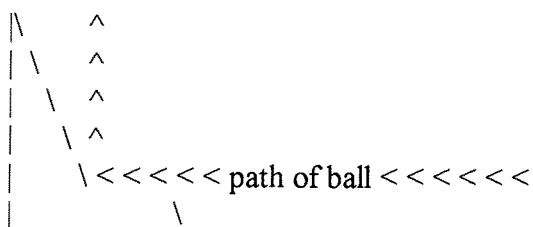


## A "BIOMECHANICS OF JUMPING" PRIMER

Understanding the mechanical principles behind a particular skill helps one learn it more efficiently and execute it more effectively. Biomechanically speaking, a good approach and jump involves "blocking" horizontal inertia and turning it into vertical inertia. That is to say, you redirect the forward momentum generated during the approach into the upward momentum of the jump. To understand this "blocking" principle at its most basic level, imagine throwing a rubber ball into a surface angled upwards at 45 degrees. The surface "blocks" the horizontal momentum of the ball, giving it only one possible direction to travel: up.



The same general principle applies to approaching and jumping, with your center of gravity (your hips) taking the place of the ball and your legs acting as the wall. To understand how this works, picture what happens when a pole vaulter "jumps." First, she generates horizontal momentum by sprinting down the runway. Then, by planting one end of the pole in the box while holding on to the other end, she effectively "blocks" her forward momentum and gives her center of gravity only one possible direction to go: up. Planting the pole in the box "blocks" the forward momentum, forcing it in an upward direction. Sprinting down the runway builds forward momentum.

When you approach to hit a volleyball, a similar event occurs. You generate forward momentum with the first couple of steps, and then "block" that momentum when you plant your feet and jump. To get the most out of this blocking action, you must:

- 1) keep your center of gravity (your hips) fairly low and behind your feet as you plant; and
- 2) think of punching your feet through the floor and pole-vaulting off your legs.

Also, as you jump, you should generate additional upward momentum by using your arms, neck, and back.

## BASIC APPROACH FOOTWORK

To achieve the maximum leap your body can provide, you must generate speed during your approach and convert it to vertical momentum as you plant and jump. Although the approach, plant, and jump are discussed separately here, you must always think of them as one fluid motion. As importantly, concentrate on doing everything *quickly*.

Two quick definitions before we get started:

- 1) In this discussion of the approach, "blocking" does *not* refer to blocking a volleyball; rather, it refers to a biomechanical action that transfers momentum from one direction to another.
- 2) Drawing from events in track and field, the term "plant" describes the two-footed take-off.

Some volleyball coaches teach their players to approach using "four steps" -- right, left, right, left -- with the final two "steps" actually being the plant. Other coaches teach a "three step" approach -- left, right, left -- with the final two steps being the plant. This paper will teach the approach by saying, "right, left, plant," or, "left, plant." These mean essentially the same thing as "four-step" or "three-step," respectively, but for reasons that will (hopefully) become clearer below the term "plant" is used.

p.s. The explanation that follows is for right-handers. Lefties, of course, need to do everything in a mirror-image.

#### THE APPROACH FOR A HIGH SET (4-Step Approach):

Prepare for your approach by standing about 15'-18' from the net, with your left foot approximately 18" in front of your right, your body facing the setter (for a right-side attack, your body will face away from the setter), and your weight resting on the ball of your left foot. If you're hitting a high set, begin your approach as the set nears its peak. Take two quick sprinting steps, starting with your right foot, to generate as much speed as possible. The second step (your left foot) should be on or behind the 10 foot line, and you **MUST NOT TOUCH THE GROUND AGAIN UNTIL YOU PLANT AND JUMP.**

Note that the left-side approach starts on the sideline and behind the 10 foot line while the right-side approach begins in bounds and is perpendicular to the net. Although these approach angles vary slightly from hitter to hitter, in general they allow you to hit the ball hard in any direction. (Keep in mind that these angles are reversed for left-handed hitters.)

