletes. The result of this work was the creation of the National Standards for Sport Coaches (NSSC). While the NSSC originated in 1995, the last revision was completed in 2006. The current NSSC consists of 40 standards organized around eight domains (NASPE, 2006; <https://www.shapeamerica.org/standards/coaching>). These domains include philosophy and ethics, safety and injury prevention, physical conditioning, growth and development, teaching and communication, sport skills and tactics, organization and administration, and evaluation.

In 2017, a new task force, representing coaches, coach educators, coach developers, sport administrators and national organizations involved in coaching (see author’s note), began a third revision of the standards to be released early next year. The task force sought to update standards to correspond to the latest scientific research and practical work in coaching as well as more closely align



with the International Sport Coaching Framework (ISCF; ICCE, ASOIF, and Leeds Metropolitan University, 2013). The intent of the revised NSSC is to document the core responsibilities coaches should possess along with supporting competences (i.e., standards) which encourage the application of knowledge and skills to support a quality amateur sport experience for athletes (SHAPE America, in preparation).

The revised NSSC are organized into seven core responsibilities (see Table 1). Like the primary coaching functions in the ISCF, the responsibilities represent core coaching functions that require the integration of professional, interpersonal and intrapersonal knowledge. Each core responsibility is associated with a set of standards that represent task-related competences coaches can develop. The standards identify the knowledge and skills coaches can acquire and apply to further enhance their coaching practice. For example, one core responsibility is to build relationships (see Table 1). There are three underlying standards that correspond to this responsibility: a) acquire and utilize interpersonal and communication skills, b) develop competencies to work with diverse individuals, and c) demonstrate professionalism and leadership (SHAPE America, in preparation). As coaches develop these task-related competences, their ability to build relationships within their sport program should improve. While the seven core responsibilities reflect the fundamental actions administrators, athletes and the public can expect of sport coaches within their sport context, differences in depth and breadth of knowledge and skills can be expected based on the level of coach expertise (e.g., volunteer beginning coach versus high school coach) and the sport-coaching context (e.g., youth sport versus intercollegiate sport).

### **Connecting the National Standards to coach learning**

To understand how the NSSC might assist with coach learning, it is important to recognize how coaches learn. One model for understanding how coaches learn was documented by Werthner and Trudel (2006). While Werthner and Trudel suggest that coach learning is unique for each coach, there are three specific learning situations, i.e., mediated, unmediated, and internal. These learning situations work best when integrated with and informed by coaches' own experiences in the field. Understanding of the NSSC, may inform how coaches approach each of these learning situations.

One learning situation is mediated learning which involves learning through formal experiences like coaching workshops, coaching conferences and coach education programs. Coaches, informed by the NSSC, can seek out mediated opportunities that correspond to the NSSC. In fact, the NSSC might be a good starting point for coaches entering the profession. As Jennifer King, collegiate basketball coach, states:

*My best advice for young coaches is to be the best you can be which means investing in your craft through books, workshops and any other avenue you can use to gain experiences and knowledge that can make you a better person and coach (Female Coaching Network, n.d.).*

As the NSSC identify the knowledge and skills coaches can acquire to develop their coaching practice, new coaches can look for coaching education programs, workshops and books that will



help them to develop the task-related competences associated with the NSSC. However, experienced coaches can also benefit from using the NSSC to identifying mediated learning experiences. For example, if more experienced coaches are interested in conducting better practices to enhance athlete performance they can turn to the standards corresponding to this core responsibility (i.e., conduct practices and prepare for competition). They could then seek out workshop or conference opportunities related to these standards (e.g., how to design appropriate progressions for improving sport-specific physiological systems; how to use effective teaching principles in practice to improve technique; how to use motivational techniques in practice; how to implement strategies to evaluate athlete training and performance; or learning rules of thumb for adjusting training plans based on athlete needs).

Another learning situation is unmediated learning experiences that are sought out by coaches to improve coach practice. Example situations may include searching the internet or print material for answers and/or having discussions with coaches or athletes. While these learning situations are often sought out by coaches because of a difficult coach situation prompting the need for more information, they could still be informed by the NSSC. As Werthner and Trudel (2006) note,

*the potential of these unmediated learning situations is limited by a number of significant aspects—the level of coaches' ability to learn by themselves, their openness and eagerness to create new learning opportunities, and the fact that coaches cannot look for information on a topic if they do not know it exists (p. 204).*

Their last point may be a place where the NSSC can offer assistance to coaches. As the standards are based on the latest research and coaching practice, it may help coaches identify the topic they need to pursue to improve their coaching. For example, if an athlete becomes injured a coach may reflect upon whether safe training practices were utilized. However, reviewing the core responsibility associated with creating a safe sport environment (see Table 1) the coach may realize it is important to reflect upon mitigating conditions that predispose this particular athlete to injury or how nutritional practices may have contributed to the injury. The NSSC may also assist in unmediated learning situations involving discussions between coaches (or communities of practice). That is, the NSSC could provide topics of discussion between coaches which can help them learn from one another.

