Advanced Weightlifting & Sport Performance Manual

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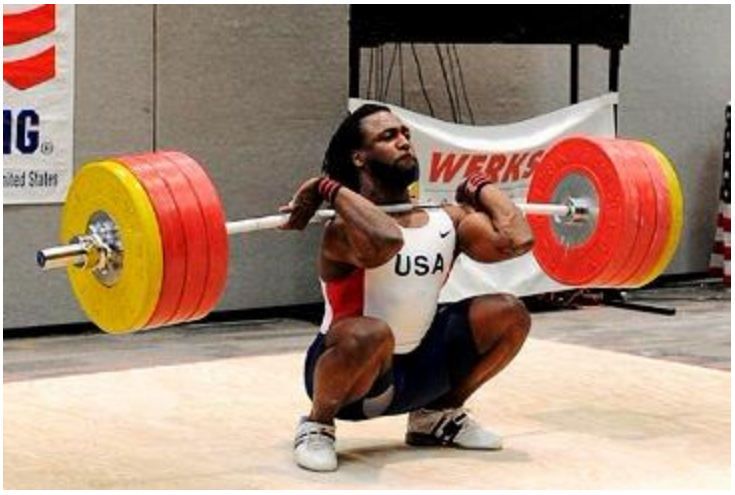
Introduction and Expected Outcomes



Welcome to the second formalized education course within USA Weightlifting's Coaching Education curriculum. This course accommodates the needs of coaches who have successfully completed the requirements of the Level 1 Coaching Course.

The objectives of the course are for coaches who would like to increase their knowledge base toward specific training for weightlifting athletes. The information will be more specific and geared toward training weightlifting athletes to higher levels of competition.

The emphasis is on deepening the coach's knowledge of Program Design, Advanced Weightlifting Movements as well as the Role and Responsibility of the Coach as it relates to developing national and even international level athletes.

A comprehensive approach to biomechanics is included and a number of new topics are introduced such as anatomy, physiology, kinesiology, nutrition, strength and power principles, and general physical preparation.

The expected outcomes of the course are to:

- Allow the Coach to improve the performance of their athletes through proven practices and approaches
- Assist the Coach in having the ability to work with athletes that are not their own both in a practice and competition setting
- Have the ability to select exercises that can both correct flaws and bring about improved technique
- Develop a practical understanding of competition strategies that will benefit the athlete and their performance.

USA Weightlifting sincerely appreciates your dedication to the sport of weightlifting and your desire to continue to advance your knowledge in our sport through our education system. We hope you find this experience refreshing and that it will compliment your current understanding of weightlifting and perhaps elicit your desires to seek current literature and research in this ever-growing field. We encourage you to be active throughout the course by asking questions and sharing your philosophies with the rest of the participants. We hope to provoke stimulating, and hopefully beneficial conversations that move both the individual and the organization forward to a brighter future for our sport.

Chapter 1
Principles of Coaching

Coaching in the 21st Century

Coaching is in its most dynamic era in history. Coaches work with ever increasingly more diverse populations and face heightening demands from their athletes and the general public. Coaching and the role of the coach have experienced a significant change as we move into the second decade of the 21st century. There are broader aims, higher expectations and more defined roles. There is access to greater information and visibility to a larger community in this digital age. All these factors make coaching both more exciting and taxing than ever before.

The *International Council for Coaching Excellence* has established a framework of six (6) primary functions that will help to fulfill the core purpose of guiding development and improvement.

VISION AND STRATEGY

The coach creates a vision and a strategy based upon the needs and development of the athletes and the organizational and social context of the program.

SHAPE THE ENVIRONMENT

The coach recruits and contracts to work with a group of athletes and take the responsibility for setting out plans for both training and competition. The coach also seeks to maximize the *learning* environment in which the program occurs through personnel, facilities, resources, best practices and the management of other coaches and support personnel.

BUILD RELATIONSHIPS

The Coach builds positive and effective relationships with the athletes and others associated with the program. The coach is responsible for engaging, contributing and influencing the atmosphere of the organization and program.

CONDUCT PRACTICE AND STRUCTURE COMPETITIONS

The Coach organizes suitable and appropriate practices that challenge the athletes and targets preparation for competitions for the athletes. Positive competitions are required experiences for continued development and improvement.

READ AND REACT TO SITUATIONS

The Coach observes and responds to all events (practice and competitive) appropriately. Development of effective decision making is essential to fulfilling this function.

LEARN AND REFLECT

UCLA Basketball Coach John Wooden made the comment *"You have not taught until they have learned."* When the coach focuses on what the athletes are learning instead of what the coach is saying development and improvement will occur at a more effective rate.

The Coach is constantly evaluating the program, as a whole, as well as each practice and competition. The Coach also supports the development and education of other coaches.

Study has shown that *novice* coaches were not prepared in these areas;

- Motivating athletes
- Managing and resolving conflict
- Building relationships
- Effective communication
- Management topics.
    - Competition preparation

People who are attracted to and find satisfaction from coaching weightlifting come from many areas. There are those who take the traditional pathway from competition. These individuals typically have a long background in the sport, and gravitate to coaching when their competitive careers have come to or are ending. In many cases, these coaches never achieve the levels as a competitor that they strived for, but find true fulfillment in helping others to maximize their talents. However, other pathways bring people to coaching weightlifting. Some just enjoy the sport and others involved in it. Still others are attracted to weightlifting because they may have applied the weightlifting movements to their own training to improve performance in another sport. These are just a few examples of the different personalities attracted to weightlifting.

Coaching Skills

Most successful coaches have developed a love and commitment to the sport that in weightlifting, almost borders on obsession. The deep commitment is evident in all of our successful coaches and is something easily recognized and appreciated by weightlifters. Individuals who become involved in coaching, no matter what the sport, find themselves in the "people business." In order to be effective, coaches must create the right conditions for learning to happen and to find ways of motivating the athletes. Most elite-level athletes are highly motivated and therefore the task is to maintain that motivation and generate excitement and enthusiasm. Therefore, coaches must develop or have available a plethora of skills to meet the needs of the athletes who they aspire to service. These include:

- Knowing how to effectively communicate with the athletes
- Understanding the learning process and training principles
- Understanding and implementing the appropriate training methods
- Understand the various coaching styles
- Advise athletes on safety
- Understand the causes and recognize the symptoms of over-reaching and over-training
- Understand how to reduce the chance of injury for your athletes
- Understand individual differences between athletes
- Assist athletes to develop new skills
- Use evaluation testing to monitor training progress and injury prevention
- Advise athletes on appropriate nutritional regimen
- Understand and know how to develop the appropriate energy system
- Effectively communicate competition performance

Coaching Roles

Not only do coaches have to develop skills, they also have to play many roles. These roles include being a:

- Leader
- Educator
- Facilitator
- Technician
- Organizer
- Manager
- Guide
- Philosopher
- Friend
- Arbitrator
- Critic
- Taskmaster

The myriad roles of a coach are demanding by the various circumstances in which coaches find themselves. The experience and age of the individual, both coach and lifter has a bearing on this rule. The goals of the coach and lifter can also dramatically alter the role the coach might take. Therefore, communication between the coach and lifter is paramount. The first thing the coach should determine is the goals of the lifter. What is he or she trying to accomplish? If the lifer's objective is to be a "social" lifter with enjoyment being the primary criteria, the coach will need to adopt a very different role than if the lifter's goal is to become and accomplished Olympic weightlifter. Likewise, if the lifter wants to use the weightlifting movements to become a better football player, the coach will need to implement yet another role.

Once the coach determines the goals and expectations of the lifter, he must ask himself "Are these expectations realistic?" If so, "Is the timeframe realistic?" From here, the coach develops a realistic plan to try to accomplish the goals and expectations. One other aspect the coach must

realize is his own ability as a coach. An objective, self-evaluation of his abilities is vital. If the athlete expects to make it to the highest level as an athlete, the coach must reassure himself he is doing everything in his abilities to get the athlete there.

However, as crucial as role-playing is to the achievement of objectives with individuals; ultimately, the coach's own personality will have an enormous bearing, and maybe the ultimate bearing, on a lifter's success. The coach will find roles that he plays easily, others that he plays well for limited periods of time and some that turn out to be a total disaster. An example may be the coach who is incredibly effective with young lifters. This coach has a tremendous rapport with kids and can teach and develop skills and engender an excellent, secure and supportive club program. However, when some of his lifters progress, mature, and develop into perhaps national or international class lifters, demanding a greater time commitment and individualized attention, the coach can find he is ineffective.

Coach/Athlete Training Roles

Over time, the roles of the athlete and coach will change dramatically. Athletes will mature physically, mentally, emotionally and psychologically in the years spent with the coach. Equally, coaches will develop and refine their roles and skills in the time spent with numerous athletes. Further, training requirements for the athlete will change over time as he progresses from the beginner to elite.

When the athlete first begins weightlifting, the coach's role is to direct the athlete in all aspects of training. The coach must guide and teach the athlete in numerous phases. These phases include not only training but in recovery, nutrition and injury prevention to name a few. Relaying these ideals to the athlete early in the training process is crucial to prevent unfavorable habits, which may limit performance in the future.

As the athlete develops and demonstrates a sound, technical understanding of the various weightlifting movements, then gradually, the coach's role changes. The change shifts from an autocratic role to a more democratic role where there is more communication between the coach and athlete. In some cases, the athlete will have more input on the workouts based on recovery, health, personal issues and various training methods.

Eventually, as the athlete matures, many will have a better understanding of training principles and methods. Different training methods will work better than others will and the athlete should communicate this to the coach. This communication process will enable the athlete and coach alike to reach their full potential.

Characteristics of the Respected Coach

Coaches must earn respect and individuals use many qualities and tactics to gain this respect. It is difficult to perceive a coach being effective in just about any situation for any length of time if he has not gained the respect of the athletes he coaches. Attitudes, which contribute to gaining respect and coaching effectively, include:

Knowledge

Coaching has become a science as well as an art where knowledge of sporting performance demands more than simply the rules and skills of the sport. Successful coaches base training programs on the principles of kinesiology, physiology, psychology and biomechanics. Our sport is objective and measurable and we can constantly compare results with workload and other scientific criteria. In addition, the advancement in the nutritional needs of weightlifters and the care and treatment of injuries is constantly improving. To be effective, the coach must constantly update his knowledge and make adjustments and modifications to his methodology.

Organization

This is a classic feature of the successful coach. One can judge the success of a coaching program by the final outcome, competition. However, the efficiency of organization in the training sessions that build activity skills and the athlete who is either encouraged or deterred by such experiences readily recognizes progress. Linking together efficient, systematic practices with successful performance also builds confidence and respect for the coach.

Communication

This is a vital and necessary characteristic of successful coaches. All effective and successful coaches are good communicators. If they cannot communicate well, it is useless having the best possible knowledge and skills. In fact, the bulk of the coach's time spent with athletes is in communicating and transferring knowledge to them and ensuring this translation into action.

The methods used for effective communication will vary with individual coaches and individuals athletes and varies from sport to sport. The most effective communication occurs on a one on one basis, which in weightlifting is typically the norm. However, all communication should be a two-way street and not a dictatorship.

A good coach communicates with a positive approach. The coach will praise a job well done by the athlete in order to reinforce desirable behaviors and to promote self-confidence. Conversely, the negative approach uses punishment or negative comments which results in fear or failure and lower self-esteem. The positive approach should be consistent and fair but not over-exaggerated.

Even if the athlete does not perform or behave satisfactorily, the coach should analyze the poor performance in a positive way.

A good coach communicates both verbally and nonverbally. Verbal communication is positive, brief and to the point. Too much talking can be a distraction and can make the athlete cautious and too concerned with evaluation by the coach rather than his performance. Nonverbal communication can include such simple things as body language, gestures and body movement. Touching behavior such as a pat on the back or using the hands to help position the athlete during a lift can be an effective communication device. Even various voice inflections can convey the real message implied by the coach: remember, it is not what you say, but how you say it.

Personality

Leadership, in simple terms, is the capacity of a person to direct and coordinate the activities of a group of people. It is essentially a position of power but in sport demands consent and compliance from talented but highly individualistic people. The individual personality of the coach will have an enormous bearing on how s/he handles his leadership and power base. What works for one will not necessarily work for another simply because of the individual's personality. Assuming technical expertise, the qualities found most desirable in a coach by athletes are a pleasing personality, the ability to show warmth and compassion, a sense of humor, enthusiasm, security and sense of fair play.

Is Coaching an Art or a Science?

To support the coach, there is enormous scientific literature based on specific research conducted with athletes. This information is available to support the coach and athlete in all areas of training and development including nutrition, biomechanics, psychology, physiology and sports medicine. The coach however, must have access and the desire to use this information.

The art of coaching comes when the coach has to analyze the scientific data and convert it into coaching and training programs to help develop the athlete. Much of this analytical process depends on the coach's experience and knowledge of weightlifting and the athlete(s) he is working with. Scientific information is useless unless the coach understands and is willing to implement the data.

By understanding science, which is the foundation of training, the coach can develop a well-designed training program that will help an athlete reach his full potential. The art is to understand the research and then to apply it in a way that will help the athlete reach full potential.

The Four C's:

Concentration, confidence, control and commitment are generally considered the main mental qualities that are important for positive and successful performance in most sports.

- Concentration- the ability to maintain focus
- Confidence- the belief in one's abilities
- Control- the ability to maintain emotional control regardless of distraction

- Commitment- the ability to continue working toward agreed goals

Concentration
This can be defined as the ability to focus on the task at hand. A lack of concentration by the athlete will affect the athlete's ability to complete the lifting movements as efficiently as possible. In weightlifting, the athlete must possess the ability for intense concentration. Since most weightlifting movements, especially the competition lifts, are completed in a short period, the athlete must be able to have complete focus for that duration. However, the coach should be aware that distractions do exist, sometimes without his knowledge. Some common distractions are:

- Anxiety
- Fatigue
- Technique issues
- Family
- Opponent
- Negative thoughts

Strategies to improve concentration are individual but the coach can lend support on a majority of issues. One example is to set goals for each workout. The athlete should know and understand what the expectations of the coach are for that day. A second example is mental preparation. The athlete should begin to prepare for the workout prior to it not at the beginning of it. A final example is relaxation. The lifter should do as little as possible physically prior to the workout. This will give the athlete the best chance for achieving set goals in the workout. Hopefully, these examples will assist athletes in improving concentration.

Confidence
Confidence results from the comparison athletes make between their goals and their abilities. Typically, if athletes achieve their goals, the results are increased self-confidence and self-esteem. Usually, confident athletes tend to persevere even in extremely challenging situations. They have the ability to adapt, overcome, and still try to accomplish what they have set out to do. In addition, if athletes do not reach their goal they are willing to accept or share in the responsibility of failure.

Control
Athletics, especially at elite levels, can take an enormous toll on an athlete emotionally. An athlete's ability to maintain control of their emotions in the face of adversity and remain positive is essential for successful performance. The coach can have a massive influence on the athlete in certain stressful situations. If the coach can identify when an athlete feels a particular emotion and understand the reason for the feelings, he may be able to help the athlete gain composure and confidence. Two emotions, which are often associated with poor performance, are anxiety and anger.

Anxiety can be physical (butterflies, sweating, and nausea) or mental (worry, negative thoughts, lack of concentration). Relaxation, mental imagery and input from the coach may help to alleviate these symptoms. When an athlete becomes angry, the source of anger often becomes the focus of attention. This then leads to lack of concentration, which may lead to poor performance.

Many times if an athlete has a poor result in the snatch this has a direct correlation with how well the athlete will clean & jerk. Athletes will think about their poor performance and this causes a poor result in the jerk. The coach must do his best to calm the athlete down and to refocus his thoughts to the next lift.

Commitment

Athletes, as well as coaches, spend an enormous amount of time training and preparing to train. Much of what coaches do, especially in the sport of weightlifting, is on a volunteer basis. Because both coaches and athletes have other obligations, it is imperative the time spent training is efficient. It is the coach's responsibility to keep the athlete interested and to make continual progress. It is the athlete's responsibility to follow the training regime and to communicate with the coach regarding any important issues. Hopefully, when both make a deep commitment the fruits of their labor will be rewarded!

Legal Responsibilities of the Coach

A weightlifting coach is required to comply with USA Weightlifting's code of ethics and conduct. With increased issues of liability and inappropriate behavior by coaches who take advantage of their relationship with athletes, it is crucial all coaches follow the sport's legal requirements. The influence a coach has on his lifters can be enormous, especially when they are maturing and impressionable. The coach has to reflect on his philosophies not only in weightlifting but also on many other aspects of life, as his athletes will often use him as a role model. The coach is a standard setter, a point of reference by which young lifters meet on a regular basis. The coach should not take this responsibility lightly. In addition, coaches also have a legal responsibility to:

- Give appropriate advice and guidance
- Not offer advice beyond their level of qualification

Health and Safety

When athletes walk into the gym, they are now under the guidance and supervision of the coach. When athletes first begin training the coach should go over the rules and regulations of the weight room. USA Weightlifting also recommends that coaches review chapter one of the Club Coach Manual periodically and know the first aid and emergency evacuation procedures of their facilities. Although the chances of serious injury are remote, one can never predict when a serious injury or event may occur.

Protection from Abuse

Coaches also have the responsibility to protect children from all forms of abuse. Four recognized forms of abuse are:

- Neglect

- Emotional abuse
- Sexual abuse
- Physical abuse

Coaches should be able to recognize indicators, which may signify abuse and take appropriate action if concerned. Coaches must also recognize these signs to prevent them from becoming abusive. All organizations (e.g. sports governing bodies, local authorities, clubs) should have a policy statement and guidelines regarding child abuse. Please contact the National Office for USA Weightlifting's Code of Conduct and Ethics forms.
USA Weightlifting is proud to be actively involved in the USOC *Safe Sport Program*. Information on Safe Sport can be found at http://safesport.org/.

Insurance
To be covered by USA Weightlifting's insurance and liability policy, all coaches must be current USAW members, certified and their club must be registered with the National Office. Due to frequent policy changes, coaches are encouraged to call the National Office for the most recent policy procedures.

Supplements
Coaches have an ethical and legal responsibility to advise, educate and provide general information to their athletes regarding supplement use and abuse and on general nutrition. USA Weightlifting encourages athletes and coaches to become familiar with the United States Anti Doping Agency's (USADA) policies, procedures and banned substance list. Failure to do so may lead to a positive test and athlete suspension. Chapter five of this manual will discuss in detail nutrition and daily regimen.

WEIGHTLIFTING ETIQUETTE

In weightlifting, as in many activities, there is a standardized code of conduct and etiquette. It allows for the various procedures of training and competing to proceed smoothly and in a predictable manner. It minimizes the possibility of misunderstanding and allows for the emphasis to be placed on the actual training and lifting of weights.

The sport has a history reaching back over a century, and during that span the decorum and civility of competition have developed. Any coach seeking to advance in a coaching career needs to become familiar with these procedures and practices in order to insure that the athletes in his or her charge are not distracted or provide distraction from the task at hand.
A standardized code of conduct, ethics and etiquette provides a measure of predictability for the national and international competitions, the latter being especially important in light of the wide variety of languages spoken in these events.

Etiquette in the Training Hall/Weightlifting Gym
A weightlifting gym typically involves a number of corpulent athletes moving about in a somewhat confined space. They are involved in explosive actions that are potentially hazardous. With a pre-defined etiquette, the chances of random injuries and accidents are minimized. Etiquette also allows for the training to proceed smoothly, efficiently and productively.
The following points will enable training to take place most effectively.

- Athletes not lifting should be seated behind the platform to minimize movement around the lifting area and hence distractions for the athlete on the platform.
- Training bags and other personal items should be kept well away from the area immediately adjacent to the platform in order to minimize clutter.
- When two or more lifters are using the same bar, loading should be undertaken equally with the last lifter and the next lifter each loading one end of the bar.
- Chalk dust can cause footing problems on the platform, so chalking should take place over the chalk tray or bowl.
- Lifters should not pass through the sightlines of a lifter on the platform as it may interfere with the viewing of a focal point.
- Music should not be played during training, nor listened to on personal listening devices. This may interfere with the hearing of verbal warnings and coaching cues.
- All equipment should be properly replaced after training sessions.

Warm-up Room and Competition Etiquette
The warm-up room should be a separate enclosed area, and as such it can get crowded and congested. The IWF recognizes this fact by limiting the number of coaches that can accompany each athlete. The limit is 2 for a single athlete and 3 for 2 athletes. It is also a very purposeful time, and one given to deep concentration before entering the competitive arena. For this reason a certain decorum needs to be maintained in order to insure optimal performances by all competitors. Overcrowding is not conducive to maintaining the proper atmosphere.
Observing these points will aid in maintaining an environment that will lead to the best possible performances.

- Keep your entourages and posses out of the warm-up room. If they are knowledgeable about the psychological preparation for competition, they wouldn't be there. Furthermore they irritate the other competitors.
- Do not "borrow" plates from other athletes without asking.

- If you are one of the later lifters, don't monopolize a warm-up platform while the lesser lifters need to warm-up
- Keep out of the sight lines of lifters taking warm-up lifts.
- Do not hover around the doorway between the warm-up room and the competition arena. Tell your friends not to either.
- Weightlifting does not require high rep sets for warm-up. Don't show off your ignorance by engaging in this practice. If you need that much of a warm-up, you are not in shape to compete and shouldn't be in the event.
- Onlookers should not inhibit access to the area behind the score table, as coaches need to view the expediting cards.
- If you are not at latest the "in the hole" lifter, do not occupy the seats in the pre-staging area.
- If you have your cell phone in the vicinity of the competition platform, put it in "vibrate" mode.
- Coaches should not offer coaching advice to other lifters that have a coach. Advice should pass through the coaches.
- Announcers and coaches should know the progression rules and not bother to determine whether a failed lift will result in a repeat, or a successful attempt will be followed by an attempt greater than 1 kg. It is always the coach's option and time is wasted by these practices.

Careful observance of the accepted etiquette will result in fewer occurrences that can inhibit the procedures of training and competition. Everyone and the sport will prosper by making these procedures more efficient and productive.

Chapter 2
Skill Acquisition

Much of weightlifting coaching is devoted to the development of skilled performance. Skill has many definitions. One may define it as the "learned ability to bring about predetermined results with maximum certainty, often with the minimum amount of time or energy or both," (Knapp, 1963). This is true when coaching beginners in learning the techniques of the competition lifts. In fact, the teaching and coaching of technique, especially in the early years, tends to dominate the coaching scene. There is also constant refinement of the production of excellence with the elite performer.

However, the development of technique alone does not improve the skills of the weightlifter. Although we are primarily concerned with the physical development of motor skills in our sport, we cannot ignore the effects of psychological environment and situational preserves on this development. So perhaps another definition of skill comes closer to the mark. Welford (1969) defines skill as, "an organized, coordinated activity in relation to an object and/or a situation which involves a whole chain of sensory, central or motor mechanisms."

Open and Closed Skills

In the coach's pursuit of the development of skilled performance with his athletes, he needs to deal with open and closed skill acquisition. In an open situation, such as basketball, white water canoeing or soccer, the athlete has to produce skilled movements in a multitude of differing situations. The athlete does not control the situation as in a closed skill but other players or changes in the physical environment contribute to the skill.

In closed skills, such as swimming, running or bowling, the athlete tries as efficiently as possible to perform the movement or technique in a standard environment. There may be some variables like weather, crowd noises, etc., but, largely, one 50-meter pool is the same as the next. In this example, the swimmer aims to produce the most refined and efficient stroke pattern possible to propel him to the end of the pool as fast as possible. Weightlifting utilizes both types of skills. Although we are endeavoring to reproduce efficient, stylized constant movement patterns, we are subject to a changing situation as the barbell becomes heavier.

Different coaching methods and approaches are required for the various types of skills. In coaching the performance of closed skills, the coach tries to encourage the performer to concentrate and shut out the external influences so that the skilled movement can be produced as

perfectly as possible. However, in the open skill situation, the coach has to make the performer constantly aware of the changes brought about by the heavier weights so that he may react in a positive way.

Stages of Skill Acquisition

As mentioned in the Level 1 Coaching Course the learning and development of skill (the translation from unskilled to skilled performance) is a continuous process. Here is a review of the three stages:

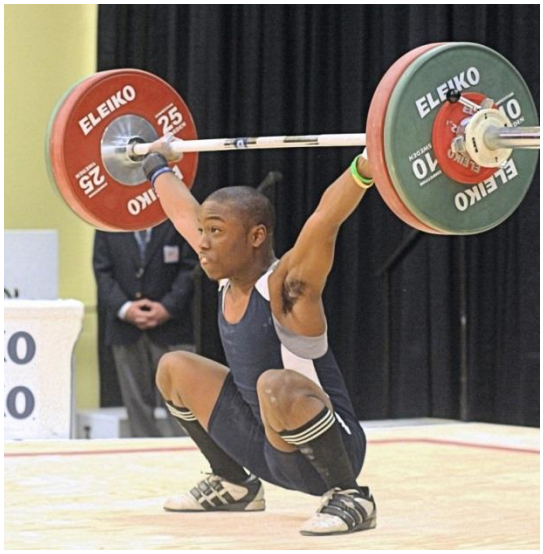
Cognitive Stage

Initially, the performer needs to understand the objective of the exercise. The beginner attempts to form a mental plan or scheme of performance that will govern his actions. During this stage, the performer is concerned with the organization of, which movements to make rather than how to make them. Errors, which are frequent, tend to be large. Once the beginner is able to reproduce the movement in considerable fashion, he may move to the associative stage of skill acquisition.

As an example, learning the power clean from mid-thigh, the beginner is initially unsure whether he should reverse curl the bar or swing it up. Gradually, he develops the feel of the movement and forms a mental picture of the whole sequence of movements. Eventually, the movement pattern develops and the athlete becomes familiar with the movement.

Associative Stage

This is a refinement stage; the athlete understands the core element of the skill and now the emphasis is on making the movement more efficient and smooth. The emphasis is on how to do the skill rather than what to do. The athlete now recognizes errors in performance without direction from the coach. The errors are no longer major. The performer slowly learns to utilize proprioceptive information (kinesthetic awareness) rather than visual and verbal information. The athlete is able to control longer sequences of response. The plan or scheme of movement formed in the earlier stage is now becoming more exact. The coach watches closely for the precise demands of the skill.



Using the power clean from mid-thigh as an example, the performer can now begin to feel the movement of the barbell and can refine movements like keeping the elbows rotated out, allowing the bar to brush the thigh, shrugging up at the finish of the pull, etc. The athlete may be in this stage for a longer period.

Autonomous Stage

This is the skill acquisition stage of the advanced performer. The movements that make up the motor responses have become more automatic. Now, athletes can concentrate on using them to accomplish the whole task. As an example, athletes can work on the gradation of the effort of the power clean. They can focus on getting the barbell moving and overcoming its inertia, feeling the shoulders in front of the bar and forcing themselves to put all-out effort into the explosion phase.

In much the same way that the type of skill influences the method of coaching, so does the stage through which the performer is progressing. During the cognitive stage, it is useful for the coach to present the skill in such a way that the beginner may view correct patterns of movement. Repeated viewing of the skill helps the beginner to formulate the movement in the mind's eye. It shows the proper performance. Practice should concentrate on the basic aspects of the task and instruction should be verbal and visual. During this stage, the coach will direct attention to essential cues to ensure the athlete learns the core element of the skill. The coach will also give more verbal feedback and encouragement.

Again, using the power clean from mid-thigh as the example, the coach will either demonstrate the skill correctly or use a video, and show how the skill approximates a jumping action and that the movement stems from leg and hip extension rather than arm action. The coach's primary goal is to get the lifter to extend the body violently and receive the bar at the chest in the correct receiving position.

During the associative stage, the coach increasingly focuses attention upon the refinements that make up the basic form of the skill. Practice will develop a far more flowing movement with the lifter being able to make more and more minor adjustments as the skill becomes more autonomous. The coach is continually emphasizing and using reinforcing cues for more efficient performance.

In the autonomous stage, performance is increasingly independent of continual attention. However, the coach has to be observant of faults or deterioration of parts of the movement as the skill develops. A word of caution regarding this phase; lifters who have progressed to the autonomous stage using an incorrect movement pattern can cause future problems for the coach. At this point, major flaws in movement patterns are very difficult to correct. This is why it is important to spend time with beginners in the cognitive and associative stages to develop sound, efficient movement patterns.

Factors Affecting the Acquisition of Skill

Athlete Quadrants

Athletes will pass through all quadrants

A **Acquisition** **What are the skills the athlete needs to know?**	**B** **Application** **Can the athlete successfully complete these skills?**
C **Assimilation** **Can the athlete successfully complete these skills routinely and automatically?**	**D** **Adaptation** **Can the athlete successfully complete theses skills routinely and automatically in a unique situation? (Competition)**

The Stages of Skill Acquirement can be, simply, explained and seen in the table shown above. The challenge of the coach is to allow each athlete to advance through the quadrants at their own pace. Of all the attributes that an athlete needs in order to be successful patience may be the most vital.

Bearing in mind the skill learning process outlined above, we now consider the vital area of teaching and coaching skills. Experience and research has shown that proper teaching and coaching has a dramatically higher success rate in skill acquisition than merely providing basic instruction or leaving performers to learn by trial and error. In addition, studies show that *skills learned first* are extremely difficult to overcome. Therefore, quality of teaching and coaching is of paramount importance. Many factors, which can ensure quality coaching include:

A) **Visual Guidance:** When introducing a new skill, it is essential to show the athlete a demonstration of the skill in good form. The coach, fellow athlete or a video can demonstrate the skill. The prospective performer can immediately apply this through imitative powers. Initially, it is important not to complicate this process with talking or instruction. Allow the beginner to see the movement and

appreciate the function, speed and timing of the skill. Let them build an image in his mind of what he is going to do. Then, follow with simple instruction and commentary before allowing the performer to attempt the skill.

B) **Verbal Directions:** This aspect is crucial in all facets of coaching. Brevity is the key, especially when the coach is introducing a new skill. Research indicates that spending considerable time describing a movement before the individual has had the opportunity to experience it is counter productive. Give a few brief comments on what is happening in the demonstration, then talk the performer into the correct starting position, and let them perform the movement. After they have attempted to experience the movement, stop them and give more verbal direction, which now has far more relevance.

C) **Manual and Mechanical Guidance:** Some performers find difficulty in translating what they see or hear into appropriate movement. The coach can often get results by actively placing the performer's body into the movement pattern. For example, when setting the back to pull the bar, many athletes achieve the hollow back position only when the coach actually positions the body parts for them manually. However, this works well with static positions like the start, but is a little more difficult, and sometimes impossible, when fast movements are involved.

D) **Knowledge of Results:** It is often unclear to the performer if he is achieving success in learning the new skills. In weightlifting, the knowledge of results in the early stages of learning is quite simple; the athlete either lifts the weight or does not lift the weight. Throughout the learning process, feedback of the results from the coach to the athlete is vital for success. A coach can use several technological sources to give feedback to the lifter. Obviously video, but also companies such as Dartfish have qualitative analysis instruments and with the assistance of the Sports Science division of the United States Olympic Committee develop software which can give the athlete immediate feedback on bar displacement, speed, velocity and power. However, the coach must learn to use these efficiently since it may prove time consuming. Conversely, the weight lifted in a skilled movement is also a very real indication of results.

Knowledge of results may not always produce the desired improvement. Individuals tend to be either "visules"or "motiles." Visiles can see and do. Motiles have to feel and do. They recognize the problem but need more help and must experiment with attempting to "feel" an adjustment with immediate feedback from the coach.

E) **Motivation:** This is an extremely complicated area as motivational factors depend on the individual. This is paramount to success achievement not only in learning a skill but also in success in the sport overall. There are principles of motivation, which can help in setting up learning processes, training sessions and training cycles.

Success is one of the greatest motivators. Especially when beginning the sport, performers should be in a success-achieving environment. Initially, failure can eliminate enjoyment and enthusiasm and if the beginner is not experiencing enjoyable activities, soon the motivation to train will be lost. In time, the lifter may find limited failure as motivation and will afford more time and effort into training. However, prolonged failure, even for the elite performer, could result in negative results.

Praise can produce great motivation, although it can be overused and prove useless. Used judiciously and honestly, praise can produce excellent results. The lifter may find public praise, as in a weightlifting meet for example, very rewarding.

Most athletes, and even the lay population, enjoy doing activities in which they excel. This superiority may lead to increased motivation to improve. However, athletes must also continue to improve on aspects in which they are below average. If not, the athlete may experience false expectations at the next competition. Athletes must work on the aspects in which they do not excel. The coach must implement a balance so that the performer feels good about what he is doing overall. When a skill is improved or mastered after a great deal of effort, this proves gratifying and motivating.

Competition can be an enormous motivator but the coach must ensure the athlete has competent skills prior to entering a competition. Luckily, in our sport the individual can compete against himself and the weight on the barbell. As skills develop, athletes lift more and more, which has great motivational powers. Later, when the individual is ready for formal competition, he may use personal records as motivation. This can also work in reverse, however, if the level of competition turns out to be overwhelming and detracts from the individual's potential to approach or increase their personal record. Also on the down side, competition can be detrimental to skill improvement if the individual perseveres with poor technique even though eventually more weight can be lifted using correct skills. Vivid examples of this occur in school age weightlifting when coaches allow performers to use poor clean or snatch technique. With inherent problems of weight transference, bar displacement and skill acquisition, the coach must initially spend time teaching proper, efficient technique. The reward of success and praise is usually enough to motivate the beginner, but with more advanced performer, material reward becomes an important motivator.

F) **Distribution of Practice**: Many coaches ask, "Should the training session be "massed' using long sessions, or should it be spread out with learning new skills?" Fatigue is always a limiting factor in our sport. Performers must practice with an "optimum" weight; doing every exercise with a broomstick will not produce the correct skill. The coach must be constantly aware of fatigue and once it sets in, the practice of that skill should cease.
When learning a new skill, research indicates massed practice does have a beneficial effect. We can illustrate massed practice by considering the split jerk. When a lifter is learning this lift, it is a sound idea to include it in every training session for a period of time, until a

competent skill level is developed. Then, the coach can distribute it more evenly in the training program. The coach might include the split jerk in every one of the three weekly training sessions for a period of four weeks until the athlete learns the skill competently and then only include the jerk twice per week. This does not mean, of course, that the only exercise in the training session is the jerk; three or four other lifts or exercises using other movement patterns are also included.

G) **Speed and Accuracy**: These two qualities have a much greater relevance in weightlifting that previously thought. In fact, the snatch and the clean & jerk, are two of the fastest, most explosive movements in sport. Consequently, the speed of movement and accuracy of positioning the barbell are essential elements of weightlifting technique. Realize also, that weightlifting technique, in particular the explosion phase of the pull and the drive for the jerk, is ballistic in nature.

In addition, there is also a proportionate speed to make most of the skills in weightlifting possible. It is impossible to do a slow snatch with any kind of weight. All research indicates that when learning new weightlifting skills, the athlete must eventually learn them at the speed in which they will occur. In fact, there should be an emphasis on speed from the start. Initially, coaches would teach weightlifting skills at a slow speed and then increase the speed as the athlete becomes more proficient. This was based on the theory that it was easier to speed up accurate movements than to correct fast, inaccurate movements.

H) **Whole and Part Learning**: In terms of skill acquisition, the whole method entails teaching the whole skill from the outset. The part method entails learned the skill in part and then fitting them together to form the whole. An offshoot of these methods is the whole-part-whole where the coach teaches the performer the whole skill, and then the coach chooses one phase or part to practice in isolation and then apply those parts to the whole skill.

To illustrate these principles, we can look at the clean. Coaches may attempt to teach it 1) as a whole or 2) choose to break it up into separate parts like the power clean, front squat or pull aspects and then practice the whole movement again. Coaches use one or all of these methodological aspects in weightlifting coaching. However, it is important to remember that we are teaching and coaching skill. The coach can also break the movement down into parts for strength and power training as part of the regular weightlifting training program.

There has been a good deal of research done on comparing the whole method to the part method approach. In many instances, the situation is still not exact. The whole method appears to produce the best and fastest results if the skill is not too complex. However, in our sport where coaches teach complicated, gross motor skill movements in the snatch and clean & jerk, the part method is sometimes appropriate. One of the advantages of the part method approach to these complex skills is the fact that each part is easily learned and the performer

gains a sense of achievement by mastering it. However, it is essential to show the performer the whole skill initially so the athlete sees the movement in its entirety. The coach should have the performer practicing the full skill as soon as possible so the lift does not appear to be "segmented."

Another derivative of these methods, which we use a great deal in coaching weightlifting skills, is the **progressive stages** approach. Here, athletes begin with a part method and progress to another more advanced stage. For example, when teaching the power clean, the athlete begins with the power clean from mid-thigh. Once mastered, he progresses to the power clean from the knee then on to the power clean from below the knees until finally the power clean from the platform.