For many players, the last step (from left to plant) seems extremely long - - perhaps too long -- the first couple of hundreds times they do it. It's not. In fact, it *must* be this long if you want to maintain your approach speed and get into a powerful jumping position before you plant. If your last step (from left to plant) is too short -- or worse, if you take little adjustment steps right before you jump -- you will have to sacrifice speed for power or vice versa. Only with a long last step will you be able to maintain your speed *and* give yourself enough time to get in powerful jumping position.

#### THE "POWER POSITION" AND PLANT

As your body passes over your left foot and the 10 foot line, prepare to plant and jump by getting low and plant both feet almost simultaneously.

1. Get your butt low, and keep it behind your heels so that you don't drift into the net after you jump.
2. Extend both arms straight behind you, palms facing the ceiling, so that you can swing both of them as you jump.
3. Drop your chest toward your knees so that you can use your lower back as you jump.

This power position prepares all your body parts to effectively and efficiently "block" your forward momentum and convert it into upward momentum.

You will first contact the ground with your right heel, with your left forefoot making contact, almost simultaneously, about 6" or 8" in front of your right foot. This staggered foot

position is extremely important because it keeps your right shoulder (your hitting shoulder) away from the net. Just as importantly, to get the most out of the "blocking" potential provided by the power position, you must begin your jumping action an instant *before* your feet strike the ground. As you push (or "block") with your legs, pull as hard as you can with your arms and lower back. (Many athletes find it more effective to think of jumping in terms of "pulling" than "pushing.") Violently "block" your arms when they reach about eye-level and block the pulling motion of your back (with your abs) when your torso becomes vertical. This blocking action is extremely important because it transfers momentum from your arms and torso to your center of gravity, lifting your entire body several inches higher.

After you leave the ground, arch your back and curl your heels toward your butt. In addition, keep your left arm at eye level and draw your right arm back in preparation for your swing. You are now in a position to drill the ball at your opponent.

### Summary of the Basic 4-step Approach

1. Begin your approach 15'-18' from the net.
2. Take two quick sprinting steps (right, left), which will put your left foot on or behind the 10 foot line. Your last step, from left to plant, must be long and low in order to get into a good "power position" before you plant.
3. Get into a good "power position" before you plant.
4. As you practice your approach, say, "right, left . . . plant."
5. Begin your jumping action an instant before you contact the ground by pushing your feet through the floor and pulling with your back and arms. Block your torso when it becomes vertical and block your arms at eye level. Think of the jumping action as a "pulling" motion.
6. Jump as quickly as possible. Think of bouncing off the ground instead of jumping.
7. After you leave the ground, prepare your body to hit.

*If you are just beginning to learn the approach, ignore all the details for a while and concentrate on one rule: "Left foot on the 10 foot line, then plant." After this footwork becomes more natural, start adding other components one at a time.*

### ADVANCED APPROACH FOOTWORK

Although the techniques described below are designed for complex offenses that use lots of quick sets and combination plays, hitters at every level should use them for two reasons. First, these techniques force attackers to actually practice their footwork, something too few hitters do. Secondly, and perhaps more importantly, after hitters become comfortable with these techniques, their range increases dramatically, enabling them attack all sorts of "bad" sets that they used to bump over the net.

As you move up the volleyball food chain, you'll find that the blockers you face are much better. There are two ways to "beat the block": 1) pure speed (shoot sets to the antenna), or 2) misdirection and deception. Pure speed is extremely risky; you will beat the block periodically,

but you will also make lots of unforced errors. Misdirection allows your team to create holes in the block while still using relatively safe sets. And while much of this deception comes from your setter, hitters can also contribute by hiding where they will hit. The techniques described below do exactly that -- they enable hitters to disguise where they will hit while still providing optimum jumping and hitting power.

Before discussing any footwork, we need to be on the same page as far as sets are concerned. In the sections below, the sets are as follows:

1ball: a short set, right in front of the setter, about 1' to 2' above the net.