A final learning situation is internal learning which entails the coach thinking about how to integrate their coaching experiences with other learning situations to inform practice and/or reflecting upon their practices to seek out ways to solve coaching problems. In fact, one of the core responsibilities in the NSSC is continuous self-improvement which encourages coaches to regularly engage in internal learning (e.g., practicing self-reflection, seeking opportunities to learn to integrate in practice) to support their development as a coach. Coaches might also use the NSSC to reflect upon their own development. For example, coaches can ask themselves how well are they achieving each of the seven core responsibilities and identify areas in need of further reflection and improvement.

Overall, the NSSC can help in each area of coach learning. While the standards only represent one piece of the coach learning process, they can be of assistance to coaches at any stage of



their learning not just formal coach education courses.

### Conclusion

The National Standards for Sport Coaches (NSSC) were created to identify the core responsibilities and corresponding knowledge and skills to assist coaches in providing quality sport experiences for their athletes. While these standards will be used by many coach educators and coach developers to drive coach education programming, it is clear the NSSC can also be used to assist coaches in identify meaningful learning experiences that meet them where they are in their learning process. Coaches are encouraged to seek out the standards as one way to improve their coach effectiveness.

**Table 1: Core Responsibilities of the Third Revision of the National Standards for Sport Coaches (SHAPE America, in preparation)**

Core Responsibility	Brief Summary of Knowledge and Skills
Set Vision, Goals, and Standards for Sport Program	Sport coaches establish a clearly defined coaching philosophy and vision for their program. They develop, implement, and manage the goals for the program, in collaboration with sport program directors and aligned with the American Development Model. (5 Standards)
Engage in and Support Ethical Practices	Sport coaches understand the importance of ethical practices, engage in ethical behavior, abide by codes of conduct affiliated with their sport and coaching context, develop ethical decision-making tools, and model and teach ethical behavior in their sport program. (3 Standards)
Build Relationships	Sport coaches develop competencies (e.g., interpersonal, communication, and socio-cultural) to effectively communicate, collaborate, educate, and support all stakeholders associated with the sport program. They also demonstrate professionalism and leadership. (3 Standards)
Develop a Safe Sport Environment	Sport coaches create an emotionally and physically safe sport environment by following the practices outlined by sport organizations, coaching science, and state and federal laws. (9 Standards)
Create a Positive and Inclusive Sport Environment	Sport coaches develop practices to maximize positive outcomes for their athletes by building season plans that promote physical, psychological, and social benefits for their athletes and encourage participation in sport. Sport coaches implement strategies to promote participation of all athletes. (3 Standards)



<p>Conduct Practices and Prepare for Competition</p>	<p>Sport coaches draw upon current coaching science, sport-specific knowledge, and best practices to conduct quality sport practices, prepare athletes for competition, and effectively manage contests. This practice is framed around how coaches plan, teach, assess, and adapt in practice and competition settings. (14 Standards)</p>
<p>Strive for Continuous Improvement</p>	<p>Sport coaches continually improve through self-reflection, mentorship, professional development, evaluation, and self-care. (5 Standards)</p>

**Author’s Note**

Task force members include Lori Gano-Overway (chair), Bob Benham, Christine Bolger, Andy Driska, Melissa Long, Anthony Moreno, Dan Schuster, Melissa Thompson, Pete Van Mullem, Michelle Carter (SHAPE America Liaison) and Wendy Fagan (advisory)

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## The 2024 Olympic Games: Reverse Engineering Coaching for Success at the Olympic Games Paris 2024

### Wayne Goldsmith

Now that the 2018 Olympic Winter Games are over, the attention of athletes, coaches, national sporting bodies, the media and the sporting public across the world are about to turn towards the Olympic Games Tokyo 2020.

Final preparations for Tokyo are well underway. From all reports, the Olympic organizers have met or exceeded their pre-Games planning, building and facility development requirements.

Athletes and coaches are well-advanced in their training plans and preparations for Tokyo in order to be in the best possible shape to compete successfully in the Olympic Games.

Yet, in training centers, swimming pools, courts, fields and gyms across the globe, there are other athletes – other coaches – already looking ahead to the 2024 Olympic Games in Paris.

### The Two Olympic Cycles

There are two “Olympic cycles”: the *Traditional Olympic Cycle* and the *Olympic Campaign Cycle*. A four-year Olympic cycle or “Olympiad” is the actual time period between Olympic Games competitions. When people talk about the Olympic cycle, they are commonly referring to this four-year period.

However, an *Olympic Campaign Cycle* is the time a coach and athlete may take to plan and prepare for success at an Olympic Games competition. This could be six, eight or even 10 years in duration as it takes considerably more than four years to develop the physical, mental, technical, tactical, strategic, self-management and holistic athletic-lifestyle skills and capabilities required to be a serious contender in Olympic competition.

The question is, how do coaches and athletes plan for success for major events like the Olympic Games six or more years in advance?

What is the process a coach can put in place to help their athletes plan, prepare and ultimately perform when it really matters in major international sporting events?

Welcome to the world of Reverse Engineering Coaching.