To summarize, the coach has numerous methods to draw and combine from, if necessary:

- Whole Method
- Part Method
- Whole-Part-Whole Method
- Progressive Stages

The coach must analyze each skill he is going to teach and decide which of these methods he will employ. The coach's decision will depend on the complexity of the skill and the ability and experience of the athlete.

Individual Factors

This is an intricate area and very frequently calls for value judgments by the coach. The coach should consider the following factors:

1) **Age and Maturation**: This has an enormous effect on the ability to learn skills. The actual chronological age is not as much a factor as the level of maturation. We all have seen cases where 12-year-old boys show enormous maturational differences. One is almost a man physically while the other is still very much a child.

Coaches may begin to teach weightlifting at a much earlier age than previously thought. It was always felt that weightlifting should not begin before puberty but the Bulgarians experimented with 10 and 11 year olds with magnificent results. However, at this age, skill learning and general physical training are stressed and not the heavy loading, which produces results later.

Children in this age range (10-12) learn skills quickly. In addition, there are no inhibitory problems from movement patterns, which are already established. This is in contrast when older people try to learn new skills. Earlier activities may have established autonomous movement patterns, which may inhibit new skill acquisition. Therefore, there really is a sound basis for saying, "You can't teach an old dog new tricks." This does not mean, however, that we should not be teaching weightlifting to anyone over twelve. The older the performer, the longer the skill learning process will likely be. Post-pubescence is the most result producing stage when considering weightlifting training. The trade-off is that youngsters may learn the skills of weightlifting easily, but they will not be as capable of developing the strength and power of the post-pubescent.

2) **Gender**: It was thought, at one time, that gender had an effect on an individual's capacity to learn skills but recent findings have shown this is not the case. Obviously, post-pubescence will show a marked difference between male and female in terms of power performance if all other things are equal. This is physiological in nature due to muscle mass in males. However, the actual skill levels will be approximately the same for males and females.

3) **Intelligence**: Although it would appear that intelligent people should learn skills quicker than less gifted people, this may not be true in actual practice. Although people that are more intelligent might understand verbal instructions more clearly, the transfer of learning to the physical may not occur. With proper coaching, there should be no difference in skill acquisition.

4) **Innate Ability**: A popular expression states, "In sport and in life, there is no substitute for ability." This tends to be true. People appear to have innate abilities in various areas of learning new skills and this is certainly one of them. Some learn skills completely while others learn some but not all skills easily.

Some people are genetically and psychologically gifted for weightlifting. Coaches enjoy working with this population as they progress quickly and with equal work, achieve the highest results. Many times, we find these athletes through talent identification. Other times, an athlete just walks through the gym doors unexpectedly. Many Elite High Performance American Weightlifters where not the product of any intense identification program but merely a person who wanted to give the sport a try and met up with a competent, confident and dedicated coach

There is a school of thought, which believes that if coaches are to achieve results they should only work with people with innate ability. This is doubtless a very efficient, cost effective way to do business, but not all coaches are fortunate to get the "cream of the crop." *We all must work with the talent we get.*

Chapter 3
Physiology, Kinesiology, and Anatomy

Physiology is a branch of biology that deals with all of the physical and chemical processes of a living organism. In strength training and weightlifting, a fundamental knowledge of physiology will help a coach understand the biological processes that happen during training and how to prescribe training according to the desired physiological response. A coach must also have a foundational knowledge of anatomy and kinesiology so that he or she can understand the structure, function, and capabilities of the human body.

Muscle Fiber Types

Muscle fiber type is one of a handful of genetically influenced factors that play a significant role in determining your weightlifting (or any sport for that matter) potential. There is some evidence that fiber type expression (particularly Type IIx) is heritable and has a strong genetic component (REF). Knowing the type of muscle fiber involved in weightlifting will allow the coach to implement a training program designed towards emphasizing the size, strength, and power of those specific fibers.

Fiber Type	Type 1	Type 2a	Type 2x	Type 2b
Contraction Time	Slow	Moderately Fast	Fast	Very Fast
Size of Motor Neuron	Small	Medium	Large	Very Large
Resistance to Fatigue	High	Fairly High	Intermediate	Low
Activity Used For	Aerobic	Long-term Anaerobic	Short-term Anaerobic	Short-term Anaerobic
Maximum Duration	Hours	<30min	<5min	<1min
Power Production	Low	Medium	High	Very High

There is a misconception that there exists only two types of muscle fiber, Type I (slow twitch) and Type II (fast twitch). Muscle fibers are better thought of as falling on a continuum between Type I and Type IIx with many isoforms and hybrid fibers in between. The general characteristics of fibers on either end of the spectrum are listed below.

A person who has a larger percentage of Type II fibers (particularly Type IIx fibers) has a tremendous advantage in a sport such as weightlifting. Type II fibers have much greater force and power capabilities. Having a larger ratio or percentage of Type IIx fibers is ideal. One issue that impacts weightlifting coaches is the trainability of muscle fiber types. How much can an individual's existing fiber makeup be shifted with training?

Trainability of Muscle Fibers
There is evidence that with training, some of the fiber isoforms in the middle of the continuum can be trained to act more like ones on the ends of the continuum (REF). This is particularly true of the cellular and enzymatic changes that occur with aerobic training where Type IIa fibers "act" more like Type I fibers. In athletes in strength-power oriented sports such as weightlifting, some of this transitioning towards the Type IIx end of the continuum can be seen. However, there is much less evidence that training can increase the absolute number of Type IIx fibers (sprinter study REF).

Muscular Contraction
Muscle contraction occurs when a motor neuron sends an impulse to a muscle fiber, causing it to contract. The motor neuron and all the muscle fibers it innervates is called a motor unit (MU). Motor units may consist of a small or large number of muscle fibers (related to gross and fine movements). When a lifter attempts a maximal load, he or she will need to recruit as many MUs as possible.

A muscle will contract if the stimulus from the central nervous system is strong enough (reaches the threshold needed for activation and causes the release of acetylcholine). If the stimulus is strong enough, all the fibers in the MU will contract and selective activation within an MU is not possible.

Provided that the stimulus is strong enough to cause contraction of a muscle, the lifter still needs to have available energy (Adenosine Triphosphate, ATP) to contract. Both the signal from the CNS and the presence of ATP are necessary to carry out muscular contraction. ATP stores within the body are miniscule so the synthesis of ATP is needed to fuel all body movements. There are three pathways through which the body can create ATP and gaining an understanding of how to train each system to function efficiently is of great importance to a coach.

Energy for Muscular Contraction
Chemical energy is released when the body breaks down macronutrients (carbohydrate, fat, and protein). That energy is then converted into biologically usable forms of energy and can be utilized by the body for muscular contraction; Adenosine Triphosphate (ATP), can be thought of as the "cellular currency" for muscle contraction, and without adequate supplies of ATP, muscular contraction and all the positive training adaptations from resistance training would not be possible. Knowing how the energy systems function is extremely important when designing training programs; a coach must design a program targeted towards developing the energy system most directly involved in weightlifting and avoid training the energy systems not involved. In competition, the primary system is the phosphagen system and to deal with high volumes of work in training, the gylcolytic system is taxed heavily. In most cases, aerobic training is not recommended as it does not contribute to the qualities needed for a competitive lifter. There are three energy systems through which ATP can be generated in the human body: Phosphagen, Glycolytic, and Oxidative.

Phosphagen: The Phosphagen energy system is the primary energy supply for very high intensity exercise lasting up to about fifteen seconds. Energy is produced when an enzyme acts upon ATP and breaks the bond with one of the phosphates creating adenosine diphosphate

(ADP). ATP is regenerated through the phosphagen pathway from creatine phosphate; the phosphate group is split from the creatine and then added to ADP to create ATP. This process is known as phosphorylation. The entire process can occur without the presence of oxygen which makes it an anaerobic system. After approximately fifteen seconds the natural stores of ATP and creatine phosphate will be depleted at which point the muscles must rely on energy production through either the glycolytic or oxidative system.

To train the phosphagen system, the exercise should be at or near maximal effort, take between one and ten seconds, and the work to rest ratio should range from 1:6 to 1:20. Examples: sets of one or two reps with 90-100% of max weight with 2-4 minutes rest between sets. Ten to thirty meter sprint intervals with one minute rest between sets.

Glycolytic: The Glycolytic energy system is the primary energy supply for moderate to very high intensity exercise lasting from about six seconds up to about 30 seconds (fast glycolysis) and up to two minutes for moderate to high intensity exercise. This system is much more complex than the phosphagen system and requires 12 enzymatic reactions to complete a cycle. The energy source in the glycolytic system for the regeneration of ATP comes from glucose (from food sources) and glycogen (the stored form of glucose in the body). Energy is produced when glucose is broken down by special glycolytic enzymes which results in the production of ATP. This process is also capable of occurring without the presence of oxygen and is referred to as anaerobic glycolysis with the end product being pyruvic acid. The glycolytic system is capable of producing energy for up to about two minutes after which the body must rely on the oxidative system.

To train the glycolytic system, the exercise should be at or near maximal effort, take between ten and thirty seconds, and the work to rest ratio should range from 1:3 to 1:5. Examples: sets of two to four reps with 80-95% of max weight with 2-3 minutes rest between sets. Forty to one hundred meter sprint intervals.

Oxidative/Aerobic: The Oxidative (aerobic) energy system is the primary energy supply for low intensity exercise lasting greater than three minutes. The oxidative system is the most complex of the three systems but has a net yield of ATP that is greater than the phosphagen and glycolytic systems which makes it ideal for energy production over a longer duration. This is also the only system of the three to utilize oxygen which makes it an aerobic process.

The energy source in the oxidative system for the regeneration of ATP through the phosphagen pathway comes from carbohydrate (glucose and glycogen) and fat. The oxidative system yields the most amount of ATP of all three systems. The oxidation of carbohydrates produces 38 molecules of ATP if starting with glucose or 39 molecules if starting with glycogen. The oxidation of fat produces 129 molecules of ATP. The larger production of ATP via the oxidative system is needed to sustain low intensity, long duration activities.

To train the oxidative system, the exercise should be low intensity and take anywhere from five minutes to several hours. If using interval training, the work to rest ratio should range from 1:1 to 1:3.

A coach should have a basic understanding of these three pathways and how to stress each of them through exercise prescription. For weightlifting, the primary energy system utilized is the phosphagen system. The phosphagen system is responsible for supplying energy for intense exercise lasting up to about fifteen seconds, and executing the snatch or a clean and jerk takes only a few seconds of intense effort. In training, a lifter may also rely on the fast glycolytic system, especially with higher volumes of work and in hypertrophy phases. Because the oxidative system contributes very little to the overall energy demand of weightlifting, coaches should not plan or include training geared toward aerobic improvement. In fact, there is good evidence that aerobic endurance training hinders strength and power development (REFs). Concurrent aerobic and anaerobic training has been shown to reduce gains in muscular strength, muscular size, and power output, particularly in athletes in strength- and power-oriented sports like weightlifting. This is also a critical point for performance in other sports that rely primarily on anaerobic factors such as basketball, American football, soccer, and baseball. Interestingly, there is no evidence that anaerobic training inhibits aerobic performance.

Agonists, Antagonists, and Synergists

Muscles must work in a coordinated pattern. A basic knowledge of this pattern can lend a coach greater abilities to train a lifter according to the pattern in which muscles must work to achieve optimal results. Furthermore, being able to appreciate the muscle involvement and firing patterns can help a coach to train the relative weaknesses of a lifter. Muscles can be described or categorized according to what they do during a specific movement. A muscle is classified as an agonist, an antagonist, or a synergist. Agonists are muscles that work as prime movers, or muscles that are largely responsible for the movement. Antagonists are muscles that work in opposition to the prime movers. Synergists are muscles that assist the prime movers. For example in a basic bicep curl, the agonist (prime mover) is the biceps brachii, the antagonist (opposition) is the triceps brachii, and the brachioradialis and the brachialis are synergists because of their assistance role in stabilizing the elbow joint.

Adaptations to Resistance Training

The muscular, neural, and hormonal adaptations to resistance training are well documented in the peer-reviewed literature and other texts. Coaches should have a firm understanding of these adaptations as the training plans they give to lifters are ultimately aimed at bringing about specific physiological and physical adaptations. Rather than summarize these complex training responses here, a list of recommended reading has been included to enable coaches to learn the most up to date knowledge.

Muscle Actions

Muscular contractions that are seen in sport can generally be described as consisting of some combination of eccentric, concentric, and isometric.

Type of Muscle Contraction	Explanation	Example
Concentric	• The prime mover (agonist) is shortening as in the quadriceps muscles in the upward portion of a squat. • Typically, concentric muscle action works against gravity and the amount of force a muscle can produce concentrically is lower than what can be produced eccentrically.	Upward portion of the bench press, clean, snatch, jerk, bicep curl
Eccentric	• The prime mover (agonist) is lengthening as in the quadriceps muscles in the downward portion of a squat. • Typically, concentric muscle action occurs in the same direction as gravity • Muscles can produce the most force eccentrically	Downward of lowering portion of the bench press, clean, snatch, jerk, bicep curl
Isometric	• A static contraction where a muscle is neither lengthening nor shortening.	Wall sit, static plank hold, plank

Planes of Movement and Joint Actions

Anatomical position is a reference posture used to describe the relationship of body parts to one another and to itself in space. This allows people to use universally understood terminology to describe body potions and movements. When describing motion, it is understood that we begin from what is called, anatomical position. Knowing the anatomical position, joint actions, and planes of movement allows the coach to implement an advanced training program designed to elicit specific characteristics of movement. Thinking about training in these terms might also help a coach to prevent overtraining about a particular joint. With so many exercises occurring in the sagittal plane or frontal planes, it may help to add in assistance exercises that work joints in other planes of movement to both stabilize the joint and to prevent injuries related to repetitive movements (ex. Tendonitis).

Movements can be categorized as occurring primarily in one of three planes: frontal, sagittal, and transverse. Movement, like a golf swing, fit none of these planes and are said to occur in an oblique plane. Weightlifting movements and squats occur primarily in the sagittal plane, though many sporting movements would be classified as multi-planar.

Planes	Explanation	Example
Frontal Plane	• Divides the body into front and back sections. • Runs from top to bottom, slicing body into thin gingerbread men. • Generally deals with lateral movements (Adduction and abduction)	Lat pull downs wide grip, pull ups, shoulder press, lateral raise, military press, push press.
Sagittal Plane	• Divides the body into left and right halves. • Runs forward and backward. • Generally involves flexion and extension.	Squats, snatches, cleans, chin ups, leg press, bicep curl, front raise, dumbbell row, preacher curl, triceps extensions (skull crushers), deadlifts, RDLs, dips
Transverse Plane	• Divides the body into top and bottom halves • Generally deals with rotation and rotational exercises (horizontal adduction and abduction)	Dumbbell flys, bench press, chest press, Russian twists, push ups, windshield wipers, wide grip pronated bent over row

One other thing to keep in mind is that the planes move with the body. The starting point is anatomical position but if your body moves then the planes move with you. This is why a push-up (facing the ground, prone), a chest press machine (vertical in a seat) and a bench press (facing up, supine) are all in the same plane (transverse).

When categorizing a movement as occurring in a certain plane, use the joint(s) that are primarily involved with the exercise. If multiple joints are involved, select the most proximal joint. For example, in the back squat, some body parts are moving in the frontal plane, but we would use the hip joint (more proximal than knee and ankle) to categorize the squat as occurring in the sagittal plane.

Main Joint Actions

The *movement* produced during the exercise is describing the action of the joints involved. How are those joints moving during the exercise? There are six primary actions of the main joints in the body and they are:

Movement	Explanation
Flexion	decreasing the angle at a joint often described as bending or curling
Extension	increasing the angle at a joint often described as straightening or extending
Abduction	moving away from anatomical position in a vertical direction
Adduction	moving toward anatomical position in a vertical direction
Horizontal Abduction	moving away from the midline traveling parallel to the horizon
Horizontal Adduction	moving toward the midline traveling parallel to the horizon

In addition to those 6 main movements, there are a number of special cases that the body can do such as circumduction. Not all joints are capable of all 6 movements. The elbow, for example, can only do flexion and extension. Other joints, such as the shoulder and the hip, *are* capable of all six movements as well as circumduction. Below is a list of the movements that normally occur at each joint.

Movements at each joint

Joint	Type of Joint	Movement
Subtalar (Foot)	Plane; Uniaxial	Inversion (i.e., adduction or supination) Eversion (i.e., abduction or pronation)
Ankle	Hinge; Uniaxial	Dorsiflexion Plantar Flexion
Knee	Hinge; Biaxial	Flexion Extension Medial Rotation[1] Lateral Rotation[1]
Hip	Ball and Socket; Triaxial	Flexion Extension Adduction Abduction Medial Rotation Lateral Rotation Horizontal Abduction[2] Horizontal Adduction[2]
Spine	Facet	Flexion Extension[3] Lateral Flexion (abduction) Lateral Extension (adduction) Rotation (shoulder rotation)
Shoulder	Ball and Socket; Triaxial	Flexion Extension Adduction Abduction Internal Rotation (medial rotation) External Rotation (lateral rotation)

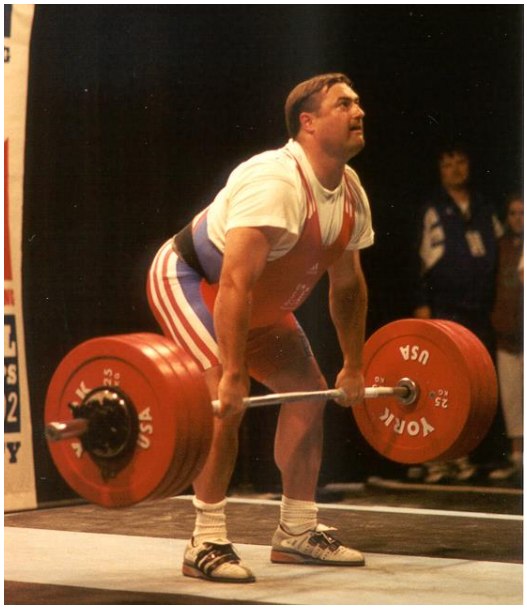
		Horizontal Adduction (protraction of scapula) Horizontal Abduction (retraction of scapula)
Elbow	Hinge; Uniplanar	Flexion Extension[3]
Wrist	Condyloid; Biaxial	Flexion Extension (anatomical position; neutral)[3]

[1]When knee is locked (extended), no leg rotation is possible. When knee is flexed, lower leg can be rotated medially and laterally. (e.g., pushing off, changing direction of the body in sport)
[2]Only starting with the hip flexed 90 degrees do these occur. These occur in the transverse plane. Note: Hyperextension occurs when leg moves behind the body.
[3]Extension beyond anatomical position (posterior direction) is considered hyperextension

All of this information about energy systems and fiber types can be put to practical use by a coach when designing training programs. A coach can use what is known about how the body responds to training to optimize the training adaptations through careful exercise selection. Aspects of training that are critical to making sure that the desired improvements are made in a lifter include volume load, work to rest ratios, and exercise order and selection. A coach that is knowledgeable in how each of the body's systems respond to exercise will have a tremendous advantage in successfully training a lifter.

Chapter 4
Biomechanical Principles in Weightlifting

Biomechanics is the intersection of physics (mechanics) and biology and can be thought of as the study of forces acting on the body and the consequences of those forces. In strength training and weightlifting, the principles of biomechanics are often used to develop efficient and safe technique. In advanced lifters, high-speed cameras and force plates can be used to help refine movement and examine force application to ensure the most effective technique.



Even when working with less advanced lifters, and especially in the process of learning the technique of the lifts, it is essential that a coach understand the basic principles of biomechanics. A basic comprehension and appreciation of biomechanics is essential for coaches. Coaches must understand why certain positions are critical to successful lifts and why a particular technique is taught. The recommended techniques presented in this manual take advantage of what is known about biomechanics and how the lifter can use levers and forces to his/her advantage.

Newton's Laws
Sir Isaac Newton revolutionized physics when he identified three laws of mechanics that underlie all motion we observe in the world. All three of these laws are of crucial importance to weightlifting.

The Law of Inertia: A body will maintain its state of rest or linear motion unless a net external force acts on it.

As it pertains to weightlifting, the barbell will stay on the platform unless the lifter applies a sufficiently large force to overcome the inertia (resistance to change in motion) of the barbell. The heavier the barbell, the greater the force required to lift the barbell.

The Law of Acceleration: Acceleration of a system will be directly proportional to the applied force assuming the mass remains constant. Stated mathematically, F=ma. In a lift, the mass of the lifter and the bar remains constant, so greater force application results in greater acceleration of the barbell.

All forces have a point of application, a line of action, an orientation, and most importantly in weightlifting, a magnitude and a direction. Increasing force production and acceleration of the bar is not only limited to increasing muscle cross sectional area of the lifter but also to applying forces in the most effective way (i.e., proper form).

The Law of Action and Reaction: Every action force is met with an equal and opposite reaction force. This is most frequently encountered of Newton's Laws in weightlifting and is critical for coaches to attend to when teaching new lifters.

A good example of action and reaction in weightlifting is the execution of the jerk. If a lifter attempts to execute a jerk by dipping onto the toes rather than the heels, this action will result in an undesirable reaction of the hips breaking backwards and the bar traveling forward rather than directly overhead. Ideally, the hips and shoulders should move downwards in the same line and as a result, the bar moves only upwards.

Example of a jerk where the weight shifts to the toes, the hips move backwards during the dip (action), and the bar is pushed forward of the correct overhead receiving position (reaction):

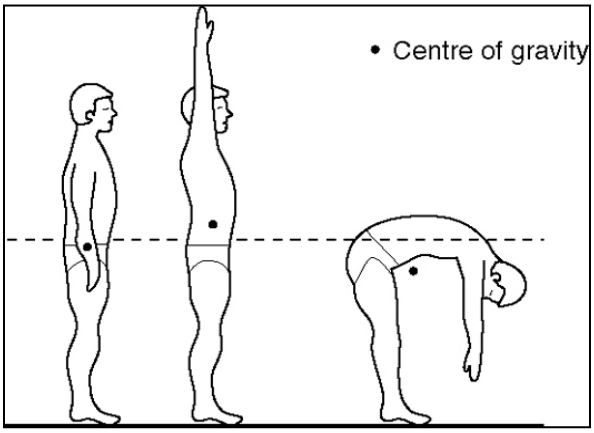
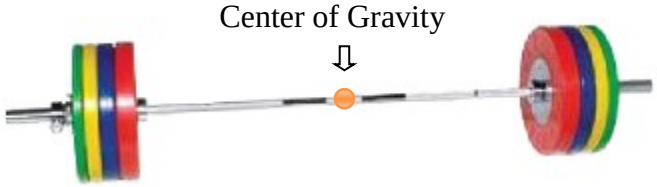


Photo from: The Oxford Dictionary of Sports Science & Medicine,
by Michael Kent, Oxford University Press

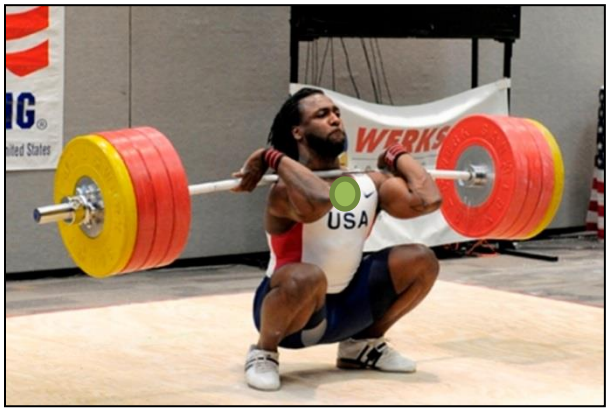
Center of Gravity (COG)
Stability and balance are essential for the execution of a successful lift and can be greatly impacted by the fluctuation of two factors, center of gravity (COG) and area of base.

The COG of a person is the point at which mass is equally distributed and can be thought of as a balance point. Females tend to have more mass distributed in their lower body relative to males, and as a result, females generally have a lower COG than men. In men, the COG generally ranges from 54% to 59% of standing height and in women COG is between 53% and 55% of standing height (McLester and St. Pierre, 2008). This holds true when an individual is standing erect. However, it is important to understand that the COG of the human body changes as body positions change. The COG may be located outside the body.

The balance point or COG of a barbell is always located in the middle of the barbell, perfectly in between the ends of the bar because weight is always added equally to either end of the barbell. A standard bar is 7' 2" and the COG is at 3' 7".



During the execution of a lift, the lifter and the barbell should be thought of as a unit and the combined COG will be in line with the individual COGs. It is important to note that the combined COG will be closer to the heavier of the two objects (hopefully this is the barbell) and it may also be outside the body. Indeed, during several phases of the snatch and clean and jerk, the combined COG is outside the body.



It is important to understand the location of the combined COG and how it changes as the bar moves from the floor to the receiving position of a lift. A lifter will be more stable the lower his or her COG is to the ground and this is also true when thinking of the lifter and the barbell as a unit. A lifter is more stable at the bottom of a clean than when holding a snatch overhead. To have a successful lift, reduce injury potential, and achieve maximum force production, the COG should remain over the lifter's area of base throughout the lifts.

Area of Base

The area of base for a lifter is determined by foot spacing and can be thought of as a box stretching from the toes to heels around the feet.

The larger the area of base (up to a point), the more stability a lifter possesses. One way lifters can increase area of base during the pull off the floor is to turn their toes out slightly (duck footed).

Area of base changes throughout the phases of the lift, and this changing foot spacing can have large ramifications for the lifter (good and bad). While some lifters have unique variations in their lifting technique, the aim of all lifters is to maneuver and catch the bar within their area of base. This is an essential aspect of lifting technique and many missed lifts can be traced to improper foot placement or moving the bar outside the area of base.

Moving the bar outside the area of base, such as pulling off the floor with the bar too far in front of the lifter, will increase the amount of force the spinal erectors must produce to counter this clockwise torque placed on the trunk. Over time, this technique will have two negative outcomes, unsuccessful lifts and increased risk for lower back injury.

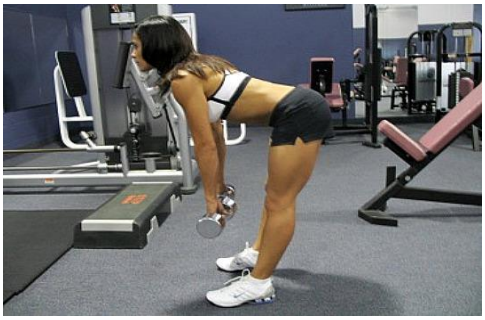
Torque is the turning effect of a force; inside the body it is caused rotation around a joint.

Torque = Force (from the muscle) **x Force Arm (FA)** (distance from muscle insertion to the joint (axis of rotation))

The actual torque needed to move a given resistance depends on the length of the force arm (FA) and the resistance arm (RA). The RA is the distance between the resistance and the axis of rotation; in a bicep curl, the RA would be the distance between the dumbbell and the elbow joint. The RA changes as the dumbbell moves up and down.

As the FA increases or RA decreases, the required torque decreases.
As the FA decreases or RA increases, the required torque increases.

As applied to a bicep curl, the farther the bicep tendon attaches from the elbow joint, the less force that is required to move a given weight in the hand (dumbbell). Typically, the bicep tendon attaches farther from the elbow joint in men than in women. This gives men a mechanical advantage when it comes to doing curls.



As it applies to a squat or RDL, the farther the load (bar) is from the fulcrum (hips), the clockwise torque on the upper body increases, and the likelihood of injury increases. An athlete doing an RDL with a 20kg load will require the spinal extensors to generate more or less force depending on how far from the hip joint (fulcrum) the 20kg load is. The farther the load from the hips, the higher the torque on the spinal extensors and the more of a mechanical disadvantage we create. In an exercise such as a good morning, the back, relative to the load on the shoulders, is in a mechanically disadvantageous position as the RA increases substantially from a squat.

Balance, center of mass (COM) and area of base all provide good rationale for keeping the bar as close to the body as possible in an RDL, but leverage highlights how this can contribute to acute and chronic injuries.

A lifter should also be careful in considering how much of an increase in muscular force generation is required when optimal biomechanics are not followed. This is true with exercises such as the squat (increased forward torso lean), jerks (too far forward or behind), and pulls (too far in front of the body).

Bar Trajectory

Bar trajectory can be greatly impacted by technique in all phases of the lifts and being aware of correct bar trajectory can help a coach identify and correct technique errors. In optimal bar trajectory off of the floor in a clean or a snatch, the bar should travel slightly backward toward the lifter from floor to knee. The bar will continue to travel toward the lifter until the bar contacts the upper thigh (power position). The bar will then travel slightly forward of the lifter as it rises. Recall that the bar should stay over the lifter's area of base, so a large forward swing of the bar should be avoided.

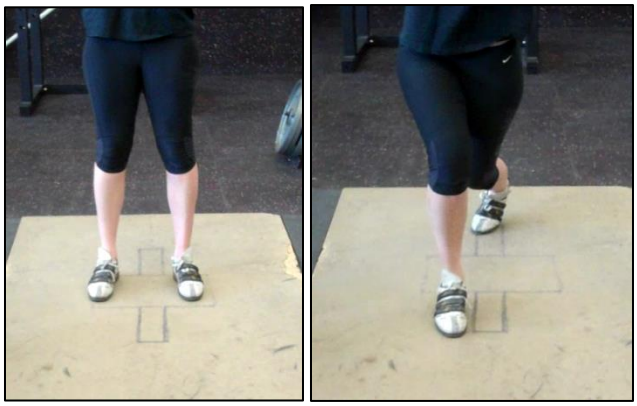
The best position to observe bar trajectory is directly to the side of the lifter. While this position obscures some of the lifter's technique, periodically checking bar trajectory can give a coach key information about what is going well or what may need addressing in an athlete's technique.

Many coaches prefer to view most of the lifts diagonally, at about a 45 degree angle from the side either in front or behind the lifter. This positioning provides the coach with the greatest amount of information regarding an athlete's technique given the diameter of the plates, by affording the coach the opportunity to observe the movement of the body forward, back and vertically along with the trajectory of the bar in the same dimensions.

A coach should pay close attention to foot spacing, bar trajectory, grip width, and receiving positions with a beginner lifter. Small deviations can make a big difference to the end result of the lift. Let us take a look at the implications of common mistakes in lifting technique from a biomechanical perspective.

Off the floor, instead of the bar moving slightly backwards and then brushing the thigh, the bar travels in front of the knees, away from the body and moves outside the area of base. By missing the power position, the athlete cannot apply as much force upward because the hips are behind rather than underneath the lifter. Also notice the nearly vertical bar path resulting from the mistake off the floor.

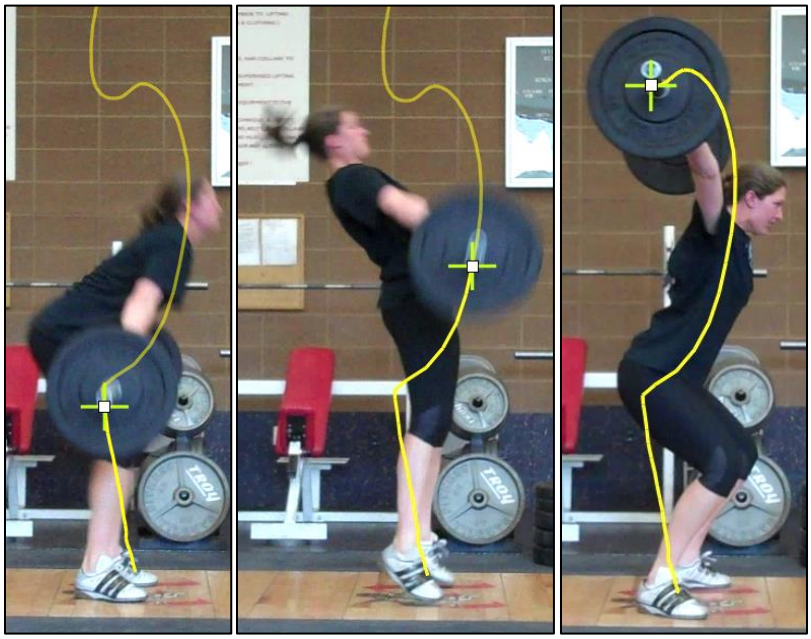
Another common issue is that the lifter's feet never move outwards (a way to increase area of base and therefore stability) from the lift-off to the receiving position. In a full snatch or clean, the lifter may lack the stable base necessary to stand up with the bar.



Lack of horizontal foot spacing in a jerk, often referred to as "tightroping" can result in lateral instability and a missed jerk.

If the shoulders are thrown backwards rather than staying over the bar during the second pull, the hips will move forward and push the bar forward, creating a more pronounced arc. The bar may also exhibit a "looping" motion to reach the shoulders, as it will be out in front of the athlete's shoulders.

Hips pushing out the bar path during the second pull of a power snatch.



Hips pushing out the bar path during the second pull of a power clean

Levers and how they apply to weightlifting

Levers are used to create a mechanical advantage, and as applied to the human body, a lever is a rigid bar (bone) that turns about an axis of rotation or fulcrum (joint). The lever rotates about the axis as a result of a force (from muscle contraction).The force acts against a resistance (weight, gravity, opponent, etc.). Some levers are designed to enhance force while others enhance ROM or speed of movement.

The relationship of the axis (joint), force (muscle insertion point), and the resistance (weight) determines the type of lever (Class I, II, III). In the chart below, A = axis, F = force, and R = resistance. The classification determines the lever's strengths and weaknesses. The majority of levers in the human body are 3rd class.

CLASS	ARRANGEMENT	ARM MOVEMENT	FUNCTIONAL DESIGN	RELATIONSHIP TO AXIS	PRACTICAL EXAMPLE	HUMAN EXAMPLE
1ST	F-A-R	Resistance arm and force arm in opposite direction	**Balanced movements**	Axis near middle	Seesaw	**Neck extension**
			Speed and range of motion	Axis near force	Scissors	**Triceps extension**
			Force (Strength)	Axis near resistance	Crow bar	
2ND	A-R-F	Resistance arm and force arm in same direction	**Force (Strength)**	Axis near resistance	Wheel barrow, nutcracker	**Calf raise**
3RD	A-F-R	Resistance arm and force arm in same direction	**Speed and range of motion**	Axis near force	Shoveling dirt, catapult	**Biceps curl, clean pull**

Mechanical advantage

Mechanical advantage is the effectiveness of a lever at moving a resistance. It is mathematically determined by the following formula: **Mechanical advantage = force arm/ resistance arm.**

Because of their different configurations, the mechanical advantage of a first class lever can favor the force or the resistance depending on the placement of the fulcrum. A second class lever always favors the force arm. A third class lever always favors the resistance arm.

Optimizing levers in lifters

Coaches tend to take notice of the lever and torso lengths of their athletes as in certain sports, these ratios and lengths can make a big difference in sporting success (ex: long armed pitchers, short armed powerlifters, swimmers with long torsos etc.). In optimizing weightlifting technique, one would hope to find an athlete with shorter levers, a low COM, shorter femurs, and wide hips.

Shorter levers are more ideal than longer levers for several key reasons:

1) For a given muscle cross-sectional area (CSA), shorter levers mean more force
2) Shorter levers mean less mechanical work (work = force x displacement) as the bar does not have to be lifted as high (displaced as much relative to the start position).
3) Shorter femurs can help optimize squat form by keeping the trunk at a more vertical angle.

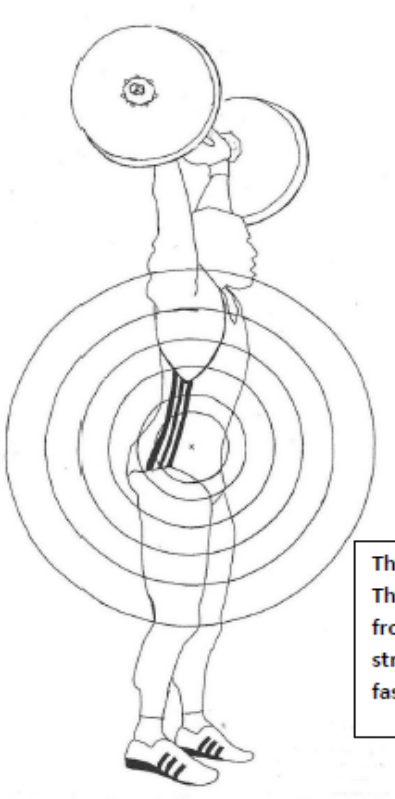
Human levers and optimizing lifting mechanics
On the most basic level, the goal of a lifter is to have the shortest displacement of the bar possible. Physics can tell us that getting from point A to B in the shortest route is ideal. Mechanical work is equal to force multiplied by displacement. Displacement is the distance (as the crow flies) from the start position to the finish position. For a snatch, the smallest displacement is to have the bar move in a perfectly straight line from floor to overhead. However, this only considers the mechanics of the bar and not the strengths and weaknesses of the simple machine (lifter) that is moving the bar. If a lifter attempted to lift the bar in a straight line (out in front of the lifter to ensure verticality), then the lifter would certainly be at a great mechanical disadvantage and be unable to produce maximal amounts of force about major joints.

