Olympic Weightliftng: Pulling Mechanics

Don Robbins

This document discusses the fundamentals of pulling mechanics that are common to both the snatch and the clean.

In order to illustrate these fundamentals, we will use the **power clean** since this exercise has been widely adopted in many different sports beyond Olympic Weightlifting (e.g., football†).

We choose to start our discussion of pulling mechanics at a critical position that actually occurs near the end of the pulling movement. In fact, this position (called the *second pull position*) is so critical that the entire pulling process is purposefully structured to accommodate it.

† Bill Starr (1976), *The Strongest Shall Survive*: *Strength Training for Football*

All pulling mechanics in Olympic Weightlifting are structured around two simple foundation concepts:

1. **Achieve a Correct Second Pull Position**

2. **Achieve Complete Extension**

Second Pull Position

The *second pull position* (SPP) is the position that allows you to generate *maximum vertical power* (i.e., make the heavy weight go *upward* with *maximum speed*). Everything in the **earlier stages** of the pull simply **serves to set up a strong second pull position**.

In order to achieve this correct SPP, the earlier stages of the pull will be performed in a manner that seems awkward and non-intuitive to most people. But in Olympic Lifting, we often sacrifice leverage in one area to gain leverage in another, more critical area (e.g., the SPP).

Second Pull Position

Key Points of the SPP

- Spine and pelvis are aligned, straight and 'mostly upright'
- Bar should be right up against your power center (hip joint)
- Legs bent under the bar, ready for violent extension
- Feet flat on ground with weight flowing through front of heel bone, not the balls of the feet

If any of these points are violated, it is usually because the bar is positioned too far forward. The most difficult aspect of learning Olympic Lifting pulling mechanics is to learn how to take the bar backwards as you take it upwards so that the correct SPP can be achieved

Second Pull Position

The correct SPP provides us with the perfect opportunity to apply maximum power to the bar by extending our hips and legs.

Olympic weightlifting is all about the generation of explosive power, focused in a very precise, controlled, single effort

So, exactly which direction will we apply the violent extension that the SPP affords us?

The answer is:
Upwards and **Slightly Backwards**

Complete Extension

From the correct *second pull position* (SPP), maximum acceleration of the bar is achieved through **violent, complete extension of the hips and legs**, and to a lesser degree, the ankles.

Important:
It is not enough to simply pull the weight to a certain required height. It is also critical that the weight should be precisely positioned front-to-back when it reaches maximum height. Ideally the weight is located directly over the front of the heel bones when it reaches maximum height. This requires that the complete extension is **upwards** and **slightly backwards**.

Complete Extension

Key Points

- **The extension trajectory is upwards & slightly backwards**
- **This extension trajectory only allows the heels to come slightly off the floor before they fall back down. If we can achieve any hang time on the balls of our feet, then the extension did not have enough backward component**
- **The process of actively lifting the bar ends precisely at complete extension, and we instantly shift to vigorously pulling our body under the bar while the bar continues to travel upwards on its own.**

Complete Extension

Note: The shoulder shrug actually occurs after we achieve complete extension and it serves more to pull ourselves under the weight as opposed to lifting the bar higher. Nevertheless, strong trapezius muscles are needed to stabilize and support the shoulder frame during the violent complete extension.

So, what happens <u>after</u> we hit complete extension?

Frame **0**:
In this frame, the lifter has achieved complete extension and maximum bar speed

The bar is moving fast enough at this point that the bar will continue traveling upwards for some distance on its own

Frames **1-4**:
Immediately after achieving complete extension and maximum bar speed, **we stop actively lifting the weight and we shift to the process of pulling ourselves under the bar**.
How does this happen?
Immediately after achieving complete extension and maximum bar speed, we simultaneously
a) unlock the legs, and
b) use our trapezius muscles and arms to pull our body rapidly under the bar, as
c) the bar continues to travel upwards on its own.
This process of pulling ourselves under the bar is very fast. Notice that in frame 3 where the bar reaches maximum height, the lifter is almost completely under the bar. Notice that in frame 4 when the lifter finally racks the bar, the bar has actually fallen slightly from its highest point in frame 3. Notice also in frame 4 that the bar is positioned directly over the front of the heel bones.