## Major Sporting Events: Three Types of Thinking

*“Nothing we do guarantees success. We can’t **guarantee** success. What we aim to do as coaching professionals is to increase the likelihood of success.”* – Don Talbot, legendary Australian swimming head coach

Many athletes and coaches wish, hope and dream of success at a major international sporting event like the Olympic Games. However, wishes, hopes and dreams do not lead to medal-winning performances without clear strategies and a focused preparation – that is, a preparation focused on the achievement of a world-class performance under Olympic Games conditions.

Ask yourself one question, *“Who is it that wins at major events like the Olympic Games?”*

Is it the **“lucky”** coaches, athletes and teams who just happen to stumble onto a formula for success and everything miraculously comes together for them at the Olympic Games?

Is it the fortunate coaches, athletes and teams who didn’t really win – it’s just that their opposition were *unlucky* and made some critical errors at the wrong time?

Or is it the coaches, athletes and teams who put in place a clear plan and detailed strategy several years prior to the Olympic Games and worked methodically, systematically and relentlessly to ensure every detail of that plan was put into action at the right time – and in the right way?

Nothing guarantees success, however, coaches can increase the likelihood of success by applying the principles of Reverse Engineering Coaching in their long-term planning.

## The Key to High Performance Coaching Success: Being a Visionary Leader

Sport is an industry steeped in story telling.

Athletes tell stories of their past successes in major competitions.

Coaches tell stories of their former glory leading athletes and teams to the attainment of remarkable achievements.

The media, the fans, the families – everyone in sport loves to tell stories about their memories of winning and medals and victories.

However, one of the fundamental qualities of all great leaders is Vision: to be one of those rare people who “see” a Vision for what’s possible and to see it with such detail and clarity that it seems for all intents and purposes that success is inevitable.

A coach planning and preparing for future success at the Olympic Games needs to be able to tell the “story” of the future success of the athlete or team: to share their Vision with the people they lead so that they too can see it and believe in it.



It is said, “*If you can see it: you can be it*”. Athletes, coaches and teams who can clearly “see” a Vision of their future can then utilize the Reverse Engineering Coaching Concepts to methodically and systematically build a successful Olympic campaign.

## How Do Coaches Prepare For Success In Major International Sporting Events?

There are coaches who consistently deliver outstanding results at major international sporting events and others who find the Olympic Games performance environment difficult and demanding and are constantly frustrated at their lack of success.

The question is – *how do coaches prepare for success in major international sporting events?*

It often comes down to their overall planning and preparation philosophy and how they think about the challenge of winning in an Olympic Games environment.

“*Let’s do what we’ve always done*” thinking: **Likelihood of success: LOW.**

- The critical difference between participation-level sport and high-performance sport is – change. Coaches who base their Olympic Games plans and programs on what they’ve done in the past, are destined to fail. Particularly, in an era where coaches are able to measure, monitor and analyze the techniques and methods of their opposition closely and accurately, relying on the “past” to determine the “future” is a thinking strategy doomed from the outset. Success – particularly at Olympic level – is a moving target.

“*Let’s copy what the others are doing*” thinking: **Likelihood of success: MODERATE.**

- In high-performance sport, **copying kills**. It is normal and natural to want to copy the best athletes, coaches and teams in your sport. The medal winners, the world-record holders and the champions set the agenda for the sport and because it is easier to *copy and replicate* than it is to *create and innovate*, most coaches choose to follow what their more successful competitors are doing. Occasionally, learning from another coach can spark some ideas and provide a new direction for your program, but ultimately winners in all walks of life and in all fields of endeavour are those who dare to be different, who do things differently and do different things.

“*Let’s dare to be different*” thinking: **Likelihood of success: HIGH.**

- Leaders do one thing: they lead. Coaches who consistently deliver medal-winning performances at major events are the ones who are leading the introduction of new ideas, new techniques and new methods of planning, preparing and performing under the pressure of international sporting competition. They are the ones who look at what they’ve done in the past – or at what others are doing – only to learn from it and then to strive to improve on it. They don’t believe in the old saying, “*if it ain’t broke, don’t fix it.*” They know that “*if it ain’t broke, tear it down and look for new and better ways to do it.*”



## Reverse Engineering Coaching: How It Works

There are three basic Reverse Engineering Coaching techniques:

- **Predicting:** Predicting is commonly used in “time” based sports such as track and field, swimming and track cycling. It involves undertaking extensive research on the past five to 10 Olympic Games cycles and examining the rate of improvement in their specific sport every four years. For example, conventional wisdom held for many years that most swimming events would improve, i.e. the world record times would get faster, by approximately 2-3% per four-year Olympic Games cycle. This then led to many coaches and swimmers planning to produce a 2-3% improvement from one Olympic Games to the next using this “prediction” of future times as a guideline and framework to be reflected in their training, periodization, competition targets and, etc.
- **Shaping:** Shaping is more commonly used with team sports. Shaping, quite literally, means to “shape” the future of the sport through innovation, creativity, new training techniques, revolutionary strategies, breakthrough equipment development and etc. It is taking the lead in the sport by finding leading edge techniques and strategies that may potentially give athletes, coaches and teams a winning advantage over their Olympic Games competition.
- **Ambushing (or Shadowing):** Ambushing (or Shadowing) is closely observing, analysing, watching, measuring and studying your opposition and tracking their ideas, innovations, strategies and etc., then in doing so developing strategies and techniques to counter them. In many ways “*Ambushing*” is the opposite Reverse Engineering Coaching technique to “*Shaping*” as it relies on being able to closely and accurately track, monitor, measure and analyze the innovations and strategies being employed by the sport’s leading thinkers and performers and to be able to “counter” what they’re doing in Olympic Games conditions.