A lifter will always have some amount of horizontal bar displacement in executing the lifts and this is related to leverage, torque, and mechanical advantage. The human body can produce large amounts of force at certain joint angles, but has considerable relative weakness at other joint angles. For example, in the power position of a clean, the lifter is able to optimize force production of the lower body, but when the bar is at the level of the knee, much less force can be generated in the upward direction.

This helps to explain the development of weightlifting technique as a process by which we maximize leverage, mechanical advantage, stability, balance, and speed while minimizing mechanical and physiological work, bar displacement, and torque on the trunk.

The path of the barbell may be similar for lifters, but there is not one "perfect" bar path that all lifters should seek out. Body segment proportions help determine mechanical advantages and optimal body positioning and ideal bar path.

Applying force from proximal to distal
Another biomechanical principle that affects weightlifting and other sports is that when force is



Athlete Power involves Torso Kinetic Energy, Torso Rotation energy and stored Kinetic Energy

Kinetic energy is the energy of motion and is related to the mass of the body and velocity. Torso Kinetic Energy is the movement generated through the weightlifting movements that produce Torso Rotational Energy allowing the athlete to generate force in multiple directions. T.R.E. involves the large muscle groups generating great force from the center of the torso outwards to the smaller, faster muscles, of the limbs. Snatches, Cleans, Squats, allow te hip joint to create a high torque or movement force situation.

The Body's POWER ZONE
The concentric circles radiate out from the body's largest and strongest muscles to the smaller , faster, groups O'Shea 2000

applied to accelerate an object like a barbell, it should always be applied sequentially from proximal to distal. For instance, in the pull, the lifter generates force at the hips with the leg, hip and back muscles, followed by the trapezius muscles, followed by the arms pulling the lifter down. This proximal to distal application of force links multiple levers together, uses larger then smaller muscles in sequences, and ensures the most efficient use of the athlete's body to generate explosive forces.

Weightlifting shoes assist the lifter with stability and balance to successfully complete the competition lifts.

Use of Weightlifting shoes

Lifting shoes have an elevated heel and the purpose of this is to allow greater range of motion to occur at the ankle joint. In turn, this enables the lifter to get into a more upright position with the torso, which is critical for Olympic lifts and major training exercises such as the squat. Sato et al. (2012) found that in the back squat, weightlifting shoes increased ankle flexion and decreased forward torso lean as compared to regular athletic shoes. The authors attributed this to the heel lift in the lifting shoes. With the lifting shoes, the knees are able to travel forward over the toes, reducing the torque on the knees and hips and keeping the torso more vertical. Lifting shoes are therefore essential to not only proper execution but to reducing the likelihood of injury.

It is important to recognize that being in the biomechanically optimal positions during a lift will not only increase the odds of it being a successful lift, but it will also greatly reduce injury potential. Recall that done correctly and with appropriate equipment and supervision, Weightlifting is an extremely safe sport.

Chapter 5
Phases of Nutrition and Daily Regimen

A good nutrition regimen is incredibly important part of training for a weightlifter. Good nutrition regimen should focus on properly timing meals, balancing composition of meals with the demands of training and energy expended as well as the necessary quality of foods, nutrients and supplements consumed. An athlete does not need to wait until they reach the elite level to begin to introduce a good nutrition philosophy into his/her training and lifestyle. Nutrition education can begin at a young age but should focus on achievable and realistic expectations.

Nutrition for Development

Phase 1 (<6 yrs old)- Nutrition focus during this stage of development should consistent of introduction of new foods and encouraging a variety at meals. The various types of animal and plant protein should be introduced.

Phase 2 (6-10 yrs old)- This is the perfect age to begin to introduce good habits around training. Children who are practicing or involved in activity should be encouraged to have a water bottle with him/her. Additionally, children should be encouraged to have some sort of snack directly after practice or structured activity.

Phase 3 (pre-growth spurt)- During this phase of development the focus can be on balancing nutrition. Young athletes should begin to understand the importance of food as fuel and a great way to achieve this is through balance in meals. Gone are the days of noodles with butter and now pasta with chicken or meat sauce to encourage consumption of all the macronutrients to support growth and development.

Phase 4 (during growth spurt)- This is a tricky time because athletes' attention is often directed to supplements but food for fuel should remain the focus as his/her body is still developing. This phase can be a great time to introduce principles of sports nutrition such as timing meals and snacks before and after practice/training. The balance of nutrition should now be further encouraged around timing carbohydrates and protein for training fuel and recovery from training efforts.

Phase 5 (after growth spurt)- Since nutrition and balance has been encouraged since an early age, the focus can now be placed on developing training and competition strategies. In addition proper weight cutting techniques should be introduced and implemented as part of competition. Individualized hydration and recovery should be encouraged (i.e. each athlete is selecting recovery and meals appropriate for his/her body size and training load as opposed to one size fits all).

Phase 6 (full maturation)- As the athlete develops at the competitive level, nutrition and fueling can be individualized based on weight class, training load, intensity and goals of training.

Nutrition can be divided into various phases of training: prep, pre-comp, competition. Weight cutting strategies should be individualized to reflect the athlete and competition schedule. Lastly, this is the proper time to begin to introduce safe and approved supplements and ergogenic aids as a part of an athlete's training and nutrition plan. Athletes should now focus on his or her own individual daily nutrition plan.

Daily Nutrition for Strength and Power Athletes

Table 5.1- Average amount of energy expenditure and replacement needed for different sports

Sport	Expenditure (kcals/kg/day)	Replacement (kcals/kg/day)
Untrained	<40	2,000-3,000
Basketball	50-80	5,000-6,000
Sprinting	55-70	4,300-6,000
Middle Distance	55-70	3,000-5,000
Marathon	50-80	2,500-6,000
Judo	55-65	3,000-6,200
Throwing	60-65	6,000-8,000
Weightlifting	55-75	3,000-10,000

The Table 5.1 should not act as a guide to recommending daily calorie intake levels to athletes, but rather represent the problem with focusing on the one dimensional aspect in nutrition that is total calorie intake. Total calorie intake in athletics is only one tiny piece of the performance puzzle. Elite athletes need to individualize: timing of meals, balancing intensity of training with adequacy and composition of meal intake, managing weight class goals, daily weight goals, hydration status, vitamin and mineral intake and a focus on total calorie intake can easily distract from the great importance which is fueling for performance. Additionally, you may notice the range of daily caloric needs represented in Table 1. This range represents the various weight classes found in weightlifting, but there is an additional variability not listed which is that found in each individual; and that is the components of energy expenditure.

The components of energy expenditure are those metabolic and physiological factors that make up our daily energy expenditure and thus dictate the daily caloric replacement needs. The components are comprised of: basal metabolic rate, physical activity, growth and the thermic effect of food. Interestingly, each of these components can vary on a daily basis which would change the total energy expenditure for that day and thus change the daily caloric needs. This variability in daily energy expenditure and caloric needs only further enforces the need for athletes to focus on more than just calories. So the golden question shouldn't be "how many calories do I need?" but should rather be "how do I eat for MY training?"

Meal Timing

Meal timing is more than just how an athlete should eat on competition day but also should apply for training days as well as days off. Small frequent meals (5-7 per day depending on needs/goals) are a great way to ensure proper fueling pre/post workout can help improve

metabolic efficiency by reducing blood sugar and insulin spikes. Carbohydrates in our diet are converted to blood glucose in the body and blood glucose stimulates the release of insulin to drive the glucose into the cells for storage as glycogen for energy. While glycogen is essential for training, the release of insulin suppresses fat oxidation so it is important to balance the amount of carbohydrates consumed throughout the day to maximize the body's metabolic efficiency. A smaller meal, especially one with fewer carbohydrates and/or sugars will create less of a spike in blood sugar and thus less of an insulin spike after the meal which means the body's ability to oxidize fat for fuel will not be inhibited as long.

Pre-Exercise

Prior to a workout or competition, athletes should eat foods that they are comfortable digesting. These foods should optimize hydration and not upset the stomach. Typically, foods higher in carbohydrate content and lower in fiber, to avoid any gastrointestinal discomfort, should be emphasized. This will vary athlete to athlete, but can include foods like peanut butter sandwich, granola bars, fruit, cereal with milk, scrambled egg and toast or even chicken noodle soup.

How much food an athlete should eat will depend on the individual based upon his or her own experiences. However, some guidelines indicate 30-40 grams of carbohydrates and 10-20 grams of protein may be appropriate. Under no circumstances should an athlete eat "new foods". The athlete may have a negative reaction to it and this may interfere with performance. New foods should be "tested" only in training.

Post-Exercise

Following a workout or competition, athletes must restore glycogen levels, repair and rebuild damaged muscle and re-hydrate to enhance recovery. This is achieved by consuming food or supplements with both carbohydrate and protein immediately within 30 minutes post workout. This can be a chocolate milk and piece of fruit, fruit and yogurt smoothie, turkey sandwich and milk, eggs and toast or an approved protein shake. Athletes should chose the appropriate recovery based on the intensity of the training! The major questions that can help you determine what to eat are: How intense was my session? How long did I train? When is my next session? As a general rule, the more intense the session the greater the utilization of carbohydrates and thus the greater the need to consume them post workout. Protein should be a consistent amount based on an athlete's body size and lean muscle mass.

Hydration Timing = All the time

The body uses water for thermoregulation, digestion, elimination of waste, recovery from strenuous exercise, transport and as a medium for cellular activity and pH balance. When the body becomes dehydrated, these processes are compromised and the body can become fatigued, cramped or overheated; which shuts down performance.

Athletes must be aware of fluid loss during strenuous activity especially during hot or humid weather and if training at altitude. Thirst is not a good indicator of fluid needs, because the body can already be dehydration by this time; further increasing the risk of decreased performance. It

is best to drink fluids consistently throughout the day and not just during activity. As a general guideline, for every pound of body weight an athlete loses during activity equals 12-20oz of fluid lost and thus 12-20oz of fluid that must be replaced to maintain hydration.

Meal Composition

The composition of each athlete meal/snack should be composed of carbohydrates, protein and fats; with the amount of each macro nutrient being determined by the athlete's goals, training type and intensity.

Carbohydrates and Performance

Carbohydrates should generally account for a slight majority in the diet. Forty to sixty percent of one's total calories should come from carbohydrate; depending on the type and intensity of training. Carbohydrate intake recommendations range between five and twelve grams per kilogram of bodyweight. This range represents the type, duration and intensity of activity an individual participates in requiring carbohydrate energy. For athletes who depend heavily on carbohydrate energy and glycogen stores, ample carbohydrate intake is critical for optimal sports performance.

Glycogen is the storage form carbohydrate stored in the muscle and in the liver. The body uses glycogen when it cannot get enough oxygen to burn fat for energy. The body's use of glycogen is determined in a number of ways including a person's diet, fitness level and type and intensity of exercise being performed.

- Higher intensity, short term exercise depends the most on glycogen stores
- Medium intensity, intermittent burst exercise also depends heavily on glycogen stores
- Moderate intensity exercise depends on glycogen stores for about 50% of its energy
- Low intensity, long duration exercise depends mostly on fat oxidation for its energy

Carbohydrates can be divided into two categories: complex, or starches, and simple, or sugars. Complex carbohydrates provide the body with a slow, steady supply of glucose because it is composed of chains of glucose that must first be broken down during digestion. Simple carbohydrates do not need to be broken down and therefore enters the bloodstream immediately, providing a quick supply of energy.

The glycemic index can be used to determine the speed of carbohydrate breakdown. The index scale ranges from 0-100 with 0 representing the slowest breakdown of carbohydrate into glucose and 100 representing the fastest breakdown of carbohydrate into glucose.

Fiber

Fiber is a type of carbohydrate that is not digested by the body and has no nutritional value. However, it does play an important role for gastrointestinal and overall health. There are two types of fiber in our diet, soluble and insoluble, with each playing a distinctive role.

Soluble fiber is in fruit, legumes, vegetables and oat bran. It is an absorbent, gel like substance, which helps slow down the movement of food through the upper intestine. This helps in the absorption of nutrients from the food, which passes through the upper intestine. Soluble fibers also assist with the regulation of blood glucose levels and help to lower blood cholesterol levels by removing fat-digesting bile acids from the intestine.

Insoluble fiber, found mostly in unrefined grains and cereals, adds bulk to the food matter passing through the lower intestine thus speeding up the food's passage through the gastrointestinal tract. Conversely, to soluble fiber, insoluble fibers speed up the movement of food through the lower intestine. This effect reduces the amount of time the lower intestine is exposed to certain toxins that might be present in the digested food. This reduces the risk for developing colon cancer and helps prevent constipation.

Protein

Protein, in the human body, is responsible for tissue repair and growth; it is used to make hormones, enzymes and hemoglobin and is an energy source in prolonged exercise. However, there are many misconceptions and unfounded claims regarding protein.

Athletes, especially weightlifters, require greater amounts of protein than sedentary people; they still do not need to load up on it excessively. Compared to carbohydrates, proteins make up approximately twenty to thirty percent of total daily caloric intake. On average, a weightlifter should consume about 2 grams per kilogram of bodyweight to support the amount of cell turnover and muscle repair associated with training.

The amount of protein a person can absorb in 1 hour will depend on muscle mass and cellular demand; but as a general rule it will not exceed 20-35g/hr. This limitation in the amount absorbed per hour makes meal timing and managing the composition of meals to ensure each meal contains protein critical to an athlete absorbing the necessary amino acids.

Good sources of protein include egg whites, lean beef, chicken, turkey, lean pork, fish, shellfish, soy and also beans.

Fats

Fat is a necessary part of the human diet. Fat is not only responsible for fuel but also for the absorption of fat-soluble vitamins A, D, E and K and essential fatty acids can only be obtained from dietary fat. In addition, fat is essential for protection of the organs and cell structure. However, only twenty to thirty percent of total calories should come from fat. Athletes should focus on consuming unsaturated fats from foods such as olive oil, nuts, seeds, avocado and fish as they promote good heart health and can enhance the immune system and reduce inflammation. Saturated fats are primarily found in foods like butters, cream and fast foods can increase inflammation in the muscle and can even increase ones risk for developing heart disease.

Nutrition Quality

Vitamins and Minerals

Vitamins are a group of naturally occurring nutrients found in foods that are required in the diet for the maintenance of health, metabolic functioning growth, recovery and athletic performance. Vitamins are necessary for health and essential in the diet because the body either does not produce them or does not produce them in adequate amounts. If one or more are lacking in the diet, metabolism is affected and symptoms may arise. They are also essential parts of the enzyme system. This means they are not nutrients in themselves but aid and facilitate other body functions. They are involved in the formation of red blood cells, the building of bones and protein metabolism. Some vitamins act as co-enzymes in the energy-releasing chemical reactions in metabolizing carbohydrates and fats. Vitamins however, are not direct sources of energy themselves. Vitamins are divisible in two groups: fat-soluble and water-soluble.

Fat-soluble vitamins are A, D, E, and K. They are soluble in lipid and organic solvents. This lipid solubility allows these vitamins to be stored in large amounts in the liver along with fat. Water-soluble vitamins include the B and C vitamins. The B vitamins act as co-enzymes and are involved in the metabolism of fat, protein and carbohydrates. C vitamins act as antioxidants and are best known for their ability to combat a cold.

Minerals are inorganic substances that are required by the body to function. While minerals are found throughout the body, they make up only four to six percent of it. Minerals are major components of body structures such as bone, muscle and skin. From an athletic point, minerals are just as important as vitamins however, athletes will not benefit from taking mega doses of minerals.

There is little, definitive scientific evidence from human studies that supplemental intakes of vitamins and minerals provide significant ergogenic actions above the Recommended Daily Allowance (RDA). However, inadequate intake of many essential nutrients can lead to impaired performance. Optimal intake of nutrients will not overcome deficits in training and consumption of excessive quantities of dietary supplements can be toxic and impair performance. If appropriate, athletes may seek a dietary evaluation from a health professional and food intake patterns can be adjusted if necessary to promote optimal health.

Supplements

Many athletes ask the question “Which supplement is right for me?” The answer to this question applies to each individual and depends on many other factors such as diet, volume and intensity of training, sleep, school or work schedule and family obligations, to name a few. There are however, general guidelines for supplement usage.

Supplements should only *supplement* a healthy diet. They should not compensate for nor take the place of a nutrition regimen. Supplements may prove helpful for athletes who may need more calories and nutrients, especially during a high volume or intensity phases. However, athletes should remember to be realistic and that there is no “miracle” supplement. Supplements can never take the place of a good nutrition regimen or will not make the athlete better physically.

When selecting a supplement for an athlete, it is critical to choose a product with the NSF certification to ensure safety and fair play. NSF certified products undergo third party testing to ensure they contain what the label states and that they are free of contamination by the 165 WADA banned substances including: Stimulants, Narcotics, Steroids, Diuretics, Beta-2-Agonists, Beta Blockers, Masking Agents and other substances.

More information on anti-doping efforts and education can be found at USADA.org or WADA-AMA.org.

Travel

When traveling, especially abroad, athletes must be aware of potential problems. One is dehydration. Spending several hours on a plane and traveling across time zones can affect the body negatively. If the athlete is trying to keep his bodyweight up, ample food and drink must be consumed to achieve this. Conversely, if the athlete is trying to lose or monitor bodyweight, he/she must be cautious not to lose too much. It is not uncommon to lose two kilograms of bodyweight on a transatlantic flight. Thus, athletes should be encouraged to pack food and supplements to maintain the consistency he/she has made a part of training. Snacks and sandwiches can easily be packed in carry-ons for fueling during the flight and items like canned tuna, peanut butter, oatmeal, rice packets and protein powders can be packed in a check bag so that the athlete can maintain a consistent routine leading into competition.

Another precaution one may take is for jetlag. Although one cannot prevent jetlag from occurring, there are steps one can take to minimize it. Upon arriving, athletes should try to acclimatize their bodies by adjusting to the current time of day. Athletes should try to eat at normal times. Taking a nap upon arrival should also be discouraged. This will only exacerbate jetlag. The athletes should try to stay awake until their normal bedtime and sleep until their normal wake times.

Chapter 6
LTAD – Long Term Athlete Development ADM (American Development Model)

The ADM utilizes long-term athlete development principles as its framework. LTAD principles can be used as a basis on which to make our existing systems and structures more consistent. Developed by internationally renowned coach educator Istvan Balyi, and adapted to ice hockey by USA Hockey. USA Swimming and USA Tennis quickly followed suit. The principles of LTAD are rooted in successful programs throughout the world. USA Weightlifting can also, greatly, benefit from the principles of both LTAD and the ADM.

This is a great opportunity to change the way we go about developing weightlifting potential. One of the first things that USA Hockey did when beginning this project was to look closely at the statistics related to player development – specifically the skill development time each player has when in both a practice setting and a game setting. When viewed from the perspective of how kids learn the number of repetitions of specific skills and situations that occur in practice versus a game, they quickly learned where players have a chance to develop the most: Practice.

USA Hockey:

Immediately they realized that they needed a change in culture and that this would not be easy. They spent a full year just talking about the ADM to their youth coaches. What they came up with was the *Play, Love Excel* Program.

"*So a model was created that valued practices and proper training above all else. This isn't to say that the ADM is about taking the fun out of hockey, quite the contrary. Practices can and should be fun, especially if the kids are all playing together and having a blast with a game that they love. The more they play it, the better chance that they'll love it. And when you combine a passion for the game with increased puck time, kids will start to excel at it. Play, love, excel. That's the ADM."*

As research was conducted in developing the ADM, it became apparent that critical areas in our system were neglecting kids at a very early age. As children mature, they each progress through the same development stages. And certain aspects of these stages must be addressed at the appropriate points along the development curve in order for our children to reach their genetic potential. Maximum development occurs through age-appropriate structure and content. Without developing skills and certain physical and mental attributes at the appropriate time, the long-term prospects of becoming a truly elite player diminish each day.

PLAY

Playing is where young athletes learn that weightlifting is, in its simplest form, *fun*. And if you can mix in age-appropriate training and practice with skills and athleticism introduction, kids will have even more fun. And to keep it fun, there should be a low priority placed on winning and losing and a high priority placed on just learning the skills and enjoying the activity.

LOVE

Once a young athlete learns *the how* of weightlifting and begins to develop skills and athleticism, weightlifting may start to take priority among other activities. Skills become more refined, their physical and mental makeup is stronger and the friendships they developed early on continue to grow. The sport become more important and weightlifting in general becomes a bigger part of their life.

EXCEL

Now that they play and love weightlifting, a higher premium is placed on excelling at it. Tougher competition and more of a focus on mastering skills play an increased role in their development. Weightlifting as a sport starts to take a larger priority over other activities. But, above all, it's still fun and the friendships that were forged at the beginning now grow into a support system for the adventure that lies ahead.

WHAT IS 10,000 Hours?

In LTAD you hear this statement a lot. "It takes 10,000 hours before you can accomplish the skill set."

Here is what the experts say about 10,000 hour

1. Early participation, but Late Specialization
2. Be patient, Don't Rush Development
4. *The only way to get 10,000 hours is to do other sports*
5. Quality of training not just quantity
6. As many activities as possible
7. 67% of the time should just be vigorous activity
8. Find time to *Just Play*

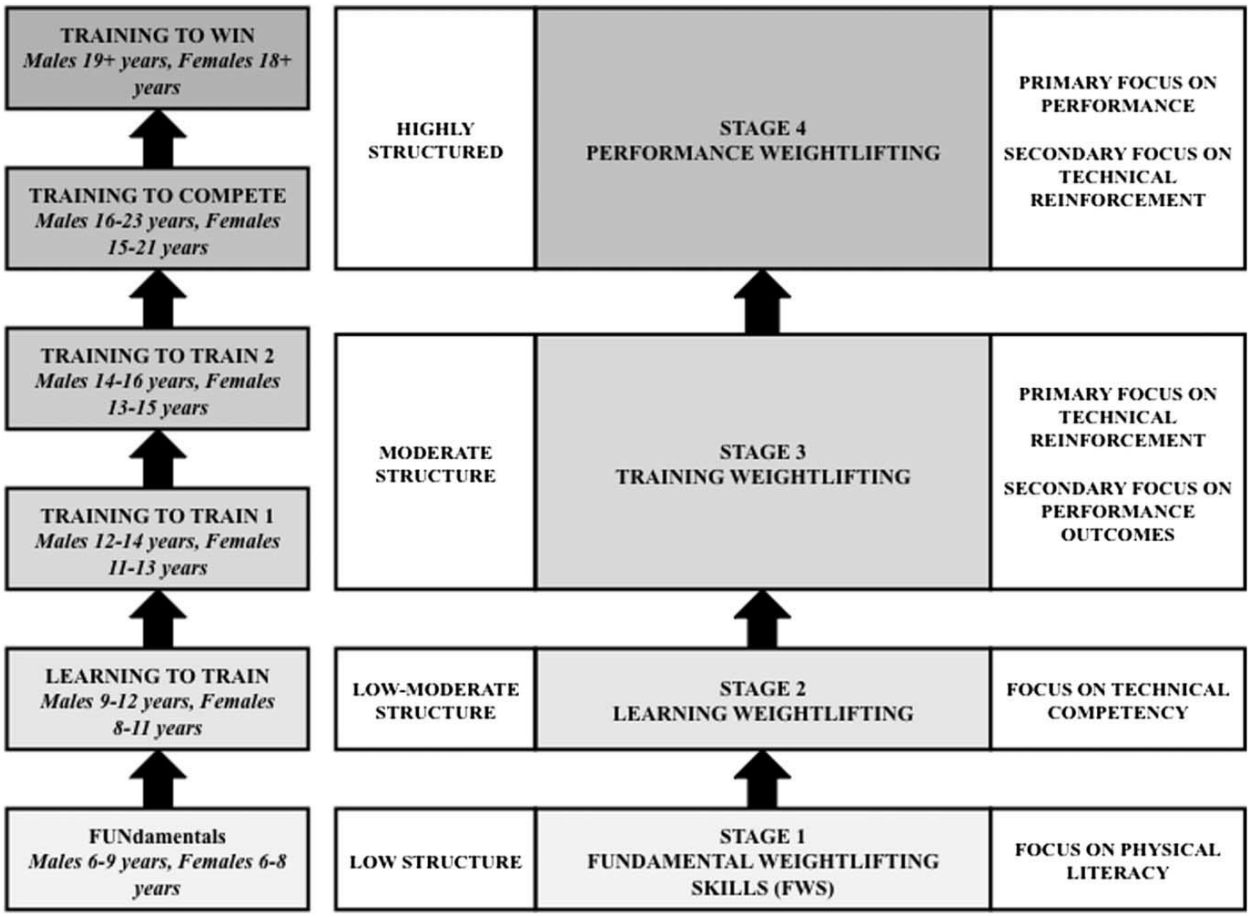
The American Developmental Model

i. *"It's not Sport, It's Culture"*
ii. Work Together to drive this model
iii. Some things are transitory
a. Mental Development

b. Emotional Development
c. ***Fun***damental Skills

iv. Age appropriate development is showing results
v. Do not get too organized

WHAT ARE THE STAGES OF DEVELOPMENT FOR AN AMERICAN WEIGHTLIFTER?



STAGE 1: FUNDAMENTAL WEIGHTLIFTING SKILLS (MALES 6–9 YEARS, FEMALES 6–8 YEARS)

This stage is relevant for children who demonstrate the emotional maturity to listen to and follow instructions. Emphasis within this stage should be placed on developing movement proficiency and fundamental weightlifting skills (FWS) within an environment that develops agility, balance, coordination, and kinaesthetic and spatial awareness. A recent review has highlighted the importance of FMS development for children and adolescents, and it is generally accepted that FMS mastery is important for physical, social, and cognitive development. It is suggested

that the strength and conditioning coach should not view every exercise within this stage as having to be specific to weightlifting. Conversely, for young children, learning to manage bodyweight through fun-based activities such as gymnastics, climbing, and crawling activities will all help condition the child for later technical specificity. In addition to developing general strength, strength endurance, metabolic conditioning, flexibility, and mobility should all be targeted within the young athlete's training program. With appropriate exercise selection, the strength and conditioning coach should be able to expose the child to such key movement competencies, such as lower limb triple extension, scapula stabilization, thoracic extension, and core strength development, in a relatively unstructured manner. Although the array of exercises appropriate for children at this stage is vast, Table 1 provides an overview of the possible exercises that can be integrated within a training program aiming to develop a range of key physical competencies linked to the weightlifting movements. It should be noted that although the table has been separated according to body parts for clarity, many of the exercises would place multiple demands upon the young athlete, thereby developing a broader range of physical literacy. Furthermore, training sessions within this phase should take a less structured approach, with the use of innovative games, to incorporate the desired movement patterns without the expense of a fun and motivating environment for the young athlete. It is possible to coach effectively and make significant progressions in posture and control even in such unstructured environments.

Table 1
Example of exercises to develop fundamental weightlifting skills

Upper limb		Trunk		Lower limb		Pre-weightlifting power development
Mobility	Stability	Mobility	Stability	Mobility	Stability	
Arm circles	Scapula push ups	Partner medicine ball rotations	"Deadbugs"	"Inch worms"	SL balances	CMJ and stick
Arm swings (multi-directional)	Bunny hops	Partner medicine ball "over and unders"	"Superman"	Spiderman crawls	Forward lunge	SL CMJ and stick
Wall slides and doorframe slides	Forward crawling	Sitting T-spine rotations	Partner/band squats	Under and overs cage walks	Reverse lunge to balance	CMJ for maximum height
Wide arm OH squat/lunge	Sideways crawling	Spiderman crawl with rotation	Crawling "Superman" balances	Arabesque	Lateral lunge	CMJ with shrug for maximum height
Y, T, W, L's	Backward crawling	Lunge with rotation	Partner/wall bracing	Super wide monster band walks	SL squat and reaches	Box jumps
Behind neck pressing	Mini-band hand slides	Foam roller supported side-lying extension-rotations	Medicine ball balance walks	Split squat	Multi-directional mini-band walks	OH medicine ball toss

CMJ = countermovement jumps; OH = overhead; SL = single leg.

STAGE 2: LEARNING WEIGHTLIFTING (MALES 9–12 YEARS, FEMALES 8–11 YEARS)

As the young athlete matures and approaches an age where more structure training is appropriate, the focus of training sessions can become more specific to weightlifting movements.

During this stage, the athlete should be introduced progressively to the different phases of each lift (Table 2), with technical competency serving as the primary goal at all times. Experience shows that, children naturally learn quickly during this stage and can develop these skills at a fast rate; however, ***it must be stressed that the coach should not treat young athletes like miniature adults*** and should not progress the child to lift heavier external loads at the expense of Technical proficiency, thus increasing the injury potential for the child.

Table 2
Suggested top-down progression model for weightlifting exercises (appropriate for Learning Weightlifting, Training Weightlifting and Performance Weightlifting)

Snatch	Clean	Jerk
Behind neck press	Front squat	Military press
Overhead squat	Vertical jump and landing mechanics	Push press
Overhead squat behind neck press	Drop clean	Push jerk
Vertical jump and landing mechanics	Power position-jump shrug	Overhead split squat
Drop snatch	Power position-second pull	Split jerk footwork line drill
Power position-jump shrug	Hang high clean pull	Split jerk footwork line drill with dowel
Power position-second pull	Hang clean[a]	Split jerk
Hang high snatch pull	First pull	Clean and jerk
Hang snatch[a]	Clean from below knee[b]	
First pull	Clean from low block	
Snatch from below knee[b]	Clean from floor	
Snatch from low block		
Snatch from floor		

[a]Stage at which the "transition" phase is introduced to the individual.

[b]Stage at which the double knee bend is introduced to the individual.

STAGE 3; TRAINING WEIGHTLIFTING (MALES 12-16 YEARS, FEMALES 11-15 YEARS)

The training weightlifting stage is the developmental stage, whereby coaches must pay attention to growth and maturational processes. During this stage it is expected that young athletes will experience rapid growth in limb lengths which may cause discomfort and a momentary loss of motor coordination. It is imperative that coaches monitor growth rates and be sensitive to sudden changes in technique. During this phase coaches must be keenly aware of accelerated growth in terms of both height and weight and adjust the training between technical competency and external loading. The focus, however, is always on the safety of the athlete and their personal development. Finally Coaches should be aware to minimize the potential for long-term dysfunction by coaching the athlete and not be misled by the rapid progress that a young athlete my show in this age group.

STAGE 4; PERFORMANCE WEIGHTLIFTING (MALES 16+ YEARS, FEMALES 15+ YEARS)

The final stage represents the time whereby young athletes can be exposed more too advanced training program design. While earlier stages focused more on technique it should be noted that a periodized plan should still be followed.
Video analysis should be employed to assure that proper fundamentals are be maintained

Table 3
Suggested guidelines for training session prescription

Training variable	Fundamental weightlifting skills[a]	Learning weightlifting	Training weightlifting	Performance weightlifting
Suggested age ranges (y)	Males: 6–9, Females: 6–8	Males: 9–12, Females: 8–11	Males: 12–16, Females: 11–15	Males: 16+, Females: 15+
Volume (total repetitions[b])	36–24	30–24	24–15	18–6
Total number of exercises per session	6–10	3–6	3–6	2–5
Intensity (%1RM)	Body weight	30–50	50–85	85–100
Repetition velocity (speed of movement)	Moderate–fast	Moderate–fast	Fast–maximal	Maximal
Frequency (sessions per week)	1–2	1–2	2–4	2–5
Recovery (hours in between sessions)	72	72–48	48	48–24

[a]The values for FWS do not necessarily equate to designated weightlifting progressions, but rather broad-ranging exercises to develop physical literacy.

[b]The total number of repetitions can be divided between different configurations of sets and repetitions based on the goal of the training session, and phase of the periodized plan.

When designing programs for young weightlifters the variables of intensity, volume and frequency and recovery must be constantly reviewed to ensure optimal development and minimize the potential risk of injury. Table three has the parameters to be considered as guidelines.

Development of General Physical Qualities
Following are five general physical qualities, which help in the development of all athletes. Understanding and applying these qualities are vital in the growth of a weightlifter.

1. *Speed-Strength*: In weightlifting, speed-strength is a basic physical quality. According to Dvorkin (1992), the development of speed-strength is extremely important, from the very beginning in weightlifting training. Because the qualities of weightlifting deal with maximum power output against heavy loads, it is associated with high power or a high rate of doing work (Siff, 1998). The resulting quantity is what distinguishes speed-strength activities from all other types of sport: a very high power output compared with other activities, which are longer in duration and have lower intensities (Siff, 1998). Finally, Verkhoshansky (1988) writes that a systematic sports training regimen contributes to the formation of a high correlation between strength and the rate of muscle contraction and absolute strength is the primary factor in determining the speed of movement.

   Young athletes can begin training these qualities as early as the ages of seven and nine. Because the neuromuscular system is most malleable between these ages, working it will reflect success in later years (Balyi, 2000). Activities high in speed-

strength qualities are sprinting, vertical and horizontal jumps, especially triple jump, sports games emphasizing spring, jumping, throwing and change of direction, and basic barbell exercises, using 30-60% of a 1 repetition maximum, like squatting, snatching and clean & jerks. All weightlifters can benefit from this type of initial training.

2. *Flexibility and Mobility*: Outside of physical limitations, factors such as age, gender, body type, laterality and training all influence flexibility. Flexibility and a regimented stretching program are grossly overlooked in the development of the athlete. According to Adler (1996), small children are quite supple during the school years then flexibility decreases until about puberty, and then will increase throughout adolescence. After adolescence, flexibility tends to level off and then begins to decrease. However, for athletes who maintain a regimented flexibility routine throughout their training, it appears decreases in flexibility are minimized (Adler, 1996). Superior flexibility in weightlifting will be advantageous to the lifter due to the positions of the competition lifts. It will assist with dexterity, coordination and confidence in the low receiving positions. Exercises that will help with flexibility are dynamic range of motion exercises, yoga, gymnastics or tumbling type movements and mandatory warm up and cool down periods.

3. *Kinesthetic Awareness and Agility Qualities*: The ability to understand where one's body is in space depends largely on proprioceptors in the muscles, connective tissues and joints to integrate this information from these areas with the senses of balance and touch (Siff, 1998). Agility or dexterity is the ease with which an athlete performs a given task (Drabik, 1996). The relationship of both these qualities are extremely important in sports such as gymnastics, diving, tumbling and weightlifting. The athlete's ability to quickly assimilate motor habits, perfect them, and quickly apply them is a quality all elite athletes seem to possess. Many of these superior athletes begin to perfect these qualities at a very young age when the nervous system is impressionable and adaptable. Team games, obstacle courses, movement drills such as carioca, side shuffling and bounding, twisting, turning and tumbling movements and balance activities will assist the young athlete in perfecting kinesthetic awareness and agility.

4. *General Strength*: Categorizations of three different, specific types of strength training are maximal strength, power and strength-endurance. Some authors have further divided power into reactive ability, explosive strength, strength-speed and speed-strength. Although several of these have their place in weightlifting training and have even been discussed previously in this manual, this section will concentrate on the three main types of strength training methods below.

    - *Relative Strength*: One definition of relative strength is the amount of strength per unit of body mass. Relative strength is important in sports where there are weight categories like wrestling, judo and weightlifting. It pits athletes of approximately

the same bodyweight against each other. Relative strength is also important in sports such as gymnastics or sports, which use similar apparatus. Athletes who excel in bodyweight to mass ratios, or who are good at bodyweight exercises, have good relative strength. They have a good base of strength development and are very efficient in their movements. On the other hand, these exercises may rely on strength per kilogram but they are not special in improving it. An example of how to increase relative strength are with bodyweight exercises such as single leg squats or lunges, dips, kips, pull-ups, push-ups, handstands and rope climbing. These exercises lay the foundation for future success.

- *Hypertrophy/Work Capacity*: The sub-maximal resistance method, or hypertrophy, focuses on increasing muscle fiber diameter. This type of training uses intensities in the range of 60-80% of 1RM. Because the focus of weightlifters is performance, hypertrophy is merely a by-product of training, and not the main focus. Hypertrophy training however, should not be totally disregarded, as this type of training may be appropriate at certain times during the training cycle. Dvorkin (1992) states that increases in muscle fiber diameter lead to higher results in the total. In addition, higher percentages of muscle mass lead to positive metabolic changes.

Work capacity training is also valuable in a developing athlete's program. Circuit training methods provide an excellent starting point for many beginning athletes as well as those returning from injury or layoff. Circuit training, with an emphasis on strength development and utilizing different means of resistance, can provide a solid base program. One may include medicine balls, dumbbells, barbells, bodyweight exercises and a special emphasis on the core of the body.