At this point, you should understand what constitutes a correct second pull position and you should also appreciate the importance of the correct second pull position.

So now let's consider the mechanics of the earlier portions of the pull, i.e., that portion of the pull that occurs prior to the second pull position.

Remember, as we stated earlier, the mechanics of the early portions of the pull will seem somewhat un-natural and non-intuitive, but we will be consciously giving up leverage in the early portion of the pull so that we can gain tremendous leverage later in the correct second pull position.

The mechanics of the earlier portion of the pull are specifically structured so that the lifter can achieve a correct second pull position.

For teaching purposes, the earlier portion of the pull will be broken down into two segments:

1) The **First Pull**
2) The **Reset**

The First Pull (from the floor to just above the knees)

The above sequence of 5 frames illustrates the First Pull

Lets first consider the mechanics of the all-important starting position (frame 1)

- Sit well down into the bar to initiate the pull from the floor (with the hips relatively low and the back relatively upright),
- Keep your back flat, and keep your pelvis aligned with your spine,
- Starting position is achieved by extreme flexion of the hip joint (no forward rounding of your back or flexion of the spine/pelvis connection),
- Your weight should flow through the front of your heel bones†, not the balls of your feet,
- Your lats and forearms are actively engaged (they are responsible for keeping your body and the bar together by pulling the bar backwards and pulling the chest forward)
- Achieving the correct starting position requires exertion (it is tiring), so you don't want to spend very much time in this position before starting the lift.

† Many coaches suggest that in the starting position, the weight should actually flow through the balls of the feet, and that over the course of the first pull, this point of weight flow should shift backwards to the front of the heel bones. Here, to simplify the process, we recommend that the lifter should try and stay centered over the front of the heel bones throughout the first pull.

The First Pull (from the floor to just above the knees)

Further discussion of the mechanics of the starting position (frame 1)

- Note that the starting position shown in frame 1 is definitely not the starting position that we would use to deadlift a heavy weight off the floor. For a deadlift, we would intuitively start with our hips higher and our back at a more shallow angle with the floor (i.e. our back would be more horizontal , less upright than we see in frame 1),
- In fact, the recommended starting position (frame 1) actually puts us at somewhat of a mechanical disadvantage, but we consciously accept this mechanical disadvantage because it is necessary in order to later achieve the correct second pull position,
- It takes much discipline and practice to be able to maintain this correct starting position as the weight increases to near maximum levels (we tend to revert to deadlift mechanics),
- As the weight gets heavier and heavier, most beginning lifters will incorrectly change their starting position by raising their hips and lowering the angle of their back. This should be avoided at all cost; it is admittedly stronger off the floor, but it prevents the correct second pull position from being achieved later.

The First Pull (from the floor to just above the knees)

Now lets focus on the whole First Pull (frames 1-5)

- From the starting position, push yourself up and back with your legs while you maintain your back at the same constant angle that you use to start the lift. It requires much focus to actually achieve some backward component to the leg extension. Intuitively, most of us want to incorrectly push ourselves straight up with our legs. In each of the five frames, there is a vertical blue line that marks the rearmost point of the hips. Notice that the blue line actually moves to the right as we go from one frame to the next (you can see this clearly if you look at the position of the blue line on the white board in the background.)
- Throughout the First Pull, your lats and forearms are strongly engaged, exerting a backwards force on the bar. This force helps keep the bar and your torso close together. This effort will make it look like you are sticking your chest out, but this is simply a byproduct of tension in the lats.
- Throughout the First Pull, the weight should flow through the **front of your heel bones**, not the balls of your feet.
- As we progress through the First Pull, our **posterior chain** (hamstrings, glutes, spinal erectors) become more and more loaded.