CHIBA, JAPAN - AUGUST 03: Members of Team United States line up for the U.S. national anthem prior to the Preliminary Round match between United States and Mexico at Akitsu Stadium on day two of the WBSC Women's Softball World Championship on August 3, 2018 in Chiba, Japan. (Photo by Takashi Aoyama/Getty Images)

**Table 1: Three of the Reverse Engineering Coaching techniques and the pros and cons of using each technique.**

REVERSE ENGINEERING COACHING TECHNIQUE	PROS OF THE TECHNIQUE	CONS OF THE TECHNIQUES
PREDICTING	<ul style="list-style-type: none"> <li>• Gives coaches, athletes and teams clear, tangible goals and targets to achieve.</li> <li>• Provides measurable preparation and performance targets to underpin the structure of training cycles.</li> </ul>	<ul style="list-style-type: none"> <li>• Does not allow for “Outliers”, i.e. exceptionally talented athletes and coaches to significantly change the standards in the sport.</li> <li>• Relies on doing a lot of “homework” and having the skills, knowledge and ability to apply the learning from the “homework”, i.e. previous performance results to the achievement of future Games success.</li> <li>• Coaches need to be aware of any potential major changes in rules and regulations leading up to the Olympic Games which may influence the accuracy and validity of the Prediction process.</li> </ul>
SHAPING	<ul style="list-style-type: none"> <li>• Places coaches, athletes and teams in a “leadership” role in their sport.</li> <li>• Provides innovative and creative coaches with the opportunity to gain a significant advantage over their opposition.</li> </ul>	<ul style="list-style-type: none"> <li>• If the timing of the introduction of the new ideas, new strategies and etc. is not managed intelligently and strategically, opposition coaches, athletes and teams may develop counter strategies to negate the advantages gained through the Shaping process.</li> <li>• Relies on the coach and athletes to find new and better ways of doing things through a commitment to continuous improvement.</li> </ul>



<p>AMBUSHING (or Shadowing)</p>	<ul style="list-style-type: none"> <li>Allows coaches, athletes and teams to increase the likelihood of success by keeping a close track on the leading edge thinking, strategies and practices in their sport.</li> <li>Can provide coaches, athletes and teams with a winning advantage that can catch their opposition “off-guard.”</li> </ul>	<ul style="list-style-type: none"> <li>Relies on the coach and athletes being able to clearly understand what it is the “Shapers” are doing and to be able to develop ways of countering the “Shapers” innovations.</li> <li>Basing a medal-winning program on being able to counter what an opposition is doing is fraught with danger as the opposition may change their strategies, tactics and etc. in the final stages of their Olympic Games campaign.</li> </ul>
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Regardless of the Reverse Engineering Coaching technique used, it is essential that all coaches, athletes and teams wishing to succeed at the Olympic Games Paris 2024, commence the planning, preparation and execution before the 2020 Closing Ceremony in Tokyo has concluded.

**Summary:**

- 1. They call a “vision” a “vision” because you can SEE it.** Coaches who lead their sport forward do so by “seeing” clearly – with great detail – the future that they themselves will create. Once a coach – or a leader in any field of endeavour - can “see” the future, they can inspire others to also “see” the future.
- 2. Leading athletes towards a successful performance at a future major event is challenging primarily because they (i.e. the athletes) can’t see, feel or measure something that might potentially happen in four years.** They CAN see what has happened in the past and what is happening right now. Successful coaches need to be able to “sell” dreams and inspire athletes to “see” the intangible, to do “the unknown” in order to achieve the seemingly “impossible.”
- 3. It all begins with the coach’s ability and willingness to let go of the rituals, habits and traditions of the past** and to change their thinking to seek new, smarter and more innovative ways of pursuing excellence in the future.
- 4. Success is a moving target** – and for those coaches and athletes who pursue excellence and seek to win, it is essential to be committed to learning every day, to strive for continuous improvement and to embrace new and innovative ways of getting better – every day – in everything they do.
- 5. In high-performance sport, copying kills!** The people who forge the future are those who’ve dreamed what’s possible and who work tirelessly and uncompromisingly towards it. Don’t seek best practice on the Internet, in books, at courses or in conferences. **Become** best practice – **live** best practice – by rigorously, honestly and continuously reflecting on your coaching and challenging yourself to get better at it.