- *Core Strength and Stability*: Core strength and stability is integral in all sports. Both must increase simultaneously with general strength development. Emphasis should be on performing a full range of motion to promote joint mobility and muscular flexibility. Weightlifting movements, such as the snatch and clean, develop core strength while other exercises may enhance core strength.

It is also a necessity to focus on the stability of the stomach and back versus over emphasizing abdominal flexion. Failure to give attention to core stability gives way to limited force production and an increased chance of injury. When increasing loads with athletes, muscular strength increases faster than passive tissue and vertebral discs take even longer to adapt to increasing loads (Grieves, 1986).
Before progressing young athletes, they should achieve certain core strength and stability levels before loading to assist in the prevention of injuries. Coaches can test athletes with general core strength tests, which have established norms.

Athletes can increase strength and stability with gross dynamic body movements with medicine balls, on the floor and from wall bars

Static holding exercises in the prone, supine and lateral positions in addition to addressing all aspects of the system; anterior, posterior and transverse (Gattone, 2002).

5. *Body Composition and Fitness*: From the beginning, it is essential coaches teach their athletes the importance of nutrition and fitness. Weightlifting is a demanding sport and neglecting either of these issues may lead to poor training, performance or injury. Regardless of weight category, fat does not contract! Below are five suggested training parameters for anaerobic endurance (Bompa, 1994).

    - *Intensity*: Typically measured as a percentage of the athlete's one repetition maximum. May range from sub-maximal to maximal. Typically, though, a training program employs a variation of intensities with the emphasis towards higher percentages.

    - *Duration*: In weightlifting training, work time is usually between 5-60 seconds.

    - *Rest Interval*: Following an activity, which was very high intensity, the rest interval must be long enough to replenish the oxygen debt. Because the interval of recuperation is a function of the intensity and duration of work, it may be within the limits of 2-10 minutes.

    - *Activity During Rest*: Activity must be minimal and relaxing. Athletes should focus on preparing themselves for the next set.

    - *Number of Repetitions*: Throughout most of the training program, the majority of repetitions will be in the 2-6 range. However, during preparation periods, the repetitions may be between 5-10.

    Activities that will aid in fitness levels include medicine ball circuits, tempo runs or sprinting, bodyweight circuits and sports games. Also, exercises that use large muscle groups emphasizing higher repetitions with controlled rest periods. Training within these parameters will help ensure body composition and fitness levels.

Pre-hab/Rehab: Addressing Specific Physical Issues

Before beginning any type of physical activity or regimented program, the athlete should acquire a pre-participation screen or a physical from a physician. Then, after sharing these results with the coach, the coach can administer an assessment. The assessment should include the needs or characteristics of the sport. Following the assessment, the coach can then determine an appropriate program. Newton (2002) suggest steps to include in program design are:

- Determine key performance characteristics (needs analysis)
- Conduct testing
- Design a training program

- Implement the program
- Follow-up assessments, which will lead to a re-design of the program

This will give the coach an opportunity to identify potential problems through evaluation and history *before* problems occur. This is especially true with joints, structures and soft tissue in critical areas like the wrists, shoulders, back/core and knees.

In addition to a needs analysis, the program should also consider the individual athlete. Individualization refers to the fact that each athlete, based on several factors, will respond differently to any given training program. The coach must consider each athlete at the individual level and make appropriate adjustments. When designing training programs the coach must consider several factors that will affect one's individual capacity for training. These factors include:

- Age (chronological and biological), body composition and bodyweight
- Training history: How long has this individual been training, in terms of weeks, months or years of training? The previous experience should dictate the amount of work.
- Individual differences in work capacity: Individuals capable of similar performance will have differences in ability to perform work
- The ability to recover from training: Many factors outside of training affect the rate of recovery such as stresses from work, school or social environment

Medvedyev (1965) adds a unified, rational (generic) distribution of training is recommended only for novices. The means for qualified athletes should only be planned *individually*. What are some of the tools necessary to construct an individualized, comprehensive training program?

1. Postural/Structural: General spinal observation, Adams Test and a press-up test.
2. Flexibility/Mobility: Hamstring, quadriceps, low back, shoulders, wrists, Achilles and gastrocnemius. Functional mobility tests include squatting, lunging, overhead squatting and pressing and a comfortable "rack" position.
3. Stability: A support (eyes closed) or bridge, side support, prone support and a static back extension.
4. Muscular imbalances: One and two leg vertical and horizontal jumps and single leg squats
5. Weightlifting ratios off one repetition maximums:
    - Snatch approximately 65% +/- 2% of squat and
    - Clean & jerk approximately 80% +/- 2% of squat
    - Decide on the percent of strength work vs. percent of technique work
    - Decide on the percent of snatch work vs. percent of clean & jerk work
6. Technical analysis: Identify and work on poor or technically incorrect or inefficient portions of the lifts.

Once the coach addresses these issues, a comprehensive and effective program is implemented. The program, however, should not end there. There should be constant revisions and changes to accommodate new issues. After an injury, an aggressive rehabilitation regime must be incorporated. Following rehab, the coach should make sure the athlete continues to address the

injury. Although the pain is gone, the dysfunction may persist. Consequently, by being proactive, the chance of recurrence will decrease.

Sport Specificity Training

Increasing the advancing lifter's capacity for work through weightlifting specific training is integral but only after the proper foundation is in place. This foundation is created by general physical preparation. The main objective of sport specific training (SST) is to further the athlete's physical development in regards to the physiological and methodical characteristics of the sport (Bompa, 1994). When athletes reach these higher levels of training, a higher level of physiological specialization is also predominant (Bompa, 1994). Yakovlev (1967) claims that an organism, which was previously fortified and strengthened would develop to high physiological levels more readily. Consequently, the improvement of specific endurance may be enhanced if training programs to achieve such capacity are preceded by the development of general endurance (Bompa, 1994).

Dr. Mike Stone, Director of Exercise and Sports Science at Eastern Tennessee State University and noted Sports Scientist states "...Weightlifters typically reflect measures of cardio respiratory (heart and lungs) fitness, which are superior to average values and suggest beneficial adaptations have taken place." He goes on, "...Evidence does exist suggesting that training to improve aerobic power/endurance using typical methods such as jogging will compromise maximum strength and power thus reducing weightlifting performance. Training to enhance endurance and recovery capabilities (as well as strength and speed) for weightlifting should be performed in as specific manner. A program of interval training or high volume weightlifting can increase endurance capabilities with little or no compromise in strength and power, compared to a typical aerobic endurance program."

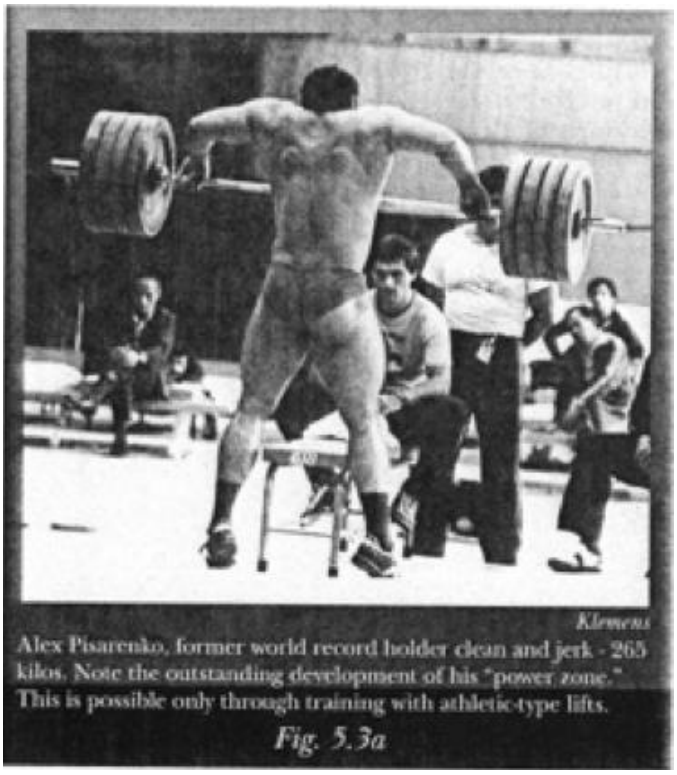
During SST, the amount of GPP is approximately 30-40%, according to the performance triangle in figure 6.2. This means that most of the training will be on the classical lifts and their derivatives, squatting, pulling and specific overhead work. If the lifter has made the commitment to the sport, the coach can introduce two a day training sessions. This type of training entails higher volumes of training and lower intensities. If the coach does not make these adjustments, the lifter risks the chance of overreaching or over training leading to poor training and competitions performance.

In conclusion, a comprehensive, well-planned training program has many influences. However, it is apparent, that a solid foundation of strength, general development and coordination are the cornerstones to future success. The coach must have patience and nurture his athletes from novice to elite levels. With this regimen in place, the chance of a long and prosperous weightlifting career is apparent.

Chapter 7
Theory of Athletic Power Production

-Newton's laws of motion as applied to lifting
-Understanding power capacity
-Comparing Power Values: olympic style lifting vs powerlifting
-Power Production: athletic-type lifting vs machines

Power- Power-Power! This is the name of the game in today's world of highly charged athletic competition. Powerful athletes are the ones who have the greatest impact on their sports. When discussing athletic power what does the term mean? How is it defined? Here, in this chapter, you will see that the concept of athletic-type power does not mean the ability to lift heavy weights, but rather the ability to apply force throughout a full range of body-joint movement with speed for maximum time and/or distance. Athletic power production involves torso kinetic energy, torso rotational energy, and stored kinetic energy. And it is the combined interaction of these elements that exert the greatest influence on shifting the force-velocity power curve to the right (Fig. 5.2b). The concept of athletic power production will be illustrated by comparing the power generated during execution of a deadliest versus an olympic style clean.



Klemens
Alex Pisarenko, former world record holder clean and jerk - 265 kilos. Note the outstanding development of his "power zone." This is possible only through training with athletic-type lifts.
Fig. 5.3a

In this chapter we also look at the individual roles plyometrics and mental imagery can play in the generation of power. The chapter concludes with an evaluation of machine training and how it fails from a scientific standpoint to qualify as legitimate form of athletic power training. As illustrated in Fig. 5.0, only athletic-type lifting (snatches, cleans, pulls, and squats) has the capacity to effectively train your body's power zone (Fig. 5.3a and 5.3b) A highly developed power zone offers the greatest opportunity for the transfer of weight trained power to your sport.

The primary purpose of athletic-type strength training is to increase maximum kinetic energy and increase maximum acceleration and speed through a full range of multi-joint movement.

Muscle Force

Strength may be defined as the ability of the muscles to contract and exert force. **Force** is the effect one body has upon another. A weight can be lifted only when force has been applied; however, it is possible to have force without motion, as in functional isometric lifting. Force does not affect motion when its result is zero (as in isometric lifting) though the effects can be seen and measured in terms of magnitude, direction, and point of application.

In power snatching and power cleaning, for example, we are mainly concerned with the use of force for changing the **state of motion** and the bar and weights. Internally, the lifter obtains his/her force through muscle contraction. The magnitude of muscle force generated is in direct proportion to (1) the size and the number of fibers contracting and (2) the speed at which active fibers are forced to lengthen (eccentric contraction), which involves the elements of **stretch reflex facilitation** and **stored kinetic energy**. *Force is inversely proportional to the speed with which fibers shorten* (concentric contraction). This means the heavier the weight to be lifted, the greater the required muscle force and the slower the fibers contract. Likewise, the lighter the weight, the less force required and the faster the fibers contract. This relationship is illustrated by the force-velocity curve (Fig. 5.1). Its implications for training are discussed shortly.

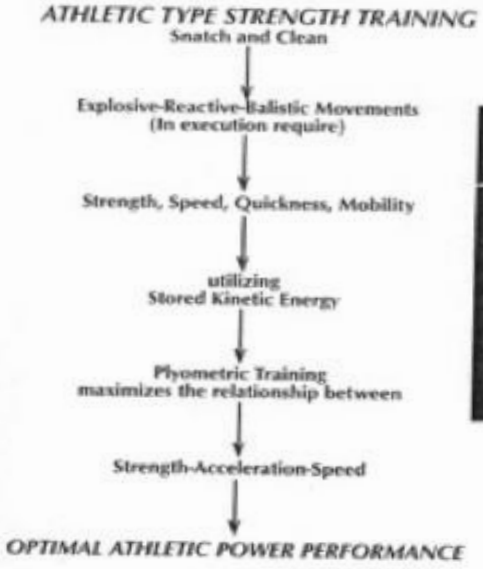


Fig. 5.0

Joe Puleo former National Champion 82 kilo class.

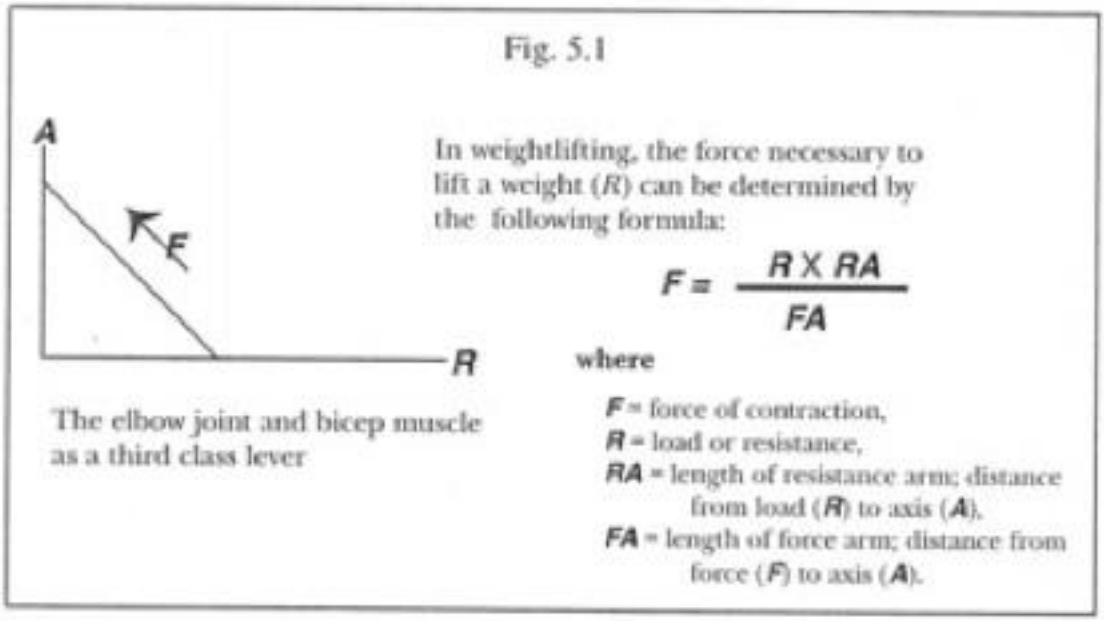
Phil Grippaldi former National Champion 90 kilo class.

Force and Motion

Newton's laws of motion. The whole science of force is based upon three fundamental laws known as Newton's laws of motion. Simply stated they are:

1. Every body continues in its state of rest or uniform motion in a straight line except insofar as it is compelled by force to change that state.

Newton's first law is known as the **law of inertia** (inertia is Latin for idleness). In simple terms, the law of inertia says that everything in the universe is at rest. Force is necessary to initiate motion; and once something is in motion, further force must be applied to slow, stop, speed up, or change direction.



Thus, to get a weight moving (as in power cleaning) you must first overcome its inertia and then keep the weight moving until the lift is completed. Overcoming inertia when lifting maximum to near maximum weight requires the generation of a strong ballistic impulse, which involves self-arousal (i.e., thinking strength and thinking speed). This relates back to the neuropsychological factors of strength performance.

2. The acceleration of a body is proportional to the force causing it.

In effect, Newton's second law says that a greater force is required to reach a certain speed in a given time if one starts from a stationary position than if one is already in motion. Applied to power snatching or cleaning, the acceleration and speed of the bar during the second pull will be dependent upon the magnitude and direction of the first pull. Thus, the first pull must be strong and as fast as body leverage permits.

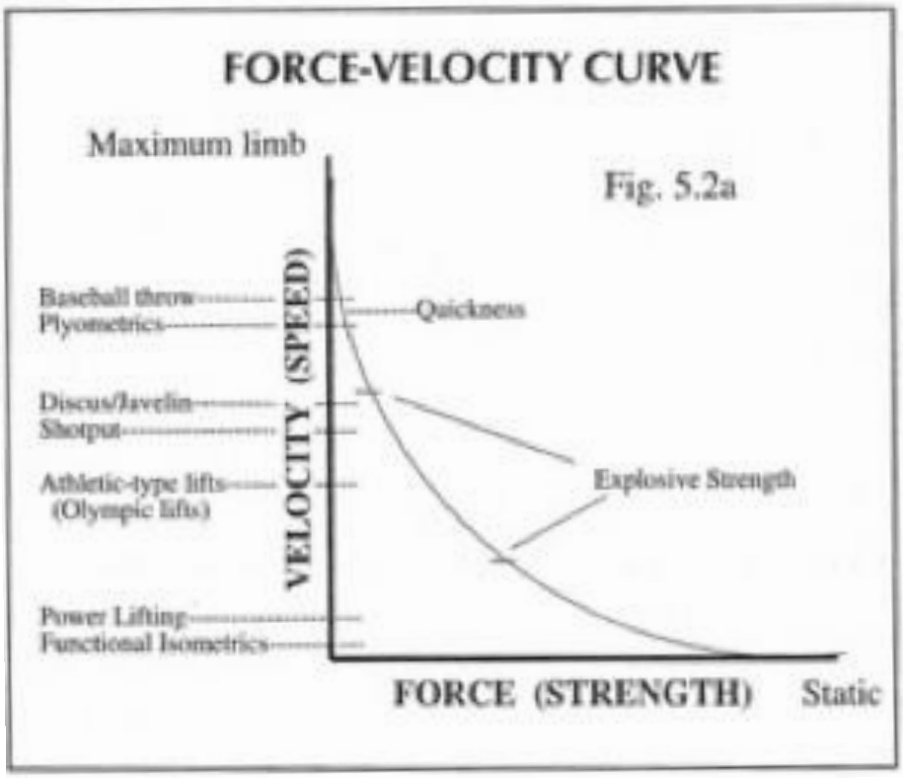
3. For every action there is an equal and opposite reaction.

The effect of force upon one body is known as the action and that upon the other the reaction. For example, in executing a power clean, the lifter applies a ballistic force to the bar to

overcome inertia and lift the weight from the floor (the action) and, at the same time, pushes against the floor with a force equal to that which moves the bar upward (the reaction). To generate a powerful action and reaction requires strong kinetic movement force from the hips, thighs, and lower back.

Lever system. Related to Newton's laws of motion and their application to weightlifting are the principles relating to **levers** both within the body and outside.

While the force of muscle contraction is dependent upon fast-twitch motor unit recruitment capabilities and muscle mass, the actual load lifted by the lifter depends on the leverage system of the skeleton. In weightlifting, a difference exists in the force a muscle is able to generate within itself and the force acting through a lever-age system. For instance, in power snatching or cleaning, poor technique or poor anatomical structure would prevent a lifter from assuming a body position which provides maximum pulling leverage and hence reduce the effectiveness of the generated muscle force.



The human body acts predominately through third-class levers such as the elbow joint. Three factors present in a lever system are **R** (the load of resistance), **F** (the muscle force), and **A** (the axis) (Fig. 5.1).

Expression of Power

Understanding power capacity and how it can be created is one of the keys to optimizing athletic performance. Power should not be confused with strength. *Power is the capacity to do a given amount of work as rapidly as possible.* By this definition, power includes the elements of strength and speed. It is dynamic strength coupled with movement speed. *Speed is the ability to apply force rapidly* (e.g., when cleaning, jumping, throwing, sprinting).

A powerful athlete has explosive strength, exceptional acceleration, and speed.

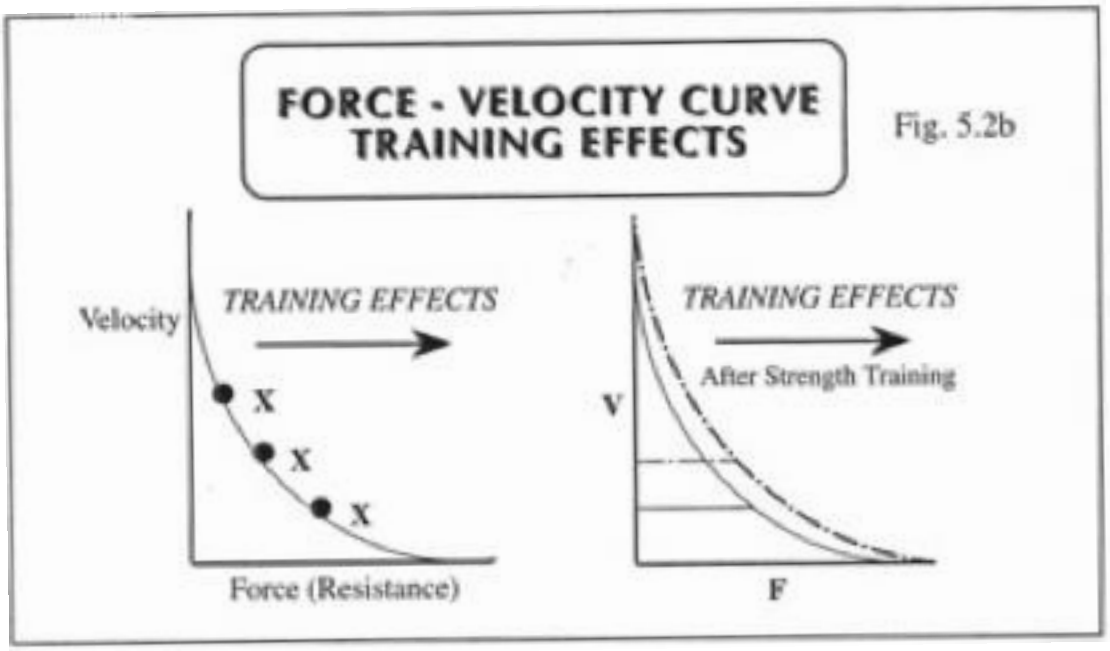
Acceleration. One of the major advantages of being physically powerful is the ability to accelerate. An athlete who is powerful can get up to full speed faster than an athlete who is just strong.

Being able to accelerate is not the same as simply being fast. *Acceleration refers to the ability to change velocity quickly.* Velocity is speed in a given direction. For instance, in cleaning a weight, the velocity of the bar is equal to its speed and the upward direction it is moving. Later in this chapter, we will take an in-depth look at speed and acceleration.

Force-Velocity Curve

O*ne of the purposes of athletic-type Wang, if not the main one, is to train and condition an athlete to generate maximum muscular force at higher and higher movement speed.* In competitive athletics, when all other factors are equal, power is the deciding factor between winning and losing.

Strength times speed equals power. The working relationship between strength and speed is illustrated by the force-velocity curve, also known as the **power-velocity curve** (Fig. 5.2a). To become a power athlete, your training must focus on shifting the middle portion of the curve to the right by either increasing strength or speed, or both (Fig. 5.2b). Let's look at how this can be accomplished.



Muscle power. Power as defined as *the rate at which work is done* is represented by the formula:

P= F x D/ t

where P is equal to Power
F is equal to force (strength)
D is equal to distance
t is equal to time

Since velocity (V) is equal to D/t, then
P= F x V

This suggests four ways to increase power through training, each of which will result in a shift of the force-velocity curve. To increase power, you can:

1) Increase strength through athletic-type lifting, powerlifting, and functional isometrics, keeping distance and time constant.

↑P =↑F x D/t = ↑F x V

2) Increase speed (decreased movement time) through acceleration, speed, and jump drills, keeping force and distance constant. Example: repetition dead hang snatches and cleans using 70-80 percent of the 1-RM, along with jump drill, develops quickness and movement speed.

↑P = F x D/↓t = F x ↑V

3) Increase power production by combining 1 and 2. To generate maximum or near maximum power output, perform snatches, cleans, and squats of high velocity, using as heavy a load as possible (90% or greater of the 1-RM), along with jump and speed drills. A bonding between mental and physical processes related to strength and speed work must occur in order to produce maximum power.

↑P = ↑F x D/↓t = ↑F x ↑V

4) Increase distance that a force acts on a body or object through technical drills, and keep force and time constant. Examples: increased power is reflected in one's ability to apply pulling force to the bar through a full range of movement in snatching or cleaning, or to apply force to a shot or discus through a full range of movement.

↑P = F x ↑D/t = F x ↑V

In any given time frame, the more work that is done, the greater the power output. As you will shortly see, power-oriented athletic-type lifting is necessary to develop the ability to produce maximum power output.

Power values. In metric terms, power is defined as work per unit of time measured by **watts (1 W = 6.12 kp m/min and 1 kp = 9.80665 N)**. Power values for strength athletes are best expressed in watts of power per kilogram of body mass (watts/kg body mass). The International System of Units (SI) for mass and weight are the *kilogram (kg)* and the *newton (N)*, respectively (1 kg 9.80665 N and I N = 0.101972 Kp).

It is common to use the terms "mass" and "weight" interchangeably, especially in making reference to an athlete's body mass in kilograms as a measure of weight. In strict terms, this is not proper use of the term "weight." The weight of an object is equal to its mass multiplied by the acceleration due to gravity, thus

O'Shea

Kenady (deadlift):
140 kg (body mass)
405 kg (mass lifted)
.40 m (height of pull)
2 sec. (time to execute lift)

Work = Force X Distance
where:
Mass = Mass lifted
Distance = Height of pull
Gravity = 9.8 m/s²
Work = (405 kg) (9.8 m/s²) (.40 m)
Work = 1587.6 (N • m)

Power = Work/Time to execute lift
Power = 1587.6 (N • m)/2 sec
Power = 793.8 (N • m)/s or watts

793.8 watts/140 kg = 5.67 watts/kg body mass

Klemens

Pisarenko (clean):
120 kg (body mass)
265 kg (mass lifted)
.90 m (height of pull)
.90 sec. (time)

Work = Force X Distance
where:
Mass = Mass lifted
Distance = Height of pull
Gravity = 9.8 m/s²
Work = (265 kg) (9.8 m/s²) (.90 m)
Work = 2337.3 (N • m)

Power = Work/Time to execute lift
Power = 2337.3 (N • m)/.9 sec
Power = 2597 (N • m)/s or watts

2597 watts/120 kg = 21.64 watts/kg body mass

W=mg

where W is weight, m is mass, and g is the acceleration due to gravity (9.80665 m/s^2). Example: An athlete with a body mass of 80 kg would have a body weight of 784.5 N (80 kg x 9.8 m/s^2).

Power lifting vs. olympic-style lifting

In the sport of powerlifting the squat, bench press, and deadlift have been designated as the power lifts. This is technically incorrect and misleading; for as you will soon see they are not true power lifts. Only the olympic-style lifts (snatch and clean) rightfully qualify. In powerlifting, muscle force is required, but ', as measured in **watts per kilogram of body weight**, is low in comparison to that generated in olympic-style lifting. This is easily illustrated by comparing the **power values** for world record lifts made by two former world champions, powerlifter Doyle Kenady (USA) and olympic-style lifter Alex Pisarenko (Russia).

Power values: powerlifter vs. olympic lifter. Kenady, at a body weight of 140 kg, executed a 405 kg deadlift. Approximately 2 seconds was required for him to lift the bar/ weight .40 meters off the floor and stand erect. Pisarenko, at a body weight of 120 kg, executed a 265 kg clean. It took him .90 seconds to squat clean the weight and stand up. The bar/weight traveled .90 meters from the floor to the chest. Calculations of the power values for each lift are as follows.

In comparing the power values of the world record lifts made by these two former champion lifters, we see that Pisarenko's 265 kg clean produced 21.64 watts/kg body weight and Kenady's 405 kg deadliest produced 5.67 wattskg body weight. As this example shows, the so-called power lifts are actually strength lifts. Convesely, the snatch and clean are true **high velocity power lifts**; they have the greatest capacity to shift the force-velocity curve to the right.

Peak power values for world class olympic lifters in lighter classes average about 30 watts/kg body weight. This means that lighter lifters have a much higher strength-to-body weight ratio, compared to heavier lifters. Kilo for kilo they are stronger athletes.

Comparative Anatomy of Elite Weightlifters (Olympic lifters and Powerlifters)

Both groups of athletes are predominately mesomorphs and they train for widely different purposes. The difference in training focus determines the difference in their appearance. Both are genetically endowed with fast twitch muscle fibers, which is the main reason they are elite strength athletes. Fast twitch fibers are known for their ability to contract with greater speed and generate force than slow twitch fibers, Olympic lifter's fast twitch fibers are utilized for explosive lifting. Powerlifters need fast twitch fibers to generate the force necessary for lifting heavy loads.

Olympic lifter

Elite Powerlifters

-Large muscle development in thighs, buttocks, lower back, chest, anterior deltoids & triceps
-Broad shoulder girdle structure
-Wide hip structure
-Short torso in relation to leg length
-Generally large joints, especially knees
-Longer arms than normal, which is an advantage in deadlifting
-Specialists in generating high muscular force as required for maximum heavy lifting

Elite Olympic lifters
-Large trapezius muscles, triceps, quadriceps, and erectors spina
-Long torso in relation to leg length
-Hyperextensive elbows (or slightly hyperextensive)
-Flexible wrist, shoulders, hips, knees & ankle joints
-Longer arms than normal, which is an advantage in snatching
-Specialists in performing explosive-reactive-ballistic lifting movements.

Principles of Power Production

ATHLETIC POWER PRODUCTION
involves:
Torso Kinetic Energy
Torso Rotation Energy
Stored Kinetic Energy

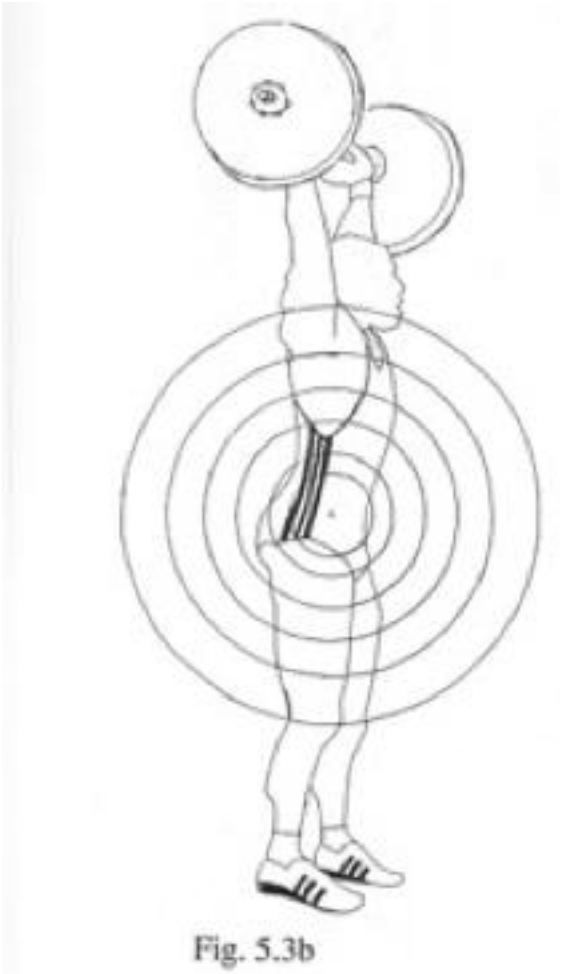


Fig. 5.3b

Kinetic energy is the energy of motion and is related to both the mass of the body and velocity. (momentum = MV). **Torso kinetic energy** is the movement which can be generated with athletic-type lifts that produce **torso rotational energy**, allowing you to exert force in multiple directions. Torso rotational energy is the energy that comes from a body segment. It involves large muscle groups generating great force through and around the center of mass (body's power zone) (Fig. 5.3). For example, bending the hip joint when jumping, squatting, or cleaning, the hip joint creates a high torque, or movement force situation.

Stored kinetic energy, also referred to as **stored elastic energy**, applies to all movement involving eccentric forces. When a muscle contracts eccentrically under external force, it stretches and stores (absorbs) energy. Subsequently, stored energy is added to the muscle force generated during concentric contraction as both are converted to kinetic energy of motion.

Application of the concept of stored kinetic energy is the key to maximum high power output during athletic-type lifting and all other activities requiring high instantaneous power (e.g., gymnastics, shot, discus, jumping, striking, football line play).

Analysis of the squat movement illustrates the role stored kinetic energy plays in high power production (Fig. 5.4). In the execution of a squat, during the **flexion** phase (descent), energy generated from eccentric hip and quadricep contraction and stretch reflex contraction, in resisting gravitational force, is stored as kinetic energy. On the **squat recoil** (extension), the lifter utilizes

stored kinetic energy to generate greater quadricep force, and greater hip and torso rotational energy to accelerate and power out of the bottom position.

The Body's "Power Zone"
Concentric circles radiate out from the body's largest and strongest muscle groups to the smaller weaker groups.

Tendon Power

Tendon strength is a critical component of explosive high power movement.

In performing instantaneous high power movements, tendons in conjunction with muscles play an important role. Like muscle fibers, tendons have the functional capacity to store elastic energy. In the stretch-shortening cycle, where the working muscle stretches and stores potential energy while contracting eccentrically, the muscle tendon is stretched and stores energy. The combined energy is then released for forceful concentric contraction as required for performance of high velocity power movements. One of the advantages of having tendons store energy is that there is less stress imposed upon the muscles while executing high velocity movements.

Tendon and force. The amount of energy that a tendon will store is dependent upon the force that is applied together with its length change, which can be represented by

$$W_t = SF_t\, dl_t$$

where

W_t is the work performed on the tendon by stretching it;
F_t is the force by which the tendon is stretched; and
dl_t is the length change of the tendon.

The larger the force (W_t) applied to the tendon, the greater the stretch of the tendon. And the greater the stretch, the greater the amount of potential energy stored and available for generating maximum concentric force. For the execution of instantaneous high power movements, stored energy must be released quickly. For quick energy release requires a rapid switch from eccentric to concentric movement, such as is required in the execution of a heavy clean or squat (Fig. 5.4).

Implications for training. Developing **high velocity explosive power capacity** for athletics demands power-oriented weight training. The power snatch, power clean, and a variety of high pulling movements train and condition the body to generate **maximum torso kinetic energy** through a **full range of multi-joint movement**. That is what athletic-type strength training is all about—developing high velocity power.

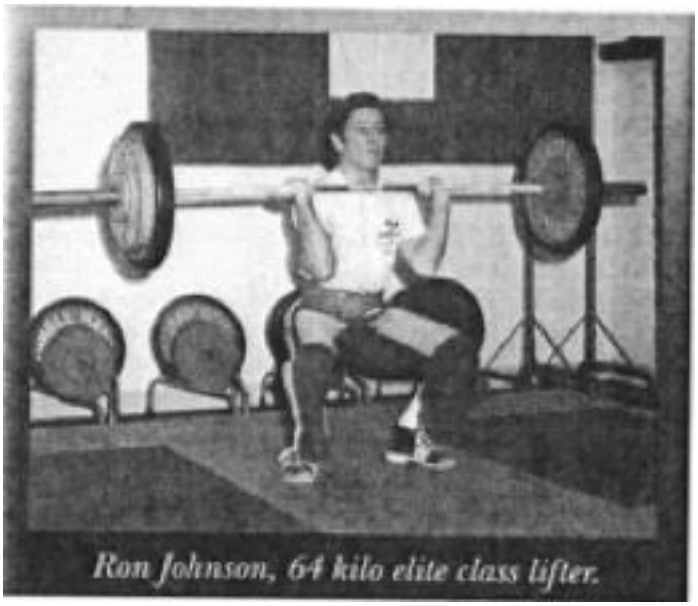
The greatest transfer of training for athletics results from athletic-type lifting movements which allow power to exert itself to the greatest degree.

To gain a clear understanding of the capacity of athletic-type strength training to maximize torso kinetic energy production, we need to analyze how movement forces are generated and flow through the multi-linked muscle-skeletal system when an athletic-type lift is executed. Let's analyze the squat clean.. For each phase of the analysis, note how **energy interaction** plays a key role in high power production. At the same time, try to visualize how so-called powerlifting or body building movements fail to duplicate the high velocity power produced during athletic-type lifting.

Energy Interaction in Squat Cleaning

PHASE 1. The act of squat cleaning begins with the generation of a strong **ballistic impulse** in the thighs and hips to overcome inertia and get the bar moving off the floor.

PHASE 2. Torso kinetic energy develops rapidly as you begin to accelerate the upward thrust of the body. As the bar passes the knees, torso rotational energy from the upward movement of the hip joint increases the velocity of the bar. This is followed by a strong **forward thrusting rotational movement** of the hips as you begin the final drive to full body extension. Maximum upward extension is achieved by extending on the balls of the feet.