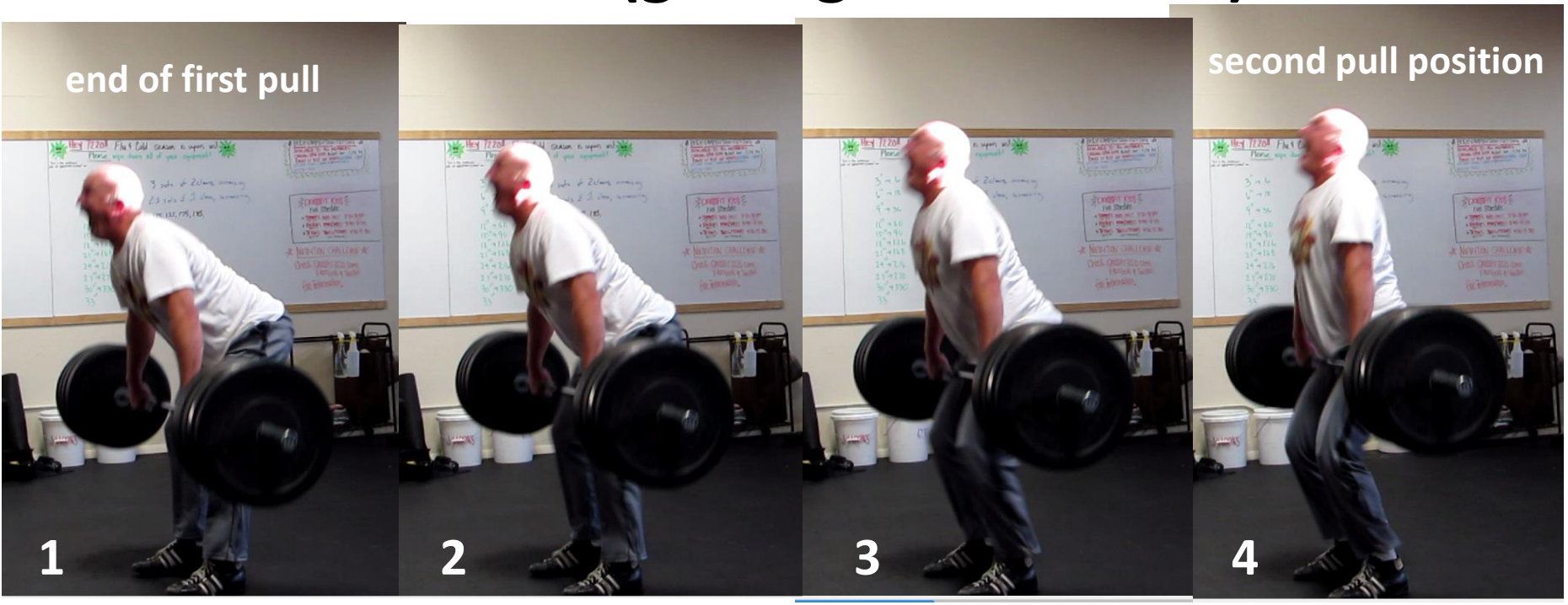
The First Pull (from the floor to just above the knees)

What should we achieve at the end of the First Pull (frame 5) ?