LAS VEGAS, NV - JULY 26: Head coach Gregg Popovich (C) of the United States talks to his players during a practice session at the 2018 USA Basketball Men's National Team minicamp at the Mendenhall Center at UNLV on July 26, 2018 in Las Vegas, Nevada. (Photo by Ethan Miller/Getty Images)

### Further Reading and Learning:

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*LAS VEGAS, NV - JULY 26: DeMar DeRozan #35 of the United States talks with head coach Gregg Popovich during a practice session at the 2018 USA Basketball Men's National Team minicamp at the Mendenhall Center at UNLV on July 26, 2018 in Las Vegas, Nevada. (Photo by Ethan Miller/Getty Images)*

## The Mechanics of Movement Preparation: How to Prioritize Preparing for Practices and Games

**Tim Pelot, Senior Strength & Conditioning Physiologist, U.S. Olympic Committee**

**Michael Thomson, Assistant Strength & Conditioning Coach, U.S. Olympic Committee**

*A pilot would never take off into the air without making sure that all systems on his/her plane were functioning at 100%; a strong case for the importance of a cockpit checklist. Similarly, the body has many complex systems and ensuring each of these systems is on and fully functioning is of the utmost importance for any athlete looking to consistently master elite performance. Contained below is the rationale and scientific thoughts on how to approach warm-ups. When striving for maximum performance output, a pre-movement checklist can be just as important as pre-flight checklist.*

The secret to long-term injury prevention strategies and orchestrating impactful workouts for the long haul may lie in pre-calculated warm-ups. How one prepares his/her body to move is critical. In sport, if the movements in practice, games, or strength sessions are fast, explosive, multi-planar, and require large ranges of motion, one must spend time in movement preparation sessions mimicking the internal demands of training. If not, then the door is opening to the possibility of injury as well as submaximal performance. Movement preparation is a high priority for setting up and maximizing training performance.

If sport participation volume is high and the movements involved with the sport actions are of high intensity, there is an increased chance of sustaining some sort of low or high-grade injury. A movement preparation routine not only helps activate the body for the movements that are looming in the near future; it is a strategic routine which resets and helps restore movement functions from previous trainings, e.g. opening joint range of motions, activating dormant neural pathways, and helping facilitate healing of traumatized muscle from previous training sessions.

No matter the age or the level of athlete, a good movement preparation routine can have a significant impact on training performance. Systematic and progressive routines impact how athletes feel physically, emotionally and mentally. Movement preparation time is not just a time to begin calibrating the body to perform, but it is also a time to dial in an athlete's attention and focus. As an athlete listens and learns how their body feels while moving through ranges of motion, they become more in tune with themselves internally. This awareness helps bring their attention to themselves and helps direct their attention, bringing an intensified level of focus for the training that follows.

High intensity movement is important. Warm-up games are fun to play and they will always help spice things up every once in a while. However, if we need to prepare all systems for explosive



and impactful training sessions it is important to understand the rationale behind not taking off too quickly into our warm ups. Sprinting, cutting, and jumping require the prerequisites of a proper warm-up.

### What the Research Says

Higher volumes of dynamic, explosive, and violent muscular contractions seen during games and intensive training sessions may lead to an increased inhibitory neuromuscular response to the antagonist muscle. This is known as Sherrington's law of reciprocal inhibition (Sherrington, 1907). Neuromuscular inhibition can be thought of as the loss of ability to control or contract muscle, leading to reduced coordination. Muscles most commonly affected are those that support and stabilize skeletal posture and/or those that stabilize the bigger, stronger muscles. This inhibition creates a weakness, reduces joint range of motion, leading to a less functional system. Inhibited stabilizers can result in joint misalignment, leading to faulty movement quality, and as a result, may place undue stress on inappropriate tissue and structures, possibly leading to aches and pains. Faulty movement patterns going into a practice or game can be detrimental to performance by influencing poor form or technique for a training or practice session. (Griegel-Morris P et al, 1990). Inhibition of muscle and loss of muscle function can come from being slightly dehydrated which happens in elite sport more than we may know. Inhibition of muscle can also come from neural damage, resulting from excessive, intense, explosive-type maneuvers (jumping, landing, sprinting and change of direction). This damage may result in a decrease in muscle excitation ability, called hypotonia. This muscle damage may trigger an inhibitory neuron, leading to lessened postsynaptic action potentials (Purves, 2001).

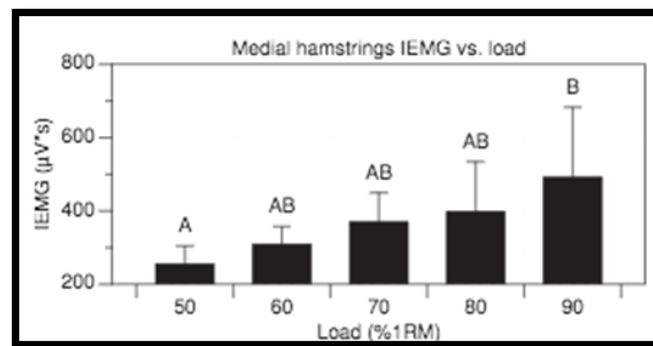
Low to moderate and high muscle activation causes a rise in muscle temperature, known as the thermogenic effect of muscle activity. Additionally, muscle activation improves the neural reflex mechanisms, muscle spindle sensitivity and reciprocal inhibition. Explosive ability of muscle contraction can be enhanced and can enable joints to move more freely due to reduced joint resistance from reduced tension (Sherrington, 1907). Activating the posterior chain (glutes, hamstring and low back) before active and transit movement can improve function and may help reduce joint stress by reducing activation levels of the musculature of the quadriceps and hip flexors (De Luca, 1987). Activation of movement in all planes of motion with all joints (shoulders, trunk, hip, neck, ankles) leads to increased stability under load, promoting increased ability to improve strength and power. Activation of the trunk will prime the nervous system and increase its capacity and ability to stabilize under loaded movements or help support during high-velocity movements.