Ron Johnson, 64 kilo elite class lifter.

PHASE 3. When you are at full body extension, the bar is given a final burst of momentum by a vigorous upward rotation of the shoulders, which elevates the bar to maximum height.

PHASE 4. At the completion of the pull, the bar serves as a fulcrum; you jump and pull yourself under, in a full squat, catch the bar at the chest, then stand erect. The final standing movement utilizes **stored kinetic energy** from hip and thigh extensors.

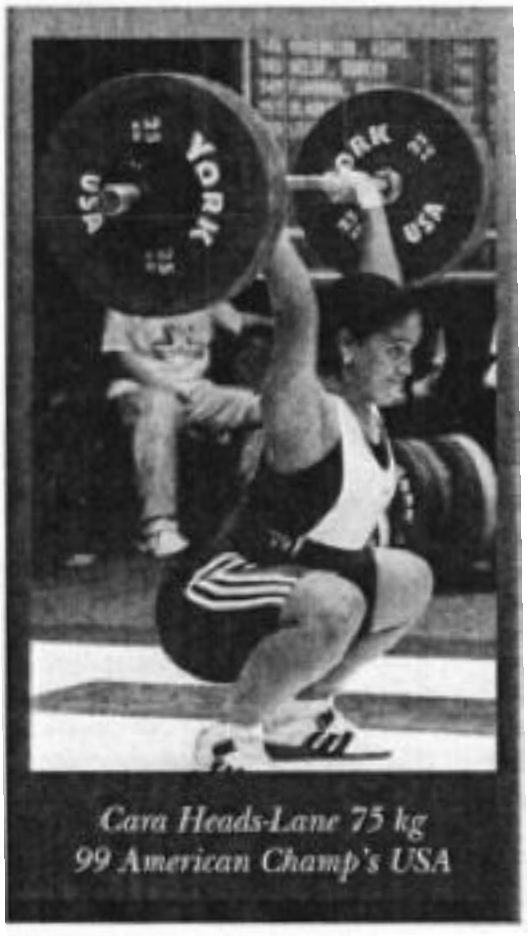
Summation of force. As each phase of the clean is executed, there occurs a **summation of force** within the multi-linked muscle-skeletal system. Energy generated by large muscle groups of the lower body (power zone) flows to smaller muscle groups of the upper body, resulting in a summation of torso kinetic energy, which is essential for maximal lifting (Fig. 5.3).

Torso kinetic energy generated during the clean is imparted to the bar as kinetic and **potential energy** (stored energy). The higher the bar is pulled from the floor, the more potential energy it has. If the bar is allowed to fall, its potential energy changes into kinetic energy (energy of motion).

Acceleration and Speed

Up to this point we have focused on the strength component of power. What about speed? As stated earlier, speed is the ability to apply force rapidly. A more comprehensive view is that

speed is determined by **reaction time** (quickness), **explosiveness** (ballistic movement), **acceleration**, **absolute strength**, and **speed endurance** (anaerobic power).



Speed has long been considered one of the hallmarks of a great athlete. It is one of the major physical attributes National Football League (NFL) scouts look for in a collegiate player. However, while great speed may be an important asset to have, not every speedy athlete becomes a star player. There are other qualities of equal or greater importance. Throughout NFL history, many of the outstanding running backs and receivers have not been known for their great speed. What accounts for their success has been *reaction time*, acceleration, and explosiveness. On the snap from center, great receivers explode off the line of scrimmage, accelerate to full speed in a stride or two (leaving faster defenders a step or two behind), snare the pass, then with quick elusive moves head for the end zone.

Reaction time, acceleration, and explosiveness are equally important for success in other sports. For example, in bike racing a rider needs quick acceleration to break away from the pack. Cyclists may demonstrate blazing speed on the flats, but if they lack the explosive power to attack and accelerate on the hills, they won't win races.

Acceleration and speed are enhanced through explosive power training such as speed drills and plyometrics (jump training). Both types of training require strong ballistic action and stretch reflex facilitation, which are the keys for the sudden release of energy for acceleration and speed (Fig. 5.5).

Developing Explosive- Reactive Power

The reactive neuromuscular apparatus of muscles can be singled out as the specific factor of the athlete's strength-speed abilities, abilities that demand explosive-reactive movements

The ability to overcome resistance quickly and execute quick forceful movements (e.g., jumping, sprinting, throwing) requires **explosive-reactive power.** Neuromuscularly, executing explosive movements involves a rapid stretching of a muscle(s) that is undergoing eccentric contraction, and followed by fast concentric contraction. The **stretch reflex**, also known as the **myotatic reflex,** is utilized to accomplish this rapid movement.

The definition of stretch reflex is: “When a muscle with an intact nerve supply is stretched, its response is strong concentric contraction.” Thus, during the performance of explosive-reactive movements such as high jumping, a slight eccentric contraction or pre-stretching occurs at the knee, hip and ankle joints in the jump takeoff. When done quickly, a slight lengthening of muscles will produce a faster, more forceful concentric movement in the opposite direction. The key point here is: the faster a muscle is lengthened, the greater the concentric force developed. If the switch from muscle lengthening to shortening is done as rapidly as possible, then the maximum advantage of the *release of stored kinetic energy to produce explosive-forceful movement* can be taken.

Chapter 8
The Training of Weightlifting Technique

The most fundamental element of weightlifting is the training of technique. This chapter will take a thematic look at this topic and the factors that influence the development of safe and effective technique.

Only proficient technical input can bring about efficient output. For this reason it is vital that attention be paid to the initial stages of preparation.

Effective technique is a system of complex movements that respects the laws of both economy and rationality.

The result of positive technique is the athlete channeling their physical abilities onto the barbell to create a personal model of productivity that at the same time respects the ideals of the theoretical model of proper weightlifting.

High level technique is both complex and difficult to attain and is influenced by the following athletic skill sets:

- Sensory Skills
- Joint mobility
- Flexibility
- Coordination
- Skeletal Levers
- The ability to develop force and speed

If the above physical qualities are developed in a harmonious manner the maintaining of technique even while lifting heavy loads is possible.

The Basic Requirements of Effective Technique

- Balance Skills, both static and dynamic
- Differentiation Skills, the ability to apply force in an effective and economic manner
- Fluidity of Motion, The coordination of the distinct phase of weightlifting movement both internally and externally to maintain correct trajectory as it relates to the most efficient theoretical models.

Performance technique has not undergone radical changes in recent years. While and individuals somatotype may result in subtle changes adherence to the accepted theoretical models is maintained.

How Barbell Trajectory Indicates the Quality of Technique

In theory the most economical way of lifting a barbell is to carry out as much vertical displacement with a minimum of horizontal displacement.

However as the amount of weight on the barbell increases the human body is challenged to maintain this ideal relationship.

In order to lift significant *loads* on a barbell in the most effective manner it is necessary to reduce the moments of force on the various body joints. Since a decrease in acceleration is not a positive factor the next available item that can be reduced is the lever arm. Therefore bringing the center of the barbell closer to the athlete is of great benefit.

AT THE START the barbell does not correspond the position of the athlete. The maximum position is, in fact, when the barbell is at knee height and the athlete tries to make contact, while at the same time keeping the arms extended.

To get past the knee angle the barbell path triggers a horizontal force that when positive can never be greater than the vertical force (*Keep the barbell close to the body throughout the pull*).

Once past the knee angle the barbell has an upward vertical trajectory with the maximum speed of the entire pull phase. This vertical trajectory is the result of the elevation and extension of the torso that produces a negative (back towards the athlete) curve caused when the barbell has completed its ascent and begins its descent and the athlete prepares to support the lift in the squat position.

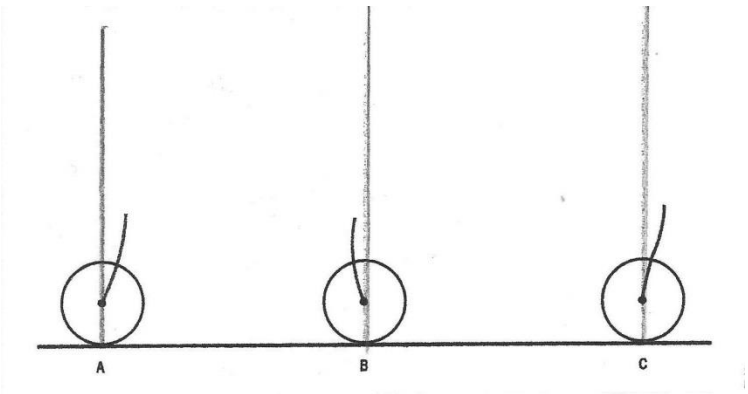
The amount of horizontal displacement in relationship to the vertical depends upon the quality of the lifter, the weight class the proportion between the upper and lower limbs, the quality of the start position and the abilities of the athlete.

Three Types of 1st Pulls

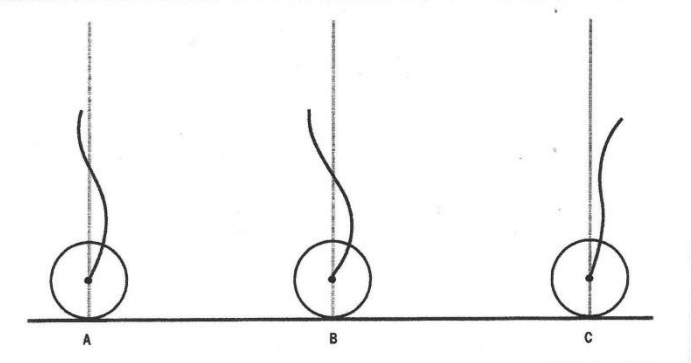
A. The Barbell comes closer to the athlete
B. The Barbell moves away and forward from the athlete
C. The Barbell moves vertically first and then comes closer to the athlete

Studies have shown that "A" is the type of movement considered most beneficial.

To get the barbell to move as it does in the first type of movement the barbell located directly above the toes and the lifter bends the knees, moving the torso forward immediately after the first pull.



Three Types of 2nd Pulls

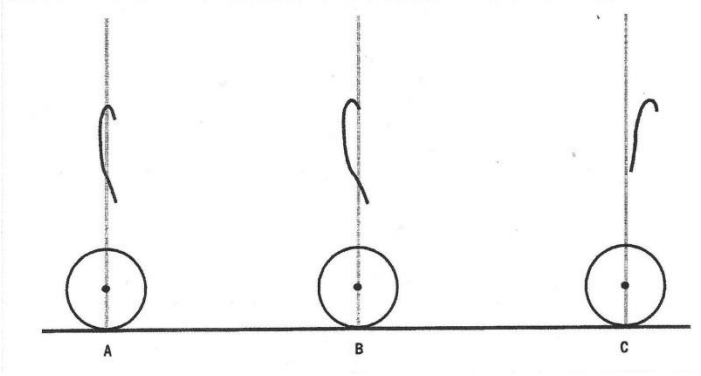


A. The Barbell crosses the vertical line at an angle of less than 30'.
B. The Barbell crosses the vertical line at an angle greater than 30'.
C. The Barbell stays behind the vertical line in a parallel manner and does not cross over.

Types A and B result in a distinct movement of the pelvis and torso which produce a loss of force a consequent waste of energy and less lift.

Type C produces much less horizontal displacement which lessens the amount of force and allows for a more effective positioning of the pelvis and knee angles at the point of maximum force application. The center of gravity moves away from the heels and the barbell moves closer to an effective position to begin the *catch* phase of the lift.

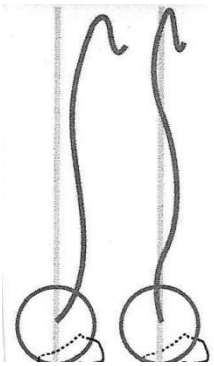
Two Types of *Top End* Trajectories



1. The Barbell follows a nearly vertical path until the descent curve begins
2. The Barbell follows a curved line.

The first type of trajectory provides a greater application of force.
The second type of trajectory results in a pronounced horizontal movement that adversely affects balance.

Three Types of Arc in the Catch Phase

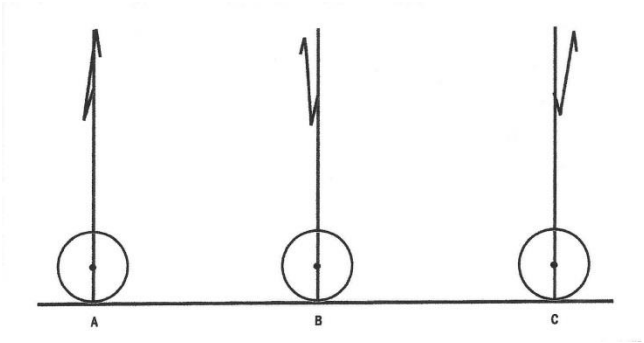


A. When the barbell crosses the vertical line but the trajectory stays close the result is a slight backward displacement.
B. The barbell is lifted sharply and at the point of maximum elevation is still in front of the vertical line the athlete will be forced to move their feet in an ineffective manner to attempt to maintain balance. This is the least productive movement.
C. The barbells maximum elevation is behind the vertical line as well as in the catch. *This is the most productive movement*.

The Trajectory of the Jerk

Three Types of Jerk Trajectories

A. The Vertical Trajectory
B. The Forward Trajectory
C. The Backward Trajectory.



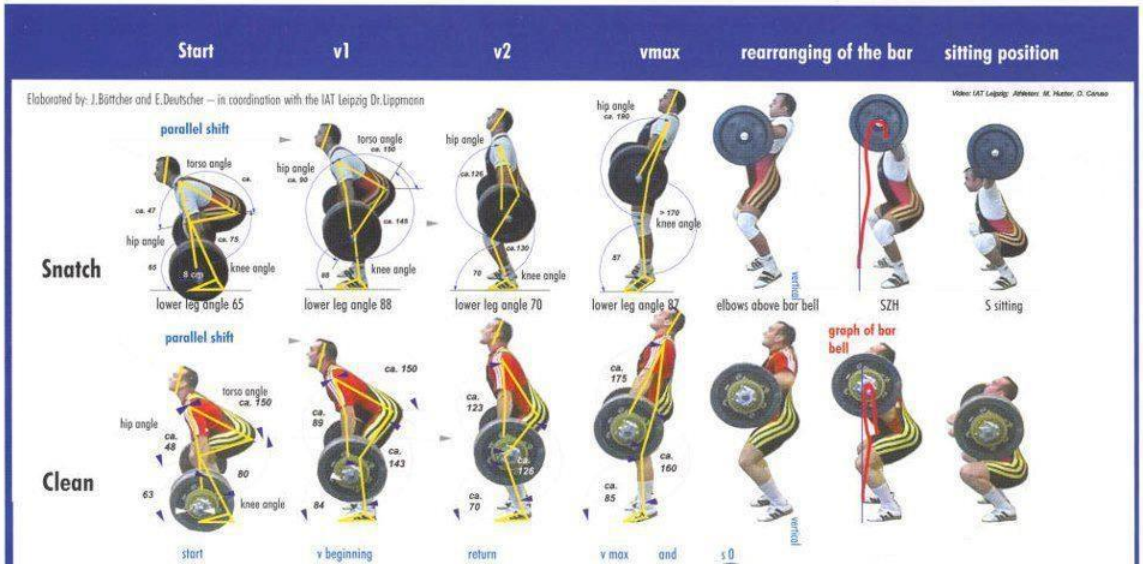
The Vertical Trajectory is most beneficial.

The Jerk Trajectory is most effective when it is strictly vertical with only minor horizontal displacements. The ascent trajectory, after the initial thrust, follows a vertical line and only crosses the at the maximum point when the descent begins. The descent has a slight backward displacement.

The Forward Trajectory forces the athlete to move their entire body forward which causes the barbell to follow the action of the athlete's body and move forward as well resulting in a movement away from the center of gravity.

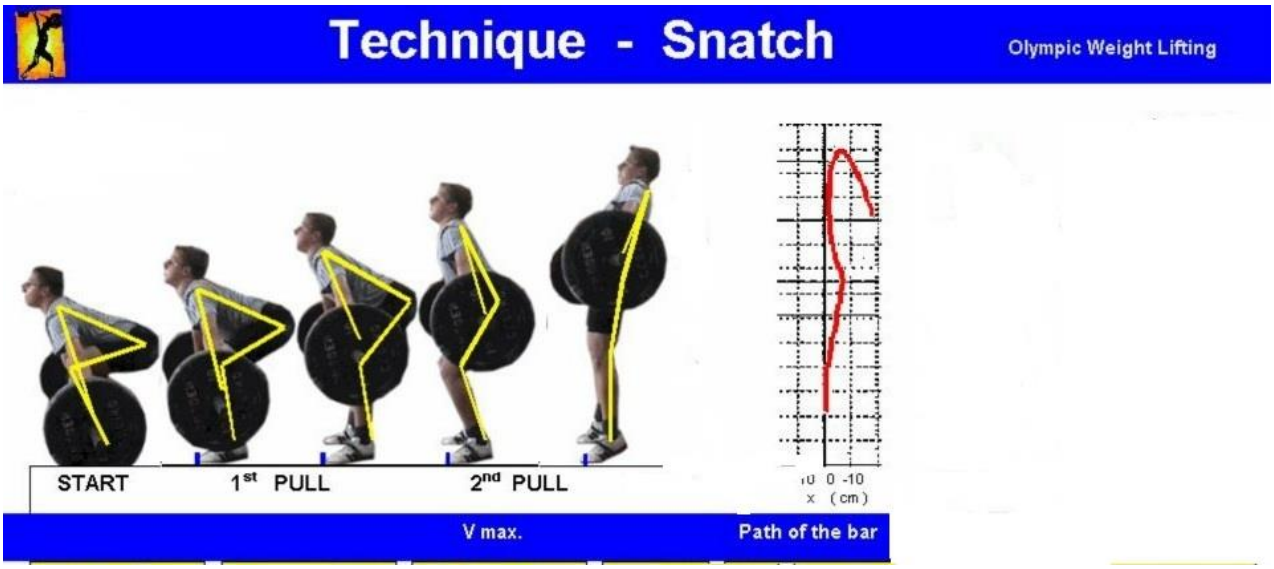
The Backward Trajectory causes the center of gravity to move, adversely to the back of the heels limiting the amount of vertical force that can be applied. Therefore the thrust is weak and *Locking Out* the barbell becomes difficult. The backwards trajectory also places negative forces onto the shoulder girdle.

TECHNIQUE OF THE SNATCH AND CLEAN



The Barbell comes back towards the athlete immediately upon leaving the floor.
Hips and Shoulders rise at the same rate.
The *Second Pull* is 'faster' than the *First Pull.*
Arms only bend to pull the athlete under the barbell.

The feet move from the *pulling* position to the *landing* position.
The landing position is usually about a shoe width wider than the pulling position and similar to the athletes "Squatting" position.



The following factors, as previously mentioned in the Level 1 course emphasized, influence these phases.

START:

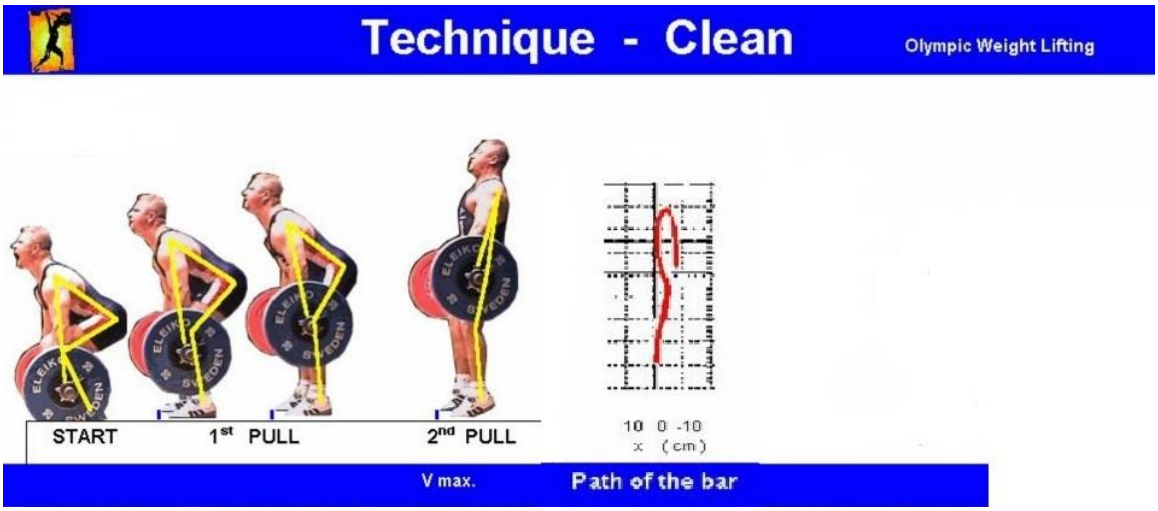
- All body levers tight. Eliminating as much "slack" as possible before pulling will reduce horizontal displacement and prevent the barbell from acting on the lifter.
- Shoulders are 'set' even to or in front of barbell
- Back Flat
- Feet hip width apart
- Toe tips under barbell
- Arms Straight at the elbows

1ST PULL

- Barbell comes back towards lifter, immediately
- Hips and shoulders raise at the same rate
- Lifter stays flat-footed
- Arms remain straight at the elbows

2ND PULL

- Barbell will attain maximum velocity
- Full torso extension
- Barbell remains close to body
- Arms are still straight at the elbow
- Shoulder muscles (trapezius) contract to provide the fulcrum for the pull under



While the grip is closer meaning that the barbell will contact the thigh somewhat lower and the barbell is not pulled as high as in the snatch, the basic technical concepts are the same.

START:

- All body levers tight. Eliminating as much "slack" as possible before pulling will reduce horizontal displacement and prevent the barbell from acting on the lifter.
- Shoulders are 'set' even to or in front of barbell
- Back Flat
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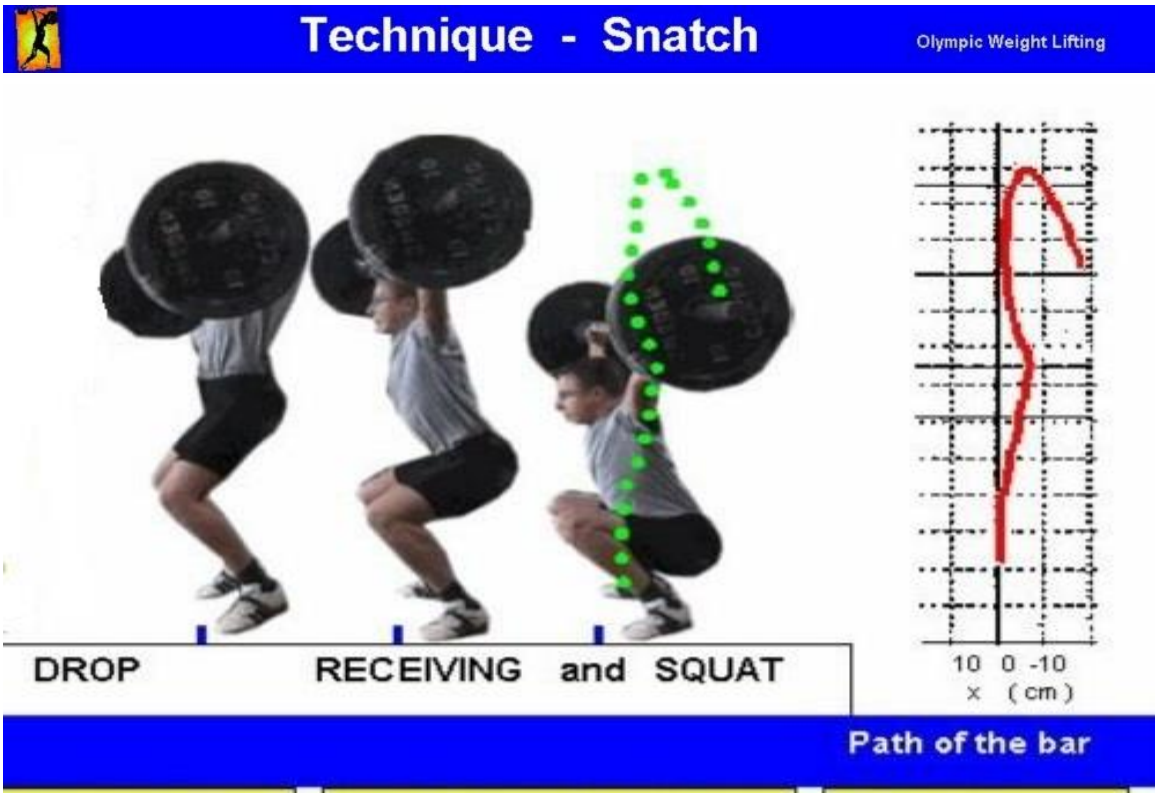


THE DROP

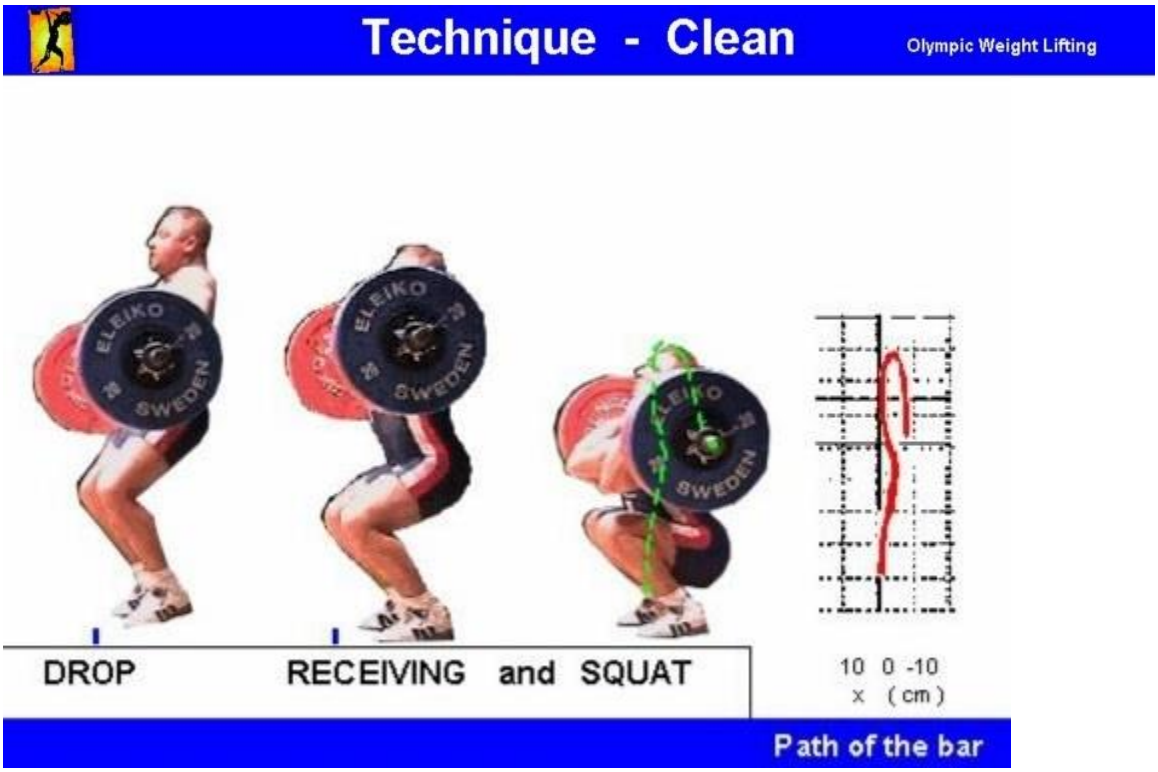
- Using the contracted shoulder muscles the lifter should actively pull themselves under the barbell with their arms
- The drop is quick and as straight as possible
- The pull under should be close to the body (do not allow the bar to swing away from the lifter)
- The feet move quickly and low to the ground.

RECEIVING

- Immediately contact the ground
- The lifter actively pushes up against the falling barbell
- Feet move to a position that is approximately a shoe width wider than the pulling position. (and should be the same position as the squat exercise)
- Stable Squat position, Muscles tight
- Elbows locked

PATH OF THE BARBELL

- Bar moves behind the vertical line
- Bar DOES NOT move around the knees (1st Pull)
- Bar stays close during 2nd Pull



Again, while there are some differences the base technique is still followed

THE DROP

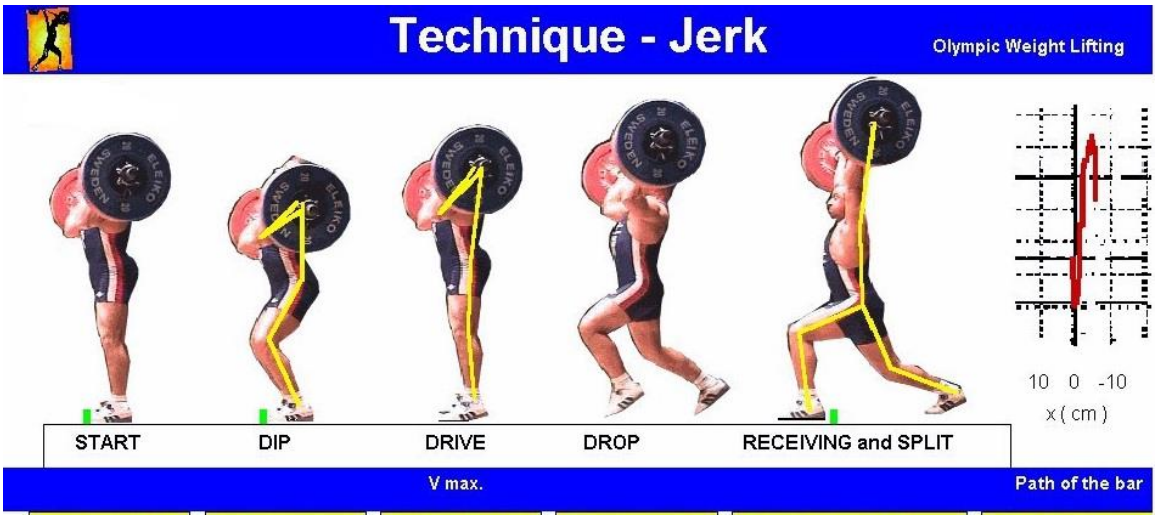
- Using the contracted shoulder muscles the lifter should actively pull themselves under the barbell with their arms
- The drop is quick and as straight as possible
- The pull under should be close to the body (do not allow the bar to swing away from the lifter)
- The feet move quickly and low to the ground.

RECEIVING

- Immediately contact the ground
- The lifter actively pushes up against the falling barbell
- Feet move to a position that is approximately a shoe width wider than the pulling position. (and should be the same position as the squat exercise)
- Stable Squat position, Muscles tight
- Elbows locked.

PATH OF THE BARBELL

- Bar moves behind the vertical line
- Bar DOES NOT move around the knees (1st Pull)
- Bar stays close during 2nd Pull



START

- Torso erect
- Feet are in start position
- Grip is relaxed (elbows will go into their natural position)

DIP

- The Dip is shallow, straight and flat-footed at the bottom
- Shoulders and torso remain erect
- Hips are back (like sitting into a chair)

DRIVE

- The dip is 'countered' as soon as the lifter feels their heels they should drive up against the weight.
- Maximum velocity is achieved
- Drive up (neither forward or back)

DROP

- Move quickly under the bar by 'stepping through the jerk'
- There is a short time of losing contact with the ground
- Feet move quickly and flat to the platform
- The athlete pushes themselves downwards to locked arms

RECEIVING

- Upon ground contact immediately press up against the bar
- Bar, shoulder, hip are all in same vertical line
- Front foot is flat on the platform with knee behind the toe
- Rear leg is slightly bent with rear heel off of the platform but solid

PATH OF BAR

- ***Dip*** Straight downward
- ***Drive*** straight upward
- Bar reaches a height slightly above and behind head

Coaching Observations of Snatch Technique

1. Once the start position has been established, ensure that the shoulders are not behind the line of the barbell.

2. When the barbell passes over the level of the knee the torso must still be in line with the barbell (It is important to avoid the *classic error* of excessive forward tilt of the pelvis and the consequent arching of the torso itself. This will not have a positive effect on the upward traction as there will be a shift horizontally rather than vertically. The Torso-Pelvis relationship must always be positive and to do so the feet must be firmly planted on the platform for the duration of complete extension of the legs and pelvis).

3. Pay particular attention to the movement of the elbows during the final pull phase and ensure that they one move during the descent motion.

4. Additional focus should be paid to the pace of the movement so that the athlete is acting on the barbell.

5. Excessive forward or backward jumping during the catch phase is the result of an improper pull.

Coaching Observations of Clean Technique

1. At the start the same observations in the clean are observed.

2. When the lift begins the elbows carry out the same movement of the snatch but at a lower level

3. The Catch on the chest should be made with a straight back and not adversely affected by the tilt of the barbell.

4. The barbell coming in contact with the chest must occur before full flexion of the legs so that the final reception is supported.

5. Recovery should be immediate.

Coach Observation of Jerk Technique

1. Be aware of the pace of the jerk Focus on the *Dip-Halt-Jerk* of the leg movement.

2. Pay attention to the vertical position of the athlete during the Dip Phase.

3. The *impulse* from the barbell must be proportioned in order to maximize force in order to reach an optimal split.
4. Avoid a backward tilt of the pelvis during the dip as this will have a negative effect on rear leg position which will result in poor movement of the front leg.
5. Excessive head movement lessens the productivity of the catch. Keep the head in a neutral position throughout the jerk.

OBSERVATION PHASES OF SNATCH AND CLEAN

Phase	**Elements**	**Optimum Position**	**Trajectory**
Start	Feet	Pelvis is parallel	Barbell on Platform
	Shoulders	Above the barbell	
	Barbell	Above the toes	
1st Pull	Shoulders	Over the barbell	Barbell comes back towards athlete
	Arms	Straight	
	Knees	Moving backwards	
2nd Pull	Shoulders	Above the barbell	Barbell approaches then moves back when over the knees
	Feet	Heels firmly placed	
	Arms	Extended	
Final	Shoulders	Move back but aligned with barbell	Barbell moves in a line very close to vertical
	Arms	Start the pull under	
	Feet	Rise up	
Catch	Back	Straight/Hyper - extended	Stable in overhead position
	Pelvis	Slightly more forward than arms	

OBSERVATIONS OF THE JERK

Phase	**Elements**	**Optimum Position**	**Trajectory**
Start	Head	Straight, eyes forward	Barbell on Chest
	Chest	Raised and inflated	
	Elbows	Forward and pointing down	
	Back	Straight	
	Shoulders/Pelvis	Aligned	
	Feet	In Line with Pelvis	
Dip and Drive	Shoulders,	Parallel to the vertical line of	Lowers and raises

	Pelvis, Torso	the barbell	in the vertical line
	Barbell	Stays on shoulders	
	Back	Straight	
Split	Feet	On Vertical Line but under the barbell	Slightly behind the vertical line
	Shoulders, Pelvis, Torso	On vertical line under bar	
	Front Leg	Angle greater than 90’	
	Rear Leg	Slight bend heel off platform	
	Head	Slightly ahead of shoulders	
Recovery	Rear Leg	Straight	Moves on Vertical Line
	Pelvis, Torso, Shoulders, Bar	Slight front to back movement	

FINAL COMMENTS ON WEIGHTLIFTING TECHNIQUE

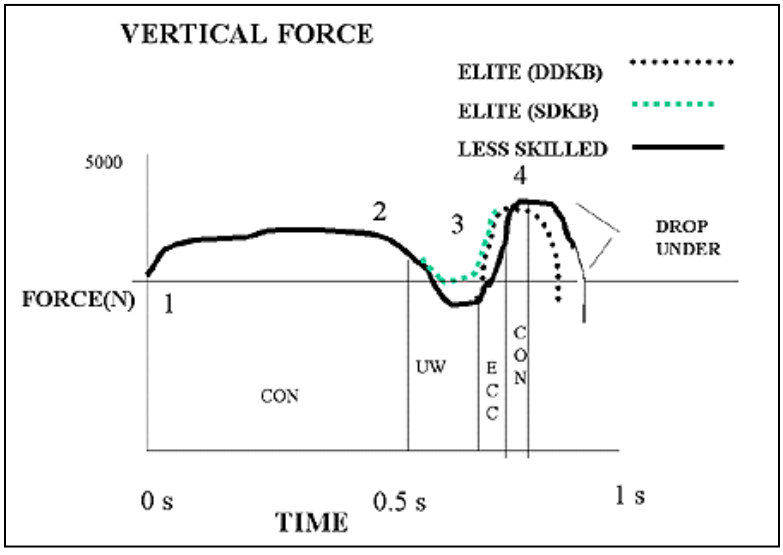
It is suggested that weightlifting technique is learned most effectively via the *Top/Down, Part Whole* teaching method.