At the end of the First Pull,

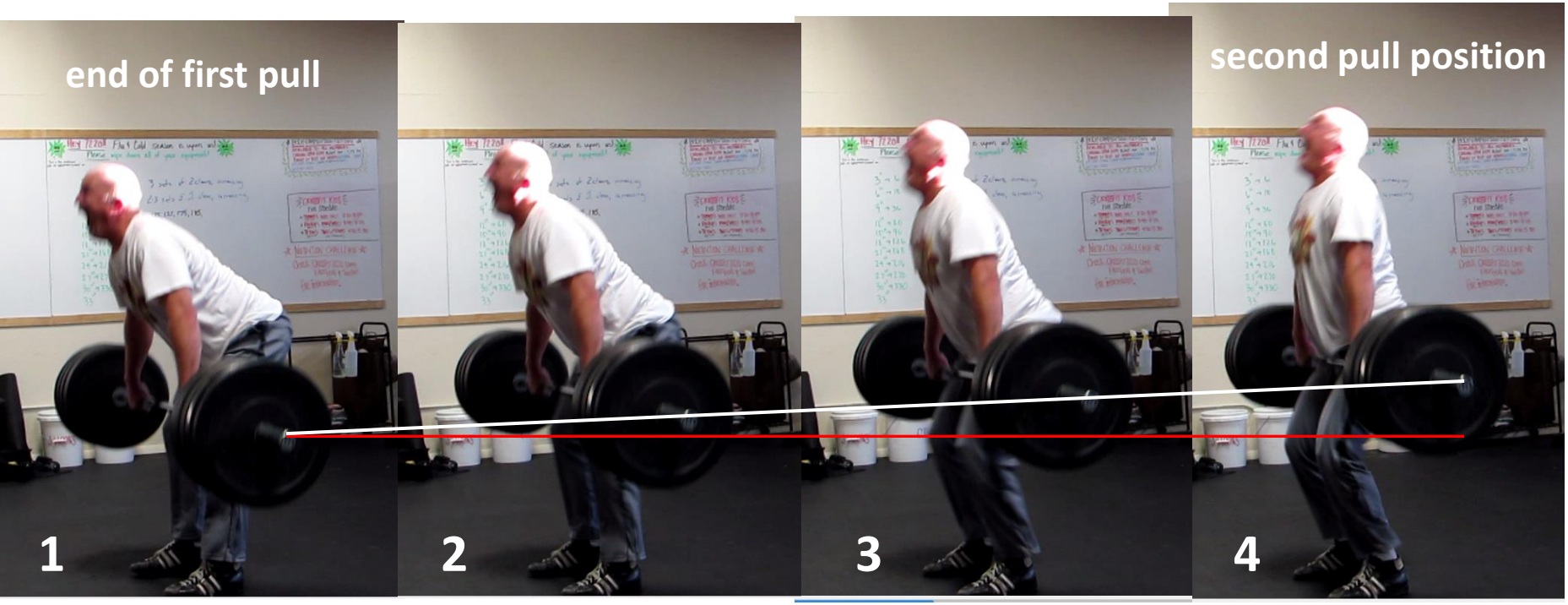
- The bar should be just above our knee caps,
- Our shins should be vertical, not inclined forward,
- The weight should flow through the front of our heel bones, not the balls of our feet,
- Our **posterior chain** (hamstrings, glutes, spinal erectors) is under **maximum tension** and is almost entirely responsible for supporting the weight in this position. In contrast, the quads are not providing much support in this position.
- Our forearms and lats are strongly engaged, pulling the bar backwards to keep it close to our body
- Assessing your performance: It is quite easy to stop the lift at this point and confirm that you are achieving all of the above points

The Reset (getting into the SPP)



The objective of this phase of the pull is to quickly transition our body from the position achieved at the end of the first pull to the second pull position that provides us with maximum leverage.
We are essentially conducting a wholesale re-setting of our position. The reset occurs relatively quickly; notice that it is completed within the span of only three movie frames. The precise timing of the various events that occur during the reset is critical.

The Reset (getting into the SPP)



Several important things occur during the **Reset**:

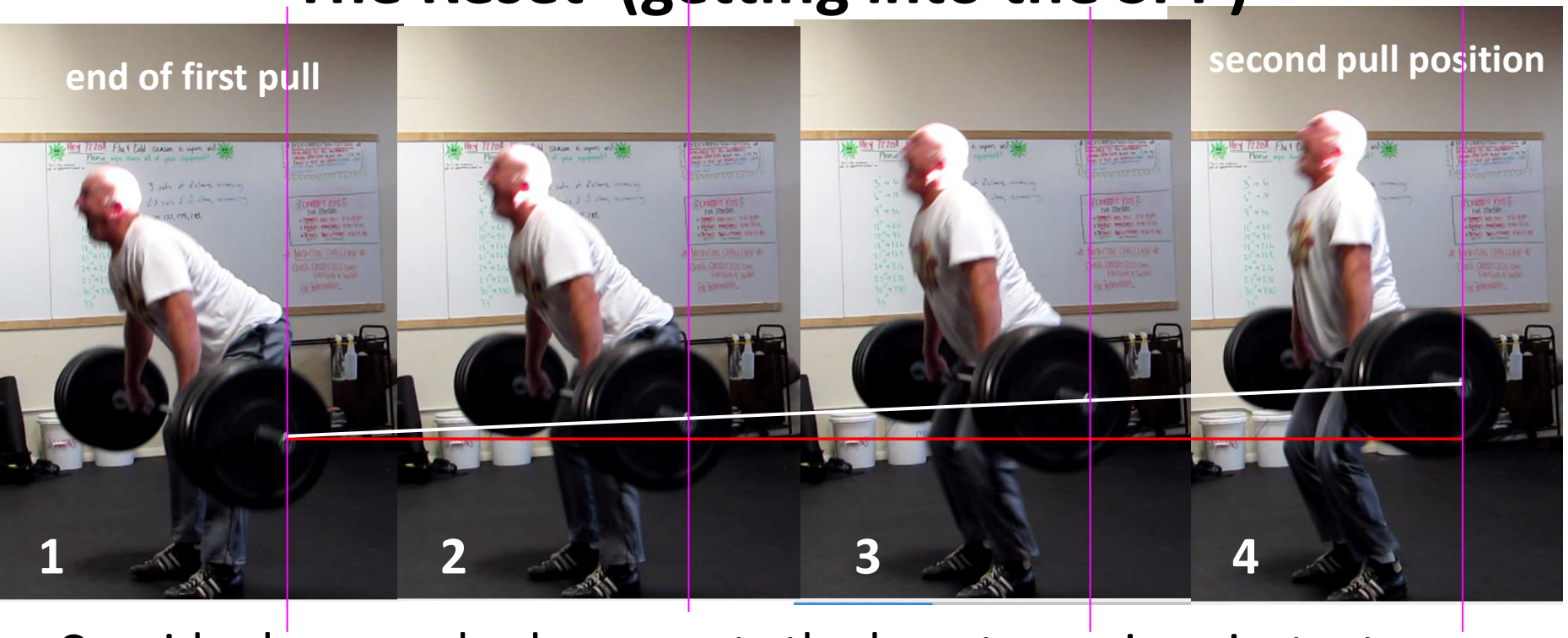
1. We actively **raise the angle of our back** (our back becomes more vertical)
2. We move our hips **down** and **forward** to meet the bar
3. We allow our legs to **bend** and our knees to come **forward**
4. The bar continues to rise throughout the reset because we are actively pulling the weight the entire time; in other words, we do not suspend the process of pulling while we are performing the reset, rather **the reset occurs as we continue to pull**. A comparison of the white line and the red line shows how much the bar is elevated during the reset.

The Reset (getting into the SPP)

Also important during the reset:

1. We continue actively engaging our lats and forearms to sweep the bar backwards into our body and to force our chest forward and upward. The vertical pink lines show that the bar continues to move backwards as it is elevated to the second pull position.
2. Our weight is maintained on the front of our heel bones throughout the reset. We don't allow our weight to shift forward onto the balls of our feet.

The Reset (getting into the SPP)



Consider how our body supports the bar at any given instant. During the reset, we are actually changing the way that we support the bar. We are transitioning from the condition of supporting the bar almost entirely with our posterior chain (frame 1) to a much more balanced combination of posterior chain plus quads to support the weight at the second pull position (frame 4). And this transition happens smoothly and quickly as we continue to pull and elevate the bar throughout the reset.

This document has described Olympic Weightlifting pulling mechanics by breaking the complete movement down into five pieces that occur sequentially:

1) **First Pull**
2) **Reset**
3) **Second Pull Position**
4) **Complete Extension**
5) **Pull yourself under the bar**

During an actual pull, these five sequential pieces flow together seamlessly without any perceptible pauses.

It should be emphasized that this method of pulling has a long evolutionary history and is designed to be very efficient for a very specific task, namely, pulling a moderately heavy weight high enough to allow you to get under it. If your objective is to simply deadlift a super heavy weight, then this is not the method to be employed.

In learning this method of pulling, it is very difficult (and unreliable) to attempt to self-judge your technical performance based on how the lift 'felt' to you. Furthermore, unless you have a very experienced coach watching you, it is difficult for most observers to watch a 'live' lift and assess the lifter's technical performance. Instead, it is much more productive to film yourself so that you step through the film frame-by-frame and objectively assess your performance. In examining the film, it is particularly helpful to focus on your position at several key moments during the lift:

1) The starting position (as the weight clears the floor),
2) The end of the first pull,
3) The second pull position,
4) Complete extension