High intensity training sessions, practices, and games may leave an athlete's muscles spastic or in a hypertonic (increased muscular tension) state. Similar to inhibited muscle, excessive tonicity over time (2 to 24 hours) may lead to undue stress and may promote joint misalignment and ultimately may instigate additional joint aches. A good movement preparation routine will help break through the state of hypertonicity and allow joints to have more freedom and function. This is of high importance especially heading into a training sessions where the skeletal system is going to be loaded. If the shoulders, hips and trunk are stiff or out of alignment, loading may lead to a significant injury. Pliability of muscle tissue increases with tissue temperature (Robertson, 2005). Cold muscles don't loosen even if they are stretched hard because the internal environmental temperature will not allow



it. A reduced level of muscle pliability may lead to increased workloads on connective tissues such as tendons. If muscles are unable to contract and lengthen through full ranges of motion, other tissues may develop injuries such as tendinitis over time.

The thermogenic component of warm ups is only a small portion of a good movement preparation routine. The thermogenic response helps increase vasodilatation, or widening of blood vessels to working muscles, thus helping prepare the muscle to do more work. It takes 2-5 minutes for the response to activity and it takes another 3-5 minutes for the increased circulation of blood to start affecting the muscles in the periphery, depending upon intensity. Explosive movements done when muscles and the nervous system are not warm and active can increase likelihood of injury (Soligard, 2008). When going into a strength training session, an under-active or inhibited muscle can lead to increased likelihood of injury. As shown in the figure, higher amounts of muscle activation are required with heavier loads (Vigotsky, 2015). Therefore, preparation to lift heavy loads or interact with high forces must include activities that stimulate enough muscle fibers, to be adequately ready to perform.



*Medial hamstring muscle activation (EMG) at various percentages of 1 repetition maximum in the good morning exercise (Vigotsky, 2015).*

Joints need to move in order to increase the lubrication properties of the synovial fluid inside the joints. The lubrication ability of synovial fluid increases as joints become more active and as temperature in the joint increases. Exercise affects the synovial fluid by turning it from a thick gel into a viscous liquid. When the body is relaxed, the synovial fluid remains inactive but with an exercise and temperature increase, the synovial fluid in joints starts to warm up in readiness to provide lubrication. If warm-up exercises are not done before a vigorous activity, the synovial fluid in joints is not prepared enough to protect against injury. As athletes age the lubrication factors become more important as joints have accumulated more physical stress (Ehrman, 2013). High impact and rapid joint motions performed when joints are not warm may lead to increased resistance of friction within a movement and potentially can have long-term joint ache and joint surface problems, such as early-onset arthritis. Warm joints have shown 25 percent differences in forces needed to move, as well as increased flexibility (Petrofsky, Laymon, & Lee, 2013).

Higher intensity movements toward the end of a warm-up can stimulate the adrenal glands resulting in a rise in blood adrenaline leading to improved vigor, alertness and readiness for training. Explosive activity at the end of a warm-up can fully activate all neuromotor components, resulting

in improved ability to recruit fast twitch muscle fibers.

Not only does activation of adrenal output increase as the intensity of warm-up increases, so does the level of activation of the lungs. The lungs expand and become more prepared to take in oxygen, if the ends of warm-ups are more taxing. As the anaerobic energy system awakens, an increase in bronchial dilation allowing for an increased ability to expand the lungs. This may promote a higher level of saturation of oxygenated hemoglobin, known as super-saturation, before movement activity. Due to the restorative and regenerative factors that a well-designed warm-up possesses, the length of movement preparation should be adjusted based upon the level of fatigue or the accrued physical stress. During phases of training or competition where volumes of training are high or toward the end of a long week where physical breakdown is higher, warm-ups should serve two purposes; regenerate and restore as well as activate and prepare for training.

Lastly in the final phase of movement preparation, the activation of the anaerobic energy system can help promote increased ability to utilize energy substrates for fuel, providing a positive impact on metabolic energy usage during workouts. Additionally, when the anaerobic energy system is activated, there is an increase in beta-endorphins, which improve mental focus, mood and help increase pain thresholds. Once these systems have been activated and lactate has been produced, they will improve lactate-clearing ability once training or competition has started. When activity is vigorous and slightly fatiguing toward the end of warm-up, there is increased deoxygenated hemoglobin circulating in the blood. Deoxygenated hemoglobin has a powerful role in lactate buffering. When these proteins are circulating in the blood, the ability to buffer lactate increases significantly.

One might wish these biological processes could occur faster, but thermogenics take time, heart rate response takes time, and awakening dormant muscle patterns takes time. Trying to speed through these routines quickly will surely not lead to maximum performance for training or competition. Furthermore, speeding through these routines may increase the likelihood of acute injury or chronic aches and pains for athletes who train as much as national team athletes do. In summary, these biological processes have a time course for which each happens and there is a logical sequential process that can be used to maximize one's physical performance.