While the original study on this approach was conducted by U.A. Druzhimin in 1980 the knowledge gained in this area is still extremely valuable. This form of instruction presents distinct advantages with very little drawbacks.

Data collected in this study should a significant increase in the level of the quality of learning and an equal decrease in the time it took to acquire the desired skill sets.

The final result is that lifters exposed to this method of learning will assimilate a significantly more effective technique faster, better and with less error production when compared to any other teaching/learning method.

Shallow and Deep *Double Knee Bends*



This study comes from Dr. Michael Stone and brings up the advantages and disadvantages of two different methods of pulling technique.

The Coaches of the former Soviet Union discovered, in the 1970’s that if an athlete stayed “flat-footed” when the barbell passed above the knees that the hamstrings would contract and

rebend the knees. At first this was refereed to as the *Anatomical Accident* and then the *Anatomical Advantage*. It went on to be called by a variety of names and terms including the infamous *Scoop.*

Currently there are two thoughts on this action. A *passive* approach and an *active* approach. The Passisve approach is the *Shallow* Double Knee Bend (SDKB) and the *Deep* Double Knee Bend (DDKB).

The shallow double knee bend is best taught first and the athetes focus is on staying 'flatfooted' once the barbell passes above the knees and then keeping the barell close as the second pull begins.

The DDKB should only be taught to advanced level athletes that are developed enough to perform this technique properly.

The challenge presented in the DDKB is that while the athlete consiously forces the knees forward when the barbell passes above the knees the barbell stays close to the body (it does not move in an adverse horizontal movement) and the athlete remains flatfooted until the shoulders elevate the torso. If the athlete gets onto their toes too soon the barbell gets an improper amount of Horizontal displacement resulting in a decrease in vertical trajectory and barbell speed. The Position shown is the photo below is an example of acceptable DDKB position as performed by two time US Olympian Kendrick Farris.

Chapter 9
Assistance Exercises

Current discussions with coaches have brought about a new approach to assistant exercises. The benefit of using assistant exercises is that coaches can focus on technique concerns work capacity issues, injury prevention and improving performance while the athlete is training, effectively.

One may classify the assistance exercises or lifts into the succeeding groups for convenience, however, realize there is a great deal of crossover with many. In addition, by no means is this a complete list but rather recommended exercises.

Competition Lifts:

1. Snatch
2. Clean & Jerk

Semi-Competition Lifts:

1. Clean
2. Jerk from Rack (blocks)
3. Snatch from different positions
4. Clean from different positions
5. Lifts from the blocks

Lift Related Exercises:

1. Power Snatch
2. Power Clean
3. Power Jerk
4. Jerk Recovery
5. Jerk Balance
6. Power Jerk Behind Neck
7. Overhead Squats
8. Snatch Balance
9. Drop Snatch
10. Power Jerk Behind Neck + Overhead Squat

Exercises for Power and Strength:

1. Back Squat
2. Front Squat
3. Lunges
4. RDL/Halting RDL
5. Good Mornings
6. Push Press Behind Neck
7. Push Press
8. Press Behind Neck
9. Military Press
10. Bench/Incline Press
11. Seated Press
12. Press Behind Neck- Seated
13. Lockouts
14. Snatch Shrugs
15. Clean Shrugs
16. Clean Pull
17. Clean Pull- to knee Snatch Pull
18. Snatch Pull- to knee
19. Functional Dumbbell Exercises
20. Combination Exercises

Remedial Exercises:

1. Hyper Extensions
2. Reverse hypers
3. V-ups
4. Abdominal Crunches/Sit-ups (weighted)
5. Hanging Leg Raises
6. Isometric Holds

Performance of ADVANCED Assistance Exercises

By the time a coach enrolls in the Level 2 Coaching Course the, he or she has been exposed and used the *standard* movements listed above.

In his time as Resident Coach Zygmunt Smalcerz has shown an ability to look at an athlete and intuitively know, exactly, which exercises will address an area that needs improvement.

The movements listed below are the ones most commonly used by the USA Resident Team at Colorado Springs and have shown to be effective in attaining the goals listed in the opening paragraph of this chapter.

Video Clips of these Movements may be found at;
http://www.teamusa.org/USA-Weightlifting/Weightlifting101/Instructional-Videos

SNATCH MOVEMENTS
Press in Snatch
Block Snatch Pull + Power Snatch + Overhead Squat
Snatch from low block
Snatch without moving the feet
Snatch onto low blocks
Snatch stop after start

CLEAN MOVEMENTS
Clean Hip, Clean Above Knee, Clean Below Knee (From Blocks)
Clean Pull + Power Clean + Front Squat
Clean from low Block
Clean without moving feet
Clean onto low blocks
Clean stop after start

JERK MOVEMENTS
Press is Split
Jerk Step
Split Clean from Blocks
Jerk behind Head + Jerk

Explanation of Movements

1. Press in Snatch

Often referred to as a "Sots" press (named after Viktor Sots (USR)

Placing the Barbell on the shoulders, behind the head, with a snatch grip the athletes descends into the bottom position of a squat snatch and presses the barbell into a straight over head position. It is important to focus on proper position with the chest and head in an upright position. Very light weights are used, 30 to 40% and for 3 to 4 sets of 3 reps

2. Block Snatch Pull + Power Snatch + Overhead Squat

A combination movement that re-enforces proper pulling technique, the speed of a power movement and the proper landing position.

The block can be of different heights but, typically, the block is low enough that the barbell is below the knee at the start of the lift.

The athlete performs 1 to 2 pulls followed by a Power Snatch. After the completion of the Power Snatch the athlete executes an Overhead Squat. The key factor is the athlete SHOULD NOT have to readjust their feet in order to perform the Overhead Squat movement. Whether or not the athlete is doing a Power Movement or a Classical movement the "land" position should be the same. While the Resident Athletes will do as much a 3+3+3 at 70% of a 1RM any combination of lifts can be beneficial but should not exceed 1+1+1 at 80%

3. Snatch from Low Block

This exercise strengthens the "transition" muscles that are used as the barbell comes off the floor but before the bar makes contact with the athlete's thighs.

The low block is, typically, a block that is 2" to 5" in height, depending upon the athlete, but the block should allow the barbell to be at the mid-shin or *lift off* position.
The athlete should be in a position that mimics where the barbell would be, at this height if the black was not in place.
The athlete then performs the full snatch movement as this exercise also re-enforces the proper trajectory of the barbell and has the greatest benefit when the lift is received in the deepest position. Standard exposures are "doubles" up to an including 80% for 3 to 4 sets.

4. Snatch without moving the feet

This exercise needs some explanation. The term *without moving feet* actually is described as follows. The athlete places their feet in the *landing* or *receiving* position of the snatch at the start of the lift. They are reminded to extend up on to their toes, as they would the finish of a classical lift, but not allow their feet to either leave the ground or to move from the original position.
The barbell will move significantly slower than it does during a 'normal' lift and the Resident Team will even *unhook* their grip which slows the barbell even more.

The benefits of this exercise are that it forces the athlete to maintain proper position, be patient and to forcefully push up against the barbell as they move into the *bottom* position of the lift. 2 to 3 sets no higher than 80% are recommended.

5. Snatch *onto* low blocks (boards)

In this exercise two (2) pieces of ¾" plywood 18 to 24" square are placed on either side of the athletes feet as they assume their start position. The athlete then snatches and move their feet up onto the boards. This little difference in height is very noticeable and will assist the athlete in learning to get their feet down quickly and to push up against the barbell. 2 to 3 sets of 2 reps at 80% bring about desired results.

6. Snatch stop after start

The athlete performs this exercise from the platform.
Once the athlete pulls the barbell from the platform they pause the bar at mid-shin (The coach can, actually, tell the athlete when to snatch) for a 'second' and then snatch. This exercise reinforces holding the proper levers and assists in diminishing horizontal displacement. 2 to 3 sets of 2 reps up to 75% are recommended.

CLEAN EXERCISES

7. Clean Hip, Clean Above Knee, Clean Below Knee (From Blocks)

Sometimes referred to as a *3 Stage Clean* The athlete takes the barbell from the block stands erect and perform a clean with the barbell from the "power" position. As soon as that 'rep' is completed the athlete performs a second clean from above the knee and a third clean from the blocks that are set up in such a way that the barbell is below the knee. The focus is on maintaining proper position, diminishing horizontal displacement and descending under the bar catch the weight in a correct position. 2 to 4 'target' sets up to 80% of a 1RM.

8. Block Clean Pull + Power Clean + Front Squat

A combination movement that re-enforces proper pulling technique, the speed of a power movement and the proper landing position.

The block can be of different heights but, typically, the block is low enough that the barbell is below the knee at the start of the lift.

The athlete performs 1 to 2 pulls followed by a Power Clean after the completion of the Power Clean the athlete executes a Front Squat. The key factor is the athlete SHOULD NOT have to readjust their feet in order to perform the Front Squat movement. As stated in the Power Snatch + Overhead exercise, whether or not the athlete is doing a Power Movement or a Classical movement the "land" position should be the same. While the Resident Athletes will do as much a 3+3+3 at 70% of a 1RM any combination of lifts can be beneficial but should not exceed 1+1+1 at 80%

9. Clean from Low Block

This exercise strengthens the "transition" muscles that are used as the barbell comes off the floor but before the bar makes contact with the athlete's thighs.

The low block is, typically, a block that is 2" to 5" in height, depending upon the athlete, but the block should allow the barbell to be at the mid-shin or *lift off* position.

The athlete should be in a position that mimics where the barbell would be, at this height if the black was not in place.

The athlete then performs the full clean movement as this exercise also re-enforces the proper trajectory of the barbell and has the greatest benefit when the lift is received in the deepest position. Standard exposures are "doubles" up to an including 80% for 3 to 4 sets.

10. Clean without moving the feet

This exercise needs some explanation. The term *without moving feet* actually is described as follows. The athlete places their feet in the *landing* or *receiving* position of the snatch at the start of the lift. They are reminded to extend up on to their toes, as they would the finish of a classical lift, but not allow their feet to either leave the ground or to move from the original position. The barbell will move significantly slower than it does during a 'normal' lift and the Resident Team will even *unhook* their grip which slows the barbell even more.

The benefits of this exercise are that it forces the athlete to maintain proper position, be patient and to forcefully push up against the barbell as they move into the *bottom* position of the lift. 2 to 3 sets no higher than 80% are recommended.

11. Clean *onto* low blocks (boards)

In this exercise two (2) pieces of ¾" plywood 18 to 24" square are placed on either side of the athletes feet as they assume their start position. The athlete then cleans and moves their feet up onto the boards. This little difference in height is very noticeable and will assist the athlete in learning to get their feet down quickly and to push up against the barbell. 2 to 3 sets of 2 reps at 80% bring about desired results.

12. Clean stop after start

The athlete performs this exercise from the platform.
Once the athlete pulls the barbell from the platform they pause the bar at mid-shin (The coach can, actually, tell the athlete when to snatch) for a 'second' and then snatch. This exercise reinforces holding the proper levers and assists in diminishing horizontal displacement. 2 to 3 sets of 2 reps up to 75% are recommended.

JERK EXERCISES

13. Press in Split

Taking the barbell from the racks the athlete assumes their "Catch" position for the Split Jerk. Keeping their torso erect they perform presses in this position. Very light weights, form 30 to 40% are used for 3 to 4 sets of 3 reps

14. Jerk Step

Taking the barbell from the racks the athlete assumes their "Starting" position for the Split Jerk. Keeping their torso erect they step forward quickly and effectively until they achieve the "Catch" position. The weight remains on the shoulders. The athlete then steps back to the original starting position for the next res. Weights from 40 to 60% are used for 3 to 4 sets of 3 reps

15. Split Clean from Blocks

This exercise is very beneficial for athletes that are not "stepping through' the jerk and leaving their front foot 'short' of the preferred position and if the athlete has a tendency to lean backwards in the receiving position of the jerk and if the rear leg is too straight at the knee.

Blocks are used as the focus is on the landing position and not on the pull.

The athlete places the barbell on the blocks and performs a clean but when they 'turn the barbell over' they step through the clean as they would on a jerk and land in the proper position. It is not necessary to alter the feet in each repetition as the athlete is trying to get their front foot into the correct position. 3 to 4 sets of 2 to 3 reps up to 75% are recommended.

16. Jerk Behind + Jerk

This exercise should be used for those athletes that lose their positions and put the barbell out in front.

Typically, when an athlete jerks with the barbell behind their head they, naturally, point the elbows downward. The bar is positioned below where it should end up and this makes the dip, drive and the step through straighter. The hope is that a jerk from behind the head will influence the athlete to perform the same Dip, Drive, and step through is a similar manner.

Chapter 10
Faults and Corrections

This is an essential part of coaching, which is challenging to learn. An understanding of the technical principles of weightlifting is as vital as how the coach interprets the technical model. Developing the ability to evaluate an individual's technique problems and provide immediate feedback is an ongoing process. In a competition setting, the ability by the coach to assess a technical problem and be able to communicate this to the lifter may mean the difference between winning and second place. However, it is in the training situation where most of the technical work and reinforcement takes place. This setting allows the coach and lifter to develop a mutual understanding and develop a communication process, which will carry over into the competition.

The coach must work at developing his ability to assess and develop the essential "coaching eye" that all successful coaches possess. A majority of coaches have the ability to evaluate a lift and relay the fault to the lifter. However, having the ability to relay to the lifter why the fault occurs is a different set of circumstances. Once the coach recognizes the fault, then he can prescribe a remedy. Most developing coaches are not able to recognize the fault initially. This is when working with an experienced coach and seeing and learning on a practical level in the weight room is an excellent way to develop the coaching eye.

Fortunately, our weightlifting techniques are standardized movements recognized by elite level coaches and scientists around the world. USA Weightlifting considers the following observations the most common technical errors, which result in failure. The remedies may assist the coach in adjudication and coaching tips while suggesting a solution.

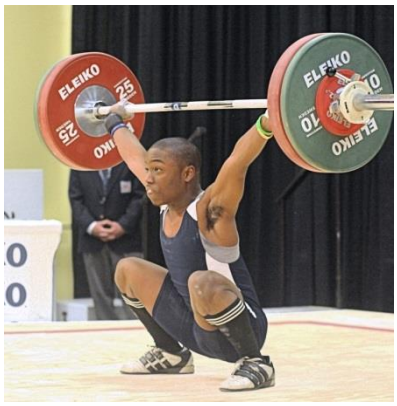
The Snatch

Fault: The lifter loses the bar in front in the receiving position.

Possible Cause:

- Incomplete pull, the lifter pulls himself under the bar before the explosion phase.

Corrections:
Reinforce technique. Perform Snatches from different positions (High Hang, Above the knee, below the knee and from blocks) Tell the athlete to finish the pull. Have the athlete focus on *turning the wrists over quickly and pushing up against the barbell. Snatch Balances are also recommended.*



Fault: The lifter swings the bar during the pull.

Possible Causes:

- The lifter throws the head and shoulders back at the top of the pull, trying for greater extension. This action causes the reaction of the bar swinging away.
- The lifter drives up on the toes too early then using the hips to generate more force, which causes the bar to swing.
- The lifter allows the elbows to rotate back and the bar swings away during the explosion phase.

Corrections:
Reinforce technique. Combination Work from Blocks (both above and below the knee). 2 pulls + Power Snatch + Overhead Squat. Emphasize that the lifter should finish the pull in a vertical position. From the blocks remind the lifter that they should keep their shoulders over the bar longer, which will assist in staying on flat feet for a longer period. The Overhead Squat will remind the lifter to push up against the barbell during the decent under the bar.
Snatch with feet in receiving position. Have the lifter put their feet in their *Land* position. They may rise up onto the balls of the feet but they should not loss contact with the ground. This will make the barbell move much slower forcing the lifter to stay flat-footed longer and hold their levers longer. When the bar makes contact on the thigh the athlete now extends the torso and actively pulls under the bar. The bar stays closer and allows the athlete to push up more efficiently.

Fault: The lifter sits back from the bar at the start and maintains this throughout the pull.

Possible Cause:

- The lifter's hips are too low in the start position causing the weight distribution to be too far toward the heels, which results in the lifter being in a poor position to produce force throughout the pull position.

Corrections:
Change the start position. Shift the athlete forward so the weight distribution is in the middle of the foot. Furthermore, the lifter needs to raise the hips until they are higher than the knees at the start of the first pull.

Stop Snatches. Once the athlete is in their "adjusted" start position they pull the barbell off the floor until it is AT mid-shin (not touching mid-shin). The athlete then holds the bar motionless for a *1 count* and then performs the snatch. This *stopping* of the barbell will force the lifter to both be in a flat-footed stance and hold the body lever.

Perform Snatches from LOW blocks. Setting the block at mid-shin the athlete performs snatches from this position. Combination lifts (2 pulls + snatch) will also re-enforce staying flat-footed and holding the body levers in the correct position.

Fault: During lift-off, the lifter actively pulls the bar back instead of pushing the knees back.

Possible Causes:

- Many novice athletes are excited or are "psyched up" for the lift and this emotion results. Another cause may be a lack of strength in the lift-off position. To overcome this deficit, athletes develop a pendulum effect in which they intentionally develop momentum from lift-off by rolling the bar back toward them, then using this momentum to aid in the lift. This lack of strength results in the bar swinging out and forward as the lifter extends the hip.

Corrections:
Many athletes have a football player mentality. Coaches must convince the lifter to channel their emotions in a positive way. Coaches can work with athletes in training to develop an appropriate and efficient start position. Furthermore, athletes must improve general core strength.

Once again, Snatches without moving the feet (feet already in *land* position) Snatches with an eccentric slide to the *below the knee position*. Snatches from the low block position. These movements will strengthen the body levers and allow the athlete to *smooth out the* initial pull from the floor . Remind the athlete that *Slow is smooth, and smooth is fast.*

Fault: The lifter jumps back or away from the barbell after the second pull.

Possible Causes:

- The lifter finishes the second pull beyond 180 degrees because he holds on to the barbell too long to "try to really finish" the pull.
- The athlete does not stay over the barbell throughout the pull.
- The athlete swings the barbell.

Corrections:
Convince the athlete to finish the pull in a vertical position. . In addition, help the athlete understand when to pull himself under the bar at the appropriate time. Keeping the shoulders over the bar will also help in assuring a proper receiving position. The athlete will not try to over pull to overcome leverage issues when the shoulders stay over the bar. The athlete will also reduce bar displacement due to a more vertical bar trajectory.

Exercises that will ensure a more vertical pull position are pulls, shrugs and lifts from different positions, as well as combination movements (pulls + snatch)

Fault: The lifter loses the bar behind.

Possible Causes:

- Throwing the head and shoulders back i.e. not finishing the pull in a vertical position
- Swinging the bar away from the body
- The athlete not keeping his shoulders over the bar
- Poor receiving position
- Lack of general strength in the low squat position

Corrections:
The first two bullet points outline the two primary reasons a lifter may lose the bar behind. Throwing the head and shoulders back creates an effect on the bar. This effect is the bar moving away from the body.

The coach can correct the first two points by emphasizing to the athlete to finish in the vertical position and to choose a focal point to prevent him from throwing the head back. By keeping the elbows out and above the bar, especially during the second pull, and stressing arm speed, the athlete will keep the bar close to his body.

To improve the receiving position, the athlete must first develop confidence in this position. Some exercises to improve confidence are higher intensity overhead squats, snatch balance, drop snatches and snatch grip push press or power jerk behind the neck plus overhead squat. Speed and meeting the bar in the low position with these higher intensity weights will develop confidence.

Fault: The lifter presses out the snatch in the receiving position.

Possible Causes:

- The lifter does not impart enough force at the finish of the pull
- The lifter is slow in moving under the bar
- Weakness in the receiving position

Corrections:
If the athlete does not apply enough force or does not give sufficient energy for developing maximal momentum, the lift may result in a press out. This insufficient force application will most likely result in the lifter being slow in moving under the bar and into the receiving position. If the athlete has weakness in the low receiving position, it will only exacerbate the problem.

Exercises, which emphasize the pull and force application, are pulls, shrugs, and lifts from different positions, particularly from the blocks as well as 3 stage snatches (1 snatch from high hang, 1 from above the knee, a final one below the knee. Snatch grip push presses as well as presses from the receiving position of the snatch (*Sots press)*

The Clean

Fault: The athlete's elbow touches the knee or thigh and/or the athlete does not meet the bar properly in the receiving position.

Possible Causes:

- Incomplete pull; the lifter moves under the bar too early
- The lifter does not meet the bar properly in the receiving position

- The lifter bends the arms too early
- The lifter shifts the knees forward, or goes on the toes, too soon
- The lifter jumps back too far in the receiving position

Corrections:
If the lifter "rushes" the pull and moves under the bar without full extension, therefore limiting force production, this infraction may occur. In addition, this technical flaw may also lead to another fault. If the lifter does not meet the bar well, it may "crash" on him. This resulting crash may force the upper body and elbows forward with a knee touch ensuing. Should the lifter bend the arms too early, limited force production will be the consequence. The lifter may bend the arms to reinforce his belief of really finishing the pull however, the opposite will occur. The lifter's power source, which he will use to pull himself under the bar, will be limited. Also, if the lifter does not stay over the bar long enough or pushes the knees forward too soon, this will affect power output as well. Finally, a result that may happen is if the lifter jumps back too far. Usually if the lifter throws the head and shoulders back, this will result. Once the action occurs there must be a reaction, which is the lifter jumping back to receive the bar. Typically, the lifter will receive it in a poor position with the bar crashing on him resulting in an elbow touch.

Exercises which will assist the lifter with finishing the pull are shrugs, pulls, lifts from different positions and back strengthening exercises such as good mornings, hyperextensions and reverse hypers. These exercises will also remedy arm pulling. During these exercises, the coach should reinforce correct arm position. When performing Front Squats remind the lifter to push up against the bar when the accent begins

Fault: Lifter jumps forward during the clean

Possible Causes:
- Poor start position
- The barbell moves away from the lifter at lift-off
- Incomplete extension during the pull
- Poor core strength

Corrections:
If the lifter is in a poor start position, there is a greater chance for him to miss the lift. The weight distribution should be toward the center of the foot or toward the heels. In addition, poor chest and hip positions, will likewise adversely affect the lift. During lift-off, the barbell should immediately move back toward the lifter. If the lifter allows the weight to control him, it will most likely move forward. This means the lifter will be on his toes almost from lift-off. If the action were that the weight distribution is on the toes, the reaction would be for the lifter to jump forward to "catch-up" to the weight. In addition, this poor position will also affect the pull. By being so far forward, the lifter is not able to finish the pull. This makes the problem worse. However, many times the athlete is not physically prepared to lift heavy weights and the lifter must address fundamental core strength issues.

Stop Cleans. Lifter pulls barbell to mid-shin position, holds for a 1 count and then performs the clean. Since this movement forces the lifter to *hold their levers* it is a good strength exercise as well.

Fault: Excessive *Foot Stomp.*

Possible Causes: Weight is too far forward from start of the lift. Lifter is overly anxious or aggressive.

Correction:
Excessive foot stomp is not effective. It can lead to the barbell *Crashing* onto the lifter. It slows the turnover of the barbell and hampers the timing of the lifter to push up against the barbell.

Snatches and Cleans with the feet already in the *land* position. This will slow the barbell forcing the lifter to hold their levers, keep the barbell close to the body and push up against the bar.

Snatches and cleans *onto low blocks.* Actually these *low blocks* are merely 18" square pieces of ¾' plywood. Place the plywood pieces to either side of the athletes feet (I n their normal start position. The lifter then performs either a snatch or a clean and lands their feet onto the plywood. The fact that the plywood is ¾" higher forces the lifter to really react to the feet hitting the "platform" quickly. This makes the lifter pull under and push up faster than they typically do. It gets them to get their feet back onto the platform quickly and efficiently and reduces the foot stomp.

The Jerk

Fault: The lifter loses the lift forward either in the receiving position or during the recovery.

Possible Causes:

- The dip is forward due to incorrect weight distribution
- The athlete allows the chest and/or elbows to drop during the dip
- The dip and/or drive is incomplete
- The athlete steps away from the bar during the split
- The athlete pushes the head forward during the split

Corrections:
The weight distribution during the dip should be on the heels. Should the weight be on the toes, the lifter will thrust the bar forward. If, during the dip, the athlete lets the elbows or chest drop, this will not only compromise the rack position, but it will also affect force production therefore decreasing the amount of watts produced during the drive. If the dip of the athlete is premature or the drive is incomplete, the athlete will have a much more difficult time making the jerk. This incomplete drive may cause the lifter to step away from the attempt during the split. Another way a lifter can miss a lift forward is due to pushing the head forward in the receiving position.

The action of pushing the head forward leads to the reaction of the hips moving backward and the chest forward. This puts in lifter in a compromising position.

Exercises to assist with proper weight distribution, with keeping the chest and elbows in the proper position and correct dip and drive skill are technique reinforcement, rack jerks, Power jerks, jerks behind the head and combination jerks (1 behind the head followed by 1 in front. Press in Split. Lifter assumes the split position and holding the barbell on the shoulders performs presses. This teaches the lifter to push up and lock out the elbows.

Jerk Steps. Taking the barbell from the rack the lifter steps forward until the front foot is in the proper receiving position and the rear leg bends at the knee and the rear foots heel is off the platform

Split Cleans from Blocks. As strange as this sounds this *Clean* exercise has shown solid results in improving an athlete's jerk

Placing the barbell on a block that is just below the knee the athlete performs power split cleans (only splitting the lead leg of the jerk forward0. The athlete needs to focus on keeping the torso upright when receiving the barbell and 'stepping through' with the lead leg. The back leg moves to its correct position as well. The reason the lift being performed from the blocks is that the bar is in a high enough position that the lifter can focus on the *Stepping though* phase that is related to the jerk and not on the pull phase related to the clean.

Fault: The jerk is lost behind in the receiving position or in the recovery.

Possible Causes:

- Incorrect dip and drive; the lifter throws his hips forward as he drives up
- The lifter steps too far through with the leading leg in the jerk
- The lifter steps back too far or too aggressively with the leading leg in recovering

Corrections:

The dip and drive should be as vertical as possible. If the lifter throws the hips forward or allows the chest to deflate, this will affect bar trajectory negatively. Also affecting the jerk adversely is if the lifter steps too far through with the leading leg. This will not only put the lifter at a disadvantage for recovering but also with stability. If the lifter steps back too aggressively with the lead leg while recovering, this may lead to stability issues due to the momentum created by the front leg.

Any overhead strength, stability or technical exercise will assist with these issues. Any type of pressing movement, power jerk, jerk from the rack (or blocks), jerk from behind the neck, jerk balance and jerk recoveries.

Fault: The lifter presses out the jerk

Possible Causes:

- Poor or weak dip and drive

- The lifter tries to push the bar with the arms during the drive
- Immobility of the shoulder girdle
- Poor arm lockout

Corrections:
If the athlete has a poor dip and/or drive, the result may be the lifter pressing out the jerk. To compensate for the poor dip and drive, the lifter may try to "muscle" up the weight. Here the lifter actively pushes up with the arms to try to get to the finishing position. In addition, poor shoulder flexibility in the shoulder girdle may also affect the jerk adversely. Finally, lifters must have a good lockout or finishing position. Lifters can be successful with a below average arm lockout however, they must be diligent in their remedial training to not lose a lift due to a poor arm lock.

To prevent a poor dip and drive, athletes can due a variety of exercises including push press and power jerks from in front and behind, jerks from the rack (or blocks), jerk dips and jerk drives from the blocks. Split Cleans from blocks.

These are examples of the more common faults and suggested corrections in the sport of weightlifting. However, we must stress that coaches should not just look at the end result but what may have affected the end result. Assisting with this is viewing the lift from different angles as the coach may notice some faults at different areas around the gym. Novice coaches may try several corrections at first and see which exercises work best with each athlete. This will give the coach a better understanding of the different exercises.

A review of Chapter 9 Assistance Exercises will also be helpful in selecting movements that can address additional flaws.

Split Cleans from Blocks. As strange as this sounds this *Clean* exercise has shown solid results in improving an athlete's jerk

Placing the barbell on a block that is just below the knee the athlete performs power split cleans (only splitting the lead leg of the jerk forward0. The athlete needs to focus on keeping the torso upright when receiving the barbell and 'stepping through' with the lead leg. The back leg moves to its correct position as well. The reason the lift being performed from the blocks is that the bar is in a high enough position that the lifter can focus on the *Stepping though* phase that is related to the jerk and not on the pull phase related to the clean.

Foremost is the technical vigilance of the coach. Especially with beginning lifters, the coach should be at every training session and make every attempt to watch each repetition. Lifters, who develop poor technical habits initially, find it very difficult to correct later. The coach too, should try to develop his own coaching style. Developing *trigger words* (words or short phases that remind the lifter to focus on a particular aspect of a skill can be very effective. Coaching, however, is an ongoing process. The better rapport the athlete and coach develop the better the communication will be in training and competition. This then, will lead to positive results.

Chapter 11
Competition Preparation

One of the great challenges for Weightlifting Coaches, especially at the National and International level is to understand and be able to deal with the nuances of the competition structure itself.

Items that a Weightlifting Coach needs to be aware of

Qualifying Period: The dates between which a lifter must meet or exceed in competition the qualifying total necessary to compete a different competition.

Qualifying Total: The minimum combined snatch and clean and jerk required to be eligible to compete in a competition.

Entry Deadline *or* Qualifying Deadline: The date by which an entry form must be submitted in order to compete in a competition.

Becoming a member of USAW

Competing in a locally-sanctioned USAW competition
At that competition, make sure to meet or exceed the qualifying total in your weight class for the National-level competition you'd like to attend.

For a list of membership benefits, information on hosting a competition and a list of sanctioned competitions visit usaweightlifting.org

Compete in the National competition.
At that competition, make sure to rank in the Top 8 overall men or Top 7 overall women eligible for the international team you'd like to qualify for.

-Further information on athlete ranking methods, eligibility criteria, such as age and/or enrollment in a University, qualifying periods, and other information specific to each international team may be found at usaweightlifting.org

-Results from some locally-sanctioned competitions may also be used to qualify for an international competition.

-Athletes selected to compete on an international team must register and comply with United States Anti-Doping (USADA) Out-of-Competition (OOC) testing pool protocols and procedures prior to competing in the international competition for which they qualified. If you think you may qualify to represent the United States internationally within the coming year, please contact USA Weightlifting's High Performance Director by emailing usaw@usaweightlifting.org with the subject line "Attn: High Performance Director" to inquire further into registering with USADA.

Qualified athletes will be notified by USA Weightlifting.
Should you or one of your athletes qualify to compete on an international team, such as the Youth/Junior/University/Senior World, Pan Am, or Olympic Team, USA Weightlifting will provide further information to you at that time.

Duties and Responsibilities of a Weightlifting Coach

Travel

The Head Coach should be involved with travel arrangements and receive the individual travel itineraries of all team members. For international competitions, the team will often assemble from various parts of the country at the international departure airport. Early arrival at this departure point is an advantage as the Head Coach can then supervise seating, etc. and a planned early arrival allows for possible domestic flight delays. On long flights, aisle seats are advantage for athletes as it enables them to get up and move around regularly without disturbing others. The Head Coach should encourage athletes to drink fluids regularly (unless they are making weight) and also to walk around the plane as often as possible.

On Arrival

The Head Coach should assist the Team Manager with baggage retrieval and aid in facilitating travel to the accommodation. Check in and rooming arrangements must be supervised. The Head Coach should make a note of all team members' room numbers and make sure that they, in turn, are acquainted with all staff room numbers. As soon as possible the Head Coach needs to ascertain the whereabouts of a weight check scale, the location and opening times of the dining hall or restaurant, and the location and available times of the training hall. A short team meeting should be called to disseminate information to all members.

Venue appraisal

As soon as possible the Head Coach should locate and visit the training and competition venue. These are often at the same location but not always. Distances from the accommodation and times of travel should be noted. Any transportation schedules available need to be collected. The Head Coach should check the competition venue and attempt to ascertain any problem areas. The following are a guide to some of the items that need attention.

· Location of weigh-in room
· Location of sauna
· Distance of warm-up room from competition area
· Type of barbell to be used in competition & warm-up
· Lighting and temperature of auditorium and warm-up area
· Position of time clock
· Position and audibility of "Down" signal
· Platform surface
· Location of warm-up room scoreboard
· Location and operation of any closed circuit TV
· Location of announcer
· Availability of chalk & resin
· Layout of warm-up room
· Appraisal of best warm-up room platforms
· Availability of drinks, food etc.
· Availability of rest area for post weigh-in & between lifts
· Location and availability of ice
· Availability of chairs
· Location of Marshals table

Entries & Competition procedure

All Weightlifting Championships are conducted within bodyweight categories. The International Weightlifting Federation (IWF) rules allow teams to consist of eight (8) men and seven (7) women, with no more than two (2) athletes competing in any one bodyweight category. The rules also allow for a Team to nominate two (2) male and two (2) female reserves. Reserves are not permitted to compete in the championship unless they are substituting for a previously nominated team member who is withdrawn.

Prior to the start of a championship, the Competition Secretary will convene a meeting to verify the entries submitted by each Team. This meeting is termed the **Technical Conference**. This meeting provides the final opportunity to make changes to the team composition by substituting reserves and/or changing the bodyweight category of nominated Team members. The Head Coach/Team Manager must supply to the organizers a list of team members in the categories in which they wish to start at this conference. The competitor's best-recorded total (verifiable) is also included as is their date of birth. Competitors are allocated – usually by a computer program – lot numbers at this conference. These lot numbers govern the order of the weigh-in and are also used in deciding the order of lifting. The competitors are listed on the scoreboards in the order of the lot drawn. Following completion of the Technical Conference a start list is produced and distributed to all teams. This list shows the allocation of lifters into groups within each category, which is based on the entry total that is also listed. In many large competitions each category may be divided into two or more groups. It also shows the start times of each category and group and the officials who will be in charge. The Head Coach needs to appraise this start list and share the contents with staff and athletes.

Weigh-in

Competitors should be accompanied at the weigh-in by their coach or other team official. They must provide evidence of athlete identity (passport for international competitions) and proof of age (passport again or other documents). The competitors are weighed while either nude or in underclothes, in the presence of officials of the same gender. The officials verify the competitor's weight which is then recorded on the Competitor's Card. The coach must verify that the bodyweight recorded on the Competitor's Card is correct and write the weights for the competitor's first attempts in snatch and clean & jerk on the card in the spaces provided. Once the coach is satisfied that all of the information on the Competitor's Card is correct, he or she signs the card in the appropriate space. The Head Coach must ensure that the addition of the starting attempts comes to within 20kg of the qualifying total verified on the entry form for men and within 15kg for women. If an athlete does not adhere to this policy the Jury can disqualify them. For each attempt lifters are allowed to make two changes from the initial chosen weight. These changes can be increases or decreases or a combination of both. Whenever a weight is nominated, be it initial or a change, the coach must sign the Competitors card. Lifters will be called for an automatic 2kg increase between 1st and 2nd attempts and a 1kg increase between 2nd and 3rd attempts, if the coach has not nominated a weight for the next attempt. If the

weight of the first snatch is decreased then the weight of the first clean and jerk must give a total, which is within 20kg/15kg of the entry form qualifying total. With the introduction of the 1kg increase rule (2005) and the 2kg increase rule (2007) coaches are tending to use their two changes/attempt far more frequently than previously. Consequently, the Head Coach's responsibilities can be quite stressful in determining and changing the attempted weights at the Marshals table.

Competition Warm Up

The purpose of the warm up is to prepare the athlete physically and psychologically for maximal performance in the competition. The routine should include general warm up and mobilization, stretching, and the specific warm up. The specific warm up consists of performing the competition lifts, starting with light weights and progressively increasing the weights up to a final lift which is close to the weight of the athlete's first attempt. The content and timing of the specific warm up is critical. It should include sufficient repetitions at light and medium intensity to practice speed and technical accuracy; and sufficient high-intensity repetitions to recruit muscle fibers and instill confidence in the athlete. The warm-up should not excessively tax their energy stores. The specific warm up should be completed with enough time for the athlete to recover from their last warm up lift before making their first attempt in the competition. There are a number of factors to consider when directing the specific warm up of an athlete at a competition, such as:

· The weight of the competitor's first attempt
· The level of the competitor's experience
· The competitor's position in the order of calling
· The prevailing conditions within the venue, e.g. temperature and humidity

Following is an example of a specific warm up for a competitor starting the snatch with a first attempt of 100kg:

- Movement Weight Repetitions
- Power snatch 20kg 3 reps
- Snatch squat 20kg 3 reps
- Power snatch + snatch 30kg 2 + 2 reps
- Power snatch + snatch 40kg 1 + 2 reps
- Snatch 50kg 2 reps
- Snatch 60kg 2 reps
- Snatch 70kg 2 reps
- Snatch 80kg 1 rep
- Snatch 90kg 1 rep
- Snatch 95kg 1 rep

Competition Tactics

It is always an advantage in weightlifting to be able to follow your opponent so that you know exactly what is needed to move into the lead. However, to be able to put your athlete into this advantageous position the Head Coach must have a thorough knowledge of the rules governing weight changes and lifting order. Making last minute changes of attempts can often upset opponents and the timing of these changes is often crucial. Sometimes this involves taking risks especially on the clean and jerk, which will ultimately decide the medals. On the snatch, it is a good idea to be risk adverse, as this lift relies so much on balance and precision that the pre-competition game plan should be adhered to. Knowing the fighting qualities of your athletes and their reaction to pressure has a great deal of bearing on the decisions as to weight increases. The more experience the Head Coach has in high-pressure competitions the better. Developing the judgment to make the right call in a tactical battle is a quality all coaches aim for. However, the bottom line in all tactical situations rests with the lifter, if they cannot lift the weight all the tactics are for nothing. The only thing the Head Coach can ensure is that they send the lifter out for attainable weights that give the lifter the opportunity to place high – then it is up to the lifter.