2ball: a slightly higher set, right in front of the setter, about 4' to 5' above the net.

3ball or shoot: same height as a 1, but the hitter contacts it 8' from the setter.

back 1: self-explanatory

back 2: self-explanatory

4ball or flare: same height as a 2, but near the right antenna

p.s. As always (it seems), these explanations are for right-handers. Lefties need to reverse everything. My apologies.

## ADVANCED FOOTWORK

### BREAK POINTS

In general, the approach you should use most of the time, even in complex, deceptive offenses, is the same as the one described in the "Basic Approach Footwork" document (4-step approach): right, left, plant (middle and right-side hitters should probably shorten this to left-plant). To make this approach more deceptive you need to incorporate a "break point," the National team's term for a turning point in the approach that allows a hitter to cut or "break" to her right or left. Although the exact location of this break point varies from hitter to hitter and from position to position, for right-handers it is usually where your left foot contacts the floor around the 10 foot line. From this point you can hit a ball 5' or 6' to your left, 8' or 10' to your right, or straight ahead without losing anything from your vertical jump.

### FOOTWORK FOR EACH HITTING POSITION

#### LEFT

Left-side hitters should start their approaches behind the 10 foot line and on the sideline. Their break point is on the 10 foot line. This position allows them to hit 5s (high sets,) 3s (shoots,) and 2s with a normal, left-plant approach.

#### MIDDLE

Middle hitters, regardless of the set they will hit, should usually start their approaches slightly behind the 10 foot line and about 12' from the left sideline. As the middle hitter begins to approach, her left foot lands on or around the 10 foot line near the center of the court. This first step should almost always make it look as though she will hit a 1 . . . yet from this position the hitter can break left for a shoot, go straight in for a 1, break right for a back one, or slide wide

right for a 4ball or flare. Or, if she chooses, she can use a step-around to hit a variety of slightly higher sets.

## RIGHT

Right-side hitters should start their approaches outside the 10 foot line and 6'-8' inside the sideline. Their break point is on the 10 foot line, 8' or 9' inside the sideline. This position allows them to hit 2s, 1s, back 1s, and back 2s with a normal, left-plant approach. It also permits them to hit flares using either a slide approach, a normal, left-plant approach, or perhaps even a step around (show a back 1 before hitting the flare).

To make your offense as deceptive as possible, each hitter's starting point should always suggest that she might be involved in a combination (which forces the opponent's middle blocker to pay attention to all three hitters). Consequently, left-side hitters should begin their approaches 5'-6' behind the 10 foot line and just inside the sideline, even if they are hitting a high outside set. (To hit a high outside set, step out-of-bounds with your right foot and use a standard "left, plant" approach.) If the left-side hitter is involved in a combination, her break point is just inside the 10 foot line and 4'-6' from the sideline. This allows her to hit a 3 (shoot), 2, or 1 with a standard two-footed plant. If she has 2 or 1 and the pass is way right, she should use a slide approach.

## CONCLUDING COMMENTS

While this document can't do justice to all the things you need to know to run combination plays effectively, four suggestions are made:

1. Always, always, always focus on ball control. If your team can't pass, you can't do anything offensively.
2. Only run combinations in serve-receive and freeballs. Your transition offense (attacking off of a dig) should remain fairly simple and straightforward, and your approaches should remain basic as well.
3. The setter must call the plays, and each hitter must know the sets the other hitters have so they can adjust their approaches accordingly. Back-row players should also know what the setter calls so they can cover the hitters without getting in the way.
4. Because each blocker generally tries to stay with the hitter directly across the net, you should incorporate some crossing action or the threat of crossing action to make the blocker's job harder. In other words, an "inside cross" (middle hitter has a 3 or shoot and left-side hitter has a 2) or right -X (middle hitter has a 4 or flare and right-side hitter has a 2) is usually a better play than a "left-side tandem" (middle hitter has a 1 and left-side hitter has a 2), because the inside cross forces the blockers either to switch assignments or run into each other.