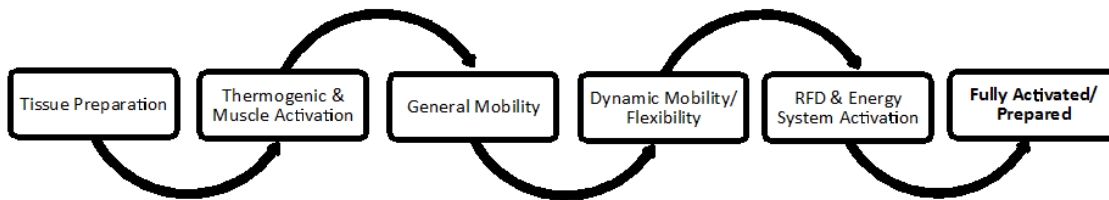
Here, movement preparation is broken down into five parts or phases, each of which is progressive from one phase to the next. This may provide some understanding of why long warm-ups make sense for long-term joint and muscle health and when maximum performance is the intention.

1. 0-5 minutes - Tissue preparation (foam rolling, lax ball and etc...)
2. 5-10 minutes – Low- intensity muscle activation (thermogenesis, prehab-shoulder, hip and trunk)
3. 10-15 minutes - General mobility work
4. 15-20 minutes - Dynamic movement (joint mobility/range of motion) and dynamic flexibility
5. 20-25 minutes – Higher intensity neuromuscular activation, coordination (sprints, change of direction, games) and higher cardio-metabolic activation.



Physiological Objectives and Progressions of a Warm-up

1. Tissue Preparation: Reduces any joint stiffness by releasing intramuscular adhesions and trigger points the occur from long periods of inactivity or from intense physical activity. Prevents muscles from lengthening.
2. Thermogenic and Muscle Activation: Activities used to increase body temperature.
3. General Mobility: Activities used to increase blood flow, take joints through ranges of motion and prepare the body for movement. Generally, they are all the low-level muscle activation, dynamic and transit exercises. Improves long-term joint health.
4. Dynamic Mobility/Flexibility: An activity that takes joints through a specific range of motion, while traveling over a prescribed distance. These movements are designed to reinforce athletic movement, increase dynamic flexibility, while also increasing the intensity of physical exertion.
5. RFD (rate of force development), Energy System Activation: An activity that takes joints through an explosive or rapid range of motion, as well as activating the energy systems needed for training/competition.



Physiological Progressions of the Warm-up Examples:

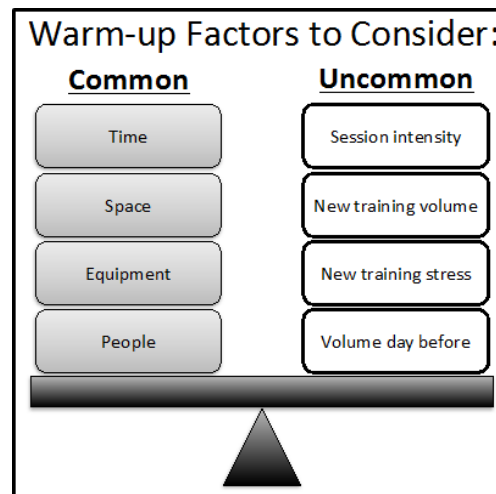
1	2	3	4	5
Foam rolling Lacrosse ball work Stick rolling Percussion tools Manual therapy Vibration	Walking Biking Prone shoulder retraction/reaches Quadruped hip series Band work for shoulders Abdominal crunches/Hip flexion Low back/Glute isometric holds Lying hip rotations Lying trunk rotations Lying knee hugs Side lying hip abduction/adduction	Downward dog/Hips to floor Deep lunge and rotate Ankle extensions Shoulder flexion/extension Scapular protraction/retraction Partial ROM squats Partial ROM lateral lunges Trunk rotations Deep squats with partner Standing band series for hips Seated hip internal/external rotation	Straight leg kicks Standing quad/hip flexor stretch Figure four squat and stand Lateral lunges Full squats Light skipping Backpedaling Shuffling Jumping jacks Double-leg hopping Single-leg hopping	Drop squats Skipping for height Aggressive shuffling with change of direction Shuttle runs Sprint to backpedal Maximal sprinting Chasing Frisbee chasing Dodgeball Mirror drills Maximal jumping

General warmups can be combined with specific warmups. For example, low intensity jumps can be added towards the end of a warm-up to prepare for jumping movements. Additional warm-up sets for specific exercises, especially as the loads become heavier, can be useful to activate the nervous system for intense activity.

Capturing attention is another critical aspect of the warm-up. It is crucial to find a mechanism to get athletes to be present and leave what happened 10 minutes ago behind. Do not be locked to specific exercise routines, but rather use categories and vary exercises. This maintains the effectiveness of the warmup without creating burnout. The warm-up is a time to connect with athletes.