Anti-Doping Control

Competitors in weightlifting are subject to drug testing both in competition and out-of-competition by USADA. If a team member is notified that they are selected for drug testing at an event, the Head Coach should direct a suitable adult person to accompany the athlete throughout the drug testing procedure. The Head Coach should ensure that both the athlete and the person accompanying him or her are aware of the drug testing procedure and their rights and responsibilities in this regard. If a lifter is selected for doping control, the anti-doping team will on completion of the lifter's final attempt, send an appointed "spotter" to accompany the lifter and provide them with a document to sign agreeing they have been informed they are to be tested. The spotter will stay with the lifter and keep them under observation – through Medal Ceremonies and any press interviews – and then accompany them to the doping control area.

Post Competition

Following the completion of the competition a closing banquet is often held (compulsory at World Championships). Normally the Head Coach accepts any team awards on behalf of the team. Consequently it is essential the Head Coach attends the banquet and is appropriately dressed. The full printed results are normally given out at the banquet and the Head Coach or Team Manager must ensure they gain a copy. Unless there are extenuating circumstances, the entire team is expected to attend this function.

Reporting

Following every event, the Head Coach is responsible for making a comprehensive written report to the association or federation represented by the team.

Topics to be covered in the Head Coach's Report:

- Competition venue
  - · Facilities
  - · Equipment
  - · Training facilities
- Coaching staff
  - · Assessment of Team coaches' performance
  - · Other Team support personnel
- Team Meetings
  - · Timing
  - · Topics covered
- Overview of the athletes' performance
  - · Individual performances and results
  - · Team results
- Behavior
  - · Attitude
  - · Cooperation
  - · Incidents
- Other issues
- Recommendations

Counting Attempts for Weightlifting Competitions

Of all the challenges that face weightlifting coaches none are as *fluid* and as important as the ability to effectively *count* attempts so that the athlete is prepared both physically and emotionally when they are called to the platform.

The first attempt is important as it sets the tone for the rest of the competition so the selection of, exactly, what weight is loaded onto the barbell is essential. Athletes want to set personal records therefore opening too *low* may prevent that goal from being reached. However *throwing caution to the wind* with the hope that something good will happen is a disservice to the athlete.

Training results are the best way to determine what the *opening* attempts should be and coaches must be aware of any *qualifying totals* at national events as the 15kg and 30kg rules are in effect. (NOTE: The 15kg rule for women and the 20kg rule for men means that the athletes opening attempts in the snatch and clean and jerk must add up to a total no less than 15kg under the qualifying total for the women and 20kgs for the men.

While the adage *"Hit your opener!"* is a good rule of thumb just what that opener is needs to be decided upon through objective reflection between both the coach and athlete.

Opening 10kg to 5kg under the athlete's previous best lift is an acceptable 1st attempt if training has gone well. The opening attempt needs to be a weight that the athlete and coach have complete confidence in. It needs to be kept in mind that and athlete may

select any weight for a second attempt. Many veteran coaches remember a day back in 1975 when Lee James (90kg class) set an American record in the snatch of 165kg his opening attempt was 150kg.

Once the opening attempts have been determined the coach and athlete need to decide on the strategy used to get to that opening attempt. In a conservative approach the coach will right down the opening attempt 10 to 5kg *less* than the intended opening attempt, not because they lack confidence in the athlete but to allow for the changes of attempts by other coaches or in case the official count experiences confusion. This is approach is very sound as the rules allow for 2 changes per attempt and knowing this rule can be used by the coach to allow the athlete to receive more time between lifts if necessary.

The *1kg Rule* needs to be understood as the barbell progression can be such that another adage *Hurry up and wait* can also come into play. How many athletes want the same weight on the bar and the number of missed attempts that result in repeating an attempt at the same weight will also affect the warm-up count.

With all the above been stated an acceptable method of counting attempt is this.

The 5kg 3 attempt Strategy

This approach focuses on the idea that most athletes take increase of 5kg between their 1st and 2nd attempts and 2kg to 5 kg between their 2nd and 3rd. (Even if the actual amount is less the count is not adversely affected by using this approach.) For every 3 attempts on the competition platform the athlete performs one attempt on the warm-up platform. Using the philosophical *Backwards Design* approach the coach and athlete can fill out their warm-card as listed below. The 1st card is blank the second card is filled in. (NOTE: In the event that the athlete is going out to the competition platform *before* the number of warm-up attempts *counted* can be completed just treat the *attempt* as a *minute*. 9 attempts becomes 9 minutes. A warm-up attempt every 3 minutes fits very well into the accepted *neural stimulus* activity studies data results concerning athletic warm-up regarding weightlifting.)

DATE				
EVENT				
ATHLETES NAME				
CLUB				
Bwt:			**Total**	
	SNATCH		**C&J**	
		Attempt		
Actual	**Intended**		**Intended**	**Actual**
		3'		

		2'		
		1'		
		3'		
		6'		
		9'		
		12'		
		15'		
		18'		
		21'		
		24'		
		27'		
		30'		

DATE				
EVENT				
ATHLETES NAME				
CLUB				
Bwt:			**Total**	
	SNATCH		**C&J**	
		Attempt		
Actual	**Intended**		**Intended**	**Actual**
		3'		
		2'		
	70	**1'**	***90***	
	65	**3'**	**85**	
	60	**6'**	**80**	
	55/2	**9'**	**75**	
	50/2	**12'**	**70**	
	45/2	**15'**	**65**	
	35/3	**18'**	**55/2**	
	35/3	**21'**	**45/3**	
	B/3	**24'**	**45/3**	
		27'	**B/3**	
		30'		

While nothing is etched in stone and only actual experience will improve the ability to count attempts effectively following the suggestions in this article should provide a foundation for becoming proficient in this area of coaching.

Chapter 12
Advanced Programing Design

Training in weightlifting or Sports Performance is a complicated task and does not respond to any theory without giving careful attention to the fundamentals principles that govern it. There must be collaboration between the factors of Volume, Intensity, Frequency and the Selection of Exercises.

Parameters

- Realistic expectations of a practical outcome
- Attention to Technique
- Ongoing Analysis
- Results

Keys to Proper Programming

- Respecting the parameters can prevent the most frustrating result possible - that of good training followed by a poor performance.
- Another critical aspect of training is flexibility.
- All training is merely a template and nothing is etched in stone.
- Each and every training session is susceptible to adjustments.
- The quality of movement drives the training
- Aspects of Training
- Putting the Training into Practice
- Managing the Training
- Control the Training
- Constant Assessment

The Coach's Tasks

Plan:
Shape and organize the training to ensure adequate progress
Program:
Effective ordering of exercises and the training plan
Apply:
Adjusting the training to meet the demands of individual athletes
Observe:
Authentic observation and adaptation of the training
Analyze:
Dealing with the factors that interrupt the progress of training
Assess:
Controlling variables that impede the connection between goals and results
Conclusions:
Objective summary and evaluation of the Program and the Results

New Training:
Edit, add, delete modify and adjust for the next training cycle

OVERVIEW OF PERIODIZATION

Types of Training "Cycles"
Research has shown that the processes of adaptation are better suited to a cyclic nature than that of a linear one. A series of stages are needed in order to increase adaptation and improve performance:

Minicycle: What is occurring within a day of training.
Microcycle: What is occurring within a week of training.
Mesocycle: What is occurring within a month of training
Macrocycle: What is occurring within a competition cycle

All cycles have a set of activities and exercises that are repeated in relationship to the focus of each cycle. Each cycle relates to every other cycle and is subject to constant revision and evaluation.

GOALS OF PROGRAM DESIGN

- Improve Performance
- Reduce Injury (rate and intensity)
- Refine Technique
- Increase work capacity
- All Training Programs should contain the Following Qualities:
  1. Easy to Understand and monitor
  2. Be of a cyclic nature
  3. Have built in checks of progress
  4. Allow for individual creativity
  5. Allow for the inclusion of remedial movements for error correction

MILO OF CROTON AND THE CONCEPT OF PROGRESSIVE OVERLOAD

One of the great stories of strength training and progressive overload is the legend of a man named Milo. While he is an actual person with 6 Ancient Olympic Wrestling Laurels to his name it is his defining contribution to strength and conditioning lore that he is best remembered. The story of Milo goes like this, when Milo was a child he had a young bull calf and every day for four years he would go and lift the calf on his shoulders and carry it to the field to graze. At the end of the day he would go out to the field and carry the calf bull back. At the end of the four years, when the bull was full grown, Milo, a young man, was still able to carry the bull back and forth from the field establishing the benefit of progressive overload training.

True Progressive Overload is a systematic increase of training load, over time and in accordance with the individual's capacity and ability.The goal is improved performance over an extended period of time.

If carried out properly the athlete may experience increases in performance for long periods of training and competitions. The Workload continuously increases from beginner to elite athlete.

Contributors to Modern Periodization

The key to be a successful cyclist is a fundamental scientific approach to training. As early as 1936, scientists like ***Hans Selye*** started to investigate the mechanisms of load, overload, and recovery. Later, in the 1940's, Russian scientist discovered that athletic performance improved by varying the training stress throughout the year rather than maintaining a constant training load.

In 1959 ***Ivan Beritov*** was given credit for the concept of *Supercompensation* Training when, after several studies he released this comment

"*When an athlete is training, his body undergoes stimulations which traumatize it, wear it down, tire it out, and even destroy it. If a recovery period follows these training sessions then the tissues will be restructured and the athlete's body will come back, not only to its former level, but even surpass this level in the case of a sufficient stimulus. If appropriate control measures are not used such a preponderance of break-down and build-up leads rapidly to injuries."*

Leonid Matveyev developed a basic periodization model in 1964 which set the standard through his understanding the relationship between volume, intensity, and technique.

East German and Romanian scientists, especially ***Dr. Tudor Bompa,*** further developed that concept and the system of Periodization was born. Bompa studies, also known as the "father of periodization", helped the Eastern Block countries to dominate in sports from the 1960's on.

Pat O'Shea was able to to explain the relationship between the physiological, muscular, neurological, and psychological adaptations with his S.A.I.D Principles. **S**pecific **A**daptations to **I**mposed **D**emands. Adaptations will occur in direct response to the imposed demands placed upon it in a systematic manner.

The less experienced the weightlifter, the greater the number of exercises will be in their 'menu'. Placing exercises into specific categories, based upon their focus will allow the athlete to progress more quickly.

Vladimir Zatsiorsky and ***Mel Siff*** also made significant comments to the concept of periodization and supercompensation when they suggested the following:

"During periods of strenuous training, athletes cannot achieve the best performance results for two main reasons. ***First, it takes time to adapt to the training stimulus. Second, hard training work induces fatigue that accumulates over time. So a period of relatively easy exercise is needed to realize the effect of the previous hard training sessions- to reveal the delayed training effect.*** It is assumed that for none workout with an average training load, the durations of the fitness gain and the fatigue effect differ by a

factor of three: As can be seen, there are general guidelines to fatigue values and when to workout again. This is not an exact science."

Following the recommendations of Siff and Zatsiorsky, an inducement of fatigue every 4th – 7th day could be optimal for most athletes. (This means if you induce a fatigue value during your workout, you will need to wait another 4 days until training a similar motor unit pattern to promote supercompensation). If an athlete wanted to train at a higher intensity, a greater fatigue rate would be induced every 7-9th day. The end result is supercompensation from each. ***These are strong scientific guidelines only, remember, each athlete is an individual, so each program/system has to be individualized to increase his/her performance. After all, isn't the goal of training… to increase performance?***

Categories of Exercises				
A. Competition Lifts	Snatch		Clean & Jerk	
B. Derivatives of Competition Lifts	Cleans	Rack Jerks	"Hang" Snatch	"Hang" Clean
C. Strength and Power Movements	Power Snatch	Power Clean	Power Jerk	Snatch Pull
	Clean Pull	Back Squat	Front Squat	R.D.L.
D. Combination Movements	Pulls + Snatch	Pulls + Clean	Power Snatch+ Overhead Squat	Power Clean + Front Squat
	Front Squat +Press	3 Position Snatch	3 Position Clean	
E. Assistance Movements	Snatch Shrug	Clean Shrug	Goodmornings	Presses
	Push Presses	Bench Press	Seated Press	
F. Remedial Movements	Jerk Balance	Jerk Recovery	Lift Offs	Lockouts
G. General Fitness Movements	Abdominal Work	Core Work	Pull-ups/ Push-ups	Dips

Sets, Reps and Weight Selection

First and foremost technique drives the training. Skills incorrectly learned early on are the most difficult to correct. Correct technique is always re-enforced.

Studies have shown that the nervous system of a novice athlete will fatigue much quicker than the muscular system. Maintaining neural integrity is a critical component to mastering proper technique.

Other studies have also shown that when performing "Higher skill" movements, fatigue sets in quickly and that sets of 3 reps seem to maintain neural integrity. It is

recommended that when dealing with novice lifters a total volume of 30 reps per Skill Exercise is followed.

Coaches should consider the following statement by German Coach Michael Kellmann:

> *" In the real training world the concept of less is more seems to be hard to sell. Most coaches feel that coaching is their job, and it is the duty of their athletes to follow their regimes. In addition, when coaches back off too much, performance may decrease. This shows that there is a careful balance between practice and recovery.* ***Practice is important to improve performance, but the focus should be on the quality rather than on the quantity of training****. During long and hard training sessions athletes tend to take "hidden rests," for example, by going at a slower pace during the exercises. A thoughtful variation of the training exercises includes a recovering element. An increase of the overall quality of training occurs when the standard regular training routine is modified, when new exercises are introduced, or simply when different types of training are applied. Underrecovery and overtraining: Different concepts—similar impact? This question can clearly be answered with a yes and a no. Yes, they have the same impact—performance declines; No, they are not similar—****underrecovery is the precursor/cause of overtraining****. Consequently, the key to prevent overtraining is an active and proactive enhancement of recovery. Coaches and athletes need to be educated about the importance of optimal recovery and its impact on performance."*

Weightlifting skills seems to be learned best when the weight is 70% to 75% of a one rep max. But when dealing with a novice when a one rep max is not known, the coach needs to consider the *quality of movement* as the beginning point, and then adding or subtracting weight in accordance with the technique.

SETS ARE MORE IMPORTANT THAT REPS.

For the Novice Weightlifters it is more important to complete a few reps correctly than to do reps until failure or until technique is lost. (In fact poor quality reps at the end of a training session are more likely to become the muscle memory.)

Novice Athletes and their coaches should place Sets in Front of Reps.

If we use the 30 rep formula for quality maintenance and that for the Novice athlete 3 reps per set for the High Skill Movements then we have established 10, TOTAL, sets for novice athletes when training the Olympic Lifts and their derivatives.

Sets and reps for other movements. Once again research has shown that Power Production begins to go down after 5 reps.
In fact Hypertrophy for Weightlifters is completely different than it is for other athletes. A Canadian study showed that once an athlete decides to do a set of 12 or more, the weight is so light that the exercise becomes completely an endurance exercise.

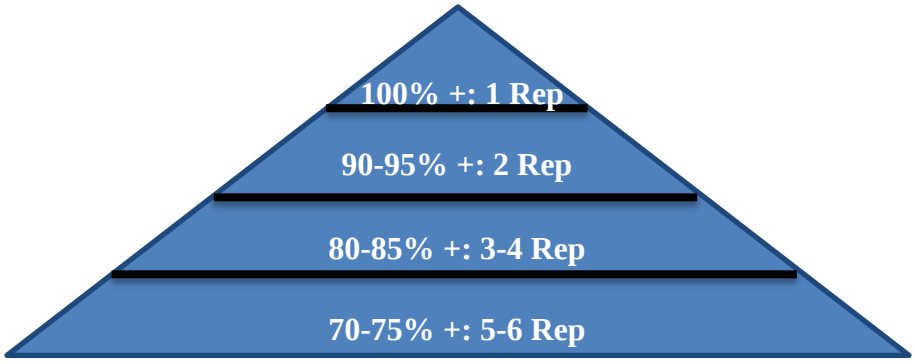
Weightlifters compete ONE REP AT A TIME and the training needs to mimic this in order for the proper body energy system to become functional.

When Training Weightlifters Consider Three Cycles :

Cycle One: Stabilize the Joints
Cycle Two: Power the Muscles
Cycle Three: Recruit the Nerves
COMPETE

If the Olympic Movements are trained for 3 reps per set (To maintain Quality of Movement) and all other movements are trained 5 reps per set (To maintain Power Production) we are now getting to the understanding of Volume for our First Cycle.
It is suggested that athletes should perform 3 to 5 warm-up sets prior to their TARGET SETS (In Target Setting the athlete performs multiple sets at the Same weight. The rationale for this is the get the athlete into the Second Quadrant of Training (Assimulation)). The rational for Volume comes from Pat O'Shea and his book Quantum Strength Training.

O'Shea (Oregon State University) stated in his book Quantum Strength Training the S.A.I.D. principle of training. SAID stands for Specific Adaptation to Imposed Demands. In this training the relationship between frequency, duration and intensity is examined. O'Shea recommends the following Reps for the related percentages of a One Rep Max.



Once again it is important to remind athletes and coaches that these are the sets and reps recommended to develop power and strength while focusing on correct technique.

Exercises may be placed into 4 main groups:

"A" Lifts	Competition Movements
"B" Lifts	Squats
"C" Lifts	Pulls
"D" Lifts	Remedial Movements

Here is what Supercompensation training looks like as an Overview

	Cycle 1 Preparation Phase ***Train the Joints***				**Cycle 2 Strength Phase** ***Train the Muscles***				**Cycle 3 Competition Phase** ***Train the Nerves***			
Week	1	2	3	4	5	6	7	8	9	10	11	12
	Base	**Loading**	**Supercompensation**	**Performance**	**Base**	**Loading**	**Supercompensation**	**Performance**	**Base**	**Loading**	**Supercompensation**	**Performance**
%	70	75	65	80	75	80	70	90	85	90	80	100
Target Sets "A" Lifts	3	4	2	2	3	4	2	2	3	4	2	2
Reps "A" Lifts	3	3	3	3	2	2	2	2	1	1	1	1
Target Sets "B &C" Lifts	3	4	2	3	3	4	2	3	3	4	2	3
Reps "B" Lifts	5	5	5	5	3	3	3	3	2	2	2	2

Creating Competition Program for Novice Weightlifters

All Training Programs should contain the Following Qualities

1. Easy to Understand and monitor
2. Be of a cyclic nature
3. Have built in checks of progress
4. Allow for individual creativity
5. Allow for the inclusion of remedial movements for error correction
6. It is recommended that each training session contain
   - One Olympic Movement (Classical or a Derivative)
   - One Pushing Movement
   - One Pulling Movement
   - One Leg Movement
   - One "Core" movement

All Training Programs should also consider the following outcomes

1. Improve Performance
2. Refine Technique
3. Increase Work Capacity
4. Reduce Injury

Training Programs are essentially regimens of stress and recovery to which the athlete adapts. All programs can only have 1 of 3 outcomes

1. Insufficient stress; No Progress

2. Too much stress; Collapse and or injury
3. Optimum stress: Ongoing improvement

Once again it is proposed that Novice be exposed to the Supercompensation Model to maximum the opportunity for ongoing progress.

Training for National Level Competitions

As the athlete improves their performance, their training must constantly improve as well. Typically weightlifters with two years of training, and competition experience, but not yet qualified for national championships are referred to as a *Club Lifter*.

Training for a National Championships means attaining a specific qualifying total which requires training to become more focused and challenging.

Many training programs that are published in other countries must be viewed with a level of skepticism for a number of reasons as the enormous amount of volume and the level of intensity are unrealistic circumstances for the *typical* American Weightlifter who has many obligations outside of being a professional, fulltime, Weightlifter.

However Americans cannot be lulled back into the thought that we can expect to compete at the international level with a 3 day per week training program.

Once again programs from other countries are usually the result of a high level identification and selection process which began at a tender age. Therefore we (USA Weightlifting Coaches) need to be very selective as to what we can and cannot use in our own environment.

American Weightlifters can become competitive at the international level but in order to do so we must move our athletes through a series of training modalities.

A Club Weightlifter can expect to see an increase in their training loads and with that an expectation of improved performance. It is, again, recommended that a Club Lifter still be exposed to the *Supercompensation* Model.

It is suggested that in order to increase the volume portion of a training model two methods be considered. *Increasing* the Number of *Days* of training per week and *increasing* the number of *Sets* at the Top End or Target Area.

Novice Weightlifters train 3 to 4 days per week. It is suggested that Club Weightlifters train 4 to 5 days per week. (It is also suggested that Club Weightlifters stay at ONE SESSION per day and not, as of yet, move to multiple training sessions per day unless they are training under *ideal* circumstances)

"There is a strong opinion, that is backed by research and results that indicate that spreading a given workload or volume over an increased number of workouts will

produce an enhanced training effect by allowing the athlete to handle an increase in intensity." (USA Regional Coach Training Manual 2004)

Comparing Novice Training to Club Training

Club Training is Different:	as the Volume and Intensity has increased, especially in Weeks 2 and 4.
	in that the expected outcomes of each Cycle has changed.
	as *Fault Correction* will have a greater degree of exercise selection change in the training. (The Programs listed are examples and it is expected that coaches will fine tune the exercise selection to fit the specific needs of their athletes.)
Club Training is Similar:	in that it still follows the Supercompensation Format and uses the Same Exercise Categories.

Goal of Cycle One: Hypertrophy, and Conditioning
Goal of Cycle Two: Power, Strength, and Skill
Goal of Cycle Three: Skill, Neural Adaptation, and Competition Preparation

Examples of Club Training Programs may be found in the Appendix

Training and Exercise Selection for the Advanced Weightlifter

Advanced Weightlifter Designation
Advanced Weightlifters are those athletes who have qualified for National Championships and are looking to the challenge of International Competition. In previously discussed programs *Cyclic Training* was explained and illustrated. Now training will move to a more individualistic and sophisticated model. The Training Model will now move from a monthly cycle to a yearly cycle with competitions built into the training. Much of what took place during the Novice and Club periods was the development of technical skills, training capacity, athleticism, competitive aplomb and biochemical pathways that would enable the weightlifter to embark upon the more demanding Advanced Training. This training is geared to produce results approaching the elite level and is in effect developmental for the Elite Athlete Designation.

The Yearly Calendar
The first item to accomplish is to map out the years training, based upon major competitions. For most National Level Weightlifters the American Open, held in early December, is the first major competition. This is then followed by a series of National Championships, Junior, University and *The* National Championships. The time between competitions are broken into Preparation Periods and Competition Periods. Competition Periods are usually 5 weeks in length but will need adjustments as the yearly competition calendar does not always balance out to meet 4 week cycles. In the periods between the meaningful competitions, the athlete may participate in other lesser competitions to determine the effect of training and to gauge the progress.
Preparation Periods are, typically, twice the length of Competition Periods and its emphasis is on Strength and Power. Competition Periods will place the majority of

training on the execution of the Snatch and Clean and Jerk. For weightlifters, early season training could be 75% Strength and 25% technique and slowly crossover by year's end. Here is how noted Strength Coach and Author Pat O'Shea sees yearly cycling.

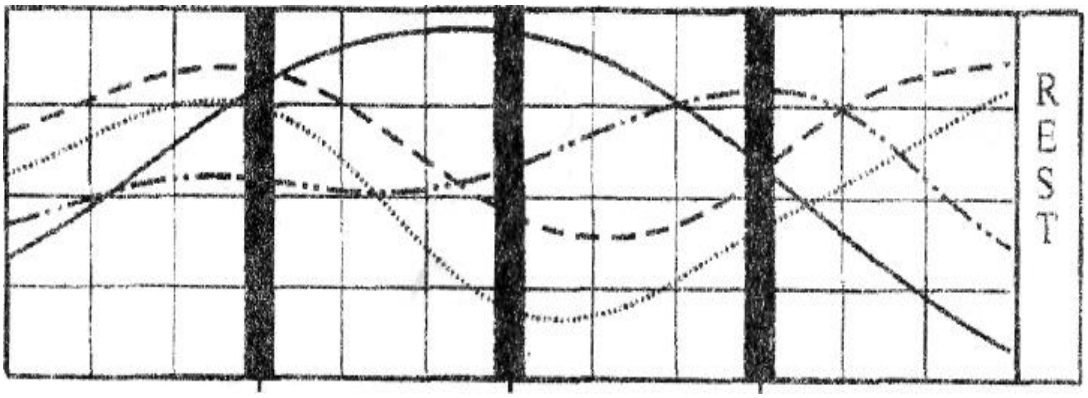


Figure 1. Each column represents a month. Each dark bar represents a rest week. The dash line represents cycling. The dash and dotted line represents swimming. The dotted line represents running. The solid line represents weight training.

Here is an example of yearly cycling.

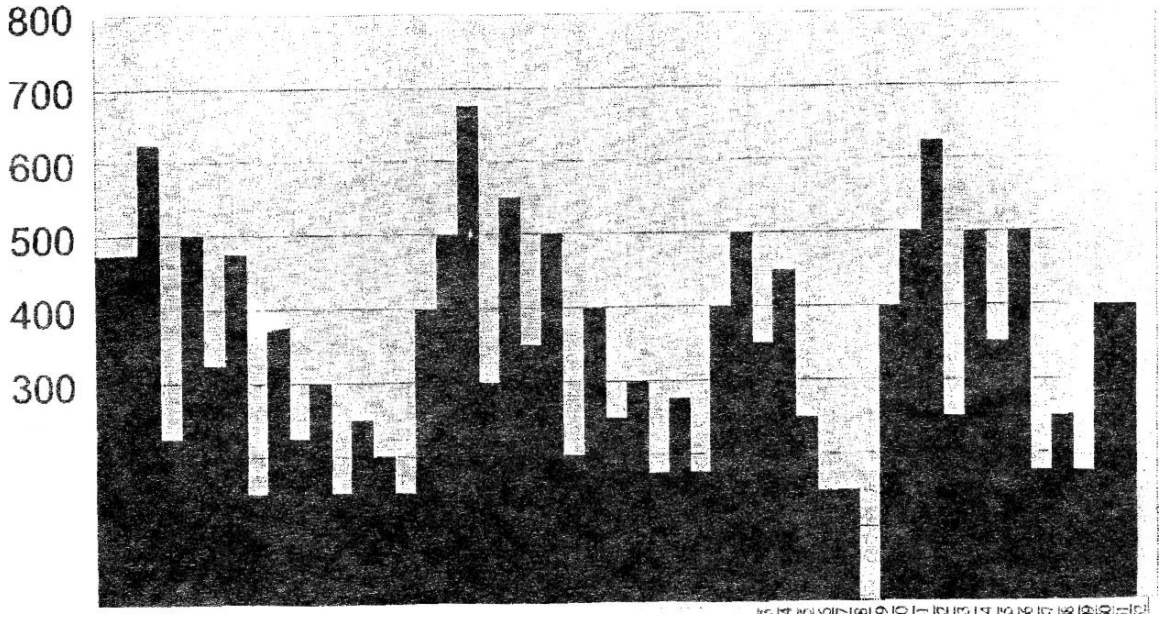


Figure 2 Each vertical bar represents a single week. The vertical axis represents the number of reps. The blank bars are weeks of complete rest.

Yearly Volume (number of repetitions)

Volume must also be calculated for these factors: Age, Experience, Gender and Bodyweight. Lightweight females can carry higher volumes then Heavyweight Males, while the heavyweights can handle higher intensities. The number of training sessions per week, total hours of training per week, as well as rest and recovery days are also planned.

Loading by Exercise and Exercise Category

Exercise selection will be determined and modified by the actual evaluation of the athlete's strengths and weaknesses. Athletes that have difficulty jerking weights after they have been easily cleaned will have more overhead work built into their training. Begin with a historical look at the volume that the athlete has accomplished, on a monthly basis, and once again place that into the Supercompensation Model.

If the athlete has, historically, performed 1,500 reps in a month's time, for a Personal Best, begin there. In the first month of training 75% of the reps in training will be on Strength and Power with 25% on the technique of the Snatch and Clean and Jerk. With that in mind an overview of the Program may look like this.

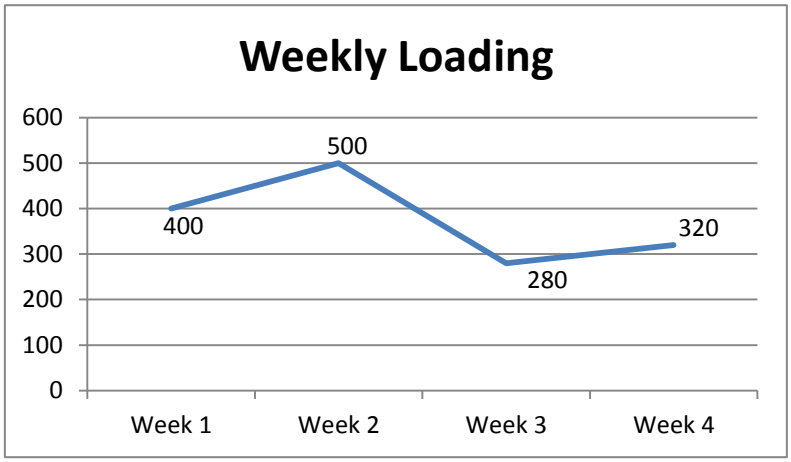
75% or 1,250 reps will be Squats, Pulls, Presses, and 25% or 425 reps will be Snatches, Cleans, and all Jerk Movements. Abdominal exercises will be included but not counted as part of the loading.

Snatches will receive more attention than the Clean and Jerks as the C&J is a more demanding movement so less will be practiced in order to maintain a high degree of efficiency.

Exercise	Reps	Exercise	Reps
Snatch	135	Clean & Jerk	115
Rack Jerk	85	Jerk Behind Neck	90
Front Squat	300	Back Squat	300
Snatch Pull	200	Clean Pull	200
R.D.L	150	Pressing Movements	125

Weekly Loading

Using the Supercompensation Model the weekly rep count would look like this:



The number of training sessions will be determined by two factors: time and volume.

Individual Session Considerations

Studies have shown that hormonal levels drop off after 60 to 90 minutes of training and that technique starts to ebb after 25 to 30 reps. Since most models of training contain One Olympic Movement, One Pull, One Press, One leg and One remedial movement, sessions may contain no more than 120 to 150 total repetitions. If quality of movement needs to be maintained 100 to 120 total reps per session may be a more conservative approach that will yield improved results.

Sessions Per Week, Day

Based upon that model Week One would have 4 sessions, Week Two 5 sessions, Week Three, 3 sessions and Week Four, 4 sessions. It is now time to consider Multiple Training Days. An easy way to maintain quality of training is to spread out the sessions over a 5 day training week.

Twice day training can be a real challenge to the typical American Weightlifter. The work demands on Americans are both high and intense. Finding time to train during a 40 to 50 hour work week will be difficult, but the rewards can be great and it is something to consider. It can be noted that 7 and 8 session weeks are becoming common for high level weightlifters under *ideal* environments. The USA Weightlifting Resident Team has twice daily training on Monday, Wednesday and Friday. Once daily training occurs on Tuesday, Thursday and Saturday with Sunday being an off day.

NOTE: All training is subject to modification. Coaches must realize that any session's workload is just a template and that adjustments must be made based upon the athletes health, career and family commitment, and technique display. Athletes must realize that quality of movement receives the highest priority and when the coach suggests that the athlete lower the weights from the days expected training that is not a negative observation nor does it bring into question the athletes desire or resolve. The speed of movement of the bar is one of the most reliable indicators by which to judge training efficacy. One of the functions of the coach is to develop the visual acuity skills to make accurate assessments of speed. This is especially true when determining the intensity of pulls.

The focus of each Cycle: As with all training programs that are cyclic in construction Cycle One will deal with Hypertrophy training and motor neuron recruitment. Cycle Two will focus on strength and power development while Cycle Three will look at neural training and competition preparation. Although the primary focus of each cycle is prescribed here, it does not mean that other aspects of training should be ignored. They are rather de-emphasized.

For those wishing to attempt Multiple Training Days a workable schedule is listed below.

A Five Day 7 Session Training Routine May look like this.

SAMPLE TRAINING PROGRAM CYCLE ONE

	Saturday	Sunday	Monday	Wednesday	Friday
AM	Back Squat Press Clean Pull	Jerk from Rack RDL			
PM	Power Snatch C&J	Power Clean Front Squat Snatch Pull	Power Snatch Behind Neck Press Back Squat	Snatch Behind Neck Jerk Front Squat RDL	Power Clean + Power Jerk Back Squat Snatch Pull Behind Neck Press

SAMPLE TRAINING PROGRAM CYCLE TWO

	Saturday	Sunday	Monday	Wednesday	Friday
AM	Back Squat Push Press Clean Pull	Rack Jerk Clean Pull RDL			
PM	Power Snatch C&J Snatch Pull	Power Clean Front Squat Snatch Pull	Hang Snatch Behind Neck Push Press Back Squat Clean Pull	Snatch Behind Neck Jerk Front Squat Snatch Pull	Clean & Jerk Behind Neck Press Back Squat

SAMPLE TRAINING PROGRAM CYCLE THREE

	Saturday	Sunday	Monday	Wednesday	Friday
AM	Back Squat Snatch Pull	Rack Jerk Front Squat			
PM	Hang Snatch C&J	Snatch Clean Pull	Power Snatch Back Squat Snatch	Snatch Push Press Behind Neck Front Squat Clean Pull	Clean & Jerk Back Squat Snatch Pull

It is critical for the reader to know that this is an *example.* Every advanced program should be set up with the specific needs of the athlete being addressed. The only *menu* to follow is that skilled movements go first in a session and when the athlete is training twice a day how they respond to training under that situation determines the set-up

The distribution of repetitions by sets and percentage ranges

The arrangement of sets and repetitions will now be discussed. Once again muscular hypertrophy for weightlifters is considered to be no more than 5 sets of 5 reps in the

Strength and Power Movements and no more than 5 sets of 3 reps in the Olympic movements in order to maintain skill levels.

There are several, acceptable, approaches to attaining proper weightlifting adaptation

Method #1: Target Setting, after performing 3 to 5 warm-up sets the athlete performs repeated sets at a prescribed load

Set	1	2	3	4	5	6
Intensity	50%	50%	60%	70%	70%	70%
Reps	3	3	3	3	3	3

Method #2: American Pyramid, An increase in weight combined with a decrease in Volume

Set	1	2	3	4	5	6
Intensity	50%	60%	70%	80%	85%	90%
Reps	5	4	3	2	1	1

Method #3: Segment Work, A *double* pyramid

Set	1	2	3	4	5	6
Intensity	80%	85%	90%	80%	85%	90%
Reps	1	1	1	1	1	1

Method #4: Double Stimulation, Training both the nerve and the muscle (80%x3),(90%x1),(80%x3),(90%x1), (80%x3),(90%x1)

Set	1	2	3	4	5	6
Intensity	80%	90%	80%	90%	80%	90%
Reps	3	1	3	1	3	1

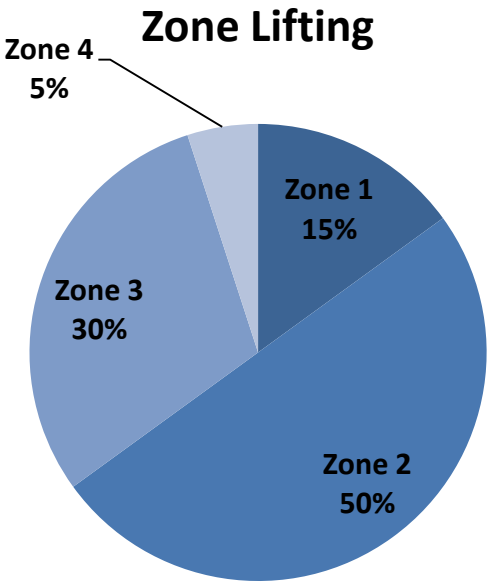
The use of these models will be decided upon the *line of best fit* as determined by the coach and the athlete. There is no *magic formula* for becoming a successful Advanced Weightlifter. There is only observation and implementation of proven scientific based training models.