See how they feel physically, mentally, and emotionally. This insight can dictate the direction for the warmup. Routines are good, but breaking monotony can bring new life. Athletes may warm-up multiple times a day. They will appreciate a refreshing way to prepare for training. A time where a consistent routine might be beneficial is before games. This routine may help athletes prepare more effectively by giving them time to bring their mental focus to where it needs to be and calm nerves that can come with big competitions.



Music is another factor that can positively influence the mood and energy of athletes. The limbic system, which controls emotion, is engaged with music and the result of stimulating the autonomic nervous system is seen in the hormone and neurotransmitter changes (Murrock, 2005). Music has also been shown to positively effect pain levels in individuals with chronic osteoarthritis (McCaffrey & Freeman, 2003).

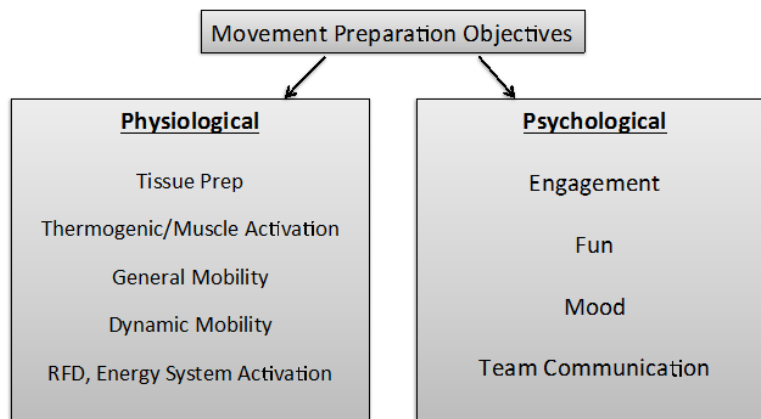
Warm-up can be used as a recovery tool , to recover from the previous training sessions. The combination of emotional and physical change can be a powerful tool to influence not only the current state but future state of athletes. Going back to the start of the discussion; if the checklist is to be all-encompassing, then it must include not only physical components but emotional and psychological components as well. Knowing how to fully prepare athletes for the demands of their training and sport will make their training more impactful, while mitigating risk of injury from intense competition and training.

A coach needs to be in tune with the “feel” of the team or athlete. “Feel” can be described as empathy towards the athletes. This encompasses not only physiological signs such as soreness or fatigue, but also psychological signs such as mood. Athletes are human beings. Tough schedules, long travel, tournaments, and intense training blocks may cause athletes to experience moments of psychological stress. A coach who can recognize signs of poor mood can meet the athletes where they are, and then use humor, music, games and other tactics to elevate mood. Improvement in mood can boost positive feelings, increase excitement, enhance energy, improve communication, and potentially even distract athletes from the aches and pains of the rigorous demands of sport. Bringing out playfulness in athletes can have positive cognitive and emotional benefits. Perhaps one of the biggest benefits can be stress relief. Athletes at elite levels deal with enormous amounts of stress, so any way to help

them feel better is therefore performance enhancing.

Psychological Objectives of the Warm-up:

1. Engagement: Meet the athletes where they are. Some days the energy might be high/low but no matter where it is, engaging with them will help influence their mental state.
2. Fun: The current state of athletes can often include pain, fatigue, soreness, and other negative factors. Having fun helps them get away from a negative state and towards a positive one.
3. Mood: Enhancing the mood and building excitement as the warm-up progresses can help athletes get to higher states of readiness. Most athletes will respond to excitement with excitement, so having a great mood personally may be important.
4. Team Communication: For team sport athletes, they will be asked to communicate in their sport, so including competition and communication during the warm-up is a good way to prepare them mentally for what is to come.



**Closing Thoughts**

Warm-ups should progress from low intensity to high intensity and low speed to high speed. Movements and drills should go from simple to complex, partial to full range of motion, and aim to activate before potentiating. What time of the week may affect what needs to be done. For example, everyone is a little sluggish on Mondays and everyone is more tired from training volume on Fridays. What the athletes are warming up for will determine what needs to be done. High-intensity testing sessions or games will require a different level of readiness compared to a low intensity pre-practice activity. The amount of time allotted for the warmup, the priority of that moment, the population and injury history of athletes, athlete age, environmental factors, training volume, and specific areas of soreness or stiffness are all factors into what determines the warm-up. Older athletes, for example, may need more time for mobility while younger athletes might need more time spent on motor control. Having a feel for the athletes and team will help a coach’s ability to influential psychological aspects such as mood. A warm-up with proper design and implementation can be an influential piece of the performance program, and help get the most out of each athlete. The warm-up serves as a bridge each day for athletes. It takes them from where they are and gets them where they need to be. Some days the bridge might only be a few feet long, and others it might span over a hundred feet. Regardless, a quality



bridge will get the athletes to their destination every single time.



*If we call ourselves teachers but cannot capture and maintain attention or create excitement for content, we fail in our efforts.*

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On the cover: DOHA, QATAR - NOVEMBER 01: Simone Biles (gold) and Morgan Hurd (bronze) of the United States celebrate after competing during Women's All-Around Final during Day Eight of 2018 FIG Artistic Gymnastics Championships at Aspire Dome on November 1, 2018 in Doha, Qatar.

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