The Determination of load within Intensity Zones

The greatest challenge of developing Advanced Training Programs is that of properly manipulating Intensity. Two factors have been determined. Training loads should be measured between 65% and 100% (loads below 60% are considered *warm-ups* and are not calculated in the training load or volume.)

Training Distribution has also been set up. 75% of the training is Strength and Power with, 25% of the training being devoted to technique.

Once again the athlete's, age, gender, somatotype and skill level will influence the training areas set up as well as determining the Preparatory phases and the Competition Phases.



Going back to Gene Baker (USA) and his *Zone Lifting* we can create 4 areas of intensity

There is an adage in weightlifting that states "80% of the time you should be training at 80%." The bulk of the training should occur in Zone 2, as high as 50% of all training. 15% in Zone 1, 30% in Zone 3, and 5 % in Zone 4.

Zone 1	65-75%
Zone 2	76-85%
Zone 3	86-95%
Zone 4	96-100+%

	Cycle 1				Cycle 2				Cycle 3			
Weeks	1	2	3	4	1	2	3	4	1	2	3	4
HE- High End LE- Low End	**Base**	**Loading**	**Supercompensation**	**Performance**	**Base**	**Loading**	**Supercompensation**	**Performance**	**Base**	**Loading**	**Supercompensation**	**Performance**
Zone	1 HE	2 LE	1 LE	2 HE	2 LE	3 LE	1 HE	3 HE	2	3	1	4

The plan for Advanced Weightlifters is not cast in stone and in fact needs to vary greatly to meet the individual needs of the athlete. However if you look at the models given you will see the proper relationship between intensity and recovery, strength and technique and volume and load.

While the scripting out of yearly plan is critical to attaining the set goals it is important that both coach and athlete be able and willing to go *'off script'* when necessary.

The original goals of all program design are always in the conversation.

1. Improve performance
2. Increase work capacity
3. Refine technique
4. Reduce and hopefully prevent injury.

One factor that should be taken into consideration when planning the training is the K-value. The K-value is 100 times the average weight lifted during each repetition of a macrocycle (2 prep cycles plus 1 competition cycle), divided by the total attained in competition at the end of the macrocycle. For most Class I athletes, the K-value will be in the range of 38 to 42.

If too many repetitions are prescribed in Zone 1 and not enough to compensate in Zone 3 or 4, the K-value will be too low. If the K-value is too low, the speed of movements will be high, but the strength gains may be slightly. This will result in a total where the snatch is high and the clean and jerk is disproportionately low. Conversely, if too many repetitions are in zones 3 and 4, but not enough in zones 1 and 2, the resultant total will show a high clean and jerk result and a low snatch performance.

Championship performances are usually made up of balanced efforts in the two lifts where the snatch is in the 77% to 82% range of the clean & jerk.

USA Weightlifting Resident Team Training Program

Currently under the direction of Zygmunt Smalcerz the Resident Team Training Program is based upon both the unique abilities of the High Performance Athletes that are training at the Olympic Training Center in Colorado Springs and Coach Smalcerz's ability to fine tune the programs to the needs of the individual.

The basic program consists of 6 days per week. 3 days of Single Session Training and 3 days of Double Session Training.

Coach Smalcerz has a *menu* of 39 Snatch movements, 39 clean movements, and 23 Jerk movements. The snatch and the clean & jerk are the end result of all the training that is completed so the athlete *can* Snatch and Clean & Jerk. What makes Coach Smalcerz's training unique is that while each session is typically, a Snatch Session or a Clean & Jerk Session, the progressions are placed in order and exercises selected as to the need of each individual athlete.

THE MAIN MENU

Snatch Movements	Clean Movements	Jerk Movements
• Starting Position Stick • Pull to Straight Position – Hip • Jump Up Hip • Jump Up Knee • Jump Up Below Knee • Starting Position Bar • Starting Position Pull/Jump • Jump Up Knee /Power Snatch • Jump Up Box Knee /Power Snatch • Jump Up Below Knee /Power Snatch • Power Snatch Knee • Power Snatch Below Knee • Power Snatch Knee non Stop • Power Snatch Hip/Knee/Below Knee • Power Snatch • Power Snatch Split • Power Snatch/Squat • Power Strength Snatch • Snatch from Hip • Snatch from Knee • Snatch Knee non Stop • Snatch Below Knee • Snatch Box Knee • Snatch Box Below Knee • Snatch • Snatch Split • Snatch without moving Feet • Snatch Standing on Box • Snatch Jump On Box • Snatch Stop after Start • Snatch/Below Knee/Knee/Squat • Power Snatch/Snatch/Squat • Snatch with Variable or Changeable Weights • Walking in Snatch • Drop Bar • Drop Bar/Squat Snatch • Drop Bar/Squat/Press in	• Starting Position • Pull to the Straight Position • Jump Up – From Knee • Jump Up – From 2/3 of the Thigh • Jump Up – From Knee to Power Clean Position – Elbows Up • Jump Up – From 2/3 of Thigh to Power Clean Position – Elbow Up • Starting Position Stick • Starting Position Bar • Starting Position – 2/3 of Thigh Pull/Jump/Power Clean • Jump Up 2/3 Thigh /Power Clean • Jump Up Box /Power Clean • Jump Up Box Below Knee /Power Clean • Power Clean 2/3 of Thigh • Power Clean Knee • Power Clean Below Knee • Power Clean Knee non stop • Power Clean 2/3 of Thigh/Knee/Below Knee • Power Clean Split • Power Clean/Squat • Power Straight Clean • Clean from 2/3 of Thigh • Clean from Knee • Clean Knee non Stop • Clean Below Knee • Clean Box Knee • Clean Box Below Knee • Clean • Clean Split • Clean without Moving Feet • Clean Standing on Box • Clean Jump on Box • Clean Stop after Start • Clean/Below Knee/Knee/Start	• Press Stick • Press bar • Half Squat • Half Squat Bar • Push Press • Jump • Jump with Bar • Power Jerk • Split Jerk • Return • Jerk Step • Split Squat Forward • Press in Split • Jerk in Split • Split • Jerk • Power Clean Split • Split Squat Front • Split Squat Back • Walking in Split Bar Front and Back • Walking in Split Bar Overhead • Dip and Drive • Jerk with Changeable Weights • Static Positions for Jerk

Snatch
• Squat Snatch
• Pull Snatch
• Grip
  • Open
  • Hook
  • Middle
  • Snatch
  • Straps
	• Power Clean/Clean/Squat
	• Clean with Variable or Changeable Weights
	• Grip
	  • Open
	  • Hook
	  • Middle
	  • Snatch
	  • Straps	

Outline of a *Typical* Session

Snatch Session (Numbers are percentage of 1RM)

AM	Set#1	Set#2	Set#3	Set#4	Set#5	Set#6
Reps	3x	3x	3x	3x		
Press in Snatch	30	40	40	40		
Reps	1x	1x	1x	1x		
3 Stage Snatch	40	50	60	60		
Reps	2x	2x	2x	2x	2x	2x
Snatch w/o/m feet	50	60	70	75	80	80
Reps	1x	1x	1x	1x	1x	
Snatch	70	75	80	85	90	
Reps	3x	3x	3x			
Snatch Pull	100	100	100			

Clean Session

PM	Set#1	Set#2	Set#3	Set#4	Set#5	Set#7	Set#8
Reps	3x	3x	3x	3x			
Press in Split	25	30	40	40			
Reps	1+1	1+1	1+1	1+1	1+1	1+1	1+1
Jk.Bk+Jk	50	60	70	75	80	80	80
Reps	2+2+2	2+2+2	2+2+2	2+2=2	1+1+1	1+1+1	1+1+1
Blk.ClPl+Cl+Sqt	50	60	70	75	80	80	80
Reps	2x	2x	2x				
Pwr.Clean	70	70	70				

Additional examples may be found in the Advanced Program Design Chapter on the course website

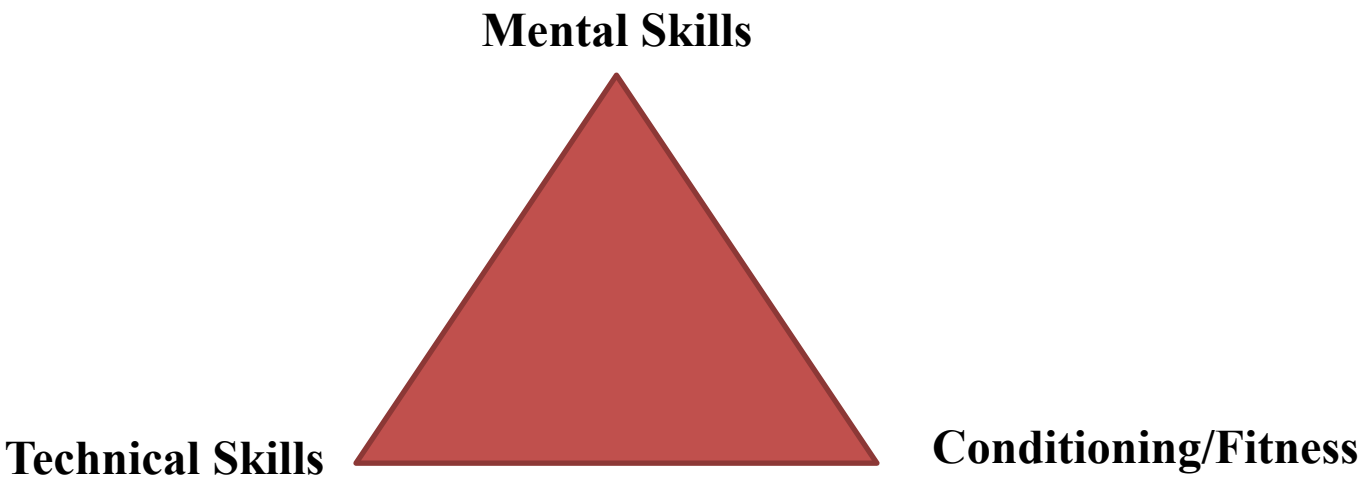
Chapter 13
Sports Psychology, Gaining the Mental Edge

Have your weightlifters ever:

- Lacked motivation to practice on a regular basis?
- Lost confidence in their abilities, especially after performing poorly?
- Become distracted or lost focus in competition?
- Become anxious and tight under pressure?
- Put more emphasis on outcome then on their own performance?
- Performed poorly after really good practice performance
- Become frustrated or mad after making a mistake or starting off poorly?

If you answered yes to one or more of these situations, then you are in good company. Most athletes (not just weightlifters) have experienced these scenarios, feelings, and thoughts. However, many have not developed the mental skills to effectively cope with these situations and achieve optimal performance. This chapter will attempt to provide a brief overview of some of the key mental skills that are associated with optimal performance along with some practical guidelines, exercises, and tips for coaches to help build these mental skills in their athletes. Before I discuss these specific mental skills, a model to help understand the relationship between technical, physical, and mental skills will be presented.

The three points to a triangle refer to the combination of different kinds of skills needed to achieve maximum performance (see Figure 1). First, athletes need to be proficient in a number of discreet technical skills. For weightlifters, these involve the specific techniques that will help produce a successful lift such as hand positioning, stance, etc. Second, athletes need overall conditioning. In the case of weightlifters, strength in different muscles groups is critical along with flexibility to help with balance, which is especially critical in certain types of lifts such as the snatch. Third, athletes need mental skills. The wrong thoughts can make your heart race, your breathing shallow, and your palms sweat. Some of these mental skills include goal setting, coping with pressure, remaining calm and relaxed, self-talk, attentional control, building and maintaining confidence, and routines.

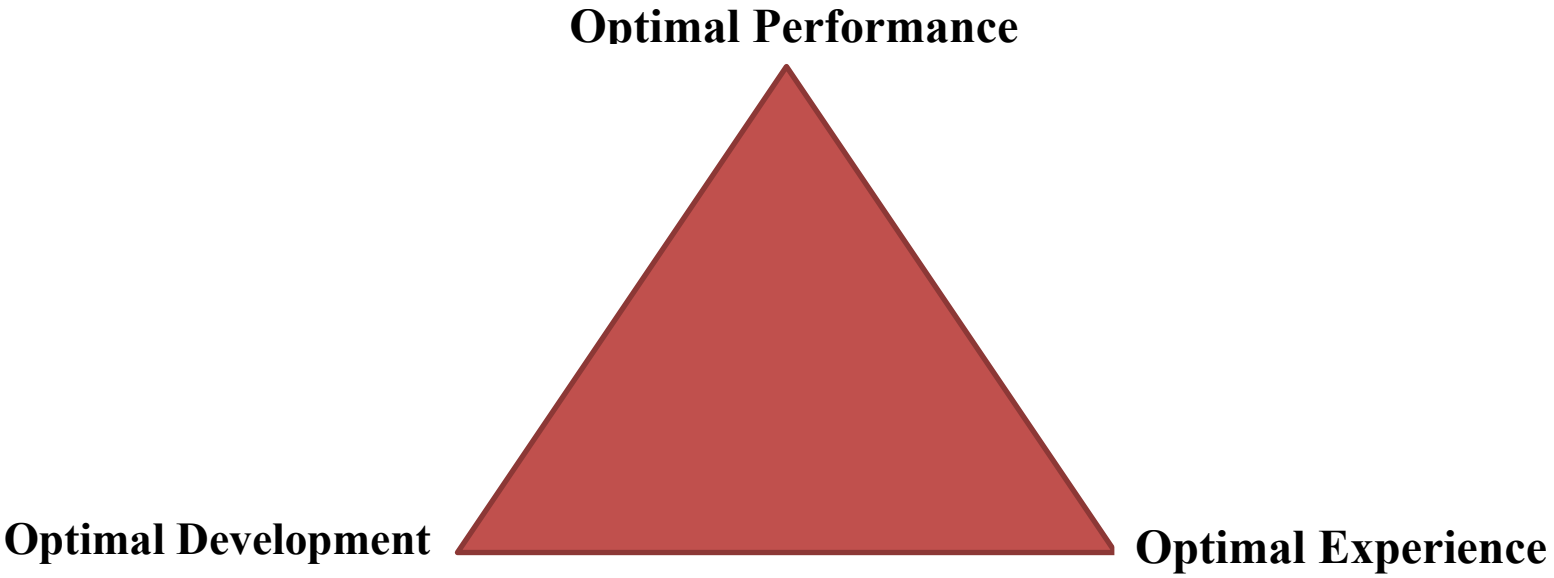


It is interesting that most coaches feel these mental skills are critical for successful performance. But when asked how often they practice these skills with their athletes, the answer is usually seldom, if at all. Coaches usually say they just don't have the time to teach mental skills or they don't know how to teach them. Thus, a major focus of this chapter is to help coaches teach these important mental skills.

Triangle Model for Optimal Performance

Most sport psychologists believe in a model that includes three main objectives of performance psychology (see Figure 2). These include (a) optimal performance, (b) optimal development, and (c) optimal experiences.

Optimal Performance. This refers to performing to the best of your ability (not simply winning). Oftentimes, the athlete who takes second or third place (or lower) is considered a loser despite the fact that coming in second place might mean you were better than 50 other athletes. Optimal performance should be viewed from the perspective of improving upon your own performance. Thus, if a weightlifter breaks their personal best by 5 kilos, but comes in 8th place, this should be seen as a success because he performed at his best and that is the only thing he can control (i.e., you can't control your other competitors).



Optimal Development refers to the important ways in which participation in weightlifting influences the individual personally. Taking part in competitive sport can help develop a healthy self-image, discipline, leadership skills, social skills, and resiliency. Developing these mental skills and transferring them to other aspects of life is not automatic. Coaches play a central role in whether, how, when, and to what extent athletes develop and transfer these skills to others aspects of their lives.

Optimal Experience refers to having fun, gaining personal fulfillment, feeling more competent and worthy, and simply enjoying the experience, regardless of the outcome or how much you are "learning." Athletes who can truly enjoy their athletic experience will typically continue participation for much longer times than athletes who simply participate for more external reasons (winning competitions, financial reward, publicity, etc.).

Mental Skills for Performance Enhancement
Now that we know a little about the importance of mental skills, their relation to physical skills, as well as the central role they play in optimal development and optimal experiences, it is time to discuss of development of these specific skills.

Goal Setting

Probably at the core of all the mental skills is motivation. If a weightlifter in not motivated, then all the other mental skills probably do not matter too much. Of course, as a coach there are a number of different ways to motivate, but we will focus on goal setting, one of the most scientifically tested and effective ways to motivate. An elite athlete is quoted below:
Motivation depends in a very large part on goal setting. The coach must have goals. Every individual athlete must have goals, real vivid, living goals. Goals keep everyone on target. Goals commit me to the work, time, effort, pain and whatever else is part of the price of achieving success.

Definition of Goals. Attempts to attain a specific standard of proficiency for a task. Goals can be **objective** such as lifting 70 kilos for the snatch or they can be **subjective** such as wanting to increase the enjoyment of practices. In either case a coach needs to be able to measure progress toward a goal. The subjective goal can be trickier to measure. But, for example, if a weightlifter wanted to measure their enjoyment in practice they first would try to understand what makes practice enjoyable (e.g., coach gives positive feedback, most of the lifts were successful, liked their workout partners, etc.). Then, they might rate their enjoyment on a scale from 1 (not enjoyable at all) to 10 (extremely enjoyable).

Types of Goals. There are basically three types of goals in sport

- **Outcome** – typically focuses on a competitive result such as winning a weightlifting competition
- **Performance** – focuses on performance in relation to your own standard of excellence. Thus a weightlifter might want to improve their clean and jerk from120 kilos to 125 kilos
- **Process –** focuses on what you need to do (technique) to be successful and perform well. For example a weightlifter may need to focus on such as "big chest" or "drive up fast."

Most athletes focus on outcome goals (winning), because society has made these the most important. There is nothing inherently wrong with outcome goals although they should not be an athlete's focus because winning (or coming in a certain place in a competition) is not under your control. In essence, a weightlifter might beat their personal best but only come in 5th place because the other competitors were simply better. The better focus is on performance and process goals as these are under the weightlifter's control. In

essence, if you reach your process and performance goals, then your outcome goal will also likely come true. Thus a weightlifter can also feel proud of himself if he breaks (or comes near to breaking) a personal best, even though he did not place well in the competition.

Goal Setting Principles. Although research is extremely clear that goal setting can significantly improve performance, goals need to be set in a way to maximize performance. Based on the research literature in sport and business, a number of principles have been developed. Many of them fit into the acronym **SMARTS.** In essence, this means goals should be

- **Specific** – state exactly what you want to accomplish – "do your best" goals do not provide specific targets for which to shoot.
- **Measurable** – make sure you can quantify your goals so you know if you are making progress toward them.
- **Action-Oriented** – defines what you need to do to reach your goals. These often are process goals which help you reach performance and outcome goals.
- **Realistic** – you can achieve the goal but it will require a good amount of effort. Goals that are too easy or too hard are not as effective as those that are moderately difficult.
- **Timely** – defines exactly when you want to reach your goal. Make sure the timeframe is appropriate for the goal that was set.
- **Self-Determined** – you set your own goal, as opposed to others (e.g., coaches) setting them for you. Coaches can certainly help set goals but weightlifters have to eventually "own" the goals.

Two more principles that do not fit into the SMARTS acronym include reevaluating goals and short and long-term goals. **Re-evaluating goals** underscores the notion that goals should be starting places, not ending places. If a goal is too difficult or too easy (as seen by performance), then that goal should be re-evaluated and changed accordingly. This will keep motivation up and continue to make the goal realistic and moderately difficult. Most goals should be both **short-term and long-term**. The long-term goal tells the weightlifter where he wants to be down the road (maybe 6 months or a year) whereas short –term goal provide feedback regarding how a weightlifter is progressing to reach his long-term goal. Thus, if a weightlifter's long term-goal (one year out) is to lift a combined 180 kilos (snatch plus clean and jerk) then his lifts each month (short-term goals) will provide feedback as to how he is progressing toward his long-term goal (maybe he will have to re-evaluate the goal based on his short-term performance). Furthermore, a short-term goal might be a daily goal or weekly goal as there is no specified time frame for a short or long-term goal.

Self-Talk

We are not disturbed by things, but rather the view we take of them

Epicitus

There is nothing good or bad, but thinking makes it so

Shakespeare

What athletes say to themselves can have a huge influence on their performance. Thus the 2nd mental skill to be discussed is self-talk.

Definition – Self-talk is what you say to yourself, either out loud or inside your head. It could be a cue word (e.g., "bend from the knees"), a statement to get you going (e.g., "I can do it"), although sometimes it can be negative (e.g., I'll never be able to lift this weight")

Types of Self-Talk

- Instructional - "keep your wrist firm"
- Motivational – "hang in there"
- Negative - "that was the worst lift ever"

Increasing Awareness of Self-Talk

Many athletes are not really in touch with their self-talk, and thus they can't alter what they don't know. Therefore, carefully reviewing the way in which they use self-talk can help identify beneficial and detrimental kinds of self-talk, and the circumstances or competitive situations bringing out different kinds of self-talk.

One good time to identify and understand one's self-talk is right after a competition (or practice). Specifically, as soon as possible after a competition, make a list of thoughts and self-statements, situations in which they occurred, and performance consequences. In essence, weightlifters should try to recall their thoughts and verbal reactions to a variety of situations throughout the competition. If possible, videotape the weightlifter with close ups of their facial expressions and verbalizations. This tape could also be used as a cue to help the weightlifter remember what he was thinking about or saying to himself at specific times. Another strategy is to have the weightlifter try to remember his best and worst performances. As they do this, it usually becomes evident that there is a distinct difference in self-talk between these two situations. Getting a good feel for one's self-talk will help to begin the process of focusing on self-talk that is beneficial and trying to eliminate or change negative and destructive self-talk.

Model of Self-Talk

A simple way to view self-talk is to think of it as an ABC model. Most performers think that situations cause reactions and responses. However, this model suggests that it is your interpretation or evaluation of the situation (i.e., your self-talk) that in large part determines your responses. This model is shown below.

A	**B**	**C**
Situation	**Interpretation/ Evaluation**	**Response**
I'll never make this lift	Frustration/ Anger	Missing a Critical Lift
Missing a Critical Lift	I know what I Need to do	Optimism, Motivation

In essence, it's what you think about (which is under your control) that determines your response to specific situations. So just because you missed an important lift or were doing poorly at the start of a competition does not mean you will have to be upset, frustrated and mad. You control your thoughts, and your thoughts have a big influence on your behavior and performance.

Changing Negative to Positive Self-Talk

In the best of worlds it would be best to totally eliminate negative self-talk, but this is not entirely realistic, as negative thoughts have a way of entering our mind. In fact, research has demonstrated that we have many more negative thoughts than positive thoughts throughout the day. So the next best thing is to change these negative thoughts into positive ones and direct your attention back to the task at hand. There are no special words to use but rather you need to find the words and statements that are meaningful to you, which help you refocus your attention. Below are a few examples of changing negative to positive self-talk

Negative Self Talk	*Change To*	**Positive Self Talk**
I hope I don't choke again		Relax and just go through the routine
I can't believe I missed that lift		Everyone misses-just focus on the next lift
This is your big chance, don't screw it up		This is what I've been practicing for
What will people think if I miss again		Just focus on your cues like in practice

Imagery

One of the most often used mental skills by Olympic athletes is imagery. Seeing themselves successfully performing a lift can help in many ways including increasing confidence, refining concentration, and managing emotions (e.g., anxiety, frustration). But what exactly is imagery?

Definition

Imagery is creating or recreating pictures in your mind (but should include as many senses as appropriate) without any physical movement. Although the term imagery implies vision or mental pictures, the real goal of imagery is to make the experience seem as real as possible. Therefore to simulate actual competition, a weightlifter should include all relevant senses so, as one imagery researcher has stated, if one's imagery is really powerful "the mind does not know the difference between real and imagined stimuli." So besides a weightlifter seeing a successful lift, he should also feel his muscles and body sensations, hear what he normally hears while lifting, feel what his body feels throughout different

parts of the lift, and feel what the bar feels like in his hands. Making imagery as real as possible will maximize its effectiveness in enhancing performance.

How Imagery Works

There are numerous theories that attempt to explain why and how imagery works. It is difficult to point to one of these theories as the best one (or only one) that explains how imagery works. So three different ones will be briefly explained as research suggests that they all probably contribute to imagery effectiveness. First, the **neuromuscular theory** (physiological approach) argues that vivid images produce an innervation (activation) in the muscles that is similar to that produced by physically performing the movement (although to a much lesser intensity). When practicing physically, all one is really doing is strengthening the neural pathways that control the muscles needed to perform the skill. Imagery helps strengthen these neural pathways. Second, (mental approach) focuses on imagery helping to understand the movement patterns necessary to perform the skill. In essence, imagery helps athletes form a mental blueprint in the mind regarding how the movement or series of movements should be done. Even though weightlifting requires fairly discrete and quick movements, there is still a series of movements that needs to be understood and performed to achieve a successful lift. Third, the **psychological skills hypothesis** focuses on the fact that imagery can help improve mental skills, which in turn will help performance. Specifically, research has indicated that imagery can have an effect on such psychological states as confidence, anxiety, concentration anger, and motivation. For example, even though a weightlifter may never have lifted 80 kilos in the snatch, he could still seem himself lift 80 kilos (given that this is realistic) which could help provide confidence that he, in fact, could do it.

Types of Imagery

When athletes use imagery, they usually do it from either an internal or external perspective. **Internal imagery** refers to imagining performance from your own eyes. In essence, a weightlifter could only see what he normally would see; like having a camera on his head, which took pictures of all the things he could see while executing the lift. From this perspective, a weightlifter getting ready to lift might see the audience, the bar and the timing clock, but he could not see anything outside of his normal vision. **External imagery** involves a weightlifter visualizing a movement as if he was watching himself in a movie. Since he is watching himself, as opposed to actually doing the movement (as in internal imagery), he could see things that he would not see doing internal imagery such as his footwork, facial expression, the bar over his head, etc. So the question is, which one of these types of imagery is better for performance? Research has revealed that both perspectives can be effective as it may depend on the task, individual preferences, and stage of skill development. For example, external imagery might be especially important if learning a new technique and it is therefore important to see exactly what it looks like to see if the correct technique was accomplished. Other situations might just require strengthening the neural patterns of the skill or just getting the "feel" of the movement and an internal perspective might be more beneficial.

Imagery Training

All of the mental skills discussed in this chapter need to be practiced, to help them become more effective. Below are some guidelines if you want to develop an imagery training program for your weightlifters

- **Start in a Relaxed State** – Research has revealed that imagery preceded by relaxation is more effective than imagery alone. This is only to be done for a short period of time (a couple of minutes) and the breathing technique which is described in the next section could be used here
- **Have Realistic Expectations** – Some athletes feel that imagery will make them better performers overnight and will magically turn them into the player of their dreams. Conversely, some athletes simply don't believe in imagery as they feel only physical practice can help them improve. The truth is somewhere in the middle of these two positions. Specifically, imagery can help improve skills but it needs to be practiced regularly just like physical skills
- **Image as Realistically (Vivid) as Possible** – As noted earlier, the use of as many senses as possible, makes the imagery as real as possible. The more weightlifters can simulate actual competition in their imagery, the more powerful and effective the imagery will be.
- **Positive/Coping Focus** – Research has revealed that focusing your imagery on the positive aspects of performance will be most effective. Most of weightlifters' imagery should be positive, seeing themselves make successful lifts with good technique and positive emotions. However, nobody is perfect and there will always be missed lifts and poor technique. Recovering from a mistake or missed lift is one of the key issues for becoming a champion weightlifter. So, occasionally, weightlifters should see themselves miss a lift or have a technical problem. But their next imagery should see themselves recover from this miss, go through their routine, stay relaxed, confident and focused and then make a successful lift.
- **Image in Real Time** – Imagery will be most helpful if it is in real time as opposed to slow or fast motion. This is part of imagery being as real life as possible, and it also helps the muscle memory to remember, since you are imprinting the neurological system to perform in the same time frame as actual performance. For example, if a weightlifter's pre-lift routine takes him 40 seconds, then his imagery should also take about 40 seconds.
- **Control the Images** – It would seem easy to have the image do whatever it is you want to do. For example, a weightlifter generally would want to see himself make a successful lift. But sometimes, he might see himself miss at a certain weight, especially if it a weight and lift that he has trouble with in the past. So, part of practicing imagery is to make sure the image does what you want it to do.

Arousal Regulation/Anxiety Management – One of the most difficult things for any athlete is to keep his emotions under control, especially anxiety. When meets and lifts become more important there is a tendency for weightlifters to put pressure on themselves or for others to put pressure on them. When athletes feel too much pressure they can have negative thoughts, tight muscles, lack of flexibility, sweaty palms, tunnel vision, etc. Every athlete has an optimal level of arousal, but it can differ widely with each athlete. Some like to be all psyched-up, others like to be real relaxed, while others are somewhere in the middle. The coach and the weightlifter need to work together to try and find what their optimal arousal is and then structure the environment and use the proper techniques to help the weightlifter reach this optimal level. In addition, a weightlifter's optimal arousal might

be different from practice and competition. What tends to happen is for a weightlifter to be too anxious and aroused for competitions and as noted above, this can get in the way of an efficient and successful lift. One general rule (like noted in the imagery section above), is to try and make practice and competition as similar as possible in every aspect, including one's level of arousal. So if the weightlifter does get too anxious (accompanied by muscle tension, worry, and irrelevant thoughts) then they need to practice being relaxed not only for the competition, but also in practice. One quick and easy way to relax when on the platform getting ready to lift (or when waiting to get on to the platform in known as **Breath Control**).

Most people generally think that taking a deep breath is a good way to relax; and they are right, up to a point. However, there is also a science to breath control to maximize its effectiveness. Here are a couple of points to keep in mind:

- Breathing consists of an inhalation and exhalation phase. The inhalation actually increases tension whereas the exhalation decreases tension
- Therefore an athlete who wants to relax should exhale for a longer time than inhale. Research recommends a 1:2 ratio of inhalation to exhalation. In essence, if a weightlifter inhales for 2 seconds, he should exhale for 4 seconds; if he inhales for 3 seconds he should exhale for 6 seconds. These are approximations, not absolutes.
- The taking in of a breath should come from the diaphragm (sometimes called belly breathing) as this allows for the most air to enter the body. Let the air out from the mouth and nose.

Concentration

Research and experience has indicated that Olympic weightlifting poses an unusual challenge to the concentration skills of weightlifters. In both training and competition, the demands of the sport are extraordinary. Hoisting twice one's body weight overhead is a consuming task. Few individuals can afford to worry about the other competitors, the audience, or a failed previous lift. Weightlifters must be able to focus all of their energies on the lift itself, with no distractions entering the mind. Of course with the pressure of competition, this is easier said than done. However, a couple of strategies will be described to help focus one's attention. But coaches' should understand that some of the techniques described earlier (e.g., self-talk, breath control, imagery) will also help focus attention and these can complement each other in maximizing attentional focus and performance.

Pre-Performance Routines

One of the important things that athletes need to understand from a mental perspective is that they should only focus on things that they can control (e.g., thoughts, emotions) and not on things they can't control (e.g., audience, other competitors). In essence, "Control the Controllable." One way to do this is through a pre-performance routine.

A routine is basically a consistent and systematic way to think, feel, and behave, especially before or during a competition. Pre-performance routines work by helping performers transfer their attention from task-irrelevant thoughts ("I can't believe I missed my first lift") to task-relevant thoughts ("keep a tight back"). In addition, they provide structure to the time right before performance to allow emotions and thoughts to be focused directly on the ensuing performance. Thus, routines decrease the likelihood that individuals

will be distracted internally or externally before and during competition. This allows performance to stay automatic without the interference of conscious awareness.

Although routines can vary from short and simple to lengthy and complex, research has revealed that generally, the shorter the time of the routine the more successful the performance. Some routines border on superstition such as wearing a lucky pair of socks. Other routines are more targeted to performance, which might include a deep breath for relaxation, imagining what to be done next, and keeping your eyes focused on the task. But the most important thing is for the weightlifter to feel comfortable with the routine and believe in it. Below is an example of a pre-lift routine by one of the weightlifters with whom I have consulted.

- Chalk up
- Walk to the center of the back of the platform
- Find my sport on the wall
- Approach the bar while thinking of process goals
- Line up my right foot then left foot under the bar
- Adjust myself
- Line up my right hand then left hand on the bar
- Rotate the bar in my hands while thinking of process goals
- Look up an find my spot again
- Take a deep breath
- Start my lift (automatic pilot while lifting)

Employ Non-Judgmental Thinking

One of the biggest obstacles athletes have in maintaining concentration is the tendency to evaluate performance as good or bad. Such judgments tend to elicit personal, ego-involved reactions such as "I just choke at big meets" or "I can't believe I missed that easy lift." Instead of judging the worth of a performance, and categorizing it as either good or bad, a weightlifter should look at his actions non-judgmentally, weightlifters should become "objective observers." This does not mean that errors and mistakes are ignored; rather weightlifters should simply see their performance for what it was, without labeling it as good or bad. For example, a weightlifter might have missed a lift. Instead of focusing on the miss, he might simply observe (or maybe felt) that he did not push hard through the ground at throughout the snatch. This objective information then is used constructively by the weightlifter to help him perform successfully on the next lift.

Confidence

Confidence is the belief that you will successfully complete a task. Confidence tends to be situation-specific so a weightlifter might be confident in the snatch but not in the clean and jerk. Research has been consistent in finding that confidence has a strong relationship to performance. In essence, believing that you can do something goes a long way to actually doing it. This is not to say that if you believe you can lift 80 kilos in the snatch it will happen, as you must have the requisite skills to be able to lift 89 kilos. But if a weightlifter goes into a lift not believing that they can do it successfully, then they probably won't. There are a number of sources of confidence and coaches can use these to help build

confidence in their athletes and some of the techniques discussed earlier also have enhancing confidence as one of their benefits.

- **Performance Accomplishments** – Although a coach can't guarantee winning or success in competition, they can help their weightlifters master skills in practice which will give them more confidence performing in competition
- **Verbal Persuasion** – Unfortunately many coaches feel the way to motivate their athletes is through fear, intimidation and punishment. But one of the ways in which athletes gain confidence is through positive reinforcement by coaches. This does not mean that all of your communication with your athletes needs to be positive. But, in general an encouraging, open positive, instructional attitude will go a long way in enhancing confidence.
- **Modeling** – Watching others perform well can also enhance confidence. The idea here is to have weightlifters watch other lifters like themselves who are performing well. The weightlifters may not be able to relate to an Olympic gold meadalist; rather they can take more positive information from other lifters who are good and around their ability level.
- **Mental and Physical Preparation** – Feeling that they have been practicing hard both mentally and physically goes a long way to enhancing a weightlifter's confidence. But this is not only the lifter putting in the hard work, as it is also the coach for giving the lifter a plan and instructing them to be prepared for all different situations. In this way, a weightlifter can go into a competition feeling that they were physically and mentally prepared and were ready for anything that might happen at the competition.
- **Imagery** – As noted in the imagery section, seeing yourself performing a skill successfully can give you confidence that you can indeed do it. For example, a weightlifter may have been unsuccessful several times with a particular weight but he could still see himself successfully lifting the weight, which can give him some level of confidence that he can do it.
- **Simulations** – We have discussed simulations before, but one of the things that simulations in practice does, is to give the weightlifter confidence because if he can perform well in practice, and practice is very much liked competition, then he should do well in competition. So, making the practices as much like competitions will help build confidence in weightlifters doing the same things in competition as they were doing in practice.
- **Focus on Process Goals** – As noted in the goal setting section, focusing on one's process goals (things a weightlifter needs to focus their attention on in order to maximize the chance of a successful lift) will help him remain confident because process goals are always under his control. By focusing on what is under his control, a weightlifter can be confident because they know what they have to do and don't have to be concerned with anyone but themselves.

Summary

I have tried to cover a number of different mental skills to underscore the relevance of sport psychology to weightlifting. Given the relatively short chapter length, only a cursory examination of these mental skills could be covered and not all were covered. More extensive resources are noted in the bibliography. It also is important to note that each coach and athlete brings a unique life history and personality to the sport. The recommendations that I offered here are meant to be general guidelines rather than absolute truths. The interactional model of behavior stresses the importance of an interface between people and the situations. Thus, coaches and athletes bring individual differences to their interactions with each other and the specific situations they encounter also make for a unique combination. Finally, the bottom line is the inseparability of mind and body. The

mental skills discussed in this chapter need to be practiced just like physical skills and these two need to be integrated to produce optimal performance and long term growth of each and every weightlifter.

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